Abstract
Carrying capacity is a concept that has attracted considerable attention in the area of recreation and tourism management over the past four decades. The idea that a natural area has a certain level of recreational use that it can sustain without detrimental impacts is an attractive concept that was originally borrowed from the field of wildlife management. Initially, reflecting the biological origins of the concept, the primary focus of research was on the idea that recreational use of an area has ecological impacts that can only be sustained up to a certain point (ecological carrying capacity). These early studies were quick to recognise that increases in recreational use may also have social impacts on the experience of other users that would only be acceptable to a certain point (social carrying capacity). Most of the original work on carrying capacity tended to focus on describing the ecological and social impacts of recreation (e.g. soil compaction, vegetation loss, crowding and loss of solitude), and trying to establish relationships between the level of use and the level of impact. This proved to be a difficult task, particularly in the area of social carrying capacity, and saw the concept lose favour after several decades of research (McCool & Lime, 2001).

Recognition that impacts of recreation are difficult to identify and predict, and that these impacts may change with time, management intervention saw a shift in focus from trying to find the “magic number” of users (inputs) to looking at acceptable changes in the environment or recreation experience (outputs) (Hendee, Stankey & Lucas, 1990). Development of frameworks for assessing carrying capacity such as limits of acceptable change (LAC), visitor impact management (VIM) visitor experience and resource protection (VERP) and the Tourism Optimisation Management Model (TOMM) have involved a realisation that impacts of visitation are inevitable, and the focus should be on managing these impacts within acceptable standards rather than focusing on the number of users. LAC, VIM, VERP and TOMM all attempt to identify indicators of the quality of a recreation experience and establish acceptable standards for these indicators. While there are difficulties in identifying appropriate indicators (often chosen for cost, efficiency and ease of measurement) and then setting appropriate standards for these indicators the four concepts have assisted managers in making judgements regarding the appropriate use of a recreation area.

This paper will examine several different studies that have approached the carrying capacity question from different perspectives and attempted to come up with tools to determine an indicator of visitation limits for a specific site.
Examination of these studies in both wilderness and cultural sites will highlight the need to consider the concept on a larger regional scale, considering the ecological and social implications of any management decisions regarding controls on use. As most studies focus on one ecological or social impact there is a clear need for research to consider visitation limits from a more holistic perspective looking at ecological, social and management factors simultaneously.

Introduction
Any attempt to define ‘carrying capacity’ in the context of tourism and recreation immediately confronts the administrator, manager or planner with a dilemma of perspective (Williams 2001; Haas 2002). The notion that there is a right perspective is not accepted; rather there are many perspectives; and the objective of this paper is to canvass some of those perspectives as they pertain to decision-making about the number of visitors an area may accommodate or the supply of opportunities which may be made available at a given site or in a particular area. Over the past four decades a substantial effort has been invested in trying to find universal principles for establishing carrying capacity in a wide range of recreational and touristic settings, and while our knowledge and understanding have benefited from this endeavour it may best be described as a work in progress. Some authors have claimed at least as far back as 1974 (Wagar 1974; Bury 1976) that the use of the term ‘carrying capacity’ is a misnomer since there are far too many variables to deal with (US Forest Chief Thomas famously suggested that: “Not only are ecosystems more complex than we think – they are more complex than we can think.” Cited in Haas 2002). McCool & Lime (2001) suggest that the concept of carrying capacity is built on a false premise – that of the now-discredited assumption of stable ecosystems, when in fact dynamic change, disequilibrium and catastrophe are more characteristic than harmony and ‘natural balance’. In this context, it is the view of this author that while a carrying capacity is not achievable in most circumstances, placing limits on numbers accessing a particular site is often necessary; but limits on numbers is not the same as a carrying capacity (see Box 1).

Some capacities are relatively easy to determine. A plane has only so many seats; a restaurant has only so many tables and chairs; a marina has only so many moorings; a car park has only so many parking bays; a cruise ship has only so many cabins; and a hotel has only so many beds. Capacity is reached when they are ‘full’. In such situations there is little or no aggravation when the limit is reached. The difficulties arise when ‘capacity’ is not simply a factor of physical properties or spatial dimensions which can be easily and clearly defined and demarcated, but when a space is not demonstrably ‘full’ yet limitations on numbers and/or restrictions on activities are imposed by a regulatory authority. This is especially the case in natural environments and in some socio-cultural sites where the intrinsic biodiversity or heritage values of the site are held to be at risk from too great an amount of visitation, but the causes of the threat are not understood by or available to the general public so that there is a credibility gap between the regulator (controlling supply) and the visitor (generating demand). In attempting to determine a visitor capacity in such a situation the regulator may foreground biological and conservation factors, but the visitor may be more concerned with perceptions of must-see attractions where the visual appeal of the site over-rides other considerations. Re the latter, whale-watching in Australia is a case in point: visitors may grumble about the numbers on a crowded boat, but the experience of
sailing alongside a whale is so subliminal that the experience outweighs all other factors. Yet other perceptions may be psychologically based, one type of visitor demanding less people because of perceptions of crowding (Urry’s (2002) ‘romantic’ tourist gaze, seeking untramelled virgin nature and isolation), even as others insist that there is no crowding and that more numbers are needed to provide a sense of dynamism and liveliness (Urry’s (2002) ‘collective’ tourist gaze). There may be technical considerations. An architect may view visitation from the aesthetic perspective of design and humans in the landscape and recommend a particular visitor capacity; an anthropologist may be concerned about adverse socio-cultural impacts on a host community if visitation is unrestricted; but an engineer may propose a technological solution to increase visitation and thus ‘solve’ a problem of unrequited demand; while a ‘green environmentalist’ may demand the removal of technology to banish ‘evidence’ of human’s domination over nature and insist on additional curtailment of visitation. Different types of visitors will have different perceptions of crowding; and the cultural values of differing ethnicities will also result in very different sensitivities of crowding and acceptable/unacceptable behaviour (e.g. as between Australian visitors and mainland Chinese). Seasonality will also affect the issue (Box 1). Carrying capacity implies a strong cause-and-effect relationship between the amount of use an area receives and subsequent impact. However, many studies of this relationship point out that use intensity is a poor predictor of total impact. The season and type of use involved, for instance, frequently are more important in explaining impacts than the amount of use. (Box 1 provides an example of different impacts even though carrying capacity remains unchanged).

In short, a complex mix of objectivity and subjectivity govern differential perspectives on what is and is not acceptable capacity. Haas (2002, p.2) suggests that decision science, which encourages consideration of a multiplicity of perspectives, can “enrich and lead to more effective and better decisions” although paradoxically it can also “be an obstacle and inconvenience to efficient decision-making”; and he advocates recreation and tourism managers engaging “in a broader dialogue of divergent perspectives in search of convergence in understanding visitor capacity.”

Before proceeding it is necessary to define what is generally meant by recreational capacity. A common definition is that capacity is the total supply of visitor opportunities to be accommodated in a given area before unacceptable impacts occur (Schwarz, Thor & Elsner 1976; Hendee, Stankey & Lucas 1990; Haas 2001). There are two major streams of investigation into carrying capacity: ecological carrying capacity and social-psychological carrying capacity. In this context ‘capacity’ covers both (i) numbers of visitors and (ii) the range of opportunities which may be provided. Visitor opportunities in turn are defined as “the opportunity for a person to participate in a particular recreational activity in a specific setting, in order to realise a preferred type of experience and subsequent benefits. Agencies manage recreational activities and settings as the inputs to recreationists consuming an experience” (Haas, 2002, p.3). By referring to a preferred type of experience it can be argued that Haas is in fact talking about LAC (Limits of Acceptable Change) and I will return to this topic in due course.

At the beginning of this discussion I should also like to note that ‘capacity’ carries the connotations in the minds of many as visitor limits or closures, and that many of the more
extreme environmentalists actively promote this negative association in pursuit of their political objectives. Haas (2002) makes the point that capacity however does not itself prescribe any specific management response and should be approached as a tool to assure the protection and enjoyment of a site or area for present and future generations; and in this context it may be interpreted in a positive sense, as in the case where additional opportunities are created or additional areas ‘opened’ because of the need for dispersal to relieve visitation pressures on areas under stress. As Hendee, Stankey and Lucas (1990, p.216) note: “Carrying capacity can be increased or decreased by management action: it is not an inherent, fixed value of the land. It can be diminished by unregulated overuse or enhanced by thoughtful management.” It should also be noted that intensity of visitation is a poor predictor of impact: many studies indicate that most damage occurs with initial visitation of very few numbers; and variables such as type of visitor and season may be more significant in understanding what it happening, rather than the amount of use. The inevitability of change should be seen as the critical issue to which management responds (Cole 1985).

For many years there was (and perhaps still is) in some circles a belief that a capacity decision can be scientifically determined. To a certain extent the so-called ‘cautionary principle’ of sustainable development rests on this approach when it demands that in the absence of definitive scientific answers or solutions no action or activity should be undertaken in the interim. It assumes that at some future date enough science will lead to an authoritative understanding of risk and certainty about proposed tourism development and its associated visitation capacity.

In some very specific circumstances exact science may be able to provide a precise understanding of a visitor impact that can be used as the basis for a decision on capacity. For example, with the natural vegetable dyes used to provide some of the colour in Aboriginal cave paintings of the central Australian desert or the murals and hieroglyphics of Egypt’s pharaonic tombs, science can tell us that if they are exposed to humidity levels of 67% irreversible damage is caused: the colours begin to fade, the pigments start to peel from the walls, and the process of deterioration cannot be halted (UNESCO 2000). It is a simple step for management to determine the number of visitors allowed inside at any one time who would expel a level of moisture from their breathing below the critical point by installing a hygrometer, monitoring it continuously, and setting a numerical limitation accordingly.

But is it so simple? If we introduce just one variable – temporality - we immediately have a different range of capacities. Suppose it takes 50 people one hour inside the cave or tomb to raise humidity to the critical level, we could double capacity by limiting time per visitor to just 30 minutes. We could double capacity again by limiting time to 15 minutes, and again by reducing time inside per person to 7.5 minutes. Our carrying capacity is thus now 400 people at the one time. Now let’s introduce another variable – technology. We could install a fan at the end of the cave or tomb to blow out everybody’s moist breath and we may find that we can have 800 visitors inside at the one time without raising humidity to critical levels. Let’s install airconditioning, which would increase our capacity to control humidity levels fourfold – we could now allow 2,400 visitors inside for 7.5 minutes each (provided we have the physical space to accommodate them). Let’s go further: we could seal the paintings or hieroglyphics behind a glass case with a dehumidifier and temperature controls to maintain
conditions at the desired standards – and humidity ceases to be a factor in determining carrying capacity. The number of visitors now has no influence at all on the state of the rock art. Science and technology have combined to produce a capacity-free zone.

But what have we done to the experience along the way? Initially we were able to spend one hour inside the cave or tomb with just 49 other visitors, able to reflect profoundly and at leisure on 5,000 years of Aboriginal survival in one of the harshest climates on earth; or absorb 3,000 years of pharaonic history, wonder at the extraordinary accomplishments of that vanished civilization, and soak up to the full its artistic and engineering heritage. Now, we are just part of a shuffling crowd, unable to stop and contemplate any one particular pictorial before shunted forward, elbows of others jammed into our sides, people pushing and shoving from behind, a babble of noise assaulting our eardrums – as bad as queuing for hours to catch a glimpse of the Mona Lisa’s smile in the Louvre in Paris for 20 seconds. No longer is it a ‘natural’ sight but an enclosed, framed object. In short, the experience has changed dramatically. Science has provided a basis for sound management of the site but it cannot provide the determinant for an appropriate carrying capacity. We are forced back onto a subjective judgement of how to define the visitor experience. A tool such as LAC becomes useful

‘Subjective judgement’ may be defined as the ability to analyse complex situations taking into account in a full, fair and principled manner all available information including the need for compliance with relevant laws and regulations, and the experience and expertise of field staff and other practically-oriented operatives. In other words, “capacity is a fundamental administrative decision” which ideally should be based on a reasonable level of certainty about impacts (good science) combined with sound professional judgement (Haas 2002, p.4). In examining the history of carrying capacity applications over the past thirty years, it is evident that in the final analysis the judgement of managers, field staff and custodians of sites rather than any exact science has been the chief input for a determination on numbers. As Cole (2000, p.12) notes: “Recreation carrying capacity is not an inherent value; it must reflect value judgments. Decisions about appropriate use must include what Shelby and Heberlein (1986) call an evaluative component.” Returning to our Aboriginal cave paintings site, we can see that it calls for the application of a concept such as Limits of Acceptable Change to determine the type of experience managers wish to provide, and that social capacity - crowding - needs to be combined with humidity levels to determine the number of visitors permitted to access the site at the one time.

I thought I had found one site which appeared to be based on application of several principles which could have general application: Undara Lava Tubes in outback Queensland, Australia (Sofield and Getz, 1998). Lava tubes are a geological phenomenon where as lava flows down a gully the outside crust of the flow solidifies while the centre continues to run downhill and drains out, leaving a hollow pipe. Subsequent eruptions may then cover the tubes in ash and transform them into long underground caverns – the situation with Undara, where the largest tube is more than 65 kilometers in length, with the diameter varying between 8-20 meters. Collapse of the roof in places permits access to the outside and at Undara the tubes themselves have evolved as specialised habitats for a particular species of bats in their thousands. Other animals such as carpet snakes, wallabies and a range of small
rodents and insects also inhabit the tubes, while the depressions where the roof has collapsed form microhabitats for a range of rainforest plants not found at the dry savannah surface. The tubes are inside a national park and operate under strict capacity guidelines.

Those guidelines incorporate a strong biological conservation ethic developed following substantial research into the bats and their adaptability to visitation. No private vehicles are permitted to enter the park from the resort (which is located near the boundary of the park) and all visitors must travel to the tubes (as far as 30 kilometers distant) in the buses operated by the resort. Numbers in any one group are restricted to 21 (plus a driver and guide – who are all graduates of geology or biology/environmental science). Groups are dispersed to lessen impacts. Because the lava is brittle it quickly erodes under continuous impact so paths and boardwalks have been constructed at some sites. Only one escorted group is permitted to visit any one part of the lava tubes complex per day, with sites rotated every day so that there is minimal disturbance of the bats: individual colonies are subjected to visitation at least two days apart. Strict guidelines on behaviour are enforced; no flash photography, no shouting, no mobile phones or transistor radios, no smoking, no loud talking once inside the tube, and minimum distances from the bats are maintained. During the bat breeding seasons, all visitation ceases for ten weeks. Social factors associated with the limitation on numbers were perceptions of crowding, and the need to maintain small numbers so that guides did not have to raise their voices for all to hear the interpretation.

Closer examination of the decision on visitor numbers revealed that science was not in fact the only determinant. Apparently the best commercial deal available to the resort for buses was for 24-seaters rather than bigger vehicles, and as that size fitted in with the notion of small group size in response to environmental fragility it was the capacity of the bus which set capacity for visitation to the lava tubes. It is quite possible that significantly larger groups could visit the tubes with no more ecological impact than the present restriction; or that group sizes should be smaller. Surveys reveal that in terms of social perspectives, crowding is not an issue and the visitors, regardless of demographic variables, market segmentation and specific interests, evidence a high rate of satisfaction from the experience.

This is where concepts such as LAC, VIM (Visitor Impact Management) and VERP (Visitor Experience and Resource Management) represent a reformulated view of the traditional notion of carrying capacity since it shifts the focus from trying to define maximum permissible use to identifying desired conditions and experiences and then managing use so that impact levels do not exceed those conditions (Stankey et al 1984; Stankey et al 1985). There are four major components to the LAC process:

i) the specification of acceptable and achievable resource and social conditions, defined by a series of measurable parameters;

ii) an analysis of the relationship between existing conditions and those judged acceptable;

iii) identification of management actions judged to best achieve the desired conditions; and

iv) a program of monitoring and evaluating management effectiveness.

(Stankey et al, 1990, p.221).

These authors then break down the four components into nine steps to facilitate application (Figure 1). The LAC provides a framework for managing biodiversity and other values in
protected areas and in its application it is important to adopt a systems approach. The LAC process needs to be applied in the context of explicit management objectives to achieve desired standards of social and resource conditions. It is the condition of the area, not the number of users that is the primary focus of attention, and depending upon how those conditions can be attained and maintained may or may not involve making decisions about reducing recreational use. There is broad agreement that any decision about use will favour certain users and certain types of experiences (Schreyer 1979, cited in Cole 2001), and this underlines the value of science that helps managers make decisions about which users and experiences to favour in their area (Cole 2001). In order to lessen discrimination against one or more types of visitors and experiences, the need is to locate the decision-making process within the context of a large system perspective. A decision to give preference to one user group over another is less discriminatory if the other user group is given preference somewhere else.

Figure 1: The Nine Steps in the LAC Process (Stankey et al, 1990)
North Stradbroke Island (Quandamooka), Queensland, Australia
A systems approach was used in formulating a recreation and tourism management plan for North Stradbroke (Quandamooka) Island off the coast of Queensland near Brisbane (Sofield, Burns and Li 1996). Quandamooka is a high sand island with a sedentary dune system running north south for 40 kilometers and between three to eight kilometres wide, some ten kilometres off the mainland. The highest dunes reach 200 metres. As the second largest sand island in the world (Fraser Island some 100 kms north and designated as a WHS is the largest) it has a highly specialized biota and is thickly wooded with some heathland and a large population of wallabies and other marsupials. More than 160 species of birds have been recorded. The most fragile areas are suspended lakes in the high dunes which were taboo (semi-sacred sites) for the original Aboriginal population.

The early history of the island created a negative image for recreation. It was used as a penal colony for the early settlement of Queensland in the 1850s-60s, and then as Brisbane developed it became a quarantine station in the 1870s, a leprosarium and an Aboriginal reserve in the 1890s. In 1937 the Catholic mission was handed over to the Aboriginal people, and during the Second World War under the threat of invasion from Japan the northeast of the island became a major military base. Until 1945 the island population was small because of its relative isolation and difficulty of access and it was rarely visited. But the infrastructure provided by the military base (which was decommissioned in 1946) began to attract recreationists, particularly small boat fishermen and subsequently four-wheel drive off-road enthusiasts, and a vehicular ferry service to handle the traffic was established. Sand mining for ilmenite began in the 1960s and created considerable controversy as about one third of the entire island was leased for that purpose. Sands mining continues to this day under strict environmental guidelines. As the top layers of sand are removed to expose the mineral, they must be stored until after extraction. The dune is then re-sculpted into its original shape with slopes restored to their original steepness, the top soil redistributed and a scientifically determined mix of native vegetation which mirrors the original flora replanted.

Subsequently much of the northern third of the island was designated as a state park and limited facilities for camping were constructed. From the 1960’s onwards Stradbroke began to attract increasing visitation caused by what Clawson (1985) called “the four fuelling factors - increased leisure time, income, access and population growth.” By 1990 the island boasted three permanent communities with a resident population of about 300 Aborigines and more than 2000 Europeans. It has its own “Millionarie’s Road”, a ridge of luxury houses owned by members of Queensland’s highest socio-economic segment. Many luxury apartments and ‘weekenders’ (second, holiday homes) were constructed and a 4-star resort was built. By 1995, 4-WD campers were the major visitor segment, more than 18,000 of them occupying a 9-kilometre stretch of beach (Flinders Beach) between December and February for an average length of stay of 14+ days. There were only two toilet/shower facilities (capacity each 300 per day) some six kilometers apart, no road access to the camp sites (vehicles simply drove along the beach to find somewhere to pitch tent). Beaches were designated as ‘roads’ and 4-WD vehicles invaded every part of the landscape. Trailer-born speedboats were hauled to one of the three suspended lakes for water skiing and some limited racing, to the chagrin of the Aboriginal community for whom it had been a taboo site. While National Parks attempted to block access tracks to the other two lakes with boulders and tree
trunks, 4-WD recreationists simply went “bush-bashing” and drove around them. National Parks had only two full-time rangers for the island, one campsite ranger, no management strategy for the island and seemed content to accept increasing numbers of 4-WD camping permit fees as a revenue-raising exercise (Sofield, Burns and Li, 1996).

By 1995 major tensions were apparent between the 4-WD off-roaders and everybody else; the Aboriginal community and many of the other users of the island; the increasingly affluent, environmentally-conscious upper class residential new-comers and second-home owners; and non-vehicular recreationists whose wilderness experience was constantly disrupted by 4-WD intrusions into the most remote parts of the island. The numbers of nature lovers increased dramatically throughout the 1980s as the Antarctic whale populations began to rise, because their annual migration route to the calving waters of the tropics takes them very close to the elevated north-eastern tip of Stradbroke. It quickly became the best land-based site for whale viewing in Queensland. Whale-watchers are often very keen conservationists and they became vocal critics of the untrammeled 4-WD activities they observed all around them (Sofield, Burns and Li, 1996).

Environmental damage (erosion, soil compaction, braiding of tracks, destruction of flora and disturbance of fauna) caused by the 4-WD vehicles was significant in every area, cultural degradation of significant Aboriginal sites was substantial (a team of archaeologists and anthropologists from the University of Queensland had recorded more than 270 sites by 1995, many of them damaged by 4-WD ingress) and pollution along Flinders Beach was reaching public health proportions. Wildlife was under stress in a number of areas, particularly raptors which had their nesting territories severely curtailed by 4-WD intrusions. Many sites had reached saturation point, and minimization of impacts was not being actively pursued by management. A major problem was that for more than thirty years 4-WD enthusiasts had enjoyed virtually unrestricted and unregulated access to Stradbroke, and as other areas on the mainland within relatively close proximity to Brisbane were closed to them the island became if not quite their last refuge certainly a symbol for the ‘freedom’ they desired to take their vehicles wherever they chose in challenging terrain. But over those years Stradbroke had been transformed from a pioneer recreationist site for 4-WD enthusiasts and fishermen, into a multi-purpose destination with a multiplicity of recreational interests and activities, a wide range of stakeholders, and many types of recreationists, albeit still dominated by 4-WD recreationists who formed more than 60% of all visitation.

A study was commissioned to develop an appropriate tourism management strategy for the Island. An adaptation of the ROS (Clark and Stankey, 1979) was used to classify different parts of Stradbroke so that a management plan could take into account the needs and preferences of different users in concert with a series of environmental and cultural research studies which had accumulated (mainly through the University of Queensland which had maintained a research station on the island for a number of years). Proposals in the plan proposed that no restrictions be placed on over-all numbers but in terms of access some areas and sites were to be closed to previous users. Culturally-sensitive Aboriginal sites became a key determinant in imposing some restrictions; Aboriginal sites were to be declared protected zones and access to sacred sites was to be denied to all non-Aborigines. Wildlife needs were similarly a critical factor in the decision-making process to deny some types of access to
some areas, particularly nesting sites of raptors, to be safeguarded with a protective zone around them. While restrictions were placed on 4-WD access to a number of previously heavily utilized areas and sites, a balance was to be struck: some of the degraded former mining leases previously closed were proposed to be opened to them and a range of different driving experiences and terrains guaranteed by those sites. 10 kms of Long Beach (occupying some 90% of the east coast of Stradbroke) was closed to 4-WD access, but a new track allowed them access to the remaining 20 kilometres. One of the lakes was permanently closed to all vehicular traffic and new walking trails constructed. A gravel road was planned along the back of Flinders Beach so that 4-WD access was no longer reliant along the beach, which had a speed limit of 30kph imposed. Additional toilet blocks were recommended. Park ranger staff were to be increased to ensure compliance with the new management regime. There were obviously winners and losers in this situation, with many of the 4-WD ‘F.I.T.’ fraternity antagonistic. Interestingly however, the new management proposals were accepted by the major 4-WD clubs who had their own codes of practice to encourage responsible off-road behaviour, and this response resulted in a proposal that National Parks offer a discount in camping fees to members of approved 4-WD clubs.

Given the institutionalized and entrenched attitudes of many users of Stradbroke Island the introduction of a new regime was/is controversial; but broad acceptance of change was enhanced because of the congruence of three decisive factors. The first is the inculcation of environmental ethics by many people in Australian society at large, a resulting awareness of environmental factors in tourism and the need for different (i.e. environmentally sensitive) forms of recreational activity and behaviour. This is combined with the political significance of the environmental movement in Australia, with ‘Greens’ holding the balance of power in several state governments and decisively influencing the outcome of federal government in Australia. This environmental empowerment finds expression in a new political will to undertake difficult decisions in protected area management in some (but not all) circumstances. On Stradbroke, these factors were manifested in an influential local environmental protection association since the problem of environmental degradation had reached crisis proportions with adverse impacts plainly obvious. The third decisive factor in operation is the empowerment of the Aboriginal community through ‘Native Title’ legislation which in the case of Quandamoooka gave added impetus to proposals for change because of concerns that the lack of management would strengthen the Aboriginal legal case to re-assume responsibility of the land, previous native title claims emphasizing the integration of Aboriginal culture with the bio-physical environment in a ‘nurturing nature’ context. The Aboriginal land title claim in part was based on mismanagement of the cultural and biophysical environment by European settlement and consequential tourism and recreational activities (Sofield, Burns and Li 1996).

It is important to note that the focus of the tourism management study of Quandamoooka was not predicated on determining numerical capacities of visitation but on creating appropriate conditions for a range of sustainable tourism development and recreational experiences across a broad spectrum of users. McCool & Lime (2201) advocate a similar move with approaches such as LAC and VERP replacing carrying capacity.
Protected Area Management Planning for Tourism in China

[Author’s note: much of the following section is drawn from a chapter by Sofield and Li in Fennell, D. & Dowling, R. (eds), Ecotourism: Policy and Strategy Issues. London: CAB International Academic, forthcoming, 2002].

A second example of a systems approach to recreational planning has been derived from ten years of involvement in tourism planning in China in which the ROS and LAC provide ways of achieving acceptable management of protected areas in a culture with very different values from western constructs. The process of formulating appropriate strategies for nature reserves in China brings the western paradigms of environmental conservation, wilderness and sustainability, upon which ecotourism is based, into sharp contrast with centuries-old Chinese values and views about the natural environment and the role of humans interacting with nature. The latter are essentially anthropocentric, with the western approach being basically biocentric. The forging of an appropriate ecotourism strategy needs to reconcile these differing, culturally-determined values (Sofield & Li 2002). Different world views concerning rights and responsibilities to nature, embedded in the culture of a society, require different management regimes “to balance the competing ideals of tourist access and nature protection” (Williams 2001). Cross cultural situations require an emic approach and modification of a strict etic approach.

The strategy also needs to contend with consumer demand for access to natural resources on a scale unmatched in most other parts of the world. As the Chinese population of 1.3 billion grows wealthier and disposable incomes increase to the point where recreational travel and tourism become attainable, literally millions of domestic visitors stream into the countryside. Existing sites are often overwhelmed with thousands and thousands of daily visitors and management regimes are often inadequate to deal with the numbers. In 2001 the China National Tourism Administration estimated that there were more than 700 million domestic tourists. In just five years Chinese visitation to the relatively isolated WHS biosphere of Jiuzhaigou Nature Reserve (a ten-hour bus ride from Chengdu City in Sichuan Province) has risen from 250,000 to 1.2 million in 2001. Experience with other newly-opened nature reserves in China suggests that within twelve months as new nature reserves are designated and opened they can expect upwards of one million visitors each year (China has increased its nature reserves from less than 1% of its land mass to 9+% in ten years: Bauer 2001). Since special interest tourism, alternative tourism and ecotourism as defined in the western sense tends to be ‘small tourism’ based on limiting numbers spatially and temporally through application of concepts such as LAC, a recreational land-planning and management scheme for nature reserves as a whole has to be incorporated as an umbrella, with these forms of tourism presented as only one part of a much larger mosaic of experiences and for which planning cannot occur in isolation. In effect special interest tourism, alternative tourism and ecotourism as defined by western literature does not exist in China: all tourism in China is mass tourism.

Underlying difficulties in tourism policy formulation is that there are no direct equivalents of key words in Chinese. While phrases and alternative wordings are available for most concepts and ideas, in the context of tourism development the absence of specific words with similar meanings which translate cross-culturally can lead to difficulties. Until 1991 when China prepared for the Earth Rio Summit there was no specific phrase in Chinese for
‘ecologically sustainable development’ or ‘ecotourism’, and even now while new phrases have been formulated and have found their way into the lexicon of tourism studies, ecotourism in the Chinese context of tourism is not underpinned by the five basic principles the western paradigm attaches to the term. Any venture which is set in the Chinese countryside and utilises natural resources and attractions tends to be classified as ‘ecotourism’ when a western definition would define it as nature-based tourism or simply a tourism facility or development located outside the urban area. For example, the ‘Ecotourism Plan’ for the rural surrounds of East Lake five kilometres from Huangzhou township in Hubei consists of five ‘development zones’ – a conference centre for 2000, a hotels and resorts area for 5000 beds, fishponds (aquaculture for both commerce and recreation), water sports (including water skiing), and a visitor reception area with amusement park.

Chinese values concerning ‘nature’ are often diametrically different from those associated with the western paradigm of ecotourism. The Chinese word for ‘nature’ – da-jiran - may be translated literally as “everything coming into being” and expresses the totality of mountains, rivers, plants, animals, humans, all bound up in their five elements - fire, water, earth, wood and metals (Tellenbach and Kimura, 1989). “Man is based on earth, earth is based on heaven, heaven is based on the Way (Tao) and the Way is based on da-jiran (nature): all modalities of being are organically connected” (Tu Wei-ming, 1989, p.67). It is an anthropocentric perspective with a sociological definition in which man lives and works in harmony with nature, where, because nature is imperfect, man has a responsibility to improve on nature (Chan, 1969; Elvin, 1973). It is thus distinct from a western perspective that separates nature and civilization (humans), which views nature ideally as free from artificiality and human intervention. The societal context in China is not necessarily accepting or understanding of these values, the Chinese view succinctly made by a senior parks administrator from Jiuzhaigou Biosphere Reserve: “Without man there is no wilderness only nothingness because wilderness needs man to appreciate it” (Zhang, personal correspondence, October 2000). Nature without man and man without nature are incomplete. Tao united everything, exemplifying the need of man and nature to bring opposing forces into a fluctuating dynamic harmony (Rawson and Legeza, 1973). In modern China nature-based tourism ventures are generally characterized by an almost total absence of any conservation message for both visitors and hosts. The economic imperative drives its development (Han, 2000), and development is bound up in construction and modernisation so that invariably the outcome is mass tourism, again in contrast to western ecotourism which tends to be developed around relatively small visitation levels. ‘Development’ which does not construct something for economic gain is alien to Chinese processes as the country charges towards modernization at a furious pace.

There is genuine puzzlement with the idea that you can have tourism development without constructing something. The anthropocentric position accepts (indeed encourages and facilitates) programs to alter the physical and biological environment in order to produce desired ‘improvements’ (Sofield and Li, 1998). These may include landscaped parks, facilities for recreation and tourism, roads for ease of access, observation towers, resorts inside national parks, and so on. Even remote isolated mountain tops will have constructions such as restaurants accessed by cable cars or stairs cut into the rock. Increasing direct human

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1 The term ‘man’ is used here to reflect accurately the Mandarin usage and should not be interpreted as unthinking sexist language on the part of the authors.
use is the objective of management and the character of the wilderness will be changed to reflect the desires of humans and contemporary standards of ‘comfort in nature’. Even the very centre of the ideal of the Taoist reverence for nature, Mount Wudang, is now adorned with a cable car that takes 3000 tourists a day to a restaurant on the highest peak next to the famed Golden Hall Temple. The integrity of the pilgrimage experience manifested in the tough climb to the Temple along the ancient sacred way through three 1000-year-old ‘gateways to Heaven’ has been aborted. The anthropocentric approach, taken to its extreme, means the loss - in western eyes - of an essential wilderness quality: naturalness (Hendee et al., 1990, p.19).

China also has a set of different values concerning ‘wilderness’. Perceptions of wilderness vary greatly and across cultures. There is no Chinese word for wilderness which has the western connotations of ‘pristine natural conditions’. The closest is “huangyie” meaning ‘uninhabited countryside’ whose connotations are negative, in the sense that the land is ‘bad’, or ‘poor’ or ‘not fertile’ (vide the American ‘badlands’). The biocentric approach by contrast emphasizes the maintenance or enhancement of natural systems, if necessary at the expense of recreational and other human uses (Hendee and Stankey 1973, cited in Hendee et al., 1990). The recreational use of wilderness is tolerated only to the degree that it does not change the energy balance inordinately. Thus ecotourism is in general an acceptable part of a biocentric approach to nature reserve management. A biocentric philosophy requires recreational users to take wilderness on its own terms rather than manipulate it to serve human needs. Like the anthropocentric approach the biocentric approach also focuses on human benefits, but the important distinction between them is that biocentrically the benefits are viewed over a longer term and as being dependent upon retaining the naturalness of the wilderness ecosystems (Hendee et al., 1990, p.19).

Both the western and Chinese values attributed to ‘wilderness’/huangyie/da-jiran are similar, but they find very different expression in use, management and acceptable behaviour. If we take the three main values of wilderness identified by Hendee et al. (1990) – experiential, scientific, symbolic/spiritual - a cursory examination is enough to highlight the differences between the western and Chinese perspectives:

i) Experiential: - the experience of feeling close to nature, of experiencing the mystical forces which shape the universe. The wilderness experience is seen as valuable in its own right. For westerners this may be translated into a form of ecotourism which allows them to experience the solitude and freedom of nature with no sight or sound of humans anywhere, camping out under the stars. For Chinese, it may be sufficient simply to visit a forest resort, and surrounded by the forests, enjoy playing cards, mahjong or karaoke in the airconditioned comfort of built facilities (three resorts located inside the boundaries of Caiyanghe Nature Reserve in Yunnan, for example, exhibit this form of tourism. They are representative of many similar facilities throughout most of China’s nature reserves including those with World Heritage Site status such as Yellow Mountain (Huangshan) in Anhui Province, Shennongjia in Hubei Province and Jiuzhaigou in Sichuan Province). The first regime will apply stringent conservation management. The second will place the comfort of visitors first: it could at a stretch be termed nature-based tourism but not ecotourism in the western lexicon.
ii) Scientific: – wilderness areas are seen “as valuable assets; as natural baselines that reveal the extent of impacts elsewhere; as sites where scientists can study natural processes; as gene pools maintaining the diversity of nature and providing a gene reservoir we are only now learning how to use; and as sanctuaries for [rare or endangered flora and fauna]” (Hendee et al., 1990, p.9). The Chinese accept and support this concept in principle and practice through the creation of biosphere reserves under UNESCO’s Man and Biosphere program, which designate ‘no-go’ core areas reserved for scientific investigation and conservation. However, Chinese approaches are closer to the Western philosophies of zoos as appropriate for maintaining gene pools and conservation and purpose-built facilities are tolerated (e.g. forest research centres in Gaoligongshan Nature Reserve, Yunnan; the Wolong captive panda breeding program in Sichuan Province).

iii) Symbolic/spiritual: – wilderness symbolizes both simplicity and stability in a fast-changing world where individuals have little or no capacity to exercise control over the pace and stress of modern life. The Western world appears to have ‘re-discovered’ this virtue of wilderness only in the twentieth century: for the Chinese it has been philosophically a guiding tenet of their society for several thousand years, as noted in the brief outline above of Taoist and Confucian values. For the majority of Chinese their Taoist/Confucian heritage invests nature with a very strong spirituality and symbolism abounds in Chinese metaphors and similes drawn from nature. Their management of wilderness resources will be foregrounded in their cosmology. They flock to the countryside in their millions, not requiring the solitude sought by many Western recreationists seeking spiritual renewal from nature.

Further differences arise in considering wildlife. There is again no exact Chinese term, the closest being ‘ye-shang dong-wu’ - which literally means ‘wild animals’. By definition ‘ye-shang dong-wu’ are either ‘dangerous’ or they are in competition with man for scarce resources and must be confronted. They are elements of nature that are unpredictable, and out of man’s control: therefore to bring man and nature into harmony wildlife (animals) must be eliminated as a danger or a competitor. In the process if wildlife can contribute to man’s livelihood through greater security or sustenance, then harmony has been achieved. Its consumption, elimination or confinement where they cannot cause harm is thus seen as a ‘public good’, in stark contrast to Western values based on maintaining biodiversity through conservation and protection.

Wildlife is an extant component of China’s tourism activity today, but its manifestations tend to be rather different from the West. Captive animals (zoos) not wildlife/wilderness tours dominate; national parks (including those with World Heritage Site listing) have zoos attached as major attractions (anathema to the Western concepts of wilderness and the values associated with natural world heritage sites); and some have animal circus acts as well. Very popular are restaurants with menus of wild animals, many of which can be viewed live and personally selected for the eating.

Confronted with very different cultural understandings, value systems and preferential recreational experiences, Sofield & Li (2002) in partnership with a group of Chinese planners
and academics developed applications of the ROS and LAC to meet Chinese needs – emic rather than etic, taking an actor-oriented approach and using endogenous values rather than attempting to impose exogenous values. In surveying Chinese visitors to nature reserves three main types can be differentiated. The majority desire an experience accompanied by as high a range of creature comforts as possible; for them it is enough to be surrounded by forests; the need is not to venture into it (indeed it is regarded as dangerous). The second type, perhaps >10%, appreciate a trail to key beauty spots provided the trail is hardened, stairs provided, and there is an assurance that they will always be in contact with other similar minded trail walkers. The third type is a mere fraction of the total, less than 1%, the hermit of Taoist virtue who lived in caves in the mountains isolated from contact with fellow humans.

One of the answers to the conundrum faced in China was to adopt the Chinese “zong yong ji dao” (‘the middle way’) and develop a strategy which incorporated both the anthropocentric and biocentric approaches. (Confucian Thought extolled ‘the middle way’, avoidance of extremes combined with a blending of both ends, and one of Confucius’ four famous texts known to all Chinese is titled “Zong Yong” (The Middle Way). Thus the application of the ROS provides an environmentally sound approach for management of reserves, allowing for ‘development’ of sites in appropriate zones able to handle very large numbers of tourists (upwards of 5,000 per day, or 1.75 million per year). This is considered absolutely essential. The pressures for large-scale mass tourism with a range of facilities accepted by Chinese domestic visitors as necessary for a quality experience (pavilions, restaurants, etc), though distant from western values of conservation and wilderness considered equally necessary to conserve and protect the environment, cannot be ignored. Planning has to take account of the Chinese desire to visit reserves in extremely large numbers and any attempt to pursue rigid western ideology and restrict planning to small-scale ecotourism ventures could put entire reserves at risk. Two or three ‘sacrificial’ sites per reserve able to satisfy the anthropocentric approach (man improving on nature) carry the probability that the remaining 99% of a reserve can be protected.

The following example is provided to illustrate the way in which an application of the ROS was designed by Sofield & Li for training purposes to develop a greater understanding by Forest Department staff of conservation-based ecotourism planning within a nature reserve.

A theoretical reserve is mapped and areas classified according to the six ROS classes - Primitive (Wilderness); Semi-primitive Non-motorized; Semi-primitive Motorized; Roaded Natural; Rural; and Urban. There is a small town (Urban) just outside the northwest boundary of the Reserve. Five waterfalls are located in the Reserve: two in the Primitive (Wilderness) zone; one in the Semi-primitive Non-motorized (Wilderness) zone; one in the Semi-primitive Motorized zone; and one in the Roaded Natural zone. The five waterfalls may then be classified according to their relative environmental values (biodiversity) on a scale of 0 - 100 and their relative touristic values assessed, also on a scale of 0 – 100. Waterfalls Four and Five are both in virgin forest and provide the habitat for rare and endangered plant species and endangered birds and animals, with respective environmental values of 95 and 85. Their height, volume of water, and scenic value of the gorges and cliffs over which they plummet are high in touristic values: 92 and 80 respectively. Waterfall Three is in a
wilderness area which was selectively logged in the past 50 years (hence, the classification ‘semi-primitive’ because it has limited old-growth forest), but it retains relatively high biodiversity values (70). It also has high scenic qualities (70). Waterfall Two is in a semi-primitive area which is bisected by a road, its surrounding forests having been logged and degraded, and its scenic qualities not very high (environmental value: 40, touristic value: 30). Waterfall One is in a Roaded Natural area, which was once impacted by swidden agriculture but has now reverted to natural vegetation; its biodiversity values are even lower (28). Its forests have been severely degraded, the walls of its gorge are eroded, and scenically it has a low attraction rating (20). The waterfalls may be graded according to the following diagram:

**Diagram 2: Classification of waterfalls**

<table>
<thead>
<tr>
<th>Environmental Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

When the Recreational Opportunity Spectrum is utilized for the waterfalls taking account of the underlying principle of conservation, a range of different tourist applications to satisfy a range of different visitor types can be devised.

**Waterfall Five** would be unavailable for general tourist visitation. Its high environmental values require maximum protection and would be of significant scientific interest, hence entry into the area would be restricted for scientific study.

**Waterfall Three** also has some limited scientific interest but it could be selected to satisfy the general tourist demand for visitation to the Reserve. The road could be extended to a point where a car park and outlook could be constructed, with short trails to the waterfall itself. This waterfall would be designated for mass tourism and in effect become a sacrificial area to keep most visitors out of the Primitive (Wilderness) zone. The relatively high tourist
qualities of the waterfall would satisfy most tourists. The decision to make this waterfall available for mass tourism would mean that the land use zone would need to be reclassified to Semi-primitive motorized, to enable the road, car-park and tour bus facilities to be provided.

**Waterfall Four** could become an ecotourism site. Access would be limited and designed along stringent conservation management guidelines. The trail from the car park of Waterfall Three would be deliberately designed for a certain degree of difficulty rather than easy for comfortable walking; it would be long (perhaps five or more kilometres); and only small numbers would be permitted to walk along it, each group mandatorily accompanied by a trained guide. Its scientific and environmental values would be mostly retained.

**Waterfall One** could also become an ecotourism site. This would appear paradoxical, given its low environmental values. However, there are examples of successful ecotourism to degraded sites which actively involve the tourists in helping to rehabilitate the environment (e.g. montane reserves in Costa Rica). This type of ecotourist product takes advantage of the desire of many people to be active conservationists willing to make a personal contribution to improving degraded sites. Thus visitors to Waterfall One could participate in tree planting, erosion control, and eradication of undesirable exotic plant species. This approach would ‘fit’ with the Chinese Taoist value of ‘man improving on nature’ – but it must be noted that few Chinese tourists adhere to this principle: as tourists they demand to be entertained, not to be put to ‘work’.

**Waterfall Two** might be left for the occasional visitor to find his/her way there but no active attempt would be made to develop it for tourism. The Forest Department would utilize its own resources (park rangers) to carry out site upgrading through tree planting, erosion controls, etc, over an extended period of time. Its low biodiversity value and its low tourist value would accord it the lowest priority.

This exercise, in Chinese fashion, was quickly christened by workshop participants as ‘The Five Waterfalls Model’ and has been used by the authors in a series of seminars in other parts of China because of its success in disseminating conceptual complexities through a practical, concrete process which helps to bridge the cultural differences between western and Chinese paradigms of development. Such a strategy, constructed with the ROS as its over-arching framework, provides a management philosophy for recreation and tourism which places conservation above short-term economic exploitation and is therefore more biocentric than anthropocentric. The provision nevertheless of carefully selected sites for mass tourism, where ecotourism is just one part of the wider nature-based tourism system, and an emphasis on an integrated, holistic approach carries the potential to cross cultural boundaries.

**Conclusion**

In the view of this author ‘carrying capacity’ is a flawed concept because in any given situation the range of variable to be taken into account negates the ability to determine a single ‘magic number’. However, it is equally obvious that some sites do require management of visitation numbers because any visitation, no matter how small, will result in some change. It is therefore suggested that application of concepts such as Limits of
Acceptable Change, where managers combine the results of science with value judgments about the desired quality of experience, provide a way forward where the interests of both visitors and protected areas can be brought into a satisfactory relationship. There is a need to continually push the envelope to examine, develop and formulate new and innovative ways to achieve such ends.

REFERENCES


Sofield, Trevor H.B., Li, Fung Mei Sarah. 2001. Processes in formulating an ecotourism policy for nature reserves in Yunnan Province, China. In: Fennell, D. & Dowling,


**BOX 1**
Shennongjia Nature Reserve WHS
Hubei Province, China

**Variable impacts of a constant number**

- 100 visitors tramping through the snows of Shennongjia Nature Reserve in mid winter will have nil impact on vegetation.

- The same 100 people walking over the alpine meadows after the spring thaw when the fragile alpine plants are just beginning to sprout can have disastrous effects on that area by destroying the plants they trample. The destruction of the vegetation can lead to bare soil. And the bare soil can lead to erosion.

- The impact will be different again if the 100 visitors tramp over the alpine meadows at the end of summer and accidentally break off or collect flowers. Their action will prevent the plants from setting their seeds and thus decrease the amount of vegetation next season.

- Again, if the 100 visitors are sensitized experienced walkers, or absolute novices who litter the ground as they go, the type of behaviour they exhibit for each season can have variable impacts.

- So even though the number remains constant, as the characteristics of the user group or their specific behaviour changes, the impacts will change as well.

- *A fixed carrying capacity of 100 is not therefore a useful tool for managing impacts.*

- *Different limits on numbers during different seasons, utilising a concept such as LAC, becomes a more practical option for regulating visitation to minimize adverse environmental and social impacts.*

- Additional sedan chair carriers could be located at the new terminus of the cable car to take the old and infirm to the top, thus generating additional employment.
- The route of the cable car up the mountain should be replanted with trees.
- All of the commercial outlets in the temple precinct and along the ancient trail should be removed and re-located to the foot of the mountain.
- A maintenance scheme should be implemented, with a percentage of all fees and other income utilised for restoration and repairs of the ancient buildings and stairs.