

## Scenarios as models for knowledge integration: ecotourism futures in Milne Bay, Papua New Guinea

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**Abstract:** The future is unknown and uncertain, and is confounded by reflexivity and beliefs based on different epistemologies, or knowledge systems. Indeed, because the future is yet to happen, there is no 'true' state of the future and as such, alternative models may collectively provide the most useful representation. Scenarios, known to be effective for offering contrasting exploratory models of how the future may unfold under different assumptions, may also be an important tool for integrating different knowledge systems into futures analysis. This latter advantage of scenarios, and how such integration can be done, has received little investigation to date. We present an example from our participatory research in Milne Bay Province, Papua New Guinea of how knowledge held by different stakeholders at different scales and scientific understanding can be brought together through scenarios. In Milne Bay, ecotourism based on the region's high ecological and cultural diversity is being considered as part of a strategy for sustainable development. We used a scenario planning process to elicit views of the future at two scales: the first with a group of provincial ecotourism stakeholders - including ecotourism operators, representatives of the Milne Bay Tourism Board, and representatives of non-governmental organisations with an interest in ecotourism - and the second with a local ecotourism operator. In each case participants were asked to identify the major drivers of change and uncertainties that they believed might influence the future, and to consider what the future might look like in 2040. We discuss the drivers and uncertainties identified, the scenarios and their consequences at the local and provincial levels, including responses to change.

The provincial stakeholders identified climate change and technology as the two most influential and uncertain driving forces for a sustainable ecotourism industry in Milne Bay Province to 2040, alongside global fuel prices, population growth, cultural change, and overharvesting and exploitation of natural resources. The four scenarios revealed a number of perceived opportunities as well as threats. Some of these had not necessarily been given much consideration by participants, such as the risks associated with rapid information exchanges, or the potential to develop alternative ecotourism activities despite climate change impacts.

The ecotourism operator stated that the biggest threat to the province was overpopulation and climate change leading to environmental degradation, and to his village was overfishing and the loss of tradition due to mining and tourism. He stated that climate change was the most uncertain change, and acknowledged uncertainty of scientific information compared to what was observed in reality. He would respond by encouraging people to move from the coast but believed this would be challenging. Aspects of the vision he described for the future – cruise ships and sea planes – potentially pose further social problems and the loss of tradition that were identified as threats.

We conclude with insights related to the purpose of integrating knowledge through participatory scenario processes, and note the need for more explicit documentation of knowledge sets in contributing to such a process. There is also a need to gauge changes in perception in response to information, and giving ample space for a diversity of views to be expressed. In future research, we plan to refine the scenarios and revisit conceptual models with stakeholders at both scales, with a focus on clarifying understandings through more detail and quantification, and identifying trade-offs of following different future pathways, and integrating information across scales.

**Keywords:** *future, uncertainty, scenarios, drivers, knowledge integration, ecotourism*

## 1. INTRODUCTION

The future is unknown and uncertain, and is confounded by complex system dynamics such as non-linearity and reflexivity – people’s actions in response to future expectations can, in fact, lead to a different future than expected (Funtowicz and Ravetz 1993). Furthermore, beliefs about the future may be based on different epistemologies, or knowledge systems. Indeed, because the future is yet to happen, there is no ‘true’ state of the future and therefore, comparative models that illustrate a range of possible states may collectively provide the most insight into what may, or may not, come.

Scenario planning is a structured process of exploring the future in situations when uncertainty is high and controllability is low (Peterson *et al.* 2003). Alternative scenarios produced through such a process are in effect models that describe how the future may unfold. In such uncertain, uncontrollable situations, scenarios have an advantage over more quantitative models (such as systems dynamics or agent-based models) in their flexibility, transparency and space for narrative to describe possible futures in their complexity. They are well suited to participatory processes where there is a need to engage audiences without scientific or technical backgrounds.

Though scenarios are increasingly used to explore the future through a participatory process, their role in integrating knowledge held by different stakeholders, including the scenario builders, at different scales has not been fully explored (but see Bennett and Zurek 2006a). Scenarios have at least two potential integrative abilities: first, they can integrate knowledge held by different actors. Even if future events can be predicted with reasonable confidence by scientific methods, it is difficult to predict how people will respond, or indeed pre-empt these events. Thus, scenarios, by bringing together participants’ knowledge and scientific information in the form of data and model projections, can produce a future understanding greater and better informed than either information source alone. Second, it is difficult to predict how different events and people’s responses to them will interact across global, national and local scales. By bringing together information at multiple scales, scenarios help to identify cross-scale processes and consequences that are not possible by looking at information from one scale alone.

Figure 1 depicts the process in which different knowledge sets can inform one another through scenarios. In this paper we view knowledge as comprising multiple realms of information, following Roth (2004)’s description of a knowledge-belief-practice complex that includes traditional ecological knowledge, environmental practices, social institutions and world views. We also include in this perceptions of the future.

This paper discusses the use of a scenario process to integrate knowledge to explore possible future options for the ecotourism industry in Milne Bay, Papua New Guinea. Ultimately, we sought to highlight divergence in views that may need resolution, and gaps where more information is needed.

Knowledge systems are not always explicitly identified as such, and the integration process is often a subtle, tacit one. We did not attempt to label the different sources of information in the scenario process and acknowledge that we are labelling them post-hoc, and through our

own lenses. Finally, we conclude with some insights for further research using scenarios to integrate knowledge.

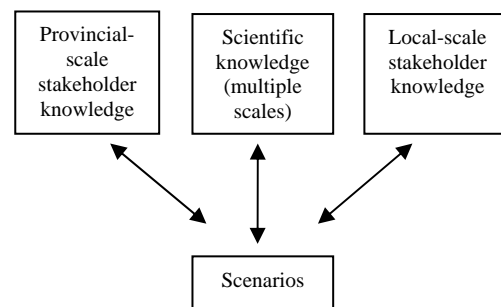


Figure 1. Process of knowledge integration through scenarios. The arrows extend in both directions to indicate an iterative process of information flows between the scenarios and the different knowledge sets. While scientific knowledge is obtained at multiple scales, and is unique among the three knowledge sets here in that it can be obtained at a global scale, it tends to lack social-ecological detail and cultural context.

## 2. A FUTURE FOR ECOTOURISM IN MILNE BAY?

Milne Bay Province, which includes the eastern end of mainland of Papua New Guinea (PNG) and some 435 islands, is an area of high national and global conservation significance due to its ecological and cultural diversity. Both are threatened by human activities at global, national and local scales.

Ecotourism is considered a desirable alternative for the province to development based on extractive industries alone, but a lack of infrastructure and institutional capacity have been noted as major challenges (King and Bartlett 2006). This is compounded by factors that are largely beyond the province’s control that can impact tourism as well as other industries to which tourism is linked.

Members of Milne Bay’s ecotourism industry have begun expressing an interest in learning how to establish sustainable ecotourism. In June 2008, an ecotourism workshop in Alotau, the provincial capital, brought together 21 stakeholders, and 5 scientists or ecotourism experts to discuss “big-picture” issues. A rapid scenario-planning exercise was conducted to identify key drivers and uncertainties affecting the ecotourism industry and to consider alternative scenario storylines for its future. Following this, interviews were conducted with one of the participants in the June workshop to identify drivers and uncertainties facing the ecotourism business he runs in his village.

### 3. SCENARIO PROCESSES

#### 3.1 Workshop with Ecotourism Stakeholders

We used a scenario planning approach that built on previous experiences such as MA (2005), Bennett and Zurek (2006b), Bohensky *et al.* (2006) and Bohnet *et al.* (2008). Following an introduction to the overall workshop goals, presentations were given by tourism experts on definitions and examples of ecotourism, and by scientists to provide examples of scenario planning. The scenario planning exercise involved a series of steps: 1) Identifying a guiding question and timeline; 2) Identifying drivers of change; 3) Ranking drivers of change for importance and uncertainty; 4) Identifying two axes of uncertainty and four scenario quadrants; 5) Forming breakout groups to develop storylines for each of the four scenarios; and 6) Presentation and discussion of the scenarios.

The identification of a guiding question first required agreement on a definition of ecotourism. In small groups, participants discussed this and identified features that they considered important for ecotourism on a map of Milne Bay Province (Figure 2). The group identified its guiding question as “Will it still be possible to have sustainable ecotourism in 2040?” The year 2040 was selected by asking participants to recall key events and trends in the past. Major changes such as collapse of the beche-de-mer fishery, doubling of human population, changes in agriculture production, and PNG’s independence all happened within the past 30 years, serving as a frame of reference for envisioning the future. Thirty years also corresponds roughly to one generation, allowing participants to envision life when their children reach their age.

The group then identified drivers that might influence the outcome of the guiding question (Table 1). Each participant was asked to write down the three drivers that they believed would be most influential for achieving sustainable ecotourism to 2040. Participants felt it was necessary to specify positive and negative drivers, and it was agreed that each person would write down three of each type. These were displayed for the group, and from these, participants selected drivers that they felt would have the highest impact and were most uncertain (Table 2).



Figure 2. (Left) Participants illustrated places they considered to have ecotourism significance on a map of Milne Bay Province. (Right) 2040 was identified as the timeline on which to explore future scenarios, based on participants’ knowledge of past events and on future projections.

Table 1. Drivers of change for Milne Bay’s ecotourism industry, listed in order of identification.

Climate change	Migration to Milne Bay	Education
Technology	Crime/law and order	Information and media
[Rising] costs of fuel	Accessibility/transport	Overharvesting and exploitation
Population growth	Infrastructure	

Culture and cultural change	Corruption	Undersea mining
Government system and structures	Water quality	Resource demand
Agricultural practices	Disease introduction and spread	Legal framework
Demographic change (ageing population, AIDS)	Alien invasive species	Energy sources
Urbanisation	Industrialisation	Growth in demand for ecotourism
	Multiculturalism	Values

Table 2. Participants' ranking of negative and positive drivers and highest impact and most uncertain drivers for achieving sustainable ecotourism to 2040. Numbers in parentheses indicate how many times each driver was identified by a participant.

Biggest negative drivers	Biggest positive drivers	Highest impact and most uncertain drivers
Climate change (9)	Education (11)	Climate change
Over-harvesting and over-exploitation of natural resources (9)	Technology (10)	Technology

As the two most uncertain, and highly influential drivers, climate change and technology became the focal axes of the scenarios. The group identified unpredictable elements of climate change as changes in land mass/sea level rise, carbon credits, changes in temperature and extreme events. Uncertain elements of technology were identified as the willpower of government to improve rural communications, impact on lifestyles, speed of adoption, market opportunities, cost, better sources of energy, microhydropower, the spread of environmental information and government policies. To stimulate the development of the scenarios, the scenario facilitators suggested four possible ways that these two key uncertainties, climate change and technology, could combine:

- 1) A climate change crisis happens in the near future and low-cost technology is available in Milne Bay Province
- 2) Climate change brings about gradual changes and low-cost technology is available
- 3) A climate change crisis happens in the near future and low-cost technology remains unavailable
- 4) Climate change brings about gradual changes and low-cost technology remains unavailable

Four groups were formed, and each group was assigned to one of these combinations, with the task of sketching a brief, logical storyline, focusing on two questions: 1) Under this scenario, how would you achieve sustainable ecotourism by 2040?, and 2) What do you think are the most important collaborations or partnerships to achieve successful ecotourism in Milne Bay Province? The groups then named their scenario (Figure 3). A summary of each is presented below.

### 3.2 Four Futures for Milne Bay

#### Down but Not Out, in Fact, Better than Ever: New Life

High level seas surge, flooding local roads. Coastal zones and small islets disappear under water. High rainfall events cause rivers to flood and there is severe erosion. Coastal homes are lost. The CBD of Alotau is flooded. The road to East Cape is cut, and the North Coast fringe is lost to sea level rise. Thanks to low-cost technology, everybody has access to mobile phones, even on the islands, and some have internet. Thus they are aware of the risks of climate change and are ready to respond.

The effect of the climate change "crisis" is to stimulate action, to start a new life. Looking to 2040, there will be a need for proper planning to relocate infrastructure, roads, health centres, schools, villages and guesthouses. There will be mangrove replanting, Coast Care, conservation, education, awareness and a focus on doing the practical. An emphasis will be placed on environment and community life. Business activities will be green-certified and eco-friendly, links will be made into carbon market, with support from overseas funds. Energy will be provided by a mix of hydropower, wind generation, solar, and biodiesel. Internet advertising and promotion of the region as an ecotourism destination will be the norm - Milne Bay's green culture becomes its selling point.

Because of the need to relocate villages and services and build new infrastructure, the climate change crisis presents an opportunity to incorporate technology appropriately into villages. This requires partnerships with organisations specialising in appropriate technology, the environmental, forestry, sustainable agriculture, planning, civil engineering, electrical and communication sectors, and with donor agencies (AusAid, EU, JICA, UN), carbon traders and the Government of PNG.

#### Kula Connections: Sailing to the Future

Climate change is still a risk but in the absence of an immediate crisis, there is time to prepare for it. The Kula Ring, a traditional system of trade between the islands, is reborn in the Information Age. Technology allows better information exchange, networking between tourism businesses and partners (e.g., NGOs), and education, energy and transport improvements. With this information exchange comes a coordinated approach to diversifying ecotourism products.

There is a risk of increased information exchange that leads to the loss of cultural uniqueness, authenticity and the ownership of ecotourism opportunities to foreign investors, but this can be addressed through legislation and increased awareness, again using networks and partnerships to assist. Technology can also support use of alternative energy, fuel-efficient transport, better communication between operators and with partners, tourist markets and global connections. This is complemented by better education at the village level, including about ecotourism.

#### Escape to East Cape: Island Hoppers

Sea levels continue to rise at the current rate. Low atolls disappear, including ‘Survivor’ Island at Haloweya and small islands in the Conflict and Engineer groups. Sea currents become stronger, jeopardising travel by traditional sailing canoes, and making diving and snorkelling unsafe. There is migration from the affected islands to the mainland, creating tension between those displaced and residents. Tourism attractions - white sandy beaches and critical wildlife habitat – are lost.

Ecotourism becomes a marginal industry. There is a lack of effective communication, information and transportation for tourists and locals alike. However, around Milne Bay the use of traditional canoes increases, and interest is revived in promoting cultural tourism, but the canoes need to be better built so that they are more reliable – especially without a mobile network for emergency calls. Tourism persists, but in a nervous “island-hopping” style; people drop in, but don’t stay for long.

Priorities are law and order to maintain security and conflict reduction. However, education and awareness are high on the agenda, and Alotau becomes a hub of research activity on climate change impacts in the Pacific. Actions include: 1) Forging relationships between groups at multiple scales to share information, much of it through word-of-mouth; 2) Proactive lobbying of government and NGOs for funding to improve communications; 3) Improving government action to re-settle economic migrants; and 4) Introducing food crops tolerant of salinity rise for local food supplies and tourists.

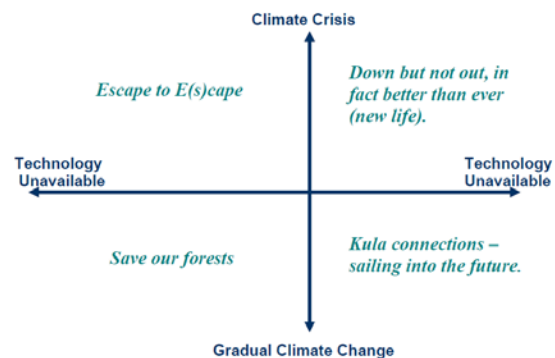


Figure 3. Four scenarios based on interactions of the most uncertain drivers identified by the stakeholder group, the speed and nature of climate change, and the availability of low-cost, readily-adoptable technology.

#### Save Our Forests

Milne Bay goes back to basics with low-technology, grassroots approaches to environmental awareness and conservation. Anticipating rising sea levels, people shift their activities from coastal to inland areas. Wise use of traditional farming is promoted - children should have a garden according to tradition – good use of gardening land instead of clearing virgin forest for gardening and causing hillside soil erosion. People plant more mangroves and traditional trees, and quickly engage in the carbon trade and lobby for government policies to help protect forests before more severe climate changes occur. Strategies also include teaching environmental issues in schools, including global climate change and carbon trading, using media to raise awareness, preserving cultural values of skull caves, awareness of sacred sites and protocols, preserving wildlife, teaching young ones to respect the environment, training resource owners, NGOs, churches and Local Level Government.

#### *3.3 Interview with Ecotourism Operator*

To understand how an individual ecotourism operator perceives and might respond to changes such as those identified in the scenario workshop at a local level, we conducted two semi-structured interviews in October 2008 and in April 2009 with one of the workshop participants.

The ecotourism operator believed that overpopulation leading to environmental degradation, along with climate change were the greatest threats to Milne Bay, while overfishing, along with threats to

tradition, were the greatest threats to his village. He stated that climate change was the most uncertain change, and acknowledged uncertainty of scientific information compared to what was observed in reality. While he indicated that he would encourage people to move from the coast he believed this would be challenging. His future vision was that the village be recognised as a tourism destination, which paints a picture considerably different from the present (Table 3).

Table 3. Summary of drivers of change, responses and future vision described by ecotourism operator.

What is the biggest threat to Milne Bay?	Population explosion and climate change, causing environmental degradation
What are the biggest threats or changes to your village, more specifically?	Overfishing, threats of mining and tourism to our traditional values and customs
What changes do you think are most likely to happen in 30 years' time?	The life of the people. More social problems coming with development.
What are you doing, if anything, to prepare for these changes?	Planning ahead and being more realistic about problems that are going to happen, going back to our traditional rules.
What changes are you not sure about?	Climate change; even the scientific theory, because of the practical realities I have seen in my life, the lives of the people.
What are you doing, if anything, to prepare for these changes?	Telling my people to move away from coastal areas, but people are very hard to move.
What changes do you think are unlikely but are possible to imagine?	Weather patterns, technology to be able to monitor these things.
What are you doing, if anything, to prepare for these changes?	Education
What will your village look like in 2040?	I want to see it declared as a tourist destination: one of the areas in the country where we have forests, rivers, reefs, sacred sites. One day we should see cruise ships, sea planes, lights all over the area. When people want a job, they come here.

### 3.4 Models of the Future

The scenario workshop in effect produced four models of Milne Bay: one a crisis-inspired, technology-embracing paradigm shift (Down but Not Out), one a high-technology, information-propelled future, in which people are proactive but aware of risks (Kula Connections), one championing a back-to-basics, grassroots activism (Save our Forests), and one of struggling through, with increasing tensions accompanying rising seas (Escape to East Cape). The four scenarios revealed opportunities – for example, the potential to develop alternative ecotourism activities despite climate change impacts - as well as threats, such as the risks associated with rapid information exchanges. Tellingly, the two scenarios that dealt with a climate change crisis explored the boundaries of what could happen in the most detail, while also suggesting solutions.

It appeared that the terms “climate change” and “technology” were overwhelmingly interpreted by the scenario groups as, respectively, “sea level rise” and “information.” The narrow focus is not unexpected given the short time that groups were given to work on their scenarios, but may also reflect an understanding of these issues that is limited to actual experiences, i.e. loss of coastline, radios, mobile phones and dinghies with outboard motors. In an extended exercise, scientific information could provide more detailed dynamics of the driving forces and projected impacts, while provincial and local stakeholders could provide contextual details such as place-names, history and cultural norms. This integration of knowledge can then address the full range of implications of these drivers.

The ecotourism operator’s view represents one individual’s model of the future. Although he was part of the provincial group discussions, this view reflects particular concerns for his village and community about negative impacts of ecotourism as well as other change. Paradoxically, aspects of the vision he described for the future – cruise ships, sea planes, people seeking employment – potentially pose further social problems and loss of tradition that were identified as the biggest threats to the village. Whether his views are similar to other villagers is unknown, of course, and it would be instructive to collect information from other localities in the province to capture the diversity of local dynamics.

## 4. INSIGHTS AND FUTURE DIRECTIONS

As in other participatory modelling processes, the use of scenarios to integrate knowledge about the future stipulates careful consideration of objectives and outcomes (Lynam et al. 2007): is it to support local people to understand scientific information, to persuade local people to adopt scientists’ views, to elicit local perspectives for the value they add to understanding, to learn from each other, or to test methodologies? Scenarios can effectively do all of the above.

In our case, scenarios helped to reveal where views about the future diverge, and where understanding is lacking. We offer a few insights on the process. First, we acknowledge that neither our work nor other scenarios we are aware of explicitly describe a process of integrating information other than building stories based on different information sources. This can resemble a random “knowledge

dump,” whereby issues of accuracy and precision, weighting, standardisation, and resolution of discrepancies do not often receive attention. That said, there is a trade-off between quantification (which invokes a scientific paradigm) and transparency and flexibility. It may be useful to develop both quantitative and qualitative scenarios to suit a range of purposes (Bennett and Zurek 2006a).

The sequence of information insertion is also important. There is a need to gauge perspectives on perceptions of future change before and after information is presented, and we have included such an evaluative component in our ongoing research. However, there is another trade-off between giving too little information to enable participants to address a full range of drivers that impact them, and giving too much information, risking confusion, disinterest or bias. Finding the right balance is key.

While scenarios can help to build consensus (Kahane 1992), a diversity of views regarding the future can be of great interest and value for learning (Bennett and Zurek 2006a). Future uncertainty means that surprise is likely, and the most robust strategy is often to invest in a range of options. For this reason ample space is necessary to accommodate differences in opinion.

In future research we plan to refine the scenarios and revisit conceptual models with stakeholders at both scales, with a focus on clarifying understandings through more detail and quantification, and identifying trade-offs of following different future pathways.

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