

Yakushima: Balancing long-term Environmental Sustainability and Economic Opportunity

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Abstract: Yakushima's endowment with World Heritage status, combined with better access to the island and improved road infrastructure has led to a sharp rise in visitor numbers to the national park. Multiple, overlapping conservation designations and multiple regulatory bodies means implementation of sustainable, integrated long-term policy for conservation purposes is extremely difficult to achieve. The World Heritage Evaluation Group, the East Asian Biosphere Reserve Network and the Japanese Environment Ministry itself have all called for a unified system. Eighteen years on from the first plea for integration the situation is unchanged, and short-term economic gain through tourism combined with advanced engineering are putting the Yakushima wilderness under pressure from ever greater numbers.

Keywords: Yakushima, Jomon-Sugi, Environmental management policy, Sustainability.

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Environment in the balance

When John Muir wrote of the U.S.A. more than 100 years ago that "The great wilds of our country . . . are being rapidly invaded . . . Every landscape, low and high, seems doomed to be trampled and harried. The wedges of development are being driven hard and none of the obstacles or defenses of nature can long withstand the onset of this . . ." , he prophesized the future that is now unfolding in Yakushima. But where John Muir himself went on to create a system of national parks to safeguard those places most wild, it is doubtful whether there is within the present Japanese authorities an equivalent figure.

Eighteen years have passed since the December 1993 designation of an area of Yakushima as a World Heritage listed site. During that same period visitor numbers have increased significantly, putting added pressure on the environment and leading to degradation of the forest along the most popular hiking routes, and wholesale clearance

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of forest for improved road access. After eighteen years, it should be possible to clearly identify the results of management policy and also pinpoint the driving forces behind any environmental change on Yakushima.

However, although several enquiries in the past have shown the situation regarding the conservation of Yakushima's wilderness to be less than ideal, and despite the fact that the authorities are well aware of the benefits of conserving the wilderness, which continues to attract large numbers of people and potentially provide an infinitely sustainable source of revenue for the island, there appears nonetheless to be an inability to implement effective long-term measures. This is despite the clear knowledge that doing so would be in the interests of the island both now, in terms of immediate preservation of wilderness, and in the future, in terms of preserving the habitat and therefore allowing sustainable use of that wilderness, and ensuring the economic benefits of a well-regulated, and continuing, tourist trade.

In the U.S.A., science has been selectively portrayed by right wing politicians as a weapon wielded by political subversives. This has helped drive through environmentally destructive legislation (O'Riordan). In Japan, where no environmental movement of any consequence operates, political decisions don't need to discredit science to bolster decision making, since public protest linked to a political / environmental standpoint is entirely absent. In Yakushima then, the *ultra vires* concept is saddled with an additional demerit to the environment because Japanese environmental legislation doesn't generate a sufficiently high domestic profile for politicians to have to worry about public reaction. In this setting, short-term plans rule the day and long-term degradation can be left with impunity for the future. A number of key points are helpful in illustrating the current situation.

1. What are the major pressures on the environment in Yakushima?
2. What is the system of protective designations in place on Yakushima?
3. How many designations are there?
4. Do these designations work effectively?
5. Are the controlling bodies of these designated authorities, and local tourist concerns, in concord or conflict over the land use on Yakushima?
6. Do the resultant conditions from points 1-5 lead to long-term environmental sustainability, or environmental degradation?

Before addressing these points a brief overview of the island's biogeography will orient the reader to the distinct vegetation zones. These change with altitude and help delineate the boundaries of the various conservation designations in place. Yakushima is a circular

island of less than 30km diameter, with a small coastal plain that rises precipitously to 1935m at its highest, central point. These unusual geographical conditions have engendered a remarkable wilderness, making this overview helpful in visualizing the situation as regards sustainable use of Yakushima's natural habitat.

Biogeographical overview of Yakushima

Biogeographically, Yakushima splits altitudinally into three major climate-vegetation zones (Fig 1).

Zone 1.

From sea level to around 800m a.s.l. warm-temperate forest predominates. All permanent human settlement is in zone 1. This naturally is also the area that has been, and continues to be, subject to the greatest change due to human activity. Although the warm-temperate forest changes at around 800m a.s.l., most settlements lie directly on the coastal shelf, less than 100m above sea level.

Because this area falls outside the zone delineated by the Yakushima National Park boundaries and the Yakushima World Heritage Area (W.H.A), (except on the west side of the island where there are no settlements), national park authorities and other concerned parties are voicing concern that this area is being developed piecemeal, due to the focus of national awareness on the W.H.A.

Zone 2.

Between 800m and 1700m a.s.l. is cool-temperate forest. The dominant climax growth is the Yakushima Cedar *Cryptomeria japonica*, many of which are over 1000 years old.

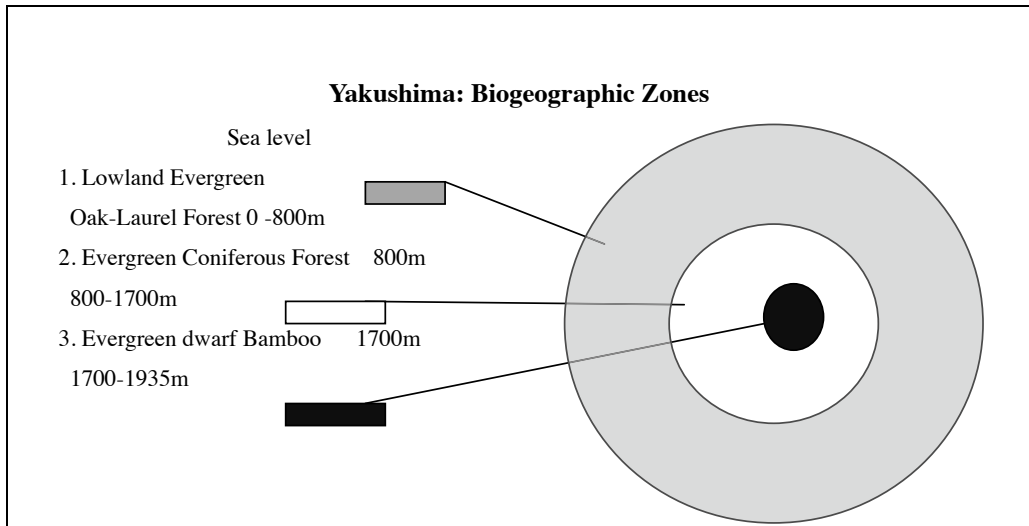
The Yakushima cedar (*yakusugi*) is composed of tightly packed rings loaded with resin, which helps prevent the wood from rotting. *Yakusugi* 「屋久杉」 was (and is) highly valued as building material in a land where timber was traditionally used for all construction. These are the trees for which the island is noted and the best-known example, *Jomon Sugi* 「縄文杉」 draws around 80% of all hikers to the island's trails (National Park Figures).

The rate of re-growth of this cedar forest is, in human terms, very slow. Recovery from natural events such as landslides due to the immense annual rainfall, or man-made destruction from logging, are a very slow process. Studies have put the estimated time of canopy renewal after gap formation in the Yaku cedar forest at between 320 (Kimura and Yoda, 1984) and 1000 years (Shimokawa and Itozono, 1984) depending on the angle of slope

(both studies cited in Tagawa and Hotta, 1996). The climax forest is therefore a habitat and resource that cannot be replaced in the short term if it is once cleared.

Zone 3.

Above 1700m evergreen dwarf bamboo is the dominant vegetation. This area is not directly accessible by any road, although a number of hiking trails lead from trailheads in zone 2 towards the island's central peaks in zone 3.



One reason for the increase in visitor numbers to Yakushima is the World Heritage status accorded to the island. This rise in popularity has led to increased numbers in certain areas, notably the *Jomon Sugi* track and the area of *Shiratani-unsui-kyo*, where resources have been needed to meet extra demand for access. Major road engineering projects have been the solutions chosen in both cases. Both roads lead from the coast level into zone 2.

Yakushima's ecosystem is adapted to local conditions; the geomorphology shapes the physical characteristics, while bio-climatic elements determine distinctive flora and fauna; however, these two roads constitute a major impact on the environment, not simply in their own right, but in the access to the interior of the island that their development has allowed to large numbers of visitors. As Worldwatch (2002:101) noted, tourist booms bring money into rural towns and are a way to diversify the economy, but tourism is also "one of the world's least regulated industries, which has serious implications for ecosystems . . . " .

Economic forces are often blamed for environmental degradation; however, choices are made in any development, and an effective management system coupled with regulated

local involvement is a key factor.

I return now to the original points of this paper, which may help to develop a clearer understanding of what is currently happening on Yakushima, how the environment is being affected, and what the longer term prognosis is.

Pressures on the Yakushima Environment

On average, about 268,000 people per year had visited the island over the period 1995-2000 (local government, Kamiyaku-cho and Yaku-cho figures, *Heisei* 11). Of these roughly 200,000 arrived by ferry (4hr car ferry or 90min hydrofoil from Kagoshima City), and 60,000 by plane (40 min from Kagoshima airport). About three fifths (on average just over 160,000/yr) of the total incoming passengers to Yakushima are thought to be tourists (as opposed to locals returning home). By the five year period from 2006 -2010, the number of visitors to the island had jumped to an average of 359,000 per year.

Prior to the year 2000, the National Parks department estimated 45,000 hikers a year took to the island's trails (probably an underestimate, as not all people register with authorities or follow surveyed routes). Interestingly, Yakushima National Park figures show that visitor numbers rose in the wake of the hydrofoil service starting, not the designation of the area as a World Heritage Site. Prior to the hydrofoil, tourist numbers were effectively limited by the transport system, a control that could equally well have been applied to hiker numbers in the interior of the island.

Instead, major road-building projects allowed easy access to these increasing numbers of tourists. Now in addition to the impact of major road construction, large diesel buses can drive directly to the jump-off points for walks to the interior of the island. The result is that since 2008, numbers have jumped to more than 100,000 hikers /year on the island's two most popular trails, and around 90,000 / year on the Jomon-Sugi trail alone. Total registered hiker numbers are currently estimated at an average of 107,764 /year, or around one in three of all visitors to Yakushima (Ministry of the Environment statistics 2002-2011).

Having facilitated access to the center of the island for ever larger numbers of people, the park authorities are now trying to clean up the mess in arrears rather than having planned in advance for a low impact development that would provide sustainable management of the wilderness on Yakushima.

This is not a situation that was difficult to predict. More than 10 years ago Mr. Higashioka, then head of the Yakushima World Heritage Center Nature Conservation

Bureau, outlined the following main problems for National Park management, all of which stem from high visitor numbers:

- “To control and disperse the number of visitors . . . concentrating around Jomon-Sugi” (The oldest known *yakusugi* cedar on the island).
- “To dispose of sewage” from huts “in mountain area(s).” Huby (1998: 132) and The Worldwatch institute also mentions this as a serious problem for many tourist concerns.
- “To protect (the island) against invading species.”
- “To (better) inform visitors about (appropriate) manners (for the mountains) in Yakushima.”

More than ten years later the first two problems still remain unresolved. The Jomon-sugi problem incorporates many of the main points in a single case and exemplifies the commodification of nature where the “concept and meaning of ‘nature’” is altered (Moon, 1997: 222). One item is used to symbolize nature thereby obtaining a disproportionate weight in the ecosystem. Jomon-sugi eclipses all other destinations and is overused while less well-represented species and destinations are undervalued and overlooked. This may be a blessing in disguise, in that it protects by default less well visited areas, but the problems arising on the Jomon-sugi trail (among others) have not been dealt with well, despite identification of the problem more than a decade ago.

Protective Designations on Yakushima

Why this should be so leads us to the second, third and fourth points. What is the system and number of protective designations in place on Yakushima, and are these designations effective?

Protective designations on Yakushima.

To say the system of designations for land use on Yakushima is complicated is a grand understatement. While the island’s designation as a World Heritage Site in 1993 is well known, the background to that designation and the current land zone designations and responsible authorities are certainly not well known.

Inscribed on the World Heritage List in 1993, Yakushima is deservedly known as a site of great natural beauty. However, this inscription, and subsequent elevation of status in the minds of many people, is only the most recent development in a continuing, confusing and conflicting, conservation effort on the island.

Conservation on Yakushima (excluding islanders traditional co-existence with nature and the subsequent self-serving protection of the forest by Kagoshima's ruling Shimazu clan in the sixteenth century [see Daniels, 2009]) started with the designation of an "Academic Reference Forest Reserve". In 1924 this was designated the "Yakushima Old Growth Japanese Cedar Forest Natural Monument (changed to Special Natural Monument in 1954) and was incorporated into the Kirishima-Yaku National Park in 1964 (Yakushima World Heritage Area Management Plan). This incorporation may appear to be a sign of environmental awareness on the part of authorities, but in fact it was precisely one year later that the island's logging industry was at its peak—an industry that targeted the very ancient cedars for which the island is now famed, and which was responsible for the wholesale clearance of the island's giant trees. The death of logging on Yakushima, when it finally came, was not due to any conservation ethos, but rather to a lack of economic competitiveness with foreign imports, coupled with the increasingly difficult task of extracting ever more remote timber. In short: the best trees were gone.

A Biosphere Reserve, also part of the Kirishima-Yaku National Park, was included in the World Network of Biosphere Reserves in 1980 (EABRN-4 Report 1996: 2). Established by the MAB (man and the Biosphere) programme, the Biosphere reserve has a 7,000 ha. core and a 12,000 ha. buffer zone and sits within National Park boundaries.

A wilderness area was established and the National Park expanded in 1983 and the Forestry Agency established a Forest Ecosystem Reserve in 1991. Subsequent to all these designations, Yakushima was inscribed on the World Heritage List in 1993. Following recommendations from a World Heritage Committee Bureau session a management plan for the heritage area was formulated in 1995, to take account of the "high level of visitation" to Yakushima and to facilitate coordination in the management of the heritage area. (Yakushima World Heritage Area Management Plan).

To recap: The World Heritage area (21% of the island) largely overlaps the national park boundaries. The Biosphere Reserve Network sits within the park boundaries. The Forestry Agency has its own Forest Ecosystem Reserve with a buffer zone separating a core area from areas likely to be affected by human activity. This is an extensive area and overlaps much of the World Heritage Area. The wilderness area established in 1983 lies within the World Heritage Area but outside the National Park boundary.

This multiple designation has led authorities (World Heritage Evaluation Group 1993 and East Asian Biosphere Reserve Network Report 1996) to rightly query the system's effectiveness. The environment agency, which administers the National Park but doesn't

own the land, was also prompted to say that a unified management system is needed, while keeping in mind “the aims of individual systems for conservation.”

Zoning designations within Yakushima’s various reserves are complicated by the number of authorities having jurisdiction over some aspect of procedure. Management of the World Heritage Site itself is not specified in law although regulations govern the other variously designated land that makes up the World Heritage Area (KICWNH on-line 2000: 2).

As is apparent from the numerous overlapping designations, managing the island’s various reserves is not straightforward. The World Heritage Area is 10,747 ha. and the Forestry Agency own 95.5% of this. Part of the western shore of the heritage area is privately owned. The National Park, ostensibly under the management of the Environment Ministry but in fact subject to the Forestry Department (which owns the land) and the prefectural government, on which it depends for funds, includes the Biosphere Reserve and overlaps the Forest Ecosystem Reserve but not the wilderness area. The World Heritage Area then overlaps a combination of all these areas. Four different agencies oversee the management of the area and they in turn have a liaison committee (comprising people from different prefectures in some cases) to coordinate meetings. The Forestry Departments detailed map of National Forest in Yakushima 「屋久島国有図」 reveals no less than thirteen different designations within the island, at least eleven of which overlap (Forbes).

Rather unsurprisingly, reports from both the World Heritage Evaluation Group and the East Asian Biosphere Reserve Network pointed out the need to simplify and clarify the management system (EABRN-4 Report 1996: 7), as did Japan’s own environment Agency; an agency which is hamstrung by the need for approval from twenty four other agencies and commissions in order to introduce any new legislation (Brecher).

Fifteen years after these recommendations, the island’s popularity as a tourist destination has increased, and in particular the number of hikers on certain trails has spiked. This has led to increased pressure on the trail itself and the facilities for hikers, but the multiple designation system with its necessarily piecemeal management system remains unchanged.

Conservation, Tourism & Local Interests

In addressing the fifth point we return to Jomon Sugi, which is Yakushima’s major tourist draw. The Yakushima Nature Conservation Bureau estimates that 80-90% of all hikers on Yakushima walk to this grand tree (even conservative estimates put the tree at 2600 years old). Seasonal pressure on this trail from walker numbers is extreme. By the late 1990’s,

400 people a day visited the tree in the May 'Golden Week' holiday; however, by 2009 this figure had doubled. In 2010, almost 90,000 of the more than 100,000 registered trail users on Yakushima visited Jomon Sugi. The peak is August and September with an average of 500 trekkers a day, while the single busiest day remains in the May Golden Week holiday, with May 3rd, 2010 registering a staggering 1049 trekkers to Jomon Sugi.

While there is a car park and toilet facilities at the trailhead, the trail itself cannot support these numbers and erosion damage initially necessitated reinforced boardwalks, stairs on the trail, and another toilet at the tree itself. Most people make a day-trip to the tree along the old logging route from Arakawa Dam, which is the easiest approach. As visitor numbers increased, the area around Jomon-Sugi was eroded, and Park Authorities saw the tree roots become exposed. In the Early 1990's hikers were encouraged to carry small bags of dirt to the tree, to replace soil being washed out from the roots as a result of hiker-induced erosion. After three years this was deemed unsuccessful. A fence was constructed around the tree, the ground covered with cedar chips to trap soil, and subsequently raised boardwalks and wooden fences were built to protect the tree (Kagoshima Prefecture Environmental Conservation Division).

Realizing that hiker numbers were becoming uncontrollably large, the National Park Authorities initial proposed response was to promote a second trail from the town of Miyanoura (*shiratani unsui kyo* 「白谷雲水峡」) and thereby take some traffic off the Anbo - Yakusugi-Land road and the Arakawa trail to Jomon-Sugi. Environmentally sound, or at least well intentioned, this idea stalled after pressure from local taxi drivers and hotel operators in Anbo where most walkers currently stay. Any move to open an alternative route to Jomon-sugi would, they not unreasonably pointed out, take visitors away from their area. In the face of this pressure Park Authorities backed down and the plan was abandoned.

As visitor numbers continued to rise, congestion on the narrow roads became a problem at peak times and a bus service costing ¥850 (return) was introduced from *Yukusugi Shizen-Kan* to the Arakawa trailhead, the starting point for the Jomon Sugi hike. Currently, walkers on the Jomon Sugi trail must leave their cars at the foot of the mountains and make the trip by bus. Toilet facilities, however, have not been able to keep pace with the increase in numbers. From 2009 park authorities were trialing a scheme with several portable toilet tents. Every hiker would carry purpose designed plastic bags in their rucksacks, for use in the portable toilets. Hikers would then carry the human waste back out with them at the end of the day. Receptacles for these sewage bags are in place at the trailhead.

Yakushima constitutes an environmental challenge on two fronts. As previously stated,

the mountain forests are a major tourist draw, but the management system in place is far from clear, and where pressed the environment agency has backed down in the face of local pressure, which resulted from perceived economic threats if new options for environmental management were introduced. Additionally, a large independent body of environmental guides running “eco-tours” has come into existence (largely post 2000). The eco tours operate within the national park, but are not run by the environment agency or the park authorities. It is essentially the improved access to the island and the trail heads combined with the success of these tours that has seen the numbers swell on certain trails.

A second point of concern is the coastal environment on Yakushima, which is the primary rookery for the north pacific loggerhead sea turtle. As far back as 1993, when the island was designated a World Heritage Site, there were concerns that growing eco tourism threatened the site.

This extends to the current day where several authorities have expressed concern that the “Leadership & capacity of local government for management is sorely lacking” . There have been requests to municipal officers and park rangers to establish policy and guidelines for eco-tourism. To date these have been ignored. By default, control has been left in the hands of local operators, who do not always operate in the best long-term interests of the turtles. The local conservation NGO “Yakushima Umigame-kan” is unable to enforce wildlife laws, particularly after dark when the turtle nesting takes place (Kinan-Kelly, U.S. National Oceanic and Atmospheric Administration).

This minority is not necessarily an indication of what the Yakushima population at large feels; however, as Bob Ward (policy & communications director, Grantham Research Institute on Climate Change and the Environment. London School of Economics and Political Science) has said, in the slightly differing but nonetheless relevant context of transition from a high-carbon economy to a low emissions economy, “There is a danger that the small but vocal minority, who perceive their short-term vested interests to be best served by maintaining the . . . status quo, will frame the public debate only in terms of . . . initial costs (The Guardian newspaper, Sep 10, 2009).” In the same way, implementing rules that would be of long-term benefit both for the island itself and those locals involved in the tourist economy would undoubtedly be costly. However, the cost of doing nothing, or having such a convoluted management system as to effectively negate the ability to act, equates to a tacit acknowledgement of a long-term slide into environmental degradation.

Looking forward.

The concept of *ultra vires* (beyond jurisdiction) was proposed by Wood and Waterman to explain governments' inability to tackle issues that have benefits accruing to the present day population, but which will lead nonetheless to negative ramifications for future generations. Worldwide, examples of this type of policy making are numerous and land degradation, often the result of short-sighted policy, is one of the most pressing concerns for environmental sustainability. Globally, since 1945, 1.2 billion ha has been degraded "to the point where the original biotic functions are impaired" . Of that area, more than 300 million ha is now almost completely unusable (Stocking). Policy on Yakushima can be added to this list.

For a sustainable solution, an effective management system with a clear plan for the future is a necessity. At present, authorities are reacting to problems after they happen, rather than setting out a long-term, sustainable agenda to follow.

Pressure of numbers is the recurring theme in this discussion, and it is clear that some effective way of limiting visitor numbers at peak times of year would be of benefit to the long-term health of the ecosystem that visitors want to see. At present the park authorities are simply coming up with temporary patches for numbers related problems, rather than pro-actively addressing the situation and regulating the numbers themselves. Hence we have the "sewage bag system" to accommodate everyone who wishes to visit, rather than regulating visitor numbers or designing adequate, environmentally appropriate facilities for the numbers involved.

In the short space of time since the island was designated a World Heritage Site, the number of companies offering guided eco-tours has gone from virtually nil to more than 200. However, the revenue generated through these companies' exploitation (environmentally friendly or not) of the World Heritage name does not go to the national park authorities, and cannot therefore be reinvested within the park in sustainable practices, trail maintenance, public education, or park ranger employment.

There are models for the national park authorities to follow. Several national parks in the U.K., for example, use trains to provide, and limit, access to fragile mountain areas. This is a source of revenue generation and also a way to control visitor numbers. Yakushima already has (as one possible solution) the railway in place; it simply requires strong management to see an effective long-term solution implemented. The future prosperity of tourist-dependent locals as well as the health of the natural ecosystem each depend upon the ability of authorities to stop the island's natural heritage from being degraded piecemeal.

Twenty years ago, Common and Perrings said, “*an ecological economics of sustainability implies an approach that privileges the requirements of the system above those of the individual. Since the valuation of resources deriving from ecologically unsustainable preferences is itself unsustainable, there is no advantage in giving special weight and special privilege to such valuations.*” The long-term benefit of all is not best served by operating as if the current system, where short term gains for those with power are given preference, “*is the sole criterion against which to judge system performance.*” In this way, ecological stability, resilience and diversity are reconciled with economics - an issue whose importance cannot be overstated, as all human welfare is ultimately derived from the biosphere (Adger, p 110-111. In Riordan (ed).

We may accept therefore that the concept of *ultra vires* explains the inability of governments to act, even when an obviously more beneficial long-term course of action is clear. However, the present position in which rugged geomorphology rather than insight is saving Yakushima does not absolve the authorities of their responsibility to plan a more coherent strategy, or at least initiate a vigorous public discussion about how best to protect and promote the future prosperity and well being of the environment. In this respect there are numerous models employed by national park authorities worldwide that might be looked at in an effort to come up with a workable solution. An effective management plan would benefit not only those who want to visit a single, currently popular tree, but would safeguard the ecosystem for future generations as well. A public mandate to act may be the only way the necessary long-term environmental safeguards can be put in place, bringing us back to the search for a Japanese John Muir.

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