

Landscape approaches; what are the pre-conditions for success?

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Abstract Landscape approaches are widely applied in attempts to reconcile tradeoffs amongst different actors with conflicting demands on land and water resources. Key principles for landscape approaches have been endorsed by inter-governmental processes dealing with climate change mitigation and adaptation and biodiversity conservation.

We review experiences from seven landscapes located in the Congo Basin, Eastern Indonesia and Northern Australia. Landscape initiatives were applied in situations where large-scale extractive industries, local peoples' livelihoods and global biodiversity objectives were in conflict. We found that common published principles for landscape approaches are not applied systematically in the areas studied. Practitioners draw upon landscape approach principles selectively and adapt them to deal with local conditions. We consider that landscape approaches do not

provide silver bullet solutions to these situations nor do they provide an operational framework for large-scale land management. Landscape approaches do, however, provide an organising framework for disentangling the complexity of the landscape and facilitating the investigation of impacts of different courses of action. They enable alternative scenarios for what future landscapes might look like to be investigated and they create the space for multi-stakeholder negotiations. Outcomes from landscape scale approaches are determined by the power differentials amongst stakeholders and the existence, or otherwise, of functional institutions to take decisions and enforce agreements. Landscape approaches cannot overcome disparities in power or entrenched interests nor can they substitute for institutions with authority to establish and legitimise property and resource rights. They can, however, provide a mechanism around which civil society can be mobilised to achieve better land use outcomes. Landscape approaches are successful when they have strong leadership, sustained long-term and facilitated processes, good governance, adequate budgets and adequate metrics for assessing progress. Private sector engagement is necessary and all parties must have sufficient shared interest in outcomes to motivate their participation.

Keywords Tropical forest conservation · Conservation and development trade-offs · Forests and livelihoods · Agricultural expansion in tropical forests · Economic development and forest change · Sangha group

Introduction

Demands upon land in the tropics are intensifying (Laurance et al. 2014). Growing needs for food, urbanisation

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and other land uses are placing increased pressure on natural areas (Bruinsma 2009). Tropical land is increasingly subject to competing claims (Giller et al. 2008) and reconciling these claims presents “wicked problems” (Rittel and Webber 1973). Initiatives to reconcile competing land uses and to achieve both conservation and production outcomes are often described as landscape approaches (Sayer et al. 2013; Milder et al. 2012). Landscape approaches are now ubiquitous in the natural resource management discourse (DeFries and Rosenzweig 2010). The environmental services that are needed to support the sustainability of agriculture are sought through landscape approaches (Scherr and McNeely 2008; Brussaard et al. 2010). Biodiversity objectives are widely thought to be best obtained through optimising land use integration through multi-functional landscape mosaics (Chazdon et al. 2009). Many conservation projects in the tropics are now framed within a landscape context (Pressey and Bottrill 2009) and there is abundant theory to underpin the desirability of seeking landscape mosaics that optimise societal outcomes from conservation and development (Naveh 2001; Sunderland et al. 2012).

In this paper, we argue that landscape approaches should not be seen as a prescriptive approach to spatial planning. Published principles for landscape approaches (Fischer et al. 2006; Lindenmayer et al. 2008; Sayer et al. 2013) should not be seen as a set of boxes to be ticked in the search for an agreed spatial plan but rather as a menu of approaches from which practitioners may draw to solve problems on the ground. The application of landscape principles might eventually lead to a spatial plan accepted by stakeholders but landscapes are constantly changing under the influence of multiple drivers and landscape blue prints appear to be the exception rather than the rule (Sayer et al. 2008).

A study of the impacts of landscape-scale projects designed to reconcile conservation and development objectives in 15 landscapes in the Mekong River basin concluded that although the projects had undoubted merit, there was little evidence to indicate whether the use of a landscape approach had produced definitive solutions to land-use conflicts (Sunderland et al. 2012). Spatial plans had not been produced and there was no monitoring of landscape scale outcomes other than biodiversity. However, shared understanding of conflicts, tradeoffs and future possible scenarios had improved. Landscape approaches are often applied in attempts to resolve “wicked problems” (Rittel and Webber 1973). There are fundamental difficulties in identifying and agreeing metrics to measure progress in solving wicked problems—if opinions differ on the optimal solution to a problem, then no single metric can measure success (Sayer et al. 2007a). National level reviews of landscape and ecosystem approaches to forest

management have revealed that this is still very much a work in progress (Sayer et al. 2005). Much of the theory and practice of landscape approaches is underpinned by the assumption that facilitation and negotiation will eventually allow for a consensus on a desired outcome (Sayer et al. 2013) but in reality there are always entrenched views and conflicts of interest and true consensus is rarely achievable (Stewart et al. 2011). In reality, conflict between industrial scale agriculture, small-scale local agriculture, other competing land uses and conservation is often the subject of strongly contested activism with highly polarised positions (Sunderland et al. 2007). Landscape approaches sometimes appear to be advocated on the assumption that they can resolve these fundamental differences in a way that will avoid conflict. In this paper, we examine evidence for the success of landscape approaches in making progress towards finding solutions to “wicked problems” in contested domains.

Methods

This paper reports on the outcomes of a meeting of landscape practitioners held at Cape Tribulation in Far North Queensland in July 2014. 24 persons who had been engaged in attempts to reconcile conservation and development trade-offs at landscape scale attended the meeting. The participants were almost equally divided between persons who had been involved in landscape-scale initiatives in Indonesia and Australia (both nationals of those countries and international researchers and practitioners) and scientists who had broader international involvement in the development of landscape concepts. The group met for three days to discuss seven landscape initiatives with which at least one participant had been involved. In each case, the initiatives were motivated by conservation organisations seeking to lessen the negative impacts on conservation values of expanding agricultural, forestry and urbanisation in rainforests and tropical savannahs. The landscape work undertaken at each landscape was presented by one of the participants and then discussed by the group. Participants worked in four groups to compile a list of the main factors which they considered limited or led to success in landscape initiatives. Success was broadly understood to be achieved when the process led to agreement on compromise solutions whereby development and conservation tradeoffs were resolved. The list of limitations and success factors from the four groups were rationalised into 18 limitations and 10 success factors. Participants were then asked to distribute five votes to indicate which limitations were most important and five for the most significant success factors. Participants voted on the list of criteria. The entire group then debated the significance of

limitations and success factors and reached agreement on ten preconditions which were considered to be of fundamental importance.

The seven landscapes studied were:

Merauke, West Papua, Indonesia: Expansion of industrial fibre plantations into rainforests, grasslands and savannahs and indigenous people's territories.

Kapuas Hulu, West Kalimantan, Indonesia: Establishment of a forest corridor between two national parks to allow wildlife to move through areas increasingly dominated by oil palm estates.

Malinau, East Kalimantan, Indonesia: Conflicts between logging, industrial plantations, mining and biodiversity conservation in rainforest areas.

Riau, Sumatra, Indonesia: Expansion of industrial fibre and oil palm plantations into rainforests.

Kaimana, West Papua, Indonesia: Expansion of industrial logging and estate crops into traditional lands of Papuan hunter-gatherers and subsistence farmers.

The Sangha Tri-National Landscape, Cameroon, Congo and Central African Republic: Conflicts between industrial logging, community forestry, subsistence agriculture and artisanal mining in rainforests.

The Wet Tropics of Australia: Conflicts between forestry, tourism, agriculture, urbanisation and biodiversity conservation in rainforests.

We reviewed published and unpublished reports on the situation before the projects, the approaches taken by the projects and the situation after the projects. We assessed each of the projects according to their respect for published criteria (Sayer et al. 2013). Our discussion of processes employed to measure changes in environmental values and local livelihoods was based upon the sustainable livelihoods framework (Endamana et al. 2010; Campbell et al. 2003).

The initiatives differed in that some were funded "projects" by development assistance agencies with plans for inputs and desired outcomes which were overtly described as landscape initiatives. Others were processes initiated by civil society and government (Australian Wet Tropics) or commercial companies (Riau and Merauke, Indonesia) in response to criticism by environmental activists. The latter addressed landscape conflicts but did not explicitly use a landscape approach. Surprisingly, landscape-scale metrics on livelihoods and natural habitat condition were not available for any of the landscapes.

Results

Table 1 gives basic information on the nature of the landscape-scale initiatives that were undertaken, who initiated them and an appraisal of their impact.

The following narrative on each of the landscapes was written on the basis of the knowledge of meeting participants who had been directly involved in each of the landscapes, and a review of the literature.

Merauke, Papua, Indonesia

This landscape is a tropical savannah consisting of grasslands and swamp forests with patches of drier forest on parts of the landscape that rise a few metres above the plain. It is in the far south-east corner of Papua Province on the Indonesia part of the island of New Guinea. An Indonesian conglomerate with agri-business interests, obtained a concession for growing wood for pulp. A foundation linked to the company funded the NGO Conservation International (CI) to develop a plan that would balance the objectives of protecting the diversity of habitats and regionally rare species, protecting hydrological processes, maximising fibre production and ensuring continued access to resources by local communities (Conservation International 2010). It took approximately, two years to derive the plan, which is currently on hold as the company awaits the development of infrastructure promised by government. The intention is still to see it implemented, though only time will tell to what extent it will be fully realised. Most of the two years was taken up with data collection and the derivation of data layers in a GIS that can be used by a multi-criteria analysis software package. The data collection phase was both time-consuming and expensive. It was necessary to derive maps of production suitability, habitat type, hydrology, the locations of rare species and the ways in which local communities used different parts of the landscape for different purposes. Established methodologies exist for these processes (Moffett and Sarkar 2006; Figueira et al. 2005). The Merauke landscape is an example where a company had legal rights to most of the land but undertook a landscape process to comply with legal requirements and to guard against potential accusations from NGOs and purchasers that its activities were destroying natural habitat and infringing on the rights of local communities. The company had de facto control of the process and the donor made generous financial support available.

Kapuas Hulu, West Kalimantan, Indonesia

The NGO WWF had been active in supporting two national parks in this landscape for several years. In the last decade, oil palm plantations have been expanding rapidly in the area and are occupying much of the land outside the protected areas. Populations of the endangered orangutan (*Pongo pygmaeus*) occur in both parks but their numbers are small and continue to decline. A habitat corridor to allow orangutans and other plant and animal species to move freely between the protected areas is thought to be essential to

Table 1 Summary of interventions in the seven selected landscapes

Landscapes	Merauke (Papua)	Kapuas Hulu (West Kalimantan)	Malinau (East Kalimantan)	Riau (Sumatera)	Kaimana (West Papua)	Sangha Tri-National (Congo Basin)	Australian Wet Tropics
Funding project	Industrial stakeholder	Development agency	No centralised funding	No funding for process	Aid agency for facilitation	Aid agency for facilitation	Government facilitation and investment with civil volunteerism
Multi-stakeholder process	Yes	Yes	Intermittent	No	Attempted	Yes	Formalised
Involvement of international NGO/facilitator	Yes—CI	Yes—WWF	Yes	No	Yes—IUCN	Yes—IUCN	No
Baseline metrics established	Yes	Yes	Partial	No	Attempted	Yes	Basic metrics available
Process maintained for more than 5 years	Implemented by company	Yes	No	Yes	No	Yes	Semi-permanent process
Landscape plan agreed	Yes	Proposed	No	Continuous negotiation	No	Yes	Yes
Landscape plan implemented	Partially	Influenced	Influenced	Influenced	No	Partially	Yes
Scientific basis	Multi-criteria analysis	Wildlife surveys	Comprehensive studies of livelihoods and environment, models developed	High Conservation Forest criteria applied	Theories of change developed	Participatory monitoring system, scenarios developed	Research on components of system and some attributes of landscape

safeguard the long-term survival of biodiversity. The land required for the corridor is at present occupied by the mixed agroforests that provide the livelihoods of local communities. The communities would increase their incomes in the short-term if these agroforests were converted into oil palm plantations but this would bring migrants to the area and domination by large companies. WWF is seeking to persuade the communities to maintain their agro-forests in a near natural state that provides habitat for orangutans and other wildlife species. Critical issues of land ownership and of how much use local people can continue to make of the forests in the corridor are the subject of continuing negotiations. Measures are being put in place to monitor both biodiversity values and changes in the livelihoods of local people relative to those who inhabit areas not impacted by the corridor.

Malinau, East Kalimantan, Indonesia

A forest area of 43,000 km² was allocated to the Center for International Forestry Research (CIFOR) in 1994 for research on forest land cover change at a landscape scale.

The area included the Kayan Mentarang National Park, several logging concessions, some watershed protection forests and land under use by local communities for agroforestry and shifting rice cultivation. Outside investors were also showing interest in developing oil palm and wood-fibre plantations in the area. CIFOR intended to demonstrate how research could help to reconcile these different land uses in ways that would achieve improved outcomes for biodiversity, local people and industrial forestry. Studies of components of the landscape were conducted, particularly on the livelihoods of the inhabitants, the sustainability of forestry operations and the status of biodiversity. Simple simulation models were used to illustrate the linkages amongst these different components of the landscape. The processes and their achievements are the subject of numerous scientific publications (Boedhihartono et al. 2007; Campbell et al. 2010; Wollenberg et al. 2007). The landscape initiative by CIFOR did not challenge the basic forest land allocation by the government of Indonesia but it did engage with the local administration to help explore the implications of different development

scenarios. In particular, the local implications of oil palm development were modelled (Sandker et al. 2007). The research activities were not designed in a way that would allow for their impacts on the ground to be assessed. Baselines and monitoring systems were not put in place and outcomes were not described in ways that would enable measurement. However, the local administration engaged fully with the process, developed its own spatial models and it appears that the information provided by the research contributed to the capacity of local decision-making on land allocation.

Riau Province, Indonesia

Riau Province on the east coast of the island of Sumatra was until the early 1990's relatively sparsely populated with people largely concentrated along rivers and practicing rubber, cacao and coffee agroforestry, rice cultivation and fishing. Large areas of the province are covered in peat swamp forests which were relatively inaccessible for traditional users. A number of large companies hold concessions to convert forests into wood-fibre and oil palm plantations and this process accelerated in the 1990 s. The province has witnessed the most rapid deforestation in Indonesia in recent decades and vast areas are now covered in oil palm and Acacia plantations. Conservation NGOs have campaigned vigorously against this conversion and have worked in the countries where the oil palm and fibre are marketed to generate consumer resistance to products that come from companies that have not respected high environmental and social standards in forest conversion. The NGOs have pressured the companies to use criteria established by the Round Table for Sustainable Palm Oil and the High Conservation Value Forest Network to conserve patches of natural forest and to protect the rights of forest-dependent local people. There was no landscape process as such but a hotly contested set of negotiations between the NGOs and the companies. The result has been that small areas of natural forest have been conserved within the plantation estates. These tend to be isolated fragments with only modest biodiversity values. When they are accessible, they are encroached upon by local people and migrants from other parts of Indonesia. One extensive forest area was considered to be of such high conservation value that it was excised from a concession and designated as the Tesso Nilo National Park. Whilst the area had remained in the concession, the company had committed to ensure protection of a significant part of the natural forest. When the area was handed over to the government-protected area authority in 2004, the company ceased its protection measures. In the ten years that have elapsed 80 % of Tesso Nilo National Park has been encroached

upon and much has been converted to small-scale oil palm plantations. Areas of high conservation value natural forest embedded within the fibre plantations have in general been better protected and remain in good condition. Riau is an example where a facilitated process could have led to forest conversion occurring in patterns that would have provided better outcomes for the companies and for biodiversity. The activist NGOs certainly slowed the process of forest conversion and protected some forests but activism in the absence of a landscape overview and a process of analysis and negotiation has resulted in a haphazard landscape configuration that does not optimise either conservation or development benefits.

Kaimana, West Papua, Indonesia

In 2003, IUCN secured major funding for a Landscapes and Livelihoods Initiative. The intention was to apply an integrated approach to landscapes where extreme poverty and high biodiversity values were co-located. Areas were targeted where major land cover change was being driven by industrial forestry or agriculture. One of the locations selected was a landscape in West Papua in the Regency of Kaimana. This remote area retained large areas of biodiverse natural forests and was inhabited by forest-dependent Papuans. Oil palm and sugar estates, industrial logging and potentially fibre plantations were all thought likely to expand in the area. IUCN with a local NGO had resources to facilitate a participatory process to reflect upon landscape change and explore scenarios that might be favourable or unfavourable for the local people and the biodiversity of the area. IUCN did not have the resources to make any more than very small-scale practical interventions. A series of workshops was held attended by local communities and officials from the district administration. Interesting ideas emerged on the likely changes in the landscape and their implications but in the absence of IUCN having significant resources to invest in the area interest from local participants was not sustained. An attempt was made to establish environmental and development base-lines but primary data collection would have required major resources that were not available and baselines depended upon limited secondary sources. Meanwhile, the local authorities approved investment projects without appearing to have been influenced by the issues raised in the scenario analysis. Funding for the Landscapes and Livelihoods Initiative was terminated after 3–4 years and IUCN withdrew from the area. There is no evidence that the efforts deployed over those years to facilitate a landscape process led to any changes in local development or conservation activities in the longer term.

The Sangha Tri-National Landscape, SE Cameroon, SW Central African Republic and N. Congo

A major landscape-scale initiative in the Sangha Tri-National was one of the 12 large forest landscapes where attempts to integrate conservation and development were launched at the Earth Summit in Durban in 2002. The landscape covers about 45,000 km² located across the borders of the three countries. The landscape includes protected areas, logging concessions and community forests and agroforests (De Wasseige et al. 2010). Several aid agencies and international conservation NGOs collaborate in the initiative. As part of its Landscapes and Livelihoods Initiative, IUCN put in place a participatory process for monitoring change in the landscape (Sandker et al. 2009; Endamana et al. 2010; Sayer et al. 2007b). Several organizations working in this landscape (IUCN, WWF, CIFOR, WCS, GTZ and local NGOs) known as “the Sangha group” meet once a year to discuss changes in the landscape. Indicators of landscape change were identified on the basis of scenario exercises conducted with local people and representatives of the external aid and conservation agencies. These indicators have now been assessed annually for 10 years and it is intended that this process will continue. The indicators show that changes in people’s livelihoods and in environmental values were influenced more by external investments and macro-economic trends than by the direct project activities of the aid and conservation agencies (Sayer et al. 2012). It was difficult to assess the indicators in a rigorous and replicable manner. There was rapid turnover in staff of the external agencies and local people’s participation was irregular. Measurement of the original indicators evolved as informants changed and interpreted the indicators differently. However, the landscape tracking efforts did improve understanding of the processes of change in the landscape and their drivers (Endamana et al. 2010). Surprisingly, the evidence produced by the assessments had little influence on the decisions and resource allocations of the international agencies active in the area or of government officials. The international agencies continued to implement programmes consistent with the directives flowing down from their head offices in spite of evidence that these were having little local impact. The Sangha group study revealed limitations in using participatory techniques to generate indicators—local actors selected indicators that were difficult to measure objectively. Conventional metrics used by conservation and aid agencies might have been more rigorous but local people would not necessarily have had the same level of engagement in the process.

Wet Tropics Rainforests, North Queensland, Australia

Some 2 million hectares of the Australian wet tropics landscape consists of a mosaic of conservation areas, agriculture, urban and rural residential development and

Indigenous land uses (Dale et al. 2008; Stork and Turton 2009). At least 18 traditional tribal groups have a mix of historical, cultural and of legal interests in all lands in the region. The most productive land is privately owned, while the more rugged parts are mainly leasehold, state forests or national parks. Agriculture is the main productive land use; with nearly 130,000 ha of sugar cane, about 25,000 ha of horticulture, 20,000 ha of dairy farms and 700,000 ha under extensive pastoralism. Improved pastures for grazing account for about 65,000 ha in coastal areas. The main crops are sugar cane and bananas. Extensive grazing is the main land use in the drier, western parts of the region. Forestry has declined in recent times, though rainforest vegetation covers about 95,000 ha of freehold land. There is still some growth in sugar estates and horticulture, especially bananas and tropical fruits, intensive livestock, private forestry, aquaculture and urban and peri-urban development.

The area has unique and long-recognised biodiversity values but it also supported profitable logging industries and much forest has in the past been cleared for sugar cane and cattle. In the 1980 s conflicts occurred between conservation activists and people concerned with jobs and local economic development (Dale 2014). Activists used civil disobedience to prevent logging and land clearing (Stork et al. 2014). The end result was that 1.2 million ha of the Queensland Wet Tropics were inscribed on the World Heritage list in 1989. All catchments in the Wet Tropics flow into the lagoon of the Great Barrier Reef, another World Heritage area of international significance. The integrity of the region’s two world-heritage areas is closely interlinked. There is an active ongoing regional debate about the need for integrated management of multiple ecosystem services. Agricultural sediments, nutrients and pesticide impact on the reef ecosystems. Clearing for agricultural expansion competes with the protection of terrestrial world heritage values and the viability of economically important iconic species such as the cassowary. The increasingly important tourism industry depends upon values that are negatively impacted by land-based development.

In the last two decades, there has been a focus on regulating and incentivising land management practices to reduce nutrient, sediment and chemical runoff into the reef. Vegetation management has also been heavily regulated. A natural resource management process has set agreed targets for resource management through a wide range of management interventions. A non-governmental body, TER-RAIN, coordinates and supports land use practices in the wet tropics.

A regional plan includes Management Action Targets and Resource Condition Targets. Payments for climate change mitigation and adaptation services are expected to

Table 2 Participant views on limitations and success factors for landscape approaches. Figures are the number of votes participants gave to each limitation and each success factor

Limitations	Australian	Indonesian	Other Nationalities	Total
Communications barriers—use of jargon and technical language	1	1	1	3
Cost and time of data collection and monitoring	2	3	2	7
Inability to resolve fundamental conflicts	1	0	0	1
Lack of human and financial resources and short term nature of funding commitments	8	6	8	22
Weaknesses of governance policies, lack of transparency, lack of formalisation	4	5	6	15
Perverse incentives	2	1	0	3
Conflicting values, entrenched positions	3	0	4	7
Lack of acceptance of values of others	1	1	1	3
Rights not reflected in responsibilities	1	1	0	2
Disconnect between policies, plans and implementation	1	0	0	1
Lack of leadership and accountability	2	2	0	4
Sectoral silos of government agencies	1	3	2	6
Poor synergies with the new investments	0	0	1	1
Inability to cope with dynamics of landscapes, especially external shocks	1	3	2	6
Breadth of competencies and institutions to deal with integrated landscape management	1	1	3	5
Insufficient breadth of competence of civil society	0	0	0	0
Process fatigue	0	0	1	1
Difficulty of demonstrating outcomes and incomes	2	1	1	4
Success factors				
Respect for diverse views, shared vision, mutual respect, trust, mediation, transparency, legitimacy	9	7	7	23
Enabling governance, policies and procedures	6	5	4	15
Ability to work across scales	1	0	0	1
Incentives for change, commitment	5	4	8	17
Human capital, capacity building, human resources	2	5	2	9
Relevant and quality science	1	0	0	1
Credible data and knowledge for decision support	4	1	4	9
Accepted baselines aligned with stakeholder views	2	2	2	6
Ownership, full involvement in the process, critical mass of civil society participation	2	5	1	8
Adaptability: resources + system to allow plans to adapt over time	0	0	3	3

pay land holders undertaking best practice activities within the landscape. Wider adoption of these practices would enhance the capacity of the region to secure the Resource Condition Targets agreed to in the regional NRM plan (Dale, Forthcoming). The present landscape was not planned in a formal sense (Bohnet and Smith 2007); it is not a designer landscape but rather emerged from many decisions by local land owners and government agencies. The community-based NRM plan, however, represents a landscape-scale approach aimed at increasing ecological functionality and economic efficiency in this heavily contested landscape (Dale et al. 2008). The present situation is now formalised under state and federal laws.

Table 2 presents the list of factors that participants considered to be limiting or needed for success. The participants in the meeting were not a representative or random sample of potential stakeholders in these landscape processes. Participants included researchers, practitioners and civil society activists who had initiated landscape processes. The practitioners and researchers had been employed to seek solutions to the divergent agendas of civil society actors. Many participants in the process had a strong conservation orientation. There is duplication and some redundancy in the factors identified and this clearly influenced voting patterns. Nonetheless patterns emerge, most notably that governance issues and the availability of

human and financial resources to operated landscape initiatives are the most important factors.

“Relevance and quality of science” and “Ability to work across scales” both attracted few votes whilst “Credible data and knowledge for decision support” was considered relatively important and “Cost and time of data collection and monitoring” was considered a limiting factor. This suggests that participants distinguished between curiosity driven, blue sky science that takes place in landscapes and the more practically oriented surveys and applied science that underpin landscape approaches. The problems of conflicting views and the existence of entrenched positions recurred in both limitations and success factors and the processes needed to reconcile these were all ranked as relatively important. The sectoral barriers between government bodies were seen as obstacles to progress.

Discussion

The review of these seven landscapes shows that the published principles for landscape approaches are not systematically applied. We contend that this situation prevails in many so-called landscape projects. The ideal situation where the outcome of a comprehensive landscape approach would be a widely accepted and translated into an enforceable spatial plan does not exist amongst the seven landscapes we reviewed. In the case of the Sangha Tri-National, Malinau and Kapuas Hulu landscapes spatial plans have been developed by individual stakeholders but these have not emerged from a multi-stakeholder process and do not necessarily reflect the views of the majority of stakeholders. Maps are therefore used by stakeholders to advocate for one view of a desirable landscape but they do not have broad legitimacy (Scott 1998). This situation appears to us to be common in situations where outside special interest groups seek to apply landscape approaches in developing countries (Sayer et al. 2008).

In a situation of plentiful planning resources and strong institutions a spatial plan would be the ultimate outcome of a landscape approach. A spatial plan shows which parts of a landscape should be allocated to specified uses and which parts should be protected. Some land uses are not incompatible with others so some locations can contribute to more than one use. There will always be winners and losers so plans do not necessarily represent negotiated outcomes that avoid conflict. More often, they represent a solution that all, or at least most, people that have legitimate interests in that landscape can live with. Even after identifying such a compromise plan, implementation takes a longer time. Social and economic conditions change and knowledge accumulates so plans have to change. There are

plenty of opportunities to influence the way a plan changes. Multi-criteria analysis is a tool that can be used to compare land use options and make trade-offs with a view to achieving compromise plans acceptable to most actors (Moffett and Sarkar 2006). This can be achieved with the use of fast modern computers and software that can identify multiple alternative spatial plans in real time. The analysis is transparent so the objectives and methods can be scrutinised, the analysis is repeatable meaning that others will get the same result if they use the same data and methods and most importantly, the costs of alternatives can be measured. This means, for example, that the cost to agriculture of allocating a parcel of land to conservation, or the cost to biodiversity of converting a parcel of land to oil palm plantation, can be reliably estimated. Thus, an agreed plan can be based on evidence, not anecdote.

The reality is that plans are strongly influenced by personal values and beliefs. Multi-criteria analysis is not a decision-making tool. It is a decision support tool based on evidence. When data are stored electronically, analyses can be iterated in response to changed circumstances and plans revised accordingly. Our review suggests that very few landscape initiatives are actually based upon such multi-criteria analysis and that agreed spatial plans are seldom developed. Instead actors pursue their land use aspirations but their decisions may be influenced by the knowledge of the interests of other stakeholders that emerge from processes of participation, modelling, scenario development and negotiated trade-offs. In all of the landscapes that we examined the reality on the ground fell far short of the ideal of a transparent, evidence-based process. Power differentials between stakeholders always exist and decisions are made on the basis of anecdotes and beliefs. Landscapes are the product of multitudes of decisions by stakeholders which all appear rational to those taking them but may not make sense to other stakeholders. Landscape approaches are still relevant but in most situations muddling through prevails over grand design (Sayer et al. 2008).

The seven landscapes that we reviewed are an arbitrary selection but they do cover a range of the conditions in which landscape issues arise and landscape approaches are applied. Our review of these cases suggests some underlying conditions that must be met to achieve success at the landscape level. These conditions go beyond the technical principles that we and others have identified in previous studies (Sayer et al. 2013; Lindenmayer et al. 2008; Fischer et al. 2006). The participants in our review identified ten pre-conditions which must be fulfilled if landscape approaches are to succeed:

1. *Inspired leadership is essential*: Local political leaders were important in achieving negotiated settlements in the Wet Tropics of Australia. Private sector

- leadership played an important role in Riau and Merauke. The convening power and leadership of research and conservation organisations contributed to the limited success in the Sangha Tri-National, the Kapuas Hulu, Merauke and Malinau.
2. *Long-term, adaptive commitment:* Changing entrenched behaviour takes time. In addition, landscapes are dynamic and ever changing, as are the pressures on them, both internally and externally. Long-term vision and deep understanding of these drivers of change are required, and this takes a longer time frame than the standard project cycle of 2–3 years. Likewise, the process of stakeholder engagement can require considerable negotiation that, again, requires long-term commitment to the process.
 3. *Facilitation is necessary but not sufficient to achieve landscape-scale outcomes:* Facilitation alone did not achieve results in Kaimana as local people, companies and the administration had no incentive to participate or respect group decisions. In those cases where decisions were enforceable by companies and the administrations, for instance in Riau, Merauke and the Sangha Tri-National facilitated stakeholder involvement was thought to have contributed to better outcomes.
 4. *Value propositions will motivate engagement:* People will engage with landscape-scale processes and multi-stakeholder fora if there is sufficient reason for them to do so. Logging companies in the Sangha Tri-National and fibre and oil palm companies in Riau and Merauke engaged with conservationists to consolidate their license to operate and access markets where purchasers favoured sustainable products.
 5. *Conflict and entrenched views must be openly addressed:* Facilitation alone will not reconcile fundamentally conflicting interests. There have to be financial incentives or legal restrictions to guarantee compliance with agreements. For example, activists could not have achieved a satisfactory outcome in the Australian Wet Tropics without government financial compensation to people who lost homes or livelihoods and enforcement of laws restricting extractive activities.
 6. *Strong systemic governance is essential:* Agreements have to be enforceable by law, cadastral records need to be in place, and land rights need to be clear. These pre-conditions were present in the Wet Tropics of Australia but not present in Riau or Kaimana and only to a limited extent in Malinau, The Sangha Tri-National or Kapuas Hulu. Governance has an important role in mediating power differentials – local people had little capacity to deal with large companies in Kapuas Hulu, Malinau and the Sangha Tri-National. Local people needed NGO activists or government agencies to defend their interests.
 7. *Private sector engagement is a key element of success:* In Merauke and Riau, large corporate landholdings were at the core of the landscapes. When the corporations saw the value of engagement, they were able to mobilise the capacity to achieve landscape outcomes. Logging companies in the Sangha Tri-National found an interest in collaborating to retain access to high value European markets which required timber to be certified as sustainable. It remains to be seen if oil palm companies in Kapuas Hulu might engage with the wildlife corridor initiative. The commitment of farmers to measures to prevent pollution of the Great Barrier Reef was an essential element of success in the Australian Wet Tropics.
 8. *Policies without budgets and implementation commitments do not work:* In all of the landscapes reviewed, the application of existing government regulations would address most of the landscape issues; but it was only in Australia that policies and programmes were supported by appropriate budget allocations and even in Australia sustaining government support has been challenging. Political figures and local administrations make positive statements but if these are not backed up by fund allocations they will not achieve improved landscape outcomes.
 9. *Formalisation and monitoring of process outcomes is eventually needed:* Agreements may be reached and company activities influenced but eventually landscape arrangements must be integrated into legal measures to achieve sustainable long-term outcomes. Legal formalisation of agreements has occurred in the Wet Tropics of Australia but in all of the other landscapes companies and local people still challenge land allocation decisions. Secure property rights that can be defended in court are an essential element of formalisation.
 10. *Metrics must be developed to establish values, track progress and enable adaptive management:* Societies' demands upon landscapes will change over time and adaptive management will be needed. Metrics must be put in place to enable the flows of goods and services from the landscape to be monitored. Only in Merauke was the landscape initiative based upon comprehensive information on the values of the landscape. Data collection in Merauke was expensive and involved the continuous presence of skilled technical staff. Other landscapes had partial data sets, often on conservation values and assembled by outside interest groups but none had adequate

information on livelihood benefits to stakeholders. The attempts in the Sangha Tri-National suggest possible methods for achieving this but experience both there and in Kaimana illustrates the difficulties of collecting adequate information (Sayer et al. 2007b; Endamana et al. 2010)

Our overall conclusion is that landscape approaches have considerable merit in reconciling competing demands on land. There are technical challenges that need to be addressed and methodologies that can be used to mediate processes but these alone will not be sufficient to guarantee outcomes. The ten pre-conditions that we identified during our meeting on Cape Tribulation have to be met. These preconditions probably also apply to other approaches to mediating conservation and development tradeoffs—for instance in the application of payments for Reduced Emissions from Deforestation and Degradation. Perhaps in general, these pre-conditions are applicable to any attempt to secure vibrant and sustainable rural livelihoods and to achieve a balance between conservation and legitimate development goals.

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