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ORIGINAL PAPER

Forest recovery in an Australian amenity landscape: implications for biodiversity conservation on small-acreage properties

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Abstract Some urbanising rural (i.e. 'amenity') landscapes have seen an increase in forest cover over recent decades. Small-acreage landowners are key stakeholders in this forest recovery and its future ecological trajectory. Using 17 qualitative case-studies of small-acreage properties located in the Noosa hinterland in south-east Queensland, this study explores the types and condition of forests on these properties, the landholder's differing forest management perspectives, practices and outcomes, and the implications for local biodiversity conservation. The properties contained a diverse mix of managed and unmanaged natural and planted forests. Invasive weed species were a common component. Protecting and enhancing the ecological values of amenity landscapes will require an increase in active, best-practice forest management on small-acreage properties. Small-acreage landowners will require greater access to labour support and other subsidised resources to implement recommended practices. Such practices include controlling and reducing the spread of invasive weeds and soil erosion, reducing fire hazards, and positively influencing the rate and pathway of succession in regrowth forests. Peer-mentoring programs incorporating guided tours of 'model' small-acreage forests, and supporting landowners to establish their own small native plant nurseries and engage with local community nurseries (i.e. supplying seeds, volunteering labour), could help to increase small-acreage landowners' forest management interests, knowledge, skills and activity. Long-term cooperative, cross-boundary forest management projects with on-going monitoring and adaptive management guided or implemented by skilled professionals are needed in amenity landscapes, particularly to increase the success of restoration

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interventions in weed-dominated regrowth forests. There is also a need for long-term socio-ecological analyses of amenity landscapes' diverse and evolving small-acreage forests to better inform their future management.

Keywords Agroforest · Ecosystem restoration · Lowland subtropical rainforest · Novel ecosystem · NRM support programs · Socio-ecological analysis

Introduction

Over the past few decades, many Australian rural landscapes have experienced dramatic land-use and population change. Many coastal hinterland areas with high 'amenity' values (including high scenery, biodiversity, recreational opportunities and agrarian character; high rainfall and a benign climate; vibrant local communities and good access to larger urban centres) have seen substantial 'landscape fragmentation' involving subdivisions of former working farms, new rural-residential estate developments and influxes of 'rural lifestyle'-seeking landowners (Burnley and Murphy 2004; Holmes 2006; Barr 2009). Similar amenity-driven change has occurred throughout many rural and urban-fringe (i.e. peri-urban) landscapes of most developed western nations (Dwyer and Childs 2004; Abrams et al. 2012). In Australia, many new in-migrants to these rural 'amenity landscapes' have acquired small-acreage properties (i.e. 0.5–10 ha) containing patches of native forest and/or ex-grazing and cropping lands. These forests and paddocks of ex-farmland are often degraded, and, in aggregate, can comprise large areas within amenity landscape settings. They are potentially available for ecosystem restoration, and other multi-purpose revegetation and small-scale agribusiness pursuits. An increase in these practices on small-acreage properties can generate important biodiversity and other environmental and socio-economic benefits at property, local community and regional scales. This makes small-acreage landowners an important natural resource management (NRM) stakeholder group throughout Australian amenity landscapes.

Amenity landscapes are commonly described as zones of transition (Barr 2009; Abrams et al. 2012). The transition, incorporating biophysical and socio-economic change, is in-part captured in descriptions of the 'post-productivist transition' and emerging 'multi-functional landscapes' (Argent 2002; Holmes 2006). These concepts describe the complex socio-demographic changes and associated trend to post-industrial or 'neo-productivist' styles of farming (i.e. small-scale/hobby farm; organic; niche, value-added products) and other 'consumptionist' uses involving recreation, farm tourism and the passive protection of natural amenities. Other biophysical changes involve detrimental ecological effects of the increase in rural-residential estate developments (i.e. a 'rural sprawl'). These include the fragmentation and ecological simplification of native forests, weed and domestic pet predator introductions, altered drainage patterns, and increased run-off, soil compaction, erosion, and waterway sedimentation and pollution (Edols-Meeves and Knox 1996; Sinclair 2001; Hansen et al. 2005; Compas 2007). In contrast, there can also be environmental improvements as a result of the reduction or cessation of past extensive agricultural uses and the new lifestyle landowners' NRM practices. For example, research in Europe (Kristensen 1999), North America (Erickson et al. 2002; Walker et al. 2003) and Australia (Parkes et al. 2012) has found a prominent change in some amenity landscape settings has been

an increase in forest cover and sometimes associated improvements in habitat potential and riparian condition.

A substantial body of literature has analysed the broad-scale increase in forest cover or 'forest transition' occurring throughout many of the world's developed and developing countries (e.g. Mather 1992; Rudel et al. 2005; Meyfroidt and Lambin 2011). However, there has been little study of the socio-ecological dynamics of this forest recovery within distinct amenity landscape settings. Forest recovery in these landscapes is a function of both natural regrowth and tree-plantings on former working farmlands. The limited research into the characteristics and conservation values of the forests recolonising abandoned peri-urban farmlands suggests they can have mixed ecological outcomes. For example, these naturally regenerating forests can support improved watershed and biodiversity conservation outcomes (i.e. reduced erosion and sediment yields, recovery of local flora and fauna diversity) but they are also commonly dominated by woody exotic species (Rudel et al. 2000; Lugo and Helmer 2004; Grau et al. 2008). In many cases, these invasive exotic species will slow or preclude native biodiversity recovery, creating 'novel ecosystems' that are ecologically different from the original ones (Hobbs et al. 2006). Similarly, the new gardens and forests established by lifestyle landowners can also have mixed outcomes for local biodiversity, depending on the type of planting, its location, the species used, and their on-going management (Gill et al. 2010; Cooke and Lane 2015).

Rural lifestyle landowners are a diverse group, with differing forest management interests, attitudes, objectives and actions (Meadows 2011). This is reflected in the types of 'natures' or 'ecologies' that are desired, created and maintained by these landowners through both active and passive or 'hands-off' forest management (Gill et al. 2010; Abrams et al. 2012). There are many recognised threats to the high biodiversity values of amenity landscapes, including the diverse NRM practices (or lack thereof) of lifestyle landowners, some of which can lead to ecological simplification and biodiversity decline (Dwyer and Childs 2004; Hansen et al. 2005; Klepeis et al. 2009; Epanchin-Niell et al. 2010; Gill et al. 2010). Hence, we consider there is a need for improved forest management by lifestyle landowners if the high environmental and aesthetic values of amenity landscapes are to be preserved. Increased adoption of best-practice forest management (as described by Lindenmayer and Franklin 2002; Salt et al. 2004; Meadows 2011) will help to develop more ecologically resilient forests throughout amenity landscapes. Such management requires on-going monitoring and interventions to protect and enhance a forest's habitat and biodiversity values.

Many Australian rural lifestyle landowners may be interested in improved forest management because they possess a sense of environmental stewardship that includes strong interests in biodiversity conservation (Hollier and Reid 2007; Barr 2009). However, capacity-related constraints including minimal NRM practical experience and confidence, and limited time, finances and physical capabilities will often reduce interested landowners' involvement (Burnley and Murphy 2004; Pannell and Wilkinson 2009; Meadows et al. 2013, 2014). A behavioural 'gap', whereby there is a disconnect between the pro-environmental attitudes of lifestyle landowners and their adoption of improved practices, can also prevent best-practice NRM by these landowners (Mendham and Curtis 2010). This so-called 'gap' can sometimes be due to a landowner's limited ecological understanding (Abrams et al. 2012). Many rural lifestyle landowners

will require information, encouragement or persuasion, and practical assistance for an increased adoption of best-practice forest management throughout Australian amenity landscapes.

Research has found Australian rural lifestyle landowners are largely disengaged from available best-practice NRM support programs (Mendham and Curtis 2010; Emtage and Herbohn 2012; Meadows et al. 2014). Additionally, the small-acreage sector has often been overlooked or excluded from these programs, and has also typically been excluded or underrepresented in rural lifestyle landowner research (Meadows 2011). Given their increasing numbers and key role in the ecological transformation of amenity landscapes, small-acreage landowners should be better recognised as a legitimate NRM opportunity and better supported to adopt improved forest management practices. Qualitative research involving socio-ecological analyses of amenity landscape settings (see examples by Klepeis et al. 2009; Gill et al. 2010; Morris 2010; Cooke and Lane 2015) can increase knowledge of small-acreage landowners' diverse social and land-use characteristics. Such research can provide rich insights into the inter-relationships between these landowners' social networks and their forest management interests, attitudes, objectives, actions and outcomes, while also revealing the heterogeneity or distinct 'types' of forest managers (Vanclay 2005; Emtage et al. 2007) among them. These insights can inform an improved and targeted NRM engagement of small-acreage landowners.

This paper reports findings from a research project (see Meadows 2011) that investigated the characteristics and land-uses of rural lifestyle landowners and the design of forest management support programs appropriate to them. The findings are drawn from 17 qualitative case-studies of selected small-acreage landholders located in the Noosa hinterland in south-east Queensland, Australia. The paper focuses on the differing forest management perspectives, practices and outcomes of these landholders and the implications for local biodiversity conservation and increasing landowner adoption of best-practice forest management. For context setting, brief descriptions of the study site and characteristics of the participating landholders and their properties are provided next. Further details are found in Meadows et al. (2013, 2014). This paper discusses the development and management of forests on small-acreage properties, and the social interactions that are informing and influencing their management. The findings provide insights into the contribution of small-acreage landowners to the socio-ecological transformation of an amenity landscape setting, and how the resultant increased forest cover could be better managed to protect and enhance local biodiversity values. The findings can aid NRM policymakers and support providers in designing forest management assistance programs appropriate to small-scale landowners in rural amenity landscapes throughout Australia and internationally.

The research context

The study site

The research focused on the areas surrounding the Noosa hinterland towns of Eumundi, Cooroy and Pomona in the Sunshine Coast region of south-east Queensland (Fig. 1). The region has a high-rainfall subtropical climate and the rural landscape is picturesque and rich in biodiversity values including the presence of numerous rare or threatened flora and

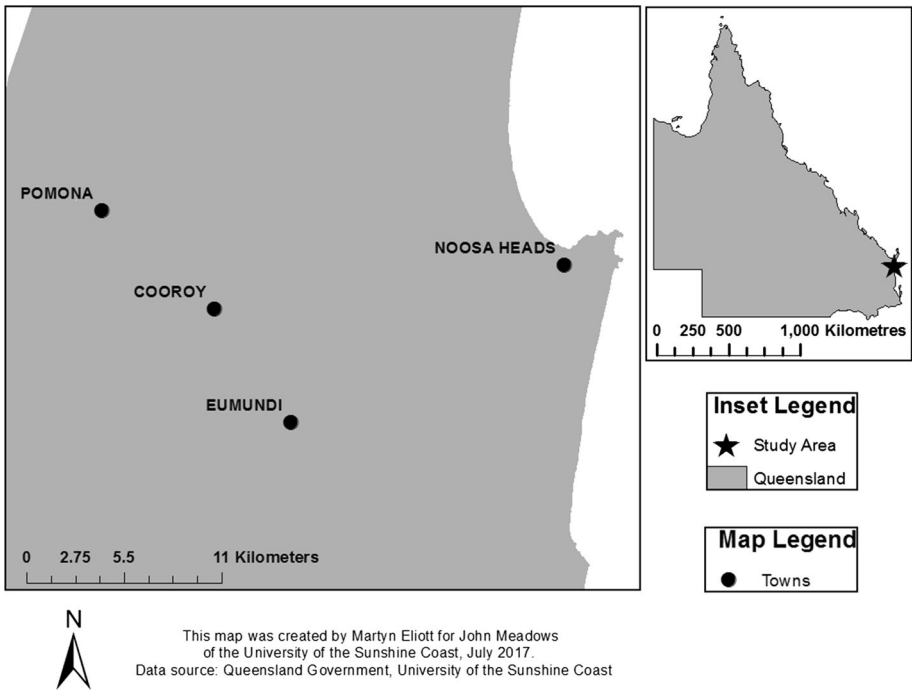

Fig. 1 The study site

fauna species and forest ecosystems (SCRC 2010). The rural landscape has seen substantial amenity-driven land-use and population change over recent decades (SCC 2013). By the mid-2000s, small-acreage properties (0.5–10 ha) had become the dominant rural land-holding category within the Noosa hinterland. In 2011, there were 4763 individual lots covering an area of 11,367 ha (the total Noosa Shire area covers 81,228 ha). Of these lots, 2135 are in the 2–10 ha range, with 2628 lots between 0.5 and 2 ha (J Nevin, personal communication, April 28, 2011). Local town planning laws (i.e. minimum lot sizes outside of the urban footprint) now prevent any further subdivisions for new rural residential estates.

The region's small-acreage properties comprise a diverse mix of forests, cropland and pastureland, much of which is currently un- or under-utilised and typically degraded. Of the Noosa Shire's 60 Regional Ecosystems (a Queensland State Government vegetation community classification system—see EPA 2005), 22 are seen as a high priority for increasing their extent (on both private and public lands), with riparian rainforest communities being particularly important (Burrows 2004). These riparian forests include a number of ecosystem types, many of which fall under the banner of 'lowland subtropical rainforest' (LSR). This type of rainforest is a nationally-listed critically endangered ecological community (Commonwealth of Australia 2012), and small LSR remnants and isolated trees and copses and associated regrowth patches are common on rural properties in the region. While small numbers of landholders, often with support from a local community-based environment group (i.e. Noosa Landcare), are undertaking ecosystem

restoration (i.e. weed control, enrichment plantings) in these forests, most are not engaged in this activity. The Noosa hinterland's small-acreage properties are therefore a largely untapped opportunity for conserving the region's high biodiversity values.

Characteristics of the landholders' properties

The 17 properties ranged in size from 0.5 to 6.4 ha and averaged 2.2 ha (median 1.05 ha). Thirteen properties were located within five master-planned rural-residential estate developments and four were positioned immediately adjacent to or nearby these same estates. The properties typically included steeply-sloping land, densely-vegetated gullies, riparian zones and other forested (remnant, regrowth and/or planted forest) areas, idle paddocks, and permanent or ephemeral streams. Most of the forests and paddocks contained weed infestations, and displayed evidence of soil compaction and erosion. Some forests also had a sparse structural complexity and a low diversity of native flora. The riparian zones often contained eroding stream-banks. Despite their commonly degraded condition, many native forests were of a high conservation value and some contained threatened or rare species of native flora and fauna characteristic of LSR communities. These forests were often contiguous with similar forests on adjoining private properties, and in many cases also with forested 'community conservation zones' within a rural-residential estate.

Characteristics of the landholders

All of the landholders were either interested in or currently actively managing all or parts of their existing forests or establishing new forests and sometimes both. Their priority forest management objectives were to improve a property's appearance and value, address weed and erosion problems, enhance native wildlife habitat, and create recreational walking trails and seating for scenic viewing. Most were also interested in tree-planting for subsistence uses (i.e. fruits, nuts, timber, fodder, mulch) and sometimes also for commercial food and timber production. Commonly-reported capacity constraints to achieving these objectives were limited knowledge, time and finance, and declining physical abilities.

The landholders were classified into 'types' based on differing levels of forest management knowledge, activity, and engagement with best-practice support programs and associated social networks (Table 1).

Table 1 Characteristics of the landholder types (adapted from Meadows et al. 2014)

Landholder type	NRM knowledge	Forest management activity	Support program awareness & participation
Engaged (4)	High	Highly-active	High
Do-it-yourselfer (7)	Minimal	Active—moderately active	Low—moderate
Constrained (6)	Minimal—none	Not-active but interested	Low—non-existent

The research method

The qualitative case-studies were guided by Yin (2003) and Eisenhardt and Graebner (2007) and the case-study properties were selected using stratified purposeful and snowball sampling procedures (following Miles and Huberman 1994; Patton 2002). These procedures included case targeting input from key informants (i.e. NRM experts from government departments and the local community-based environment group Noosa Landcare). Small-acreage landowners with an interest in forest management were targeted for participation. The key informants suggested a number of potential case-study properties based on their past discussions with the landholders and, or, property visits to provide forest management support (i.e. advice, plants, labour). Some of these suggested landholders were included in the study. In total, seventeen landholders with an interest in forest management were recruited in the multiple-case research design.

Data sources for each case-study included an initial e-mailed questionnaire, a follow-up on-property interview 2–3 weeks after questionnaire return, and guided property inspections that included forest observations and discussion building on the previously provided questionnaire and interview responses. Key informants provided input into the design of the questionnaire and interview schedules, and expert knowledge of the regional biophysical and socio-cultural landscape, the available NRM support programs, and the status of local landowner engagement with these programs. The data collection was undertaken in 2009. All interviews were digitally recorded and transcribed verbatim. Additional field notes (e.g. forest type and condition, management actions, outcomes, problems) were taken during the property inspections. The interview and field observations took approximately 2 h for each case.

The data analysis first involved developing comprehensive individual case databases that included the interview transcripts and field notes, detailed 'write-up' summaries (incorporating quotes and observations relating to the interview topics), and shorter 'descriptive' summaries and 'case narratives'. For the 17 cases, these datasets totalled 262 pages of text. All landholders were subsequently provided with their case narrative for verification of the researcher's interpretation of their data and the datasets were amended as needed. The datasets were then manually reviewed and compared to develop multi-case and aggregated summary tables addressing topics of interest. This process involved content and thematic analysis, pattern-matching and within- and across-case analyses (following Miles and Huberman 1994; Patton 2002; Yin 2003). Notes on the reliability, quality and credibility of the research can be found elsewhere (see Meadows 2011; Meadows et al. 2013, 2014).

Results and discussion

The Noosa hinterland is an archetypal amenity landscape—a coastal hinterland setting subject to the globally-occurring 'urbanisation of rural land' phenomena. One environmental outcome of this process in parts of the Noosa hinterland has been an increase in forest cover. The following sections discuss challenges and opportunities for the improved management of this increased forest cover. While the discussion focuses on the local-level (i.e. Noosa hinterland) context, the broad management themes, issues and associated recommendations have potential external validity to coastal and inland rural amenity landscapes elsewhere in Australia and throughout the developed world.

Forest recovery in the Noosa Hinterland

There has been a marked forest recovery throughout parts of the Noosa (and surrounding district) hinterland over recent decades. Much of the region has transitioned from extensive timber cutting and subsequent forest clearing for farm (primarily dairying) development during the late 1800s to early 1900s, through decades of large-scale commercial cropping (mainly bananas, pineapples and beans) and cattle grazing, to the current trend of small-scale agricultural production, 'hobby farming' and rural-residential living. Regrowth forest (eucalypt, LSR, acacia-dominated) has colonized many areas of former farmland, commonly expanding from the edges of remnant patches (often riparian zones, gullies and other steep areas) and isolated paddock trees and copses. For example, Local Government mapping has identified more than 6000 ha of acacia-dominated LSR regrowth throughout the north-western parts of the Noosa hinterland (Burrows 2004), and Council staff recognise both the challenges associated with promoting the values of these forests to the community and the opportunities for better managing the succession occurring in them (D Burrows, personal communication, April 20, 2005). New tree-plantings are another component of the forest recovery and include timber plantations, fruit and nut orchards, ecological restoration and amenity plantings (windbreaks, shade trees) on remaining productive farmland, the streetscaping of rural-residential estates, and diverse revegetation by new small-acreage landowners. Some of the regrowth forests are now protected within State Forests, National Parks and other Reserves including 'conservation zones' within rural-residential estates. Some regrowth forests on private land are protected by State and Local government regulations.

During the interviews, some landholders showed historical images or personal photos and/or described their observations or knowledge of the striking increase in forest cover both on and surrounding their properties, and both prior to and during their time of property ownership (1–33 years, median 7 years)—

> …by what I've been told, this place was like a moonscape 30 years ago, you know earlier on the timber cutters had come through and cut all the trees down, ….older people have said to me it was just bald back then, but if you look around Pomona now it's pretty green, because most people have been planting something.

Throughout three of the five estates there had been an increase in forest cover since their development in the mid to late 1990s. This was primarily the result of a combination of streetscaping and landowner revegetation, with most of the native regrowth forests having already colonized large areas of these estates following the earlier farming abandonment—

> …there are actually a lot more trees on this property now and through the whole estate since the subdivision, because lots of people are planting trees. …it's better than it was before.

> Well we used to hear so many mowers in the summertime in the early years here, because there were still a lot of empty blocks in here, and there'd be people like me mowing their block, and now in summertime you don't hear that as much. …so there is a change, and most people have planted bushes and trees.

In contrast, the other two estates were developed (1999–2001) on densely-forested sites and landholders from these estates reported there had been a reduction in forest cover. This was a result of the estate's initial development (streets, community parkland, man-made lakes, lot delineating) and subsequent further clearing by many new landowners –

> …and the estate had covenants that stated no trees should be unnecessarily removed. …but that covenant was worthless. …As the estate grew, it was obvious to buyers that the cheaper land was covered in trees. So to build their McMansions ….just about all of a 6000 sq m block needed to be cleared. So they brought in monstrous machines that grabbed the trees and hauled out everything.

> The blocks with similar forest to ours, most people seem to have mowed under the eucalypts and created non-native gardens or removed as much of the native vegetation as possible.

The forest loss had been only partly offset by new tree-plantings throughout the estate.

Ten of the 17 landholders reported an increase in forest cover on their own properties during their time of ownership. This was primarily a result of their tree-plantings. Most of the native regrowth on the properties was pre-existing forest that was now typically being contained at its margins, although some landholders were allowing forest to recolonise formerly regularly mown paddocks—

> …and then we went away for 6-months and when we came back there were all these Commersonia (*Commersonia bartramia*) seedlings and other things growing up, so we thought fair enough, we'll leave that and let it do its things, and that's when we realised how much it could do for itself.

The newly planted forests included densely-spaced native rainforest revegetation; wider-spaced plantations or arboretum-like plantings of rainforest, eucalypt and exotic species; and multi-layered orchards (i.e. agroforests or permaculture-style *food-forests*). Some diverse understorey plantings were also being established within existing forests. Overall, the forest cover on the landholders' properties comprises a complex mix of contiguous and isolated patches of managed and unmanaged natural (some remnant, predominantly regrowth) and planted forests that include purely native or native and exotic (both planted and weeds) mixtures. Steering these forests along a preferred ecological trajectory beneficial to local biodiversity is challenged by the landholders' differing management interests, objectives and associated perspectives and practices.

The landholders' forest management perspectives, practices and outcomes

The landholders' forest management plans and actions were underpinned by a desire to *do our bit for the local environment*. They were all evidently driven by an ethic of environmental stewardship although this was being interpreted and enacted in different ways, resulting in preferences for and the creation of (or plans for) varying styles of forest. Some differences were evident between the landholder types. It was also evident that with longer-term residence there can be an 'evolutionary trajectory' (Emtage et al. 2007, p. 488) or transitioning through types by some landholders as they learned to be environmental stewards (Cooke and Lane 2015). That is, some of the 'engaged' and 'do-it-yourselfer' landholders described their complete lack of expertise when they first moved onto their property before their forest-related knowledge, values and confidence to attempt on-ground activities developed through self-learning (including study and experiential-learning) and social interactions—

> We were so ignorant when we came here… But subsequently, after I started out here and as far as rainforest species go I found out I know more about it than they (other members of a local conservation group) do, so I've started giving talks now and then.

Some of the landholders were difficult to categorise and so the types discussed realistically represent 'caricatures within a larger spectrum' of landowner types (Vanclay 2005, p.100). Nonetheless, they provide a sound picture of the variation in forest management interests, values, capacity, actions and outcomes likely to be found among populations of small-acreage lifestyle landowners. They may also inform the design of NRM support programs targeted at these landowners.

The 'engaged' landholders

The 'engaged' landholders practiced and advocated revegetation using locally-native flora, restoring degraded native forests to the species diversity and structural complexity of their original remnant (Regional Ecosystem) status (…*to try and restore it, to let it come back to what it might have been in the early 1900s*), and on-going forest monitoring and active management interventions. This position is consistent with the best-practice management recommended by local NRM agencies. Although highly-active forest managers, capacity-related constraints (i.e. primarily time, finance and physical ability) and steep slopes precluding access (i.e. deemed too dangerous) meant some, although wanting to do more, were reluctantly not managing some native forest areas. Their engagement with local NRM agencies, locally-available NRM support programs and associated landowner networks were highly influential in developing their forest management beliefs and expertise. These channels of influence also aided a continued learning about the composition, dynamics and sustainable management of the planted and natural forests on and surrounding their properties (…*there are some very knowledgeable people in that group* (local conservation group)*, they keep you on your toes*).

The 'engaged' landholders had achieved good rainforest revegetation, native forest restoration (…*former weedy areas have shown a remarkable ability to regrow almost exclusively rainforest tree species by natural self-regeneration*) and agroforestry outcomes. Their tree-plantings were consistently performing well and they had the most success in managing weed infestations and creating new biodiverse forest habitat. For example, there were reports of high survival rates, rapid growth to achieve site capture (i.e. canopy closure) within 2–3 years (…*growth of eucalypts and understorey renewal has been immense*) and high fruit tree productivity, few if any weeds were evident, plantings commonly had a high compositional and structural diversity, and an abundance of birds and other local wildlife were reported to make regular use of the plantings –

> The return of the understorey has encouraged swamp wallabies, echidnas and bandicoots;

> There's a lot more birds now, I've noticed a lot of birds nesting in there that otherwise wouldn't have been here. …we've even had a koala in here, just a couple of years after we planted the propinqua (a local eucalypt).

The assistance provided by incentive programs, including labour support, had greatly contributed to their forest management successes. All of the 'engaged' landholders were championing best-practice forest management among their social networks and interested

neighbours and had sometimes successfully encouraged its uptake on adjoining properties (Meadows et al. 2013). Two had also hosted field-days on their properties and were often sought-out by their peers for forest management advice (Meadows et al. 2014).

The 'do-it-yourselfer' landholders

The 'do-it-yourselfer' landholders possessed a sense of independence and sometimes strong aversions to government and other local NRM support providers. While some were implementing best-practice forest management, many were disinterested in any details of best-practice revegetation, native forest restoration or local ecosystem dynamics –

> …there is still a stigma about planting trees from somewhere else, and I don't just mean from overseas. I've spoken to people down at Landcare and they've said something about Alexander Palms that they are not from around here, you know. I think just as long as they are native (laughing at the local provenance 'purists'), so, no, I don't have any respect for that sort of thing, unless the plant is a bloody weed or something, but I don't have much from other places.

These landholders typically sourced their tree-planting advice from local retail gardening centres, plant stallholders at local markets, and fellow members of the local permaculture group or ornamental gardening club. They also commonly obtained exotic and non-local native trees and shrubs from these sources and incorporated these plants into their revegetation plantings. Two commonly obtained exotic species were Agapanthus (*Agapanthus orientalis*) and Duranta (*Duranta erecta*), while popular non-local natives included hybrid Grevilleas (*Grevillea* spp.) and Native Gardenia (*Randia fitzalanii*).

The 'do-it-yourselfer' landholders' native tree-plantings had often performed poorly and not to their potential or the landholders' expectations for growth, health or habitat value. This was mostly due to inadequate establishment and maintenance practices, and sometimes also a result of inappropriate site:species matching (often resulting from market stallholders' advice). The former was particularly evident when the poorly-performing plantings were compared with the 'engaged' landholders' well-managed plantings of similar species. A commonly-held sentiment among those with poorly-performing plantings was expressed by the following landholder—

> …I didn't really know what I was doing, I did what I thought was best….they've been slow to grow. They only got watered and fertilised once, so maybe more information about how to better establish the trees would've helped.

A common outcome of the poor performance of native tree-plantings was for the landholder to lose hope, patience and interest in continued tree-planting efforts using the same (or related) native species. They were also less inclined to attempt further plantings of a similar scale.

Some of the 'do-it-yourselfer' landholders' forest management actions were potentially threatening to the local environment. For example, a number of their acquired exotic and non-local native plants were recognised weedy species and were commonly planted in arboretum, permaculture gardens or food-forests, and other revegetation plantings including areas adjacent to native forests. These other revegetation plantings sometimes followed understory clearing in native forests. Some of the landholders who had undertaken this type of revegetation (or intended to do so) explained such actions (or intentions) were to improve the aesthetic values of the native forest (…*We plan to partially clear the forest understorey, to tidy it up a bit and replace it with alternative plants, …maybe*

building some tropical garden areas…). In some cases, planted exotic species had spread into the adjacent native forests including parts of neighbouring properties and the 'conservation zones' of an estate. Two of the landholders who were replanting the native forest understorey with exotic species were self-described ardent permaculturalists. They were also nurturing and transplanting the natural regeneration of two regionally-significant noxious weeds—Camphor Laurel (*Cinnamomum camphora*) and Singapore Daisy (*Sphagneticola trilobata*). Despite recognising their weed status, the two landholders believed these plants had much aesthetic appeal and use for stabilising exposed soils.

Most of the 'do-it-yourselfer' landholders extolled the value of setting aside *untouched zones* on their properties. These un-managed areas included native and planted forests, and idle paddocks with varying densities of woody weed and native regrowth. Some lamented the *overwhelming* extent of weed infestations, and felt it was probably environmentally beneficial to *let nature take its course* in these areas anyway. Some had also planted trees or were interested in tree-planting to create future untouched *natural areas*. In these cases, the tree-planting was seen to create a *cover crop* to quickly eliminate a site's on-going and increasingly costly, physically-demanding and often dangerous (i.e. ride-on mowing of steep slopes) maintenance needs (…*and I've already rolled one mower*). Many of these landholders viewed forest cover as a no- or low-maintenance (i.e. edge management only) approach to achieving their conservation and aesthetic objectives.

The 'constrained' landholders

The 'constrained' landholders had little confidence they could achieve good forest management outcomes without support and this was a key factor in why they were not yet attempting any forest management—

> …as we said, we have no idea, because this isn't our area of expertise. So we basically need to know the types of trees and things to suit that area;
> We need someone to assist us in identifying natives versus weeds and non-natives and make recommendations to us.

The 'constrained' landholders' vegetation management activities were largely restricted to small gardens surrounding houses and other infrastructure and the establishment of fruit and nut orchards. Exotic species, including some with a recognised high weed potential, were commonly used in all gardens. Some of these landholders also preferred not to engage with local environment groups or government support providers. All were currently sourcing their gardening and tree-planting ideas and advice from *like-minded small-acreage gardeners*, landscaping contractors, and garden centres attached to large hardware chains.

The 'constrained' landholders were a mixed group and were evidently on differing forest management trajectories. Some were interested in best-practice forest management (but did not know who to contact) but most were not, or were not yet sure. The former landholders made much greater use of native species and gave greater consideration to the location of their exotic plantings, avoiding positions adjacent to native bushland. In contrast, the latter landholders gave these concerns far less consideration and, in two cases, had disposed of exotic garden prunings into an adjacent native forest. In both cases the materials had taken root, creating a new (although minor) weed incursion into these native forests. These same landholders also expressed an interest in clearing the native forest understorey to *enhance it* with preferred tropical exotic species. All of the 'constrained' landholders with native forest on their properties were also intending to leave some areas untouched, based both on philosophical grounds and steepness precluding access.

Other 'disinterested' landowners

It is evident that many small-acreage landowners within the study site currently have no interests in forest management. Many approached landowners (i.e. cold-call door-knocks) cited this and their lack of knowledge of or time for forest management as reasons for not participating in the research. Participating landholders also regularly commented on the prevalence of 'disinterested' landowners and felt the high turnover of property within rural residential estates was a contributing factor. They also noted they were a diverse group that included *young working families* (*…they're too busy trying to scruff out a living to be interested*), *English and southern* (Victorian) *migrants*, *horse people*, *part-time residents*, and *renters* and absentee landowners (including *speculator* owners of vacant land).

Many of the 'engaged' and 'do-it-yourselfer' landholders also expressed a frustration at the prevalence of *suburban values* among the apparently disinterested landowners, and their extensive use of exotic species in gardens (*…in this estate, …most are just creating a suburban yard with its associated hedges and trendy non-native plants*). These landholders were particularly concerned about the lack of management of weeds within native forests on these properties and the high potential for new weed introductions from the exotic-dominated gardens. Past studies have identified 'disinterested', 'disconnected', 'passive' and 'absentee' sectors among rural land and forest owners and the challenges they pose for NRM engagement (Meadows 2011; Petrzelka et al. 2013). Indeed, some authors have suggested regulation may be necessary to persuade these landowners to undertake needed NRM actions such as noxious weed control (Hollier and Reid 2007; Meadows et al. 2014).

Implications for supporting best-practice forest management on small-acreage properties

The NRM support providers active in the study site strive to facilitate an increase in best-practice forest management among the region's small-acreage landholders. Optimal regional biodiversity conservation outcomes are dependent upon this, but these and similar organisations active in amenity landscape settings throughout the country face significant financial and other resource constraints. This is reflective of an increasingly precarious nation-wide conservation funding environment (i.e. increasingly limited, competitive and short-term focused) and the recommendations included in the following sections should be considered in this context. Nonetheless, the recommendations provide guidance for NRM support providers to reorient existing programs or design new programs that will address a demonstrated need.

The landholders' forest management information and assistance needs

All of the landholders sought some forest management information and assistance. Table 2 summarises the topics of most interest to the landholders. The 'constrained' and 'do-it-yourselfer' landholders required substantial technical (including silvicultural, ecological and hydrological) information. Site-specific information and guidance were commonly sought-after, reflecting lifestyle landowners' preference for on-property NRM assessments and recommendations from local experts, and locally-relevant NRM guidebooks (Hollier and Reid 2007; Meadows et al. 2014). All of the landholders were also interested in practical assistance (including labour support and resources) to help implement their forest management objectives. Cost-sharing incentive programs were a common preference.

Table 2 The Landholder's Forest Management Information and Assistance Needs

Support category	Details
Forest management	Understanding incentive programs—availability, application procedures, engagement implications; support for joint-neighbourly projects and management of rural-residential estates' 'conservation zones'
Forest silviculture	Creating *natural-looking*, *self-regenerating, low-maintenance rainforest patches*; collecting & propagating seed, nursery management; native understorey development; multi-purpose agroforestry systems; conditioning heavy clay soils; commercial forestry practices
Erosion mitigation	Repair and management of existing erosion; preventing new erosion; best-practice management of stormwater/infrastructure run-off
Forest ecology	Species and ecosystem identification; flora & fauna associations; weed control options; fire ecology and fire management implications; acacia regrowth treatment; *tidy-up* storm-damaged forests
Forest regulation	State Government land-use and vegetation management regulations; local Town Planning implications; permit requirements; harvest security
Forest hydrology	Improving the *condition* of waterways/water quality, drainage-lines and dams; stabilising dam-walls/stream-banks; *wildlife-friendly* aquatic weed control; *planting and managing the catchment of the dam*

Weed and erosion control, fire management including ecological burns and wildfire hazard reduction, and regulatory issues (harvesting planted trees, thinning in native forests) were key information and assistance requirements. There was a strong interest in attending local field-days highlighting best-practice management of these issues. These findings are consistent with previous research suggesting that for optimal NRM outcomes, most life-style landowners will require expert NRM advice and assistance, including having projects planned and organised for them (Klepeis et al. 2009; Pannell and Wilkinson 2009; Epanchin-Niell et al. 2010). In many cases, impinging constraints mean it will be necessary to pay skilled contractors to undertake much or all of the on-ground work for the land-owner (Pannell and Wilkinson 2009; Morris 2010; Parkes et al. 2012).

The issue of benign neglect

There is a need to convince many small-acreage landowners of the benefits of active forest management. The forests (both native and planted) on most small-acreage properties throughout our study site are largely unmanaged or effectively abandoned. While this is partly due to the prevalence of 'disinterested' landowners, many of the participating landholders (with strong environmental and forest management interests) also believed their 'hands-off' management offered the best path to achieving their conservation (and sometimes timber production) and aesthetic goals. This was often underpinned by their limited ecological (and sometimes silvicultural) understanding. This has been found among lifestyle landowners elsewhere and has been described as a 'benign neglect' (Klepeis et al. 2009; Gill et al. 2010).

Active forest management is particularly important for maintaining and enhancing biodiversity values in highly human-modified rural landscapes (Lindenmayer and Franklin 2002). Our findings suggest key biodiversity management considerations for the forests on small-acreage properties include controlling invasive weeds and preventing their further spread, reducing soil erosion and wildfire hazards, and, where appropriate, working to

restore the remnant ecosystem's composition, structure and functioning. Achieving these and all other landholder objectives will require on-going forest monitoring and adaptive management strategies (Lindenmayer and Franklin 2002; Salt et al. 2004) but encouraging adoption will be challenged by the 'passive management' philosophy held by many lifestyle landowners. Without site-specific and timely active management interventions, the degradation of fragmented forests can be exacerbated, potentially rendering them environmental liabilities (Salt et al. 2004). In amenity landscapes, this liability can quickly spread to neighbouring properties and impact neighbourly relations (Klepeis et al. 2009; Epanchin-Niell et al. 2010; Meadows et al. 2013). Many lifestyle landowners will need to be convinced that passive forest management can degrade the very environmental and social values they seek to foster.

Gardens and food-forests

There is a need for improved management of exotic species on small-acreage properties if local biodiversity values are to be preserved. Most of the landholders were using exotic species with a high weed potential in their gardens and other tree-plantings and some of these species had spread into adjacent bushland. Such species included Agapanthus, Duranta, Mock Orange (*Murraya paniculata*), Jacaranda (*Jacaranda mimosaefolia*), African Tulip (*Spathodea campanulata*), Cocos Palm (*Syagrus romanzoffiana*) and running Bamboo (*Bambusa spp.*) spreading from garden and arboretum plantings, and Coffee (*Coffea arabica*), Brazilian Cherry (*Eugenia uniflora*), Ice-Cream Bean (*Inga edulis*) and Leucaena (*Leucaena leucocephala*) spreading from food-forest plantings.

Some of the above-noted invading exotic species are established weeds throughout the study site and others are potential 'sleeper weeds' (Low 2001). The latter pose a high risk of further introduction and spread throughout the study site and similar amenity landscapes. For example, permaculture-style food-forest plantings are embraced by an increasing number of rural lifestyle landowners and the permaculture industry advocates the planting of numerous highly weedy exotic fruit tree and other multi-purpose species. A number of the landholders in our study were strongly aligned with the permaculture industry and many others were obtaining exotic plants and advice for their planting from local markets, garden clubs and retail nurseries. Previous research has also found advice from such sources can be inconsistent with best-practice NRM (Gill et al. 2010).

Our findings suggest there is a need for many lifestyle landowners to better understand and practice their ecological responsibility when utilising exotic species. In particular, the use of recognised highly invasive species (i.e. nationally and/or state-listed 'declared' species) should be avoided. Greater monitoring and enforcement of plant sales at local markets by State and Local Government authorities could help to achieve this. Authorities could also run market stalls in conjunction with local NRM groups to inform and educate landowners about locally-invasive exotic species, native alternatives (also provided for sale at subsidised prices), and appropriately designing property plantings. This 'zonal' planting approach would advocate restricting exotic species to landscaping around a house, Australian natives to a property mid-zone, and utilising only locally-native species at property perimeters and particularly in areas bordering native forests.

NRM groups could also collaborate with local permaculture and organic producer organisations to support landowners in establishing locally-appropriate and responsibly-managed food-/agro-forests. This has the potential to increase small-acreage landowner engagement with best-practice NRM. Adaptations of the smallholder tropical agroforestry/home-garden or analogue forest models that integrate permaculture-style production and

biodiversity conservation (e.g. Senanayake 2000) would match many lifestyle landowners' environmental, subsistence and commercial objectives (Meadows et al. 2014). Importantly, such a collaborative project could support the development of networks of micro-scale 'hobby' growers and artisan food producers thereby facilitating improved product utilisation and marketing opportunities. For example, these networks could help to reduce the common wastage of product from weedy exotic orchard species (e.g. tropical fruits, Coffee, Olives—*Olea europaea*) that is often left for the birds and bats to spread into the local environment.

Regrowth forests

In our study site, there is a need for increased active management of regrowth forests, including on small-acreage properties, if local biodiversity values are to be protected and enhanced. Throughout the study site, the exotic tree Camphor Laurel and species of the native Wattle (particularly *Acacia melanoxylon*, *A. disparrima* and *A. o'shanesii*) are dominant components of the regrowth forests on former LSR sites. These species occur as single large paddock trees or copses, monoculture or near-monocultures, and in mixed-stands with other native and exotic species. Besides Camphor Laurel, other common woody weed species (trees and shrubs) include Privet (*Ligustrum spp.*), Chinese Elm (*Celtis sinensis*), Easter Cassia *(Senna pendula var. glabrata*), Lantana (*Lantana camara*), Groundsel (*Baccharis halimifolia*) and the naturalised North Queensland natives Cadaghi (*Corymbia torelliana*) and Umbrella Tree (*Schefflera actinophylla*). Vigorous exotic vines including Morning Glory (*Ipomea indica*) and Cats Claw Creeper (*Macfadyena unguis-cati*) are also increasingly problematic in some areas. With their combinations and relative abundances of introduced species unnatural to the local biome and their high potential for transforming local ecosystem functioning, these regrowth forests are characteristic of 'novel ecosystems' (Hobbs et al. 2006). There is debate over whether it is feasible or even appropriate to attempt ecosystem restoration in these forests, which then flows on to questions about both the level of resources that should be allocated to their management and the most effective management strategies for them (Lugo and Helmer 2004; Hobbs et al. 2006; Kanowski et al. 2008). Given the critically endangered status of LSR, we consider that in the regrowth forests on former LSR sites throughout the Noosa hinterland, increased interventions are required to restore the compositional, structural and functional features characteristic of the LSR communities. Catterall and Harrison (2006) have suggested such management presents an opportunity for large-scale cost-effective ecosystem restoration in similar regrowth forests along Australia's east coast.

Our findings suggest most small-acreage landowners are not controlling Camphor Laurel trees on their properties and many will need convincing of the benefits of doing so. Landholders' attitudes towards this species ranged from utter disdain (with accompanying control efforts) to acceptance to reverence. For example, two 'do-it-yourselfer' landholders were nurturing and planting Camphor Laurel seedlings (…*we just make them look nice and manage them*), and one English immigrant 'constrained' couple felt the trees had much aesthetic appeal and intended to retain them on their property. Two other landholders reported their English neighbours' admiration and nurturing of the trees, as described by one—

> …he loves them, so he keeps them nicely trimmed and in Spring you can clearly see the twenty or so Camphor Laurels dotted across his place, yet he'll cut down rain-forest trees.

Other landholders, well-aware of the species' problematic weed status, conceded its prevalence meant it must now provide significant wildlife habitat. Clearly, Camphor Laurel trees are valued by some lifestyle landowners in the study site. A similar sense of community attachment has been found in parts of northern New South Wales where Camphor Laurel-dominated regrowth forests are pervasive (FNCC 1998). Such a cultural acceptance, reflective of the 'rogue-to-respectability' phenomenon (Low 2001, p. 252), is also somewhat evident among restoration professionals as a result of research confirming the high value of Camphor Laurel for facilitating LSR restoration (Kanowski et al. 2008; Parkes et al. 2012).

Despite being an invasive weed species, Camphor Laurel-dominated regrowth forests can support promising levels of LSR biodiversity. They provide habitat for native frugivorous birds and a micro-climate for native plant regeneration (Catterall and Harrison 2006; Kanowski et al. 2008). Both early- and later-successional native species of a range of life-forms were observed in the understorey of Camphor Laurel-dominated regrowth forests in the current study. Rather than rapid, wholesale eradication of these forests, current best-practice recommends carefully-planned, progressive conversions involving strategic individual tree (i.e. thinning) and patch-scale removals (Kanowski et al. 2008). Combining these approaches and applying variable tree removal methods can help with 'risk-spreading' (Lindenmayer and Franklin 2002; Salt et al. 2004), thereby increasing landscape diversity and associated habitat opportunities for local flora and fauna. It can also be a more socially-acceptable approach to ecosystem restoration within urbanising rural landscapes (Knoote et al. 2010). Practitioners should therefore consider a patchy combination of strategic pruning (to release suppressed regeneration), whole tree felling (to create larger gaps) and the ringbarking or poisoning of trees to create standing dead wood (to retain shading, create bird perches). These practices can be also used to provide coarse woody debris, erosion control and streambank stabilisation, and soil carbon and moisture-retention benefits. Diverse under-plantings can complement the natural regeneration and could include vigorous (i.e. strangling) native vines and *Ficus* spp. planted around live and standing dead Camphor Laurel trees. While these interventions can accelerate the development of desired LSR characteristics, many small-acreage landowners will need to be better informed and educated that the conversion process, which they may perceive as overly destructive and unsightly, will result in improved long-term ecological and aesthetic outcomes.

There is also an opportunity to accelerate LSR recovery in the Noosa hinterland's substantial areas of Wattle regrowth. Many of the region's rural landowners are known to view these dense, near-monoculture forests as unworthy (Burrows 2004) and a number of our study's landholders (from all of the types) expressed this view. They commonly stated it was *weedy* (*…it's a bloody weed virtually*), was suppressing preferred native rainforest regeneration (*…because of the* (Wattle's) *very high canopy and it* (undergrowth) *doesn't grow so much. The young trees that do take root don't survive because they are struggling to get the light.*), and was restricting their revegetation opportunities. Gill et al. (2010) have found similar undesirability sentiments regarding Wattle trees among lifestyle landowners elsewhere in Australia. Our study's landholders also often lamented the lack of native understorey and groundcover in these forests, particularly following successful weed control efforts, and the resultant run-off and erosion problems they encountered (*…because you see Wattle trees like this one over in the paddock, and there is a big dead ring all around this tree, nothing grows there*). Most of the landholders were interested in diversifying the composition and structure of these forests but were wary of the local Council

regulations preventing any thinning seen as necessary to achieve this. Nonetheless, some 'engaged' and 'do-it-yourselfer' landholders were still actively intervening—

> …there was a number of Wattles down there and there still is, and up until about two years ago I used to go around a ring-bark some of those and gradually get rid of them. Because I found with the Wattles, I mean they are a regenerative tree, but they don't really allow much to come up underneath them because they just take it all, so you either end up with just Wattles or if you're lucky you might get a few other things coming up.

Natural regeneration of a range of native rainforest species was evident in many of the Wattle-dominated regrowth forests occurring on the case-study properties, and many of the landholders understood the succession process the Wattle regrowth was facilitating. However, with the regeneration typically sparse and small, the landholders felt its development would be frustratingly slow—

> I'm too old to see those cabinet (rainforest) timbers grow up through that, I'd rather remove (thin) them (the Acacia trees) and plant the canopy species straight up.

The above-noted best-practice methods for converting Camphor Laurel-dominated regrowth forests to LSR also have potential application to Wattle-dominated regrowth forests. Anecdotal evidence from local restoration experts suggests there can be good growth responses in existing recruits and a vigorous development of pioneer species following patchy removals of large Wattle trees. Observations in North Queensland restoration plantings also suggest that Wattle removals can stimulate an increase in native species recruitment (Freebody 2007). However, the broad-scale effectiveness of the conversion strategies in Wattle-dominated regrowth forests remains unclear and field-trials are required to test the strategies across a range of sites. Trials also need to determine the best-practice methods for enhancing these forests' groundcover and understorey complexity to slow run-off, trap its sediment loads, and thereby reduce erosion and waterway pollution. Local authorities should reconsider vegetation management laws that currently restrict landowners from positively influencing the rate and pathway of succession in regrowth forests. This would obviously also require careful consideration of the potential for perverse outcomes and how these could be mitigated.

Other considerations

Project scale and contract length are important considerations for forest management incentive programs on small-acreage properties. Projects involving cooperation between neighbouring landowners are important for maximising investment efficiencies and potential biodiversity and aesthetic outcomes of forest management interventions throughout amenity landscapes (Erickson et al. 2002; Klepeis et al. 2009; Epanchin-Niell et al. 2010; Knoote et al. 2010; Meadows et al. 2013; Cooke and Moon 2015). The cross-boundary nature of many NRM issues of concern to small-acreage landowners (i.e. weeds, erosion, wildfire, wildlife corridors) also makes neighbourly cooperation important in these settings. Successfully converting Camphor Laurel- and Wattle-dominated regrowth forests to LSR will require long-term maintenance, underpinned by regular monitoring and adaptive management interventions (Kanowski et al. 2008; Parkes et al. 2012). Strategic planning and on-ground work will need to be guided or implemented by restoration professionals skilled in identifying weeds and regenerating native species (Parkes et al. 2012).

We recommend a minimum contract length of 10-years for these restoration projects, with staged payments based on measurable outcomes.

All of the landholders were interested in field days (…*field-days are useful and Landcare does have some good ones*), particularly to visit properties showcasing exemplary small-acreage forest management and learning from the property owners and other visiting like-minded landowners. Many considered landowners like the experienced and influential 'engaged' landholders should be involved in support program delivery because they are knowledgeable and would be trustworthy conduits between traditional support providers. Program managers can engage this type of landowner as peer-mentors and potentially increase the credibility of and participation in NRM support programs (Emtage and Herbohn 2012; Meadows et al. 2013). The agroforestry Peer Group Mentoring program operating in Victoria (Australia) is a successful example of this approach to extension whereby the mentors are supported by professional advisors and paid to train other landowners (Curry and Reid 2009). This program has much potential for adaptation to other settings and NRM scenarios. For small-acreage forest management, contracted mentors could be paid to develop their properties into best-practice examples of native gardening, agroforestry/food-forests, and, or mixed-species revegetation including the restoration of weed-dominated regrowth forests, and also to host site-visits and training for interested landowners. This extension role could include one-on-one and small group tours, and 'open forest' field-days. These model small-acreage forests would also be useful as case studies in local NRM guidebooks.

Most of the landholders were interested in propagating native rainforest plants. This was mostly driven by a desire to reduce revegetation costs—

> Yeah, so I collect a bit of seed and I've got a little nursery down there…, because I knew money would be a problem for us.

Some landholders also recognised the importance of utilising local seed sources and particularly those found on and surrounding their own properties. Throughout subtropical eastern Australia, many small-acreage properties contain relicts of LSR which are valuable refugia of local genetic diversity for this critically-endangered forest type. Extension and incentive programs could therefore better educate landowners about the benefits of utilising these seed sources for on-property revegetation, and encourage and support their propagation. This could involve landowner training in best-practice nursery management (e.g. seed collection ethics, seed processing/treatment, hygiene, irrigation, nutrition) and the provision of subsidised resources for landowners to establish their own small plant propagation and storage facilities. It could also involve encouraging and facilitating these landowners' engagement with the community nurseries often attached to local NRM support groups. For example, this could involve the landowners supplying seeds sourced from their properties and providing voluntary labour in exchange for subsidised seedlings. These measures could help to increase small-acreage landowner appreciation of the important values of fragmented LSR relicts, and further encourage their preservation and expansion.

Concluding comments

Like other amenity landscape settings, forest cover has increased throughout parts of the Noosa hinterland over recent decades. Our research highlights that small-acreage landowners are key stakeholders in the forest recovery occurring in amenity landscapes

and the future ecological trajectory of these forests. Small-acreage landowners have diverse forest management interests and objectives and their properties host an equally diverse mix of managed and unmanaged remnant and regrowth forests, gardens and tree-plantings. These forests and gardens will commonly contain invasive weed species. The varying levels and types of forest management activity on small-acreage properties has important implications for the conservation of biodiversity in amenity landscape settings like the Noosa hinterland. We find a need to increase active and best-practice forest management on small-acreage properties in order to better control and reduce the spread of invasive weeds and soil erosion, reduce fire hazards, and positively influence the rate and pathway of succession in regrowth forests, particularly those dominated by woody weeds.

Increasing small-acreage landowner adoption of best-practice forest management will require an increase in the support programs available to them. There is a need to raise many small-acreage landowners' awareness that active forest management is important for improved long-term ecological, productive and aesthetic outcomes. Peer-mentoring programs that include guided tours of small-acreage properties containing 'model forests' managed according to best-practice principles could be an effective means of transferring forest management knowledge and skills to interested landowners. Incentives should include labour support and other subsidised resources to help landowners implement recommended practices. Supporting landowners to establish their own small native plant nurseries and to engage with local community nurseries (i.e. supplying seeds, volunteering labour) would help to increase their forest management interests and knowledge, and potentially their revegetation and restoration activity. More cooperative, cross-boundary forest management projects with long-term contracts involving on-going monitoring and adaptive management guided or implemented by skilled professionals are needed in amenity landscapes. Such projects are particularly important to increase the success of restoration interventions in weed-dominated regrowth forests. Our findings also suggest that forest cover may continue to expand in parts of the Noosa hinterland study site as regrowth forests further develop and small-acreage landowners continue to plant trees. Best-practice interventions can help to steer these forests (and those in other amenity landscapes) along a preferred ecological trajectory that will protect and enhance local habitat and biodiversity values. There is also a need for long-term socio-ecological analyses of amenity landscapes' diverse and evolving small-acreage forests to better inform their optimal future management.

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