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Reforesting the grasslands of Papua New Guinea: The importance of a family-based approach

Jack Baynes [a, *], John Herbohn [a], William Unsworth [a, b]

[a] University of the Sunshine Coast, Sippy Downs, Qld, 4556, Australia
[b] New Britain Palm Oil Limited, Ramu, Papua New Guinea

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ABSTRACT

The complexities of Melanesian customary land tenure greatly influence the adoption of community-based reforestation (CBR) in Papua New Guinea (PNG). CBR has recently become a focus for the PNG government due to declining yield from native forests which has renewed attention on developing timber plantations to augment villagers' livelihoods. In this paper, we investigate the factors which affect adoption of timber tree-growing by farmers and communities. We assess the efficacy of a policy frequently employed by non-government organisations (NGOs) in which single or multi-clan based seedling nurseries are used to encourage tree growing. A key finding is that people's need for technical assistance is subordinate to social and cultural factors, principally the need for community harmony. Farmers' motivation to plant trees is adversely influenced by uncertainties inherent in PNG's system of customary land tenure. Interventions – in this case extension assistance to grow trees – may create or exacerbate intra- and inter-clan conflict by bringing long term uncertainties into short term focus. For villagers in PNG, as in other cultures, we conclude that key enabling conditions for collective action revolve around strengthening villagers' bridging social capital in a manner which is sensitive to their longstanding social traditions. Targeted, do-it-yourself, family assistance may be as effective as attempts to encourage collective action. The implications of our findings for Forest Landscape Restoration (FLR) which envisages a participatory approach to community engagement, are that cross-community initiatives may not be feasible without extensive investment in building social capital. Initiatives targeted at families or family-groups may be most successful.

1. Introduction

Increasing the adoption of CBR[1] depends (*inter alia*) on supportive government or NGO policy. In PNG, government policy relating to CBR is not well developed because until recently, the focus of the PNG Forest Authority (PNGFA) has been on managing native forest. As one of the few industries which operate in remote areas, native forest harvesting has provided one of the few ways rural people can enter the formal workforce and earn wages (PNGFA, 2007). However, declining revenue because of overharvesting, has refocused attention on plantations, such that timber plantations now are part of the PNG Medium Term Development Plan 2 (DNPM, 2015). In the National Forest Plan, the role of the PNGFA is described as 'develop and maintain community forestry with the view of empowering … communities in … woodlot farming' (NFP, 1991). A 'white paper[2] which partly dealt with agroforestry and small-scale woodlots, was produced by the Ministry of Forests in 2004, but subsequently withdrawn. Apart from this broad statement of intent, little detailed policy has been promulgated by the PNGFA relating to how CBR might be developed. In the absence of government policy (or action), NGOs have filled the gap, often by promoting community-based nurseries in which to grow seedlings for subsequent out-planting.

* Corresponding author.
E-mail addresses: jbaynes@usc.edu.au (J. Baynes), jherbohn@usc.edu.au (J. Herbohn).

[1] In this paper, we use the term 'community-based reforestation' to distinguish it from native forest management, which is also known in PNG as 'eco forestry'. We use the term reforestation rather than afforestation because the PNG grasslands are anthropogenic.

[2] The white paper is titled 'National eco-forestry policy' (2004) and was produced under the aegis of the then Minister of Forests, the Hon. Patrick Pruaitch MP.

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Given that policy implementation requires allocation of typically scarce resources, the embryonic state of CBR in PNG suggested that priorities for interventions might be found in the general literature. Byron (2001) listed the four conditions essential to small-scale forestry as land and crop tenure, a viable production technology, protection and markets. More recent reviews or meta-studies of conditions necessary for CBR often emphasise the interconnectedness of the conditions, albeit with different foci, e.g. Seymour et al. (2014) focused on tenure security, Cronkleton et al. (2012) emphasised the need to allow communities regulatory freedom and Gritten et al. (2015) discussed regulatory barriers in terms of their effect on developing livelihoods from forests. The effect of socio-economic and gender-based inequality is discussed in terms of causing the community conflict which precludes collective action (e.g. see Pulhin et al., 2007; Le et al., 2012; Baynes et al., 2015). Gilmour (2016, p.78), noted that although 'while some consistent results have emerged from reviews and studies, every one of them is subject to numerous caveats and conditions'. However, there is broad agreement that security of tenure (tree and land), intra-community governance, government support and material benefits are key enabling conditions (Baynes et al., 2015).

A more farmer-oriented perspective is offered by Franzel et al. (2002, p. 27) whereby the adoption potential of tree growing depends on farmers' perceptions of *feasibility*, i.e. whether they have the land, labour and technology. A decision to plant trees must also be *acceptable* in terms of 'profitability, feasibility, and a range of criteria that are difficult to quantify such as risk … ' Farmers' decisions in regard to tree planting are therefore a personal decision – which if adopted by a group of like-minded people – may evolve into CBR. From a policy perspective, diffusion of tree planting technology to other people hopefully follows.

Even if woodlots are feasible and acceptable to farmers, community forestry depends on farmer's *social capital,* i.e., the relationships of trust between people which facilitate interaction in the various spheres of their lives (Nannetti and Holguin, 2015). Collective action is not feasible if the group is not able to cooperate and meet group goals. This poses difficulties for the Bonn Challenge[3] which aims to restore 150 million hectares of the world's deforested and degraded land by 2020 and 350 million hectares by 2030. The Bonn Challenge is underpinned by a Global Partnership on Forest and Landscape Restoration[4] which envisages FLR as occurring at a landscape level. Although the landscape can be defined on a case by case basis for any project or situation (Mansourian, 2016), the principles of FLR specifically include requirements for restoration to be undertaken in an inclusive and participatory manner by all stakeholders (Sayer et al., 2013; Appanah, 2016).

Melanesia and PNG in particular, offer a challenging environment for either government-led CBR or FLR. At independence in 1975, the people of PNG became citizens of a country without a sense of national identity (May, 2004; Jorgensen, 2007). Local and traditional obligations to extended family and language groups frequently supersede allegiance to the State. PNG also has a 'resource curse' i.e. abundant resources but weak governance and limited human capital, resulting in less development than expected (Laurance et al., 2012). A large proportion of the population still engage in subsistence agriculture and fire, drought, and intra and inter-clan fights are constant short-term threats (Bourke, 2000).

Before the 1950s, almost all people devoted a large part of their life to growing food in home gardens. Data from a recent study conducted by Fisher et al. (2017), of two villages in the Ramu and Markham valleys and one village in the Madang hinterland, indicated that villagers are still heavily dependent on subsistence agriculture for their livelihoods. Villagers grow a wide variety of crops for their basic needs, with less than half of villagers' overall livelihoods generated as cash, and less than a half of that income generated through formal employment. The remainder is derived from activities such as selling vegetables in local markets. Only a few villagers cultivate cash crops, principally cacao (*Theobroma cacao*), partly because of the limited outreach of agricultural extension programs and the high cost of genetically improved seedlings. Hence, any economic activities which help people to directly meet their livelihood needs, (e.g. food, firewood or house poles), are important to them. Woodlots, particularly when intercropped with coffee, cocoa or vegetables, potentially meet this need.

The potential of current economic policy to develop CBR as a livelihood activity – promoted in principle by the PNGFA and in practice by NGOs – provided the impetus for this research. We present the results of our research into enabling conditions for CBR in the Eastern Highlands adjacent to Kainantu and the grasslands surrounding Ramu (Fig. 1). The purpose of our research was to ascertain the efficacy of extension assistance in assisting people to reforest grassland. Hence, our research methods were aimed at discovering the factors which either assisted people to undertake collective action in support of CBR, or dissuaded them from participating. A second purpose was to assess the feasibility of a landscape approach to forest restoration, for PNG and other countries in comparable social and biophysical situations. In the next section of this paper, we present the background to clan culture in PNG as it affects CBR. In the following section, we present the methods and results of our research. We then present the implications of our research for government and NGO-led interventions in PNG in relation to CBR and in a wider context, for FLR.

2. Research methods: background to PNG and the study site

PNG is situated approximately 6° south of the equator. Average rainfall is high, being 3,000 mm of rainfall per year. Hence, much of the vegetation is (or was) tropical rainforest. The total land area is approximately 46 million hectares of which some 29 million hectares is forested. Approximately 95% of all land is owned by clan members under customary land tenure arrangements (PNGFA, 2007).

This research was conducted in villages adjacent to the townships of Ramu in the Ramu and Markham valleys and Kainantu on the eastern side of the highlands. Small villages and hamlets, often with a population of only several hundred people, are typically spaced several kilometres apart and occupy land owned by a particular clan. Although PNG has over 800 separate languages, and is ethnically very diverse, the living conditions and day-to-day problems of people in the Ramu and Markham valleys are typical of many rural areas in PNG.

2.1. Background to farmers' livelihoods: motivations and insecurities

Food security is much greater than it was before the 1950s (Bourke, 2000). However, shortfalls still occur. The frosts and droughts of 1997-98 (see Allen and Bourke, 2000) and 2015-16 (see Walsh, 2016) severely affected families who lived in parts of the highlands. For a farmer with little or no cash income, food security is therefore a compelling motivation. The only people from whom a farmer may confidently expect assistance in difficult times are his

[3] See http://www.bonnchallenge.org/content/challenge.

[4] See http://www.forestlandscaperestoration.org/what-forest-and-landscape-restoration.

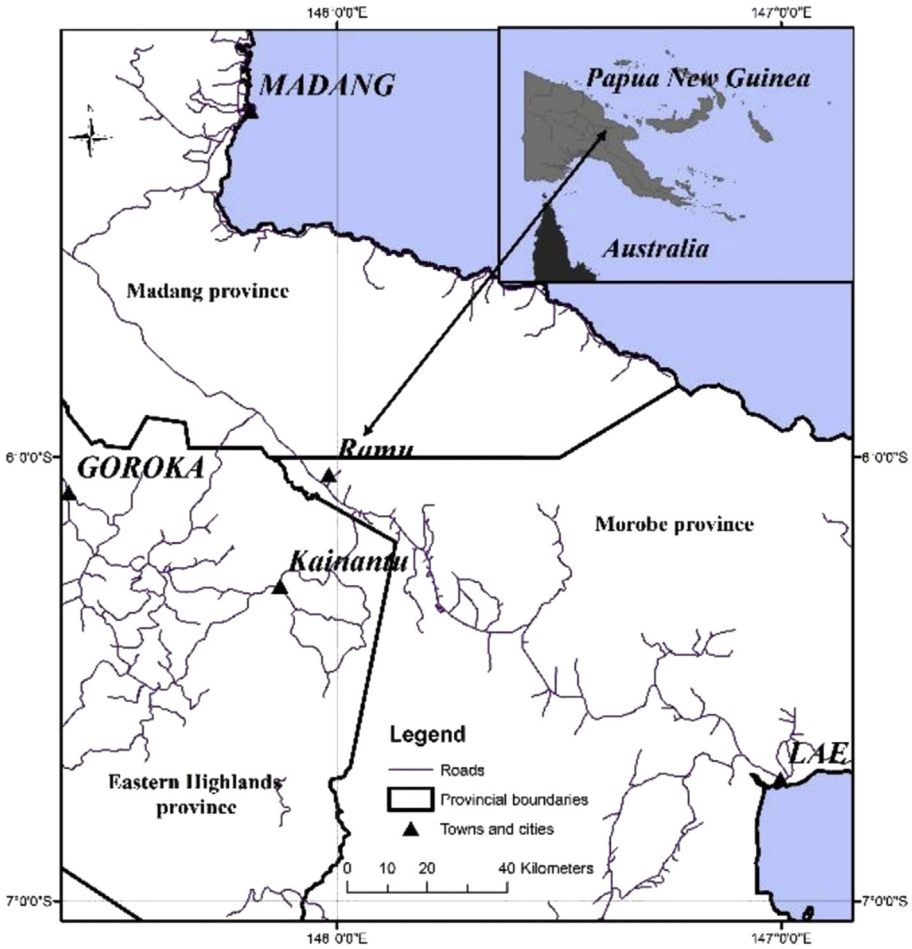

Fig. 1. The study sites in Papua New Guinea, adjacent to the towns of Ramu and Kainantu.

immediate *wantok*,[5] i.e. close family and fellow clan members.

Clan membership has benefits, including mutual protection from outsiders, but it carries reciprocal obligations to the clan. A farmer has a right to be allocated clan-owned land on which to tend a vegetable garden. However, other clan members with more influence may have rights to larger areas of (probably) more fertile land (see Barker, 1990; Zimmer-Tamakoshi, 1997). In a wider sense, customary land 'ownership' in PNG is extremely complex. A range of overlapping rights may apply to any given stretch of territory, and numerous candidates may justifiably argue their claims in any given case (Jorgensen, 2007). However, from an individual farmer's perspective, clan-given rights to grow a garden will fulfil his or her immediate needs for food. In addition, because clans in the Ramu and Markham valleys are patrilineal, rights and obligations are passed on from father to son.

For the approximately 80% of the population who live in rural areas and the 65% of these people who live further than 10 km of a main road (Ongugo et al., 2011), villages and hamlets are semi-cloistered social environments. Clans are not stable institutions, if indeed they ever were, and leadership is often achieved rather than inherited (Bonnell, 2012). Out-marriage and adoption result in a steady stream of outsiders into communities and forging of new alliances (Barker, 1990). In time, the children or grandchildren of these outsiders may become fully accepted as clan members (van Helden, 1998).

In any dealings with clan members, a farmer's feelings of social affinity and trust will guide his actions (Gesch, 2007; Reilly, 2008). Hence, land use has always been essentially a family matter (Weiner, 2013) in which people may relate more to 'security circles' which successively encompass livelihood activities with kin, in-laws, gardening, hunting and trading partners, rather than bloodlines (van Helden, 2001 p.158).

Melanesian society is currently undergoing a period of intense social change with a consequent tension between commitment to past customs and globalisation which affect all societal groups (Robbins, 1998). Increasing population pressure means that holdings are split and fertile land for a garden is becoming increasingly hard to secure (Mulung, 2009). There is always a threat that other clans or immigrant settlers may encroach on clan holdings. Village and Land Courts may adjudicate on these claims but because their judgments are often based on oral '*story*', claimants may embroider their evidence and disputes become complicated (Westermark, 1997). Against external threats, clans will come together to resist, but amongst themselves, people may fight over land-use rights and other scarce resources. The mental model which guides their livelihood activities is focused inwards towards these people.

2.1.1. The threat to gardens and long-term crops from fire and theft

Fire is a constant threat to gardens. Even though gardens are weeded, fire scorch from burning grass can cause damage to

[5] In *TokPisin* language the term *wantok* translates literally as 'one-talk', i.e. kinsmen.

vegetable leaves situated several meters inside the garden. Grass growth is also only slowly reduced as perennial crops, e.g. coffee or timber trees, achieve site dominance. Hence, in the first few years of growth, long-term crops are vulnerable from arson or burning-off to prepare gardens.

2.1.2. Existing or alternative institutional arrangements which could promote CBR

Two institutions which have been designed to formalise land ownership and usufruct rights are Incorporated Land Groups (ILGs) and Clan Land Use Agreements (CLUAs). ILGs are a legal mechanism whereby customary groups are recognised as a corporation and thereby empowered to hold, dispose and manage land in their customary name. In the resource sector, e.g. mining, petroleum, agriculture and forestry, ILGs are used as the conduit for distributing royalties and rents (DLPP, 2014). Unfortunately, forming an ILG is expensive because of administrative requirements to provide birth certificates from each member and to pay for a formally surveyed map of the land. ILGs have also fallen into disrepute because of problems such as disenfranchisement of clan members who fail to be recognised as part of the group, corruption in benefit sharing and high transaction costs (Golub, 2007; Lea, 2009; Filer, 2014).

As an additional instrument to a land sale or rental agreement, Clan Land Use Agreements (CLUAs) have also been used to mediate land disputes between traditional owners and settlers in the oil palm industry. While they have proved useful to clarify mutual rights and obligations, they involve an agreement between the entire clan and the second party (e.g. a tenant). Hence, much still depends on the good faith shown by both parties.

2.2. Background to the theory of social capital

Over the last 30 years social capital has been a subject of wide discussion in the social sciences, much of this being over its definition and measurement. We use the definition provided by Nannetti and Holguin (2015), that social capital is the relationships of trust between people which facilitate interaction in the various spheres of their lives. Social capital is usually considered to be an asset of the group, not individuals, and in social science research it has been used as an independent variable for such diverse uses as the nature of civil society (e.g. Lasinska, 2013; for Poland), development assistance (e.g. Cramb, 2005; in the Philippines) and health (e.g. Rostila, 2013; in Europe; Alawiyah and Held, 2015 in Indonesia). As the trust between a family or small group, *bonding* social capital forms the basis of *bridging* social capital which is characterised by reciprocal relationships of trust and interaction with wider society. A high level of bonding social capital may provide support for members, but it may also inhibit individual initiative. In addition, widening group membership may reduce the share of the benefits which were available to the smaller existing group (Woolcock and Narayan, 2000).

For community forestry, social capital can be easiest to measure in its negative state, i.e. the conflict which precedes group dissolution. For this research we assessed communities' social capital through observations of how communities cooperated to meet goals, whether conflict caused problems within the group, and changes in group participation.

2.3. Collecting data relating to people's motivation to engage in CBR

We used small-scale forestry as the technology and nursery extension as the means of accessing communities and providing assistance to provide insights into farmers' decision making. Small tree seedling nurseries are well suited to village-based community forestry because one nursery may produce enough seedlings to satisfy community requirements and the technology is interesting and transferrable to people who make their livelihoods from vegetable gardens.

In a preliminary visit to PNG, we had visited two communities which had been provided with infrastructure and training by an NGO to grow seedlings in community nurseries in order to reforest unused land. As a means of promoting tree planting within the community or to other communities, they had failed for reasons which were difficult to discern. It was suggested that the problem may have been because of geographical separation from other communities or perhaps for cultural reasons. Melanesian societies maintain social relationships through reciprocal exchange (Henning, 2015), and perhaps farmers who were not directly associated with the nursery would not have expected to be able to access seedlings. Hence, we undertook extension activities in five communities to investigate the factors which either assisted people to undertake collective action in support of CBR, or dissuaded them from participating. We also used the success of the extension activities to assess the feasibility of a landscape approach to forest restoration.

For five cases within one overall case study[6] of communities' reaction to extension assistance, i.e. at Warit, Masua, Zaria, Burula and Ragium villages, we used a mixed methods approach to data collection, including qualitative information (i.e. what farmers said), combined with visual observations and descriptive statistics of what they actually did. Data collection began in late 2014 and continued until mid-2017.

To assist the five communities to grow timber tree seedlings we first contacted their clan leaders using staff from our project partner Ramu Agri Industries Limited (RAIL) to effect introductions. We then held a meeting with interested people in the community to outline our offer of assistance. The offer included a declared exit strategy, i.e. community members were advised that the purpose of the assistance was to allow them to develop self-efficacy in growing tree seedlings so that further assistance was no longer necessary. In all communities except Zaria, (where our offer was refused), project staff trained participants in nursery techniques and provided shade-cloth, a wheelbarrow, a spade and plastic seedling bags. The training typically took 2-3 days and included collecting seed and setting up a small-scale nursery with wooden poles and a gravel floor. Potting soil was mixed and sterilised and the process of germinating seed in small trays was begun. Finally, a watering roster was organised with participants.

Project staff found that the training established goodwill and this facilitated follow-up visits, approximately six visits per community at monthly intervals, to provide advice and to allow opportunities for dialogue. Subsequent less-frequent visits, e.g. at Masua as late as July 2017, have provided opportunities for monitoring and evaluation. All visits were arranged between RAIL and the clan leader, and in practice, project staff talked to whoever was available at the nursery at the time. Rather than being formal interviews, these conversations served to corroborate or explain what was visually evident at the site.

We also held a field day in conjunction with RAIL for community representatives from the villages of Warit, Masua, and Ragium. The field day was used to demonstrate the effectiveness of post-planting weed control and fertilising to achieve high seedling survival and growth.

[6] Because extension assistance was similar in all five communities, we treated them as individual cases and the overall investigation as one case study.

3. Results: efficacy of extension activities in motivating people to engage in CBR

3.1. CBR at Warit village

Warit village is a community of approximately 200 people, approximately 20 km southeast of Ramu township. Initial meetings with villagers indicated that the clan was highly cohesive. Clan leaders were adamant that they had approval from other villagers to establish a woodlot which could be used for house poles.

Nursery training was conducted in late 2014 and by March 2015, a planting site had been slashed and approximately 500 seedlings had been out-planted. Further assistance was provided to improve seedling quality and simple improvements proved effective, e.g. providing a 200 L drum on which to place germinating seedlings and thus prevent rat predation. The extension officer noted that villagers had a duty roster to water seedlings and there appeared to be a high level of cooperation within the group.

At this stage the only discordant note occurred at a meeting between villagers from Warit and villagers from an adjacent hamlet. It became apparent that the 'active' group of tree planters were from a small number of households from the Ngaru clan who live in the hamlet of Warit. Members of other clans also live at Warit but were not included in the active group. Members of the Ngaru clan also live in other hamlets. The planting area belonged to the whole clan and not just the active tree planters. Hence, clan members living in other hamlets considered that they should have been paid[7] for reforestation activities. It became apparent that disputes would occur over ownership of the trees, once they matured.

In late 2015, the extension officer was told that further planting had been stopped pending resolution of a land dispute on a nearby hill on which a telecommunication tower was being erected. The dispute would be resolved by the District Land Court and planting may then recommence.

In early 2016, the active group expressed interest in a proposal for a multi-species, multi-purpose, livelihood-based woodlot which included vegetable gardens to provide fire protection. As a preliminary step, extension staff visited Warit to survey an area of land (approximately 3 ha) so that the proposed plantation could be discussed with the general community. As extension staff were leaving the village, they were accosted by villagers from an adjacent hamlet who ordered them to desist from any further planning, because they considered that the proposed planting site was on general clan land. A letter confirming this demand has since been received from the Local Level Government Council.

A villager from Warit explained the dispute to a project researcher as follows: In years past, a lady, with the oral agreement of fellow (male) Ngaru clan members, was permitted to bequeath the clan land in question, to her four sons. One of the sons was chosen as leader and the other three became sorcerers, by which means to control their fellow clan members. The land had little value except for vegetable gardens, but the tower and now the tree-planting have changed perceptions of its worth. The tower is a source of rental income and the trees are a long-term asset. Hence the dispute will be tested in the Local Land Court, with no hard evidence except existing land use and oral *story*. In addition, the four sons are now grandfathers and have formed their own sub-clan groups. Tree planting by the active group is seen as an attempt to create ownership boundaries. Hence, the dispute is concerned with succession issues and boundary marking, as much as tree planting itself.

As at July 2017, no decision from the court has been handed down and no further visits to the community have been made.

3.2. CBR at Masua village

Masua village has a population of approximately 500 people and is situated on the inaccessible (by road) side of the Ramu River. Hence it was prioritised by project extension staff for assistance, because people living there are isolated from local economic opportunities and markets for products. In August 2014 an expression of interest was received from a Masua community leader requesting assistance to set up a nursery and to engage in reforestation. A local leader insisted that the nursery should be placed adjacent to the church and not adjacent to the river as proposed by extension staff, and that they would cart water to the seedlings when the river receded. Approximately 10 people showed interest in the nursery, and two people expressed interest in constructing their own private small nurseries.

By late 2014, the nursery had been neglected, e.g. there had been no potting, transplanting, sowing or watering. In July 2015, it became apparent that the nursery was viewed by the community as belonging to the leader because the nursery was located away from the main hamlet and in his backyard. Visiting the nursery would have been seen as trespassing on his home area.

A meeting was held with community members and it became apparent that few people understood what the project was about. They mutually agreed to relocate the nursery and begin seedling germination. As of late 2015, nursery assets had been taken over by one family, 200 seedlings had been grown and out-planted and more were being germinated. A site visit in mid-2017 confirmed that the nursery was still active and that tree planting was continuing, albeit at a low level.

3.3. CBR at Ragium village

Ragium is a multi-clan village with a population of about 6000. It has its own primary school and the community has more formally employed people than other villages. As of late 2014, the community had an active cocoa cooperative and had allocated communal land on which to build a cocoa nursery. In early 2015, the cooperative requested assistance from the project to grow tree seedlings which would act as shade trees for the cocoa. After several preliminary meetings, training was provided and a tree seedling nursery was established in mid-2015. It was stated that cocoa and timber tree seedlings would be distributed among the clan and wider community members according to their participation. Both nurseries were therefore a means of encouraging rival clans to work cooperatively.

In this instance, a key difference between Ragium and either Warit and Masua was that the cooperative had invited membership from other clans. Unfortunately, several months later extension staff noted that out of the 25 members who they had met during the initial meeting, only two attended the second meeting. They interpreted this as a sign of community disharmony. They also noted that in the first visit the community had talked proudly about their cocoa business and the setting up of cocoa nursery shed, but cooperative members had hinted at unresolved conflicts. In February 2016, a visit to Ragium confirmed that the multi-clan cooperative had collapsed, a group from the Dapi Dapi clan had taken over both nurseries. Production of cocoa seedlings and timber tree seedlings has continued.

3.4. CBR at Burula village, Kainantu

Following an approach by community members from Burula

[7] In PNG these payments are often called *kompensation*.

village at Kainantu in late 2014, a nursery was constructed and seedling propagation began with pine, eucalypt and casuarina seedlings. In following months, ownership of the nursery passed to a retired farmer, and assistance from extension staff resulted in an improvement in seedling quality and diversification into other species. Instead of out-planting seedlings, the farmer decided to grow seedlings for sale. By November 2015, the nursery was raising healthy and well hardened seedlings. The farmer was selling his seedlings to other villagers and in the market place at Kainantu. By February 2016, the farmer proudly stated that he had earnt over K3500 (approximately USD1200) from the nursery and that he had back orders for 5000 seedlings from schools and local citizens.

3.5. CBR at Zaria village

Zaria village is inhabited by people from the Munsi and Arida clans who live in separate hamlets but have a common land boundary. The village had originally been considered as a potential site at which to promote small-scale forestry because the community, through a clan leader from the Munsi clan, had requested assistance from RAIL to build a nursery. In November 2014, extension staff visited the community after making arrangements to speak at a community meeting at which members of both clans would be present. They first outlined the general nature of the project and explained how they would be able to help the community. Their report describes the unfortunate result:

> 'The leader of the Arida clan bluntly retorted that no company is going to come into our area and steal our land again. He stated that RAIL land belongs to his clan and the company has not compensated them and now they are trying to again land grab in disguise by using outsiders'.
>
> 'What transpired here confirms our opinion that different clans are in competition with each other. If one clan leader organizes something for the community other clan leaders oppose it. Not that the project is bad, but from pride'.

In March 2015, extension staff again visited Zaria with similar results. In July 2015, RAIL management advised that they also had difficulty getting rival clan leaders to meet at either of each other's hamlets. No further contact has been since made with the Zaria community.

4. Discussion

4.1. Implications of our research findings for CBR and FLR

For PNG, the key finding which emerged from the five cases is the difference between FLR theory – which envisages landscape-level forest restoration being undertaken by all stakeholders in a participatory manner (e.g. see Appanah, 2016) – and what is possible. In PNG, communities have very limited capacity for collective action to support CBR or FLR, particularly over the timeframe required to realise the benefits of tree growing. As the focus of this research, timber tree growing is heavily influenced by social and cultural factors, principally the need to maintain community peace and harmony. This is not to suggest that villages are not a happy place in which to live, but that high levels of physical and social proximity create an atmosphere which subordinates collective and individual action to social norms. For community members, making tree growing technically feasible for them may not make it acceptable if there is any risk of creating ill-will within the community.

Evidence from the mining industries – of the contested nature of clan membership when mining royalties are being distributed (Bainton, 2010; Bacalzo et al., 2014) – mirror our experience at Warit. Clans do not provide stable institutional arrangements through which an individual can act and intra- and inter-clan quarrels and disputes are the normal part of life, not an aberration (Golub, 2007). In terms of economic development, there is little to motivate clan members to collective action.

Attempting to organise communities at a clan or multi-clan level will be difficult. However, at a sub-clan or family group level, cooperative tree planting may be possible, although our evidence suggests that farmers are most comfortable planting trees on land for which they have certain usufruct rights. The major difference between our results and FLR, is that in PNG, reforestation is more likely to occur as small patches of planted trees which are socially and biophysically uncoordinated across the landscape. We suggest that our results may be applicable beyond PNG and Melanesia. For example in the Philippines, Cramb et al. (2000) found that the traditional labour exchange system (*alayon*) in which small groups of farmers cooperate – even pooling capital to purchase tools – does not translate into potential whole-of-village cooperation.

A lack of social capital emerged as a major obstacle to CBR in three of the five communities (i.e. Warit, Masua and, Ragium) in which we worked. Extension assistance was well received, but because it only enabled CBR at a family group level, out-reach to the wider community was poor. Communities appear to have the bonding social capital to operate as small family groups, but lack the bridging social capital to work collectively with wider groups. Lifting bridging social capital via a range of extension activities – as occurred with the Landcare program in the Philippines (see Cramb, 2005) – may enable communities to undertake CBR. However, long term and necessarily expensive assistance will be required. In addition, attempts to modify longstanding social traditions may create dilemmas as well as providing solutions (Woolcock and Narayan, 2000).

4.2. Enabling conditions for CBR and FLR

The results of the cases suggest three enabling conditions for CBR and FLR, each of which poses a dilemma. The first enabling condition is to selectively target assistance at only those communities which have stable leadership and community harmony. The dilemma is that the process of determining social harmony in communities will, of itself, raise expectations of material assistance. Ethical considerations preclude raising people's expectations and then being dismissive of those expectations. Project workers should immerse themselves in communities and avoid 'acting like missionaries rather than detectives, wanting to assemble and address a group of villagers instead of finding out what village leaders had to say' (Filer, 2000, p.7). Hence, some wastage of time and resources will be incurred as working relationships are alternatively developed, or not.

The second enabling condition is for extension staff to help farmers to develop bridging capital via relationships with other farmers and organisations. For example, extensive research has recently been undertaken by the Australian Centre for International Agricultural Research, Canberra (ACIAR) to promote planting of *Canarium indicum* trees (locally known as galip) for their nuts, which are sold into local and export markets. However, capacity development is needed to bring more actors into the supply chain, and promote supply networks (Wallace, 2016). Similarly, genetically improved cacao seed is available from the Cocoa and Coconut Research Institute (CCRI) in Madang, but purchasing seed is complicated by a need for fumigation certificates. Also, seed must be personally collected, not posted. These requirements are beyond the capacity of many farmers who live in remote locations.

However, extended development assistance may have unexpected results. For example, some farmers have little interest in trees *per se*, but (as at Ragium) they may value them as shade for coffee or cocoa. For a program with a main objective of increasing CBR, the dilemma is that is that increasing people's self-efficacy to manage their relationships with outside agencies may result in unexpected outcomes. The purpose of assistance may be misconstrued or a mismatch may occur between community and donor expectations (Benson, 2012). In a similar research-for-development project, van Helden (2001) recommended that agencies should avoid a 'blue print' approach to project success, and encourage people to make their own choices.

The third of the enabling conditions is to supply technical and material assistance in a do-it-yourself format which adapts technology (e.g. via small home-nurseries) so that it can be managed by individual families. This would avoid the wasted resources of trying to impose collective action on communities which are not capable of it. The dilemma is that encouraging and assisting individual farmers may build up a clientele of 'champion farmers', which may inadvertently exclude other less-powerful community members.

We acknowledge that our findings are most relevant for villages in which clan leaders control land allocation. Other parts of PNG address land tenure differently. For example, in the Eastern Highlands adjacent to the town of Goroka, fertile and commercially valuable land is regularly bought and sold between individuals, even though it is still theoretically owned by a clan. However, in both the RMV and in the Eastern Highlands, our key finding – that family forestry is more likely to be adopted than community forestry – is still applicable.

5. Conclusion

In PNG, people may wish to grow trees, either at a family or community level, but are currently inhibited by a lack of tree growing technology, insecure land tenure and the risk of disturbing community harmony. Inter-clan competition also precludes technology diffusion to the wider community. We suggest that participatory third party interventions which strengthen communities' bridging social capital to enable them to engage in participatory negotiations and decision-making, should be a primary focus of development assistance to grow trees. From a CBR or FLR policy perspective, our findings suggest that extending the timeframe for engagement with communities and shifting community-based forestry to family-based forestry, may be necessary. Collective action may not be achievable.

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