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Planning Nature-based Hiking Trails in a Tropical Rainforest Setting

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Tropical rainforests are under threat and tourism has been identified as one industry that has some potential to add value to this important natural resource. This paper examines how nature-based hiking trails may be developed in a sustainable manner within a planning framework that recognizes the role of inputs and outputs. Consideration of outputs is restricted to visitor demand for hiking experiences and consideration of inputs is similarly restricted to measuring the satisfaction of the hiking experience, although it is acknowledged that the impact of hiking on the ecosystem is also important. A case study approach is adopted, based on an assessment in 2007 of visitor demand and satisfaction with hiking trails in Australia's World Heritage tropical rainforest.

Key words: hiking, sustainability, planning, rainforest, Wet Tropics, World Heritage

Introduction

Globally, tropical rainforests are under threat from a range of activities, including farming, timber harvesting, mining, urban growth, tourism in some cases and, increasingly, from climate change. Deforestation particularly in the tropics has, according to Menkhous and Lober (1996), become a significant global problem. Even where tropical rainforests

have been nominally protected as national parks or given another form of protection, management authorities often have difficulty protecting rainforests from illegal activities, including logging, and clearing for farming and mining. Corruption, an inability to find alternative livelihoods for local communities, poor law enforcement and lack of management resources are major concerns. Examples of rainforests under threat include Papua

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New Guinea where illegal logging is widespread, the Amazon basin where logging and clearing for farming has reduced the size of the rainforest by 14% since 1970, and Madagascar where 95% of the original rainforest has been cleared (Williams, 2006a).

Tropical rainforests are important ecological systems and beyond their economic value are important for their biodiversity, intrinsic values and the provision of ecosystem services. These services include carbon storage, oxygen generation, pest control provided by birds and water purification in water catchments (Mercer, Kramer, & Sharma, 1995; Tobias & Mendelsohn, 1991). According to Menkhous and Lober (1996, p. 1), these latter values are “often excluded or inaccurately measured in most market transactions”. In response to these problems, policy-makers and researchers have attempted to identify alternative uses for tropical rainforests to eliminate or at least slow down their destruction. One alternative use has been the development of tourism, particularly in national parks and other protected areas. This paper looks at nature-based hiking trails as one form of tourism development that can be undertaken in tropical rainforests using Australia’s World Heritage Wet Tropics rainforest as a case study. Specifically, the paper proposes an input/output planning process that can be used to measure both the ecological sustainability of hiking trails in a protected area and the level of visitor satisfaction that hiking trails are able to provide.

Despite the aesthetic values of tropical rainforests, their rich resources of flora and fauna, and the increased number of protected areas worldwide, the tourism sector has been slow to develop tropical rainforest regions, with some notable exceptions. Where tourism has developed in tropical rainforest areas including parts of Thailand, Australia and Central

America, the tourism industry has been able to make a significant contribution to the local economy, creating jobs and contributing to community prosperity. The Wet Tropics rainforest of Northeastern Australia is an example of a protected area that supports an extensive tourism sector that includes walking and hiking trails and numerous visitor sites. Research by Prideaux and Falco-Mammone (2007) found that tourism in this rainforest generates a net income of AUD\$426 million per annum. In other nations, including Costa Rica and Borneo, rainforest tourism has emerged as a major tourism sector (Williams, 2006a).

Development of tourism in many tropical rainforest areas has been difficult for a number of reasons, including a lack of investors, limited infrastructure, poor management, corruption, inadequate planning and, importantly, the peripheral location of many rainforest areas. The Amazon is the world’s largest tropical rainforest region, but even in Brazilian terms the region is seen as remote and largely ignored by domestic visitors (Prideaux & Lohmann, 2009). In other tropical rainforest areas including Africa, regions of South America and in Asia, remoteness works against tourism development but assists illegal users of the rainforest. In those cases, remoteness creates two levels of difficulty when attempting to build substantial transport and marketing links between the resource and potential generating regions. The first difficulty is poor transport connections. The second difficulty is dispersal within the protected area. Previous work by Prideaux (2000) has highlighted the strong relationship between the supply of transport networks and demand for travel via these networks. Poor schedules and lack of competition create impediments that drive up costs, resulting in low demand. Attracting investment from the private sector is also a major

problem, particularly in remote areas and where there is lack of government support.

The ongoing attachment that visitors have with beach and city destinations is also a significant factor. Beaches and cities are viewed as places for having fun, where the “other” is within easy reach. Rainforests often signal a different image, one of heat, high humidity, torrential rain and a place where danger can exist in forms ranging from “wild” threatening animals to disease-carrying mosquitoes and fatal tropical diseases. In the case of the rainforest, the “other” has lethal consequences for the unwary, requiring extra precautions and the adoption of a seriousness not apparently required on a beach. For these reasons it is more difficult to build substantial tropical rainforest tourism, although there remain good prospects for small-scale ecotourism development and larger-scale development where the visitors’ perceived fears of the discomforts and dangers of this environment are ameliorated. However, it is also apparent that, where accessible, rainforests could be developed as a sustainable tourism resource able to make a significant contribution to the local economy. In Europe and North America, temperate forests are popular attractions and support significant tourism development. Part of the popularity of these forests is a function of the planning, which has created attractive visitor facilities that are managed by well-organized and funded management agencies (Font & Tribe, 2000).

Where forests are accessible and located in close proximity to major population centres, Europe and North America again being good examples, tourism activity can add value by providing employment, investment income and infrastructure investment that supports tourism as well as the local community. The protection of areas for recreation and conservation dates back to the 19th century and,

since that time, the demand for nature-based, recreation tourism and activities such as hiking, camping and mountain biking has increased substantially (Font & Tribe, 2000). Liddle (1988) has suggested that this ongoing demand is a result of three key factors: increasing populations, growing private vehicle ownership and increased leisure time. To these should be added the development of forest infrastructure that is able to support high levels of visitation and a desire by some members of increasingly urbanized societies to reconnect with “nature” (Akama & Kieti, 2003; Priskin, 2001). Akama and Kieti (2003, p. 73) observed that “postmodern social and economic changes, especially in the developed countries in the North, have enhanced the value of natural areas and the promotion of nature-based tourism and recreational activities”.

Activities found in forests that are open to tourism include hiking, camping, wildlife viewing, water activities and photography. Although each of these activities has a relatively low environmental impact, they must be well managed to ensure long-term sustainability. Of the range of activities available in forests, hiking is one of the most popular, least expensive and can be provided in a form that has a relatively low impact on the environment (Turton, Kluck, & Day, 2000). Hiking can take many forms, ranging from short walks from a parking area to a famous site, to a longer day hike and overnight hikes. In Europe and North America, in particular, both day and overnight hiking are popular activities. Classed as a predominantly active pursuit, hiking is an important and popular recreational tourism activity. For instance, Brown (1993) noted the popularity of a number of recreational tourism activities and identified walking, particularly hiking, as one of the most popular. This is not surprising

given the large number of hiking trails globally. These hiking trails include the Overland track (from Cradle Mountain to Lake St Clair) in Tasmania, Juan De Fuca Marine trail in Canada, the El Yunque hike in Puerto Rica and the Taman Negara rainforest hike in Malaysia. Stunning rainforest scenery and at times physical challenges from hiking are major drawcards. However, without proper management linked to effective planning, hiking trails may suffer from high visitor demand, leading to overcrowding, the presence of invasive species and physical damage to the immediate environment (Graham, 1994; Karger, 1997; Liddle, 1988; Turton et al., 2000).

Chhetri, Arrowsmith, and Jackson (2004), in a study of hiking experiences in nature-based tourism destinations, identified a series of positive and negative experiences. The positive experiences included pleasure, enjoyment, relaxation, stimulation, attractiveness and excitement. At the other end of the spectrum, negative experiences such as overcrowding and isolation evoked feelings of boredom, depression and frustration. Although not the focus of this paper, it is important to appreciate the significance of these experiences in identifying the market sectors interested in pursuing hiking activities, particularly in tropical rainforests – the case study for this paper.

Planning Framework

In the past, the development of infrastructure such as hiking trails has tended to be driven by the demand side, with development often being of an *ad hoc* nature. Less attention has been directed to impacts that can occur on the ecosystem component of the supply side. This imbalance has changed in recent decades, with an increasing understanding of the need

to balance development of natural experiences within the ability of nature to supply these experiences on a sustainable basis. The key to achieving a sustainable balance between demand and supply is the adoption of a planning approach that first considers what forms and at what level of intensity the ecosystem is capable of sustaining activities such as hiking followed by an analysis of the demand for hiking experiences. To achieve maximum effectiveness, responsible tourism needs to be incorporated as a crucial component for both the input and output stages of the planning framework. Moreover, planning needs to incorporate other tangible elements beyond the demand and supply side, including consultation with stakeholders, management of ongoing maintenance, and in some cases marketing.

When planning incorporates considerations of demand and the impact on the ecosystem (the supply side), the opportunity to achieve long-term sustainability can be enhanced considerably. In effect, good planning needs to balance what the resource is capable of providing with what is demanded by visitors (inputs) and how visitors rate the experience (outputs). The consideration of inputs and outputs needs to be integrated into the planning process of hiking trail developments to ensure the sustainability of visitors' hiking experiences in a rainforest or nature-based setting in general. Although notions of sustainability can encompass tourist experiences and activities, resources and the local community, this paper focuses on the sustainability of visitors' experiences and activities within the setting of the wet tropical rainforest. Several feedback loops need to be designed to link inputs and outputs. These should include measuring visitor satisfaction, monitoring visitor impacts on the ecosystem, and linking the impacts of tourism on the environment with visitor use of the area.

Figure 1 highlights an approach to hiking trail development that is resource-centric and where the quality of the resource is the primary concern in determining how it may

be developed. The model is an adaptation of the standard seven-stage planning model advocated by a number of authors (Gunn, 1994; Prideaux, 2009), but in this case tailored

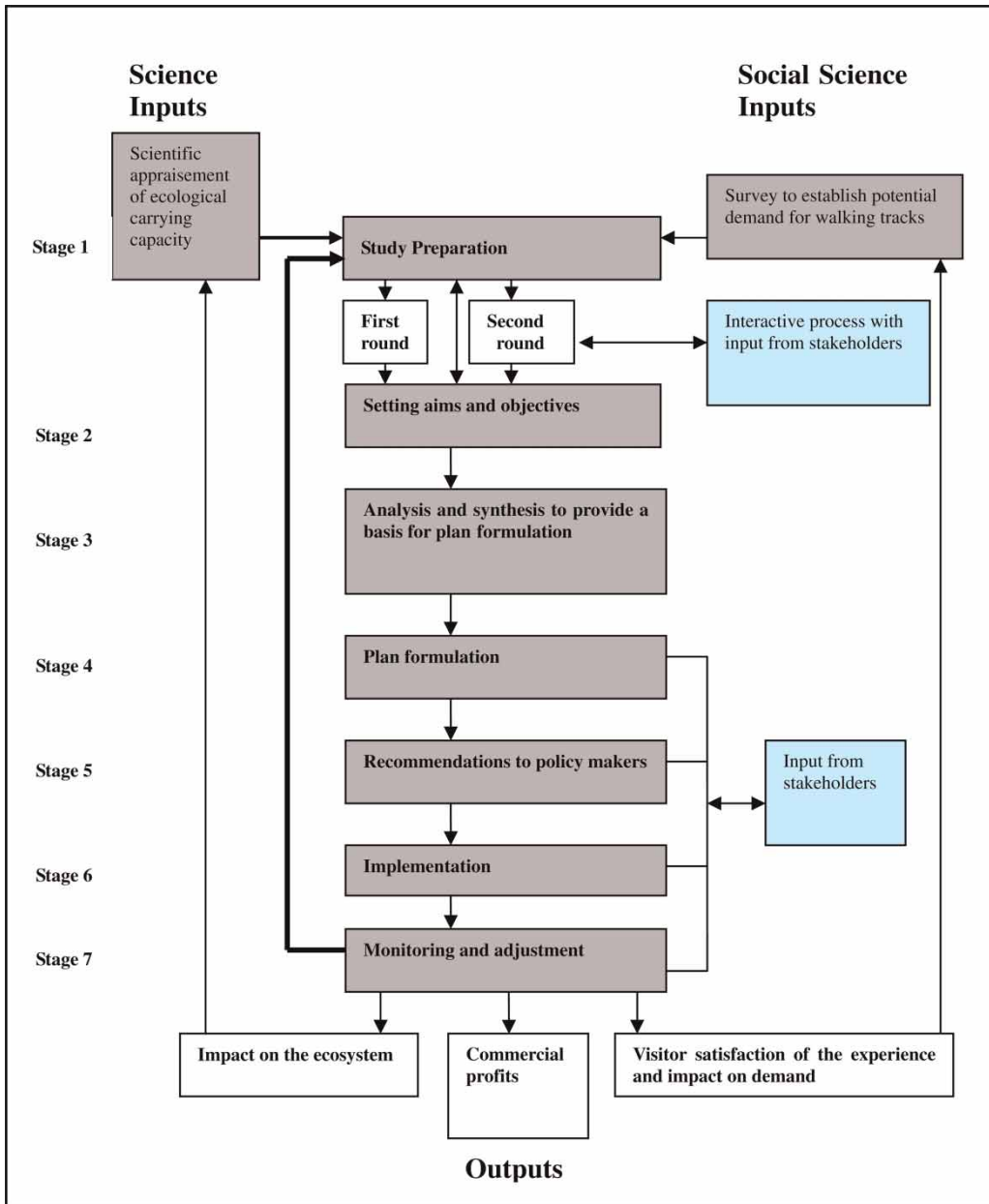


Figure 1 Hiking Trail Planning Framework.

specifically to hiking trails. Once a decision has been made to invest in trail construction, a series of inputs are required, based around two major actions. The first action is a science-related input that requires scientific appraisal of risks that may reduce long-term sustainability and carrying capacity thresholds. As Carter, Baxter, and Hockings (2001) noted, the tourism discourse has largely ignored resource management issues, and many tourism developments have ignored issues that ultimately affect sustainability adversely. In a similar observation, Eagles and McCool (2002) stated that the successful provision of nature-based tourism is ultimately dependent on environmental quality. Scientific analysis of the resource should provide an understanding of the ecological parameters within which hiking trail development may occur. These might include the impact of invasive species, soil compaction, introduction of exotic diseases and interference with wildlife breeding and feeding habits.

The second action is a social science-related input that requires an analysis of potential demand to determine what type of hiking infrastructure is required. Collectively, both types of input inform planners during the study preparation stage about the potential demand for hiking trails and the potential supply of such experiences. As used here, the process combines both scientific and social science methods in a manner that has been neglected in previous research. Surprisingly, analysis of potential demand for experiences such as hiking is often missing in planning strategies. In cases where the protected area has significance to Indigenous groups a third action is required to ensure that pre-existing cultural and heritage values are respected and conserved.

Ideally, planning should start prior to the development of protected areas for tourism, but where the area is already used by

tourism, planning should still follow the steps outlined in Figure 1. As illustrated here, the first step should entail an assessment of required inputs, including the biological character of the area, investment required in infrastructure by the management authority and investment by the private sector. Where trails already exist, an assessment of demand should include an analysis of satisfaction with existing trails as well as an analysis of demand for new trails. Assessment of existing trails may be undertaken using indicators such as satisfaction scales.

The inputs suggested for stage 1 have received little attention in the literature, particularly where they relate to hiking trail development. There are five major classes of inputs, which are outlined below.

1. *Sustainability of the resource.*
 - Determining carrying capacity based on an ecological assessment of the area.
 - Identifying dangers associated with development, such as the introduction of invasive species and loss of biodiversity.
2. *Role of the management authority.*
 - The level of investment and maintenance required by the management authority.
 - The capacity of the management authority to supervise the operation of the trails.
3. *Demand factors.*
 - The demand for particular styles of trails and, where trails already exist, the level of satisfaction with these trails.
 - The potential size of the visitor market likely to use the trails.
4. *Commercial input.*
 - Investment by the private sector in off-site accommodation and other infrastructure.
 - Investment by the public sector in visitor infrastructure.

5. Key stakeholder input.

- Local communities that have an interest in the protected area.
- Indigenous groups that have an affinity with the protected area.

At the conclusion of this initial stage of planning, the protected area's management authority should have a good understanding of what the area is able to offer, its supply-side limitations (expressed as carrying capacity and ecological impacts), its ability to manage hiking trails and an idea of the demand for various types of hiking trails. From this position, it is possible to commence the planning process, which should engage both the public sector and the community (Prideaux, 2009). Beyond stage 1, stages 2–7 of the planning model show a standard process of consultation with stakeholders, including Indigenous groups, setting of aims and objectives, plan formulation, recommendations to policy-holders and, importantly, monitoring. The final outcome (stage 7) of this process should be a resource that is sustainable, and built and operated in a manner that satisfies the demand for hiking but within the ecological limitations of the resource. The success of planning can be measured from a demand-side perspective by measuring visitor interest and from the supply side by measuring the impact on the ecosystem and financial resources generated by private sector investors and management agencies, if applicable.

Two major classes of outputs may be identified: impact of hiking on the quality of the natural resource and the impact of the experience on participants. Impacts on the resource can be measured by assessment of any degradation of the resource through compaction, disruption of breeding and feeding habits, and introduction of invasive species using the pre-hiking trail condition of the resource as a benchmark. The impact of the hiking experi-

ence on visitors may be measured by the level of enjoyment they derived from the experience and the level of learning that occurred through the experience.

In a recent paper, Dwyer and Edwards (2000) observed that quality is a very important factor in the supply of nature-based tourism experiences. They noted that “there is growing community expectations of high quality facilities and interpretation at natural attractions” (Dwyer & Edwards, 2000, p. 284). The need for quality has been endorsed further by a number of scholars (Eagles & McCool, 2002; Lee, Graefe, & Burns, 2004). As Eagles and McCool (2002) observed, mapping and measuring visitor experiences and expectations is very important, as is the need to achieve a balance between the environment and the provision of tourism infrastructure. In this case, measuring visitor experiences is an important feedback mechanism for park managers and private sector investors, providing them with data that can be used for management.

Historically, the planning of visitor infrastructure in many protected areas followed an *ad hoc* approach constrained by annual budget cycles. As interest in visiting natural areas has increased in recent decades and additional public sector resources have been made available for protected areas, there has been a growing recognition of the need for strategic long-term management plans. In the case of the Wet Tropics, the authority published a Tourism Strategy in 2000 followed by a Walking Strategy in 2001.

Research Aim

The aim of this research was to examine how nature-based hiking trails may be developed in a sustainable manner within a planning framework, recognizing the role of demand-side

inputs and outputs. In this research, consideration of inputs is restricted to visitor demand for hiking experiences. Consideration of outputs is similarly restricted to measurement of the hiking experience, although it is acknowledged that the impact of hiking on the ecosystem is also important. To demonstrate the importance of inputs and outputs, the study has adopted a case study approach based on Australia's Wet Tropics rainforest. This rainforest has been studied extensively, including research on the impact of tourism and recreation activities on the vegetation and soil, and overall capacity of the rainforest (Graham, 1994; Graham & Hopkins, 1993; Karger, 1997; Turton et al., 2000; Wet Tropics Management Authority, 2001). In most areas of the rainforest, hiking trails can be constructed without adversely affecting the local ecosystem; because the science component of the planning inputs required for stage 1 of the model has been undertaken, this element of stage 1 is not pursued further in this paper.

Over a number of decades, a series of walking and hiking trails were built throughout the Wet Tropics rainforest in response to visitor and resident demand. By the late 1990s it was apparent that a comprehensive walking and hiking trail strategy was required to review existing trails and plan for new trails. The management authority commissioned a Walking Strategy report that was published in 2001. When the planning process, recommended in Figure 1, was compared with the history of hiking trail development in the Wet Tropics rainforest, it was apparent that there was an ongoing gap in understanding the demand for hiking trails. The failure of the 2001 Walking Strategy to identify either the demand for walking and hiking trails or the level of satisfaction with current trails was a major cause of this gap.

Therefore, the primary objective of this research is to demonstrate the advantage of incorporating demand and satisfaction assessment into nature-based hiking trail planning using Figure 1 as a trail planning template. Specifically, the paper:

1. Investigates the demand for additional hiking trails in the Wet Tropics rainforest (input); and
2. Assesses the quality of existing hiking trails using visitor satisfaction as an indicator (output).

The Study Region

Historically, much of the original lowland rainforest of Northern Australia was cleared for agriculture, forestry and urban settlement (Frost, 2004). According to Frost (2004, p. 495), Queensland, the site of Australia's only tropical rainforest, "had a reputation for being highly pro-development", promoting traditional primary sectors in the majority of cases. Economic development based on timber cutting and farming outweighed conservation concerns throughout much of the 19th and 20th centuries. By the 1980s, concerns about the continuing loss of rainforest to farming, urbanization and other extractive industries encouraged the Australian Federal Government to apply to have the rainforest listed as a World Heritage site. The rainforest was listed in 1988 and in 2001 the rainforest was recognized further when it was placed on *The Global 200 List*, which showcases the world's most diverse and outstanding terrestrial, freshwater and marine environments (Olson & Dinerstein, 1998).

The Wet Tropics rainforest is a significant national resource and holds the majority of Australia's remaining tropical rainforest,

totalling 9,000 km² (Driml & Common, 1996). Since 1988, extensive research has been undertaken into the region's biological diversity (see Bradford, Westcott, & Hogan, 2006; Harrington, Bradford, & Sanderson, 2005; Pearson, 2005; Williams, 2006b), giving the area's management authority a good idea of the capacity of the region to be developed for various forms of tourism activities, including hiking. The area contains around a third of Australia's 315 mammal species, 13 of which are endemic, a quarter of Australia's frogs, over a third of the nation's freshwater fish species and nearly half of Australia's birds species (more than 370 species); see Wet Tropics Management Authority (2007). Many of the 3,000 plant species have long evolutionary histories with at least 50 species of primitive flowering plants found only in the region. The entire Wet Tropics bioregion has a mosaic of land-holdings, including national park (64.2%), leasehold (8.9%) and freehold (1.9%) (Wet Tropics Management Authority, 2007).

The rainforest has 180 visitor sites, 94 of which have infrastructure (Bentrupperbauer, O'Farrell, & Reser, 2004), as well as a number of commercial tourist attractions situated in close proximity to the World Heritage area. Given the sheer number of visitor sites, it is beyond the scope of this case study to provide detailed visitor findings on each of these sites. While recognizing that site conditions and visitors' demand and satisfaction might vary depending on which sites are visited, in the interest of containing the scope of this study, individual site assessments are not presented here. A large range of nature-based attractions and activities is available within the rainforest. These include interpretive tours, boardwalks, swimming, bird watching, rafting and even jungle surfing. A recent estimate of visitation to the rainforest

found that there were 4.65 million visits (from both domestic and international visitors) during 2001–2002, with 75% of visits occurring across 15 different locations.

The Wet Tropics Management Authority, jointly funded by the Queensland State Government and the Australian Federal Government, has responsibility for policy development to manage and preserve the unique features of the rainforest. While the management authority coordinates strategic direction and policy on a park-wide basis, the Queensland Environmental Protection Authority oversees the day-to-day management of the resource. At its inception, the management authority established a number of advisory committees to assist it in managing the rainforest. These committees allowed the community and the tourism industry to have direct input into the process, as advocated in Figure 1.

In the State of the Wet Tropics report for 2005–2006 (Wet Tropics Management Authority, 2006), concern was raised over the possible impacts of increasing tourism on sections of the rainforest. One area of concern was visitor access to rainforest sites, as well as visitor hiking beyond set trails.

Research Approach and Sample

Several methodologies were considered for this study, but it was apparent that data collection based on a visitor survey would be the most effective approach to collect detailed data on visitor behaviour, satisfaction and demand. The survey instrument was developed through a rigorous consultative process that included meeting with representatives from industry, government and university, and was piloted before the commencement of the research. The survey instrument contained

open-ended and closed questions. Closed-ended questions were designed to gather information on socio-demographics, motivations (using a Likert scale), interest in and pursuit of various hiking activities, travel dispersal patterns and overall trip satisfaction. Determining visitor satisfaction has previously been identified by Vittersø, Vorkinn, Vistad, and Vaagland (2000) and Ryan (2000) as major factors in understanding visitor behaviour and, by inference, demand for certain types of experience. This hiking trail study was part of a larger 4-year study that was designed to monitor aspects of tourist use and experiences of the rainforest.

A total of 1,408 visitors were surveyed at six key sites throughout the region between January and December 2007 during daylight hours. Sixty-six per cent of respondents were first-time visitors to Tropical North Queensland. Of the remaining 34.2% of respondents who had previously visited the region, 75.4% had visited the region up to three times. During 2007 the average length of stay was 8.73 nights. Just under half the respondents were male (47.3%) and just over 40% were from overseas. The largest group of respondents were domestic visitors (59.8%), followed by the those from the UK and Ireland (14%), North America (8.9%), Europe (7.6%), Germany (3.4%), New Zealand (2.2%), Scandinavia (1.7%) and Asia (1.6%). The percentage of respondents aged under 20 years was low (3.9%), rising to 21.1% for the 20–29 years age group, 20.1% for 30–39 years, 17.3% for 40–49 years, 19.5% for 50–59 years, 8.5% for 60–65 years and 9.6% for respondents aged 66 or over. Younger respondents were significantly more likely to be international visitors ($\chi^2 = 41.919, p < 0.05$). The majority of respondents were travelling as a couple (55.8%), followed by those travelling with

friends (13.7%), as a family with children (13.6%) and with relatives (6.7%). Visitors were all individually approached and asked whether they wished to participate, which resulted in an 80% return rate – comparatively healthy for surveys of this type (Coghlan & Prideaux, 2008).

The majority of tourists visit rainforest locations either on tour buses/coaches or as independent travellers using a private or rented vehicle. To ensure coverage of each mode of transport, surveys were distributed by employees of participating tour operators and attractions (and, to a lesser extent, accommodation facilities and visitor information centres) as well as by trained survey staff at key rainforest locations. Operator support was sought through a number of meetings and discussions with operational managers, directors or owners. Throughout 2007, a total of three large and one small tour operator, one small accommodation facility, three tourism attractions and three visitor information centres participated in the project. Although these distribution methods limited randomization of the data, it was considered to be a necessary compromise in order to ensure acceptable survey returns.

Before generalizing the results, care must be exercised as the research approach used has a number of limitations. First, seasonality was a limitation in the collection of surveys. During the low tourist season (January–March and November–December), many rainforest tour operators either closed or operated a reduced number of tours, making it difficult to achieve a high response rate during this period. Throughout 2007, it was also difficult to collect consistent data from visitor information centres because they relied primarily on volunteers, and as such were time-poor. A further limitation was that the survey was only distributed in English,

potentially causing a strong bias towards Anglophone visitors.

The Market for Experiencing Rainforest Scenery

The survey posed an attitudinal statement to visitors, “I came to experience rainforest scenery”, to test travel motivations using a Likert scale of 1 (“strongly disagree”) to 4 (“strongly agree”). In this case, the generic use of the term “experience” or “experiential” incorporates a range of subjective meanings such as emotions, thoughts, feelings and moods invoked in visitors as they move through the rainforest. The mean from the entire sample was 3.42. Figure 2 compares the mean of respondents to the importance of experiencing the rainforest with their gender, origin and age.

The results found that female respondents were slightly more likely to consider experiencing rainforest scenery as an important part of their trip to the region (but not significantly). In terms of visitor origin, there was not a significant difference between the origin of respondents and their level of interest in experiencing rainforest scenery. However,

Scandinavians clearly had the strongest interest in experiencing the rainforest as part of their trip to the region. A significant difference existed between age groups and their desire to experience rainforest scenery ($F = 4.237$, $p = 0.018$). As Figure 2 highlights, visitors in the mid-age group were significantly more likely to want to experience rainforest scenery as part of their trip to the region.

Based on travel party, visitors travelling with relatives (3.48), family with children (3.46), or alone (3.46) were most interested in experiencing the rainforest. Visitors travelling as part of a tour group (3.38) had a slightly lower level of interest (but not significantly). The study also found that respondents who were repeat visitors to the region were slightly more interested (but not significantly) in experiencing rainforest scenery (3.45) than those on their first trip (3.40). Although there was only a slight difference between repeat and first-time visitors, this result shows that repeat visitors were highly motivated and interested in experiencing the rainforest again. First, this points to how visitors enjoyed their first, original experience and wished to return. Second, it illustrates that

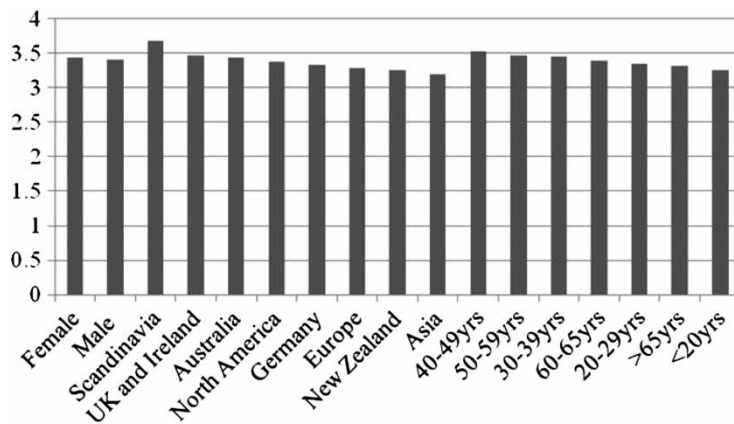


Figure 2 Comparing Respondent Gender, Origin and Age with their Level of Importance for Experiencing the Wet Tropics Rainforest (Expressed as Average Mean Value).

visitors do not consider rainforest visits to be merely one-offs, which is the case for many visits to the Great Barrier Reef (see McNamara & Prideaux, 2008). Instead, rainforest visits are treated as new experiences every time. In this way, we can infer that people can gain a variety of experiences from their rainforest visit, providing social, recreational, educational, spiritual and/or cultural benefits (Wet Tropics Management Authority, 2001).

Visitors were asked to rate their overall satisfaction with the quality of their Wet Tropics rainforest visit using a scale of 1 (“not at all satisfactory”) to 10 (“highly satisfactory”). As mentioned earlier, the experience of the visitor has been well documented as a key determinant in understanding visitor satisfaction (Ryan, 2000; Vittersø et al., 2000). The overall annual mean score for visitors surveyed in 2007 was 8.55. Visitors who “strongly agreed” or “agreed” that they came to experience the rainforest scenery while on holidays also had significantly higher levels of satisfaction with their trip (8.93 and 8.24, respectively) than those who “disagreed” or “strongly disagreed” (6.83 and 8.00, respectively). This statistically

significant result ($F = 26.550$, $p < 0.05$) establishes a strong link between overall trip satisfaction and positive experiences visiting the Wet Tropics rainforest.

Visitor Demand for and Satisfaction with Nature-based Hiking Trails

Respondents were asked about their interest in participating in rainforest hiking options during their visit to the rainforest, using a scale of 1 (“not at all interested”) to 4 (“very interested”). They were also asked to evaluate any hiking experience they had undertaken in the rainforest. The most popular hiking option was a short rainforest hike (3.54), followed by a one-day unguided hike (2.41), one-day guided hike (2.25), overnight guided hike (1.82) and overnight unguided hike (1.68). While seasonality did not greatly influence visitor interest in hiking activities, the gender and origin of visitors did. Figure 3 compares the gender and origin of respondents with their interest in these different rainforest hikes.

Male respondents were significantly more likely than females to be interested in both

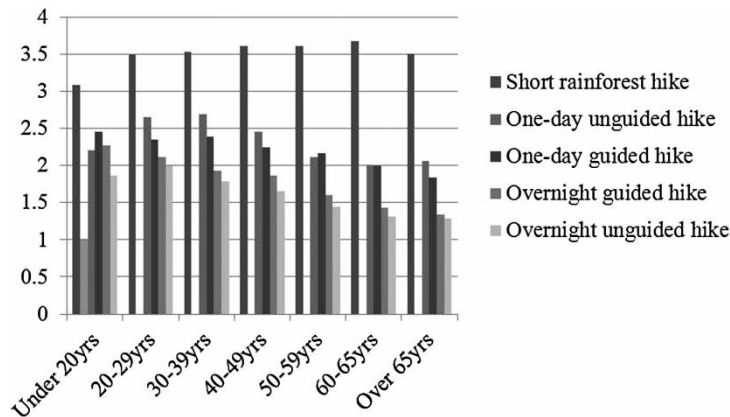


Figure 3 Visitor Interest in Rainforest Hiking Options According to their Gender and Origin (Expressed as Average Mean Value).

unguided hikes (one-day, $F = 7.903, p = 0.005$ and overnight, $F = 16.395, p < 0.05$). Those from North America, Australia and Scandinavia were all significantly more interested in a short rainforest hike ($F = 2.286, p = 0.020$). Visitors from Europe and Scandinavia were significantly more likely to be interested in other hiking options. For example, Germans were most interested in the one-day unguided and overnight guided hikes ($F = 6.683, p < 0.05$ and $F = 11.582, p < 0.05$, respectively), Scandinavians were most interested in the one-day guided hike ($F = 8.006, p < 0.05$), and Europeans were more interested than the others in the overnight unguided hike ($F = 4.010, p < 0.05$). Overall, domestic visitors were significantly more likely to be interested than international visitors in participating in a short rainforest hike ($F = 40.779, p < 0.05$). International visitors were significantly more interested in all other hikes (one-day guided and unguided, and overnight guided and unguided; $F = 52.378, p < 0.05$; $F = 7.487, p = 0.006$; $F = 74.165, p < 0.05$; and $F = 13.628, p < 0.05$, respectively).

Some interesting trends were revealed following an analysis of the age of respondents

and their interest in rainforest hikes. These trends are displayed in Figure 4.

Visitors most interested in a short rainforest hike were significantly more likely to be aged between 60 and 65 years ($F = 5.494, p < 0.05$). However, younger respondents were most interested in a one-day unguided hike (30–39 years, $F = 11.806, p < 0.05$), one-day guided hike (under 20 years, $F = 5.345, p < 0.05$), overnight unguided hike (20–29 years, $F = 15.330, p < 0.05$) and overnight guided hike (under 20 years, $F = 15.746, p < 0.05$).

As with the significant relationship between overall satisfaction and interest in experiencing the rainforest, respondents who showed a strong interest in hiking activities also had a higher level of satisfaction with the rainforest. This trend was consistent across all five of the hiking options, as Figure 5 shows.

Most of these relationships were statistically significant. These included the relationship between rainforest satisfaction and interest in the short rainforest hike ($F = 25.715, p < 0.05$), as well as the one-day unguided hike ($F = 6.771, p < 0.05$), one-day guided hike ($F = 25.715, p = 0.012$) and overnight

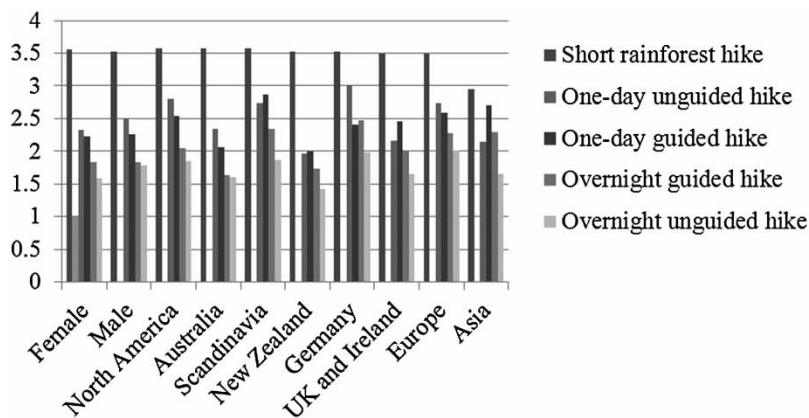


Figure 4 Visitor Interest in Rainforest Hiking Options According to their Age (Expressed as Average Mean Value).

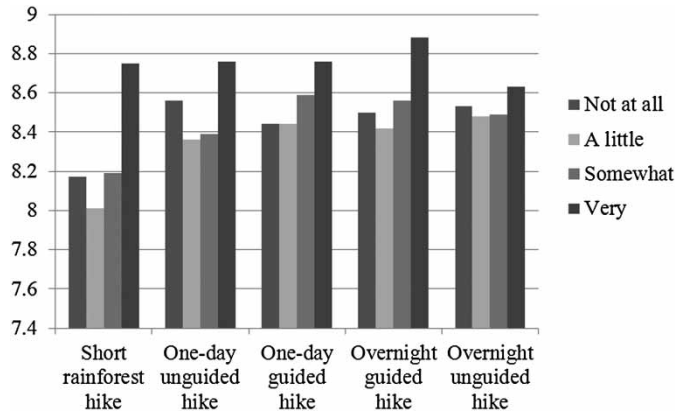


Figure 5 Overall Satisfaction with the Rainforest Compared with Visitor Interest in Hiking Options (Expressed as Average Mean Value).

guided hike ($F = 3.813$, $p = 0.010$). This finding highlights how satisfaction with rainforest visits is linked to the interest of respondents in attaining positive rainforest hiking experiences.

Discussion

Input/output analysis is a methodology regularly used by economists to measure the relationship between the input of goods and services into an economy, and the output that occurs as a consequence of how the inputs are used to produce goods and services. By using the same approach in a protected area setting it is possible to establish a link between inputs invested in the area and the outputs that are produced. In this case, inputs consist of demand for hiking, the ecological sustainability of the resource, management resources and investment by the private sector. Outputs are measured as visitor satisfaction with the experience, accrual of financial resources for investors and ecological impacts on the protected area.

The process of turning inputs into outputs in a natural area must be guided by the impact that

use of the resource will have on its sustainability. In the case of hiking trails, and other activities, the most effective process for developing trails is to embed the process in a planning framework that recognizes the need for sustainability and also considers that hikers require a pleasurable experience. The planning model, illustrated in Figure 1, outlines the role of inputs and outputs in this process and shows how they need to be linked for this process to occur.

When applied in a specific rainforest setting, it is apparent that the level of inputs will determine the structure and quality of hiking opportunities, and will influence the level of satisfaction that hikers have with the trails they are provided. In the case of the Wet Tropics rainforest, it is apparent that existing hiking experiences provide a relatively high level of satisfaction. This is based on the survey conducted in 2007, where visitors provided a satisfaction assessment of their entire rainforest experience, and this was correlated with their participation in hiking activities.

The findings of the research also highlight the desirability of embedding the process of hiking trail provision within a formal planning process, whereby demand can be identified

and from this the size of inputs required can be calculated and, if sustainability rules are not breached, trails can be developed. The feedback loops that are built into the model allow measurement of visitor's enjoyment with the hiking experience and the impacts that the construction of hiking trails has on ecological sustainability.

Conclusion

The aim of this research was to examine the role of demand-side inputs and outputs in hiking trail planning, with the range of inputs restricted to visitor demand for hiking experiences. It is apparent that while inputs such as demand are a key indicator in the process of hiking trail development, the level of development needs to be considered within a planning framework that pays particular attention to the sustainability of the resource. It is also apparent that considerable attention needs to be paid to the outputs of the provision of hiking trails, including the impact on the ecosystem and the level of satisfaction experienced by hikers. In the case study used in this research, it is apparent that there have been gaps in the application of an input/output philosophy in the planning of hiking trail development. This may be resolved if the planning model illustrated in Figure 1 is used in the future.

Moreover, the research illustrates that hiking is a major forest activity that has been growing in popularity for many years. In a tropical rainforest setting, the development of hiking trails can encounter environmental problems (less encountered in temperate forests) including a harsh hot and moist environment, concerns about threats from animals, insects and plants, infrastructure that must be climate-resistant and problems with invasive

species. Developing hiking trails, where they are viewed as a desirable addition to park infrastructure, should be viewed as a staged process. A process that commences with a scientific assessment of the resource followed by an assessment of the demand for various potential activities and, finally, an appraisal of the level of visitor satisfaction and a study of impacts on the sustainability of the resource.

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