Why we fail: Stakeholders' perceptions of the social and ecological barriers to reforestation in southern Malawi

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Handling Editor: Laura Graham

Abstract

1. Reversing deforestation is a pressing challenge for planetary health and global development, but the path to restoring forests on a globally significant scale is ill-defined, and government implementation of afforestation projects often generates conflict with user groups. Understanding the needs and values of forest-reliant stakeholders in developing countries and effectively engaging them in forest landscape restoration planning and implementation are critical steps towards meeting afforestation goals, and yet few examples of practical methods to include the poor in participatory environmental governance processes exist.

2. Inspired by an approach used to mediate other natural resource conflicts, I structured a series of stakeholder focus groups in the Zomba–Machinga region of southern Malawi around Systems Thinking and Bayesian Belief Networks. Through these focus groups, I engaged forest-reliant households, academics and government staff in a participatory process to explore the conditions of past restoration failure; identify the barriers to future reforestation success; and develop proposed solutions.

3. Out of eight focus groups held, seven viewed poverty as the single greatest obstacle to afforestation success, and all seven perceived small business capacity building as one of the three most important factors in poverty alleviation, followed in order of frequency by improved agricultural practices (six of seven groups), and non-forest employment (three of seven groups).

4. If each focus group could successfully implement the three factors they considered most important, the groups' perceptions that poverty could be alleviated ranged from a likelihood of 15.8%–62.3%, with differences among focus groups that underscored inequities in social agency and vocational opportunities of the participants based on age and gender.

5. This study illustrates where these diverse groups of stakeholders from a single region converge and diverge in their thinking, underscoring the importance of establishing durable participatory processes to work through conflicts, nurture trust and collaboratively develop solutions that are relevant to local conditions in order for global forest landscape restoration to succeed.
Deforestation is a persistent and complex challenge for global development (Meyfroidt, Rudel, & Lambin, 2010; Nijnik, Nijnik, Bergsma, & Matthews, 2014; Sunderlin et al., 2005). Between 1990 and 2015 alone, 129 million wooded hectares were cleared, representing more than 3% of Earth’s forested landmass (FAO, 2015). Though the rate of net annual loss declined over this period (FAO, 2015), the indirect costs of deforestation continue to accrue (Lawrence & Vandecar, 2014). Deforestation is accelerating biodiversity loss, degrading ecosystem function and lowering Earth’s capacity to provide critical ecosystem services such as climate regulation and greenhouse gas sequestration (Barlow et al., 2016; Kindermann et al., 2008; Mantyka-Pringle et al., 2015; Mora & Sale, 2011). Thus, finding effective ways to reverse deforestation is proving to be one of the pre-eminent challenges of the Anthropocene. Over the past decade, the UN has formally embedded ecological restoration in the sustainable development agenda with a series of declarations, including the 2011 Convention on Biological Diversity and the 2013 Convention on Combating Desertification (Verdone & Seidl, 2017). The Bonn Challenge,1 launched in 2011, has become a vehicle to coordinate achievement of these and other multinational commitments, with the goal of restoring 350 million hectares of forest by 2030 (Suding et al., 2015; Verdone & Seidl, 2017). It is an ambitious effort, reflecting the globalization of reforestation research and strategy (Crouzeilles et al., 2016; Menz, Dixon, & Hobbs, 2013). Yet the path to practically achieving forest landscape restoration on the scale envisioned by the Bonn Challenge is ill-defined (Chazdon et al., 2017; Suding et al., 2015).

Reversing deforestation has proven to be particularly challenging in developing countries, where natural forests are often central to a complex socioeconomic system of subsistence and traditional uses, and the socioeconomic and spatial externalities of large-scale restoration are poorly understood (Adams, Rodrigues, Calmon, & Kumar, 2016; Kalaba, 2014; Meyfroidt & Lambin, 2011; Shackleton, Shackleton, Buiten, Bird, 2007). In these settings, public forests often function as ‘commons’, offering asset-poor communities access to wood fuels, food, livestock fodder and construction materials including timber and roof thatch (Shackleton et al., 2007). Top-down environmental conservation or restoration efforts imposed by governments or outside organizations, while well-meaning, may set up a direct conflict with these resource-reliant communities if the interventions fail to consider the needs and values of these stakeholders (Bennett & Dearden, 2014; Redpath et al., 2013). Conversely, effective engagement of stakeholders can improve environmental outcomes by increasing the likelihood that decisions will reflect local resource conditions and stakeholders’ visions for the future, increasing stakeholder trust in governance and engagement in democratic processes and mediating greater compliance with the resulting decisions and policies (Beierle & Konisky, 2000; Reed, 2008). Advances in describing the linkages between forest dependence, poverty, equity, livelihoods and deforestation underscore the critical importance of engaging poor households with a high dependence on resources extracted from forest commons as stakeholders in the forest landscape restoration planning process in order to understand localized forest resource use conditions, and to design responsive policies that can effectively turn the tide on deforestation (Angelsen et al., 2014; Kamanga, Vedeld, & Sjaastad, 2008; Soltani, Angelsen, & Eid, 2014; Sunderlin et al., 2005).

In order to arrive at a shared vision for solutions to deforestation in developing countries, as with any other environmental conflict, it is essential to establish a forum and process for stakeholder participation, and to develop a currency of trust between parties (Ansell & Gash, 2008; Redpath et al., 2013). It is also necessary for all parties to recognize that forest landscape restoration goal-setting and implementation planning must look beyond tree-planting when defining success, explicitly incorporating outcomes for human livelihoods, equity and well-being (Brancalion et al., 2016; Chazdon & Uriarte, 2016). Despite global calls to action for these kinds of inclusive planning processes (Chazdon et al., 2017; Lazos-Chavero et al., 2016), the forest landscape restoration literature currently provides few examples of practical methods for engaging the forest-dependent poor as critical stakeholders in a participatory environmental governance process.

Recent work in stakeholder-driven aquaculture development and climate change adaptation planning has demonstrated the viability of integrating Systems Thinking and Bayesian Belief Networks to understand, negotiate and move beyond conflicts in these resource contexts (Richards et al., 2013; Salgado, Bailey, Tiller, & Ellis, 2015; Tiller, Gentry, & Richards, 2013). Inspired by the results, I used the same approach to begin a participatory dialogue about the failure of government-initiated reforestation and opportunities for change through a series of focus groups in the Zomba–Machinga region of southern Malawi. Systems Thinking allows stakeholders to develop a shared understanding of the social, economic, political and natural environment that the resource conflict occurs in. Bayesian Belief Networks provide a structured model for documenting local values, and knowledge about the factors influencing the realization of those values, as well as addressing statistical uncertainty about the relative strength of such influences (Richards et al., 2013). Together, these approaches lay the groundwork for co-visioning solutions to current challenges. I designed the focus group series to engage three subsets of stakeholders representing this geographic region: (a) households

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**KEYWORDS**

Africa, Bonn Challenge, forest landscape restoration, Malawi, participatory process, poverty and development, socioecological system
residing in forest-adjacent villages who may depend on forest resources for subsistence, (b) government staff engaged in forest research, forest extension or agricultural extension work and (c) academic researchers from the national forestry college, sited in Zomba. The purpose of the study was to explore the conditions of past restoration failure, identify the barriers to future reforestation success and elicit proposed solutions from these stakeholders. To achieve this, I structured the focus groups around two branches of inquiry: why have forest restoration projects failed to deliver ecological or social benefits, and under what circumstances might outcomes instead be positive?

In the remainder of this section, I will provide background information on the landscape ecology of the Zomba–Machinga region and the sociopolitical context in which this study took place. In Section 2, I will lay out the methodological approach I used to facilitate the initial Systems Thinking exercise and the development of stakeholder-defined Bayesian Belief Networks before presenting the results of the Bayesian Belief Network analysis in Section 3. In Section 4, I discuss my findings in the context of Malawi’s history, culture, development challenges and current afforestation model. Finally, I offer concluding thoughts on why the country has failed to gain traction on meeting its commitments under the Bonn Challenge, and on the broader importance of participatory engagement of stakeholders to effect progress towards global forest landscape restoration goals, in Section 5.

1.1 | Background

Malawi is an apt model system for this case study because the environmental and economic challenges it faces are representative of those facing numerous developing countries (Kamanga et al., 2008; Sunderlin et al., 2005). Malawi is among the 10 poorest countries on Earth, and has undergone marked land-cover change as a result of population growth since political independence in 1964 (Figure 1) (Bone, Parks, Hudson, Tsirinzeni, & Willcock, 2017). Over 80% of the population still depends on agriculture for primary income (Tchereni & Sekhampu, 2013), and forest dependence is high (Green, Eigenbrod, Schreckenberg, & Willcock, 2017; Kamanga et al., 2008). Malawi’s government has committed to restore 4.5 million hectares of forest under the Bonn Challenge—roughly 38% of the country’s land area—yet the success of public planting projects on the ground has been poor (Moyo, Chikuni, & Chiwotha, 2017).

Malawi’s native forest is Miombo woodland, one of several savanna woodland ecotypes commonly found in sub-Saharan Africa (Chidumayo & Gumbo, 2010). Many endemic species are found in these native forests, and they are increasingly threatened by urban development, agricultural expansion and climate change as Miombo acreage continues to contract across southern Africa (Mwase, Bjørnstad, Bokosi, Kwapata, & Stedje, 2007). No commercial-scale timber harvesting occurs in Malawi’s Miombo woodlands due to restrictive government policies and degraded forest stocks (Zulu, 2010). Informal, largely unregulated foraging of Miombo forest materials for personal use is common in rural areas, including but not limited to the collection of downed wood for cooking fuel, and the harvest of wild fruit and other plant materials for consumption or medicinal uses (Chidumayo & Gumbo, 2010).

I identified prospective participants for the citizen focus groups within a cluster of nine villages in the Machinga District, along the base of the Zomba Plateau in southern Malawi. Household poverty rates throughout this area were very high at the time of this study. Though the focus groups captured participants from households across the rural poverty gradient, and some heterogeneity in asset holdings did exist, none of the households that were interviewed as part of a larger regional effort to understand forest resource dependence (J.M. Rhemtulla, A.R. Whittaker, L. Nerfa, & J. Timko, unpubl. data), or that I subsequently invited to participate in the focus groups, owned cars or had indoor plumbing. Less than 1% of the households interviewed had electrical service from the national grid.

The rural landscape was dominated by a mosaic of villages and agricultural fields along the lower slopes of the Zomba Plateau, with the Zomba–Malosa Forest Reserve encompassing the land at higher elevation (Figure 2a). The Miombo woodland ecotype that

FIGURE 1  (a) Example of intact Miombo woodland in the Majete Wildlife Reserve, southern Malawi, clearly illustrating the character of the understorey and canopy in this ecotype. Note that intentional thinning of the understorey had occurred in the foreground of the photo, in the vicinity of the Reserve’s tourist lodge. (b) The Zomba Plateau and surrounding landscape—the site of this study, and the area where the citizen focus group participants lived and worked. This entire region was historically dominated by Miombo woodland, but the hillsides, which fell within the Zomba–Malosa Forest Reserve, were nearly barren of woody species. The low trees seen in the foreground of the photograph were non-native fruiting species planted in the villages for food.
once characterized the region had been highly degraded under harvesting pressure in the forest reserve and practically replaced in the vicinity of the villages (Figure 2b). Introduced species of mango, eucalyptus, avocado, banana and bamboo were the dominant canopy and thicket species in the study area.

Above the elevation of the villages, the Zomba–Malosa Forest Reserve was subdivided into regional blocks and governed under a co-management regime. In the wake of government decentralization efforts that took place in the late 1990s, natural resource management agencies and local communities were said to be ‘partnering’ in restoration, landscape management, law enforcement and benefit-sharing on the reserve lands, though follow-up studies reported mixed outcomes (Chinangwa, Pullin, & Hockley, 2016; Mwase et al., 2007; Zulu, 2010). The management block of the Zomba–Malosa Forest Reserve that served participants in my focus groups had been heavily degraded by historic and contemporary timber and fuelwood harvesting, and illegal but largely unpoliced agricultural intrusion. The production of charcoal from timber, roots and forest slash to fuel higher-efficiency cooking stoves was also a major driver of landscape degradation and frequent cause of wildfires, though it was illegal (Zulu, 2010). The spatially dispersed, transient nature of charcoal production; multi-layered supply and distribution network; and widespread consumption made effective policing of these activities difficult. Market demand for charcoal was very high even in urban areas, where wealthy residents could afford this commodity to serve their cooking needs during the country’s frequent electrical grid outages.

2 | MATERIALS AND METHODS

I organized a series of eight focus groups in July 2016, engaging a total of 49 participants in a dialogue about why forest restoration efforts in their region had failed (Table 1). I separated the participants who lived in forest-adjacent villages from government staff and academics in the focus groups. Participants from village households were further divided by gender, age and experience in forest management or community leadership, to assess how these distinctions might influence their perspectives. Every focus group began with a Systems Thinking session to establish the importance of each participant’s contributions to the discussion, to encourage critical thinking and to elicit a shared awareness of the context of afforestation in the region. Building on this informal exercise, the facilitator guided the group through collaborative development of a Bayesian Belief Network to document participants’ perceptions of obstacles and solutions to forest restoration (Richards et al., 2013; Salgado et al., 2015; Tiller et al., 2013). The focus groups were structured around a problem-solution framework, motivated by two questions:

1. What has kept forest restoration in Malawi from being socially or ecologically successful? (Systems Thinking)
2. What is the one thing that will be critical to ‘get right’ in order for future restoration efforts to have socially and ecologically beneficial outcomes? (Bayesian Belief Network)

2.1 | Participant selection

Out of eight total focus groups, six were composed of citizens who lived in forest-adjacent villages, and two were composed of government staff or academics from the state-managed university (Table 1). Citizens had volunteered to participate in these focus groups during household surveys conducted in June and July 2016 (J.M. Rhemtulla, A.R. Whittaker, L. Nerfa, & J. Timko, unpubl. data). Surveyed households were randomly selected using a geospatial technique (Pearson, Rzotkiewicz, & Zwickle, 2015), and represented approximately 15%–20% of all households in the nine subject villages. Household survey respondents who volunteered for the focus groups were pooled based on demographic information obtained in the survey. I aimed to invite 7–10 participants to each focus group; if there were more than 10 volunteers, participants were randomly selected from the pool of volunteers. This target for focus group size aligns with earlier applications of participant-constructed Bayesian Belief Networks to natural resource management issues (Richards et al., 2013; Salgado et al., 2015; Tiller et al., 2013) and the broader literature on the applications of focus groups in social research (O.Nyumba, Wilson, Derrick, & Mukherjee, 2018). The intimacy of Bayesian Belief Network focus groups in comparison to the high participant counts expected under many other techniques commonly employed in natural and social science research reflects the inherent trade-off between participant number and participant heterogeneity when using this analytical approach (refer to Section 2.6 for additional information).

Notably, fewer male adults than female adults were participants in the household survey, and fewer volunteered for the focus groups, so in some cases it was not possible to reach target participation levels for male focus groups. Based on my informal observations during the household survey process, there appeared to be fewer adult men than women present in the villages. This may be a legacy of the country’s historically high AIDS infection and fatality rate, particularly for adult men during their prime working years or could reflect the social toll of circular migration in response to stochastic or declining crop yields (Johnson, 2017; Lewin, Fisher, & Weber, 2012; Mtika, 2007).

I divided citizen groups by gender because rural Malawians generally lived under a strongly patriarchal social structure, with a high proportion of households adhering to the Muslim faith. My goal was to ensure

| Focus group | Participants | Composition |
|-------------|--------------|-------------|
| GOVT        | Researchers  | Professional researchers at FRIM, faculty members at Chancellor College Biology Department |
|             | Practitioners| Staff at the Agricultural Extension, staff at the District Forestry Office |
| CITIZENS    | Male Experts | Men >18 who were or had been employed in forest management/enforcement; were or had been engaged in development of community forest initiatives; held public leadership or public service roles (excluding village headmen); or had a 4-year degree |
|             | Female Experts | Women >18 who were or had been employed in forest management/enforcement; were or had been engaged in development of community forest initiatives; held public leadership or public service roles (excluding village headwomen); or had a 4-year degree |
|             | Men Over 40 | Men >40; could include village headmen |
|             | Women Over 40 | Women >40; could include village headwomen |
|             | Men Under 40 | Men <39 |
|             | Women Under 40 | Women <39 |

*The District Forestry Office is the regional forest restoration, resource governance and enforcement body for the greater Zomba–Machinga region.

*Two women attended this group; they were encouraged to participate, but the data were analysed without their contributions.

*One woman attended this group; she was encouraged to participate, but the data were analysed without her contributions.
that women felt the freedom and confidence to share their thoughts openly, with each other and with the group facilitator, in a cultural environment where women are often expected not to speak openly in the presence of men. I was particularly interested in women’s perspectives on forest restoration failure because they are intimately familiar with natural resource conditions as the household’s low-skilled forest and farm labourers; they face distinct and gendered livelihood barriers; and they have an otherwise limited voice in household and community decision-making (Kiptot & Franzel, 2012; Pouliot & Treue, 2013).

I also divided citizen groups along lines of age to explore whether participants born prior to Malawi’s liberation from colonial rule and the subsequent population and deforestation boom perceived the factors playing into afforestation failure differently than younger generations, or envisioned different solutions. Ideally, this would have meant using an age greater than 50 as a selection boundary, but in a country where the average life expectancy hovers between 50 and 60 years, very few elders were captured by the randomized household survey or volunteered to participate in the focus groups. By lowering the age cut-off to 40, I was able to approach the target group size while still capturing a subpopulation that had lived through the immediate post-colonial period.

Participants in the government focus groups were identified by a local research liaison at the Forestry Research Institute of Malawi (FRIM) as regional experts on the state and challenges of reforestation. I divided these participants into those drawn from research-oriented agencies and academia (‘Researchers’), and those employed in applied conservation agencies (‘Practitioners’). Though many participants initially confirmed attendance in the Practitioners group, the event had to be rescheduled due to facilitator illness, and turnout on the new date was low. However, the two participants were engaged, well-informed and worked closely with rural communities in their official capacities. I welcomed the opportunity to learn from this expertise, though I acknowledge that the results are less representative than those generated by larger groups.

In general, small or inconsistent focus group size was the primary weakness of this study and the single largest challenge to using this methodological approach in a field setting in a developing country. I encourage readers seeking to replicate this approach in other developing countries to plan proactively for the numerous potential barriers to robust participation, including but not limited to language or dialect barriers; reliance on local liaisons to deliver oral invitations; inaccurate recall of the details of these oral invitations; lack of basic literacy in many adults which prevented implementation of written invitations; the absence of time-keeping devices, or means of powering time-keeping devices, from many households; lack of reliable public transportation service in rural areas; lack of private vehicles; local customs (e.g. in the region of this study, it was generally considered acceptable for a female householder to attend in the place of an invited male householder if he had pre-existing commitments as a financial provider for the family); the timing of daily or weekly religious practices for multiple faith traditions; and potentially conflicting care-giving responsibilities for women. Despite my efforts to mediate the effects of these participation barriers, I recognize that they did impact focus group turnout to some extent, and that additional precautions might have been implemented to better control for them.

2.2 | Focus group facilitation

The same focus group script was used for each group, and the script had been approved by the University of British Columbia’s Office of Research Ethics. All participants were provided with a consent form in their preferred language (English or Chichewa) which detailed the purpose of the study and the way the data would be used. The focus group facilitator read the consent form aloud, and each participant affirmed their informed consent to proceed with the focus group by signature or mark. The focus groups for Researchers and Practitioners were facilitated in English, while the citizen groups were facilitated by native Chichewa speakers.

The focus group script was designed to be completed in 2 hr. The facilitator began each session by emphasizing to participants that there were no right or wrong answers in the discussion, and that the focus group was an opportunity for the research team to learn from their experience and knowledge. The facilitator stressed that participants’ perspectives would be invaluable in identifying potential areas of change that could increase reforestation project success and ensure that future projects better reflected the values of diverse stakeholders.

2.3 | Understanding reforestation as a socioecological system

The Systems Thinking session was a discussion of the socioecological system in which prior reforestation efforts had taken place, as perceived by the participants. The facilitator presented eight prospective ‘drivers’ of the reforestation system—factors that influence outcomes of the system, but are not directly influenced by the system—to guide the discussion. The drivers were identified through literature review and expert consultation: management, money, livelihoods, public access, enforcement, climate change, poverty and politics. Participants were encouraged to discuss each driver, and the relationships between drivers, in the context of the question, “What has kept forest restoration in Malawi from being socially or ecologically successful?” Participants could define additional drivers if needed, but the eight primary drivers adequately framed the dialogue in most focus groups.

Drivers were drawn on a large chart as bubbles radiating from the central issue of ‘reforestation’. During the discussion, each system dynamic described by a participant was summarized by the facilitator on a sticky note and then placed near the primary driver(s) the participant related it to. Related ideas were aggregated to form ‘rays’, which was useful in stimulating additional discussion, and in helping participants to arrive at a shared view of the socioecological system before moving forward to the development of a Bayesian Belief Network.2
2.4 | Development of a user-defined Bayesian Belief Network

After 45 min of Systems Thinking discussion, the facilitator transitioned to the Bayesian Belief Network session. The goal was for participants to identify the central challenge to reforestation success (‘primary issue’) and posit solutions to it. To isolate the primary issue, the facilitator asked participants to reflect on the preceding discussion, and to collectively answer the question, “What is the one thing that will be critical to “get right” in order for future restoration efforts to have socially and ecologically beneficial outcomes?”

When participants had agreed on a primary issue, the facilitator prompted them to identify the three most important factors that influenced the outcome of that issue, adding these to the network as first-order determinants (Figure 3). Then, the facilitator prompted the group to identify the three most important factors that influenced the outcome of each of the first-order determinants; these are referred to as second-order determinants. The result was a hierarchical network with 13 nodes (depicted as boxes in Figure 3) on three levels. Following the example of a previous application of this method in a developing country, I constrained network development for all of the focus groups to this format to limit the analytical complexity of the Bayesian Belief Network, and to improve the likelihood that the final network represented a collaborative agreement among participants on the most critical factors (Salgado et al., 2015).

Finally, the facilitator would prompt participants to define what a positive or desirable outcome would look like for each node, and what a negative or undesirable outcome would look like. I constrained each node to only two states—one positive and one negative—which had to be mutually exclusive (Kjærulff & Madsen, 2013).

![Figure 3: Structure of the user-defined Bayesian Belief Networks, given the constraints that were imposed on node number to limit complexity](image)

2.5 | Development of Conditional Probability Tables

Once participants had developed their Bayesian Belief Network, I generated a set of four Conditional Probability Tables during each focus group; one for the primary node, and one for each of the first-order determinants. The Conditional Probability Tables present the eight possible combinations of the respective parent node states (Table 2). The facilitator read each combination aloud as a scenario, asking participants to indicate their belief in the probability of a positive outcome under those conditions. Each participant completed this portion of the session independently by marking a ballot, which was designed to be accessible to participants who might have only basic literacy and quantitative reasoning skills. Each line of the ballot was a bar marked with 100 increments. Participants were shown how to draw a continuous line, from left to right, to indicate their view of the probability of a positive outcome. The facilitator demonstrated and provided several samples, explaining how a longer line meant the outcome was more likely to be positive, and a shorter line meant it was less likely to be positive. A second translator was present at each of the citizen focus groups to provide assistance and clarification to individual participants as needed. Each participant was presented with a total of 32 scenarios; eight in which the primary issue was the child node, and eight for each of the first-order determinants.

In a Bayesian Belief Network, each node is independent. The probabilities for all states of a given node sum up to 1.0 (100%), but there are no additive properties among nodes. It is therefore plausible that participants could be very optimistic about the probability of positive outcomes for first-order determinants, and yet assign a low probability to the positive outcome of the primary node or vice versa. Rationally, this could be an indicator that participants believe that the first-order determinants do not capture all of the variables in the real world that would have to align to effect positive change. Alternately, an individual may have chosen one or more determinants differently than the group did, and thus they feel that a key

| Scenario | Parent 1 State | Parent 2 State | Parent 3 State | What is the probability of a positive state for child node? |
|----------|----------------|----------------|----------------|----------------------------------------------------------|
| 1        | Positive       | Positive       | Positive       | 1 - p<sub>positive</sub> state                           |
| 2        | Positive       | Positive       | Negative       | Positive                                                 |
| 3        | Positive       | Negative       | Positive       | Negative                                                 |
| 4        | Positive       | Negative       | Negative       | Positive                                                 |
| 5        | Negative       | Positive       | Positive       | Negative                                                 |
| 6        | Negative       | Positive       | Negative       | Positive                                                 |
| 7        | Negative       | Negative       | Positive       | Negative                                                 |
| 8        | Negative       | Negative       | Negative       | Negative                                                 |
determinant of the outcome is absent from the network. In any case, this should not be considered a logical inconsistency or flaw in the network. It simply reaffirms the highly complex nature of socioecological systems, and the coordination of many factors required to alter real-world outcomes. Striking a balance between focus group size and heterogeneity of perspectives is one of the challenges of developing user-defined Bayesian Belief Networks.

2.6 | Bayesian Belief Network analysis

I analysed the Bayesian Belief Networks in Netica (Norsys, 2016) using a conjugate gradient descent algorithm. I also ran sensitivity analyses on the primary node of each Bayesian Belief Network to identify the determinants in each network that exerted the greatest influence on the outcome of the primary node. Additional notes on model parameters are available in Appendix S1 of the Supporting Information for this article.

3 | RESULTS

Across lines of age, gender and experience, seven out of eight stakeholder focus groups converged on poverty as the primary hurdle to afforestation success, although they may have defined positive outcomes differently (Table 3). Sensitivity analysis revealed that first-order determinants related to agricultural practice improvement were the most influential factors in determining the outcome of poverty alleviation for four out of the eight groups, followed by factors related to non-forest employment opportunities, which were influential for two groups. The stakeholder-defined Bayesian Belief Networks for each focus group are presented in the following subsections, and the definitions and implications of emergent patterns are examined in the Discussion that follows in Section 4.

3.1 | Government: Researchers

Researchers identified Reforestation Includes Community Benefits as critical to the success of future forest restoration efforts (Figure 4), but they were among the least optimistic that the primary issue was tractable (31.9%). They were more optimistic about the likelihood of positive outcomes for the first-order determinants, assigning an average probability of 48.0% to Alternative Livelihoods being available and viable, 50.1% to Enforcement being effective and 51.2% to Forest Management being valued. Sensitivity analysis revealed that the state of Reforestation Includes Community Benefits was most strongly influenced by the state of Alternative Livelihoods.

3.2 | Government: Practitioners

Practitioners identified Poverty Alleviation as critical to the success of future forest restoration efforts (Figure 5), and were among the most optimistic about the likelihood of a positive outcome for their primary issue (60.2%). They were less optimistic about

### TABLE 3 Primary issues and first-order determinants of a positive outcome across all focus groups, where (*) indicates the factor identified through sensitivity analysis as having the greatest influence on the outcome of the primary issue. Note that first-order determinants are not ranked in this list; the list order simply mirrors the structure of each Bayesian Belief Network.

| Focus group | Primary issue identified | First-order determinants |
|-------------|--------------------------|--------------------------|
| GOV'T | Researchers | Reforestation Includes Community Benefits | Alternative Livelihoods\* Enforcement Forest Management |
| Practitioners | Poverty Alleviation | Alternative Livelihoods Family Planning Improved Agricultural Practices\* |
| CITIZENS | Male Experts | Poverty Alleviation | Employment Opportunities\* Ending Corruption and Greed Small Business Empowerment |
| Female Experts | Poverty Alleviation | Irrigated Agriculture Small Business Loans\* Youth Activities |
| Men Over 40 | Poverty Alleviation | Education Improved Agricultural Practices\* Small Businesses |
| Women Over 40 | Job Availability for Poverty Alleviation | Paying Forest Jobs Improved Agriculture\* Small Business Loans |
| Men Under 40 | Poverty Alleviation | Business Opportunities Employment Opportunities Agricultural Practices\* |
| Women Under 40 | Poverty Alleviation | Business Opportunities Employment Opportunities\* Improved Agricultural Practices |
positive outcomes for the first-order determinants, assigning an average probability of 46.8% to Alternative Livelihoods being viable, 50.0% to Family Planning being adopted and 43.6% to Improved Agricultural Practices being adopted. Sensitivity analysis revealed that the state of Poverty Alleviation—specifically, whether sufficient resources were available to alleviate poverty—was most strongly influenced by the state of Improved Agricultural Practices.

3.3 | Citizens: Male Experts

Male Experts identified Poverty Alleviation as critical to the success of future forest restoration efforts (Figure 6), but they were not optimistic that the primary issue was tractable (49.9%). They were similarly equivocal about the likelihood of achieving the first-order determinants, assigning an average probability of 50.0% to Employment Opportunities being high, 57.3% to Ending Corruption and Greed and 50.0% to Small Business Empowerment being available. Sensitivity analysis revealed that the outcome of Poverty Alleviation was most strongly influenced by the state of Employment Opportunities.

3.4 | Citizens: Female Experts

Female Experts identified Poverty Alleviation through job availability as critical to the success of future forest restoration efforts (Figure 7), but they were not optimistic about the likelihood of a positive outcome (44.8%). They were slightly more optimistic about the likelihood of positive outcomes for some of the first-order determinants, assigning an average probability of 44.5% to Irrigated Agriculture being available, 48.4% to Small Business Loans being available and 48.4% to Youth Activities being available. ‘Activities’ is a cumbersome translation from Chichewa and can be better understood in this context as ‘broad interventions in vocational training and capacity-building for future employment of young people’. Sensitivity analysis revealed that the state of Poverty Alleviation—effectively, whether jobs were available or not—was most strongly influenced by the state of Small Business Loans.
3.5 | Citizens: Men Over 40

Men Over 40 identified **Poverty Alleviation** as critical to the success of future forest restoration efforts (Figure 8). Of all the focus groups, this group was the most optimistic that the primary issue was tractable (62.3%). Participants were equivocal about the likelihood of positive outcomes for the first-order determinants, assigning an average probability of 48.4% to **Education** being high quality, 50.0% to **Improved Agricultural Practices** producing high yields and 50.5% to **Small Businesses** being viable employers. Sensitivity analysis revealed that the state of **Poverty Alleviation**—in this case, whether self-sufficiency was achieved or not—was most strongly influenced by the state of **Improved Agricultural Practices**, though the relationship was weak.

3.6 | Citizens: Women Over 40

Women Over 40 identified **Job Availability for Poverty Alleviation** as critical to the success of future forest restoration efforts (Figure 9), but viewed the primary issue as very unlikely to have a positive outcome (21.3%). They were more optimistic about the likelihood of achieving positive outcomes for the first-order determinants, assigning an average probability of 51.0% to **Paying Forest Jobs** being available, 43.4% to **Improved Agriculture** being available and 58.1% to **Small Business Loans** being available. Sensitivity analysis revealed that the outcome of **Job Availability** for **Poverty Alleviation** was most strongly influenced by the state of **Improved Agriculture**.
of a positive outcome for their primary issue (15.8%). They had a negative outlook on the likelihood of achieving positive outcomes for the first-order determinants as well, assigning an average probability of 33.0% to Business Opportunities being viable, 39.3% to Employment Opportunities being numerous and 38.0% to Agricultural Practices resulting in high yields. Interestingly, Men Under 40 were one of only two groups to include factors relating to the establishment and success of factories as determinants of Employment Opportunities. Sensitivity analysis revealed that the outcome of Poverty Alleviation was most strongly influenced by the state of Agricultural Practices.

3.8 | Citizens: Women Under 40

Women Under 40 identified Poverty Alleviation as critical to the success of future forest restoration efforts (Figure 11), but they were not optimistic about the probability of a positive outcome (30.1%). They were equally pessimistic about the likelihood of achieving the first-order determinants, assigning an average probability of 33.4% to Business Opportunities being viable, 36.9% to Employment Opportunities being high and 32.9% to Improved Agricultural Practices resulting in high yields. This was the second group to include the availability and viability of factory jobs among the determinants of Employment Opportunities, following the Men Under 40 focus group. Sensitivity analysis revealed that the state of Poverty Alleviation—effectively, whether self-sufficiency is achieved or not—was most strongly influenced by the state of Employment Opportunities.

FIGURE 10 Bayesian Belief Network developed by the Men Under 40 focus group

FIGURE 11 Bayesian Belief Network developed by the Women Under 40 focus group

4 | DISCUSSION

Ambitious global reforestation goals may bode well for biodiversity conservation and climate change mitigation on paper, but often incite conflict with resource-dependent communities on the ground. In southern Malawi, government-backed forest landscape restoration efforts largely faltered over the years leading up to this study, and a new approach to engaging poor communities with high forest product reliance in co-envisioning solutions to afforestation challenges was needed. Through eight focus groups structured around participatory construction of Bayesian Belief Networks, I endeavoured to understand the causes of reforestation failure and the essential conditions for enabling future forest landscape restoration success, through the eyes of diverse groups of stakeholders. These conversations yielded important findings for Malawi to consider as it endeavours to meet its Bonn Challenge commitments, and more broadly, to make strides towards sustainable development, including achievement of SDGs 13 and 15, CBC Aichi Target 15, the UNFCCC REDD+ goal and the Rio + 20 land degradation neutrality goal. Most notably, seven of the eight focus groups identified poverty alleviation as the primary issue in their Bayesian Belief Network—the most critical factor to ‘get right’ in order for future reforestation efforts to have socially and ecologically beneficial outcomes.

It cannot be overstated that these focus groups represented a vast spectrum of ages, educational attainment, livelihoods, personal wealth and residential environments. Government representatives were college-educated and lived in gated enclaves in a comparatively urbanized community (Zomba), while citizen participants from rural villages may or may not have completed primary school, and often lived with...
Multiple generations of their family in single-room, mud-brick dwellings. Even among citizen groups, there was broad variation in the life experience of participants, from village leaders, forest rangers and local police officers to agricultural labourers and grandmothers bringing up their orphaned grandchildren. Though individual focus groups may have defined a successful outcome for the primary issue in different terms, Government Practitioners and all six citizen groups agreed that poverty is the principal hurdle to successful forest restoration, and that forest product extraction is a symptom of need rather than preference. As one participant expressed it, 'if there was no poverty, nobody would be exploiting the forest'. This insight underscores the value of forests as a coping mechanism (Kalaba, Quinn, & Dougill, 2013) and a form of insurance (Fisher & Shively, 2005), though falling back on forest resources may not be the only strategy the poor can employ to survive unexpected hardships (Wunder, Börner, Shively, & Wyman, 2014). The convergence around poverty as a hurdle to forest landscape restoration also reinforces earlier work which suggests that a virtuous cycle of poverty alleviation is possible when interventions target the livelihood needs of stakeholders as a means of enabling long-term forest restoration (Sreedharan & Matta, 2010).

Furthermore, there was a remarkably high convergence among these disparate stakeholder groups around three broad categories of critical development interventions. Across lines of gender, age and expertise, stakeholders who had identified poverty alleviation as the primary issue in their Bayesian Belief Network believed that first-order determinants related to (a) small business capacity-building (seven of seven groups), (b) improved agriculture (six of seven groups) and (c) non-forest employment (three of seven groups) were important factors in overcoming future restoration challenges (Figure 12). Two focus groups also cited forest-based employment as being important, though one of these had not identified poverty alleviation as the primary issue. While this represents only 25% of the focus groups, it suggests that some stakeholders could envision the forest reserve playing a role in a new, post-dependence economy.

Interestingly, Government Researchers were the only focus group participants who did not collectively choose poverty as the primary issue in their Bayesian Belief Network. Researchers defined the primary issue in their Bayesian Belief Network as ‘reforestation includes community benefits’. Unlike the other seven groups, who saw the major challenge to restoration as something exogenous—poverty—Researchers viewed the major challenge as being endogenous, stemming from flawed design and implementation of restoration projects. In other words, Researchers seemed to perceive the biggest issue as a structural rather than a social problem.

In their view, if restoration projects were tied more effectively to other types of government development projects, the government could incentivize higher compliance with forest reserve enforcement by providing law-abiding households with livelihood benefits through other government programmes, and denying benefits to households that violated forest regulations (refer to Appendix S2 of the Supporting Information for a more complete recounting of their justification for the primary issue). When developing the Bayesian Belief Network, Researchers therefore framed solutions as arising out of improvements to project design and implementation practices. In contrast, the other seven focus groups built their Bayesian Belief Networks on the premise that reforestation would succeed only after forest-dependence for livelihoods and sustenance was effectively lessened through investments in human capital and economic development in rural communities.

This subtle distinction in problem-framing translated into very different portfolios of interventions when focus groups began identifying first-order determinants—the factors most likely to influence the outcome of the primary issue. First-order determinants proposed by Government Researchers were the least like those proposed by other groups (Figure 12). Researchers were the only focus group that included forest enforcement as a first-order determinant, and the only group that did not include a first-order determinant related to small business capacity-building. In the absence of a durable process for stakeholder participation in forest landscape restoration governance, this divide in perception could be highly problematic given that research agencies play a large role in shaping policy, planning and programme implementation at the regional and national level in Malawi.
The other focus groups’ insistence on the importance of small business capacity-building focused squarely on needs for training and access to start-up capital or growth financing. This accords with an expanding body of work that spotlights the potential of entrepreneurship training and improved capital access networks to accelerate stable growth of small and medium enterprises (SMEs) and local economies in sub-Saharan Africa (Mensah & Benedict, 2010; Okpara, 2011). When discussing the second-order determinants of this kind of business capacity development, two groups of female citizens (Female Experts and Women Over 40) identified the formation of community savings and microfinance cooperatives as important factors, rather than expecting development of such programmes from financial institutions. Such programmes have shown considerable promise in other countries in the region, though the full realization of this growth potential is unlikely to be experienced without a shift in institutional and social norms, including an increase in women’s educational access and attainment, and cultural support for women to own land and enterprises (Mbaruku & Mutalemwa, 2015; Ondiba & Matsui, 2019; Siringi, 2011).

Agricultural improvement was another issue that transcended divides of age, gender and experience. Stakeholder groups that raised this as a critical component of poverty alleviation almost unanimously included subsidized or free seed or fertilizer among the determinants of success. Positive perception of these kinds of interventions attests to the overall successes of Malawi’s farm input subsidy programme, which evolved from a hotly contested political move to a model programme for other sub-Saharan nations. Despite its flaws, which have included uneven benefit distribution, it has achieved pro-poor growth in agricultural production, local commerce and international exports (Arndt, Pauw, & Thurlow, 2016; Chibwana, Shively, Fisher, Jumbe, & Masters, 2014). Initial analysis also documented forest-sparing behaviour in recipient households in cases where agricultural intensification on existing land alleviates the need for additional land-clearing to support crop yields (Chibwana, Jumbe, & Shively, 2012). Extension and structural improvement of the programme has been recommended by programme evaluators, and would seem to be favoured by many participants in these focus groups as well (Arndt et al., 2016). It is notable that sensitivity analysis identified first-order determinants related to agricultural practice improvement as the most influential factors in the outcome of poverty alleviation for four out of the eight groups—the highest frequency of any single determinant.

Finally, various types of non-forest employment were recognized by multiple groups as important factors in poverty alleviation. Of the three groups that defined a first-order determinant that fell into this category, two groups (Men Under 40, Women Under 40) contained the youngest contingent of participants, including some focus group members who were in their late teenage years. Both groups went on to define the outcome of this determinant as depending on the successful establishment and operation of factories that would cultivate a new workforce. Despite the nearly sacrosanct view in the development community that foreign direct investment and industrialization are economic boons in countries struggling to escape poverty (Dinh, Palmade, Chandra, & Cossar, 2012), recent work has hinted caution. Even after broad shifts towards industrialization, staying abreast of technological changes and maintaining a competitive edge can be an enduring challenge for underdeveloped nations, particularly under regressive political climates (McCartney, 2016), and the emphasis on attracting foreign direct investment may ultimately undermine efforts to bolster SMEs (Van Der Ven, 2018).

When comparing all of the focus groups, optimism about positive outcomes for the primary issues in Bayesian Belief Networks ranged from 15.8% to 62.3%, with Men Under 40 expressing the lowest probability of a positive outcome, and Men Over 40 expressing the highest (Figure 13). All three female groups were compressed in a tight range of average probabilities from 21.3% to 44.8%. Government Researchers were far more pessimistic than Government Practitioners, but given that they had chosen a different primary issue than the other seven groups, direct comparison is not relevant. Bearing in mind that each focus group’s Bayesian Belief Network composition was unique, this optimism spectrum generally supports past work on the links between social agency or freedom of choice and feelings of self-determination (Alkire, 2005; Sen, 1985). Groups of participants with greater agency tended to have a more optimistic view of the future in this comparison, and groups with limited agency tended to take a pessimistic outlook.

Participants in the Men Under 40 and Women Under 40 focus groups, many of whom were in their late teenage years, were living through the emergent youth unemployment crisis in sub-Saharan Africa. Their pessimism about the future seems consistent with structural inequities facing rising generations, and the failure of development interventions to adequately address the dearth of employment opportunities for the future workforce (Hajdu, Ansell, Robson, & van Blerk, 2013; Page & Shimeles, 2015). The agency of young women is further reduced by the spatial constraints surrounding marriage in many African cultures (Ansell, van Blerk, Robson, & Hajdu, 2012).

In that vein, all three female groups fell below Male Experts and Men Over 40 on the scale. This negative outlook may broadly relate
to the fact that women constitute the majority of the agricultural workforce, and as such have an intimate understanding of the impacts of climate change, yet are commonly afforded lower educational opportunities and fewer socioeconomic avenues to change their circumstances due to gender inequities (Anyanwu & Augustine, 2013; Huyer, 2016; Kiptot & Franzel, 2012). However, the Female Experts in this study—those who had college education, forest management experience or public service experience—were the most optimistic of the female groups. This underscores that education and experience in leadership may increase women’s real or perceived self-determination, a phenomenon which has been previously described in other contexts (Wilson, Kickul, & Marlino, 2007), and is worthy of further study in the scope of its implications for forest resource management (Coleman & Mwangi, 2013).

In a patriarchal culture, it is not surprising that Men Over 40 would be the most optimistic citizen group. They likely enjoyed positions of patriarchal leadership in the household and the community, and may have had larger landholdings in comparison to other community members, inherited during or after the colonial period. This demographic is afforded greater agency than other citizens in the Malawian context, which I would expect to see reflected in a more positive outlook about their future.

Considering the results of this case study in a broader context, Malawi is not alone in its struggles to gain traction on afforestation under a devolved management framework. Numerous examples illustrate the failures of resource governance decentralization efforts in other African countries (Bouda, Savadogo, Tiveau, & Ouedraogo, 2011; Bratton, 2012; Ribot, Lund, & Treue, 2010). However, given Malawi’s very public commitments to forest landscape restoration under the Bonn Challenge, it will be necessary to holistically reform this failed model in order to achieve the pledged forest coverage and reap the benefits of carbon capture. In the new paradigm, it will be critically important to effectively engage a broad community of stakeholders and to provide a durable participatory process for channelling their insights into an inclusive policy-making process (Cvitanovic, McDonald, & Hobday, 2016; Redpath et al., 2013). Substantive engagement between government and the communities who live with and off of forests, and explicit incorporation of these communities’ livelihood needs into afforestation planning and implementation, may be pivotal in realigning decentralized resource management to achieve forest landscape restoration and emissions reduction targets (Sreedharan & Matta, 2010). Finally, it will be essential to unleash the potential of women as cultural influencers and leaders in forest resource management in order to improve afforestation project longevity, increase social impacts and mediate productive, peaceable collaborations (Agarwal, 2009; Coleman & Mwangi, 2013; Leisher et al., 2016).

5 | CONCLUSIONS

Globally, halting deforestation and implementing forest landscape restoration is a critical factor in arresting climate change, safeguarding biodiversity and protecting a range of ecosystem services that are critical to the survival of the human species. Forest restoration has therefore been elevated to the national agenda for many countries, yet throughout the developing world, government commitments to afforestation and plans for implementing projects on the ground often fly in the face of local livelihood and subsistence needs, leading to entrenched conflicts and lose–lose situations for forests and impoverished communities. The forest landscape restoration literature has called for inclusive approaches to pursue the global reforestation agenda but offers few practical examples of how to achieve this.

Using an approach that has facilitated collaborative planning in other natural resource contexts, I developed a series of eight focus groups structured around Systems Thinking and stakeholder-defined Bayesian Belief Network development to engage residents of forest-reliant communities, academic researchers and government research and extension staff in southern Malawi in a dialogue about why restoration is failing, and how to turn the tide. My goal was to explore the conditions of past restoration failure, identify the barriers to future reforestation success and elicit proposed solutions. Through the focus groups, these disparate stakeholders—ranging from national government workers who had high levels of agency and high comparative wealth to citizens living in rural villages who had low levels of agency and very low comparative wealth—were provided an opportunity to ‘sit around the same table’ conceptually. Across lines of age, gender and experience, seven of these diverse groups independently agreed on a single challenge to forest restoration: poverty. They also concluded that government afforestation efforts were futile without coordinated, strategic investment in human capital and economic development in rural communities, shifting subsistence pressure away from public forest lands. Furthermore, stakeholder groups frequently cited the same three broad categories of interventions as critically influencing the tractability of poverty alleviation: (a) small business capacity-building (seven of seven groups), (b) improved agriculture (six of seven groups) and (c) non-forest employment (three of seven groups).

Though this study covered a limited geographic area, it yielded important lessons for Malawi and other nations endeavouring to reverse land degradation and restore functional forest ecosystems. A historically narrow focus on tree-planting activities has resulted in large public expenditures with small public returns. If Malawi is to meet its ambitious commitments under the Bonn Challenge, and more broadly, to advance towards sustainable, inclusive development, the government must find new approaches to create the enabling conditions for reforestation success. This work strongly suggests that those enabling conditions are socioeconomic, rather than being ecological or structural.

It is therefore notable that the focus groups illuminated a striking distinction in the way that researchers in academia and government framed the primary challenge to afforestation, and strategized to overcome it, in comparison to the way that community members and practitioners did. Researchers were the only focus group that seemed to perceive the greatest barrier to forest restoration as a structural rather than a social problem. This clearly illustrates why the establishment
of inclusive, durable participatory processes to foster examination of deeply held values, communication, trust, transparency and equity among stakeholders is so essential to averting conservation conflict by encouraging collaborative identification of problems and formation of solutions (Madden & McQuinn, 2014; Redpath et al., 2013). Ultimately, attainment of global afforestation targets will hinge on our collective ability to transform conservation conflicts into opportunities to advance forest restoration practices that are reflective of local ecological conditions, shaped by livelihood needs and cultural values and endorsed by stakeholders.

Building on this initial application of a coupled Systems Thinking-Bayesian Belief Network approach to forest landscape restoration planning, future research needs to address two areas: (a) the extension of participatory engagement structured around Systems Thinking and Bayesian Belief Networks to other community clusters and regions, and (b) the systematic, iterative development, updating, and version testing of one or more stakeholder-defined Bayesian Belief Networks at the sub-national or national level to guide forest landscape restoration policy and implementation standards (Marcot, Steventon, Sutherland, & McCann, 2006; Richards et al., 2013). Though scaling up this approach and incubating consensus on a regional scale will undoubtedly present numerous challenges, my findings suggest that this approach is a worthy methodological addition to the conservation social scientist’s toolbox, and a viable path towards defining and overcoming the barriers to forest landscape restoration at scale.

ACKNOWLEDGEMENTS
I am grateful to Jeanine Rhemtulla for her intellectual guidance and financial support for the study; Hugo Salgado Cabrera and Joleen Timko for constructive feedback during development of the focus group script; Willie Sagona, Silekiwe Mwenelupembe, Wezi Phiri and Mcmillan Saddick for their skilled and tireless support with cultural outreach, facilitation and translation; Queen Elizabeth Scholars Hannah Crisp and Caitlin Laidlaw for their hard work and unflagging cheerfulness in the field and the laboratory; all the focus group participants for giving their time and knowledge generously; and the Forestry Research Institute of Malawi for enabling and supporting the initial household survey research and this focus group series. Two anonymous reviewers provided insightful comments on earlier versions of this manuscript that materially improved the theoretical framing and presentation, and I extend my sincere thanks for their feedback. This study was supported by a UBC Hampton Fund Grant.

CONFLICT OF INTEREST
The author has no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT
Data deposited in the Dryad Digital Repository https://doi.org/10.5061/dryad.zs7h4j5b (Whittaker, 2020).

ENDNOTES
1 The Bonn Challenge was initiated in 2011 by the German Ministry of the Environment and the International Union for Conservation of Nature (IUCN), who together ‘challenged’ world leaders to collectively achieve 150 million hectares of forest landscape restoration by 2020. This effort aimed to push governments beyond nodding assent with existing international goals (including SDGs 13 and 15, CBC Aichi Target 15, the UNFCCC REDD+ goal, and the Rio + 20 land degradation neutrality goal) into setting specific land-cover targets in their jurisdictions and taking action on the ground. The Bonn Challenge was recognized as an action item at the 2014 UN Climate Summit, resulting in the New York Declaration on Forests, which raised the challenge’s original goal to include up to 200 million additional hectares of global forest landscape restoration by the year 2030. Land restoration pledges of corporations, indigenous peoples and civil society groups are counted alongside those of countries as steps toward achieving the global acreage goals. Additional pledges towards meeting these goals were made at the 2014 COP (Lima) and the 2015 COP (Paris), and the IUCN-founded Global Partnership on Forest Landscape Restoration continues to actively solicit new members and pledges. Member organizations receive guidance on grant funding and incentive opportunities; access to technical assistance, including land suitability assessments and insights on restoration best practices; and support in crafting a business case for restoring degraded and deforested lands for their multiple benefits to humans and ecosystems.
2 I deviated from the methodological approach used in the studies that inspired this research approach during the Systems Thinking session (Richards et al., 2013; Salgado et al., 2015; Tiller, Gentry, & Richards, 2013). I simplified it to the concept-grouping chart described here for two reasons: (a) local advisors and other researchers who had worked in the area suggested that a focus group should be no longer than 2 hr to minimize lost wages for the citizen participants and (b) many citizen participants had limited literacy skills. After piloting the network mapping component in an early focus group, I was concerned that the extra step of drawing and labelling concepts to ensure that attendees with limited literacy could still participate fully. Streamlining this activity also allowed the facilitator to focus more time on supporting participants in constructing their Bayesian Belief Network, which I saw as the core analytical component of the study. This shortcut was effective in my field context, but I encourage readers who are considering using an integrated Systems Thinking-Bayesian Belief Network approach to refer to earlier studies for a more complete description of the Systems Thinking activity.
3 Poverty alleviation may not have been the only issue which stakeholders viewed as deeply problematic to afforestation success; rather, it may have been the only issue on which they could unanimously agree. By constraining the focus groups to address only a single primary issue during the Bayesian Belief Network session, I effectively narrowed the breadth and nuance of the Systems Thinking discussions to a single point. For a richer context in which to consider the Bayesian Belief Network developed by each group of stakeholders, I urge readers to refer to Appendix S2 of the Supporting Information, where I have used a combination of audio and visual recording techniques, supported by the invaluable assistance of skilled local translators, to capture and summarize the Systems Thinking sessions into narratives. These narratives have been rephrased and reorganized in an effort to present the major points under discussion as clearly as possible to an English-speaking audience.
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**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section.

**How to cite this article:** Whittaker AR. Why we fail: Stakeholders’ perceptions of the social and ecological barriers to reforestation in southern Malawi. *People Nat.* 2020;2:450–467. https://doi.org/10.1002/pan3.10084