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DEVELOPMENT IN EASTERN INDONESIA: ARE THERE ALTERNATIVE APPROACHES?

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Abstract
Development in Wallacea, and eastern Indonesia generally, is gaining momentum. Here we query the applicability of what has become the standard or western Indonesia, model of development, for that part of Indonesia east of Wallace's line. The numerous small islands with their finer grain of biological and cultural diversity suggest that alternative models focused locally with strong local community engagement might promote a different kind of economic development that maintains the natural resource base, including biodiversity, while providing opportunities for profitable enterprises to flourish. We describe some current examples that might be applicable more widely. The main problem with wider implementation is scaling up. Multiple conflicting goals have to be accommodated and because these are often not compatible with one another, the problem can only be solved at the landscape or seascape scale. We describe some modern methods for data management and computational analyses that can be used as decision support tools to help achieve this.

***Key Words*:** Wallacea, local development, landscape scale, multi-criteria analysis

Introduction

Many islands in eastern Indonesia are feeling the pressure of more intensive development and there is only going to be more to come. Everybody depends on the natural resource base for livelihoods, and

economic development is driven by the exploitation of natural resources. If we can view natural resources as our natural capital, similar, say, to financial capital, and try to live off the interest rather than deplete the principal then we can begin to imagine models of economic development that husband natural resources and develop them in a more sustainable way.

In his address to the 2nd international conference on Alfred Russel Wallace and Wallacea in Wakatobi, November 2013, Emil Salim made some important observations on the part of Indonesia east of Wallace's line and issued a challenge to delegates. He noted, for example, that 85% of Indonesians live in Java, Sumatra, Borneo and Bali, all west of Wallace's line. He also noted that economic activity on those islands account for approximately 85% of Indonesia's GDP. Wealth is in the hands of the people of western Indonesia. Emil Salim pointed out that not only biogeography, but the geography and ecology of the numerous small islands, as well as the demography and existing economics of eastern Indonesia call for a different approach to development. His challenge was for scientists, corporations, governments and communities to be imaginative and create a new development model embracing social, economic and environmental sustainability. He thought such a model should be built on a strong foundation of education and capacity building and be driven by science and technology and the boundless energy and optimism of the Indonesian people.

As development proceeds in eastern Indonesia, the default development model already pertaining in the west of Indonesia and on some islands in the east, will most likely be one of extracting natural resources through logging of forests, industrial scale mining and the Bali model of tourism, which threatens the very resources that its tourism was based on in the first place. Logged forests are replaced by tree crops and other forms of industrial scale agriculture, and many of a location's natural resources leave that location, along with the profits that were made in exploiting those natural resources.

So, is it possible to imagine alternative development models for eastern Indonesia, including Wallacea? Can Indonesians, perhaps with the help of their non-Indonesian colleagues, design, implement, test and evaluate models of economic development that retain natural resources as community assets, reduce environmental impacts and the loss of biodiversity and deliver profitable enterprises for community livelihoods? In this paper we argue that yes, there are alternatives which, while they may not become ubiquitous, could comfortably sit alongside the more usual and more destructive western Indonesia model. We provide some examples of existing practices at local scales that could serve as starting points for different approaches to development. The problem is to scale these up. We propose some mechanisms for doing that and describe some scientific tools that are now available, or are emerging, to assist with the process.

What is special about Wallacea?

Wallacea differs from Western Indonesia in having much finer scales of cultural and biological diversity. The dispersal of people and fauna and flora throughout the very many small- and medium- sized islands has led to great richness but also to significant challenges. Wallacea has a very high level of local endemism superimposed upon a remarkable diversity of cultures and ways of life. Its isolation has, until recently, protected it from most of the major investments in land-based industries that have transformed Sumatra and Kalimantan at great environmental and some social cost. One consequence of this relative isolation from industrial investment is that Wallacea has some of the highest levels of poverty in Indonesia. The scores on the

Millennium Development Goal indicators are low. Levels of education, for instance, are lower than in Java and other Western Indonesian provinces. That is now changing as mineral and industrial plantation industries move rapidly into the islands of Wallacea. There are many large and small mines springing up throughout the archipelago. Oil palm, sugar and fibre plantations are expanding rapidly. Most of the investors have their roots in Western Indonesia and they bring their trained labour with them, so Wallacea is experiencing major settlement by people from outside the region. This is superimposed upon a high local population growth rate to give Wallacea one of the highest population growth rates found anywhere in the world.

Wallacea already has several large national parks in areas of outstanding biodiversity value but these have not received much attention from conservation organisations. These parks need urgent conservation management programs. But Wallacea also has 450 recognised key biodiversity areas (KBAs; Wood *et al*., 2015). Many of these are small fragments of habitats which are home to locally endemic species. The model of large national parks may not be appropriate for them. Much of the land surrounding them and in some cases, the KBAs themselves, is already under some form of use by local people and they claim traditional *adat* rights to the land. So conservation programs in Wallacea will have to include large numbers of small protected areas. Models for the protection of such areas do not really exist in Indonesia and will need to be developed. Small nature reserves – Cagar Alam or Hutan Desa – under local community management appear to be a promising option to explore. Examples of such models exist in the Tanggkoko reserve in Minahassa and the proposed Nantu reserve in Gorontalo. The strengths and weaknesses of such local management need to be examined and we need evidence of their effectiveness in protecting biodiversity of more than local significance. Could the expansion of tourism in Eastern Indonesia lead to the emergence of numerous small local conservation initiatives? There is some evidence that this is possible. The elite hotel on Pulau Moyo in Nusa Tenggara Barat protects outstanding marine resources and the forests within which it is located. Komodo and adjacent islands support a thriving tourist industry and conservation brings benefits to local people. Tourism on the island of Sumba is raising interest in the conservation of the island's remaining forests and their endemic birds. The example from Bali Barat described below suggests that partnerships between developers and local communities might be productive in some locations.

Will these local initiatives be able to resist the juggernaut of large scale industrial investment and colonisation? Could industry be an ally in supporting conservation? The Newmont mine in Sumbawa claims to protect the native forest within its concession. Can we learn lessons from this experience? Weda Bay Nickel on Halmahera is striving to protect the numerous endemic species that are found within their concession and tourists visit the area to observe the rare Wallace's Standardwing (*Semioptera wallacei*), a locally endemic bird of paradise.

Scuba diving is a growth sector for tourists throughout Wallacea and in many cases the reef areas that are frequented by recreational divers are better protected than those where divers are not present. Some parts of the Wakatobi island chain are now the subject of conservation programmes. In the section below we elaborate briefly on three examples of development models that are more environmentally benign, improve the livelihoods of local communities and retain a degree of local ownership of natural resources.

Local development models

***Mining in North Sulawesi*:** Sitting side by side in the Bitung and North Minahasa Districts in North Sulawesi Province, are two forms of mining, one utilising small scale operations and one an industrial scale enterprise (Langston *et al*., 2015). Small scale mining returns more to the local economy, though is not as profitable overall as the large scale mine, is less damaging to the landscape and to local biodiversity and encourages local entrepreneurship. Mine sites are adjacent to local communities and tailings can be found scattered throughout the dryland agroforestry landscape, so they undoubtedly have an impact on local environmental quality and the working conditions for those who mine are generally unsafe. However, the unemployment rate is decreasing as the flow-on effects of mining create market needs that can be filled by local entrepreneurs and labourers. Before the arrival of mining, agriculture and fishing were the main sources of livelihoods. Gold mining has brought prosperity in the form of increased income, better infrastructure and increased market niches to the village but there are issues with governance. Control and management of the mining operations take place though local agreements but payments for this control and security agreements are not part of written law so are open to abuse.

The large scale mining operation takes place much further away from local communities, changes the shape of the landscape and reduces local biodiversity. People believe that large scale mining activities have spoiled the water and soil and have led to decreased fish stocks. Local people are not as directly involved as they are at the small scale mining site. The large scale mine contributes corporate social responsibility (CSR) funds to 13 surrounding villages and employs some local people. Those that are employed have greater job security and safer working conditions. On the other hand, profits leave the area along with the minerals that have been extracted. Profits are retained locally at the small scale mining site.

These are two quite different development pathways emerging through mining in almost the same place. There are advantages and disadvantages of both. Closer attention to the governance of the small scale mining operations could lead to a more even distribution of benefits throughout the communities affected. But there will always be large scale mining operations. People will choose to participate in employment they perceive to benefit them most. Some will prefer small scale mining and others large scale mining. Both will occur in landscapes so the issue arises of where they should take place. There needs to be minerals, of course, but there are social, environmental and infrastructure issues to be taken into account as well. In section 3 we canvas options for making trade-offs at the landscape scale between the various interests of people living in and influencing the fate of those landscapes.

***Agroforestry on small islands in North Sulawesi*:** Siau Island is in the Sitaro District of North Sulawesi Province. The people who live on the island are heavily dependent on agroforestry. They grow a variety of tree crops, many for local consumption or inter-village trade. The main export crop is Nutmeg, which is a Siau Island speciality and is now marketed as Siau Nutmeg worldwide. The island is dominated by an active volcano, Mt Karangetang, which is both provider of, and threat to, local livelihoods. Volcanic ash periodically renews the soil and forms the basis of the very high quality nutmeg that is produced. But volcanic eruptions threaten not only tree crops but the very lives of people. Siau islanders have lived with the volcano for a long time and perceive the greatest threat to their livelihoods to be nutmeg price fluctuations on the international market. The island is a

six hour boat ride from the nearest large city, Manado. The island is poorly served by government support services such as infrastructure development, health and agricultural extension. The people are generally self-sufficient and socially cohesive and farming as a skill is being passed on to the younger generation.

In contrast, the much larger Lembeh Island is close to the port city of Bitung only a 15 minute boat ride away. Agroforestry is practised on the island with coconut the main income-producing crop. However, there are employment opportunities in Bitung City so most young people seek work there. Farmers are aging and not being replaced. Health and other services are more readily available because of their proximity. For better or worse, social structures on Lembeh Island are changing. Agroforestry is not the dominant creator of livelihoods that it is on more distant islands.

These islands illustrate, as for the mining example, contrasting development models. Siau is the more traditional of the two but is engaging with the modern world as producers of branded, widely recognised nutmeg. On Lembeh, people seek employment in nearby Bitung City, forsaking farming income for wages that are not as subject to fluctuations caused by climatic variability or natural disasters such as volcanic eruptions. Both are legitimate and the differences demonstrate two points. First, support services such as the development of infrastructure and health and agricultural extension should view needs across the landscape or seascape, not focus on nearest accessible communities. Second, alternative development models are both sensible and desirable where degrees of isolation lead to strongly contrasting geographical settings, such as are found in Wallacea.

***Ecotourism in Bali Barat*:** This is not an example from east of Wallace's line but it is an example of the type and scale of development that could easily be applied in eastern Indonesia. Menjangan Jungle and Beach Resort are adjacent to Bali Barat National Park. This part of Bali has a long dry season. The vegetation is a savannah type, more typical of islands to the east of Wallace's Line than the rest of Bali, such as those found in Nusa Tenggara Barat and Nusa Tenggara Timur. This means that agricultural productivity is low, poverty is rife and people encroach into the National Park for fuel wood and to bolster their livelihoods. The owners of Menjangan Jungle and Beach Resort recognise that the national park is a major asset for them, attracting tourists to the resort. They have an interest in maintaining the quality of the park. They also recognise that the sustainability of their business venture, as well as the development of the communities that are their neighbours, rests on a stable productive local economy.

The resort has been working for a number of years to implement a three-pronged approach to the sustainability of its business and to neighbouring community development; poverty alleviation, environmental education and conservation, as shown in Fig. 1.

Poverty alleviation has focused on four strategies; sustainable farming, waste management, cooking with waste wood and employment within the resort. In collaboration with Udayana University, a farming system has been implemented that combines agriculture, forestry and animal husbandry, which provide fodder in the dry season as well as a higher income in the more favourable wet season. One of the attractions at the resort is horse riding. The resort purchases feed for the horses from the local farmers with rice. Waste from the horses is then processed into an organic fertiliser for farmers. The aim is to make this financially viable by commercialising the process and selling fertiliser outside the local area. The resort also employs local

community members thus increasing local livelihoods.

Environmental education is taught through classroom teaching, practical workshops and field trips to the National Park. In the words of the resort owner, the aim is to provide a sound basis for care about the environment, in order to set school children on a long-term path to a sustainable future. Conservation activities focus on three aspects, tree planting, habitat management and the endangered Bali Starling (*Leucopsar rothschildi*). In an attempt to involve tourists in conservation activities the resort collects fees from guests who would like to plant a tree with their name on a plaque. This helps finance the other conservation activities. Since 2008, about 150 trees have been planted. As part of habitat management, invasive species such as *Lantana camara*, and *Acacia nilotica*, both invasive plants and *Acanthaster planci* the destructive Crown of Thorns starfish that attacks corals, are physically destroyed by resort employees. Other activities include fire management and mangrove rehabilitation. Finally, there is a Bali Starling breeding program. The Bali Starling is a critically endangered species. Since the breeding program began 11 birds have been released into the wild. Three pairs are using nest boxes that have been installed by resort staff and in 2009 two pairs successfully raised chicks.

Thus, local communities have benefited from a close collaboration with the resort, environmental education has been added to the school curriculum and conservation measures are aiding the National Park play the role it is meant to.

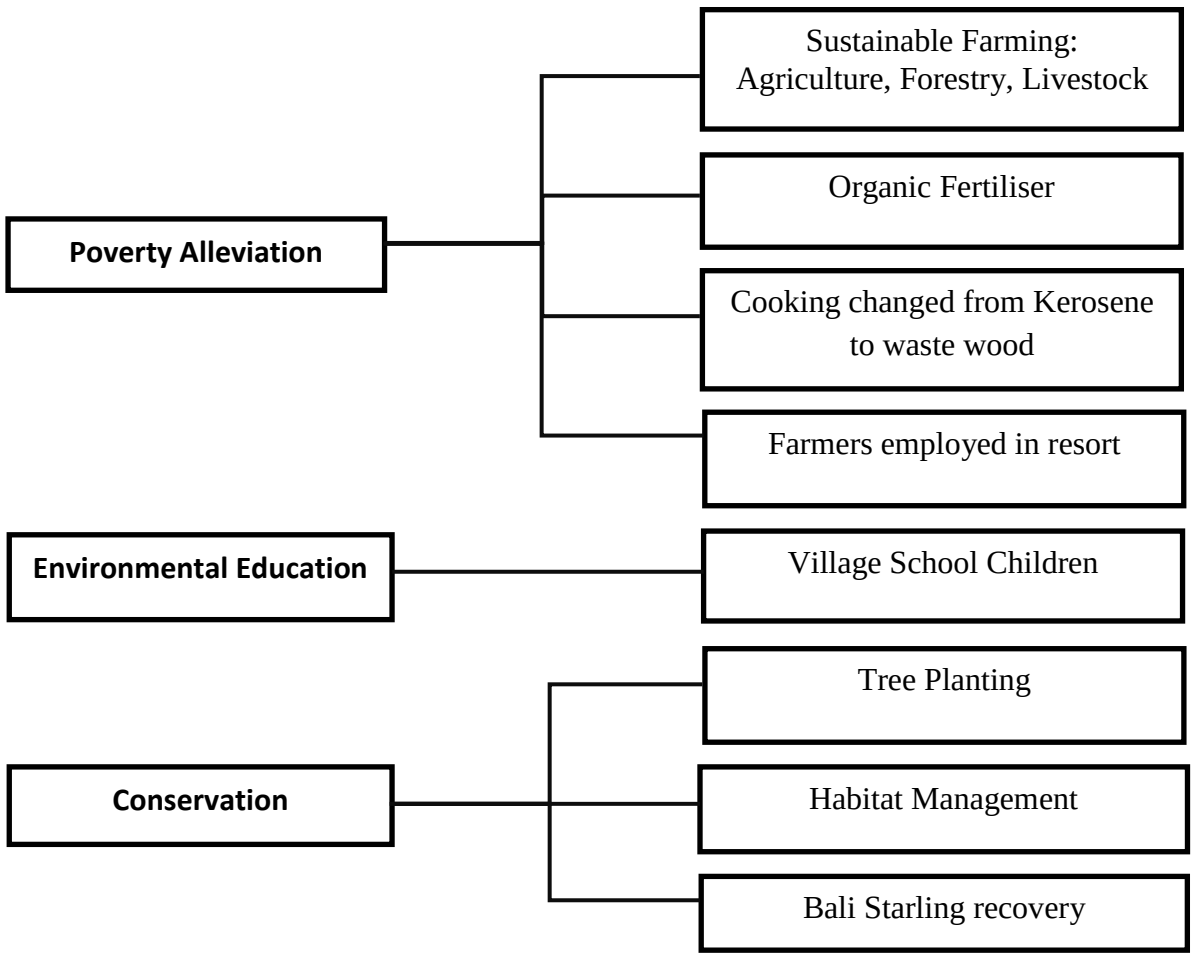

Figure 1: Activities at Menjangan Jungle and Beach Resort in community development and conservation.

***Scaling up*:** The three examples above illustrate different possible local development pathways; two different forms of mining, different strategies on near and far islands and on active volcanic islands, and community development associated with a national park. These are just some of the many possible development models that either already exist or could emerge in eastern Indonesia. Eastern Indonesia is already a mosaic of natural, modified and transformed landscapes (e.g. Wallace, 1896; Pisani, 2014). Spices have been grown and traded with the rest of Asia and with Europe for many hundreds of years. Industrial scale mining is more recent but artisanal mining has been going on for millennia. Tourism is also more recent but people of different ethnic and religious backgrounds have been trading and mingling in eastern Indonesia for centuries.

More sustainable development models seek multiple outcomes; the protection of biodiversity and the natural resource base as well as development; the generation of livelihoods and improvements in human well-being. Multiple outcomes call for a landscape or seascape approach (Sayer *et al*., 2013) because different parts of the land or seas have to be allocated to different uses. Not all desirable outcomes can be achieved at single locations. Indeed, win-win outcomes are rare. In addition, if decisions about land use are made for particular locations without considering surrounding locations or places even further away, they can turn out to be bad decisions. One ubiquitous example is run-off from agricultural activities degrading neighbouring places such as reefs and reef lagoons or polluting downstream farms and settlements. Ecosystem processes occur at scale. They are not confined to local areas. Governance arrangements should also apply at scale. As noted in the small island example above, government, corporate and civil society support services should view needs across landscapes and seascapes if they are to be effective.

Taking the mining example above, a question relevant at the landscape scale would be 'where should small scale mining take place and where can large scale mines go ahead?' The issues that need to be taken into account when seeking answers to this question not only depend on where minerals occur. The potential cost in alternative forms of land use, such as agriculture, should also be considered. Similarly, what would the cost to biodiversity protection be? Which ecosystem services might be lost, e.g. carbon sequestration or the provision of clean water? And what are the social consequences? Would local people prefer to work in small scale mines or large scale mines or would they prefer no mining at all? Similarly, decisions to establish new agroforestry or plantation activities and new areas for the protection of biodiversity have to address multiple, often conflicting, concerns. What is the cost to biodiversity and ecosystem services of establishing an oil palm plantation? What would be the cost to potential palm oil production of creating a new national park? What would be the benefits of a new national park to local people that attracts large numbers of tourists, compared to, say, income generated by an oil palm plantation or a mine? These are all questions that need to be addressed spatially and at the landscape scale.

***Modern methods and tools to support decision-making at landscape scales*:** A landscape approach has to be based on a plan of some sort, and plans show which areas should be allocated to different uses and which areas should be protected, given the assumptions and constraints built into the planning process. Some uses are compatible with others, so some locations can contribute to more than one use. But there will always be winners and losers so plans rarely 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 long time. Social and economic conditions change and knowledge accumulates, so plans have to change in response and, with time, there are many opportunities to influence the ways in which a plan can change.

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 that most stakeholders can live with (see, for example, Dyer *et al*., 1992; Figuera *et al*., 2005; Moffett & Sarkar, 2006; Margules & Sarkar, 2007). The purpose of multi-criteria analysis is decision support for these stakeholders, typically with assistance from external decision analysts. This type of analysis begins with an explicit recognition that there may be a multiplicity of potentially incompatible goals between which tradeoffs must be made. These basic goals are called ‘‘fundamental objectives’’.

For instance, in the example of the Menjangan Jungle and Beach Resort in Bali, the fundamental objectives were poverty alleviation, environmental education, and conservation, which are not necessarily mutually compatible. Poverty alleviation through improved agricultural practices takes place adjacent to, but not in, the National Park and is supported by the exchange of rice for fodder, the provision of dung as fertiliser and the employment by the resort of farmers during unproductive periods of the year. Environmental education occurs in schools outside the park but also with visits within the park. Conservation occurs mainly within the park. If the park was not already there, this would be a clear case of conflicting interests that would benefit from a spatially explicit multi-criteria analysis to identify which parts of the landscape are best suited, in environmental, social and economic terms, to which land uses. As it stands, the park provides the conservation role and the related activities are described here as an example of the kind of development that could be associated with nature conservation.

As we scale up, the question of where conservation should take place, as opposed to agriculture, extractive industries and human habitation, needs to be addressed as the potential for conflict increases dramatically (Sarkar, 2012). This is, perhaps, best done by optimally, or as near optimally as possible, allocating different localities to these different uses. Such allocation cannot be based solely on underlying biophysical attributes, but must also take into account social and economic criteria. As the Bali example shows, people can benefit from biodiversity protection just as they can benefit from agriculture and mining.

Ultimately, decisions should be made by all legitimate stakeholders including, especially, people living in the localities affected. Typically, decision analysts work with stakeholders to decompose each fundamental objective into a hierarchy of sub-objectives. For instance, the fundamental objective of conservation in Bali Barat National Park could be decomposed into increasing the population size of the critically endangered Bali Starling, eradicating invasive species and re-vegetating degraded areas, to name just three. There may well be others. Once the objectives have been structured well enough to measure the performance of alternative plans on their basis, the next step is to introduce trade-offs between those objectives by assigning weights to the different objectives and sub-objectives. These weights must be elicited from stakeholders in an iterative process that may also benefit from the participation of decision analysts (Edwards, *et al*., 2007). The result of the process is a portfolio of options, that is, potential uses for different locations, which can be deliberated upon by

the stakeholders (Margules & Sarkar, 2007).

On the regional scale, computing all the weights for all locations for all objectives potentially leads to formidable problems of data management and computational analysis. Luckily, the last decade has seen the development of a variety of methodologies to make this process feasible so that multiple alternative spatial plans can be compared by decision makers in real time (Margules & Sarkar, 2007). These include methodologies for acquiring and storing spatial data including remote sensing data (vegetation indices, hydrological variables, etc.), the analysis of these data to produce spatial values for the objectives across landscapes and seascapes (vegetation types, agricultural suitability, economic potential, etc.), and area prioritisation (Sarkar *et al*., 2006). Special high speed software has been developed for spatial area prioritisation using multi-criteria analysis (Ciarleglio *et al*., 2009a, b; 2010).

What makes the process just described most useful, is that 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, within the accuracy of the data. Thus, an agreed plan can be based on evidence, not anecdotes, or worse, beliefs. In addition, because the data are stored electronically, analyses can be iterated in response to changed circumstances and plans revised accordingly. Multi-criteria analysis is not a decision-making tool. It is a decision-support tool based on evidence.

In order to conduct any planning process and to implement the results, there are some basic conditions that have to be met. There has to be an enabling policy framework. The relevant government has to be involved and has to want a plan to be produced. In Indonesia, the district level (*kabupaten*) is appropriate, although in large districts a sub-district may be applicable. The local communities that will be affected by the plan also have to be engaged. If they are not then implementation will fail. Crucially, the technical knowledge and the relevant hardware and software have to be available, along with the skills needed to facilitate the planning process and elicit the wants and preferences of all stakeholders. This usually falls under the umbrella of capacity, which will need to be built if it is not already there. Funding is also an issue because the development of a plan and its implementation can be expensive. It is not something that District governments are likely to be able to afford. Possible sources of funds include non-government organisations (NGOs), Corporations with vested interests in the District and potentially, aid agencies, although the latter could only contribute with the blessing of the central government.

Discussion

Eastern Indonesia, including Wallacea, is experiencing increased industrial scale mining, logging and agriculture. This is the default, or business as usual, development model that the east is inheriting from western Indonesia. But are there, as Emil Salim has suggested, alternative development models more suited to Indonesia east of Wallace's Line that manage to retain, or at least minimise the loss of, natural resources, reduce environmental impacts and the loss of biodiversity and deliver profitable enterprises both for businesses and for communities? The finer scales of both cultural and biological diversity expressed in eastern Indonesia suggest that alternative

models may be more appropriate than the western Indonesia model.

We have argued the case here that such models should be developed and implemented in order to test that notion that they are viable and economically, environmentally and socially sound. We have illustrated this idea with some existing development pathways in Wallacea and one from Bali that is likely to be applicable in Wallacea. These examples are local and without doubt, there are others already in place. However, the main problem with wider implementation of these sorts of development models is scaling up. Decisions such as where to locate protected areas or where to open mines, where to put industrial scale plantations or where to encourage traditional agroforestry backed up by marketing support (e.g. the Siau nutmeg model), and so on, require the solution of spatial allocation problems. Multiple, often conflicting, goals have to be accommodated in the same landscape. We have described tools that are available for solving spatial allocation problems with multiple objectives. Modern computers and associated software provide the opportunity for multiple alternative spatial solutions to be examined by stakeholders in real time, making multi-criteria analysis a viable decision-support tool. We stress that these are decision-support tools and cannot replace the decision-making role of elected leaders. What they do provide, crucially, is evidence on which to base such decisions.

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