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Forest and Social Services – the Role of Research

Tuija Sievänen
Cecil C. Konijnendijk
Linda Langner
Kjell Nilsson
(eds.)

IUFRO

VANTAAN TUTKIMUSKESKUS – VANTAA RESEARCH CENTRE

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Proceedings of IUFRO Research Groups 6.01, 6.11.04 and 6.14 sessions in the XXI IUFRO World Congress 2000, Kuala Lumpur, Malaysia

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These proceedings include 15 papers presented during four group sessions at the IUFRO XXI World Congress held in Kuala Lumpur, Malaysia during August 2000. Six papers were presented during two sessions organised by IUFRO Research Group (RG) 6.01.00 'Forest recreation, landscape and nature conservation'.The first of session was titled 'Integration of nature-based recreation and tourism with sustainable use of natural resources'. The focus of the session was on discussing the sustainable use of natural resources for recreation and tourism. The second session was titled 'Nature experiences and sustainable management of landscapes and recreation resources'. The papers discuss the issue from the perspective of large-scale land use as well as management problems of a specific recreation site.

The third session (RG 6.14 'Urban Forestry') offered an overview of developments within the new, multidisciplinary approach on urban forests and trees, and information on management issues of urban forests, as well as on the monetary valuation of the socio-economic values of urban forests. The fourth session (RG 6.11.04 'Economic evaluation of multifunctional forestry) dealt with economic issues of multiple use of forests and was titled 'Bridging the gap between monetary and non-monetary valuation of environmental amenities'.The papers discuss the scientific basis of valuation of amenity resources and non-market products and services.

Keywords: forest recreation, landscape management, nature conservation, urban forestry, amenity values, economic valuation

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Foreword

The IUFRO XXI World Congress was held in Kuala Lumpur, Malaysia during August 2000. The theme of the congress was 'Forest and the Society – the Role of Research'. The growing focus on social services of forests, for example because of the ongoing urbanisation process, was an important topic during this congress. In the developed, urbanised countries, people most often only get in contact with nature when recreating in urban forests or forest-based recreation areas. But urbanised people as well need to understand the meaning of the ecosystem and natural resources to the survival of humankind. This was an important message presented by US Forest Service chief Robert Lewis Jr. In these proceedings, the focus of papers included is on recreation, landscape and amenity values, urban forests and land use, that is subjects that are important to urban as well as rural people, to the whole world society. The papers in these proceedings show the need for more research to assess the multiple social and socio-economic benefits forests provide society.

These proceedings include 15 papers which were presented during four group sessions at the congress. Six papers were presented during two sessions organised by IUFRO Research Group (RG) 6.01.00 'Forest recreation, landscape and nature conservation', five papers by RG 6.14 'Urban Forestry', and four papers by RG 6.11.04 'Economic evaluation of multifunctional forestry'. This publication is an example of the co-operation of the three IUFRO research groups, which have collaborated during many years.

The first of the four sessions presented in this publication was titled 'Integration of nature-based recreation and tourism with sustainable use of natural resources'. The focus of the session was on discussing the sustainable use of natural resources for recreation and tourism. Three papers from Asian countries offer a good insight into practical problems related to and the role of research in improving management of recreational resources.

The second session was titled 'Nature experiences and sustainable management of landscapes and recreation resources'. The three papers included in this report discuss the issue from the perspective of large-scale land use as well as management problems of a specific recreation site.

The third session (on urban forestry) offered an overview of developments within the new, multidisciplinary approach by means of papers presenting the state of the art of research and knowledge on urban forests and trees in Europe and the USA. Other contributions to the session provided more detailed information on management issues of urban forests, as well as on the monetary valuation of the socio-economic values of urban forests.

The latter topic is closely related to the focus of the fourth session presented in these proceedings. The session dealt with economic issues of multiple use of forests and was titled 'Bridging the gap between monetary and non-monetary valuation of environmental amenities'. The papers included here discuss the scientific basis of valuation of amenity resources and non-market products and services. Moreover, they deal with political and practical tools for better incorporating economic information in planning processes.

As session leaders and editors, we hope that these proceedings will be of value to the international community of forest researchers, but also to practitioners working in the fields of forest recreation, landscape planning, nature conservation and urban forestry. The value of this publication lies mainly in its providing ideas and information for the benefit of the sustainable management of recreation resources and urban forests all over the world.

Tuija Sievänen, Cecil C. Konijnendijk, Linda Langner and Kjell Nilsson

Chapter 1

Integration of nature-based recreation and tourism with sustainable use of natural resources

Prospect of Ecotourism in the Sundarbans Mangrove Forest of Bangladesh

M. Emran Ali and Toshiyuki Tsuchiya

Abstract

This study analyzes the prospect of ecotourism in the Sundarbans mangrove forest of Bangladesh. The residents of local communities of the Sundarbans are directly or indirectly dependent on the forest resources and the resources are increasingly threatened by overexploitation. It requires a proper strategy for multiple utilization of resources in this area as sustainable manner. Tourism in the Sundarbans has a history for decades and the Bangladesh Parjatan Corporation (BPC) now considers it the first priority for tourism development. It is the largest contiguous block of mangrove forest, several endangered species and numerous environmental points of interest. Although all the tourism in the Sundarbans area is a kind of nature-based tourism, the activities are carried out not in systematic way. The study revealed that there is a great prospect of ecotourism in this area and it must be developed in a way that is compatible with the principle of sustainable development.

Keywords: The Sundarbans, Ecotourism, Local people, Bangladesh

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Introduction

The environmental problems of developing countries are now one of the major issues along with poverty and scarcity of resources. The consequences of the environmental problems could threatened economic and social wellbeing. This could include reduced agricultural productivity, coastal flooding and storm surges, and destruction of unique ecological environment. Environmental conservation is a multi-sectoral responsibility-in which some may have bigger roles to play them others. Forests, as a biological resource, influencing and influenced by soil, water, atmospheric conditions, ecological changes, social and economic growth, recreational and cultural needs etc., tends to have a crucial role in environmental conservation. Ecotourism has attracted increasing attention in recent years, as a means of economic development and environmental conservation. Proponents and some scholars believe that it can potentially focus the benefits of tourism on the local population and environment while minimizing negative impacts. Other observers remain skeptical, warning that ecotourism has not yet been proven to be either beneficial or sustainable. A growing number of researchers agree that local control is key to avoiding many problems resulting from ecotourism development. By scaling down production processes and returning power to local units of governance, ecotourism may reduce economic leakages, minimize negative impacts and concentrate the benefits locally.

Bangladesh, apart from its geographic location and physiographical features, environmental situation of the country is unfavorable from the point of resource use. Conservation and protecting biodiversity suffer from a low priority in Bangladesh. Sustainable development of the country needs a proper strategy which would accelerate economic growth with equitable distribution of benefits across different segments of population without harming the environment (Ahmad et al. 1994). As a resource-poor country, Bangladesh has to make efforts to diversify her economic base. The country possesses considerable potential for ecotourism development which has remained unexplored and expansion of ecotourism can play critically important role with relatively low investment being made. There is the world largest Sundarbans mangrove forest in Bangladesh which plays an important role in the national economy. The people living adjacent to the forest are overwhelmingly dependent on the Sundarbans directly or indirectly, for much of the economic activities carried out therein. The forest is in pressure due to continuous dependencies on it. The scarce resources of the Sundarbans are increasingly threatened by overexploitation. It requires a proper strategy for multiple utilization of resources in this area as sustainable manner. Ecotourism development which considers the all aspects of forest resources as well as the local communities, may protect the forest and help local people to improve their socio-economic condition.

Although the Sundarbans is frequently studied forest in Bangladesh, but a serious analysis has not been carried out emphasizing on non-consumptive utilization of resources of the Sundarbans. This study is an attempt to bring together compre-

hensive sets of data, information and analyses on resource utilization, constraints and environmental aspects within the Sundarbans of Bangladesh. The purpose of this paper is to find out the possibility of ecotourism in the Sundarbans area.

The Sundarbans

The Sundarbans is the single largest chunk of productive mangrove forest in the world, covering some 1 000 000 hectares of land and water, formed from sediments deposited by three great rivers: the Ganges, the Brahmaputra and the Meghna covering on the Bengal basin (Hossain and Karim 1994). The western part of the Sundarbans lies in India and remainder 60 per cent, is in Bangladesh (Figure 1 and Asian Development Bank 1997). To the south the forest meets the



Figure 1. Bangladesh and the Sundarbans.

Table 1. Land types in the Sundarbans.

Land Type	Area (km^2)
Total Land Area	4 143
Production Forest	3 841
Existing Wildlife Sanctuaries	301
Water (rivers, creeks and canals)	1 874
Total Area Inside Sundarbans Boundary	6 017
Additional Marine Area	1 603

Source: UNDP/FAO

Bay of Bengal; to the east it is bordered by the Baleswar river and to the north there is sharp interface with intensively cultivated land, all of which is intersected by a network of tidal rivers, canals and streams (Vere Moss 1993). Table 1 shows the present land types within the Sundarbans.

The Sundarbans is the mirror image of many facets of a single one. Although classified as a reserved forest, a much border understanding of the importance of the inter-relationships of the flora, fauna, aquatic and water resources and the edaphic conditions on which they occur, and that make up the mangrove ecosystem, is emerging in Bangladesh. This combination of resources and conditions, occupying the special ecological niche where seawater meets freshwater, fertilized periodically by sediments from the land and the sea, are the foundation of its high biological productivity, uniqueness and diversity.

The forest is the natural habitat of the world famous Royal Bengal Tiger *(Panthera tigris)*. The Sundarbans provide a large refuge in the region for a large number of other mammals, birds, reptiles and amphibians, many of which are classified as endangered. There are spotted deer, jungle fowl, wild boar, lizards, rhesus monkey and an innumerable variety of beautiful birds in the forest and crocodiles in the rivers. Migratory flock of Siberian ducks flying over thousands of sail boats loaded with timber, golpatta (round-leaf), fuel wood, honey, shell and fish further add to the serene natural beauty of the Sundarbans (Vere Moss 1993, ADB 1997).

The Forest Department

The Sundarbans is one of the oldest and primary forest administrative set-ups in the Indian sub-continent. It is a forest division- the primary forest management unit under the control of the Divisional Forest Officer (DFO). The DFO is responsible for all administrations including operational plans, controlling tourism, staff

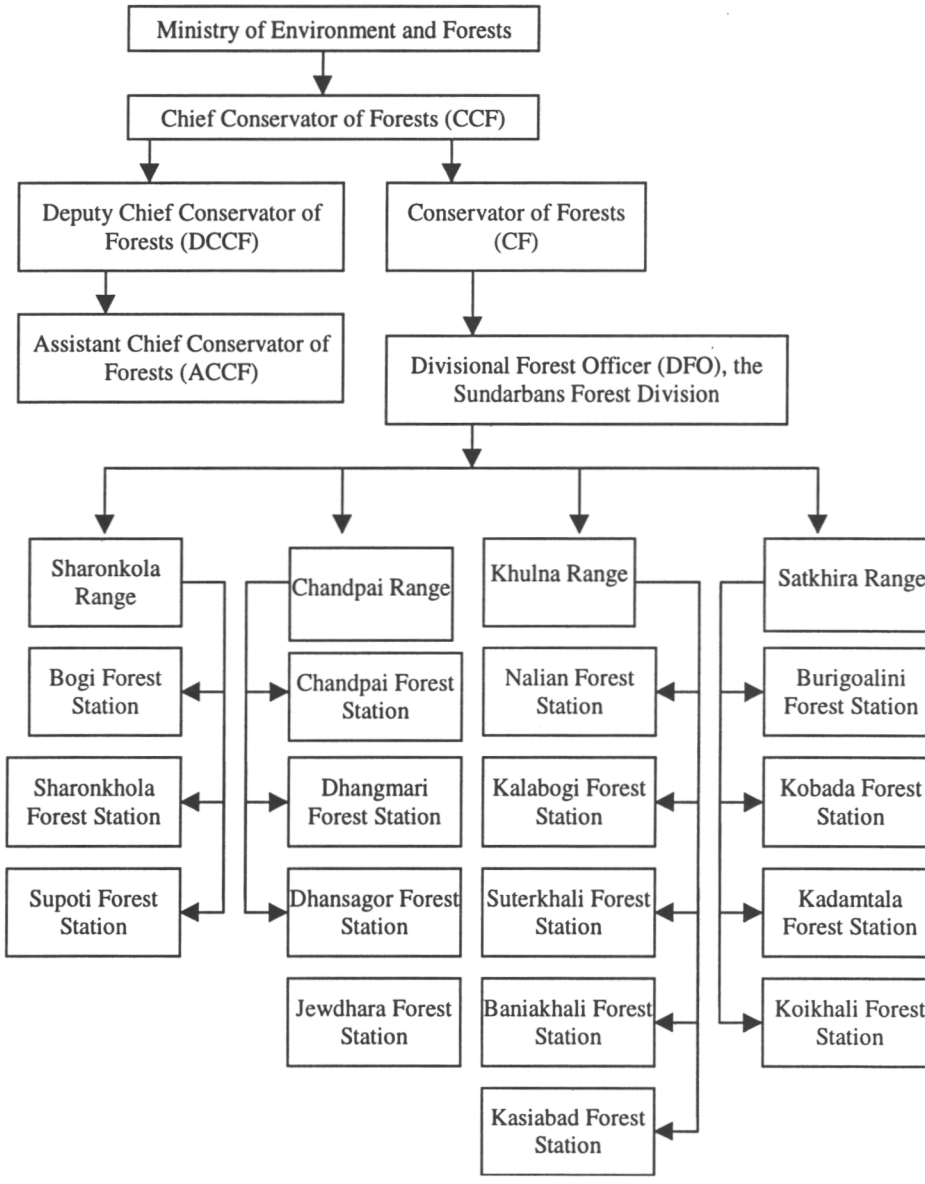


Figure 2. The forest Deparment structural organization and the Sundarbans.

discipline, revenue collection, budget, execution of Forest Act, silvicultural norms, sales of forest produce and industrial and public liaison. He is assisted by one Assistant Divisional Forest Officer (ADFO). The Forest is divided into four ranges with distinct boundary layouts which primarily follow natural water courses. The four Range Offices are located at the periphery of the forest at Sharonkho-

la, Chandpai, Nalianala and Burigoalini and headed by professional foresters, Assistant Conservator of Forests (ACFs). Each of these ranges has from three to five permanent revenue check stations; there are 16 in all in the Sundarbans, sited at conspicuous river-front entry points to regulate and control forest product extraction, and to combat pilferage. In addition to this, temporary coupe offices are established wherever timber and fuel-wood extraction operations are carried out according to the management plan prescriptions. To cope with the law and order situation, fifty security outposts, called patrol posts are functioning in Sundarbans. At present, more than 1000 persons including professional or technical staffs are working in the Sundarbans Forest Division. The FD´s structure is shown in Figure 2.

Local People and Resource Use

Local People

As the Sundarbans is the reserved forest, no people reside within the forest, however approximately 2.25 million people live within 20 km of the reserve and it is estimated that 0.25 have direct economic ties to the region. Over three-quarters of the people in the closest zone (with 0–2 km band), and two thirds of those living in the zone from 8–10 km rely on the forest from income generation (MARC 1995). The large population living outside the boundaries of the Sundarbans includes commercial and industrial enterprises dependent on the forest products.

Honey Collectors
The honey collectors known as Mowalis collect honey from the Sundarbans. Honey is the most popular non-wood forest product in the Sundarbans, and it is greatly in demand for various purposes throughout the country. The two or three month period from approximately the end of March to the end of May is the prime time for honey collection.

Wood Cutters
The wood cutter collects golpata (*Nypa Fruiticans*) or goran-woods from the Sundarbans. The goran is most often used for fuel by people not only adjacent to the forest, but far beyond. It is also used in the manufacture of bricks. Golpata is the most important non-wood forest product of the Sundarbans. It grows almost in all parts of the forest and a section of the society is dependent on golpata harvesting as a source of income and employment.

Fishermen
In the coastal areas, shrimp fry collection is one of the major occupation for men, women and children. Shrimp cultivation commenced in the region in the early eighties. A large number of people from the villages located on the bank of the bordering rivers and canals of the Sundarbans now concentrate on this occupation.

Moneylenders

Moneylenders are known as Mahazan in the region who are very active entrepreneurs in the region and closely involved in lending to shrimp fry collectors, wood cutters or the honey collectors. They play an important role in the exploitation of the resources of the Sundarbans. Moneylenders generally lend money to specific stakeholders groups with conditional arrangement and conditions of repayment vary considerably between lenders and different stakeholders and between moneylenders.

The permission for entering into the forest is issued by the FD and the honey collector, wood cutter or the fishermen obtain their entry permits paying entry fee to the FD. After the collection from the forest, they have to pay their revenue to the FD according to their collection.

Economic Condition of the Local People

Accurate data on the socio-economic situation remains incomplete. A study undertaken by Multidisciplinary Action Research Center in 1995 under the auspices of UNDP provides the only site specific data (Table 2). People surrounding the Sundarbans are dependent on the resources to fulfil their day to day needs. Due to the seasonality of the occupations, there is some overlap in participation in the various stakeholder groups. The average yearly earning obtained by the different stakeholders is Tk 16 000 to Tk 23 000 (Table 8) which, assuming an average

Table 2. Economic Activities and Estimated Household Incomes.

Major Occupations			**Other Occupations**			Tentative total yearly income (in Tk)
Occupations	Duration (in months)	Earning (in Tk)	Occupations	Duration (in months)	Earning (in Tk)	
Wood-cutter	6 Nov-Apr	9 000	Agricultural labor Fish fry collection Day labor Shopkeepers	3	7 200	16 200
Honey Collector	2 Apr-Jun	7 000	Agricultural labor Day labor Fish fry collection Petty traders Shopkeepers	10	9 000	16 000
Shrimp fry Collector	12	18 000	They do other work also	5	5 000	23 000
Money-lender	12	Indirect beneficiaries, receives the major share of benefits through lending money to the various stakeholders.				

Source: Asian Development Bank 1997

household size of 6.3 from MARC study, gives a per capita income of Tk 2 540 to Tk 3 651. Comparing these figure with the poverty line threshold income selected by Bangladesh Institute of Development Studies (BIDS) of Tk 6 300 indicates that the local people are living in a state of poverty. Some indication of the variation in poverty can be gauged from the World Food Program (WFP) Food Security Indicators. WFP used 1991 population census data together with the latest data available from the Disaster Management Bureau of Ministry of Disaster Management and Relief, and Agricultural Statistics Wing of the BBS to assess the relative level of food security. Information for the thanas near to the Sundarbans is given in Table 3 and it may be gauged that a major portion of the local people are living under the state of poverty.

Table 3. GOB/World Food Program Relative Insecurity Rankings.

Thana Code	District	Thana	Population (1995 estimated)	Food insecurity level
35	Khulna	Batiagata	151 000	High
3 501		Dacope	170 000	Very High
3 505		Paikgacha	266 000	Moderate
36	Satkhira			
3 601		Assasuni	242 000	Moderate
3 604		Kaliganj	247 000	High
3 606		Shyamnagar	291 000	Very High
37	Bagerhat			
3 706		Rampal	185 000	Very High
3 707		Sharonkhoal	119 000	Very High
3 709		Mongla	153 000	Very High
42	Pirojpur			
4 203		Mothbaria	276 000	Low
47	Barguna			
4 702		Bamna	73 000	Moderate
4 703		Barguna	241 000	Low
4 704		Betagi		High
4 705		Patharghata	148 000	High
		Total Population	3 114 000	

Source: GOB/WFP VGD Program Food Insecurity Level

Relationship between Local People and the FD

The key extractive users of the Sundarbans such as honey collectors, woodcutters or fishermen have a relationship with the FD people. They get permits by paying entry fee to the FD people. Their relationships are not good enough. The moneylenders and other stakeholders have relations and mutual understanding, the poor stakeholders are fully dependent on the moneylenders for their occupations. Most of the cases, the key extractive users do not obtain competitive market price for their collected products, because they do not have the right to sell their products themselves. Moneylenders sell it and take a percentage from the profits. Sometimes the stakeholders earn by selling their labor, profits go to the moneylenders. The moneylenders sometimes pay a large sum of money to the FD people as bribe and to recover these costs they instruct the key extractive users to collect excessive amount of products. The moneylenders are indirect beneficiaries and retain all the benefit keeping illegal relations with the FD people. The relationship is shown in Figure 3.

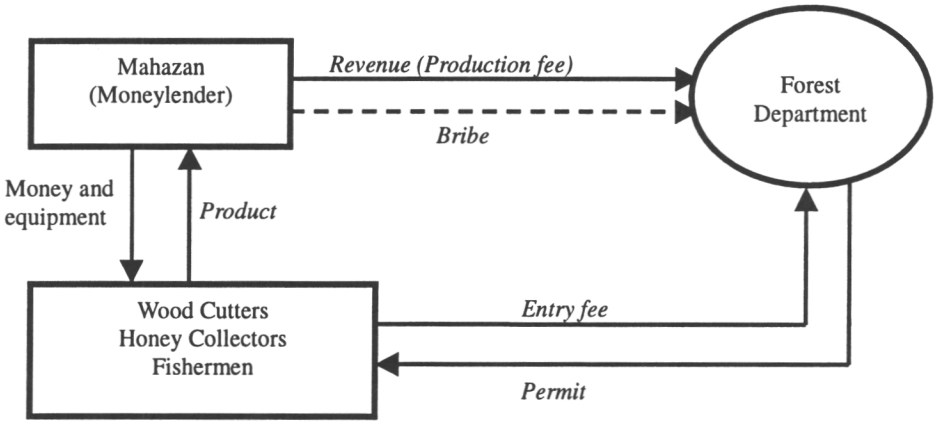


Figure 3. Relationship between Local People and The Forest Department.

Existing Tourism in the Sundarbans

Overview

Tourists have been visiting the Sundarbans for decades and the Bangladesh Parjatan Corporation (BPC) now considers it the first priority for tourism development. It is the largest contiguous block of mangrove forest, several endangered

Table 4. Attractions of the Sundarbans Mangrove Forest.

Description	Comments
Location	on the Bay of Bengal and largest mangrove formation in one of world's largest river deltas
Tropical climate	cool and dry during the tourist season
Rivers	large and small giving opportunities for cursing and jungle boating
Forests	unspoiled mangroves, forests ecology
Wildlife	especially the largest population of Bengal Tiger (USP) and exceptional population of spotted deer and wild boar, adequate bird watching, migratory species and raptors in particular
Beaches	unspoiled, wild, unpopulated and totally undeveloped beaches throughout on the Bay of Bengal and around some islands
History/archeology	rare sites set in the jungle
Sociology	fishermen in particular, otter fishermen, also other traditional collectors of jungle produce
Cuisine	many different species of edible fish, prawn and crabs
Culture	annual festivals at Dubla and diverse cultures

Source: Vere Moss 1993

species and numerous environmental points of interest. There is also village life and culture in the surrounding villages and traditional fishing activities on the rivers. The forest represents mystery and mythical image, it provides peaceful and relaxing refuge from the population densities of Bangladesh. It is one of the few places where visitors can find quiet and relaxation. In the Sundarbans there are many attractions for casual visitors or specialists and these are summarized in Table 4.

Tourism Administration and Services

Tourism activities in the Sundarbans combine the efforts of private tour operators, and the FD and Bangladesh Parjatan Corporation (BPC). The FD controls tourism activities; controls over rights of entry into the Sundarbans. The department operates Karamjal Deer Station and provides rest house accommodation in the Sundarbans for tourists and has built several observation towers and fresh water ponds for viewing spotted deer and the Royal Bengal Tiger. The deer station at Karamajal is the most popular attraction in the Sundarbans and a crocodiles farm is being built by the FD and this will add to the attraction. BPC´s tour division offers a variety of tours ranging from short half-day excursions to longer package throughout the country. The tours to the Sundarbans are arranged on an ad hoc basis usually involving hire of Mongla Port Harbour Authority boats which are

Table 5. Involvement of the local people in tourism in the Sundarbans.

Tour Operator	Tourist Type	Operating Size	Local Involvement
Local people	Students/Teachers Local Tourists	Unorganized	Full involvement
Operators of Khulna city	Domestic Urban people Foreigners	Medium size and organized	Little involvement
Operators of Dhaka city	Foreigners	Large size and well organized	No involvement

boarded at Mongla port. Private tour operators offer overnight cruises from Mongla to Katka or Hiron Point, very deeper part of the forest. The private sector has been the catalyst for tourism development in the Sundarbans. The urban tour operators are well organized, high-cost tourism is carried out by them, on the other hand local tour operators are unorganized and operate the low-cost tourism in this area (Table 5).

Tourist Types and Market Segment

The tourists who make short trip across the river on country boats are mostly the students and the people of the communities nearby. It may be treated as low cost tourism as it takes a little money for hiring the boat and entry fee only. The high cost package tourism in the Sundarbans, is organized by private tour operators. This type of tourism is comparatively costly and it takes two days three nights or more and tourists of this type are from far away of the Sundarbans or from abroad. Although there is no identified ecotourism market segment in Bangladesh much of the population could be interested in a nature-based experience in a well organized location and Sundarbans may be a destination for Bangladeshis for that reason alone. Despite the relatively low visitor volume to the Sundarbans, there are several distinct or emerging market segments. They may be classified as:

Nature Tourism
A broad market segment which includes activities such as bird watching, wildlife observation, amateur botany, nature photography, etc. This segment does not necessarily include a cultural/heritage component, interaction with the local communities or a contribution to conservation.

River Cruising and Sightseeing
The largest market segment is river cruising and sightseeing which includes those who enter either as day visitor or with their major tour operators. They spend most of their time on either the tour boats or country boats.

Study Tours
The Sundarbans may receive as many as 60 000 students visitors as word of the educational and entertainment value of a visit to the Sundarbans, most coming through Munshiganj and Mongla. The length of stay is only several hours.

Research Tourism
The unique flora and fauna of the Sundarbans has made it a destination for domestic and international researchers who have conducted studies of the area. The annual number of visitor day is unknown, but greater awareness of the endemic and threatened species and the need for greater data on many of the resources could attract more of this segment.

Visitor Numbers

Visitor numbers have been steadily increasing over the last 5 years but it is difficult to give a comprehensive and accurate estimate of average annual tourists numbers on which to base projections of potential growth in the sector. Official permit records, kept over only the last few years, seem to contradict expectations and opinions among the travel operators who service the market. Then too, recent years of political unrest have doubtless restrained the real development of the marketplace. As all would agree, however, tourism levels and trends are growing, suggesting the high potential for development of the Sundarbans as a key tourism market in Bangladesh.

The DFO office provided that 7 764 permits for tourists was issued by the Khulna office in 1998 but the office was not be able to give the records of the other primary entry points of the forest. Discussion with the FD officials and two big private tour operators, it may be taught that more than 15 000 domestic tourists visit the Sundarbans every year. This does not include another 40 000 or so tourists who make the short trip across the river on country boats to visit the popular Karamjal Deer stations. Student visitors are also likely to increase as word of educational and entertainment value of a visit to the Sundarbans and the increasing ease with which it may be accomplished, spreads among the schools and communities nearby, and even further afield.

Local Perceptions

Local perceptions of the resource management and ecotourism in the Sundarbans was carried out using questionnaire survey. A total of 105 households from two regions of the forest (namely Sharonkhola and Munshiganj) has been taken as respondents for this study. The survey was conducted with only adult (age 18 years or more) residents of each selected household. To measure the attitudes a 5-point Likert scale was used on which a response of 5 meant a respondent strongly agreed with a statement and a response of 1 meant a respondent strongly disagreed

with a statement. There were also some open-ended questions and the answers are carefully noted. The questionnaire was prepared in English but at the survey time it was translated in Bangla to the respondents. In addition to the questionnaire survey some local people and FD people were interviewed.

The people´s attitude towards management of the Sundarbans is shown in Table 6 .Of the total sample 32.4 % thought that FD people were doing their

Table 6. Opinions about the Forestry Department with the statement "Forestry Department is managing the Sundarbans very efficiently".

	n	Strongly Disagree or Disagree (%)	Neutral (%)	Strongly Agree or Agree (%)	χ^2 Significant
Total sample	105	51.4	16.2	32.5	
Education					
Illiterate	22	11.4	2.9	6.7	p >0.05
Primary	37	19.0	3.8	12.4	
Secondary	29	11.4	6.7	9.5	
Higher Secondary	9	5.7	1.9	1.0	
Graduate and More	8	3.8	1.0	2.9	
Income					
Upto Tk 1 500	30	20.0	3.8	4.8	p < 0.05
Tk 1501 – Tk 2 500	21	13.3	3.8	2.9	
Tk 2501 – Tk 5 000	34	13.3	4.8	14.3	
More than Tk 5 000	20	4.8	3.8	10.5	
Age					
Upto 25 year	9	3.8	2.9	1.9	p >0.05
26 year – 35 year	48	22.9	4.8	18.1	
36 year – 45 year	33	21.0	3.8	6.7	
46 year – 55 year	11	2.9	2.9	4.8	
More than 55 year	4	1.0	1.9	1.0	
Occupation					
Agriculture	10	2.9	2.9	3.8	p >0.05
Boatman	5	2.9	0.0	1.9	
Wood cutter	25	13.3	4.8	5.7	
Business	9	4.8	1.9	1.9	
FD	7	0.0	0.0	6.7	
Fishing	22	11.4	4.8	4.8	
Money lenders	4	1.9	0.0	1.9	
Small Business	16	8.6	1.9	4.8	
Service	7	5.7	0.0	1.0	

duties efficiently, 16.2 % were neutral and 51.4 % thought that FD people were not doing their duties efficiently. Table 1 reveals there is no literacy differences in opinions ($\chi^2 = 4.67$; df = 8; p>0.05). No significant differences are found in the opinions by age ($\chi^2 = 12.98$; df = 8; p>0.05) and by occupations ($\chi^2 = 12.98$; df = 16; p>0.05) but differences among the income groups are statistically significant at 5 % level ($\chi^2 = 15.87$; df = 6; p<0.05) i.e., the proportion of the respondentsí disagreement reduced as increasing income level. Respondents who agreed or strongly agreed with the statement were of relatively high-income groups.

If the respondents t thought the Sundarbans was not being properly managed by the FD, they were asked what the reason(s) was for it. Table 7. shows that most of the respondents (42.8 %) indicated the poverty of theyhe local people, 31.7 % indicated dishonesty of the FD officials and 14.9 % indicated that dishonesty of the local rich people as the main reason. According to the 73.3 % of respondents, there was no participation of the local people in management, 14.3 % said that there was some participation of local residents and 12.4 % of people defined themselves as either neutral or having no opinion (Table 8).

Some questions were asked relating to the wildlife and tourism in the Sundarbans. 25.7 % of the respondents were agree with the statement that visitors in the Sundarbans were mostly wildlife viewers, and 62.9 % were in opposition. 11.4 %

Table 7. Reasons for not being able to proper manage the Sundarbans.

Reasons	Percentage
Lack of proper knowledge	4.3
Dishonesty of FD people	31.7
Poverty of the local people	42.8
Dishonesty of the local rich people	14.9
Shortage of FD people	6.3
Total percentage	100.0

Table 8. Participation of local people in management of the Sundarbans.

Participation level	Percentage
There was some participation of the local people in management of the Sundarbans	14.3
Don't know	12.4
There was no participation of the local people in management of the Sundarbans	73.3
Total percentage	100.0

stated that they did not know well about it (Table 9). The opinions were not significantly different by literacy ($\chi^2 = 3.87$; df = 8; $p>0.05$) and occupations ($\chi^2 = 13.83$; df = 16; $p>0.05$), but significantly different by income ($\chi^2 = 13.62$; df = 8; $p<0.05$) and age ($\chi^2 = 24.69$; df = 8; $p<0.01$) groups. Most of the high-income earners either disagreed or strongly disagreed with the statement (Table 4). In terms of the age, the young people were less likely than old people to identify the visitors of the Sundarbans area.

Table 9. Statement: "Visitors in the Sundarbans area are mostly wildlife viewers".

	n	Strongly Disagree or Disagree (%)	Neutral (%)	Strongly Agree or Agree (%)	χ^2 Significant
Total sample	105	62.9	11.4	25.7	
Education					
Illiterate	22	16.2	1.9	3.8	$p>0.05$
Primary	37	20.0	3.8	10.5	
Secondary	29	16.2	2.9	8.6	
Higher Secondary	9	4.8	1.9	1.9	
Graduate and More	8	5.7	1.0	1.0	
Income					
Upto Tk 1500	30	13.3	5.7	9.5	$p<0.05$
Tk 1501 – Tk 2500	21	9.5	2.9	8.6	
Tk 2501 – Tk 5000	34	23.8	1.9	5.7	
More than Tk 5000	20	16.2	1.0	1.9	
Age					
Upto 25 year	9	4.76	1.90	1.90	$p<0.05$
26 year – 35 year	48	31.43	5.71	8.57	
36 year – 45 year	33	23.81	2.86	4.76	
46 year – 55 year	11	2.86	0.95	6.67	
More than 55 year	4	0.00	0.00	3.81	
Occupation					
Agriculture	10	6.7	1.0	1.9	$p>0.05$
Boatman	5	1.9	1.0	1.9	
Wood cutter	25	11.4	2.9	9.5	
Business	9	5.7	1.0	1.9	
FD	7	3.8	0.0	2.9	
Fishing	22	15.2	2.9	2.9	
Money lenders	4	1.9	0.0	1.9	
Small Business	16	11.4	1.0	2.9	
Service	7	4.8	1.9	0.0	

There was a statement about illegal hunting of the wildlife of the Sundarbans. 58.1 % of the respondents stated that illegal hunters were the local people, 28.6 % disagreed or strongly disagreed with the statement and 13.3 % was neutral (Table 10). Statistically the opinions were not significantly different at 5 % level by literacy, income or age group. These were significantly different by occupations (χ^2 = 27.35; df = 16; p>0.05).

Table 10. Statement: "The illegal hunters are mostly the local people or the local people help the illegal hunters".

	n	Strongly Disagree or Disagree (%)	Neutral (%)	Strongly Agree or Agree (%)	χ^2 Significant
Total sample	105	28.6	13.3	58.1	
Education					
Illiterate	22	3.8	1.9	16.2	p >0.05
Primary	37	10.5	5.7	18.1	
Secondary	29	8.6	3.8	15.2	
Higher Secondary	9	1.0	1.0	6.7	
Graduate and More	8	4.8	1.0	1.9	
Income					
Upto Tk 1500	30	6.7	2.9	19.0	p >0.05
Tk 1501 – Tk 2500	21	4.8	3.8	11.4	
Tk 2501 – Tk 5000	34	10.5	3.8	18.1	
More than Tk 5000	20	6.7	2.9	9.5	
Age					
Upto 25 year	9	1.9	1.9	4.8	p >0.05
26 year – 35 year	48	12.4	3.8	29.5	
36 year – 45 year	33	8.6	2.9	20.0	
46 year – 55 year	11	3.8	2.9	3.8	
More than 55 year	4	1.9	1.9	0.0	
Occupation					
Agriculture	10	1.0	0.0	8.6	p < 0.05
Boatman	5	1.9	0.0	2.9	
Wood cutter	25	5.7	2.9	15.2	
Business	9	1.0	3.8	3.8	
FD	7	2.9	1.0	2.9	
Fishing	22	2.9	2.9	15.2	
Money lenders	4	1.9	0.0	1.9	
Small Business	16	9.5	1.9	3.8	
Service	7	1.9	1.0	3.8	

Table 11. Statement : "Meeting tourists is a valuable experience".

Agreements	Percentage
Strongly disagree or disagree	12.4
Neither agree nor disagree	11.4
Strongly agree or agree	76.2
Total percentage	100.0

Table 12. Relationship between locals and the tourists.

Relationship with tourists	Percentage
There is no relationship at all	32.4
Don't know	14.3
There is very close relationship	53.3
Total percentage	100.0

A majority of the respondents (76.2 %) described that meeting tourists was a valuable experience, 12.4 % were against the statement and 11.2 % were neutral (Table 11). More than half of the respondents (53.3 %) stated that there was very close relationship between the local people and the tourists, 32.4 % stated that there was no relationship and 14.3 % was neutral to give the opinion (Table 12).

Discussion

The Sundarbans is one of the richest and most diverse natural resources of Bangladesh. It is recognized as most valuable forest in the country. Over a long period, the FD has been working to safeguard the forest. They are managing the resources in the traditional manner, FD is still working under the old management structure with old laws. People of surrounding areas are dependent on the resources to fulfil their day to day needs and the resources of the Sundarbans are being depleted at an alarming rate. There are many reasons for this including natural disaster, increase of population uncontrolled exploitation and mismanagement of the forest. The situation has been aggravated by illegal harvesting of all kinds of resources of the Sundarbans in ways condoned, even encouraged by corrupt officials in the FD and local elite. The existing policies, pricing system and corruption among the managers are also contributing to the degradation of the resources base. Hence the

normal causation is reserved: the key to the proper management, conservation, and development of the biological resources is held by the various people and agencies who are its major stakeholders. Moneylenders are very active actors as indirect beneficiaries from the Sundarbans. Different stakeholders receive money by a mutual understanding. Extracted resources like honey, wood, shrimp fry etc. are sold by the moneylender and he gets a major portion of profit. As there is no bank or financial institution, poor stakeholders have no way without lending from moneylenders. Government should assist by authorizing private sectors to set up small banking at village levels under appropriate rules and laws.

Tourism has often been mentioned as a desirable objective in multiple use schemes for optimizing economic returns from the forest resources. If the assets and attractions appear to match the market then a choice of recreational activities could be developed to suit the perceived market. These activities should be organized both to satisfy the client´s needs and at the same time to preserve or maintain the asset on which it is based. There are wide ranges of options available in the Sundarbans

The study of FAO/UNDP suggested that to achieve higher economic returns and provide new opportunities for local people, organized tourism and recreation should be incorporated in integrated resource development plans. It has been recommended that due to the difficult terrain and the conservation needs of the forest ecosystem, the Sundarbans should be considered a site for low volume high-cost ecotourism rather than for a wider, less affluent mass market (Vere Moss 1994).

Asian Development Bank (ADB) carried out a project titled ëBiodiversity Conservation in the Sundarbans Reserved Forestí in 1997. It is reported that there is an important opportunity for ecotourism in the Sundarbans to become a significant revenue and income generator. It is within the context of both constraints and opportunities that the tourism development for the Sundarbans was assessed. Many international destinations or protected areas would be pleased to have the growth rates of Bangladesh and the unique resources of the Sundarbans. If properly planned, tourism has the potential to generate a reasonable return on investment and offer substantial community benefits.

Although there are various constraints to developing the tourism potential in the Sundarbans the Sundarbans remains a source of attraction both in terms of aesthetic and wildlife value as well as in terms of research potential and educational value. So it is important to equate the relationship of each component to the whole since it is by understanding the interrelationship of the various parts that a cohesive and rational policy can be derived. The Sundarbans has a lot of resources but all are in danger due to the lack of proper management. So changes in the way are essential and must take account of all the resources of the Sundarbans. It has a strong name association, nationally and internationally. It combines forest, fisheries, wildlife and offers a number of unique tourism development opportunities based on its out standing ecological and cultural values. The forest catches the eyes of the nature tourists and its main attraction is the usual mangrove ecology.

There are a variety of internationally significant wildlife viewing, research and interpretation opportunities that would appeal to the ecotourism market. If Bangladesh is to gain the ecotourism reputation it deserves with its Sundarbans product then it will necessarily require proper management of the forest. The chief objective of the National Forest Policy, other environmental policies and initiatives is to protect the remains of the natural forests and forest resources and the FD is the chief implementer of the policies and program initiatives in the forestry sector.

The local people hold strongly negative attitudes towards the present management done by the FD but expressed their positive attitudes towards tourist and tourism in Sundarbans area. Participation of the local communities is very low and all illegal activities are being done by the local residents. Involvement of local communities in the management of the Sundarbans might improve management of the forest, conserve the wildlife and the ecology of the forest all of which are the attractions of the ecotourists. Participation of the local communities may improve the relationship with the FD as well. It should be borne in mind that without the improvement of the economic condition of the local communities, it is not possible to get any positive result. Ecotoursim development in this area must be carried out in way that is compatible with the principle of sustainable development. Integrated regional planning, including the idea of monitoring and assessment should be included in the ecotourism planning of this poverty stricken area.

Conclusion

It is clear that there is an important opportunity for ecotourism in the Sundarbans to become a significant revenue and income generator. Revenues for biodiversity conservation, community environmental education, local economic benefits and building national and international support for responsible resource management can be generated. Infrastructure and tourism facilities should be developed in modest way by international tourism development standards. However because it is associated with such an exceptional resource base, a well-balanced developments could both establish a world-class image and reputation for the Sundarbans. As well, because the forest is such an important resource to both Bangladesh and global mangrove ecosystems, the facilities designed should appropriately reflect this situation. The accommodation facilities including a network of jungle camps and lodges should be developed.

The ecotourism market should not be confused with the backpacker segment. Ecotourists are sophisticated, educated and conscious travelers. If Bangladesh is to gain the ecotourism reputation it deserve with its Sundarbans product then it will required a well trained and professional staff. Service should exceed that in most other protected area destinations in South-East Asia or Indian Subcontinent.

In fact if the Sundarbans is to successfully compete in the international market, it must do so on service delivery.

Policy should be taken to develop the surrounding communities otherwise successful ecotourism development should not be possible in the Sundarbans area. It may be possible by providing communities in the surrounding areas with an opportunity for alternative income-generating activities, development of non-consumptive use of the forest. Micro-credit for alternative income generating activities and micro-credit for resource extraction activities may be helpful for the local communities.

Ecotourism development in the Sundarbans needs a mechanism to involve communities in tourism planning and development. Local people may involve in the tourism sector by implementation of community tourism in collaboration with different NGOís community development plans and offering micro credit to create small tourism businesses. Creating a ecotourism organization with the participation of local communities, NGOs and Forest Department, may be the one of the ecotourism destinations in the whole world. The Process is described in the Figure 4.

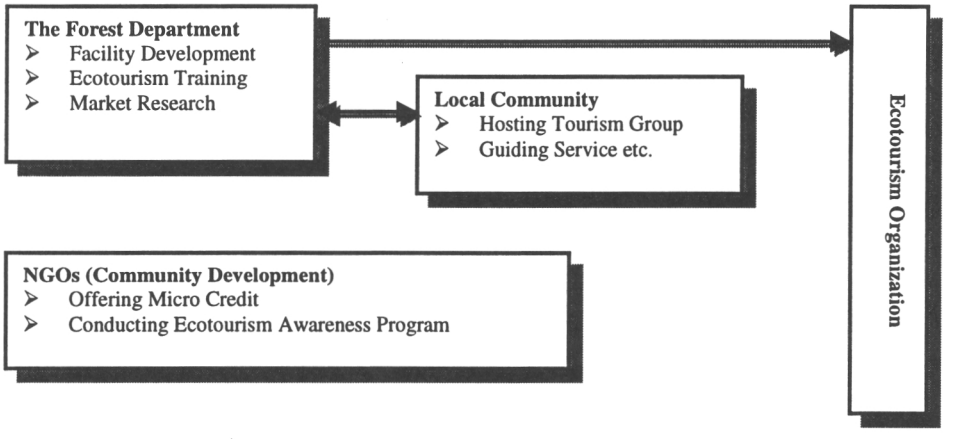


Figure 4. Ecotourism Model for the Sundarbans Mangrove Forest.

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Motorized Access Control as a Wildland Recreation Management Tool: Access Changes and Visitor's Behavior at Daisetsuzan National Park

Keiko Shiratori and Taiichi Ito

Abstract

In order to clarify the feasibility of the motorized access control method in wildland recreation management, the authors studied the relationship between access change and visitor's behavior at Daisetsuzan National Park, Hokkaido, Japan. First, historic statistics told us that motorized access improvement rapidly increased the number of visitors to Daisetsuzan area, especially to trailheads at higher altitude with connection to other sightseeing routes. Second, such improvement also changed walking access patterns. Remote areas that required over-night stay disappeared, and day-use areas expanded. Most of core areas of the park with fragile alpine vegetation fall under the category of day-use areas now. Third, almost 70 % of visitors come by their own cars and tend to prefer short and easy walks. Furthermore, such day-use visitors expect more access improvement, while overnight backpackers welcome longer walking access. Fourth, more than 20 % of tramway users mentioned willingness to walk paralleling trails, but those who really walk the trail are very small. This gap between intention and behavior hints that they know that more walking give them deeper experiences and other benefits, but they cannot resist the temptation of tramways. From these analyses, we suggest that motorized access should be regulated and walking access be enhanced. This can be an effective management tool not only for nature conservation but also for deeper visitor experiences.

Keywords: Wildland recreation, Motorized access, Access control, Daisetsuzan National Park

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Introduction

Environmental deterioration triggered by overuse is a common issue in protected areas such as national parks. Especially Japan's national parks observed many mountain roads and tramways were installed within their boundaries in the 1960s. Coincidentally, rapid increase of park visitation occurred. Motorized access lures potential casual visitors since it drastically decreases the walking distance or access time to attractive landscapes in national parks. As an inevitable result, soil compaction and erosion, scattering garbage along trails and other environmental problems are on the rise. At the same time, social problems such as crowdedness are occurring. In other words, the primitive side of the Recreational Opportunity Spectrum is decreasing as a result of development of motorized access.

There are several ways to minimize negative impacts caused by overuse such as law enforcement, hardening and visitor number regulation. However, such approaches require a certain budget and staff, both of which are often under supply in most protected areas. Furthermore, Japan's national parks are often designated over private lands. Therefore, controlling visitor's numbers or their activities is extremely difficult as a means of park management. On the other hand, regulating motorized access at forest roads seems more practical because casual visitors tend to avoid such areas only reached after a long-distance walk. At the same time, those who are willing to walk can obtain deeper environmental experiences in quiet well-preserved places.

American father of wilderness, Aldo Leopold must have recognized the deep impact of road construction and succeeding encroachment of motorized means (Leopold 1925). Therefore, wilderness preservation movement has been strongly related with roadless-area protection. From such an experience, we recognize the access control, especially motorized access control, is the most effective tool to preserve the natural environment as well as solitary atmosphere.

When access is investigated from such a viewpoint, the authors found access rigor is playing an important role in the visitor's behavior during wildland recreation especially in mountains. However, we need concrete data to utilize access control as a management tool in wildland recreation. Thus the authors started to collect basic data on this issue at Daisetsuzan National Park (Shiratori 1999).

Study Area and Methods

In order to clarify the feasibility of the motorized access control method in the wildland recreation management, the authors studied the relationship between access change and visitor numbers in Daisetsuzan National Park in Hokkaido, Japan (Fig. 1). In 1934 Daisetsuzan was designated a national park consisting of several volcanic mountains with the altitudes of 2 000 meter level. This is the largest park in Japan; the total area is 2 308.94 km^2 with a vast wilderness area.

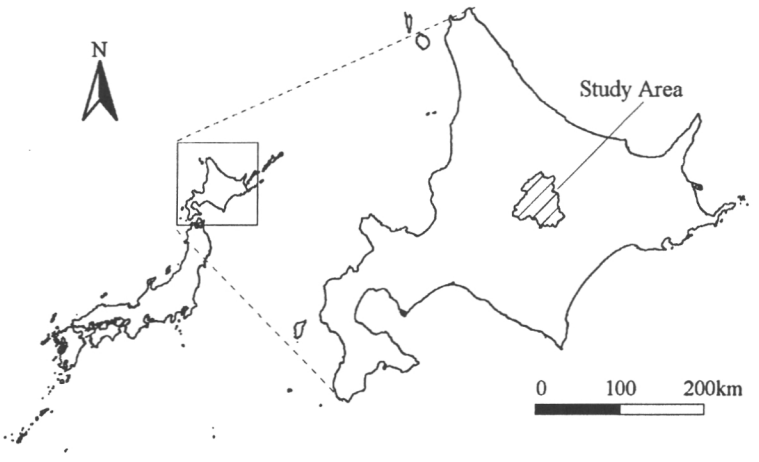


Figure 1. Location of Daisetuzan National Park.

Still, previous studies indicate the increasing impacts both on natural environment such as vegetation and soil (Park 1993, Kobayashi 1998) and on the social environment like visitor satisfaction (Aikoh *et al.* 1992, Aikoh and Kobayashi 1993, Aikoh *et al.* 1994). Especially, its northern part was well developed in the 1960s; currently there are six gateway points, two with tramway access. Thus, overuse has become a serious problem.

The authors approached the access issue at the northern part of Daisetsuzan National Park from three directions: documents and statistics, Geographical Information System (GIS), and questionnaire to visitors. First, for the purpose of clarifying the relation between motorized access improvement and visitor increase, the authors analyzed historic documents and the visitor statistics since the 1960s when road improvement and tramway service began. Second, by using a walking access rigor model, changes in walking access hours at each trail were presented on maps using GIS. Third, the authors conducted visitor survey at two major gateway points with tramways; visitor's preference of hiking routes as well as their opinions on access improvement were collected.

Development of Motorized Access and Visitation

The first recognition of Daisetsuzan area as recreational purpose can be traced in 1911 when the village master submitted a proposal to establish a national park. In 1923 the first trail from Sounkyo Spa (630 m) to Tenninkyo Spa (623 m) via Mt. Kurodake (1 984 m) and Mt. Asahidake (2 290 m) was established (Fig. 2). The next year two stone refuges were constructed at the foot of each mountain. As the third gateway point, Aizankei Spa (1 010 m) was developed in 1930, and soon became the main gateway to Daisetsuzan area because of higher altitude.

In the 1950s, roads to Asahidake Spa (1 050 m) near Tenninkyo Spa, to Ginsendai (1 490 m) and to Kogen Spa (1 231 m) were constructed as new gateway points. The latter two roads were originally constructed to harvest fallen trees damaged by a typhoon, which severely attacked Hokkaido in 1954. Immediately-Ginsendai became popular because of the highest altitude in the six gateway points. At the same time, fragile vegetation in surrounding alpine meadows was damaged at Ginsendai.

In 1967, a tramway with gondolas for 101 passengers was constructed from Sounkyo Spa to the halfway point to Mt. Kurodake. Then, a lift constructed from the upper tramway terminal in 1970, and the motorized access reached to the 1 520 m point. The army surveyors struggled for 3 days to reach the top of Mt. Kurodake from Sounkyo Spa in 1921. Then the trail constructed in 1923 shortened trekking time to 4 hours and 30 minutes. Now, it is just 1-hour walk for 300 m gain after 7 minutes gondola plus 14 minutes lift ride. Thus, Sounkyo Spa, the oldest and the lowest gateway point, became the most popular and developed place. On the other hand, the other tramway from Asahidake Spa to the halfway point to Mt. Asahidake was also constructed in 1968. This terminal is located at the altitude of 1 600 m and became the highest gateway point (Fig. 3).

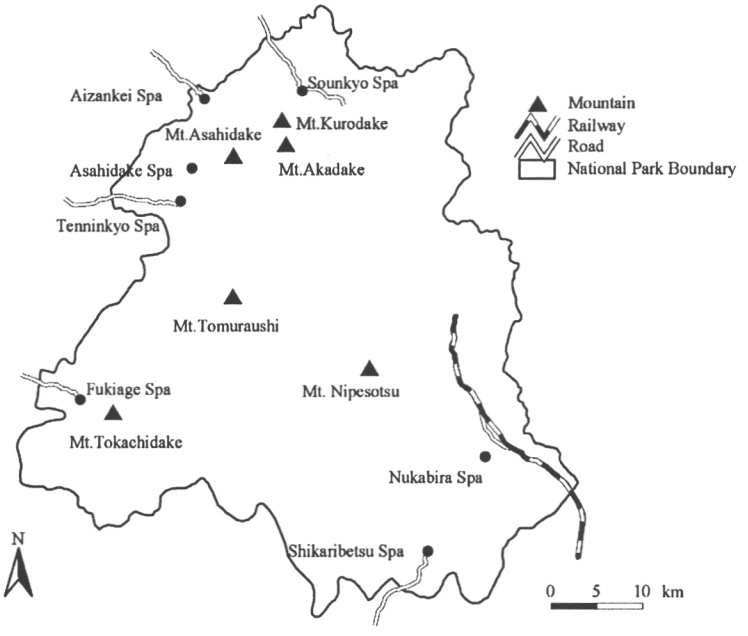


Fig.2 Access Map of Daisetsuzan National Park in 1940

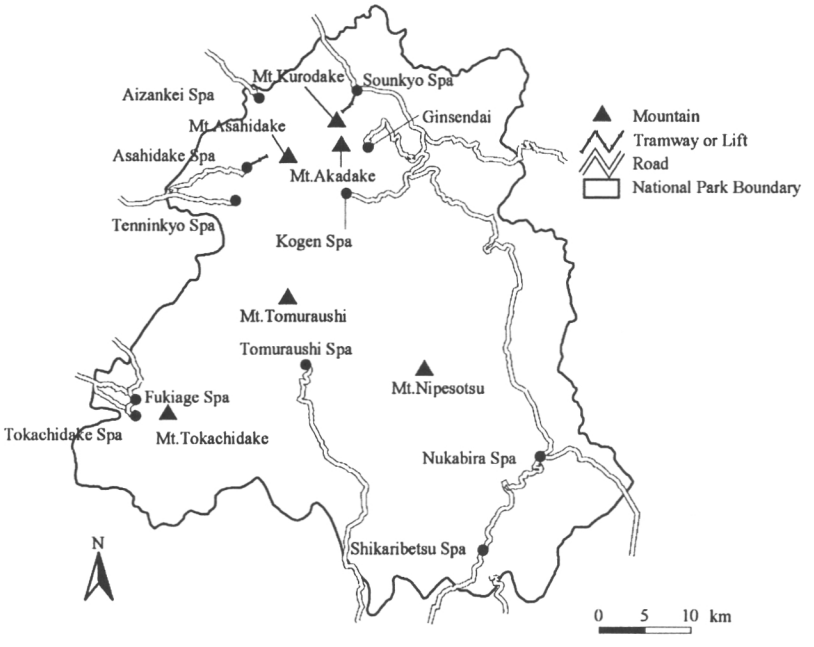


Fig.3 Access Map of Daisetsuzan National Park in 1997

Table 1. Comparisons of Six Gateway Points

	Altitude(m)	Number of Accommodations	Guest Capacity	Road Surface	Road Feature	Tramway
Sounkyo Spa	1520 (tramway terminal)	25	8013	paved	through to the eastern Hokkaido	yes
Asahidake Spa	1600 (tramway terminal)	9	725	paved	dead end	yes
Tenninkyo Spa	623	4	1158	paved	dead end	no
Ginsendai	1490	1	40	unpaved	dead end	no
Kogen Spa	1231	1	56	unpaved	dead end	no
Aizankei Spa	1010	2	90	unpaved	dead end	no

The Table 1 shows the comparisons of six gateway points to the northern Daisetsuzan area. From the review of the access history, it is clear that mountaineers preferred highest and easiest gateway point at each stage. Now Sounkyo Spa is by far the largest developed area. This is because Sounkyo Spa is acting as transit point to other national parks in the eastern Hokkaido connected by Route 39 (Daisetsu National Road) constructed in 1958 while all other points have only dead-end access. This trend can be obvious by comparing transition of visitor numbers (Fig. 4). The pass-through route and the tramway support the dominance of Sounkyo Spa over other gateways. Sounkyo Spa received 2.7 million visitors in 1996. About 10 % of them use the tramway. Thus, the combination of motorized access such as roads and tramways is affecting popularity of gateway points.

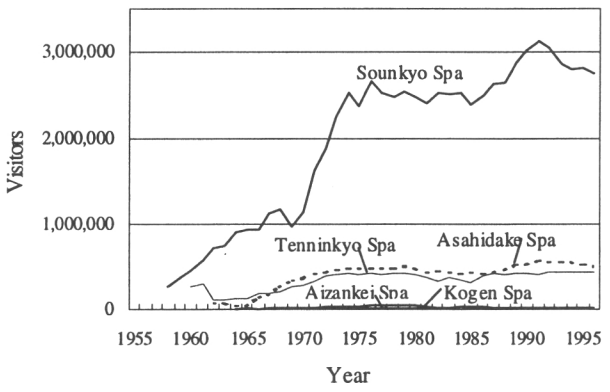


Fig. 4 Visitors to Major Gateway Points

On the other hand, Ginsendai is the least popular gateway for visitors in spite of the third highest motorized access altitude of 1 490 m. This can be attributed to two main factors. First, Ginsendai is the only trailhead without hot springs and other attractive facilities. There is an overnight cabin, but its facility is basic compared with other places. Second, the road to Ginsendai is difficult to drive; namely, narrow and gravel forest road.

Walking Access and its Rigor

Such improvement of motorized access also influence walking access patterns. Millward evaluated trail rigors by the distance (Millward 1996). On flat areas it is reasonable to evaluate trail rigors by the distance. However, the mountain trails in Japan is steep enough to discourage the use of distance in measuring the difficulty. Therefore, in order to follow the changes of walking access rigors, the authors adopted walking difficulty index based on waking time used by Yamaki. He classified the trail into four categories according to required time to reach a certain part (Yamaki 1996). According to the index, level 1 is easy hiking in less than one hour. Level 2 is half-day hike in 4 hours. Level 3 is one-day hike in 8 hours. Finally level 4 is over-night hike for more than 8 hours. Then, the authors produced three GIS maps with weighted trails according to difficulty index.

In 1940 (Fig. 5) there were only three gateway points, namely Sounkyo Spa, Tenninkyo Spa and Aizankei Spa. All the trails connecting mountaintops were ranked as level 4. That is, mountaineers have to stay overnight to reach the mountaintops except for Mt. Kurodake. By 1961 three more gateway points, Ginsendai, Kogen Spa and Asahidake Spa, were added by construction of new mountain roads. Accordingly, the trails with level 4 dramatically reduced (Fig. 6). The construction of two tramways by 1970 wiped out such arduous points from the northern Daisetsuzan area, and every mountain peaks can be reached by one-day hiking. Most of core areas of the park with fragile alpine vegetation fall under the category of day-use areas now (Fig. 7).

Thus, it became clear that isolated places, which required heavy rucksacks with overnight gears to appreciate the landscape, disappeared from the study area with penetration of motorized access to higher altitudes. However, as shown in Figure 8, those with level 1 and 2 did not increase very much, and level 4 had changed into level 3. In other words, accessibility of existing trail did change, but new short trails did not constructed very much. Even after the construction of tramways at Sounkyo Spa and Asahidake Spa, old trails paralleling with the tram routes still exist. However, those who dare to walk such trails are very small in these days.

Visitor Survey Results

It is difficult to distinguish casual visitors with those who came to enjoy hiking or mountaineering from visitor statistics. At the upper terminal of the lift connected from Sounkyo Spa by the tramway, there is a registration point to submit hiking plans. According to such plans, 40 to 50 thousands visitors enjoy hiking from there. Put it differently, 15 to 20 % of tramway passengers are hikers, and the oth-

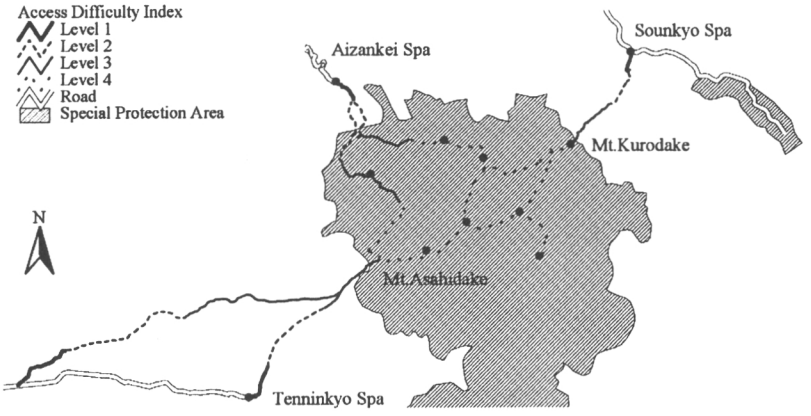


Fig.5 Access Difficulty Index Map of 1940

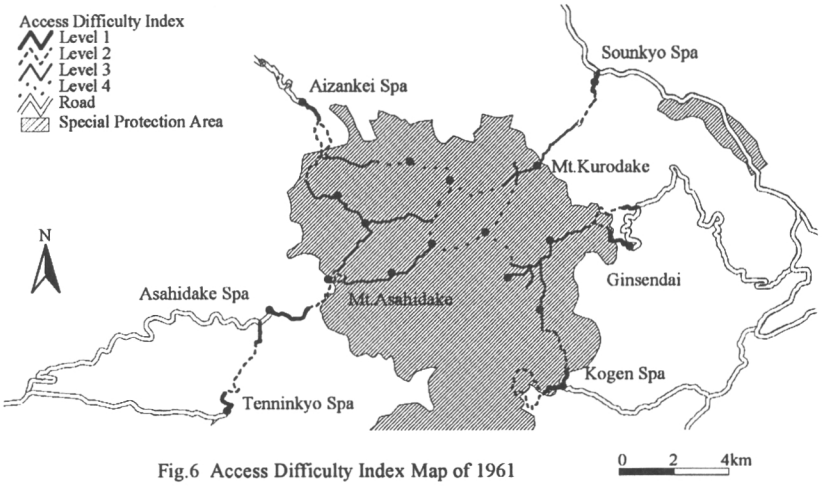


Fig.6 Access Difficulty Index Map of 1961

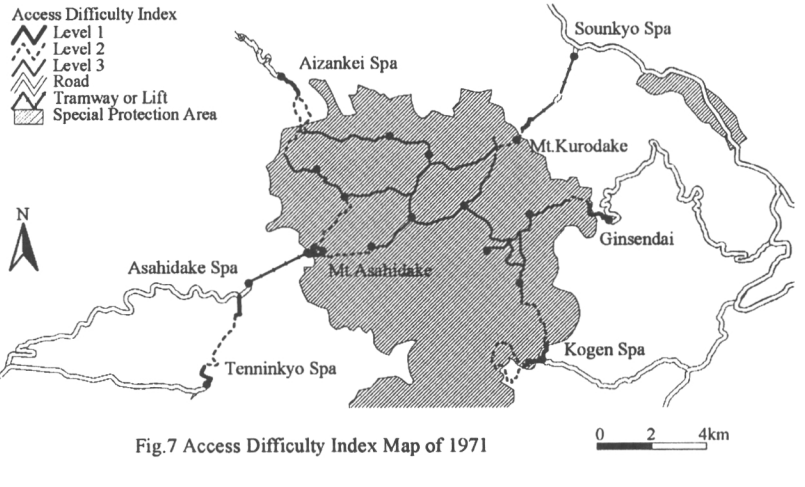


Fig.7 Access Difficulty Index Map of 1971

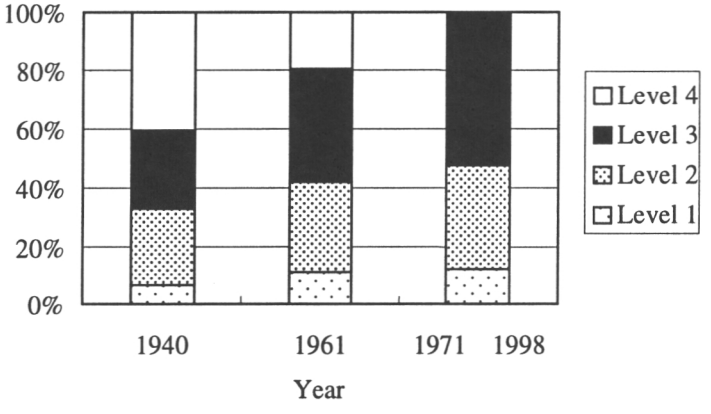


Fig. 8 Transition of Trail Difficulty Shares

ers are casual tourists just to enjoy the scenery from the observation deck at the top of the tramway terminal.

To obtain detailed information on visitors, the authors conducted direct visitor surveys at Sounkyo Spa and Asahidake Spa especially targeting at those who waiting for next gondolas at ticketing gates in 1998. Recognizing the seasonal behavior changes of visitors, the surveys were conducted in summer when wildflowers bloom and autumn for tinted leaves. The four surveys supplied the following answers: 127 on August 15 to 16, 170 on September 13 at the Sounkyo Spa terminal, 85 on August 21 to 22 and 186 on September 12 at Asahidake Spa terminal. Questionnaire included their profile, mode of transportation, itineraries and activities, opinions on trails and other development at Daisetsuzan National Park. Among them, the answers related to access were analyzed below.

First of all, 63 % of visitors in August and more than 70 % of them in September are in their forties, fifties and sixties. Thus, the majorities of visitors are in and beyond their middle age and prefer to use tramways in order to reach alpine zone easily.

Regarding to their origins, 68 % of visitors at Sounkyo Spa in August were from outside of Hokkaido. However, in September, residents in Hokkaido occupy more than 70 % of visitors. This drastic seasonal change is attributable to the fact those from outside are restricted by summer vacation period. Therefore, more long-distance trekkers can be found during summer season. On the contrary, typical autumn visitors come from their hometown by their own cars, then enjoy day hike appreciating autumn leaves. When Sounkyo Spa and Asahidake Spa are compared, those from outside of Hokkaido dominate the Sounkyo Spa visitors. This is because they prefer Sounkyo Spa with through roads to other sightseeing spots like national parks.

Table 2. Experience of the Trail Paralleling with the Tramway

	Sounkyo Spa		Asahidake Spa		Total	
Yes	16	9.4%	24	12.9%	40	11.2%
No	153	90.0%	161	86.6%	314	88.2%
No answer	1	0.6%	1	0.5%	2	0.6%
Total	170	100%	186	100%	356	100%

Table 3. Willingness to Use the Trail Paralleling with the Tramway

	Sounkyo Spa		Asahidake Spa		Total	
Yes	63	37.1%	53	28.5%	116	32.6%
No	104	61.2%	122	65.6%	226	63.5%
Not sure	3	1.8%	9	4.8%	12	3.4%
No answer			2	1.1%	2	0.6%
Total	170	100%	186	100%	356	100%

With regard to the means of access to these two gateway points, more than 70 % of visitors come by their own car or rent-a-car. Those who used such private mode tend to prefer short and easy walk. Furthermore, such day-use visitors expect more access improvement, while overnighters welcome longer walking access.

When the walking experience of the paralleling trails along the tramway was asked in September, 12.9 % answered yes at Asahidake Spa and 9.4 % at Sounkyo Spa (Table 2). This gap will be due to the difference of trail conditions; the Asahidake trail is not only gentler and well maintained, but also separated from the tramway corridors. The questionnaire did not ask when they used the paralleling trails, but casual conversation revealed that it was in their youth before construction of the tramways.

On the other hand, those who expressed their willingness to use the paralleling trail were more than 20 % of tramway users (Table 3). But those who really walk the trail are very small. This gap between intention and behavior hints that they know that more walking give them deeper experiences and other benefits, but they cannot resist the temptation of tramways. Those visitors have potential to be willing hikers if the tramway service is disconnected for some reason.

Discussion

From three approaches to wildland recreation access, the followings are found. First, the development history of Daisetsuzan National Park has been the pursuit of higher motorized gateway points. Hikers always chose the highest point as their trailhead at each stage seeking for shorter and easier walking. Second, the

higher reaches the motorized access, the lower shifted the trail difficulty level. Thus, the area, which requires over-night access to visitors, has disappeared from the Northern Daisetsuzan area at present. However, new trails with access difficulty level 1 or 2 were not added, and total distance of trail did not extend through the history of access improvement. Third, the visitor survey especially on the access to the gateway points and on the access to mountains revealed that there is considerable number of visitors with willingness to walk the trail along the tramway, but the real number is very small.

These analyses clarified that access improvement increase the visitation, especially day users with private cars. Among six gateway points, the visitors always choose easier motorized access and easier walking access with maximum amenity. However, detailed analysis of visitors revealed behavioral differences between casual day hikers and heavy-duty overnight backpackers, or those remain the trail of level 1 to 2 and those walk beyond level 3 as shown in Table 4.

While the former prefer conveniences supplied by private car access or the tramway the latter use public transportation access and do not mind walk the trail along the tramway route. The public transportation preferred by the backpackers because they start from one trailhead and that they often descend to the other route to avoid walking the same trail back. In addition, according to the mountaineering registration, they often come from the area other than Hokkaido. The other finding that the heavy-duty backpacker's willingness to walk the route along the tramway can be explained by two accounts. First, they have enough time, and extra walk of less than three hours does not matter to them. Second, they have more mountaineering experience than day hikers and physically prepared for long walk. Such a behavioral difference is also reflected to opinions on the development of the Northern Daisetsuzan area. Day hikers often preferred more development for comfort and convenience. On the other hand, backpackers expect less development and more natural settings.

Table 4. Access Difficulty Index Related to Visitor's Behavioral Differences

Access Difficulty Index	Low	⟷	High
Access Mode	car sightseeing bus	⟷	taxi public bus
Length of Stay	short	⟷	long
Overnight Accommodation	none (return home)	⟵ hotel or inn around trailheads ⟶	backcountry campsites
Experience of the Paralleling Trail	none	⟷	yes
Willingness to Use the Paralleling Trail	none	⟷	yes
Quality of Facilities	comfort and convenience	⟷	unmodified nature

Based on these relations between visitors and access, the following two points can be suggested to apply motorized access control as wildland recreation management tool.

First, since visitors tend to rely on easier access as long as convenience is available in spite of their willingness to walk, motorized access regulation will be accepted with little resistance if walking benefits such as nature conservation and visitor satisfaction are well explained. Already at Shiragami Mountains World Heritage Site in Aomori and Akita Prefectures, the forest road to its core area is closed to automobiles. Those who want to visit core areas have to walk half day on the closed road before reaching the old trailhead. This action drastically reduced the visitor number and the environmental impacts related to overuse with little complaints. In addition, during the summer season of 1999, Asahidake Spa tramway was completely out of service for renovation. As expected, the visitors to Asahidake Spa decreased during the season. From this fact, we could say many visitors were attracted to Asahidake Spa by easy access supplied by its tramway, and that they prefer 12 minutes ride to two and half hours walk. However, the number of hikers on the paralleling trail is increasing. Interview with some of them revealed that they chose Asahidake Spa trail knowing the tramway is out-of service because they expect quieter atmosphere without the tramway.

Second, not to ignore the demand of casual hiking especially from elders and other with less physical strength, well-maintained hardened nature trails should be constructed around the ending points of motorized access. The fact that the ratio of easy trails is increasing not by new trail construction but by access improvement of existing trails is important. It means that ROS of this area is decreasing since new trails were not added during the development of access. There is a necessity to supply new nature trails with the difficulty level 1 and 2 especially after motorized access to some gateway points is limited.

Conclusion

In conclusion, the authors revealed the motorized access control is a practical tool for wildland recreation management in areas with over-use problems. Motorized access should be regulated, and walking access be enhanced from the point of local and global nature conservation and for rich visitor experiences. Longer walking access is effective to discourage casual visitors and to reduce accompanying overuse problems while enhancing willing- to-walk visitor's environmental experiences. At the same time, this access management method costs very little to managers of protected areas compared with other management tools if they can obtain consensus with access providers. Therefore, the motorized access control can work as a useful wildland recreation management tool.

To realize such suggestions, closing mountain roads and reduction of tramway service is ideal. But, we should not ignore local economy as well as people with

physical limitations. Visitors will walk longer if motorized access is regulated by economic incentives such as higher tramway fares or introducing parking fees at high seasons. At present more than 70 % of visitors come by their own car since parking is free. If parking fee is introduced, more visitors will use public bus. As the result, they will have more freedom to walk to other trailheads while reducing the necessity of parking lots.

Such extra revenue should be directed to improvement of public transportation services and existing trails. Especially, interpretation activities on trails supported by such fund will enhance visitor experiences. Higher cost may divert some visitors to other areas. Even if the total visitation decrease, overnight visitors contribute more to local economy than passing-by day-use visitors, and the impact on the natural environment will be reduced. Thus, motorized access control can be a powerful and effective tool to wildland recreation management.

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Benefit-based Recreational Forest Management in Korea

Won Sop Shin and Reiner Jaakson

Abstract

Benefits-based management seeks to provide recreation benefits for recreation participants by managing the physical environments in which recreation occurs. This study investigates the relationship between benefits desired by visitors and the physical, social and managerial characteristics of settings that facilitate realization of recreation benefits. Data were collected from 370 visitors to Sorak-san National Park in the eastern part of the Korean peninsula. Cluster analysis was used to group visitors desired benefits into twelve domains: relationship with nature/scenery, escaping pressure, learning about nature, family togetherness, introspection, exploration, autonomy/achievement, being with friends, leading others, skills/learning, risk taking, and meeting/observing new people. Multiple regression was used to link benefit domains with the characteristics of settings. The social attribute of recreation settings was found to be linked to eight of the ten benefit domains. There were two strong multiple regression correlations: (1) between "relationship with nature /scenery" and the attributes "forest/water", "attractive nature", and "facility/maintenance" (R.40) and (2) between "escaping pressure" and the attributes "attractive nature" and "social" (R.386). The paper discusses how the findings can be used to develop recreation services and marketing strategies to respond to client needs and preferences.

Keywords: Benefits-based management, Sorak-san National Park, recreation benefits

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Introduction

The goal of resource management to provide high-quality outdoor recreation has been emphasized by many researchers (Driver and Tocher 1970, Manfredo, Driver and Brown 1983, Lee and Driver 1992, Stein and Lee 1995). The "Benefits-Based Management" (BBM) framework has been developed to guide recreation resource policy analysis and management (Bruns et al. 1994) with the goal of facilitating the realization of recreation benefits. In BBM a benefit is defined as a desirable change of state or improved condition of an individual, a group of individuals, a society, or even nonhuman organism or the prevention of a worse condition by sustaining the desired condition (Driver et al.1987). A benefit therefore is an improved condition in the users which results due to how recreation resources have been managed. As with other management strategies, BBM aims to provide recreation services without causing damage to individuals or groups of users or to the natural environment. However, BBM goes further than more traditional management approaches by positing that if a recreation opportunity were not provided, users who have been denied the opportunity may experience a reduction in or frustration of their desired goals (Driver 1994).

BBM builds on and is an extension of the activity and experience-based approaches to recreation resource management (Lee and Driver 1992). Activity-based management views a recreation opportunity as an option for people to participate in a specified activity such as camping, fishing, hiking, etc. This approach is primarily supply oriented and is focused on facilities with relatively little attention given by managers to what benefits recreationists actually obtained from a specific activity. Management objectives were defined in terms of numbers of activity opportunities to be provided, with lesser concern for what constitutes quality recreation (Driver 1994). BBM extends the definition of recreation participation to mean more than simply the participation in activities, and instead focuses on the psychological outcomes and experiences realized from recreation. The word "experience" is used synonymously with the word "psychological outcome", to denote a specific type of response, such as feeling relaxed, invigorated, closer to members of one's group or family, more self-reliant/ confident, or more knowledgeable (Lee and Driver 1992). The BBM approach to recreation postulates that recreation outcomes are produced and realized by individuals and that managers have the ability to manipulate recreation settings to directly or indirectly influence recreation behaviour so as to produced recreation experiences and benefits for the visitor (Brown 1984). This approach is founded on a systematic understanding of the relationship between the characteristics of recreation setting, and the recreation experiences made possible by those setting. Using BBM principles, forest recreation managers can manipulate the physical, social, and managerial characteristics of the setting where recreation takes place, in order to facilitate opportunities for the visitors to achieve desired experiences. BBM expands on the Recreation Opportunity Spectrum (ROS) approach to

recreation management, which is based on the premise that the providing a diversity or spectrum of recreation opportunities through management of recreation settings will help ensure that a variety of visitors will be able to achieve desired recreation experiences (Stein and Lee 1995).

BBM as experience-based resource management centres on the key ideas (1) that the reason public recreation opportunities are provided is because people benefit from them and (2) that management will be most responsive, efficient, and effective when it explicitly targets specific types of benefit opportunities that will be provided at designated locations. These goals are achieved by providing activity and associated setting opportunities defined in terms of the beneficial experiences and other responses that may be realized from using those opportunities. However, BBM looks not only at individual recreation benefits, but also at social, economic, and environmental benefits. For example, people can improve their cardiovascular systems while hiking (Froelicher and Froelicher, 1991), they can learn more about the environment while experiencing the outdoors (Roggenbuck et al. 1990) or they can strengthen family bonds while camping (Orthner and Mancini 1991). In summary, BBM is focused on the beneficial consequences of forest recreation opportunities in terms of maintaining or improving the lives of individuals and groups of individuals. Benefits are the outputs around which recreation managers formulate their decisions, achieved by providing an array of recreation opportunities from which the visitors can choose. Clearly, a site may generate more than one type of benefit from several compatible recreation activities.

In order to achieve high quality recreation experiences which will generate desired benefits for the visitors, managers should have some knowledge of the relationship between resource characteristics and benefit outcomes (Stein and Lee, 1995). Managers have to understand how different resource characteristics influence the experiences and benefits of recreationists. However, the link between the setting of recreation and the beneficial outcomes of recreation is extremely difficult to determine. An attempt to identify this linkage has been the focus of a number of studies, including the study discussed here. The study had the objectives, first, to determine what benefits recreation visitors perceive to be desirable and, second, to explore the relationship between desired benefits and the characteristics of the settings which are conducive to the achievement of those benefits.

Methods

The Study area

Sorak-san National Park, consisting of 373 square kilometres of rugged mountains and valleys, is located in the eastern part of Korean peninsula. The park has the third highest mountain in Korea, Mount Deacheongbong, at 1 708 metres. The park was established in 1970 to protect some of the most scenic and signifi-

cant landscapes in Korea and to provide opportunities for recreation and nature appreciation. The Sorak-san National Park has a wide range of physical and social attributes.

Respondents

The population of this study consisted of visitors in Sorak-san National Park. There were 377 respondents in this study: 57 percent males and 43 percent females. Respondents ranged in age from 18 to 65 years with a mean of slightly under 34 years. Most of the respondents were high school or college graduates.

Instruments

The selection of benefit items was taken from scales developed by Driver and Brown (1975) and modified for this study. A panel of Korean experts evaluated whether each item on the original list could be adapted to the respondents in the Korean study. The benefit items were rated on a nine point scale which measures whether an attribute item adds to or detracts from the recreation experience of visitors to the park. The attribute items in the questionnaire enable the respondents to indicate which specific attribute items contributed to their recreation experience. Attribute items were refined further through a Delphi survey of a panel of 17 experts who rated the attribute items on a five point scale which measures whether an item adds to or detracts from the experience of visiting Sorak-san Park.

Data Collection

A sample of 377 visitors to Sorak-san National Park was interviewed during the summer and fall seasons of 1999. Each day of the sampling period was divided into two sampling blocks: morning (7:30 a.m. to 12:30) and afternoon (1:00 p.m. to 6:00 p.m.) Sampling blocks were drawn randomly and trained interviewers were assigned to contact visitors at one of several interview locations throughout the study area during the selected sampling block period at defined sampling locations. The selected visitors were briefed about the study and the questionnaire was then administered to those who agreed to participate in the study.

Results

Benefits Preference

Ward's (1963) method of hierarchical cluster analysis was used to reduce the list of benefit items to twelve mutually exclusive benefit domains. Each respondent´s desirability scores for benefits included within each domain were averaged to create a mean desirability score for each benefit domain. Visitors desirability means

Table 1. Benefit domains and the individual benefits that compose those domains.

Cluster Name and Content	Mean[a] (S.D.)	n
RELATIONSHIPS WITH NATURE/SCENERY	8.02	
Viewing the scenery	8.07 (1.18)	368
Viewing the scenic beauty	8.01 (1.25)	369
Enjoying the sound and smell of nature	7.97(0.129)	368
ESCAPE PRESSURE	7.73	
Giving your mind a rest	7.92 (1.36)	369
Being away from noise	7.88 (1.33)	369
Getting away from the usual demands	7.77 (1.48)	369
Releasing tensions	7.62 (1.52)	369
Tranquility	7.44 (1.62)	369
LEARNING ABOUT NATURE	7.66	
Being close to nature	8.09 (1.13)	369
Learning more about nature	7.42 (1.41)	368
Study nature	7.40 (1.61)	370
FAMILY TOGETHERNESS	7.58	
Doing something with family	7.62 (1.45)	369
Bring the family closer together	7.53 (1.61)	371
INTROSPECTION	7.46	
Thinking about good time you had	7.55 (1.37)	369
Thinking about what you are	7.55 (1.58)	369
Thinking about your personal values	7.29 (1.52)	367
EXPLORATION	7.32	
Experience new and different things	6.84 (1.62)	367
Having a change from daily routine	7.80 (1.48)	369
AUTONOMY/ACHIEVEMENT	6.83	
Gaining a sense of self-confidence	7.03 (1.73)	367
Learning what you are capable of	6.89 (1.71)	367
Being free to make your own choice	6.80 (1.70)	369
Feeling your independence	6.59 (1.71)	368
BEING WITH FRIENDS	6.48	
Being with friends	7.01 (1.71)	366
Sharing what you have learned with others	6.59 (1.62)	368
Being with others who enjoying the same thing with you	6.33 (1.90)	365
Teaching your outdoor skills to others	5.97 (1.81)	366
LEADING OTHERS	6.31	
Showing others you could do it	6.57 (1.75)	368
Helping direct the activities	6.04 (1.85)	368

table 1. continues

Table 1. Benefit domains and the individual benefits that compose those domains.

Cluster Name and Content	Mean[a] (S.D.)	n
SKILLS/LEARNING	6.29	
Experiencing excitement	7.04 (1.65)	365
Developing skill and abilities	6.53 (1.74)	368
Testing your abilities	6.27 (1.85)	367
Testing and using your equipments	5.32 (2.23)	367
RISK TAKING	6.06	
Changing dangerous situations	6.61 (1.99)	368
Taking risks	5.50 (2.11)	366
MEETING/OBSERVING NEW PEOPLE	5.99	
Talking to new and varied people	6.23 (1.78)	367
Being near others who could help	6.03 (1.84)	368
Observing other people	5.72 (2.02)	369

[a]A 9-points scale was used where 9 equaled most strongly added to experience outcome and 1 equaled least strongly added to outcome.

for the twelve benefit domains and the individual benefit items that clusered within each domain are presented in Table 1. These clusters were titled Relationships with nature/scenery', 'Exploration', 'Learn about nature', 'Escape pressure', 'Autonomy/achievement', 'Skill/Learning', 'Introspection' 'Family togetherness', Being with friends', 'Meeting/observing new people', 'Risk taking', and 'Leading others.' Sixteen of the 53 items were not assigned to any clusters because they had a communality with the remaining items of less than 0.20. Clusters in Table 1 are listed from highest to lowest mean scores.

Settings Attributes

Attribute items were grouped together based on five physical/biological, managerial, and social categories (Table 2). The Forest/water" and Attractive nature domains are composed of attributes related to the physical/biological category. The "Information and Facility/Maintenance domains are composed of attributes relating to managerial category. The Social domain includes the two attributes "crowding" and "type of company". As Table 2 shows, the respondents rated the Forest/water related domain as being most important for their experience.

Table 2. Attribute domains and the individual item.

Cluster Name and Content	Mean[a] (S.D.)	n
FOREST/WATER RELATED	4.69	
Clean water/valley	4.94 (.24)	376
Beautiful forests	4.93 (.29)	376
Biodiversity	4.19 (.89)	368
ATTRACTIVE NATURE	4.45	
Outlook	4.65 (.65)	372
Sound by nature	4.40 (.85)	372
Nature trail	4.30 (.92)	372
FACILITY/MAINTENANCE	4.39	
Clean of facility	4.46 (.92)	368
Scenic beauty maintenance	4.37 (.87)	370
Trail maintenance	4.36 (.87)	372
INFORMATION	3.85	
Booklet/leaflet	4.07 (1.07)	368
Interpretation	4.01 (1.00)	369
Variety of program offered	3.46 (1.13)	367
SOCIAL	3.83	
Crowding	3.99 (1.01)	370
Type of company	3.66 (.98)	365

[a]A 5-point scale was used where 5 equalled most strongly added to experience outcome and 1 equalled least strongly added to outcome.

Setting Attribute-Benefit Relationships

To test for links between preferred setting attributes and preferred benefits, multiple regressions were performed. Multiple regression identified the setting attributes which are predictive of each benefit domain. Table 3 shows each benefit domain, its predictor attributes, multiple R, and R square. Attributes which are significant at p> .0005 are shown.

Table 3 shows that there are significant linear relationships between ten benefit domains and, in each case, one or more attribute domains. The R square ranges from 0.152 for Relationships with Nature/Scenery to 0.052 for Risk taking. Four benefit domains have an R square of 0.10 or more. The data indicate that 15 % of the variability between relationships with 'nature/scenery' and the attribute dexplained (R squared 0.152). The 'Social' attribute domain is a predictor variable for eight benefit domains, the 'Attractive nature' for three benefit domains, and the 'Forest/water' and 'Information' for one benefit domain. Two of the benefit domains are not resource dependent: 'Exploration' and 'Skill/learning.'These benefits might be dependent on other, unknown attributes beyond the scope of this study.

Table 3. Significant (0.0005) multiple regression analysis results relating setting attributes (predictor variables) to benefit domains (criterion variables.)

Cluster name and content	Attribute Domain	Multiple R	R2	F
RELATIONSHIPS WITH NATURE/SCENERY	Forest/Water Attractive Nature Facility/Maintenance	.405	.152	13.454
ESCAPE PRESSURE	Attractive Nature Social	.386	.137	12.079
LEARNING ABOUT NATURE	Attractive Nature	.345	.106	9.259
FAMILY TOGETHERNESS	Social	.299	.076	6.795
INTROSPECTION	Social	.365	.121	10.565
EXPLORATION	–	–	–	–
AUTONOMY/ACHIEVEMENT	Social	.287	.069	6.146
BEING WITH FRIENDS	Social	.327	.094	8.124
LEADING OTHERS	Social	.310	.083	7.311
SKILLS/LEARNING	–	–	–	–
RISK TAKING	Social	.256	.052	4.797
MEETING/OBSERVING NEW PEOPLE	Information Social	.332	.097	8.493

Discussion

The focus of this study was to identify the relationship between the benefits desired by recreationists and the attributes of natural environment settings that are conducive to the achievement of those benefits. The data indicate that the benefits recreationists desire are related to particular physical, managerial, and social characteristics of the recreation setting. The benefit domain "Relationships with nature/ scenery, for example, was linked significantly to the "Forest/ water related and Attractive nature attribute domains, while the benefit domain Being with friends was significantly related to the Social attribute domain. There are several park and resource management implications of these findings. As Stein and Lee (1997) have argued, managers cannot provide benefits directly but they can manage recreation settings to create opportunities for the visitors to achieve particular experiences and benefits. The results of the present study are useful to managers in their efforts to provide recreation opportunities for visitors to achieve beneficial outcomes. Table 3 shows that the 'Social' attribute is linked with eight out of ten benefit, perhaps because visitors to the study area are motivated by the psychological goals of finding solitude, getting away from the crowds and city conges-

tion, escape from frustrating or boring work, and escape from routine, the familiar, and urban stress. These results are consistent with the findings of Driver (1972) regarding the stress-mediating value of outdoor recreation and his premise that outdoor settings, especially wilderness, provide opportunities for finding release from the psychological pressures of crowding.

The usefulness of the results of this study to the marketing of public or private outdoor recreation lands can be illustrated by focusing on the linkages between settings and benefits. Declining public sector budgets, competition by the private sector, uncertain political support, and other factors have forced public recreation agencies to operate at a higher level of accountability and efficiency by using aggressive marketing strategies (Crompton and Lamb 1986). Outdoor recreation managers can use market segmentation to differentiate between various benefits and experiences and thereby determine which particular resource settings are most likely to be used by recreationists seeking particular benefits. The benefit-based management approach also shows promise as a useful framework for private sector planning and management of outdoor recreation where managers often must follow rather narrow marketing strategies focused on a specific market segments (Floyd and Gramann 1997). The findings from the present study offer guidelines for owners of private operations to identify those specific market niches in which visitors may gain the greatest benefits from visiting their sites.

The key finding in this study has been to specify the link between recreation means and recreation ends. That is a recreation opportunity as the opportunity for a person to engage in a recreation activity in a defined setting where the characteristics of that setting (the recreation means) help to achieve predictable recreation benefits (the recreation end). Future research is desirable to investigate further how this means ends schema may be used to greatest benefit in planning and management of natural resources by both the public and private sector. Research using populations and natural environment settings different from the ones used in this study and including a greater array of benefits, would be of interest. This is an area of inquiry that remains rich with potential for further theoretical and applied research.

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Chapter 2

Nature experiences and sustainable management of landscapes and recreation resources

Sustainable Management of Natural Resources: Is It Possible at the Urban-Rural Interface?

Joanne M. Westphal

Abstract

Despite the vast landmass of the United States, resource managers, landscape architects, and planners are becoming increasingly aware of the difficulty in protecting natural resources at the urban-rural interface. Part of the problem stems from the fact that a comprehensive national land use plan has not been forthcoming from the federal government. Thus, state, county, and local government bodies have been left to determine priorities in land use as well as preservation and/or protection strategies for properties under their jurisdiction. Because each of these layers of government has different agenda, oftentimes, a coordinated, effective land use planning effort that could protect natural resources, especially at the urban-rural interface, is impossible to develop. This paper examines historic land use management tools in the United States from a planning perspective, and it provides insight to the political and economic factors that determine the success or failure of these tools to create and/or enhance sustainable landscapes. Suggestions for alternative land use planning strategies in the face of urban sprawl are provided using a case study from a rapidly growing area in Michigan (USA).

Keywords: Sustainable Landscapes, Land Use Planning, Urban-Rural Interface

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The Problem

The United States is blessed with abundant natural resources, prime agricultural land, and a landmass that exceeds 3.5 million square miles. From the perspective of most countries, it seems that the United States would be the least likely country struggling with issues of natural resource protection and sustainability. However, because of it unique constitution, any rights not specifically assigned to the federal government have been reserved for the states. Land use planning falls under this rubric. Therefore, despite its landmass and extraordinary resource base, historically the United States has failed to have a unified, singular plan of action for protecting its land legacy. The consequence of this failure has been to allow states to determine the appropriate use of the land; and they in turn have relegated the responsibility to local governments. The result has been a patchwork of rules, regulation, land use ordinances, and planning strategies, based on county, township, and/or municipal government priorities and policy.

In the past, the abundant natural resources and landmass of the nation could absorb the population growth of a civilization less than 200 years old. But even with abundant resources, some destruction of different segments of our natural resource base took place (e.g., lumber baron years of the late 1800's, extinction of the passenger pigeon in the 1930's, etc.); but never was land – the underpinnings of those natural resource segments – so directly and irreversibly attacked as it is today.

This attack is taking place in every geographic region of the country – from the sparsely populated intermountain areas of Montana to the densely populated urban corridor between Washington, DC and Boston, MA. Anywhere an urban-rural interface exists, a battle is going on between forces that wish to develop the land for its real estate (or fair market value) and those who wish to protect and preserve it for its natural resources and agricultural value.

In Michigan, a Midwestern state, over one million acres (0.4 million ha) of its 11 million acres (4.4 million ha) farmland has been converted to primarily residential land use over the past 15 years (Michigan Farm Bureau, 1999). With residential development, has come the need for commercial and industrial land use. Many of these acres are in prime agricultural landscapes that once surrounded and served as a source of food for urban areas. Other acreage also has been threatened by development due to its potential for recreational use; these areas include acreage in unique wildlife, forest, riparian, and/or dune ecosystems.

Land Use Planning Tools

Legal Framework

Three basic legal doctrines provide the underpinnings to the regulation of land use in the United States – property rights, police power, and takings/eminent domain. Each of the doctrines is discussed extensively by a number of authors (Machemer, et al 1999, Wright 1994, Hagman and Juergensmeyer 1986, Barlowe 1978). A brief synopsis of each concept based on the work of Machemer et al (1999) follows.

Property rights is a concept that emanated from the English land tenure system and goes back to the Middle Ages in terms of its origin. Although often thought of as an absolute right (Wright 1994), in the American system of land ownership, the real property owner actually holds the rights to use the property in an exclusionary manner. These rights include deed restrictions, liens, mineral resources, easements, use, and development rights (Michigan Department of Environmental Quality 1995). These property rights, according to Barlowe (1978) are "subject to the controls and limitations vested in the sovereign power", in this case the states. Therefore, the overall interests of society especially as they affect the health, safety, and general welfare of the general public will always supercede the individual rights to use the property.

Police powers involve the right to legislate and regulate on the behalf of the citizens. State, county, township and/or municipalities can exercise police powers through planning and land use controls and ordinances on the grounds that they are protecting the general welfare. This power can be exercised even though it places burdens on the individual landowner's use and enjoyment of the property. Limitations exist in terms of the regulations/restrictions that can be placed on one's private property in the federal constitution so some balance between government and citizen interests in property is insured.

Takings and eminent domain are concepts that involve the authorization of government to take property for public use. Often this is done through condemnation or expropriation proceedings. In all cases, the property owner must be justly compensated for the loss and a due process of law must be followed.

Practical Operation of the Legal Framework

Because land use in the United States occurs within a legal as well as institutional framework, it is not considered to be federally regulated. As a result, responsibility for land use planning has been assumed by the states. Because few states have statewide land use planning systems, most planning activities are enacted at lower levels of government – often at county, township, and/or municipality levels. In Michigan where over 1 800 planning entities are working in the absence of statewide and regional planning systems, the creation of effective land use poli-

cies that support sustainable ecosystems and protect natural resource health are nearly impossible to achieve (Wyckoff 1997, Michigan Department of Natural Resources 1992). Other states even those with statewide plans, face similar situations.

States empower local government through "enabling legislation" to exercise land use planning decisions and to control land uses by zoning regulations. In Michigan, four state planning acts and three legislative zoning acts provide local authorities with the power to place restrictions on the land and its property owner. "Zoning" regulates land use by delineating boundaries between areas that are set aside for certain uses (e.g., agriculture, commercial, industrial, or residential use). Within each use zone, certain restrictions will apply for buildings in terms of size, height, and occupancy, setbacks from property lines or roads, minimum parcel size and/or percent of parcel (in square footage) that can be developed. Variations in standard zoning exist, including sliding scale zoning and open space zoning. Each of these variations attempts to preserve agricultural or open space by permitting certain densities of buildings (especially residential buildings).

Other techniques that can be used to regulate land use are districting and development review; creation of planning and zoning commissions; and enforcement activities involving fines, closure, and/or removal. In districting, certain areas within a municipality or township are designated for certain uses – e.g., central business districts are often delineated for commercial use with certain structural densities, architectural standards, or special taxing. Likewise, historic districts can be defined and certain land use restrictions placed on property owners within the district to protect its historic integrity. Development review requires developers to present concepts for subdivision layout (including lot lines, roads, open space, and non-motorized circulation) before construction of the site commences. In some cases, the review process is facilitated by local government when housing developments called Planned Unit Developments (PUDs) – a form of open space zoning – are proposed; PUDs conserve open space by clustering housing on smaller, more densely placed lots within the allotted zoning guidelines for the land parcel. Another strategy for land development is New Town development, which basically calls for the creation of villages or hamlets on a designated piece of property by moving development rights from one part of the property and concentrating them in another part. Finally, planning and zoning commissions can recommend to a township board that special use permits be granted to a property owner that allows a use not normally permitted on a property by zoning regulations. An example is permitting a bed and breakfast establishment to be created in a "single-family" residentially zoned area of a township or municipality. All of these established planning and zoning tools have been used in Michigan to control land use for some time (MSOP 1995a). Similar legislation exists in other states.

Modern planning methods and/or tools have not been enacted in many states; and Michigan is no exception. Among the more progressive land use planning techniques needing enabling legislation is Transfer of Development Rights

(TDR), Purchase of Development Rights (PDR), use value assessments, concurrency, and service district creations. TDR involves creating zones (areas) on a regional scale where additional development rights can be sent (or deposited) and thus housing density is increased; these additional development rights would be purchased from landowners based on their fair market value. These rights must be sent from areas where lower residential development is desired; thus these latter areas are called "sending zones". A PDR program involves the creation of an ordinance that authorizes local government to purchase development rights from private citizens on the behalf of all citizens within its jurisdiction. The purchase of the development rights may be financed by bond issues, loans, or property tax increases. Private landowners are compensated for removing development rights from their properties based on the difference between the fair market value of the property with, and without, the development rights. Use value assessment involves the establishment of property tax value based on the parcel's current or designated use, rather than its maximum economic use. Concurrency calls for development only after or concurrent with the provision of public services (like water, sewer, roads, schools, policy, fire, etc). A service district (also known as urban growth boundaries – UGB) is a growth management technique that establishes boundaries for development within a time context; needed infrastructure within the district reinforces the boundary by keeping land development costs lower to the developer. Growth tends to occur in concentrically larger spheres. Some limitations to this technique occur due to economic windfalls or wipeouts that can be created depending on the placement of the boundary.

Factors Contributing to Urban Sprawl and Lost Sustainability of Natural Resources

Low-density housing patterns have marked residential development over the past half century in the U.S.. An offshoot of Levittown, New Jersey (the first single use residential suburb developed in the 1930's), the concept was embraced as the "American Dream" by post World War II society in the United States. Because these developments required large tracts of undeveloped land at relatively low cost to the developer, agricultural and natural areas on the outskirts of municipalities became prime targets for this type of development. As these housing developments moved further from the urban cores, greater dependence on the automobile occurred since mass transit became less efficient in serving these far-flung urban fringe communities (MSOP 1995b).

Increased reliance on the automobile became a reality as residential communities moved away from the mass transit service areas that normally supported a densely configured urban core of residential, commercial, and industrial use. With the advent of the interstate highway system in the early 1950's, Americans were able to access formerly remote areas (due to time and distance limitations)

in relatively short time periods and with unprecedented ease. Travel in and through the countryside allowed many Americans to experience nature for the first time; this fact, when coupled with the social unrest of many urban areas in the 1960's, resulted in many families moving from cities and establishing residences in the countryside. Dependency on the automobile became a way of life, as commuting to one's job or school marked the lives of many American families in the 1970s–1990's.

Several phenomena contributed to the problem. Public policies, including transportation policies, favored highway development at the cost of mass transit and rail systems. Subsidies and tax practices that allowed home mortgage interest deduction and capital gains exemptions encouraged Americans to purchase increasingly larger, single family residences, further from the urban core. Environmental policies that discourage the reuse of brownsites and/or the adaptive reuse of former industrial or commercial sites for residential occupancy have contributed to residential development of the countryside. With residential development comes the need for infrastructure like sewer and water, fire and police, and schools. Once this infrastructure is in place, areas between the former boundaries of the municipality and the new suburb "fill in" with commercial buildings, so further development of the rural landscape occurs. Finally, as communities disperse over a broader area, the need to concentrate jobs in centralized locations becomes less compelling, and industry begins to disperse across the landscape as well.

Finally, competition for the property tax base among local governments has resulted in townships competing for commercial and residential development. Oftentimes, this development occurs at the expense of unique ecosystems or prime agricultural land. The belief that tax benefits outweigh the intrinsic value of intact natural ecosystems and open space is often the short-sighted argument that many municipalities embrace as they re-zone land from agricultural use to residential or commercial uses at the rural-urban interface. Studies by the American Farmland Trust (1997) show that the benefits to cost of particular types of land use when compared to the costs required in infrastructure development (e.g., commercial tax revenues generated: infrastructure costs to support this type of use) is substantially lower on lands designated as "agricultural" in use.

Case Study of the Old Mission Peninsula

This case study was chosen to illustrate that sustainable land management can occur in the United States if citizens are willing to take some risks, and assume some costs, to protect the natural resources of an area. The case study has evolved over the past 10 years, but it had its humble beginnings in the bankruptcy sale of a large farm on the Old Mission Peninsula. Concerned citizens were instrumental in encouraging local government to seek means for protecting viewsheds, open areas, and agriculture; they also followed through by funding the first locally based PDR

program in the nation. Standard planning and zoning techniques were combined with modern ones to create a unique Agricultural Plan for the study area.

The Old Mission Peninsula is in Peninsula Township, Grand Traverse County, in the Northwest corner of the lower peninsula of Michigan. An unusual physical landmass, the township occupies a narrow sliver of land that is 17 miles (27.37 km) long and 1.25–4 miles (2 km–6.44 km) wide; its long, thin configuration literally bisects two-thirds of Grand Traverse Bay in a south to north direction. The peninsula is known for its unusual topographic relief and microclimate, which permits the production of stone fruit at a latitude of 45 degrees north. In North America, this is one of the most northern areas on the continent for this type of fruit production. As a result, it is one of the premiere agricultural areas in the United States for tart cherry production; sweet light and dark cherries, peaches, apricots, and plums also are produced. In the last twenty years, production of *Venifera sp.* grapes has begun.

In 1972, the first subdivisions for residential development were created on two farms located near the base of the peninsula, approximately three to five miles from Traverse City, MI. As Traverse City grew in the 1970's and 1980's, more subdivisions were platted on agricultural land in the southern areas of the peninsula. Initially, shoreline parcels were sold and developed because of their relatively low productivity (due to heavier soils) as compared to the sandier soils found in the upland areas of the peninsula. But as shoreline property became scarce and the value of shore lots began to quadruple in cost, residential developments began to move further north and claim more prime agricultural land at the higher elevations and ridge tops. In 1989, the township lost one of its largest agricultural producers to bankruptcy. As this 505 acre (202 ha) farm was put up for sale on the northern tip of the peninsula, the citizens of the township decided that action beyond their standard zoning regulations was necessary if agriculture and the remaining natural areas were to be protected.

Township officials organized citizen groups to identify the key issues affecting quality of life on the peninsula. Groups focused on farmland preservation, open space and natural area conservancy, business development, and residential needs. Each group identified priorities that the Planning and Zoning Commission (PZC) needed to address in updating the 1972 Master Plan for the township. As a result of the citizen focus groups, the PZC put forth a number of proposed revisions to ordinances in the Master Plan. One of the revisions called for the creation of a subplan within the Master Plan, which was, called the Agricultural Preservation Plan. This "plan within a plan" called for the creation of a four part program designed to protect the agricultural and natural resources (including visual resources) of the township. The four part Agricultural Plan included: 1) a Purchase of Development Program (PDR); 2) a Transfer of Development Program (TDR); 3) a facilitated Planned Unit Development (PUD); and 4) a New Town Development (NTD).

In at least one case (i.e., the TDR), enabling legislation from the State Legislature was not even available to enact such a program at the local level. The township, however, felt confident that development pressures elsewhere in the state would inevitably lead to the State Legislature adopting such legislation for local government use. For the other parts of the plan, township officials were encouraged to interpret existing legislation for planning and zoning purposes very liberally with the expectation that at least one (the PDR program) part had a good chance of being challenged in court. The facilitated PUD was the easiest part of the four-part plan to adopt since only a revision of an existing township ordinance was needed to operationalize this planning tool. The New Town Development took several years, and hundreds of man-hours in design, planning, and engineering activities, to develop concepts acceptable to the residents of the township and to private developers. The idea behind the (NTD) was that it would serve as a receiving zone for development rights that were sent from sending zones where the township wanted less development. Thus, a high density, village hamlet would serve to concentrate development rights that were not purchased in the PDR program. Since the private sector would purchase the development rights from local property owners, the township only served to define the boundaries of the sending and receiving zones within its legal jurisdiction. Because NTD depends on a TDR program to become operational, it is temporarily stalled until the State Legislature passes enabling legislation for local TDR programs.

The mainstay of the four part Agricultural Preservation Plan, however, was the PDR program. The PDR program called for the purchase of development rights from local landowners who had property in one of 13 important viewsheds *and* prime agricultural or natural resource lands. These two important criteria – viewsheds and prime agricultural/natural ecosystem lands – were the basis upon which properties were prioritized for the program. A third consideration was whether adjacent properties were in the PDR program. Landowners who voluntarily entered the PDR program had a portion of their development rights stripped from the property, and they were compensated at the difference between the fair market value of the property with, and without, the development rights. The township then holds these development rights in perpetuity on the behalf of all residents.

To pay for the development rights, a referendum vote of township residents was necessary. Money for purchasing the development rights from property owners was authorized through a 1.25 mill increase in property taxes. (A 1.25 mill increase means that a person owning a $100 000 home would be assessed an additional $125 00/year over fifteen years to fund the program). The amount of mileage increase was determined by two factors: 1) the unlikeliness that voters would authorize a larger increase; and 2) the anticipated cost of purchasing development rights (which was believed to be around $1 800/acre). Because development rights from at least 2 000 acres (800 ha) were projected as necessary to protect the critical mass of farmers and landowners sensitive to sustainable agriculture, the mileage increase needed to generate at least $3.6 million dollars. A successful

campaign for passage of the ordinance and the referendum to fund the ordinance occurred in the spring and summer of 1994, respectively (Bidwell 1996). With these successes, township officials began negotiating with landowners who had voluntarily entered the PDR program after appraisals were completed on each property. A citizen committee arbitrated on any issues arising from the ordinance or its administration by the township.

At its conclusion in 1999, the PDR program actually protected approximately 1 100 acres of farmland and natural areas on the peninsula. Escalating land values and delays in entering conservation easements with landowners resulted in fewer acres being purchased at increasingly inflated market values. As development rights were removed through the PDR program, remaining lands with development rights became even more valuable (a basic law of supply and demand). But even with fewer acres protected, a major stride was taken forward by this local township effort. With the PDR and PUD parts of the Agricultural Plan in place, the stage is set to enact the remaining two parts of the program – the New Town Development and the Transfer of Development Rights program.

Conclusion

The success of the Old Mission peninsula in creating, funding, and implementing an initiative such as this, was entirely anti-thesis to the prevailing practice of land use planning and environmental protection in the United States. It is presented here to illustrate the power of citizens in a democracy to elicit change in government when such change is necessary to protect valuable natural resources and farmland. By building a consensus among citizens as to the types of land use planning programs and/or strategies that can be effectively implemented on a local level, tremendous support for relatively expensive local programs can be obtained. Peninsula Township success comes from the fact that it was a grass-roots effort of local citizens who asked their government officials to help them achieve a certain goal with objectives. Government responded by finding legislation that appeared to allow certain planning strategies to move forth. The key was being able to operationalize the strategies in terms of ordinances and practical programs of purchase; this is what allowed the dream of a sustainable environment to become a reality. Today, the Peninsula township serves as an excellent model for other local bodies of government who have been reticent to initiate more modern tools of planning and zoning.

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Assessment on Recreational Impacts in Malaysian Recreation Forests

Noor Azlin Yahya

Abstract

A study was conducted at three Recreation Forests near Kuala Lumpur to assess impacts of recreational activities on the natural resources of the area. This paper mainly reports the results of the study and suggests a management action to be taken.

Recreation Forests in Malaysia are usually scenic forests with rivers where the most popular activities conducted are picnicking, swimming and relaxing under the forest shade. Camping, trekking and photography are also carried out but to a lesser extent. As owner of the Recreation Forests the Forestry Department usually manages the areas. However, some areas are fully or partly privatized where the management of certain facilities or the whole area is given to private concessionaires.

Visitors to Recreation Forests have been shown to be in great numbers especially during weekends and school holidays. Studies showed that visitation to each Recreation Forest often exceeds 100 000 a year. The majority of visitors to the Recreation Forests are the Malays, who are also the major ethnic group in Malaysia, from the middle and the lower income group, and with highest education attainment of secondary education.

Impacts of recreational activities on the natural resources of the three Recreation Forests, namely Sungai Chongkak, Lentang and Sungai Tua were assessed for soil and vegetation parameters. From this study it was found that soil compaction is always higher at recreation sites compared to control sites for all three Recreation Forests. For vegetation parameters, it was found that vegetation cover is greater and there are more mother tree species at the control sites. It was also found that, there is a domination of forest species at the control sites, whereas vandalism signs were found to be more common at the recreation sites. The results on soil and vegetation parameters show that areas used for recreational activities are losing their natural conditions, whereas similar control areas along the river that was not used by visitors shows better regeneration and in more natural conditions.

Visitor's opinion on problems of the Recreation Forests was also evaluated to assess perceptions on the conditions of the natural resources. Out of several parameters tested, it was found that many visitors to the recreation forests are aware

of the litter problem, and many perceived it as a big problem. The conditions of tree vandalism and soil erosion are also considered as big problems to visitors.

In recreation management, educational programs have been suggested as possible mitigation measures to lessen the visitors' impacts. This paper also discusses the possibilities of education as a tool to reduce negative impacts in nature-based recreational areas, where awareness could lead to the sustainable use of forest resources. It is hoped that recreational areas could be the major outdoor classrooms where awareness and love for nature can be inculcated among the public. It will hopefully lead to the protection of natural resources not just within the recreational areas but also for the country at large.

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Introduction

In Peninsular Malaysia, Recreation Forests are components of the Permanent Forest Reserve that are opened to the public for recreational purposes. The objective of Recreation Forests is for conservation of adequate forest areas for recreation, education, and the protection of the country's unique flora and fauna (Forestry Department 1978). With the National Forestry Act amendment in 1992 (Forestry Department 1992), the objectives of Recreation Forests were slightly redefined as to conserve enough area as places for recreation, ecotourism and to enhance the public's awareness on forestry.

There are 84 Recreation Forests encompassing an area of 6.723 ha covering all states in the peninsula (Forestry Department 1997). Therefore, Recreation Forests in Malaysia comprise about 0.05 % of the total 12.7 million ha of permanent forest estates (Malaysia Timber Council 1996) in Malaysia.

Most of the recreation forests are fully managed by the Forestry Department of the respective states. In some Recreation Forests, certain facilities are privatized where minimum charges are imposed on visitors, for example for parking spaces, camping sites, chalets, and toilet facilities. Very few of the Recreation Forests are wholly privatized, where entrance fees are imposed for the use of the area and for the facilities. Recreation Forests like Gunung Ledang, Kota Tinggi, Kuala Kenong and Camp Nusa are examples of fully privatized Recreation Forests.

Where fully managed by the Forestry Department, all costs of maintenance and construction are borne by the government. Depending on budgets, the development that would take place in a Recreation Forest includes picnic huts and benches, toilets and changing rooms, parking areas, pathways (usually going up to the waterfalls), camping sites and chalets; generally in that order of priority. Management mainly in terms of cleaning the area and care for facilities are handled by staff of the Forest District Office.

For semi-privatized Recreation Forests, private operators take care of the maintenance of the facilities where they will gain from the fees charged on the users. For this level of privatization, the respective District Office are also responsible to identify problems and propose further development of the area, similar when it is fully managed by the Office. On the other hand, when fully privatized, the whole area are rented out at a cost to private concessionaires, where they are responsible for all development and maintenance of the area.

Recreation Forests are usually scenic forests and most of them have waterfalls or river running through, most suitable for swimming and picnic activities. Since Malaysia is a humid tropical country it is indeed very common for people to seek the shadiness of the forests to swim and have a picnic near the river.

A survey conducted for the forestry department in 1995 found that 32.4 %, 22.9 % and 15 % of visitors first mentioned activities that they participated in as picnicking, swimming and sightseeing, respectively. Other activities quoted by less than 10 % of visitors each, are nature walks, photography, camping, trekking,

sports and games, fishing, climbing, and others. (Forestry Department, pers comm).

Basically, there is no restriction on types of recreational activities conducted, except those prohibited under the Forest Enactment that involves the removal of flora and fauna from the area. However, in certain areas where enforcement is weak, coupled with visitors' attitude, problems often occur where visitors act against the law in pursuing their otherwise harmless activities, for example by cutting trees for setting up their camps. Again, as picnic is one of the most popular activities, the problems most often encountered are disposal of food remains or newspapers that the visitors used to sit on.

As a form of information to aid management of the area, most recreation forest has signboards that displays activities prohibited like animal trapping, fish poisoning and putting up open fires. In some areas the fine imposed if visitors are caught doing prohibited activities would be stated. However, many negative acts are still conducted which could be due to lack of manpower for enforcement, lack of facilities as well lack of notice for information or ineffectiveness in communicating the information. Visitors' basic attitudes could also be a major problem. For example, in more open areas where park personnel are visible fewer negative impacts are found but in more remote areas, worse conditions are encountered. This indicate that visitors are only behaving for fear of being caught but the mentality towards low impact recreation still need to be improved.

Recreation Forests' Visitors

Since most Recreation Forests are very accessible to the public and have multiple entry points, not many Recreation Forests keep records of visitor numbers to the area. From reports of studies for various Recreation Forests, visitations to the Recreation Forests could be estimated. Jalil and Chee (1983) stated that over 100 000 visits were received at Hutan Lipur Telok Bahang and Sekayu per annum, based on entry counts since 1983. Entry counts estimated a total of 318 000, 466 000 and 371 000 visits per annum to Hutan Lipur Kanching, Ampang and Lentang respectively (Berkmuller et al., 1992). Studies conducted at three Recreation Forests serving the Klang Valley population showed that for Sungai Chongkak, Lentang and Sungai Tua, yearly estimates were at 238 000, 183 000 and 146 000 respectively (Noor Azlin 1999).

The number of visitors received by the various Recreation Forests indicates that Recreation Forests are very popular among the Malaysian population. This is not surprising since Recreation Forests are usually accessible by private or public transportation and normally there is no charge to enter the area, unless the forest is partially or fully privatized. A consultancy report for the Forest Department which was based on 20 Recreation Forests in Malaysia found that among those

interviewed mean visits per household to Forest Recreation areas is 2.661 in six months, and on average the distance traveled to these areas is 59.55 km. (Forest Department pers comm.). From the same study it can be deduced that about 80 % of visitors are between the age of 21 to 45 years old and over 65 % earns income below RM 1 800. The majority of visitors are the Malays (71.9 %), married (62.8 %) and only 23.27 % are educated above secondary school qualification (Forestry Department, pers comm) .

Environmental Impacts from Forest Recreation Activities

Although visitors come to the forests to appreciate nature and to get away from the crowds, intentionally or not, their activities could bring negative impacts on the natural resources of the area and affect solitude for other users. Many studies conducted showed that recreational activities in natural areas left the areas degraded where its natural resources, especially soil and vegetation is impacted (Cole and Bayfield 1993: Cole and Knight 1990, Chi 1987).

A study on recreational impacts was conducted at three Recreation Forests near Kuala Lumpur, Malaysia's capital city. The Recreation Forests are Sungai Chongkak, Lentang and Sungai Tua (Figure 1, Appendix 1).The study found signs of negative impacts, where changes from the natural resources were observed. Assessments on certain parameters were conducted that include unintentional damages to the soil and vegetation of the area as well as intentional damages of vandalism and littering. For each Recreation Forest 4 sites were chosen at random; 3 sites are recreational sites generally used for picnics activities while one site that is not used for recreational purpose serves as the control. For each site, 5 plots of 1m x 1m were established, where results were averaged to yield the findings.

In conducting recreational activities, human trampling can change the soil condition of the area. This effect is unintentional, but nevertheless would result to problems in the long run. Soil compaction will affect the regeneration of new veg-

Table 1. Soil Compaction for Different Sites in Three Recreation Forests.

Recreation Forest	Picnic Site 1	Picnic Site 2	Picnic Site 3	Control Site
Sungai Chongkak	3.2	2.4	2.8	1.1
Lentang	2.9	3.4	3.6	1.3
Sungai Tua	3.3	2.6	2.8	1.2

Note:Soil compaction was measured in kg force/m^2

etation and the health and vigor of existing plants. Table 1 shows soil compaction measurements with a portable penetrometer. For this penetration resistance parameter, the results agrees with findings from previous studies of impacts in recreational areas where sites used for recreational activities show higher compaction than control plots (Kamaruzaman 1989, Chi 1987, Crawford and Liddle 1977, Lutz 1945).

Also from 4 sampling plots at each site, vegetation conditions were observed (Table 2). The coverage refers to the percentage of the plots that was covered by vegetation, either by forest species or introduced species. This percentage was obtained by averaging total cover of the five sampling plots in each site. The observation on whether forest species dominate the plots was also assessed and result is presented in the same table. Table 2 also shows effects of intentional damage by visitors, where 10 trees above 100 cm diameter were randomly selected at each of the picnic sites and control sites. Vandalism marks visible to the eyes, for example, slashes by knives or writings with sharp objects were counted.

For vegetation, the results indicated that all control plots within each Recreation Forest shows higher percentage of ground coverage than the recreation sites. It is also found that although some plots in the recreational areas have high percentage of ground cover, they are mainly grasses that were not native to the forest. These results of deviation from natural conditions in the vegetation components of recreational area also agrees with many previous studies (Cole 1995, Cole and Knight 1990, Chi 1987, Crawford and Liddle 1977, Bayfield 1973) where vege-

Table 2. Vegetation Conditions at Different Sites in Three Recreation Forests.

		Recreation Forest		
	Site	Sungai Chongkak	Lentang	Sungai Tua
Coverage (%)	1	45	64	11
	2	32	16	27
	3	37	30	20
	Control	73	62	49
Domination by Forest Species	1	No	No	No
	2	No	No	No
	3	No	No	No
	Control	Yes	Yes	Yes
Mother trees species	1	0	0	0
	2	0	0	1
	3	0	0	9
	Control	15	3	0
Vandalism counts	1	30	20	25
	2	20	29	27
	3	41	37	31
	Control	0	3	0

tation was often found affected by recreational trampling. For the vandalism count, it was found that control sites suffered fewer damages than the sites used for recreational activities where a maximum average of 41 markings was seen on a tree at the sites. Compared to the control plots, all recreation sites that the conditions of the vegetation were more natural.

Visitor Awareness of Environmental Conditions

The profile of the respondents for three Recreation Forests studied are presented in Table 3 where similar results are found compared to Forestry Departments report mentioned in the introduction (Forestry Department pers comm). Most respondents are from the age below 44 and most with incomes in the lower brackets.

Table 3. Profile of Recreation Forests' Visitors.

		Sungai Chongkak N=725 (%)	Lentang N=541(%)	Sungai Tua N=413(%)
Age Group	<15	18.5	4.1	7.0
	15-24	56.3	54.8	43.9
	25-44	23.3	38.2	45.6
	45-65	1.9	2.8	3.4
Ethnic	Malay	87.1	91.5	93.5
Group	Chinese	5.3	6.0	4.8
	Indian	3.2	1.4	1.8
	Others	4.4	1.2	0
Income	<400	56.0	24.0	22.1
	400-599	10.6	24.7	9.6
	600-799	7.9	19.1	17.0
	800-999	7.0	7.8	18.2
	1 000-1 499	12.7	14.4	16.7
	1 500-2 999	3.3	5.4	10.7
	>3 000	16	2.4	4.6
Highest	Primary	8.3	1.7	2.1
Qualification	Secondary	68.6	83.8	77.1
	Diploma	7.1	8.2	9.4
	Bachelor	16.0	6.3	9.9

Source: Noor Azlin and Wan Sabri (1997)
Note: Figures denote valid percentages after missing values

To evaluate the litter problems in the Recreation areas, visitors responses to a question of perceived problem was used (Table 4). It was found that rubbish disposal was quoted as a big problem for most visitors of two Recreation Forests namely, Sungai Chongkak and Sungai Tua. At these Recreation Forests vandalism falls second. However, for Lentang Recreation Forest the results were slightly different. Nevertheless, in general the results indicated that of the different parameters asked, rubbish disposal is considered as a big problem to most visitors, followed by vandalism. This result agrees to previous literature (Shafer and Hammit 1995 and Manning 1986) where litter disposal is most noticeable and objectionable factor in forest recreation environment.

Noor Azlin and Wan Sabri (1997) discussed on satisfaction of several factors in the same Recreation Forests. It was found that cleanliness is ranked as the second last factor of having satisfactory condition while facilities were found to be the last. It was concluded that visitors are generally more satisfied of the conditions on the natural resources in the area but are less satisfied with the cleanliness and facilities available. Also, as illustrated by Table 3, visitors do not perceive areas cleared from vegetation as a problem, although through measurements it was found that ground coverage was much reduced compared to the control sites. This indicate that visitors are not exactly aware of the conditions of the natural resources the area.

Table 4. Visitors' Perceptions of Recreation Forest Conditions.

Factor	Sungai Chongkak (N=725)			Lentang (N=541)			Sungai Tua (N=413)		
	Not a problem	Small Problem	Big Problem	Not a Problem	Small Problem	Big Problem	Not a Problem	Small Problem	Big Problem
Rubbish disposal	5.5	16.5	78.0	5.1	53.8	41.1	4.8	7.4	87.8
Tree vandalism	5.9	29.7	64.3	5.4	50.2	44.4	5.7	20.4	73.9
Erosion	9.3	29.9	60.8	4.9	44.5	50.6	6.7	21.6	71.7
Water conditions	10.5	29.7	59.7	7.2	50.3	42.5	13.0	27.1	59.9
Soil condition	17.0	48.4	34.6	16.5	62.6	20.9	12.6	46.2	41.1
Clearance of vegetation	25.4	44.6	30.0	38.1	46.4	15.4	21.5	47.8	30.7

1) Visitors were asked whether the conditions of the parameters above posing "no problem", "small problem" or "big problem" for the Recreation Forest.

2) Figures denote valid percentages after missing values are ignored.

The Need for Environmental Education in Recreation Areas

From the results of the assessments it was found that the natural resource conditions of recreational sites are not as natural as the forested conditions found in the controls. Both intentional and unintentional damages were evident, hence efforts to reduce these problems should be initiated.

As a management suggestion, environmental education is proposed as one of the method to prevent further negative impact to the areas. It could also aid the management and conservation of the Recreation Forests, where environmental education encourages positive attitudes towards nature, and intentional damages by visitors could be reduced. Several authors discussed on visitor education as encouragement for low-impact recreational activities (Doucette and Cole 1993, Chi 1987).

Since Recreation Forests are areas for conservation of local flora and fauna, and as ecotourism and to enhance public awareness (Forestry Department 1992; 1978), ideally it is the place for environmental education to be conducted. Currently Recreation Forests are mainly serving the recreational settings for activities, which is indeed very popular among the population. However, it is also timely that programs on environmental awareness will be intensified.

At present, the Local Forest Department offices maintain general works for the Recreation Forests. However, the lack of fund and manpower in certain areas might impose some constraint, especially when the number of users in these areas is very large. Ideally, environmental education not only is portrayed through knowledge of nature, but also through changes in attitude and mentality that support the course of loving nature. With awareness of the users it is believed that the burden countered by the management agency could be reduced.

In Malaysia, leisure activities are increasingly getting more attention. The increase in recreational needs could be due to the rising number of the population, increase of leisure time and income, mobility as well as the upward trend in nature appreciation. In the early 90's, issues were raised that the Malaysian youths are not spending their leisure time constructively. There was concern on youths spending time unwisely, for example "hanging out" at the shopping malls that could contribute towards an unhealthy lifestyle. Under a youth development program in 1994, called "Rakan Muda" or literally translated as the "Young Friends", many projects were implemented where youths were encouraged to spend their leisure time in constructive ways that benefit the physique, spirit or mind. Related to recreation and forests, two themes of the "Rakan Muda" are relevant, one "Nature friends" while the other was "Recreation friends". Previously, under these schemes many recreational trips to the forests, mountains and others of adventurous kinds were organized.

However, recently there were concerns expressed about the "Rakan Muda" program (Sabaratnam and Sai 1999). One of the issues was that the locations of the centers were too far away for teens in the rural areas. To partially address this

problem, it is proposed that environmental education programs be set up in the Recreation Forests where it is easily accessible to the public and the forest setting is believed to be perfect for such activities. As indicated previously, most visitors to the Recreation Forests are from the younger age groups. However, not just for the young, adults can also benefit from this program depending on how it is conducted.

Methods of Education in Recreation Areas

Berkmuller (1992) explained environmental education in contrast to traditional, disciplinary education. Where traditional education prepares one for functions in society, through environmental education people learn not only to react to growing pressure of the environment but also to anticipate and prevent problems. Berkmuller (1992) further proposed that environmental education should instill a feeling for and a rational understanding of environmentally sound values and draw attention from environmentally unsound values, preferably in a problem-solving context.

Given the wide context of environmental education, this paper could only attempt to describe some forms of environmental programs that can be implemented in the Recreation Forests. Far from proposing a complete program, this paper suggests some methods of visitor education or interpretation possible to be conducted. These methods and techniques could be developed or expanded from what is already available at the Recreation Forests.

At the moment, attempts at enhancing public awareness are mostly conducted through personnel as guides to the forests. Some Recreation Forests have maps or brochures, while many have displays, but however only for tree names. Having personnel for education at the site is a good method, especially if conducted by a well-trained and personable person. It is suggested that during the many camping programs held at the Recreation Forests, the young campers are made compulsory to join at least an activity conducted by the management agency. Through guided walks in the forest or a campfire talk, the management can convey messages to visitors on how to reduce impact on the natural resources.

Doucette and Cole (1993) proposed several techniques in carrying wilderness activities. Methods of dissemination of educational information like printed materials can be intensified in addition to personal guiding. Doucette and Cole (1993) emphasized that a combination of techniques is likely to be most effective. They listed possibilities of media-based techniques that generally require little personnel time such as commercial periodicals, agency periodicals, brochures, maps, posters, signs, guidebooks, displays at trailheads, and others.

In Malaysia, research on effectiveness of environmental education studies has not been conducted or documented well. However, according to Doucette and

Cole (1993), studies conducted elsewhere showed that the littering could be reduced through persuasive communication techniques. Successful programs have been based on rewards, punishment and environmental cues such as trash cans, written appeals and role models. These techniques can be adapted to address the users of Malaysian Recreation Forests

Conclusion

In Malaysia, degradation from recreational use can be seen in Recreation Forests. Personal observations at Sungai Tua Recreation Forest showed other degradations such as eroded trails, cleared vegetation cover and burnt tree trunks. Of these environmental conditions, litter condition is the most noticeable to visitors that it was also an issue brought to the newspaper (Going to ...1992).

Although most visitors are not aware of the soil compaction and loss of natural species of the areas, many are aware of the problem in litter dispersal and vandalism to trees. It is hoped that with visitor education techniques or programs the public can be made more aware of the problems existing at the Recreation Forests.

Through educational explanation, the importance of forest and the role of man in protecting nature in term of low impact massages can be emphasized. The public would benefit in term of gaining awareness and knowledge of nature, and hopefully would return the favor by being involved in nature conservation for the area and for whole country.

Acknowledgements

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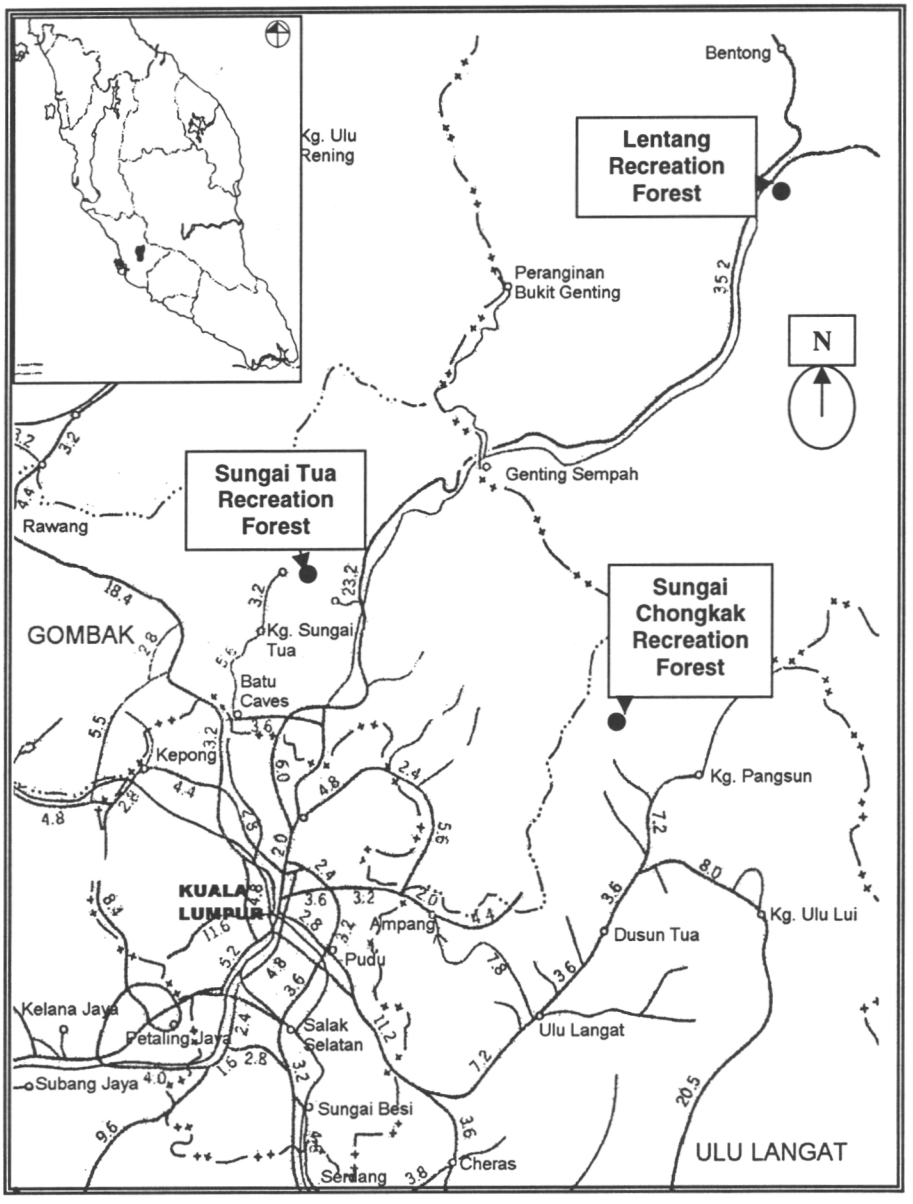
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APPENDIX 1



Note: Numbers indicate distance from one intersection to another.
Inset indicates Kuala Lumpur in relation to Peninsula Malaysia

Figure 1. Location Map of Study Areas.

The Experience of Forests

John Murray and Peter Aspinall

Abstract

The purpose of this project is to contribute to design issues relating to the restructuring of production forests for recreational purposes. Two contrasting sites in the Southern Highlands of Scotland were selected for the study. The study was divided into two parts. Firstly, walkers were invited to make a self-directed film of their walk using a hand held camcorder. No guidance was offered, other than to film anything of interest or anything which was liked or disliked. The second part of the project was a de-briefing in the form of a short questionnaire. One special design challenge emerges from the study. Visitors want wayfinding information but they want it in a way which minimises indications of human intervention as a major function of forest walks appears to be that of enabling visitors to grow closer to their ideal of undisturbed nature.

Keywords: landscape planning, landscape management, forest experience

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Introduction

The primary aim of this project is to investigate the experiences of people while on a forest walk. Experience is used here in the broad sense to include thoughts, feelings and aspects of interest which all contribute to the totality of experience. From this perspective the project sought to identify multi-sensory experiences, not just visually derived ones, and to allow people freedom to report on whatever occurred to them. The second aim of the study was to gather information about which parts of the walks were preferred or important to people during a walk in the forest, in order to provide better information for designers about future layouts and composition.

The research has used a qualitative approach towards understanding peoples' experience of the forest. This approach is user led and falls within the general transactional theoretical context for studies of this kind. This context aims to free person/environment investigations from an objectivist environmental determinism on the one hand and a subjectivist approach, which focuses on psychological phenomena in individualistic and intra psychical terms. Interdependent dynamic relationships linked to purpose and action are key issues in this alternative approach (Bonnes and Secchiaroli 1995)

Background

The forest walks

Two sites, contrasting in composition and usage, in the Southern Highlands of Scotland were chosen for study:

- The Waterfall Walk at the David Marshall Lodge Queen Elizabeth Forest Park, Aberfoyle, Stirlingshire.
- The Allean walk (both red and yellow routes), Queen's View, Loch Tummel, Pitlochry, Perthshire.

Both sites benefit by good Visitor Centres, although the Centre at Queen's View is half a mile from the beginning of the walk. This walk has its own car park, picnic area and WCs. Almost without exception, every visitor to the Queen Elizabeth Forest went to the Visitor Centre. Some people then went on to take a walk. They have a choice of three routes of varying length – the waterfall walk is the shortest. At Queen's View, only a few people came solely to use the picnic or WC facilities. Most of those arriving here intended to go for a walk. They too have a choice of three routes of varying length. At Queen's View, the survey participants were asked if they had visited the Visitor Centre and a number had not done so. Indeed of those questioned, nearly all said such a facility, were it too near their

walk would attract the wrong type of person, namely coach parties and non-walkers, which would spoil their experience.

The Waterfall Walk at the Queen Elizabeth Forest Park is of 20–30 minute duration and although it involves a descent to a waterfall, neither this, nor the inevitable climb back out of the valley is arduous. The route is through deciduous woodland, mainly *Betula pubescens*, with just a small stand of *Picea abies* by the waterfall and only distant views of commercial forestry. The path has an all weather crushed stone finish with a handrail along most of its length. Copious interpretation panels and waymarking were found to be confusing in places. There are sculptures and seats punctuating the length of the route. The principal focus however is the waterfall.

In contrast the Allean walk at Queen's View passes through an area of commercial forest planted predominantly with a range of coniferous species, such as *Larix eurolepsis, Picea sitchensis, Pseudotsuga menzisii and Tsuga heterophylla.* A wide forest path designed for timber extraction ascends to just below a ridge above a valley. It then continues east along the ridge with occasional views afforded by a large area of clear fell. The shorter yellow route then branches off through the trees on a narrow grass path, muddy in places, beneath a canopy of larch trees. The longer red route continues further along the ridge, before cutting down to the lower path through the trees, on a similar narrow grassy, muddy path. Both routes return to the car park along a lower forestry road of a slightly reduced width, which rejoins the main wide pathway near the access from the main road. Points of interest along the route include a clachan (a reconstructed 18th century settlement), a viewpoint over the loch and a sculpture which was just off the main path, reached by a narrow grassy track. On the longer red route, the remains of an Iron Age, ring fort settlement are also to be found.

Data collection and survey participants

Data collection took place mainly at weekends between 11th July and 8th August 1998.

- At the Queen Elizabeth Forest Park data was collected on 11.7.98–18.7.98–24.7.98–5.8.98.
- At Queen's View data was collected on 25.7.98–27.7.98–1.8.98–2.8.98–7.8.98– 8.8.98.

The survey participants at the Queen Elizabeth Forest park were mainly family groups with dogs and/or children using the walk very much as an educational tool or just as a short break to stretch their legs or to exercise their dogs. Yet most people had travelled between 10 and 50 miles to get to the walk. The great majority were aged under 50.

Those taking the Queen's View walks were more serious walkers, often with children and/or dogs, but with the expectation of taking exercise and enjoying the

peace of the forest. At both sites, walkers enjoyed being close to nature. There was a much greater willingness to participate in the project at Queen's View. Almost all those approached at this site were happy to take part, whereas approximately two thirds of those approached at the Queen Elizabeth Forest park were unwilling to take the video with them, whether walking the waterfall route or not.

The gender split of walkers was approximately 60:40 in favour of men and at each site there were relatively few walkers over 50 years of age. It was of interest that most people had travelled from 10–50 miles in order to go on the walk with relatively few 'locals' i.e. within a 10 mile radius participating. Because of the language problems, only a few of those approached at either site were non-English speaking.

Overall the type of person using the Allean walk at Queen's View was noticeably different to those seen at the Visitor Centre down the road and were also different to the majority of people using the Centre and walking the waterfall route at the Queen Elizabeth Forest walk.

The weather was mixed to fine on the walks. It seemed impossible to predict the numbers of walkers and therefore participants on any particular day. Weather seemed to have little effect. Dull and rainy days could be busy, while brilliantly sunny days could see few people walking.

Methods of analyses

The methodology of the project needed to be open ended and flexible if it was to avoid intruding upon the chosen recreational activity of the participants. It was decided to use a camcorder which participants used to film anything they saw, which they liked, disliked or which was of general interest. They could also record any comments or observations they wished to make, on the camera's soundtrack.

The video footage was then transcribed and analysed. For each participant a map of their walk was prepared (figure 1). Each stop was noted sequentially. For example, number 3 represents the third stop of a participant. A letter noted the subject of their interest. The letter c) shows that the participant was looking at a view. Therefore, 3c represents the third stop made by a participant, to look at a view. Other stopping categories are for: a) objects b) aspects of the path d) human interest e) flora and fauna g) human intervention.

From these maps a composite analysis chart was prepared for each site (figure 2). The horizontal axis shows the journey. The vertical axis is a list of survey participants and the date on which they took part. For each location, charts facilitate quick assessments of where people had stopped and what they were looking at. They also show features, views, and details which had been ignored, failed to register or which were considered unimportant by each participant.

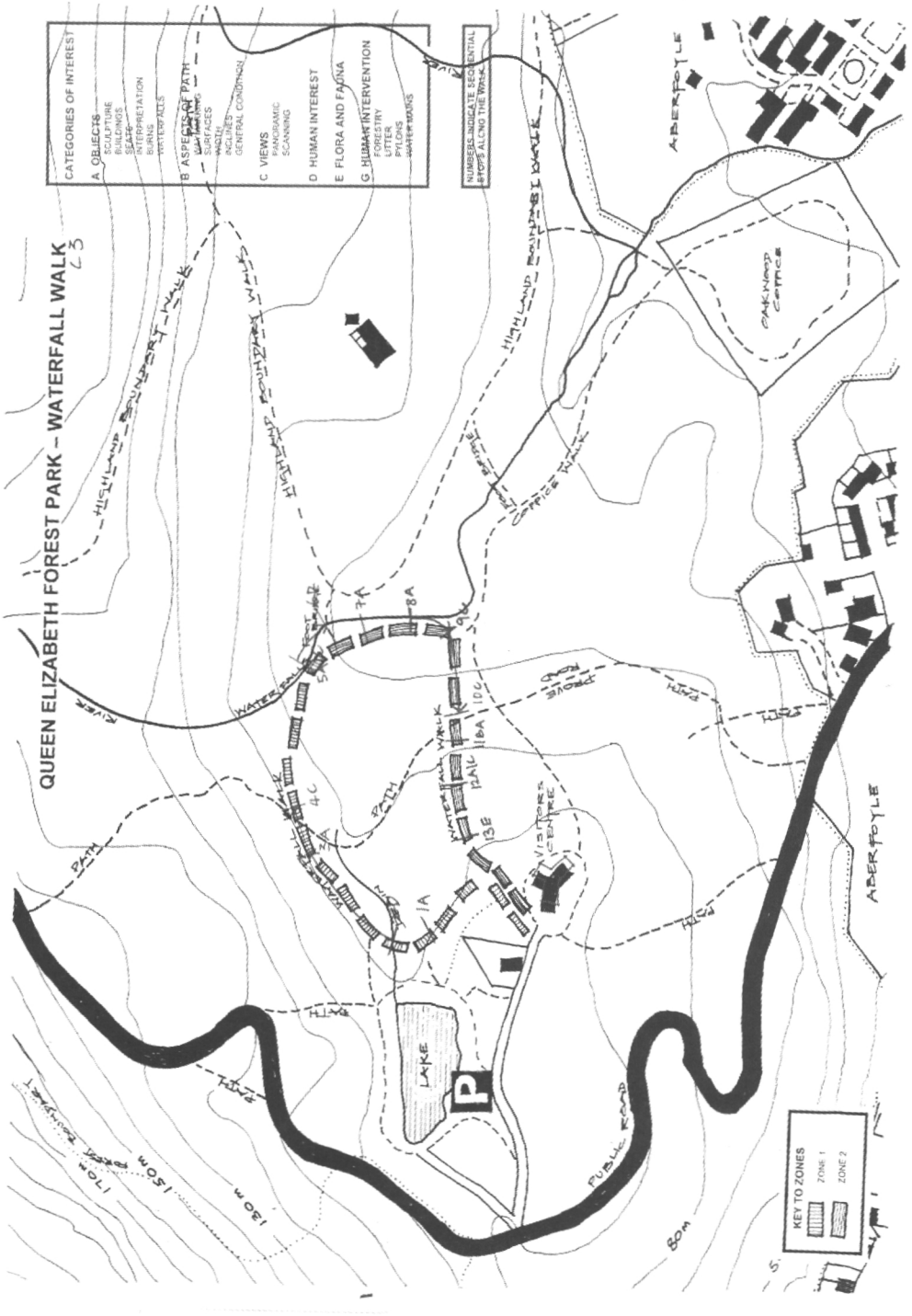


Figure 1. The map of Queen Elizabeth Forest park.

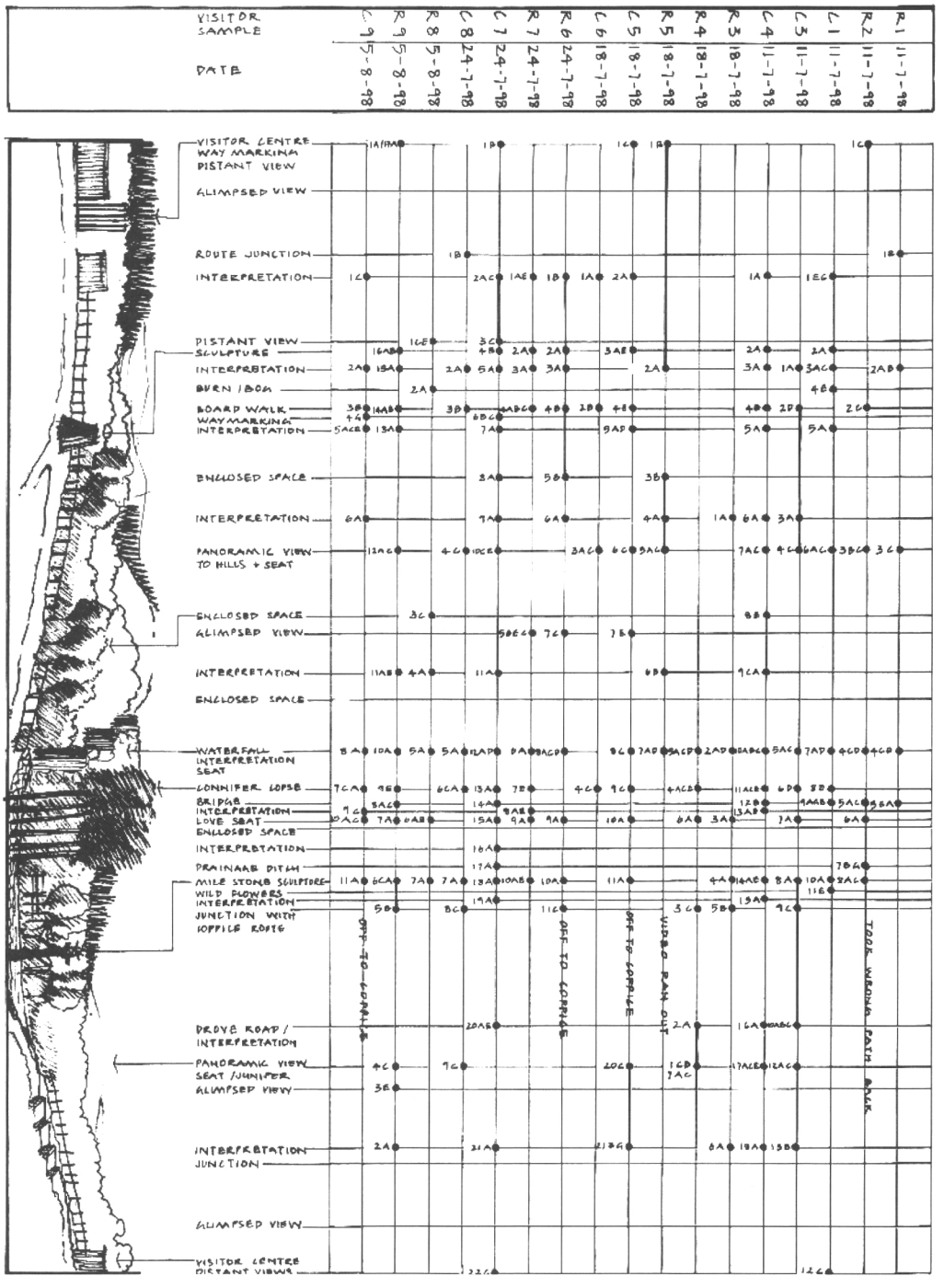


Figure 2. A composite analysis chart.

This open-ended approach using the video camera was complemented by a short questionnaire which participants were asked to complete. Again, this was deliberately kept short to encourage a high completion rate, as people made their way back to cars after their walk

This unusual method of conducting a survey into forest experience proved to be rewarding, but time consuming. The flexibility, which the method encouraged, was its greatest strength in providing unrestricted insights into walkers' experiences.

Constraints

From a practical perspective, the use of the camera for the collection of data had both advantages and disadvantages. The principle advantage was the diversity of interests it was possible to record, not just in the filmed footage but also by commentary. The disadvantages stemmed from the problems of dealing with the technology and from the operators unfamiliarity of dealing with video cameras. Those for whom video cameras were a novelty, either used it like a still camera or travelled the length of the walk with the camera glued to their eye to the detriment of the film quality. With the longer walks at Queens View, participants made fewer stops and comments as they progressed into their walk. In summary:

- Participants were instructed to film anything. As a result, there was a huge variation in amounts of information gathered and the quality of that information.
- The very act of filming probably restricts or impinges on peoples' use of the walk. We have no evidence on how this affected the data gathering.
- There can be few methods of data collection, which give such a volume both qualitative and quantitative information.

Results

The results of the study are collected here: 1) comments recorded on tapes, 2) information collected by questionnaire (table 1), and 3) information collected by video filming.

Comments recorded on tape by participants whilst on the walks

Comments were made both by the landscape architects working on the project and by the participants. They were made so that an 'expert' or 'professional' view could be compared with the lay views of visitors. This is comparable to the methods of Kevin Lynch described in 'The Image of the City' (Lynch 1960) which

sought to establish commonality between the cognitive maps of laypeople and the expert analyses of three cities in the US. Comments should be read in conjunction with the visual analyses made for each walk (figure 3).

Waterfall Walk, Queen Elizabeth Forest Park – Visitors

- Whilst few people mentioned the spatial qualities of the walk, there was an obvious reaction to open spaces and views.
- The need for information was seemingly insatiable. Everyone read at least some of the interpretation boards and many asked for more information on plants, trees and sculpture. Only one person criticised the information panels.
- People liked the variety within the route and remembered the various elements along the path well. They also were aware of the changes in gradient of the path.
- Only two people found the handrails offensive and some found their presence a positive point.
- Several people mentioned a 'large' tree within one panoramic view. This turned out to be a columnar juniper, which was not large at all, but merely a marked contrast to the surrounding deciduous forest.
- Most people enjoyed their walk, even in poor weather conditions, but large numbers of people arriving in any one place together, spoilt the experience for those who found it too busy. The peace and feeling close to nature were the principal reasons for visiting this walk.
- Many people participating in the survey knew the walk and had followed it in the past.

Waterfall Walk, Queen Elizabeth Forest Park – Landscape Architects

- The walk is attractive with a good focal point - the waterfall. The density of tree cover is comfortable throughout.
- Waymarking is confusing in places, e.g. at the departure point of the coppice walk.
- The access to the walks is particularly unattractive owing to intrusive fencing at the departure point from the Visitor Centre. There is no disabled access to the walk.
- There are no leaflets with maps of the walks at the Visitor Centre and no maps en route.
- The handrails, which line the route, are intrusive and poorly designed, apparently serving little purpose.

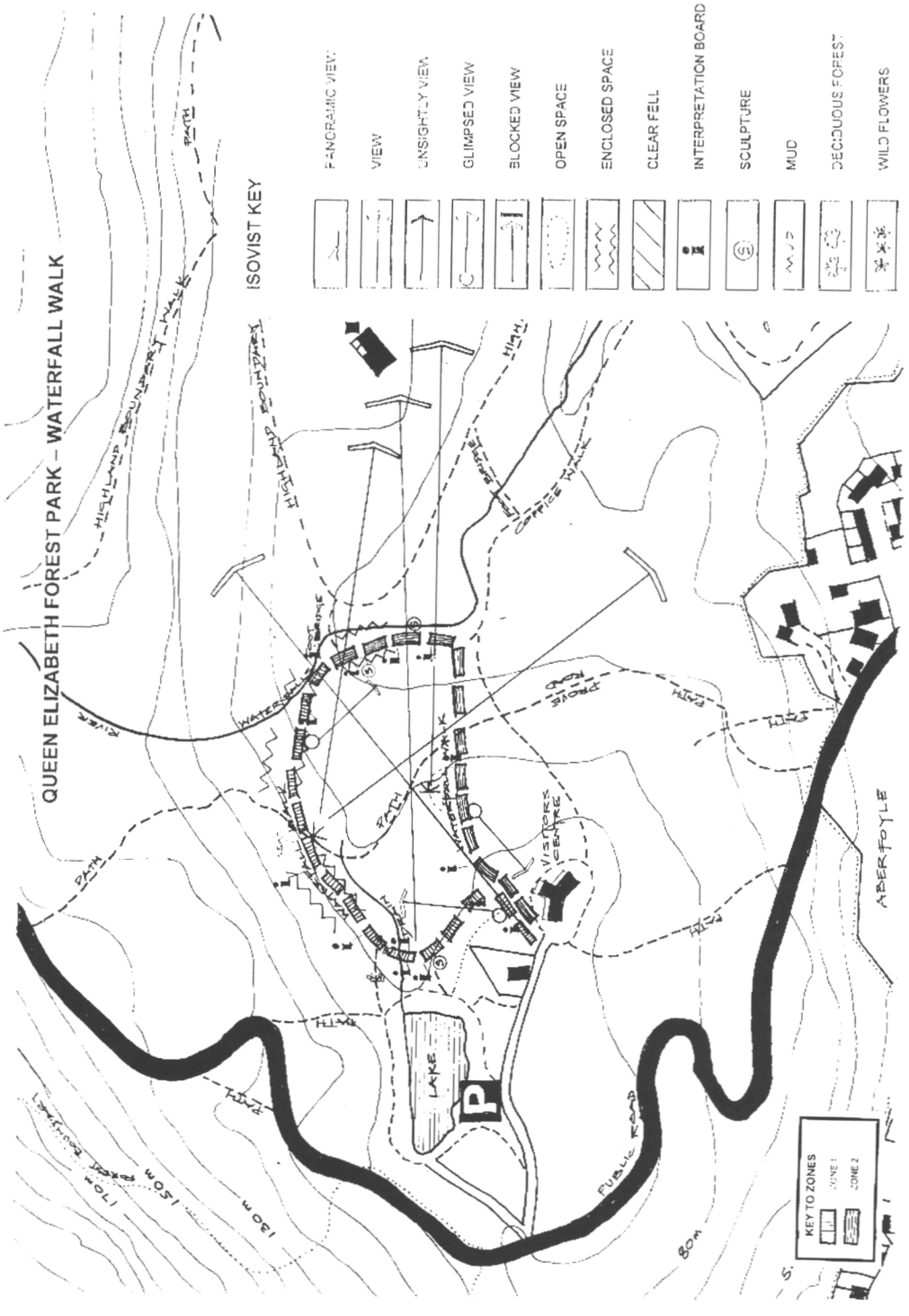


Figure 3. The visual analyses of a walk.

- Many of the views could be improved with better forest management and the felling of certain trees.
- The bracken is out of control where the tree canopy had been opened to the detriment of the wild flower diversity.
- On the ascending path desire lines have been worn to the side, possibly because the path is too narrow or possibly to avoid the low wide steps which are not particularly comfortable to walk up.
- The smaller interpretation panels seem a little condescending. The larger panels are poorly and clumsily framed and not weatherproof.
- There is little information on the sculptures lining the route.
- The cramped area around the milestone sculpture could be improved, and a seating area in the very attractive setting beside the stream could be provided.
- In places, the cycle path and footpath are combined to the detriment of both.

Allean Walk, Queens View – Visitors

- Most people did not want a visitor centre here. They wanted peace and quiet and to feel at one with their natural surroundings.
- Most found the clear fell area offensive but would have been more tolerant if they understood why it was necessary and what was going on.
- Despite realising that this was a planted forest, walkers found evidence of human intervention unacceptable. They reacted against litter, scars in the landscape, forestry work, water hydrants and pylons.
- A thirst for information was apparent and more information on flora, fauna, sculptures was requested.
- Those who had young children in particular wanted some indication on way-marking boards of distances. They wanted to know how far they still had to go and how far they had already come.
- Some wanted seats and picnic sites within the forest to add to the facilities provided by the car park. They liked these picnic facilities and appreciated the discrete design and placing of WCs.
- Walkers found water a great draw and wanted better access to the streams, which ran through the site.
- All found the narrower paths more interesting and attractive, feeling they were really 'in the forest' on these paths.

- The participants appreciated the restoration of the Clachan and access to the Ring Fort. Some would have liked to see these sites developed further, with the surrounding views reinstated, as they would have existed in the past.
- There was less consensus on the siting of the sculpture at the viewpoint. Most liked the sculpture but queried if the style was appropriate for the setting.
- One walker queried the colour coding on the waymarking which he thought might be a problem for the colour blind.

Allean Walk, Queens View – Landscape Architects

- The wide path necessary for timber extraction is too wide in scale for walkers, whereas the lower return path is a more comfortable width. The width of the path did make the initial ascent easier to cope with and it was felt a narrow path, which, when climbed continuously, would have been even less appealing.
- Views could have been improved or even opened up with strategic felling of trees and this would have created interest on stretches of the wider path where there is little currently of interest.
- Clear felling can appear unattractive owing to a proliferation of debris, but does add a new dimension to the forest. Operational work would be better understood and tolerated, were there information available on interpretation boards.
- More information is needed on flora and fauna. This was borne out by the interest the survey participants expressed in this aspect of the forest.
- Better use could have been made of the open spaces at the intersection of major paths by celebrating such junctions.
- There are no picnic areas or seating areas en route.
- The presence of overhead cables at the Ring Fort site is distracting and offensive.
- Access through the kissing gate entrance is impossible for the disabled, for those with pushchairs and even difficult for dogs.
- A few narrow alternative paths off the main wide path through the trees would add diversity and interest.

Many of the deficiencies in style and siting identified above by landscape architects would have been avoided had design manuals been employed (Bell 1997, Forestry Commission 1993).

Results of the questionnaires

The results concerning the opinions of path characteristics and reasons to visit are collected in table 1.

Table 1. Questionnaire results

Questions	Queen Elizabeth Forest	Queen's View
Why do you like walks like this?		
Exercise	2 (9.5 %)	3 (15.8 %)
Good for kids and safe	5 (23.8 %)	2 (10.5 %)
Easy to follow	2 (9.5 %)	
Close to nature / peaceful	12 (57.1 %)	12 (63.1 %)
Views		1 (5.3 %)
Educational		1 (5.3 %)
What led you to come here specifically?		
Visited before	7 (36.8%)	7 (43.7 %)
Passing by	3 (15.8%)	4 (25 %)
Tourist information	6 (31.6%)	4 (25 %)
Waterfall	3 (15.8%)	1 (6.2 %)
Which was your favourite place on the walk?		
Waterfall	18 (81.8 %)	
Lochs and watercourses		3 (14.3 %)
Views	1 (4.5 %)	3 (14.3 %)
Down hill stretches with valley below		2 (9.5 %)
Open tracks	1 (4.5 %)	
Narrow paths		2 (9.5 %)
Conifers	2 (9.1 %)	
Flora and fauna		1 (4.8 %)
Clachan (reconstructed 18th century settlement)		5 (23.8 %)
Sculpture		3 (14.3 %)
Iron age fort		2 (9.5 %)
Which was your least favourite place on the walk?		
Uphill return section	7 (70 %)	
Handrail	2 (20 %)	
Retracing route on same path	1 (10 %)	
Wide forestry rides		2 (15.4 %)
Mud on narrow paths		1 (7.7 %)
Extraction debris		2 (15.4 %)
Clear felling		8 (61.5 %)

Table 1 continues

Table 1. Questionnaire results

Questions	Queen Elizabeth Forest	Queen's View
What section of the path did you enjoy most?		
Downhill section	4 (19.0 %)	
Flat sections	1 (4.8 %)	1 (25 %)
Narrow section		1 (25 %)
Clachan to upper ridge		1 (25 %)
Views (panoramic)	2 (9.5 %)	
By waterfall	9 (42.9 %)	1 (25 %)
Loch edge		
Sheltered sections	2 (9.5 %)	
Conifers	2 (9.5 %)	
Duck board bridge	1 (4.8 %)	
What views appealed to you most?		
Panoramic to hills beyond		6 (37.5 %)
Waterfall	15 (75 %)	
Loch	5 (25 %)	8 (50 %)
Forest (short)		2 (12.5 %)
What features or things did you most like?		
Waterfall	12 (54.5 %)	
Watercourses		4 (18.2 %)
Fauna / flora	3 (13.6 %)	7 (31.8 %)
Conifers	3 (13.6 %)	
Interpretation panels	3 (13.6 %)	
Chair sculpture	1 (4.54 %)	
Sculpture		2 (9.1 %)
Clachan		6 (27.3 %)
Iron age fort		3 (13.6 %)

Results from video filming

The video data fell into 6 categories of general interest derived from the filming itself. These were:

A. Objects
- Sculpture
- Buildings
- Seats
- Interpretation displays
- Watercourses
- Waterfalls
- Condition

B. Aspects of the path
- Waymarking
- Surfaces
- Width
- Inclines

C. Views
- Panoramic
- Scanning

D. Human interest

E. Flora and fauna

G. Human intervention
- Forestry
- Litter
- Pylons
- Water mains

Category D is equivalent to 'people watching people' identified by Gehl (1987) in his observations of city life.

Table 2. The relative number of stopping points and filming time allocated to different categories.

	Queen Elizabeth Forest	Queen's View– yellow walk	Queen's View–red walk
A. Objects	115 (47.5 %)	41 (28.0 %)	25 (29.1 %)
B. Paths	26 (10.7 %)	29 (19.7 %)	14 (16.3 %)
C. Views	58 (24.0 %)	35 (23.8 %)	18 (20.9 %)
D. Human interest	10 (4.1 %)	0	0
E. Flora and fauna	30 (12.3 %)	30 (20.4 %)	20 (23.3 %)
G. Human intervention	3 (1.23 %)	12 (8.2 %)	9 (10.5 %)
Total	242	147	86

The attention given to these categories can be estimated from the relative number of stopping points and filming time allocated to them across the groups and walks. These are shown in the table 2 above.

Conclusions and Discussion

It is interesting that the rank order of stopping points across the categories is relatively stable with objects of interest scoring highest. The next three categories, views, paths and flora and fauna all have similar levels of perceived interest and attention. The relatively low frequencies of human interest/interventions reinforce the comments of walkers that a central function of the forest walk is to escape from human society. This finding helps to justify the naturalistic style favoured by the UK Forestry Authority in the design and management of upland forestry (Forestry Commission 1998, Bell 1993).

As each route was assessed by landscape architects, we were able to record which aspects caught the attention of the professional. Surprisingly, of those characteristics identified by professionals only around 50 % of views, and 50 % of spaces were of interest to the lay group. This may be because the forests were spatially illegible to lay people. Landmarks were of more significance than space defining elements. It is instructive to relate this to Lynch's (Lynch 1960) findings that in less readable cities, such as Jersey City as opposed to Boston, there was less congruity between the views of experts and lay persons.

Sensory Information

The data from the questionnaire on sensory information shows clearly that sight was the most important of all the senses. Interestingly sounds in the forest came second in importance. The majority of participants were more neutral about the relevance of smells and touch.

Feelings

An attempt was made in the questionnaire to assess the overall feelings of people while on the walk. The technique was to take two principle dimensions of emotion identified in the literature (pleasure & arousal) and ask subjects to locate their present state of feeling on a diagram comprising these two dimensions. Not surprisingly most people enjoyed pleasurable experiences. Perhaps more surprisingly almost 50 % of the sample considered themselves in an excited state (pleasant and aroused) while the other 50 % considered themselves in a relaxed state (pleasant & unaroused).

Likes and Dislikes

Findings from the survey indicated peoples' love of forest walks emanated from a desire to enjoy contact with nature while feeling absolutely safe and confident about where they were going. Their reactions to incidents along the routes were surprisingly uniform. Despite not thinking consciously about spaces, all reacted positively to the sense of enclosure and open space at different points. They enjoyed clearings and views. In particular they loved narrow paths where they felt enclosed by the forest. They all liked water/waterfalls and most took a keen interest in the flora and fauna. Parents taught their children along the way and sought to learn themselves. There was a surprising thirst for interpretative and waymarking information.

Everyone wanted to feel the peace and enjoy contact with nature. There were complaints therefore, about places, which were crowded on the walks. Least enjoyable aspects of the walk were at points where clear felling had been carried out and along uphill sections. Human intervention in the forest landscape was criticised. Yet the facilities of seats, waymarking, shelters, and interpretation boards were all seen as necessities. It was felt that these should have been designed into the walks with sufficient subtlety to be scarcely noticeable.

The results of the study would apparently point to a clear design dilemma, which ensure that there are enough signs to ensure people do not get lost, whilst minimising any evidence of human intervention in the form of a visible sign system. Of course this dilemma rests on the reasonable assumption that designed places need signing. There is however an alternative approach. One quality of good design is that there is a close fit between the designed environment and peoples' desired behaviour. It may be possible therefore to use the basic elements of

design (e.g. spatial relationships, open or closed vistas) to reinforce the orientation of the user. Within this alternative the orientation clues are embedded in the design in an unobtrusive manner. Some research along this line has shown that topographical properties of space can be used to facilitate orientation (Hillier 1998). Such a system which integrated signs at strategic choice points in a topographically designed spatial system would have the benefit of minimising additional signage. Research is underway in Edinburgh to explore this possibility on wayfinding in the internal design of forests.

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Chapter 3

Urban forestry

State of the Art of Research and Knowledge on Urban Forests and Trees in Europe

Kjell Nilsson, Cecil C. Konijnendijk and Thomas B. Randrup

Abstract

In an urbanising society, urban green spaces are recognised as major contributors to the quality of the urban environment. They assist in creating liveable cities through their range of ecological, economic, cultural and social functions. The full potential of urban green spaces, however, is often not met, for example due to the high level of urban pressures, the lack of integrated planning and management and the limited specific knowledge on urban forests and trees. During the past decades, 'urban forestry' has emerged as a promising integrative, efficient and socially inclusive approach to the planning and design, plant selection, establishment and management of urban woodlands, parks and trees. As any new approach, it still needs co-ordination efforts, especially as many different disciplines are involved in the field. In this paper, an example of a co-ordination effort in Europe, COST Action E12 'Urban Forests and Trees', is introduced. This network of urban forestry researchers from 23 countries aims to improve the knowledge base for urban forestry. An overview of recent and ongoing research on urban forests and trees in Europe has been one of the main activities of the Action. This overview indicates that relevant research activities are currently fragmented, monodisciplinary and primarily local and regional. A clear need exists for further co-ordination, integration and development of research efforts, so that a sustainable urban green space management can be supported.

Key words: urban green space, urban forestry, research, co-ordination, Europe

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The Benefits of Urban Forests and Urban Trees

World-wide, the urban population is growing at a three times faster rate than the rural population. The 20th century can be characterised as the century of urbanisation: soon, more of the world's population will live in urban areas than in rural ones. In Europe, more than two-thirds of the population resides in urban areas. This stresses the need for developing liveable cities. During recent years, an increased international policy attention for the urban environment can be noted, for example through the Habitat-conferences and Agenda 21 of the United Nations Conference on Environment and Development. The quality of the urban environment, including green areas, is becoming increasingly recognised as a key to the ecological, economic and social reconstruction and development of European cities (e.g., CEC 1990, EEA 1995).

The proportion of green areas varies greatly in European urban areas. While the Slovakian capital of Bratislava hosts over 60 % of green spaces, green areas account for only about 5 % in Madrid. In Copenhagen, green areas, including natural areas and forests, account for about 23 %, which corresponds to 43 m^2/inhabitant (Juul 1995). Urban green spaces are composed of many different elements, ranging from street trees, private gardens and churchyards, to urban parks and woodlands. Although the combination of city and forest may seem odd, urban woodlands are a common phenomenon in most European cities, but again, major differences can be noticed. While less than 1 % of the municipal area of Amsterdam is covered by woodlands, the German city of Freiburg hosts 42 % of forests (Konijnendijk 1999). Typical for these woodlands as well as for other types of green spaces is that many are relatively small and geographically fragmented.

The green infrastructure of cities provides urban society with an essential range of goods and services. Some of these are *ecological* or environmental. Green areas, for example, play a vital role in urban biodiversity, as they are main habitats of wild plants and animals (e.g. Owen 1992). Urban green spaces also contribute to wind sheltering and water protection. Trees intercept particulate matter and absorb such gaseous pollutants as ozone, sulphur dioxide and nitrogen dioxide, thus removing them from the atmosphere (e.g., Harris et al. 1999). By transpiring water and shading surfaces, trees lower local air temperatures (e.g., Nowak 1995, McPherson et al. 1999), thus making the urban climate more liveable in warmer areas.

In addition, urban green spaces can contribute to the local *economy*, for example by enhancing real estate prices and by attracting economic activity and taxpayers (e.g. NUFU 1998). A recent study by Tyrväinen (1999) in Finland shows that the prices of apartments are significantly raised in the presence of nearby woodlands or other types of green space.

Perhaps most importantly, urban green areas have manifold *socio-cultural*, including aesthetic and psychological, functions. They provide a safe haven to escape from stressful city life, and have a positive influence on health and wellbeing

of urban populations. A well-known study by Ulrich (1984) showed that hospitalised patients recovered faster when they had a view through a window, allowing them to see trees. Grahn (1989) carried out extensive studies on the significance of parks to different groups of the population in Sweden. Studies show, for example, that periods spent out-of-doors had an actual medicinal value for patients and residents of hospitals and old people's homes. People became happier, slept better, needed less medicine, were less restless and far more talkative. Studies by Kaplan and Kaplan (1989) indicated that vegetation and nature reinforce our spontaneous attention, allow our sensory apparatus to relax and infuse us with fresh energy. Involvement in urban green planning and management, furthermore, may enhance community building by strengthening social ties (e.g., Burch and Grove 1993).

Closely related with the ecological and social values of urban green spaces is their educational function. Since a major part of Europe's population lives in urban areas and receives its daily perception of nature therein, nature in urban areas is important to increase environmental awareness and an understanding of nature.

The full ecological, economic and social value potential of urban green spaces, however, is often not realised. Mainly, this may be explained by the high level of urban pressures and the lack of effective and efficient planning and management, for example due to funding restrictions and public opposition to management measures, and insufficient expertise and knowledge. The latter implies a need for specific research and development activities. In this paper, the need for an integrated and well co-ordinated approach to urban green space research will be discussed. COST Action E12 'Urban Forests and Trees' will be introduced as a recent example of such an effort.

The need for Coordination

Many agree that green spaces in high-pressure urban areas can only be planned for and managed in an effective and efficient way when they are seen as parts of the overall green structure. Street trees, parks, private gardens, churchyards as well as peri-urban woodlands all contribute to this structure and its many functions. During the past decades, 'urban forestry' has emerged as such an integrative approach to urban green structures. In spite of its name, urban forestry does not only look at urban woodlands, but also at urban trees and associated resources at large. The concept of urban forestry as encompassing the planning, design, establishment and management of trees and forest stands with amenity values situated in or near urban areas, has become widely accepted, but only recently in Europe (COST 1997, Miller 1997, Randrup and Nilsson 1998). Urban forestry has a strong social dimension, as the catering for and involvement of local stakeholders is stressed in most definitions. Here, a close link with concepts such as community forestry and social forestry is obvious (Konijnendijk 1999).

Urban forestry is an approach under development, not only in North-America where it is believed to have its roots (e.g. Miller 1997), but also in Europe (Randrup and Nilsson 1998, Konijnendijk et al. 2000). This very fact means that co-ordination in the new field is also still at its early stages. Traditionally, studies on urban forests and urban trees often seem to concern applied, small-scale research at the local (municipal) level (Konijnendijk 1999, Konijnendijk et al. 2000). This local focus for research, coupled with a lack of suitable networks and institutions to facilitate co-ordination, means there is a high risk of duplication of effort. When there is a mutual exchange of experiences and findings, and subsequent joint efforts are undertaken, the efficiency and effectiveness of urban forestry research can be improved.

A second motive for improving urban forestry co-ordination in Europe results from the multidisciplinary character of the new research field. It involves a range of disciplines, including horticulture, landscape architecture, urban planning, landscape ecology, social sciences, and forestry. This multidisciplinary character has also resulted in many different definitions and concepts of urban forestry (e.g., Forrest et al. 1999). The different perspectives and approaches can be an asset, as long as they are carefully co-ordinated under the common denominator of urban forestry.

COST Action E12 'Urban Forests and Trees', a European Initiative

During recent years, a number of co-ordination efforts in the field of urban forestry have been undertaken. The International Union of Forestry Research Organisations (IUFRO), for example, has a special urban forestry unit, and has set up a European forum for urban forestry practitioners in 1998 (Krott and Nilsson 1998). The International Society of Arboriculture (ISA) has recently extended its activities in Europe, supported by the establishment of a European office.

A third initiative is COST Action E12 'Urban Forests and Trees'. The limited overview and co-ordination of research on urban forests and trees in Europe, particularly at the international level, was a major incentive for its establishment in 1997 (Randrup and Nilsson 1998). COST stands for 'European Co-operation in the field of Science and Technology'. The COST-programme aims at the stimulation and co-ordination of research via the establishment of networks, which are called COST Actions. Currently, there are about 160 of these Actions, their main focus ranging from telecommunications and medicine to agriculture and forestry. Funding for the COST programme, used mainly for financing meetings and seminars, is primarily provided by the European Commission.

COST Action E12 'Urban Forests and Trees' will run from September 1997 until summer 2002. Within the first years of its existence, E12 has developed into one of the largest COST Actions and has evoked a great deal of research and policy interest. Currently, 23 European countries are directly involved and contacts

have been established between the Action and a range of other countries. About 80 individual urban forestry researchers from 60 institutions, universities and research institutes mainly, are involved. The disciplinary background of the national experts is varied, with emphasis on forestry and horticulture, but also including landscape ecology, pathology, landscape architecture, planning sciences, and others (Randrup and Nilsson 1998, Forrest et al. 1999, Konijnendijk et al. 2000).

The overall goal of 'Urban Forests and Trees' is to improve the knowledge-base needed for the planning, design, establishment and management of urban forests and trees, by positioning urban forestry as an independent scientific topic in Europe (COST 1997). In order to improve the working efficiency of the Action, it has been subdivided into three working groups:

1. Objectives and functions of urban forests and trees. The domain of this working group includes the planning, design and assessment of urban forest benefits as well as aspects of policy.
2. Establishment of urban trees for urban uses, including identification and selection of species, provenances and cultivars.
3. Management of urban forests and urban trees. The domain of this working group includes pruning, silviculture, diagnosis of damaged trees, as well as overall management methods, including computer-based inventory techniques and GIS.

Great care is taken to integrate the activities of the three working groups, and to ensure that their activities relate to the three commonest locations for urban trees that have been identified to date: urban woodlands, parks and streets.

COST Action E12 holds a joint meeting and seminar twice a year, and in June 1999 an international research conference was arranged in Copenhagen (Randrup 1999). In addition to the networking activities, it has developed a range of research pilot studies. One specific project is aimed at compiling a state-of-the-art overview of recent and ongoing research on urban forests and trees in Europe, as well as on higher education in urban forestry. This information can serve as a knowledge base for further co-ordinating efforts. In the next section, some first findings, focusing on research, of this ongoing study are presented.

State of the Art of Urban Forestry Research in Europe

A state of the art publication, consisting of 20 national reports and giving a good though not complete overview of recent and ongoing research on urban forests and trees in Europe, was compiled during 1998 and 1999 (Forrest et al.1999). In all, over 400 specific research projects were listed.

The report shows that universities and colleges are clearly dominating urban forestry research, with involvement in over half of all projects, with a significant

role also being played by state research institutes. Most of the research is undertaken of forestry and horticultural research institutions. The other main disciplines involved are planning sciences, (landscape) ecology, landscape architecture, nature conservation/biology, and pathology. State funding is involved in a majority of the projects, with an important secondary role for municipal funds. So far, only very few urban forestry projects have been funded by European Union sources (Konijnendijk et al. 2000).

The largest group of projects related to the theme 'Objectives and Functions' deals with strategic urban forestry and green structure planning, as well as recreation studies, ranging from 'traditional' inventories of recreational use to public perception and preference studies. Only very few studies have looked at psychological and health aspects of urban forests and trees. Other main types of studies include research on benefits in general, with only minor attention for the economic valuation of urban forests. Some selected research highlights are:

- Attitudes of citizens towards forest recreation and forest management (Jensen and Koch 1997, Ottitsch 1998)
- Monetary valuation of urban forest amenities (Tyrväinen 1999)
- Psychological and psychosomatic effects of urban green areas (Grahn 1991, Ottosson 1997)
- Comparative study of urban woodland policies and management in Europea (Konijnendijk 1999)
- An ecosystem concept for urban environmental planning (Pauleit and Duhme 1999)
- Sustainable resource management in urban and adjacent rural areas (Persson et al. 1999)
- Progressing the social agenda for urban forestry (Bussey and Coles 1999)

Within the theme 'Establishment & Selection', the selection and testing of plant material for urban areas is the largest category, followed by establishment studies and research on e.g. growing medium and soils, and de-icing agents. Some selected research highlights are:

- Inventory of native forest genetic resources (van Slycken 1998)
- Selection of climate adapted trees (Saebo and Johnsen 1999)
- Selection of elm varieties resistant to the Dutch Elm Disease Pinon and Feugeay 1994)
- Eco-physiological evaluation of woody plants in urban conditions Supuka et al. 1997)
- Effects of de-icing salts on trees and shrubs (Sieghardt et al. 1999, Pedersen et al. 2000)
- Establishment methods for harsh urban growing conditions (Couenberg 1993, Kristoffersen 1999)

- Effects of nursery production method and planting techniques (Ferrini et al. 1999)
- Inoculation with mycorrhiza (Garbaye and Churin 1996)

Determining, preventing and managing various stresses, such as intensive recreational use and the resulting wear and trampling, is the main focus of the 'Management' research theme. Some selected research highlights are:

- Management of urbanised ancient woodlands (Salbitano et al. 1999)
- New tools for urban woodland management planning (Gustavsson and Gemmel 1997, Rydberg 1998)
- GIS as a tool for management of urban trees (Pillmann and Klar 1995)
- Effects of fragmentation and trampling (Löfström et al. 1999)
- Wound response of trees (Oven 1997)
- Pruning techniques (Drenou 1999, Dujesiefken and Stobbe 1999)
- Health status of plane trees (Biocca and Motta 1992, Tello et al. 1999)

Not all of the European countries show the same level of activity or the same focus in research on urban forests and urban trees. Specific problems, for example, direct research. These include the harsh growing conditions in Northern Europe, forest fires in Southern Europe, and political and economic transformation in Eastern Europe. In Western Europe, afforestation policies for (peri)urban areas are supported by research on urban woodland design, planning, use and stakeholder participation. On the other hand, main research topics and needs are rather similar, resulting from the common challenge to deal with urban pressures, such as intensive use, pollution and the competition for land. In all countries, the primacy of the social functions of urban green spaces is recognised. Although quite a number of relevant project have been identified, these are widely spread among countries, institutes and disciplines. Many studies still have a mono-disciplinary scope. Co-ordination of research is complicated by the local and regional character of many projects and by the fact that distribution of most findings is at the national level only.

Future Demands

The city of tomorrow asks for sufficient healthy and multifunctional green spaces. Therefore, a pressing need exists to enhance the conservation, management and development of these areas, while keeping in mind the many different values these areas have. Urban sites are harsh on most types of vegetation. According to Gilbertson and Bradshaw (1985), 50 % of all trees planted in urban areas dies in the first year. Miller and Miller (1991) found that the mortality rate varied between 25 and 50 % for a number of species planted in Wisconsin, USA. Overuse, vandalism, soil compaction, de-icing agents, drought and traffic emissions

are among the many threats to urban forest and tree health. The scarce urban forest and tree resource base is under continuous stress. Planners and managers have to try and maintain a sustainable resource, while meeting the many demands of urban society. While doing this, their efforts are hampered by budget cuts, administrative reforms, challenges to the legitimacy of their actions, the demand for more public involvement, and changing public demands and preferences. As an example of the latter development, a survey among the population of Vienna has shown that recreational use is changing towards more active, more nature-oriented, and more 'information-rich' forms (Bürg et al. 1999).

This paper has stressed the importance of a sound knowledge base for urban forestry. With the help of relevant and accessible research findings, urban forest planners and managers will be more successful in developing the right type of green space for the right place, be it a line of street trees, a small neighbourhood park or a community woodland. This means, first of all, that the green area must be optimally adapted to local urban site conditions. These include biotic and abiotic factors such as soil, climate and other organisms, but also site-specific human pressures and demands. These ecological and social conditions can be met by means of proper planning and design, plant selection and establishment, and management, while keeping the economic framework in mind. The latter implies that all costs and benefits of urban forestry have to be considered, not only in terms of management costs but also with regards to the many goods and services urban forests provide.

Research needs in Europe follow this line. More information is needed about the characteristics of urban sites, and on how to successfully grow trees on them. Quite a number of studies has been undertaken, but the exchange of results and experiences has been very limited so far. In conjunction with the need to study urban sites, there is a need to investigate and develop environmentally sound methods of urban forest management. Methods should be based upon a minimum use of herbicides, fungicides and insecticides, in order not to harm green spaces' natural values. On the other hand, techniques need to be efficient and effective. While striving for this, it has to be recognised that traditional approaches and research are not sufficient. Traditional forestry approaches applied in urban areas, for example, have evoked high levels of public criticism. Moreover, silvicultural practices have to be adapted to better take the primacy of the recreational function of urban woodlands into account, and focus less on wood production (e.g. Rydberg 1998, Konijnendijk 1999). But even adapted forestry will only be successful when integrated in an urban forestry approach that includes the contributions from other disciplines.

The demand-side of the relationship between people and urban trees is another main topic for future research. Changing urban demands for e.g. recreation opportunities have to be monitored and anticipated. Apart from a proper valuation of social functions of urban green spaces, more studies should be initiated which look at assessing their ecological and economic values. Only in this way can the

full value of urban forest and tree resources be determined, which is a crucial input to policy-making and planning. This brings us to the need to develop integrative planning. Urban forestry promotes an integrated approach towards urban green space planning and management. But for the sustainable development of urban green structures, urban green planning has to be properly integrated into overall urban planning.

Finally, the increased interest in urban environmental problems will probably mean a considerable increase in urban forests and trees over the coming decades. Most of these will be laid out in the larger cities of Asia, Africa and Latin America (Nilsson et al. 1998, FAO 1999). Obviously, we are all looking forward to this. Similar expansion of the green infrastructure was carried out in Europe and North America during the years after the Second World War and up to the 1970's. It was done with a strong belief in high technology, heavy machines and liberal application of chemical aids. Over the coming years, the main challenge is to ensure that the expansion and management of the green infrastructure of the world's urban areas will be implemented within the framework of sustainable development, without the use of a technology and methods inimical to man and nature.

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Urban Forestry Research in the United States: The State of the Art and Future Prospects

John F. Dwyer, David J. Nowak and Gary W. Watson

Abstract

Urban forestry research promises to continue to be an integral part of the growth and development of forestry in urban and urbanizing areas of the United States. The future is expected to bring increased emphasis on research in support of the care of trees and other plants, ecological restoration, and comprehensive and adaptive management across the landscape. Particular emphasis will be needed on research to guide new developments in the comprehensive health of urban vegetation; ecological restoration techniques; resource inventory and monitoring; dialogue among forest resource owners, managers, and uses; collaboration among agencies and groups; understanding of how forest configurations influence forest use and benefits; knowledge about urban forest health; and dissemination of information about urban forests and their management. It is the integration of the landscape, ecological, and tree/plant-care research that will provide for the comprehensive and adaptive management needed to sustain urban forest structure, health, and benefits over the long term.

Keywords: urban, forest, arboriculture, landscape, collaboration

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Introduction

Urban forestry research is alive and thriving in the United States, due, in part, to widespread recognition of the increasing importance of forests in urban and urbanizing areas, as well as the realization that research is critical to much-needed improvements in the management of these resources. Many factors are operating to increase the scope and complexity of urban forestry research, and these pose new challenges for the future. The purpose of this paper is to outline the status, challenges, and opportunities for urban forestry research in the United States. Since research has been and promises to continue to be intertwined with the growth and development of urban forestry in the United States, our discussion starts with an overview of developments in urban forestry.

Urban Forestry

Urban forestry involves the management of trees and associated resources in urban and urbanizing areas. This management may be planned and undertaken at several scales, ranging from the individual tree to the metropolitan landscape.

Individual trees and plant communities

In urban and urbanizing environments, individual or small groups of trees can be valuable for many different purposes (Dwyer et al. 1992). Value can be measured in economic, esthetic, psychological, social, and ecological terms. The high values of trees in an urban environment, combined with significant threats to their growth, development, and survival have led to significant advances in the field of arboriculture. These advancements include a wide range of practices that help to improve tree selection, planting, growth, maintenance, and protection. Maintaining tree health is becoming more important than trying to remedy symptoms of poor tree health (Harris 1983, Anonymous 1997).

The interest in a comprehensive approach to plant health care is growing, and there is increasing attention to the 'landscape below ground' as a key component of tree health and care (Watson and Neely 1994, Neely and Watson 1998). The emphasis on tree health has been fueled, in part, by increasing concern over damage and liability associated with hazardous trees.

As more attention is given to trees in diverse environments throughout the urban system, important challenges emerge for sustaining tree health in a wide range of environments, some of which pose significant challenges for sustaining healthy plants (i.e., limited rooting space, soil compaction, tree damage, air pollution, etc.). Urban sites rarely provide environmental and plant growth conditions found in the natural habitat. Increasing advocacy for use of native plants in urban landscapes often overlooks the poor match between the plant material and the site.

Individual land holdings and trees are not isolated in urban areas. The homeowner soon learns that a neighbor's trees affect his property and vice versa. Welcomed shade on the house or unwanted shade on the vegetable garden are often from a neighbor's tree rather than one's own. Cooling shade from street trees during an afternoon walk down the block and around the neighborhood may begin to build an individual's awareness of landscape trees on a community scale. As increasing numbers of individuals and groups become involved in tree planting and care throughout urban and urbanizing areas, there is a critical need for disseminating tree care information to a wide range of audiences using a broad range of methods.

Management of prairies, savannas, and other natural ecosystem remnants within urban areas presents resource management challenges different from management of developed landscapes. Ecosystem management rarely focuses on individual trees. Efforts to restore pre-settlement vegetation in these systems have received significant attention in recent decades and have resulted in increased study of the development of plant and animal communities in urban ecosystems. The practice and science of ecological restoration are developing rapidly to address the challenges associated with the restoration, management, and protection of these diverse areas that include prairies, savannas, woodlands, and forests.

The thousands of publicly and privately owned trees and other plants along streets, in gardens, parks, campuses, and natural areas, together provide the entire community with economic, esthetic, psychological, social, and ecological benefits. More than any other forest, the building block of the urban forest is the individual tree, but the aggregate effects of these individual trees and associated resources can have a major impact on our communities.

Comprehensive and adaptive management across the landscape

There is increased attention to comprehensive and adaptive management of forests across the urban landscape (Dwyer and Nowak in press, Dwyer et al. in press). The diversity of urban forest resources and their extension across land uses, property lines, and political boundaries call for management programs that bridge jurisdictions and employ multiple disciplines. Among the fields that may be involved in urban forest planning and management are forestry and arboriculture, ecology and wildlife management, entomology and pathology, hydrology and soils, meteorology and atmospheric science, landscape architecture and recreation management, psychology and sociology, planning and economics, and political science.

Given the unique and varied character of urban forests found in particular settings, effective management requires different forest management strategies within an urban environment (for example, by land use, land ownership, degree of development, and population density) and among urban areas (with different ecoregions, populations, and other attributes). Because of the complex land uses,

ownerships, and resources, a "one-size fits all" urban forest management scheme is not appropriate.

A key element in managing urban forests in a regional context is the coordination of activities among different owners and managers across jurisdictions. The participation of multiple stakeholders in urban forest management requires a forum to help link forest structures and their management throughout and beyond the urban system. Such collaborative stewardship should involve not only owners, users, and managers of natural resources, but also individuals and groups involved in the management of other urban components (for example, commercial developers, city planners, utilities, and residents). Collaboration among a wide range of decisionmakers who affect urban forest resources provides opportunities for those involved to identify common interests, resolve potential problems, and coordinate efforts to meet multiple objectives.

The diversity and connectedness of forest resources across an urban system demand comprehensive approaches to their planning and management. The complex interrelationships between urban forest components and air and water quality, wildlife habitat, utilities and other infrastructure, and the overall esthetic character of the community support the adoption of an ecosystem-based approach to natural resource policy, planning, and management.

Because urban forests are dynamic systems, their management must also accommodate rapid changes in the extent, health, and use of resources over time. Implicit in adaptive management of urban forests is the ability to monitor progress and evaluate the effectiveness of management decisions. By monitoring the effects of program activities on the extent, health, and use of the resource, by identifying areas for improvement, and by modifying management plans to address problems, adaptive management provides the flexibility necessary to sustain and enhance important forest resources in changing urban environments.

Research Emphases

The advantages of improvements in individual plant care, ecological restoration, and comprehensive and adaptive management of urban forests are clear. However, the implementation of these improvements can be a difficult challenge for urban forest managers (Dwyer et al. in press, Dwyer and Nowak in press). A high level of research support will be required in the following areas: improving comprehensive health of urban vegetation; improving ecological restoration techniques; improving resource inventory and monitoring; improving dialogue among urban forest owners, users, and managers; fostering collaboration among agencies and groups; improving the understanding of how forest configuration influences forest use and benefits; increasing knowledge about urban forest health; and improving the dissemination of information about urban forests, their benefits, and their management.

Comprehensive health of urban vegetation

Because of the increased attention to management of vegetation throughout the urban environment, researchers working to enhance plant health face new challenges that range from planting trees adjacent to structures to planting in former toxic waste sites. Increased concern over plant health and the high cost of dealing with unhealthy plants are good reasons for increased research on sustaining and improving plant health. New techniques for plant health monitoring and information dissemination need to be developed to support comprehensive plant health care. There may also be a need for new developments such as specialized rootstocks for small trees, soil amendments, innovative approaches for planting on difficult sites, and new tools for detecting structural problems in standing trees.

Ecological restoration techniques

With increased interest in restoring a wide range of diverse plant communities in urban areas, and controversy over the appropriateness of some techniques for creating and maintaining these communities, there is an increasing need for research to guide ecological restoration efforts. Important needs include research that will help predict the future growth and development of these communities under various resource management programs. Also needed are restoration techniques that are acceptable to site users and nearby residents (Gobster 1997).

Improving inventory and monitoring of the urban forest resource

Comprehensive inventory and monitoring of the urban forest resource is needed to provide an essential base for understanding diverse urban resources and how they change over time, as well as for helping to improve resource management and resulting benefits. Research is needed that will support the development of new inventory and monitoring systems to: 1) address the lack of critical urban forest resource information; 2) identify forces for change in the urban forest and their influence on the extent, use, and management of urban forest resources; 3) provide a starting point for the development of predictive models to estimate the growth and development of urban forests in the future; 4) collect information that is essential to the implementation of important urban forest-related projects, such as air and water quality models; and 5) monitor the rates of change, extent, and health of urban forests, providing a foundation upon which evaluations of adaptive management programs may be based.

To accommodate the dynamics of resource components, techniques for comprehensive inventories of urban forests need to be developed that involve continuous, long-term monitoring. The establishment of permanent field plots and continuous data collection within urban areas is necessary to obtain long-term information about change in the urban forest resource. This monitoring has been started in a few cities (e.g., Syracuse, NY, and Baltimore, MD) as part of USDA

Forest Service research as well as the National Science Foundation's long-term-ecological research (LTER) programs. Comparisons of repeated inventories may be used to monitor forest health, observe natural resource trends, and evaluate the effectiveness of management programs at multiple landscape levels. Frequent inventories of urban forest structure in diverse areas are necessary to achieve an adequate understanding of this complex and important resource, as well as to help develop partnerships and guide comprehensive and adaptive management.

Improving dialogue between forest resource owners, managers, and users

Given the large number of stakeholders involved, the diverse and dynamic character of their interests and activities, and the potential for their actions to have a substantial impact on the urban environment, an effective dialogue among urban forest owners, managers, and users is critical. The dialogue must serve complex needs. Interaction must occur among groups that are disproportionately experienced and educated in urban-forest-related disciplines, and have a broad range of valid concerns. Despite some heroic efforts, this dialogue is seldom effective, and research is needed to guide new efforts at building and sustaining a useful dialogue.

Improved participation of urban forest owners and users in decisionmaking is important for several reasons. First, the values, attitudes, and concerns of urban residents provide the foundation for determining what urban forest structure and benefits should be sustained. Thus, participation of owners and users in identifying the goals of urban forest management is fundamental to creating a sustainable urban forest. If citizen input is omitted from the management framework, the process is unlikely to achieve urban forest sustainability. Further, because individual urban residents control a substantial portion of the urban forest, their understanding of how their activities influence the urban ecosystem is crucial to sustaining desired benefits. Open dialogue among the involved parties not only clarifies management issues, but also creates a mechanism that will enhance information sharing and technical assistance to landowners and community residents. As part of this partnership, managers also have a heightened ability to reduce detrimental human forces for change in the urban forest such as improper pruning, unnecessary tree removal, and damage to trees.

Fostering collaboration among agencies and groups

Given the large number of public agencies, not-for-profit groups, private firms, and other organizations that influence urban forests, their management, and use, the actions of many entities often have far-reaching implications for the structure, functions, and benefits of urban vegetation. Consequently, collaboration among these players is critical for working toward urban forest sustainability. Collaboration requires knowledge about the partners. For example: What are the goals and

objectives of urban landowners? Are they willing to participate in cooperative management programs involving multiple holdings?

There is a strong need to develop methods for collaboration among the many agencies and groups that focus on particular components of the urban forest, including single trees or other plants, restoration of urban plant communities, and various other components (i.e., street trees, parks, preserves, greenways, etc.). Also needed are improved methods of collaboration among public and private groups concerned with the urban forest.

Urban forestry can play a critical role in enhancing the sustainability of the urban community as a whole. Urban renewal and community revitalization programs have several dimensions to which urban forest management can make significant contributions (Dwyer and Schroeder 1995, Feldman and Westphal 1999). Urban trees can contribute to urban improvement programs through microclimate improvement, pollution prevention and mitigation, local economic development, and city beautification. The participation of urban residents in urban forestry programs can also facilitate community organization and empowerment, which subsequently strengthen the vitality of the area. The contribution of urban forests to the quality of the urban environment and the inherent links between urban forestry and other components of urban and surrounding systems enhance the desirability of integrating urban forestry with the activities of other agencies and groups. Because the management of urban forest resources can improve the environmental and social well-being of communities, the collaboration among multiple groups to meet common goals is an important emphasis for the future. But it is clear that collaboration among these diverse agencies and groups does not just happen on its own; special efforts are needed to make it happen and continue into the future. There is much to be learned from evaluating the successes and failures in previous collaborative efforts. This area is closely tied to the generation and distribution of information about forests and their management and use, since the availability of improved information is essential to collaboration.

Improving the understanding of how forest configuration influences forest use and benefits

Urban forest benefits are directly dependent on the configuration of vegetation and its location with respect to other natural and human-made attributes of the urban environment (urban forest structure). To achieve community goals, managers need to design and work toward an appropriate vegetation structure to provide desired benefits. This task requires an understanding of how forest configuration influences the flow of benefits. Knowledge about the relationship between forest structure, function, and benefits enables managers to develop management objectives and programs that reflect community interests, and allows them to determine the scale at which management efforts must be implemented to attain community goals.

The most desirable configuration of the urban forest resource depends on the conditions and management goals unique to each location. Because the desired benefits from urban forests vary among individual communities and across land use types and landowners, the best configuration of trees to provide the needed benefits for one area can differ markedly from the forest structure required to meet the goals in another area. For example, obtaining particular benefits from trees in an urban park site (e.g., to provide shade) requires a different landscape design than what is needed to secure urban forest benefits in a residential (e.g., to reduce energy use) or transportation setting (e.g., pollution removal).

Urban forest structure influences the provision of important benefits at several different geographic scales. The large-scale or landscape configuration of the urban forest is important for providing significant benefits to broad areas, including air and water quality, and wildlife habitat. Alternatively, small-scale configurations may be primarily designed for local, more immediate benefits, such as esthetics, microclimate, energy conservation, or opportunities for outdoor recreation. These local-level effects often combine to affect the entire region. Since urban forests are often managed at multiple scales, management decisions need to consider the complex interactions of management objectives and forest structure in meeting local and regional needs.

Critical research on the linkages between urban forest structure and benefits needs to be conducted in a wide range of environments and at multiple scales. The task is substantial given the complexity of the urban forest and the urban environment, as well as the wide range of important benefits that can be provided. However, without this important information, managers and planners lack critical guidance for how to develop plans and programs that will provide desired benefits. Models that help predict benefits based on urban forest structure are likely to be particularly useful. It is important to recognize that various configurations of the urban forests have important implications for forest health and associated maintenance/management.

Researchers are linking forest benefits with the structure of the urban forest through innovative modeling efforts. A new Urban Forest Effects (UFORE) model that utilizes tree cover and field data from across the urban ecosystem quantifies urban forest structure and associated functions (for example, impacts on air quality and greenhouse gases) across a variety of urban areas (Nowak and Crane in press). Previously developed models that predict scenic beauty, perceived safety, and probability of human use as a function of forest structure can also be instrumental in developing comprehensive management plans to enhance and maintain the beneficial functions of urban forests (Dwyer et al. 1989, Lein and Buhyoff 1986, Schroeder 1982, 1983, 1986, 1988, 1989, Schroeder and Anderson 1984, Schroeder et al. 1986, Schroeder and Cannon 1983, 1987). A critical need in the modeling efforts is to build dynamic models that estimate changes in benefits as the forest changes over time. This requires improved information on the growth and development of trees and forests.

Increasing knowledge about urban forest health

Inherent in sustaining urban forest benefits is preserving the health of the resource. This emphasis area represents a continuing effort to maintain a healthy and functioning urban forest system as a vital component of sustaining urban forest benefits. This area addresses several critical concerns associated with the vitality and perpetuity of urban forests and their surrounding environment. In addition to targeting the key factors that directly affect tree and forest health, this emphasis area also includes research and development efforts to identify and deal with the indirect impacts of human activities (disturbance and pollution) on the extent and condition of urban forests. This research can provide managers with the means necessary to attain their management objectives in light of environmental and human threats to urban forest health.

A recent Urban Forest Health Needs Assessment Survey conducted by the USDA Forest Service Northeastern Area State and Private Forestry (Pokorny 1998) found a disparity between the high level of interest on the part of urban forestry professionals in preserving the health of urban forests, and the shortage of programs that specifically address and actively implement urban forest health management and preservation. Less than 25 percent of these professionals ranked the current general health of the urban forest in their state or city as good or better. The most frequently cited adverse impacts on the current condition of urban forests were specific tree health problems. This survey suggests a need for more tree health-related research.

Some of the most immediate and direct concerns in maintaining the health of urban forest resources are natural forces, including insects and disease, invasive species, fires, and storms. Extensive losses of urban trees due to these threats in the past have forced managers to expend significant percentages of their budgets on containment, treatment, clean up, and replacement activities. Such reactionary management can eventually become counterproductive, as efforts to sustain desired forest structure, functions, and benefits are forgone to support damage control. Development of programs to encourage prevention measures and cooperative response to disaster events can allow managers to pursue their management objectives while dealing with forest health issues (Andresen and Burban 1994).

The conditions under which we often expect trees to grow in urban areas present a far greater and more chronic problem than individual natural disasters or disease problems. Poor quality soils, restricted spaces, extreme environmental conditions above and below ground, and pollution all contribute to poorer health and shorter life expectancies (Watson and Neely 1994, Neely and Watson 1998). Additional research is needed to learn how to provide the critical elements of the natural environment to trees in urban environments. Developing trees more adapted to harsh urban environments could also result in healthier trees (Ware 1994). A combination of tougher trees and more tree-friendly landscapes will undoubtedly be the most successful approach for sustaining urban tree health.

Research can play a critical role in developing tree and forest health programs and methods for increasing their cost effectiveness. Arboriculture is a labor-intensive industry operating in a limited pool of available labor (Thaler-Carter 1998). Two approaches hold the most promise for improved tree care and tree health. A better understanding of tree biology, targeting a better match between trees and urban environments, and improved tree health may reduce the need for tree care services. Increased use of technology may help tree care operations to become more efficient. Efforts to maintain forest health are especially critical in urban areas, given the importance of urban forests, the high level of public scrutiny of these forests (including their health), and the difficulty and high cost of restoring forest health. Concerns for the implications of hazardous trees have also given increased impetus to research on tree health.

The recent establishment of long term ecological research in urban environments (Baltimore, MD, and Phoenix, AZ), funded, in part, by the National Science Foundation, has affirmed the importance of researching natural environmental processes in urban settings. The research questions that are fundamental to the LTER projects will move both researchers and managers toward improved understanding and management of specific factors that threaten forest health in urban areas. Some of the key questions now being addressed include: How will the structure and function of an urban forest change over time, given a range of management and ecological restoration techniques? How does urbanization impact the soil, water, air, and meteorological conditions that influence urban forest growth and development? How does natural plant succession in urban areas differ from that in rural areas? What are the lifespans of different urban tree species, and what environmental and management factors affect the lifespans and health of urban trees?

Improving the dissemination of information about urban forests and their management

The key to adaptive management is applied learning: a process that is fundamentally driven by a continuous influx and application of new information (Bormann et al. 1994, Lee 1993, Maser et al. 1994). Thus, a critical responsibility of managers and researchers is to provide stakeholders, decisionmakers, and users with information and sources for information to enhance community-wide planning and management. The effective distribution of information is an essential precursor to users' (homeowners, planners, educators, and researchers) ability to sustain urban forest benefits. As groups generate new information on urban forest structure, functions, and management technologies, the need for a reliable mechanism to ensure its dissemination in a useful form and timely manner continues to grow. Research can play a key role in helping to develop these dissemination systems, as well as the means for getting feedback from users on the effectiveness of the information and their likely future needs.

Improving the dissemination of urban forest information is an important element of comprehensive and adaptive management of urban forests for a number of reasons. Primarily, educating public and private landowners and groups about urban forest benefits, tree and forest health issues, and management/maintenance options enables them to make informed decisions in the urban forest planning process. Residents who are aware of the benefits and costs associated with urban vegetation are more likely to achieve maximum net urban forest benefits related to their environment and community well being. Similarly, residents who have sound information about tree selection, planting, maintenance, and preservation are more likely to be effective managers of the urban forest. Improved dissemination of information can also be a useful tool for coordinating management efforts across the community. Public education on maintenance techniques, urban forest health issues, and other management topics offers foresters and others in public and private organizations an opportunity to influence the management of vegetation outside of their immediate responsibility. Because the activities of private residents and other landowners affect a large portion of the urban forest resource, informational programs aimed at these audiences provide managers with a means to enhance benefits from a significant portion of the resource.

While essential to the comprehensive and adaptive management of urban forest resources, improved information exchange can also be a critical component of general environmental education for all ages. Circulating pamphlets, providing literature, and hosting public workshops about natural resource issues within the community may generate awareness of similar issues beyond urban areas. These efforts may encourage environmentally responsible behavior among residents, or may prompt citizens to volunteer their resources and efforts toward natural resource-related causes outside of their communities. Learning how to best accomplish this information exchange amid the complexity of the urban forest, urban environment, and information flows in urban areas is a major challenge for researchers.

Summary and Conclusions

The management and use of urban forests is becoming more complex, the outcomes are becoming more significant to people, and an increasing number of individuals and groups are becoming involved in the planning and management process. These changes have increased the need for scientific information to guide important decisions about forest management and use. As the scientific questions have increased in number, significance, and complexity, a wider spectrum of scientific disciplines has become important to urban forestry research. There is an increasing trend towards managers and researchers working collaboratively to identify and solve problems. These partnerships have become a powerful influence on urban forests and forestry, and have placed new demands on researchers

for answers to complex questions about urban forest management and use. Researchers from many different disciplines are working together, often in teams, to tackle complex problems that range from mitigating urban heat islands, to protecting natural areas in the face of rapidly expanding urban developments, to helping guide the restoration of urban ecosystems. Expansion of the scope, complexity, and scale of urban forestry has brought increased attention to a landscape perspective for urban forestry research.

Sustaining forest structure, health, and benefits throughout the urban ecosystem over the long term will require comprehensive and adaptive management approaches. Implementing these approaches will require increased involvement of urban forestry research. It will be particularly critical that research supports improvements in the following: comprehensive health of urban vegetation; ecological restoration techniques; resource inventory and monitoring; dialogue among forest resource owners, managers, and users; collaboration among agencies and groups; understanding of how forest configurations influence forest use and benefits; knowledge about urban forest health; and dissemination of information about urban forests and their management.

As research on urban forests and forestry increases in scope and complexity, the boundaries between urban forestry, arboriculture, landscape architecture, and other areas tend to blur. As urban forest management becomes more comprehensive and the issues addressed mirror those in rural areas, linkages with research in ex-urban areas also increase. The urban-rural linkages also increase as we recognize that many of the physical, biological, and social processes that influence forests operate across the urban to rural continuum.

Future urban forestry research efforts are likely to be most effective if they involve collaboration with managers, teams involving researchers from a wide range of disciplines, and a focus on multiple scales across the urban landscape (i.e., from single trees to urban and urbanizing landscapes) in support of collaborative and adaptive management. This integration of the landscape, ecological, and tree-care research in urban forestry will provide for comprehensive and adaptive management to sustain urban forest structure, health, and benefits over the long term.

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Monetary Valuation of Urban Forest Amenities: Possibilities and Constraints

Liisa Tyrväinen

Abstract

Urban development projects often decrease the amenity values of green spaces, which should be taken into consideration in planning. Land-use planning procedures do not include systematic assessment of urban forest benefits and therefore quantitative information on residents' valuations is needed. This paper discusses the possibilities to value urban forest benefits in monetary terms and the application possibilities of such information in land-use planning. The paper sums up European research experience from two economic valuation methods, hedonic pricing and contingent valuation in the field of urban forestry. Furthermore, recent results of empirical studies conducted in Finland are presented.

The hedonic pricing method examines external benefits and costs associated with housing. In contingent valuation people are asked directly what they are willing to pay for provision of green space services. The main use of valuation methods is economic evaluation of the impact of urban land-use plans and the evaluation of profitability of urban greening projects. The results of case studies show that management of urban forests for amenity benefits is profitable in economic terms. Furthermore, the results suggest that a limit can be found where condensing town structure, i.e. building on green areas, is not worthwhile from the point of view of the society if the losses of green space benefits are taken into account.

Keywords: amenity benefits, CBA, contingent valuation, green areas, hedonic pricing, property values, town planning, urban forests.

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Introduction

The quality of the living environment needs to be improved in many cities and towns. The importance of urban green areas has in particular been noted in highly urbanized European countries (Forrestet al.1999). In developing countries, urbanization has been dramatic in creating an environment practically without any amenities. Even in countries with abundant forest resources such as Finland, preserving forests or trees in construction has been neglected, and the reasons for this are often economic. Although preservation of urban forests may rank high among strategic objectives in city planning, it is less successfully put into practice in land use decisions (Vuolanto and Tuhkanen 1982, Tyrväinen 1999). In addition, the guidelines for protecting trees during construction are not systematically in use.

In the 1990s, condensing the existing town structure has been seen as a general solution for attaining the goals of sustainable development by achieving as main targets: savings in transportation costs and in the use of natural resources and energy (e.g. Lahti and Rauhala 1994). The population growth has resulted in an increasing demand for land within city limits and demands to build on existing green areas. Today, also in Finland, the problems related to compact city policies are clear because of continuing migration from the countryside and smaller towns to development centers. This exerts increased pressure on land use in urban population centers - in particular in the Helsinki metropolitan area, which is expected to receive 180 000 new inhabitants by the year 2020 (Väestö 1999). Thus far, the economic aspects -as narrowly defined- have dominated the discussion on urban development, but the criteria for environmental quality have been discussed much less. Rather little consideration has been given to determining the impacts of infill on green areas and how successfully condensed town structures and sustainable use of green areas can be combined.

In Finland, the municipalities own the large majority of urban forests and are also responsible for providing the green space services. The urban forest (*taajamametsä*) is typically defined as a forest or woodland located in or near urban areas, which main purpose is to provide recreational and other amenity benefits for residents.

However, urban forest policies including specified objectives for forests, are rare in Finnish cities and towns. According to Löfström (1999), multipurpose objectives are commonly lacking in urban forest management. Furthermore, the economic difficulties of municipalities have been reflected in cuts in the maintenance budgets in many towns. A similar trend is also found across Europe (e.g. Konijnendijk 1999).This implies that the amenity values of urban forests have not been adequately recognized by decision-makers in municipalities and in general.

The land-use planning phase, which includes questions of how many and what kind of areas are to be allocated as green spaces, determines the long-term possibilities for sustainable management of green areas. The costs of establishment of new woody vegetation are more than ten times higher then those of preserving existing forest vegetation (e.g.Vuolanto and Tuhkanen 1982).In addition, local res-

idents often oppose development plans such as infill of residential areas. Therefore, the losses and gains of different development alternatives should be assessed comprehensively from the point of view of society.

Monetary valuation aims at measuring the benefits and costs of environmental goods in the same quantitative unit as market-priced goods. The value of urban forests mainly consists of non-priced benefits, such as providing a pleasant landscape, clean air and tranquillity. Collectively, these values can be termed as 'amenity values'. Today, land use planning procedures do not include any systematic assessment of these benefits. Furthermore, the law for environmental impact assessment (EIA) required in city planning is qualitative. These types of valuations are difficult to integrate into the assessment procedure and, in practice, it is difficult to speak in favor of green areas in the face of strong economic interests. Nonetheless, if the benefits of urban forests are not valued explicitly, they will still be valued implicitly through policy decisions. Therefore, quantitative information is needed as a component of land use planning.

Methods for Monetary Valuation of Amenities

One approach for valuing urban forests is to study how much people pay for amenity benefits in housing. The *hedonic pricing method* (HPM) estimates the value of environmental benefits from the costs and prices of related market transactions. The most common application of the HPM is in the property market. The approach assumes that differences in property prices are due to different housing characteristics (cf. Palmquist 1991). Firstly, the price reflects characteristics of a dwelling such as the number of rooms, size, age, size of garden, etc. Secondly, the price reflects locational and environmental features such as the view onto or access to a wooded park or watercourse, proximity to shops, schools, etc. (cf. Palmquist 1991). Theoretically, if a household wishes to enjoy a view onto a forest or a park or to have easy access to wooded recreation areas, it will buy this type of house and pay a premium for it.

A hedonic price model can be computed from data concerning the prices and features of properties. There are, however, several limitations and problems involved in conducting a comprehensive HPM study, and they have led to an abundant literature on the subject (e.g. Freeman 1985, Palmquist 1991). The method requires large data sets collected during restricted time periods, and which are difficult to obtain. The main limitation is that property markets have to be relative stable to combine the price data from different years. In addition, some of the major econometric problems, such as collinearity, the choice of the functional form of the equations, and the separability of variables should be addressed.

One can use the price model (i.e. implicit prices) directly to evaluate the benefits or losses arising from marginal changes in the supply of urban forests. The assumption of marginal changes applies in the majority of cases involving urban

forests: where green spaces are converted into another use or new areas are established, the spatial impact on dwelling prices in the housing area will be restricted. The main losses or received benefits will be experienced by nearby inhabitants, while the impact diminishes the farther away residents are located. In this case, the prices of dwellings affected will adjust to the level of dwellings with similar characteristics, but the hedonic equation will remain unchanged. If dwellings are owner-occupied, the environmental improvement (degradation) will provide a capital gain (loss) for those living in the area (Palmquist 1991). In a case of large changes a second phase of the analysis i.e. an inverse demand function has to be estimated.

The application possibilities of the method include an assessment of lost benefits of condensing the existing town structure as well as the economic impacts of establishing new green spaces. Understanding that the investments in new green areas will be capitalized in the property prices helps in, for example, justifying greening projects. It is also possible to estimate the value loss to nearby properties due to construction of a green area or compare the benefits of green areas to their maintenance costs. In addition, property value models may serve as a tool for pricing apartments or for pricing the building sites where environmental variables can be included.

Another promising approach is *contingent valuation method* (CVM), which belongs to the class of preference elicitation methods called 'stated preference' (SP). Other types of SP approaches such as choice experiment, capable of eliciting environmental preferences, have not been yet widely used in environmental valuation (e.g. Boxall et al. 1996). In a CV survey the respondents are asked what they are willing to pay (WTP) for the preservation or improvement of an environmental asset. The researcher can then estimate the monetary value of the asset by calculating the average WTP of respondents and multiplying this by the total number of consumers.

As the CV questionnaire is the principal tool for using the method, formulating a good questionnaire is crucial. Mail surveys or interviews (in person or by telephone) are normally used in data collection. The problems of survey design have been widely discussed in the literature (e.g. Carson 1991, Mitchell and Carson 1993). Care must be taken in the design to minimize the risk of bias. Typically, CVM surveys have different types of components: a description of the good being valued and the situation in which the respondent has to imagine him/herself; willingness to pay questions for the environmental good; and questions concerning general attitudes towards the good in question and the socio-economic characteristics of the respondent.

At the municipal level, it is necessary to assess whether the provision of recreation services and the financial resources are in balance with the demand of the areas and their management. The CV method produces monetary estimates of amenity benefits that can be used directly in benefit-cost analysis. The monetary estimates of green space benefits could be used in evaluation of land use alterna-

tives in town planning or to compare whether or not the management of the areas is cost-efficient.

CVM's main advantage is its flexibility and ability at least theoretically to estimate total value including non-use values (Carson 1991). In urban settings the great advantage is that the method can be used parallel to HPM. The main weakness of the method is that responses are based on hypothetical and not actual behavior. To obtain valid answers, the respondents must understand and accept the hypothetical market situation introduced by the CVM, where payments are to be made for services which were previously free. In general, it seems that there is considerable validity in the estimated use values, which is the main value category attached to urban green spaces (Tyrväinen 1999).

Review of previous research in Europe

In Europe more than 200 economic valuation studies have been carried out (Navrud and Pruckner 1997). Most of them have been undertaken in Northern Europe, i.e. in the UK, Norway and Sweden. The main focus has been on the non-use values of environmental goods. Most of the European studies have used contingent valuation and travel cost methods, but few examples of recent applications of HPM are known (Navrud and Pruckner 1997). In particular, there are very few examples of the monetary valuation of urban forest amenities (e.g. Forrest et al. 1999, Tyrväinen 1999).

In the UK, Willis and Garrod (1993) studied the effect of countryside characteristics on property prices. They found a significant positive relationship between broad-leaved woodlands and house price, and a significant negative relationship between mature coniferous forests and house price. Their conclusion was, however, that the explanatory variables for forest benefits were inadequate. There was no precise information on how the houses were actually located with respect to the forest areas, because measurements of the amount of woodlands and proportion of tree species were made using 1 km^2 units, due to data acquisition problems.

In Germany, Bergen and Pfister (1995) applied the method in a small case study to value neighbourhood externalities related to an afforestation project in the Göttingen region. One of the factors included in the property value model was landscape value. Afforestation was found to improve landscape amenity value in the area and capitalize in properties. In the Netherlands, Luttik (1998) found that a pleasant view alone would lead to a considerable increase in house price, particularly if the house overlooks water or open space. Results with regards to the role of trees were less clear, however. In some cases, a value-increasing effect was found but in most cases the hypothesis that a view of trees adds to the property value had to be rejected. Proximity of public parks also yielded ambiguous results; only when water was a distinctive feature in the park could a premium on

the house be demonstrated. It was found that the added value of being situated in a town surrounded by a pleasant landscape – with woods, lakes or a diversity of landscape types – could be 5 to 12 percent.

In the UK, Bishop (1992) applied contingent valuation to study the recreational value of two urban fringe forests. The study is one of the few in which different land use values were compared to gain an insight into the relative importance/value of woodland environments. A sample of 100 respondents was taken at each site and different willingness to pay question modes were used in the study. Respondents were found to be more willing to pay an entrance fee than other types of payment. Furthermore, the existing user benefits, in terms of recreation value, were found to exceed the associated management costs by a factor three. In Switzerland, Nielsen (1992) studied the value of urban fringe forests in Lugano region with travel cost and contingent valuation methods. The annual value of the urban forests was estimated to be 3 700 CHF/ person, which included both recreational value and other amenity benefits of forests. Using this monetary estimate the annual amenity value of the forests in the region was calculated to be 65 000 CHF/ ha.

In Germany, Elsasser (1996) applied the CV method for valuing the recreational use of two urban fringe forests in the Hamburg region. The data set used was exceptionally large (approximately 3 500 respondents) and the travel cost method was used to verify the results. The mean WTP/year for the use of the forest was 114 DM in Hamburg forest, which was higher than that of the more remote Pfälzerwald area (WTP 101 DM/year), since using remote areas means higher travel costs.

In Finland, the CV method has been previously used for estimating the benefits of regional recreation areas on the outskirts of Helsinki (Sievänen et al. 1992). Visitors to the Luukkaa area (north of Helsinki) were asked to pay a hypothetical entrance fee. Three different kinds of WTP questions were posed: a conventional question on WTP for an entrance fee, WTP for traveling to the site and an attitude question in which the visit was to be compared to other leisure activities familiar to the respondent. The idea of the last question mode was to make the question less hypothetical and capture the psychological value of the visit rather than elicit the monetary value of the forest experience. The data was collected via in-person interviews (406 visitors). Here, the average WTP for an entrance fee was about 12 FIM.

Recent Results in Valuation of Amenity Benefits in Finland

Study towns

Both economic valuation methods, i.e. CVM and HPM, were applied between 1995–1999 in two different urban environments, Joensuu and Salo, Finland. Joensuu is a town of 48 000 inhabitants and the capital of North Karelia, located in eastern Finland. The landscape in Joensuu is rather flat. Typical landscape features in the town are water and abundant urban forests. Green spaces represent 34 percent of the town area, the majority of which are forested parks preserved from natural forest vegetation. Two thirds of the areas are dominated by Scots pine and birch species dominate another 17 percent. Most of the areas consist of middle-aged (60–70 years old) forest stands. Most of the housing districts have some sort of wooded recreation area with facilities such as skiing and jogging trails.

Salo is a town of 23 000 inhabitants in southwestern Finland. The town is an old commercial center in a large river valley. The main features in the landscape are agricultural fields and forested eskers between the fields. The town has considerably less urban forest than Joensuu: a large part of the housing is located on former agricultural land. In 1996 the green spaces covered 17 percent of the planned town area. 81 percent of the green areas were forested and 19 percent were constructed parks or shelterbelts. Most of the forested areas are found at the urban fringe, located on hills emerging abruptly from the valley. Recreation possibilities on municipal land within town limits are few. Therefore a part of the recreation areas have been established in private forests and are maintained by the town's park office.

Urban forest benefits reflected in property values

The price data for the property value studies were collected in both study towns from owner-occupied terraced house apartment sales. Price data from real estate transactions in Joensuu consisted of 1006 observations and in the Salo region of 590 observations. The data included approximately 20 variables on apartment features as well as locational and environmental data concerning the properties. Environmental attributes, for example, distance to watercourses and recreation areas as well as locality data, i.e. distance to town center, shops or schools, etc., were measured with respect to the specific row house.

The urban forests were inventoried from forest management plans and from aerial photographs. Four different variables describing urban forest amenities were also measured with respect to each dwelling. These variables included: (i) distance to the nearest wooded recreational area; (ii) distance to the nearest forest park; (iii) relative amount of forested areas in the housing district; and (iv) view from the dwelling window. The data collection is described in detail in Tyrväinen (1999).

The results of the first property value study conducted in Joensuu showed that on the average, an increasing amount of forested areas in the housing district as well as nearness to a watercourse and recreation area increased apartment prices. In contrast, the influence of forest parks had remained unclear. One problem was that the range of variation in variable values remained small, because most of the apartments (78 %) were at a distance of 100 meters or less from a forested area. It was concluded that direct distance to the nearest forested park was a rather rough variable and which did not capture forest benefits well enough in near-home environment. There was no information, for example, on whether there was actually a view to a forest. Therefore, further research concerning the effect of small forest parks on property prices was needed.

The second property value study, conducted in Salo, included an additional variable – the quality of the view from apartments – in the price models. The results of the investigation confirm that urban forests are clearly an environmental amenity and that people pay for such benefits through property prices. On average Salo residents are willing to pay 4.9 percent more for obtaining a forest view. In addition, proximity to forested parks was found to have a significant positive effect on house prices. According to the semilog model, an increase of one kilometer in the distance to the nearest forested area leads to an average decrease of 5.9 per cent in the market price of the dwelling (Fig.1). However, according to the price model, where the distance to a forested park was logarithmic the effect was strong up to a distance of 300 meters, after which price changes were increasingly smaller. Furthermore, where the distance to park was established as a dummy variable in the model, a positive relationship between dwelling price and the distance could be demonstrated only up to 600 meters. The results suggest that distance to forested parks has a price effect as long as the areas are within walking distance (600 m) from home. This is line with several other studies that also report that the intensive use of the areas occurs near the home environment (Jensen 1998, More et al. 1988). This is true in particular concerning small parks, but larger areas may be attractive even at longer distances.

Use of the property price models

Here, the use of the hedonic price models is illustrated by calculating the monetary value of a hypothetical forest park using the estimated price model in Salo (Figure 1). First, we determine the total value of the forest views and secondly stage attention will be given to the effect of the distance to the forest park.

The results show that residents in Salo pay 4.9 per cent more for a dwelling with a forest view. It is assumed that size of the forest park is one hectare and it is circular. Given the average yard size of 400 m^2, the number of dwellings next to the park is 35. The total value of these apartments is approximately FIM 13.31 million, and the value of the forest view is 4.9 per cent of the total value of dwell-

ings, which is 652 000 FIM (110 000 Euro). Here, the average size of an apartment is 90 m^2 and the average unit price is 4 225 FIM/ m^2.

Moreover, according to the semi-logarithmic model used an increase in distance of one kilometer reduced the average price of a dwelling by 5.9 per cent. It is assumed that the price effect is zero at one kilometer distance. Here the price effect is calculated only up to 600 meters, because it is a relevant assumption in a case of a small park. The total value of apartments within 600 meters from the park is 454.27 mil FIM. The aggregate value of the park reflected to dwelling prices can be calculated geometrically using the estimated price model for the 600 meters, because the relationship is close to linear (Fig.1). The value of the park is 4.88 % from the total value of apartments, which is 22.17 mil. FIM. When the value of the view is added to this figure, the total value of the park is 22.82 mil. FIM (3.84 mil. Euro). If conversion of the park into other use is considered, this value should be compared to increased costs when providing the building sites somewhere else. A more general calculation example and the illustration of the price model is presented in Tyrväinen and Miettinen (2000).

The value of a park capitalized in property prices can be calculated similarly using any other price model. In this example it was assumed that the park was the only one influencing the apartment prices within 600 meters, which applies in situations where parks are few. In practice, different type of green areas may influence apartment prices, which should be also taken into consideration in

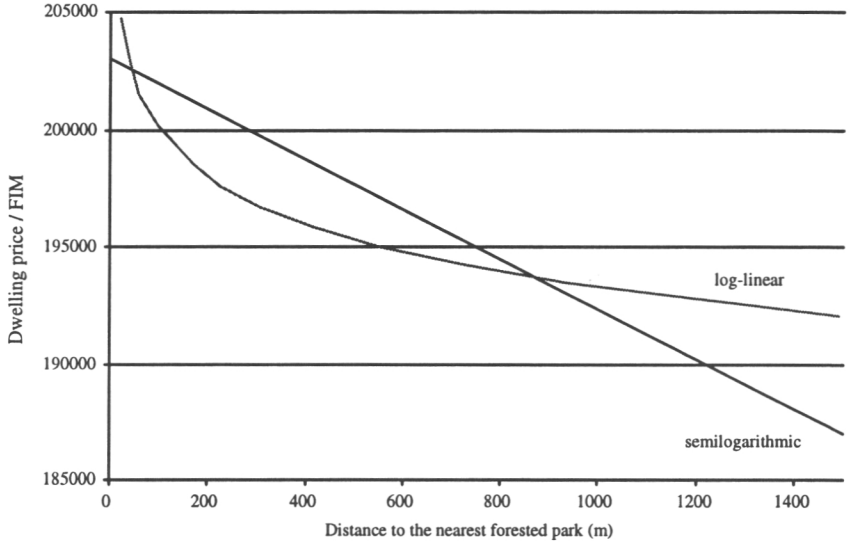


Figure 1. Effect of distance to the nearest forested area on dwelling price in Salo. Both semilogarithmic and log-linear relationship between the dwelling price and the independent variable

calculations. If the construction intensity is higher i.e. there would be mostly blocks of flats instead of small houses in the area, the estimated value of the park would also be considerably higher, approximately 66–89 mil. FIM. Here it should be stressed that the social and ecological carrying capacity of the green area are limited. After a certain limit, the high use of the park becomes also a nuisance to the nearby habitants, which may decrease property values.

Willingness to pay for recreation

The CVM questionnaire was sent in both study towns to 500 randomly chosen residents 15–75 years of age. In the questionnaire, respondents were first told to consider the benefits of urban forests and their use. Subsequently, people were asked to express their valuations in monetary terms. In the survey, the actual users were first asked to state their WTP for the use of the three main wooded recreation areas in each town. The respondents were asked to imagine a situation where free access to and use of the areas was denied. It was explained that the maintenance costs of the areas were to be collected from the users and not covered by taxes because of the recent budget cuts by the town council. Payment cards presenting an array of potential WTP amounts to the respondents was used.

The second WTP questions concerned town planning projects, where new housing areas were planned in forested areas. All respondents were asked to state their WTP to prevent the development of forested parks in the town for housing purposes. The question was: 'How much additional tax would your household be willing to pay annually during the next three years in order to help the town buy the land (or preserve the land) and maintain it as a green space? "The response rate of the survey in Joensuu was high, (68.0 percent) and in Salo moderate (47.0). The data collection, the structure of the survey and statistical analysis are reported in detail in Tyrväinen and Väänänen (1998).

The majority of the visitors in both towns were willing to pay for the use of wooded recreation areas. In Joensuu, half of the visitors were asked to pay an entrance fee per month and half a seasonal fee for the use of the recreation areas. The mean WTP ranged from 42–53 FIM/month (108–141 FIM/season) depending on area and season. The results are reported in detail in Tyrväinen and Väänänen (1998).

The direct use of the benefit estimates can be illustrated by comparing the aggregate benefits to the maintenance costs of the areas or to the value of the land in alternative use. The aggregate recreational value was calculated by multiplying the average WTP in the area by the proportion of users among residents. The following example shows that the monetary benefits of urban forest are much higher than the present maintenance costs.

In Joensuu, the aggregate recreation value of the Repokallio area (86 ha) using the conservative WTP estimate (mean WTP/season) is 1,79 mil. FIM. The estimated costs include the direct forest management costs and the maintenance of

recreation facilities. The average maintenance costs of forested parks were 10, 152 FIM/ha/year, and the present management interval is 5–10 years. In addition, the maintenance costs of recreation facilities are approximately 42 000 FIM/year. Furthermore, the costs should include opportunity cost of land i.e. reduction in timber values due to management adjustments such as prolonged rotation period and small-scale management units required by the recreational use. The commercial value of the annual yield in the Repokallio area is 93 000 FIM (mean yield is 5.7 m^3/ha/year). In the Repokallio area the loss of timber production value is estimated to be 20 % compared to commercial forests, which results an annual loss of 18 600 FIM. Thus the annual aggregate recreation value would be 7 to 12 times higher than the total costs of provision of the recreation services in the area.

In Salo, the actual users were asked their WTP for a two-hour visit to the area. The visitors' mean WTP ranged from 9 to 17 FIM for a visit. The aggregate recreation value in each area per visitor/month was calculated by multiplying the average WTP by the average number of visits/month/person. In Salo, the use value per visitor in different areas ranged from 31 to 76 FIM/month. The estimates in Joensuu for the monthly fee fall within this range.

In Salo the differences in aggregate values are larger, but also the quality and size of the areas varied more than in Joensuu. The use value per visitor in the most intensively used and best-managed area was twice as high as in the other areas. The lowest WTP was allocated to the smallest area, which also had the poorest trail system. It can be concluded that good location and active management raised the average WTP. In Salo the aggregate benefits from the recreational use were found to be 23 to 26 times higher than the management costs depending of the area. These results indicate that on social grounds urban forests are a cost-effective concept.

Willingness to pay for green neighborhood

The key question in the urban setting is more often where to build, rather than whether to build at all. The lost value of amenity benefits in construction in green areas may be considerable. Therefore, these values should be included in the assessment of the best land-use alternative from the point of view of society. The economic value of amenity benefits should be compared to the increase in costs when providing building sites elsewhere.

Here, use of the economic value estimates will be illustrated by comparing people's willingness to pay for green neighborhood with the option of buying an equivalent area at the urban fringe i.e. with the price of unimproved land.

The WTP question concerning preservation of forested parks was ascertained from all the respondents in both towns. In Joensuu, approximately half of the respondents were willing to pay for preventing the construction in urban forests in the housing area. The average WTP ranged from 126 to 206 FIM depending on the area. The lowest WTP was found among residents living in the southern part of the town, which was least affected by the proposed construction. The highest

WTP was in western part of the town, where the development scenario meant condensing the housing area. Here, the estimated total WTP for preserving the potential construction area within housing areas was 8.23 mil. FIM. It exceeds the value of similar size, unimproved land area by 0.73 mil. FIM. This sum can, if necessary, be used to cover the increased costs of infrastructure when building at the urban fringe. This example suggests that in-fill of present housing areas is not always worthwhile from the point of view of society, if the losses of green space benefits are taken into account.

In Salo from 48 to 66 percent of respondents were willing to pay to prevent the construction depending on the area. The average WTP varied from 74 to 169 FIM/year/household. The highest WTP was found as, expected in the case area which had the largest remaining forest area located in the northern part of the town.

In this case area the residents' willingness to pay to preserve the forest (2.05 mil. FIM) would cover only 24 percent of the costs of buying an equivalent area elsewhere. Here, it must be noted that in Salo all the potential development areas were located at the urban fringe instead of inside present housing areas, which would affect more people. This was because of low amount of forested areas within city limits in general.

Conclusions

The results received with both valuation methods show that the urban forest is an important quality factor in the built environment and people receive considerable benefits from the areas measured in monetary terms. The results stress the importance of the quality of the near-home environment and in particular the aesthetic value of urban forests. This fact encourages the maintenance, but also establishment of new green areas nearby homes. The results also bring out the importance of well-managed larger urban wooded recreation areas in the home environment.

The resultant use of economic estimates of the benefits in decision-making would impact at different levels. At a minimum level, they might stimulate public awareness of potential values lost in the construction of urban forests. At a more ambitious level, their value lies in the ability to influence or identify decisions through cost-benefit analysis at project level. Although economic valuation is hardly the solution to all problems, it helps in connecting urban forests and trees to an integrated weighting of interests in spatial planning.

It is difficult to draw final conclusions which of the two methods, contingent valuation or hedonic pricing, in general produces more accurate estimates or if there is any systematic bias such as one produces higher/lower estimates. The main advantage of HPM is that it relies on actual market data instead of hypothetical valuations. Furthermore, HPM expresses only the benefits associated with housing and does not cover the whole range of the multiple benefits ensuing from

urban forests. It captures some of the external benefits that occur off-site, such as reductions in air pollution, temperature, noise, and greater diversity of wildlife. Excluded are, for example, non-use values such as the value of urban biodiversity, benefits from timber production as well as the recreational benefits experienced by other visitors not living in the area. In consequence, the capitalization of amenity benefits is only partial, and present in a way just a minimum value of the benefits. This has to be kept in mind when using the monetary estimates.

The effect of an attractive environment on house prices may be intuitively evident, but it is unclear which environmental factors make a location pleasant to live in and of high quality. The benefits are difficult to classify and measure quantitatively for property price models, and today, information on the values that residents attach to forests remains still insufficient. In this research presented, view and distances to green areas are suggested as descriptions of different benefits received from urban forests. In Finland, as in the other Nordic countries, a wooded environment is generally appreciated. In other countries, however, landscape preferences and demands for quality in urban greens differ as a result of cultural differences and the history of land use. Although collecting data for property value studies was time-consuming, in the future data on house prices will be more readily available from price registers. Moreover, the use of the GIS and, for example, numerical town maps and green space structures in a digital format facilitate the automation of measurements for this kind of study.

In addition, attempts were made to estimate whether forest management might have an impact on valuation. In Salo, forest views were classified according to age and species distribution of the nearby forest. Differences were subsequently found only between views onto young seedlings and mature forests, which implies that impacts of management can be captured with the used method. However, there was not enough variability between the age classes. Urban forests may often be rather even-aged, and insufficient variation is found in the quality of the forest view (age and species distribution). Therefore, HPM may not be a suitable tool for detecting this kind of more detailed effect caused by management, suggesting that other research methods will also have to be used. These methods include different states preference methods (contingent valuation, choice experiment). These investigations should include clear visualizations of the proposed forest management alternatives to the respondents.

Moreover, even CVM does not fully capture all urban forest benefits, but only those benefits that people experience. The residents are most likely not to be aware of the benefits such as rainwater retention and erosion control, which are becoming increasingly important in highly urbanized countries. Economic valuation has also the drawback that market prices reflect only the prices that the consumers are able to pay. The approach tends to ignore important equity and moral considerations such as economic values are limited and conditioned by the distribution of wealth. Therefore, it can be concluded that the CV estimates will probably also understate the real value of urban forests.

Typically, in Finland, it is rather difficult to formulate willingness-to-pay questions concerning forest use due to the traditional right of public access. Nevertheless, in this study the scenario presented was generally accepted rather well. Most visitors were willing to pay for the use of the forested recreation areas and the number of protest bids was rather low. Thus it is concluded that in an urban setting, people are more accustomed to pay for their leisure time and therefore payments for e.g. outdoor recreation are probably more acceptable than in other forest areas. One of the problems in applying the CVM is that knowledge of use intensities in urban forests is still rather poor. One of the key components in assessing the validity of the results is the accuracy of the use-intensities that play an essential role when aggregate benefits are calculated. Therefore, statistics and databases on use intensities and types of use are needed, preferably on a continuous basis.

Although in this study the valuation methods were applied to forested areas, the methods are suitable in valuing all types of green spaces. The total value of a certain area depends on its location, size, quality, use intensity and the amount of substitute areas. In general, the scarcer the resource becomes, the higher the value is per hectare. Here, it should be stressed that social and ecological carrying capacity of a forest area is limited. The amount and quality of urban forests is, in the end, a political question and a matter of whose interests are to prevail in decision-making.

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Effects of Fragmentation and Trampling on the Understory Vegetation of Urban Forests in Southern Finland

Leena Hamberg, Irja Löfström, Minna Malmivaara and Ilkka Vanha-Majamaa

Abstract

Urbanization threatens many natural habitats and therefore useful ecological knowledge about urban ecosystems is needed. The application of this knowledge in urban planning and the management of green areas are important matters. The number of recreationists in relation to the size of the forest patches should be taken into consideration when trying to maintain the sustainability of these forests. In Finland, access to forests is unrestricted for recreation purposes according to the country's so-called Everyman's Rights. The most worn-out forest patches are to be found in urban areas, where the recreation pressure is the highest. In the Greater Helsinki area urban forests have suffered from trampling. As a consequence of trampling, the cover of the understory vegetation has decreased and the proportionate area of 'unofficial' paths has increased in many forest patches. The bottom layer was found to be the most susceptible to trampling. In addition to decrease in cover, minor changes in species composition were also noted, although the replacement of more sensitive plant species by secondary species was not immediately obvious. In the most deteriorated areas, where the understory vegetation was totally worn out and where the vegetation will not recover naturally, adding dressing materials and sowing grasses is necessary. This considerably increases management costs.

Keywords: urban forests, ecological sustainability, trampling, wear, revegetation

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Introduction

About 80 % of Finnish population lives in urban environments (Niemelä 1999a). Urbanisation, e.g. increased numbers of people, construction, and fragmentation, threatens many natural habitats. In Finland, about 80% of the urban green areas are forests (Lindén et al.1999) and therefore urban development usually encroaches upon them.

Urban ecology can be defined as ecological research focusing on the urban setting (Rebele 1994). This kind of research is needed because the considerable variation in urban habitats and their species diversity has been poorly documented (Niemelä 1999b). We need to know what kind of nature exists in urban areas. Ecological processes in urban forests are the same as in rural areas. Nevertheless, knowledge about anthropogenic disturbances is needed to improve our understanding of urban ecosystems.

In Finland, urban forests are defined as forests which are located in or near urban areas (Lindén et al. 1999). They are mainly used as recreational areas. Urban forests consist mainly of natural forest vegetation and formations such as man-made parks are excluded. The size of urban forests varies from less than half a hectare to tens or hundreds of hectares. Urban forest patches are often quite small but usually numerous.

Finland has a tradition of free access to forests for recreational purposes according to so-called Everyman's Rights. Therefore, the most worn-out forest patches are to be found in urban areas, where the number of people is the highest. Urban planning has an essential role in maintaining the ecological, and also social, cultural and economic, sustainability of these forests. Ecological sustainability can be maintained if the effects of urbanisation, e.g. recreational use, do not exceed the carrying capacity of urban forests. The carrying capacity is exceeded when the wearing out of the ground vegetation exceeds its natural regeneration.

Excessive intensity of recreational use impairs the sustainability of urban forests and causes visible damages, which also diminish the aesthetic and recreational values of these forests. The management of deteriorated forest patches calls for special, and costly remedial measures. In the most deteriorated areas, where the understory vegetation is totally worn away and will not recover naturally, adding dressing materials and sowing grasses is necessary. Thus, the ecological sustainability of urban forests forms the basis of social and economic sustainability.

Some ecological research has been done with regards to urban environments in Finland (e.g. Löfström 1996, Ranta and Siitonen 1996, Lehvävirta 1999). Still, there is need for further ecological knowledge about urban ecosystems and this can then be incorporated into the management of green areas and urban planning. Our aim in the present study was to look into the anthropogenic effects inflicted on the understory vegetation of urban forests, and based on the knowledge thus obtained attempt to formulate guidelines for urban planning and urban forest management. The key questions addressed were:

1. What are the effects of fragmentation and trampling on bottom and field layer vegetation cover, species composition and abundance?;
2. what is the minimum size of an ecologically sustainable urban forest?;
3. are there differences in the wear-resistance of different forest site types? and
4. What are the most favourable methods to be applied in the revegetation of erosion-damaged recreation forests?

Effects of fragmentation and trampling on understory vegetation in the Helsinki region

Based on studies of urban forests of varying size (1–1 600 ha), we found the understory vegetation in the Greater Helsinki area to be clearly affected by trampling (Hamberg 2000, Malmivaara et al. in prep.). The cover of the understory vegetation was lower in the Helsinki area than in the rural commercial forests that were used as reference areas. The mean total cover of the understory vegetation in *Myrtillus* site type forests studied was 69 % (Malmivaara et al. 2001). In areas subjected to low recreation pressures the mean vegetation cover was 74 % while in the most deteriorated areas it was 43 %. The bottom layer was affected more by trampling than the field layer. The cover of the bottom layer in urban forests was 22 % and that of the field layer 48 %. The cover percentages in the reference areas were 58 % and 42 %, respectively (NFI 1985–1986, Jalonen and Vanha-Majamaa in press). The differences in the cover of the bottom layer between urban forests and the reference areas were statistically significant. There were no difference in the trampling tolerance of *Myrtillus* and *Vaccinium* site types (Hamberg 2000).

The size of the forest patch had only a minor effect on the vegetation cover. Deteriorated areas were found both in small and large forest patches. Despite this, the cover percentage increased when moving towards the forest centre (Hamberg 2000). The sample plots were located more than 30 metres in from the forest edge. The number of residents and children in kindergartens and schools in the vicinity of the particular forest patch were important factors affecting the vegetation cover. The cover of vegetation decreased 8 % per 10 000 residents and by 4 % per 100 children in kindergartens and schools. The path area increased 5m^2 per 10 000 residents.

Especially dwarf shrubs and mosses were found to be sensitive to trampling. Their cover decreased when the total cover of vegetation decreased. The cover of grasses and herbs did not correlate with the total cover of vegetation. Although the cover of the understory vegetation decreased due to trampling, many original plant species were found also in trampled areas if the most deteriorated patches were excluded. There was a small increase in the number of alien species in slightly and highly trampled *Myrtillus* site type patches.

Preventing erosion damages and methods of revegetation

In heavily used recreational areas, special measures, as well as traditional forest management are needed to prevent and remedy damage. Construction of a network of paths is an effective way to guide and direct people and to prevent damage to vegetation (Kellomäki 1977). The addition of dressing materials and the sowing of grasses have been used to restore erosion-damaged forest areas.

It is recommended that when the forest floor vegetation has been worn away and the tree roots are exposed, dressing material should be applied. This material protects tree roots from mechanical damage, binds water, and creates favourable conditions for the development of the ground vegetation. The dressing material should be well-aerated and its nutrient content should be appropriate to the site. It is recommended that a thin (3–5 cm) layer of dressing material be applied over the exposed mineral soil (e.g. Löfström 1986). The dressing materials used here were composted bark, fine sand, peat, moraine soil, and mixtures of several soil types.

The revegetation of erosion-damaged recreational forests has been monitored through long-term field experiments with special emphasis on the composition and cover of the understory vegetation and by studying both the short- and the long-term effects of different dressing materials (Löfström in prep.). Four dressing materials were applied: composted bark and peat-mull (1:2) in *Myrtillus* site type forest and sand-peat (1:2) and sand-clay mull (1:5) in *Vaccinium* site type forest. In addition, 0.006 kg grass seeds were sown per hectare on plots representing the *Vaccinium* site type forest.

Except for composted bark, all the dressing materials proved to be favourable for the understory vegetation. On the peat-mull plots, the cover of the field layer increased from 10 % to 80 % in a period of ten years. On the sand-peat and sand-clay mull plots, the cover percentages of the field layer increased rapidly during the first year, from 10–15 % to over 100 %. By the end of the 10-year study period, the cover percentage of the field layer on the sand-peat plots was 40 % and on the sand-clay plots 60 %. Composted bark was not favourable to the growth of the understory vegetation. The cover of field layer increased from 10 % to 26 % during the study period. Changes in the cover percentages in the control plots were similar to those of the composted-bark plots.

Sowing of wear-resistant grass species is recommended especially in combination with dressing materials. It accelerates the binding of the dressing material to the mineral soil. The idea is to obtain a uniform wear-resistant plant cover on the forest floor. Recommended species to be sown include hair grass (*Deschampsia flexuosa*), smooth meadow grass (*Poa pratensis*), common bent (*Agrostis capillaris*) and creeping fescue (*Festuca rubra*). The amount of seed needed is about 0.005 kg per hectare (0.5 kg/100 sq.metres) to result in sparse plant cover on the forest floor (Florgård 1981).

Discussion

According to the results of our studies, the cover of the understory vegetation has diminished in urban forests. (see also LaPage 1967, Kellomäki 1973, Weaver and Dale 1978, Bhuju and Ohsawa 1998). In our study, recreational use was found to decrease the cover of the bottom layer vegetation more than that of the field layer vegetation in *Myrtillus* site type forests. This was probably due to bryophytes' sensitivity to trampling (Kellomäki and Saastamoinen 1975, Nylund et al. 1979, Hamberg 2000, Malmivaara et al. in prep.).

According to our study, there were no statistically significant differences in the trampling tolerance of vegetation on *Myrtillus* and *Vaccinium* site types. The results of earlier studies were conflicting in regard to the wear-resistance of the vegetation of these site types. Some studies have indicated that the wear resistance of *Vaccinium* site type vegetation is better than that of the *Myrtillus* site type (Kellomäki and Saastamoinen 1975, Kellomäki 1977). According to Holmström (1970), wear resistance increases with increasing fertility.

The size of the forest patch was not found to correlate with the vegetation cover. Nevertheless, the smallest forest patches, which are easily accessible, were found to be the most prone to trampling if recreational use was high, especially if there were kindergartens and schools in the vicinity. The cover of vegetation increased towards the centre of the forest patches. It seems that recreationists use areas near the edge of the forest more frequent than on areas in the middle of the forest patches. However, the centre parts of the smallest forest patches are susceptible to trampling because they are easy to access.

The location of the forest patch may be an important factor affecting the amount of trampling and thus the cover of vegetation. Also, the smallest forest areas can avoid the effects of trampling if they are situated in areas where the recreation pressure is low. For example, large roads or rivers act as barriers, and thus vegetation can persist even though the number of people living in the area is considerable. On the other hand, attractive places in the vicinity of the forest may promote trampling through the forest area.

In the field layer it were especially dwarf shrubs that suffered from trampling. In the light of the results of an earlier study, the trampling tolerance of dwarf shrubs and grasses was found to be higher than that of herbs (Kellomäki 1973). However, in this study by Kellomäki, the differences between the floristic groups were not statistically significant. Although trampling had the effect of decreasing the vegetation cover, there were only minor changes in the species composition and the proportion of grasses, for example, did not increase. This may be due to the fact that grassy forest edges were excluded from our study to minimise the edge effect on the vegetation. Our results did not support the common belief that grasses become more abundant during and after trampling disturbance (see LaPage 1967, Holmström 1970). The earlier studies on the subject, however, did concentrate on more open habitats where the light conditions are ideal for grass

species. Grass species and alien species will not replace initial forest species in the centre parts of forests with closed canopy unless the light conditions change more suitable and the invasion of species is possible.

A considerable part of Finland's recreational forests has been damaged by erosion (e.g. Löfström 1990). Still, despite the need for it, applying of dressing material is seldom resorted to as a reconditioning treatment. This is because of its high costs and the lack of information and experience regarding its use.

Mixtures of peat and mull, sand and peat and sand and clay-mull proved to have long-term effects favourable to the understory vegetation. All the dressing materials showed their effectiveness in protecting soil and tree roots. In extremely worn areas, the dressing materials partly replaced the worn-out humus layer by binding water and nutrients. The improving effects of dressing materials on the ground vegetation and tree root protection last over 10 years.

Conclusion

Large and contiguous forest patches tolerate trampling better than small and fragmented ones. The total area of small patches is easy to access and the area influenced by the edge effect is greater. The number of potential recreationists should be taken into consideration in urban planning. If the number of users is too high in relation to the size of the forest patches, the sustainability of these forest ecosystems will be exceeded. It is important to prevent the fragmentation of urban forests into excessively small and isolated patches in order to preserve the native forest vegetation.

Research in urban ecology is needed in the endeavour to prevent the deterioration of urban forests. Our knowledge about the wear-resistance of the vegetation of different site types, for example, is useful in city planning when trying to steer recreational use to the most wear-resistant areas. Ecologically sustainable urban planning and forest management can alleviate the negative consequences of urbanisation, and thus bring about savings in management costs, too.

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An Analysis of Green Space Management Strategies in Metro Manila

Armando Manito Palijon

Abstract

The study covered the following cities in Metropolitan Manila: Manila, Makati, Marikina, Mandaluyong, Pasig and Quezon. Information on the biophysical, social and political conditions, management capabilities and practices were gathered through actual survey and interview, and were analyzed and described. Tree survival, tree health condition, and species composition to determine the status of both the street and park green spaces in each city were assessed and their statistical significance was evaluated. Biophysical, social, political, management practices and management capability variables were correlated with survival, health condition of street and park trees. Major findings are summarized and significant conclusion and recommendations are presented in this paper.

Keywords: green space, management strategies, tree survival, tree health, Metro Manilla

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Introduction

Green spaces are areas either naturally vegetated or artificially planted trees and other plants for a variety of purposes. Management of trees and other plants in street corridors or in parks or in any specific green space is appropriately considered **green space management** while management of these various green spaces or the whole urban vegetation system influenced and utilized by the urban population is referred to as **urban forestry**. Both are aimed at enhancing the urban setting for maximum social, economic and environmental benefits of the society (Ehlers 1978, Grey and Deneke 1986, Jorgensen 1986, Miller 1988).

Many urban growth centers – commercial, industrial, residential and even slum or squatter areas – of most countries have metamorphosed from naturally wild, undeveloped green areas. Very fast rate of urban development has caused the degradation of the primordial ecosystem (the forest) which is understandably responsible for sustaining the ecological balance. Consequently, adverse effects like air and soil pollution from automotive fumes, manufacturing firms and industries; noise and other outdoor discomforts; high thermal heat; and other environmental stresses have been and are continuously being felt in many urban areas like Metro Manila in the Philippines (Ganapin 1993).

Cognizant of the sad state of the urban ecosystem, reintroduction, preservation, development or management of green spaces in particular and the urban forest in general had been given importance. Particularly in the Philippines, the urgency and importance in improving and enhancing the environment were recognized; hence, environmental policies, programs and plans which included green space and/or urban forest development and management focusing on Metropolitan Manila were instituted.

Given all the programs that were conceptualized, developed, promoted and implemented in Metropolitan Manila designed to alleviate its degrading environment, it is worthwhile to study how the local authorities respond. Presumably each of these authorities has its own management strategies considering the public open areas (e.g. streets, parks) targeted by the programs under its jurisdiction and responsibility. Furthermore, each city or municipality differs insofar as biophysical, social, economic and political environment and managerial capabilities are concerned. These factors may influence the kind and intensity of management of a particular green space by any of the local authorities, which is manifested in the conditions of their green spaces in particular and their urban forest in general.

Objectives of the study

The study sought to analyze the green space management strategies by various local entities as influenced by the environmental biophysical, social, and political factors and management capabilities. Specifically, it aimed to:

1. Characterize and evaluate:
   a. Biophysical, social and political environment in each of the cities/municipalities studied.
   b. Management practices (from planting and maintenance to removal and replacement) applied by each of the local entities in charge of particular green space.
   c. Management capabilities of each of the implementing local entities.
2. Compare management strategies of the implementing local entities given the existing biophysical, social, political conditions and management factors and capabilities.
3. Evaluate and compare the conditions or status of trees in street and park green spaces of some cities in Metropolitan Manila and relate them with the biophysical, social, political environment and the management capabilities.
4. Come up with alternative management strategies for an effective and efficient green space urban forest management, if necessary.

Conceptual framework

Urban green spaces are to be developed and managed for the maximum social, economic and environmental benefits of the society. In order to achieve these ben-

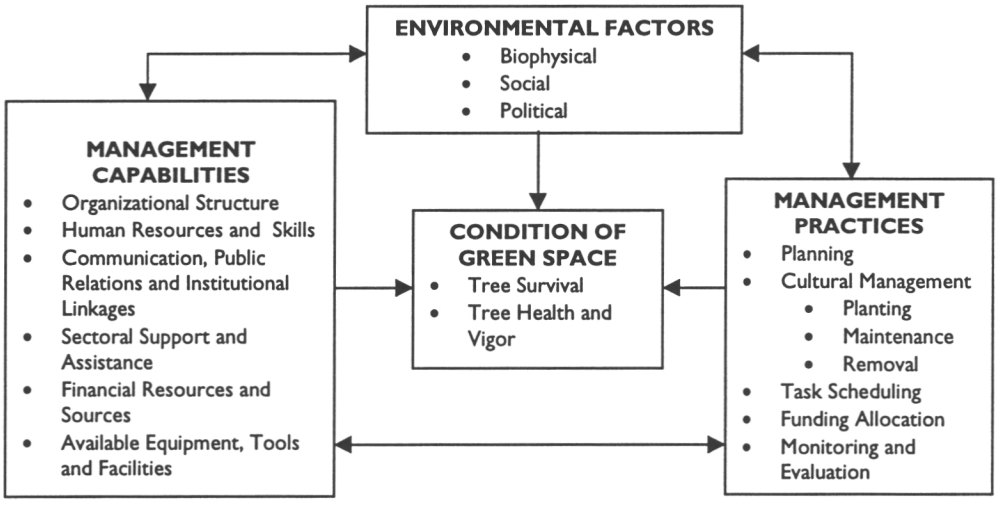


Figure 1. Conceptual Framework for Green Space Management Analysis.

efits, it is necessary to view green spaces as existing in a unique urban ecological system. As such, various biophysical, social, political and management factors interact. These factors and their interactions have to be considered if efficient and effective green space management is to be desired.

From this view, a conceptual framework (Fig. 1) was developed for this present study which presents interrelationships of the various factors or elements involved in green space management necessary to produce an environmentally and socially beneficial green space.

Methodology

The study sites. Out of the 13 cities and municipalities in Metro Manila, only six, namely: Manila, Makati, Marikina, Mandaluyong , Pasig and Quezon city were selected for the study.

Sources of data and methods of data collection for the characterization of the study sites. In each of the cities selected for this study, three street and three park green spaces were characterized in terms of their biophysical, social and political conditions.

Included in the biophysical factors were soil, space, pollution and climatic conditions. The soil physical and chemical properties analyzed were soil separates, water-holding capacity, pH, nitrogen (N), phosphorus (P), potassium (Na), cation exchange capacity (CEC), organic matter (OM) content, copper (Cu), zinc (Zn), iron (Fe), manganese (Mn). Space conditions were width and area of tree lawn, presence of below- and above-ground utilities, size of basin, paved and unpaved spots. Climatic conditions included in the study were rainfall, temperature and humidity.

Social factors included perceptions, attitudes and participation of people in greening activities. These were determined through sampling of respondents using appropriate survey questionnaire. Meanwhile, the political factors such as attitude, participation and support of politicians in greening, legislation, budget generation and allocation were assessed using primary information from questionnaires, and information from secondary sources.

Sources of data and method of collection for the management aspects. The secondary data were collected from the office/section/department in charge of the development and management of green spaces in each city. Development and management plans and objectives, implementation, accomplishment reports and other relevant references/sources were used to scan information useful for this study. Specifically, basic and detailed information about the management capabilities and management practices of street and park green spaces of each city were obtained through a survey questionnaire.

Conditions or status of trees in each green space. Conditions or status of trees as indicator of the performance or success of green space management were measured using tree survival, and tree health condition of the trees. In each of the cities, three streets and three parks were systematically selected. From each of these green space locations, 100 hills were systematically sampled.

Data collation and statistical analysis. After sufficient data became available, they were collated as to each category for easier processing and analysis. For the biophysical conditions and status of green spaces, the Duncan's multiple range test was used.

For the social and political support environment, the Z-test of two independent proportions was used. This test was done by computing the value of the Z-test statistic from the data. The comparison of the two proportions was made by computing the test statistic computed value with a tabular value from the Z-table at a prescribed level of significance. If the test statistic value is greater than the tabular value (say 1.96 at 5 % level of significance) it was concluded that the two proportions were significantly different at the prescribed level.

Descriptive comparisons were made for the management capabilities and management practices.

For the factors related to the conditions or status of green spaces, simple correlation analysis (SCA) was made. SCA is a technique to measure the degree of linear association between two variables which are jointly normally distributed. The measure of the strength of association is the simple correlation coefficient, denoted as $\underline{r}$. An $\underline{r}$ near to zero indicates weak or no association, an $\underline{r}$ near to +1 indicates strong direct association, while an $\underline{r}$ near to -1 indicates strong inverse association.

Results and Discussion

Bio-physical environment

Soil Conditions. Street and park green spaces of the cities studied have varying soil physical and chemical properties.

The majority of both the streets and parks in the cities studied have sandy loam and sandy clay soils except the parks of Makati and Quezon City which have clay soil, and also the parks and streets in Manila which have loam and clay loam soils, respectively. Characteristically, sandy loam and sandy soils are well drained while clay, loam, and clay soils have high water-holding capacity. Some soils have pH of more than 7, while others are near 7. This means that most soils are saline which are considered problem soil particularly during summer when there is very high sun's intensity and hot temperature. The range of CEC values from 17.00 to 34.40 me/100g of soil in streets and parks, respectively, is considered low.

Based on the Phosyn Chemicals Limited's guideline level for soil analysis (1987), the following results were obtained: Organic matter content of the soil which only ranges from 0.5 to 2.03 % is considered very low to relatively low. P contents of soil in the street of Manila exhibits normal level (above 50 ppm) while the rest of the streets and parks have very low P level (only 6.93 ppm to 25.33 ppm). K content ofs soils in the streets of Marikina and parks of Mandaluyong and Pasig are below the normal level of 200 ppm and are considered very low to slightly low while the rest of the cities have above the normal levels but not beyond the level considered adequate or high. Zn and Fe contents are way above the normal levels of 1.5 ppm and 30 ppm, respectively, and are therefore adequate. Only the parks of Quezon City have soils with adequate Mn contents, the rest have much lower Mn contents than the normal level of 45 ppm and are therefore considered inadequate.

Space Characteristics. Widths of the street corridors do not vary significantly. The range of widths, however, is below the standard for a street corridor with a walkway of at least 1.5 meters and a planting verge of 2 meters. Sizes of basin or planter in the street green spaces vary significantly. The sizes of basins (1 050 cm^2 to 2 366 cm^2) are considered very small as compared to the standard used in other countries which is 10 000 cm^2 to 40 000 cm^2 (Mouchel's Landscape Maintenance Project Document 1986). Percentages of the trees planted underneath aboveground utilities in the streets of the cities studied are considerably high. Their differences are not significant. Aboveground utilities are considered one of the constraints in tree care and maintenance. Manila has the most (65) and the largest (65 ha) parks being managed directly by the greening office while Mandaluyong had the least (1) and smallest (0.5 ha). Sizes of the parks are relatively small.

Climatic Conditions. The range of the average yearly amount of rainfall (1 512 mm/yr to 2 584 mm/yr) in Metro Manila is within the mean annual rainfall requirement of most tree species. It is drier (73 % mean annual relative humidity) and warmer (28.7°C) in Manila than other cities. The ranges of mean annual temperature (27.5 to 28.7°C) and mean annual relative humidity (73 % to 77 %) are, however, still favorable for the growth and development of the plants (Devlin 1977).

Pollution levels. Manila was found to have the highest mean total suspended particulate (197.33 ug/m3) and mean SO_2 (0.0134 ppm), Makati and Mandaluyong have the least total suspended particulate (176.5 ug/m3) while Quezon City has the least SO_2 (0.0064 ppm). The pollution levels in Metro Manila are still bearable to plants particularly to moderately and highly resistant species (Uriarte 1996).

Social support environment

Awareness on the importance of the green spaces is remarkably high in the cities studied. Such awareness is significantly highest in Makati (97 %) and lowest in

Mandaluyong (88 %) and Pasig (89 %). Usefulness/benefits from street and park trees indicated by majority (50 % or more) of the respondents include (from the most to the least cited): beautify the landscape, provide shade, ameliorative role through absorption of $C0_2$ and through release of 0_2, provide economic production, and serve as habitat for wildlife. Other benefits cited by less than 10 % of the respondents include: source of income, prevent floods, minimize erosion, proper place for relaxation, and used for hanging/attaching Christmas trees.

A considerable percentage (under 50 %) of the respondents cited the following disadvantages of the street and park trees particularly if the trees are not properly cared include (from the most to the least cited): interfere with power lines; serve as hazard to people, properties and traffic; roots damage curbs and concrete pavement; nuisance in the city; produce litter that makes garbage problem worst and/or clog drainage system; host harmful organisms; and block sidewalk, pathways and parking.

The awareness of the Greening Program is likewise noticeably high. Again, such awareness is significantly highest in Makati (96 %) and least in Quezon City (85 %) and Mandaluyong and Pasig (both with 88 %). The most known greening program is the Clean and Green Program which is likewise considered as the most successfully implemented greening program in all the cities studied. This program is the most recent and widely disseminated and promoted with a contest at the national, metro area, city and municipal level for a one million peso (approx. 24 250 USD) prize as incentive.

Participation. On average, only a small percentage of the respondents (constituents) had actually participated and/or are participating in greening programs. Makati has the highest percentage of participation (37 %) while Mandaluyong (24 %), Marikina (24 %) and Pasig (23 %) has the lowest. Participation of individuals is significantly highest in Manila and least in Pasig. However, participation of groups/associations does not vary significantly between cities.

Willingness of the respondents to participate in greening is evidently high. Manila and Mandaluyong have significantly the highest willingness (85 % and 83 %, respectively) while Quezon City has significantly the least (69 %). The most preferred greening activities by majority of the respondents in all the cities and municipalities include actual planting, care maintenance and soliciting money for greening.

Political support environment

Membership and involvement in greening and other related committees and activities. The majority (59.3 %) of the respondents are members of the environment and natural resources committee. Some are members of the Clean and Green (36.1 %) or beautification and landscaping committee (20.3 %) and still others though only a small percentage (9.7 %) are members of the street and park development committee. Between and among the cities and municipalities studied, memberships in these committees do not vary significantly.

Activities related to greening and environmental improvement claimed to have been initiated by the politician respondents include: Clean and Green (41.7 %), cleanliness and beautification (30 %), street and park tree planting and maintenance (22.2 %). Between and among the cities and municipalities, again no significant differences were noted as to the politicians' involvement in such activities.

Participants in greening and other environmental activities. As claimed by the politician respondents, LGUs and city residents are the most involved in or frequently requested for undertaking greening and environmental improvement activities. Civic organizations, NGOs and schools are likewise included as active participants in these activities. Least involved are environmental, religious and military groups. Except for environmental groups, involvement of the above sectors was found to be rather similar in all the cities and municipalities.

Financial resources and sources. The main source of fund for greening and other environmental activities initiated by the respondents in their respective cities is the city government. Other, secondary sources of fund include contributions from the following (from the most to the least cited): concerned individuals/residents; personal contributions; civic groups; commercial and industrial firms; and environmental groups.

Local legislation. Most of the ordinances proposed and implemented in majority of the cities studied are those concerning waste management, except in Manila and Quezon City where establishment of parks and creation of the greening office, respectively, were mentioned. It was only in Manila that a tree planting ordinance, which will require couples to plant trees in their barangay prior to issuance of marriage license, was proposed.

Reasons as to why very few or no ordinances/orders specifically on greening have been proposed include (from most frequent to least cited): politically sponsored greening or environmental programs are less welcome than other social and economic development programs; greening does not make much appeal to city constituents; greening receives less political support; politically sponsored greening makes one politically unpopular. Except for the reason that greening receives less political support, all the other reasons were cited by a similar percentage of the respondents in all the cities and municipalities.

Problems and constraints in greening in each city and municipality as perceived by the respondents include (from the most to the least cited): lack of assistance from the national agencies in terms of funding, technical, political and material support; ineffective implementation of existing policies and laws; lack of specific ordinances to greening and UF development; lack of coordination and linkage; absence or lack of formal structure or organization to undertake greening; and apathy and indifference of the urban planners and managers to integrate greening in urban planning due to lack of space, high cost of urban space, and competition with other more economically profitable use.

Recommendations made by the politician respondents to make greening successful are the following (according to importance): sustained participation of all sectors; sufficient and sustainable funding; strong political will; legislation and policy reform; aggressive and effective information campaign; strict implementation of existing policies, laws, and ordinances including zoning; strong political support; credibility; and public relations by the city leadership. Making the organizational structure permanent and regular was also mentioned in some cities, including Marikina, Mandaluyong and Pasig where the structure is still ad hoc or 'quasi' in nature, and under reorganisation in other cities like in Manila and Quezon City, where greening offices have been in existence for quite some time.

Policies/laws/ordinances that are needed to make greening part of planning, development and management. Concerning this topic, the following suggestions were made by the politician respondents (listed in the order of importance): urban planning must be promoting urban greening; strict compliance with existing greening laws, zoning ordinances; no conversion of green spaces into other uses; imposition of green taxes to every polluter like the commercial and industrial establishments and owners of car, jeepney, taxi, bus, motorcycle; requiring every citizen to plant and care trees; and imposition of higher taxes to idle open space/ lands and lower to lands planted to trees.

Except imposition of green taxes to owners of vehicles and higher taxes to idle lands, all the other suggestions did not significantly vary between and among the cities and municipalities studied.

Management capabilities

Greening organization. All the subject cities and municipalities have their own specific offices particularly responsible for greening. These offices however, vary in status, the manner or legal basis of their creation, and the year when such offices formally started operation.

Manila has two permanent and oldest greening offices in Manila, the Parks Development Office (PDO) and the Parks and Recreation Bureau (PRB), which were created through Executive Order No. 13 S76 and Republic Act 5 264 S69, respectively. The PDO is responsible for green space development while PRB is on maintenance. Quezon City also has a permanent greening office, the Parks Development and Administration Office (PDAD), created by Ordinance No. NC-134 S90.

Makati and Mandaluyong have new but also permanent offices both named as Department of Environmental Services (DES). Makati's DES was also created by City Ordinance No. 54 S92 and resolution No. 92-015 S92. On the other hand, Mandaluyong's DES has been claimed to be created by an Executive Order in 1992 but no records are available. This DES office is said to be permanent but the greening unit is not. It is specifically responsible for the greening of streets, avenues and islands. Management of park was and is still done by the Mandaluyong

City Administrative Office. Marikina and Pasig have the newest offices, the Parks Development Office (PDO) and the Clean and Green Office (CGO), respectively. The former was said to be an offshoot of Executive Order No. 0009–S93 while the latter was claimed to have evolved through the Mayor's directive in response to the government's greening program.

All the cities claimed that they have been doing greening or planting in green spaces even prior to the creation of the greening offices but it is only now that this is given more concern.

Offices in charge of greening in all the observed cities and municipalities are directly under the Mayor's Office. The authorities of the head or administrator of such unit naturally evolve from the city/municipal executive. Offices in charge of greening in Manila, Quezon City and Marikina are more focused only on greening than those in other cities because the responsibilities of the latter include clean/ waste management and even pollution control and monitoring. Organizational structures of the offices in charge of greening in Manila and Quezon City are noticeably 'steeper' than those in other cities and municipalities due to the presence of district greening units in these cities.

Composition of the greening organization. Manila has more management and technical personnel (administrator and assistant, chief and deputy of greening unit, district heads and over-all supervisor and technical experts like forester/arborist, agriculturist, and horticulturist botanist) than the other cities and municipalities since it is maintaining two greening offices. However, in terms of operational field personnel, Makati has several times more skilled and unskilled operational field personnel than the greening offices of the other cities and municipalities.

As regards educational background, most of the administrators and their assistants, greening chiefs and even district heads in most of the offices in charge of greening in the observed cities and municipalities have an engineering background. Other educational training of the management staff in the greening offices of some of the cities include veterinary medicine, management/administration, fine arts, business, architecture with horticulture experience, agriculture, and animal husbandry. There was even a religious pastor.

As for the cities with management staff having training related to greening like agriculture, horticulture, forestry and arboriculture, Quezon City has 2 (District Heads) and Pasig has 1 (Greening Unit Chief). However, in terms of technical staff supporting the management group, Makati has the most, having 1 experienced arborist, 3 agriculturists, and 1 horticulturist/botanist. Manila has 1 horticulturist/botanist while Marikina has 1 agriculturist. Except for Marikina and Mandaluyong, the majority of the cities and municipalities felt the need for additional technical staff like landscape architect, horticulturist, forester/arborist, and monitoring officers.

The majority of the management staff and the field operation personnel (FOPs) in Manila and Quezon City are regular. In Makati as well, all personnel are regular employees except for the unskilled FOPs who are contractual. Other cities have

either a regular administrator and contractual and/or consultant greening unit chief or a contractual, volunteer administrator and a regular greening unit chief. FOPs of these other cities are all casual or contractual employees.

Management and technical staff and field operation personnel of the greening offices in Manila and Quezon City generally have longer years of service, which is understandable due to the much earlier existence of the greening offices in these cities.

Except in the case of Manila and Quezon City, most offices in majority of the cities intended to undertake greening were installed immediately after the Clean and Green program was launched in August 1992 by virtue of Memorandum Order No. 5.

Goals and objectives of each of the greening programs in all the cities and municipalities studied are similarly tailored to make their respective cities a showcase of green, clean, beautiful, healthy and pleasant environment except that these are described differently and in an attractive fashion. For example, Manila's objective is to initiate sustained beautification and cleanliness program not only aimed at making Manila a 'Garden City' but also a 'City of Men for Men'. Quezon City's focus is on the technological aspect having its goal being as a showcase of the nation in making and maintaining the city into a unique, green and beautiful landscape through its parks and recreational areas. Makati's goal is to develop a wide canopy of lush green growth, the focus of which is to promote the city's special qualities and tourism values aside from effectively protecting the city's environment from the ravages of all kinds of pollution. Meanwhile, Marikina's goal is to make the city not only a green and ecologically friendly zone but also to transform all plant life and their landscape into a 'feast of the senses' e.g. through multi-colored flowers, fragrance through sweet- smelling flowers of trees and other plants, and pleasant tunes of various kinds of attractive birds inhabiting the planted trees in both the streets and parks.

Strategies to attain the goals. Each city or municipality has its own specific approaches or strategies designed to attain the goals and objectives. A number of these approaches/strategies are similar while others are different from those in other cities and municipalities. Most cities claimed that, aside from actual development and maintenance works to be done by their respective greening offices, active involvement of the city government employees, residents and LGUs and support of government, private and business sectors, non-government and other civic, environmental, religious organizations are being harnessed. Some emphasized aggressive information drive as an approach not only to create awareness but also to encourage and be able to harness to the fullest extent the participation of barangay officials and residents in the implementation of the greening efforts. Others cited promotion of the adopt-a-green space scheme as a strategy to encourage residents to be part of the Clean and Green program of the city.

Greening Task Forces/Committees. In spite of the existence of the greening offices, each of the cities and municipalities likewise has either a Clean and Green

committee or task force. In Makati and Pasig, the chairs of the Clean and Green committee were no other than the City's First Lady. Members common to the Clean and Green committee or task force include greening offices, barangay affairs committees, city or municipal councils and schools. In some cities and municipalities, other appropriate and concerned city/municipal government offices are included while in others, national agencies including NGOs, civic and religious organizations and the business sector are also requested to participate.

Available facilities, equipment and tools. In terms of available facilities, equipment and tools as an indicator of capability, again Makati has the advantage over the other cities and municipalities. It has more and better facilities, heavy and light equipment and tools. The majority of the cities and municipalities claimed to have insufficient facilities, equipment and tools. Some did not specify but others mentioned that water trucks and more sophisticated equipment and tools including safety gears are still needed. Some safety gadgets are available in few of the cities and municipalities but still these are not enough to provide personnel protection and safety in the workplace.

Budget for greening. Makati has the biggest average yearly budget, several times higher than the average yearly budget in other cities and municipalities. City or municipal allocation is the main source of budget for greening in majority of the cities and municipalities, except in Marikina where savings from projects done by administration are used to fund greening activities.

The majority of the observed cities and municipalities spend 80 % of their greening budget for street trees and only 20 % for park trees. Exceptions are Manila and Quezon City where 30 % and 10 % is spent for street trees and 70 % and 90 % for park trees, respectively. Such is understandable since the mandate of the greening offices in these two cities is park development.

Most of the funds in most cities and municipalities are spent on planting, care and maintenance except in Quezon City whose previous funds were allegedly spent more on designs and maintenance of the parks. Other aspects of greening that are being funded include planting materials, removal and replacement and monitoring and evaluation. Marikina claims that all its greening activities are receiving almost equal funding since each activity is considered necessary in the success of the greening efforts.

Except for Makati and Marikina, the majority of the cities and municipalities studied feel that the budget for greening is not sufficient. Reason for this is the low and very low priority given to greening in most of the cities and municipalities.

Management practices

Each city and municipality undertakes greening through the following cultural management practices:

Species selection. Availability is the most common criterion being used for the selection of species. Other criteria used (from the most frequent to the least cited)

are resistance to pollution, drought, heat, and pests and diseases; cost of planting materials; form, size and structure of trees and their suitability to shallow and narrow sites and tolerance to pruning. Choice of species in some cities and municipalities is likewise influenced by the species recommended by the DENR and MMDA. In Makati and Marikina, species best for their area based on the objectives of the greening program are said to be selected.

Type of Planting Stocks. Containerized, healthy and vigorous saplings with heights of 1 to 2 meters are cited to be commonly used stocks for greening. Despite having a nursery of their own, majority of the cities and municipalities use 80 % of the planting material requirements from commercial nurseries. Reasons given are: planting materials are readily available from commercial nurseries and therefore easy to procure what is required and to supplement the production from its own nursery; and lack of manpower and skills to produce stocks in their own nursery. Pasig, for its part, relies on government nurseries like DENR due to lack of funding support.

Site Preparation. All cities and municipalities have similar site preparation techniques both in the paved and unpaved street corridors and in parks. Size of planting holes is always a little bit bigger than the rootball or container regardless of the kind of soil. This is likewise practiced in other countries, particularly if the soil has good physical and chemical properties. However, in many countries bigger sizes of holes are required.

Soil dug in paved and unpaved streets is re-utilized if suitable. If inappropriate to use, the soil is replaced with ordinary garden soil. Similarly, this is done in other countries but the soil mixture required is well specified to include proportions of compost or peat moss, slow release fertilizer or organic fertilizer, and ordinary garden soil or top soil.

Planting. Regardless of species, a distance of 6 m between trees is used in streets in majority of the cities and municipalities except in Manila which is using 4 m or 5 m and 10 m or 12 m planting distance. In other countries, planting distance is based on the size (height and crown spread) of the tree at maturity. Planting and management of trees either in the streets or in parks are consciously done not only due to the growing interest in urban greening but because of other roles performed by trees.

Care and maintenance. All the observed cities and municipalities undertake care and maintenance activities like watering, weeding, pest and disease control, fertilizing, staking and tying, tree guard provision and pruning. However, the methods need improvement. Bracing and cavity treatment are not being practiced due to lack of skilled personnel for such activity.

Among the problems and constraints in greening, vandalism which includes uprooting, chopping of stems, and indiscriminate parking on the street corridors causing destruction to plants and tree guards seems to be common to majority of the observed cities/municipalities.

Specific problems in each city include: lack or inadequacy of resources like equipment (water truck, and sprayer) and supplies including planting materials due to slow procurement and delivery for Marikina; water during summer, space, and aggravating pollution for Mandaluyong; manpower, materials, financial; encroachments/squatting and use of parks for other purposes without coordination with the greening office; funding and other support including technical training for Quezon City.

Recommendations by the greening offices for further improving the greening efforts include (from the most to the least important):

- Continue to encourage participation of all sectors in the various aspects of greening from planning;
- implementing and managing greening program and in information dissemination;
- training staff and personnel and other people involved in greening on the proper and cultural management practices;
- employing trained/skilled manpower;
- implementing improved methods, procedures and techniques;
- integration into the curriculum of young students the values of protecting the environment;
- provision and/or allocation of enough funding for greening;
- continuous implementation of the greening program even with the change of administration; and
- provision of adequate tools, equipment and high quality planting materials.

Conditions or status of trees in street and park green spaces

Tree survival, tree health conditions and species composition in both the street and park green spaces of the cities and municipalities were assessed. Results of the study revealed the following:

Marikina's street green spaces have the highest tree survival (96.7 %) followed by those in Makati (95.3 %), Manila (84.7 %), Pasig (71.7 %) and Mandaluyong (69.9 %). Marikina also has the healthiest and vigorous street trees (85.7%) followed by those in Makati (77.0 %), Manila (66.7 %), Mandaluyong (66.3 %) and Pasig (59.3). Manila has the highest number of species (10) grown in streets, followed by Makati (4), Marikina (4), Mandaluyong (4) and Pasig (2). Differences in survival, health and species composition of street trees were found to be statistically significant.

Makati's park green spaces have 99 % tree survival followed by Mandaluyong with 98 %, Quezon City with 96.7 %, Manila with 96 %, Pasig with 95.5 % and

Marikina with 95.0 %. In terms of tree health, Makati's park has 86.3 % healthy trees followed by Marikina and Mandaluyong both with 83 %, then Quezon City with 82.0 %, Manila with 81.7 %) and Pasig with 77 %. Manila's park green spaces have the most number of species (22) followed by Makati (20), Mandaluyong (17), Pasig (12) Quezon City (10), and Pasig and Marikina (4). Differences in tree survival and tree health are statistically insignificant but significant in species composition.

Factors related to the conditions or status of trees in street and park green spaces

Simple correlation analysis revealed that street tree survival and tree health are significantly correlated with some biophysical, social, political, management capabilities and practices variables.

Size of basin or planter is the biophysical factor that is found negatively correlated with survival. The result shows that if the basin is made bigger survival may become low. By actual observation in the field, the bigger the basin the more chances of trampling and compacting by people, thus survival is sacrificed.

Social factors found significantly correlated positively with survival include awareness of the public on greening, high regard of the public to environment, and responses of the public to greening and environmental ordinances. In addition, positive attitude and respect to authorities were found to positively and significantly influence tree health condition.

Political factors that have significantly shown positive association with survival include aggressive and favorable political support in regard to legislation and allocating budget/generating fund; political will, credibility and public relations; and strong leadership. All these political factors except political support in regard to legislation are also positively correlated significantly with tree health condition.

The management practice found positively correlated significantly with survival and tree health condition is weeding. This, however, does not mean that other cultural management practices are not important.

Management capabilities that have shown significant positive association with percentage survival include number and quality of technical staff involved in greening; adequacy of human resources and appropriateness of skills; financial support by government; sufficiency of budget; proper utilization of budget; better coordination and linkages between and among non-government organizations (NGOs), local government units (LGUs), (GOs), and people's organizations (POs); morale of employees; and effective and efficient implementation of greening programs. Except for the number and quality of technical staff involved in greening, all the others are likewise positively correlated significantly with tree health condition.

Simple correlation analysis revealed that unlike in the street green space management, only two (i.e. one biophysical and one management practice) out of the

86 variables considered for analysis were found significantly correlated with tree survival and tree health. Probable reasons for this is the great differences of the ages of the park trees and therefore the correlation of the variables with the condition and status of trees could not be manifested in this study. Percent silt content in soil is correlated negatively with tree health condition while frequency of watering is correlated positively with tree survival.

Conclusions and Recommendations

Noticeably, each of the observed cities and municipalities has developed its own green space management system to respond to the challenges posed by the greening programs despite the changing approaches, directions, focus and even names as a result of the change in national and local administration. As observed in the past, greening in Metro Manila has over and over again been 'a fresh start', but not a continuation of what had been started before. Formal creation of offices in charge of greening though mostly done lately will provide the continuity toward efficient and effective realization of the goals of making their respective cities a showcase of green, clean, beautiful, healthy and pleasant environment.

From the results of the study, it is recommended that in developing green space management strategy, cities should seriously consider the biophysical, social, and political conditions, management capabilities, cultural practices and their interrelationships to assure certain acceptable level of success. More specifically, there is a need to:

1. Undertake a thorough biophysical characterization before any greening activity is done.
2. Institute systematic information and education programs that will further increase awareness of the public on greening and its importance or benefits, enhance and sustain positive attitude, and develop high regard for environment. Promote favorable responses to greening and environmental ordinances and improve level of respect to authorities.
3. Develop and implement greening and other environmental programs/activities on a participatory approach and encourage all sectors, individuals or groups, to organize into greening movement or urban forestry societies that will be equally responsible for management of the green spaces in the community.
4. Make policy makers in the city and municipality more aggressive in legislating tree and other environmental related activities and in allocating funds for greening.

5. Make urban planning promote urban greening. Each city or municipality has its own zoning ordinances and therefore development must be based on these. Greening laws must be implemented and followed religiously. Urban planners must likewise be exposed also to environmental programs. Strict implementation of existing zoning and greening laws must be done. Non-compliance must be penalized.
6. Encourage city executives and political leaders to have the desired political will to pursue greening programs and establish the most acceptable credibility and public relations and strong, decisive, leadership.
7. Make the offices in charge of greening permanent, not ad hoc or quasi in nature. Although in the present study, this issue of permanency did not matter much. However, a permanent nature will provide stability for operation to continue without fear of being dissolved.
8. Employ technical experts and adequate skilled personnel. Ideally, a greening unit chief must have both the management as well as the technical background. It is manifested in the study that hiring people with the right technical expertise who can backup the chief and provide the technical requirements of the job is enough.
9. Provide a budget for greening that is sustainable and sufficient. Sponsorship by individuals, groups, associations or cooperations must be continuously harnessed.
10. Build up the capacities of the greening organization in terms of improving the facilities, equipment and tools.
11. II. mprove cultural management practices. Species selection, site preparation, planting, early and late care and maintenance operation, removal and replacement must likewise be improved. Planting of more species to promote diversity must be encouraged.
12. Consistent with the Local Government Code, develop the functions of cleaning and greening of major thoroughfares in the cities and municipalities but provide human, technical and financial support.
13. One last recommendation is that the cities and municipalities in Metro Manila should organize, establish a network or linkage and develop a doable/workable strategy for green space or urban forest management wherein sharing and complementation and not competition would be the driving force in achieving the goals/objectives of greening.

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Chapter 4

Bridging the gap between monetary and non-monetary valuation of environmental amenities

Integration of Monetary and Non-monetary-Values in Environmental Decision Negotiation

George L. Peterson

Abstract

Environmental decision negotiators need to hear and understand messages provided by several important information systems, including political activism and conflict resolution, economic analysis, scientific analysis of human dependence on environmental states and processes, ethical propositions, and technical assessments of public perceptions, values, preferences, and expectations. The economic information system can provide important advice about financial and economic efficiency and distribution, but the spectrum of human values involved in environmental decisions goes far beyond the domain of monetary economics. This paper identifies the role and limitations of monetary economic analysis and demonstrates the need for complementary non-monetary information systems concerned with environmental values. The paper builds a bridge between monetary and non-monetary valuation of environmental goods and services toward an integrated valuation framework for environmental decision negotiation.

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Introduction

When well understood and correctly applied, the economic information system is a powerful tool that can answer important questions for environmental decision negotiators.[1] Under appropriate conditions, it can tell them whether a proposed program improves the economic welfare of society as a whole (economic efficiency). It can also show how a program distributes its economic costs and benefits among various economic and financial accounts and among social, geographic, and economic sectors of society (equity). There are important policy questions, however, that the economic information system does not answer. Expecting economics to answer such questions is as inappropriate as expecting hammers to drive screws or cut wood. And, it is equally inappropriate to criticize either economics or hammers for not doing a good job with tasks they are not supposed to perform. We need to use economics (and hammers) for the jobs they do well and use other tools for other jobs. We also need to understand the strengths and weaknesses of our tools so as not to let the weaknesses spoil the product. And, as with any tool, one gets what one pays for. Using a cheap version of the right tool can make the job more difficult or even spoil the product. Bad economics can be worse than no economics at all.

The purpose of this paper is to work toward peace between defenders and critics of the economic information system by attempting to build a bridge between the two camps, a bridge based on complementarity and cooperation rather than competition. A simple metaphor demonstrates the need. Two meals with very different nutritional consequences or two automobiles with very different performance characteristics can have the same price. Likewise, two environmental programs with the same price can have very different spectra of personal and social consequences. Knowing the price is necessary but not sufficient. One should never agree to purchase a thing without knowing the price, but it is equally foolish to agree to the purchase if all one knows is the price. In the broader context of environmental policy, the "price" is the information economics can provide. Other information systems can and must complement economics by telling the rest of the story.

The discussion that follows is in four sections. The first outlines the policy role of scientific information about environmental values and shows where economic information fits in the broader information system of which it is an important part. The second briefly describes what economics can and cannot contribute. The third briefly describes the contributions of other scientific disciplines and shows

1. We use the term "decision negotiator" rather than "decision maker" because most public decisions about environmental policy and management emerge from processes of political negotiation, not from unilateral decisions made by agency line officers.All participants in the negotiation process make their own decisions, but the public decision it self emerges from negotiation among those participants.

how those contributions complement rather than compete with economics. The fourth and final section provides a summary and conclusion.

The Role of Scientifically Derived Environmental Values in Policy and Management

Environmental policy is the outcome of whatever process has been sanctioned by the sovereign authority that reigns in the society in question. In the United States the U. S. Constitution creates the framework of law that governs all aspects of public and private activity. As authorized by the Constitution, the legislative branch of government creates statutory law in response to specific needs or problems. The executive branch creates rules and regulations, as authorized and required, and implements law through agencies, programs, and procedures. The judicial branch reviews legislation, rule-making, and implementation for consistency with existing law and resolves disputes among or between public and private interests. Members of the general public participate through political activism, voting, and litigation. Environmental policy thus derived establishes the background and context from which environmental decision negotiators derive the objectives that guide their actions and constraints that limit their options.

For maximum public benefit, all participants in environmental decision negotiation need to be well informed. Legislators need to understand all the facts surrounding the issues they address, including the needs and wants of their constituents. Judges and advocates need to understand the laws, issues, and facts pertaining to the cases in question. Executives and managers who implement policy need to understand the laws that empower and constrain them. They also need to know what choices are available to them, the alternative futures contingent on those choices, and the preferences and concerns of the publics they serve. Members of the public need to be aware of environmental issues and pending decisions. They need to understand their rights and responsibilities pertaining to those decisions, how the decisions will affect them, and the avenues that are available for effective participation in the environmental policy and management process.

Whether by legislators, judges, executives, or private interests, environmental decisions ultimately boil down to preference, that is, deciding which available option has the greater value. Values and preferences get defined and expressed through several channels, including citizen participation, political conflict resolution, and scientific measurement and analysis. Our focus here is on what the scientific information system can contribute.

Unless otherwise authorized by law, science occupies a staff advisory function in the public decision process. Decisions ultimately are sanctioned by sovereign authority, with or without consistency with relevant and available scientific findings. Decision negotiators have a responsibility, however, to understand the rel-

evant science and know why and when they choose to disregard it. The responsibility of scientists is to ensure that they communicate the best available scientific facts and implications to the participants in the environmental policy and management process. Scientists and their partners, applied technologists, identify and describe environmental conditions and problems, identify or create policy and management options, and predict and communicate the alternative futures contingent on those options. Given policy-specified criteria and constraints, scientists may also be asked to evaluate policy options or management prescriptions. Given alternative or hypothetical sets of criteria and/or constraints, scientists may be asked to predict the alternative futures implied thereby. Scientists have a further responsibility to broadcast science-based technical information assertively and effectively when policy or management decision participants fail to request it or choose to ignore it and, in the expert opinion of the scientists, important decisions will not be well-informed without it (Lubchenco 1998). They must be careful, however, to keep technical and political issues separate and hold themselves to technical issues when speaking on behalf of science. Political issues are matters of value judgment, not technical judgment, and pure science will lose scientific validity if not value-neutral. Whether it is appropriate for scientists to publicize political opinions is a controversial question (Mills 2000).[2]

Measurement and analysis of economic values is an important part of the scientific information system. Many economic values find expression as prices established by markets. Economic measurement and analysis can derive much useful information from such prices and then present that information legibly and efficiently to environmental decision negotiators. Markets do not assign correct prices to some important goods and services, however, because of market imperfection. Public environmental goods, such as clean air and water, nature preserves, threatened and endangered species, biodiversity, and some forms of outdoor recreation often fall into the non-priced category, as do otherwise priceable services the government chooses by policy to provide without price (or under-priced). In order to understand the implications of such non-priced (under-priced) goods and services for equity and economic efficiency, environmental decision negotiators need scientifically and/or politically expressed information about the values in question.

2. As with any private citizen, scientists have a right and responsibility to seek their own special interests through political activity. The controversy arises over whether they compromise their credibility as objective scientists when they align themselves publicly with specific political positions.

Where Economics Needs Help

Of all the social and behavioral sciences, economics is probably the most rigorous and well developed. It is solidly founded in theory; it provides a rigorous definition of economic value; and it offers a rich framework of analytical methodology by which to derive and communicate policy-relevant findings. It also suffers weaknesses, however. Without valid prices for non-priced goods and services, the powerful tools of economics can mislead. Basing cost-benefit or distribution analysis only on market prices will produce a biased result where environmental public goods are involved, for example, and can cause inefficient and unfair resource allocation. Economic methods such as contingent valuation for estimating non-priced values are least effective where they are most needed (i.e., for public goods). The state-of-the-art is imperfect, although still developing, and rigorous application often is too expensive. Major problems such as large-scale environmental resource damage assessments often can justify the cost, but smaller project-level decisions often cannot, and haphazard or incompetent applications can be more misleading than making decisions without such findings. It makes no sense in any case to spend more on the analysis than the cost of being wrong.

Another problem often lies more with using or advocating economics as a decision machine rather than as one part of a more complex puzzle. Even if economics were perfect and complete, it would not (and does not claim to) adequately represent the full range of all human concerns. Non-economic questions require answers derived by non-economic approaches. Economists (or others) who present economics as a cure-all harm its usefulness by inviting criticism. And, anti-economic critics often deliberately (or naively) represent economics as claiming to be a cure-all and then attack it for the things it cannot (and does not intend to) do. Such doings are unfortunate, because they disperse misleading propaganda among the under-informed, thereby depriving them of the good information economics can provide. The wise approach consists of several components: (1) understand the difference between economic and non-economic questions, (2) understand when economics can and cannot give good answers to economic questions, (3) invoke complementary approaches to help answer economic questions when state-of-the-art problems or inadequate funding prevent economics from functioning effectively, and (4) use other ways to answer non-economic questions. To criticize economics for not giving good answers to non-economic questions is naive, devious, or dumb. It is akin to criticizing trains for not going to Australia or hammers for not driving screws.

Sate-of-the-Art Limitations: Economists derive non-market valuation methods from neoclassical microeconomic consumer theory. That theory is both an asset and a liability. It is an asset because of the theoretical and methodological rigor it provides. It is a liability because, in the opinion of psychologists and others, it does not adequately describe and predict human valuation behavior. Contingent valuation methods depend on survey sampling and hypothetical questions that are vulnerable to multiple biases. Research has made good progress toward overcom-

ing the problems, but the methods remain controversial, especially in application to environmental public goods. Revealed preference methods are vulnerable to questions about underlying assumptions, sampling biases, and complex analytical procedures. They are irrelevant where there is no link of complementarity between the good in question and an effective market as is the case, for example, with existence values.

Invalid Assumptions: The user of economic information must be aware that economic theory implies certain assumptions that may not agree with the political context in which the information is to be applied. If political equity is a high priority and requires special treatment for economically deprived people such as indigenous subsistence-based groups or ethnic subcultures, for example, economic values based on willingness to pay may not be appropriate because of limited ability to pay. In the case of the damage assessment for the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska, it was deemed inappropriate to use willingness to pay methods to estimate the monetary value of the damage suffered by subsistence-based indigenous cultures. Such cases require other criteria and other methods.

Cost Constraints: Correct application of non-market valuation methods requires specialized knowledge and can be very expensive. Many project level decisions simply cannot justify the cost. Value transfer methods by which to generalize findings from other studies are under development (Rosenberger and Loomis 2000).

Non-economic Questions: When asked in an Exxon-Valdez focus group about her willingness to accept compensation for the environmental damage caused by the oil spill, a young woman responded angrily with, "You mean to say I've been raped and you think there is some amount of money that will make me feel it didn't happen?" For some things money may be irrelevant because there are no substitutes money can buy. For other things cultural values or personal beliefs may make money an inappropriate measure of value. Such cases require alternative treatment.

There are many things decision negotiators need to know about environmental decisions that simply are not economic questions, at least not in a monetary sense. If, for example, a restaurant patron asks an economist about the nutritional consequences of consuming an item on the menu, the result will be either a blank stare or a lay opinion. She should ask a nutritionist, not an economist. Likewise, asking an economist about the social and ecological consequences of environmental investments and disturbances is not appropriate. Such questions are the domain of sociologists, anthropologists, ecologists, etc. Carbon sequestration, climate change, energy balance, and causes of political conflict are very important topics that economics does not pretend to address. To expect such answers from economics is naive, and to criticize economics for not dealing with them is foolish. Economics addresses one piece of a much larger complex puzzle, and the picture will never be complete until all the pieces fit together.

With a Little Help from Our Friends

Space does not allow detailed examination of all the sources of the information needed by environmental decision negotiators. As implied above, many scientific disciplines offer answers to important questions.

Psychology has much to offer and until recently has been neglected by economists in the area of non-market valuation. There is a rich history of conflict between the two disciplines, with psychology (and institutional sociology) lobbing grenades while economics digs deeper and deeper into the defenses of revealed preference. There has also been a tendency for economists to "reinvent the wheel" as far as non-market valuation is concerned. Psychology has studied human perception, judgment, and decision behavior for more than a century. In the 19th century G. T. Fechner (1860), a physician, physicist, and polymath, founded a new discipline he called "psychophysics" and used methods like paired comparison to quantify human perceptions and judgments. During the early 20th century, S. S. Stevens (1995, I spent a productive career in psychophysics at Harvard developing improved methods for quantitative measurement of human judgments and subjective responses, including value and utility. Among other things, he developed and applied methods of magnitude estimation and ratio scaling. Also early in the 20th century L. L. Thurstone (1927) developed what he called the laws of comparative and categorical judgment, which he then used to develop techniques for deriving interval scale measurements from paired comparison and categorical (e.g., rating and ranking) responses to stimuli. If modern computational ability had been available then, he would have developed the economists' discrete choice methods long before they appeared in economics. Indeed, in 1927 he described his underlying model as a probit model. Economists need to look more closely at what psychologists and psychometricians have learned about how people respond to the kinds of stimuli presented in contingent valuation surveys.

At a more general level, psychology has raised serious questions about the ability of economic theory to describe human valuation behavior. In an excellent review article, Rabin (1998) raises numerous intriguing questions. Participants in a 1985 conference at the University of Chicago on the Behavioral Foundations of Economic Theory (Hogarth and Reder 1987) asked (without deciding) whether economic theory is positive, normative, or descriptive. As an axiomatic-deductive theory, neoclassical microeconomic consumer theory is descriptive only in so far as it accurately predicts human behavior. It is apparently the tradition of economists, however, to accept the theory as correct and judge and justify the validity of their findings by consistency with theory. Their first attack on dissonant findings is generally to suspect bad experimental design or faulty analysis as the cause without adequately questioning whether the fault lies with dissonance between theory and behavior. Psychology and other behavioral sciences, on the other hand, are observational. When scientists in those fields find dissonance between theory and findings, they tend to look for the causes of the dissonance in a quest

for better theory. Without abandoning the power of economic theory, economists need to climb more often out of their trenches and see what lies beyond. And, without abandoning the strengths of their discipline, psychologists and others need to become more interested in the behavioral aspects of economic phenomena. Greater cooperation and collaboration will be mutually beneficial.

For example, the 1989 Exxon-Valdez oil spill in Prince William Sound, Alaska caused indigenous subsistence-based communities to suffer severe environmental damage. Assessment of the economic value of that damage to the public interest is, in concept, an economic question, but it proved evasive to economic treatment. Initially judged by the U. S. Department of Justice to be less economically significant than damages suffered by other communities and environments, it proved to be very significant by expressing itself powerfully through political and legal channels. Efforts to apply traditional economic methods proved fruitless because of equity concerns and cultural barriers. Subsistence-based non-monetary barter economics does not translate easily into monetary economics. Limited income (ability to pay) constrains willingness to pay well below the level of importance expressed through political and legal channels or judged by public opinion to be fair. And, culturally-based styles of negotiation and deeply rooted distrust of the "establishment" prevent effective use of traditional economic methods such as contingent valuation. After much debate, it was decided jointly by the Economic Steering Committee and U. S. Department of Justice attorneys to use an ethnographic approach by which anthropologists and sociologists would develop an understanding of the cultural meaning of the damage. Out-of-court settlement aborted the effort, however.

Another example comes from ecological economics, a sometimes divisive collection of ideas that find expression through several disciplines or schools of thought. One approach is to use economic theories and models to analyze ecological processes, such as nutrient recycling, carbon sequestration, or energy balance. Another is to use a numeraire other than money, e.g. energy, to study and evaluate the global economy. A third is simply to declare the economics of money to be an evil influence and advocate other ways to define human welfare and measure progress. All three can contribute useful information to the environmental decision process, information that complements, rather than competes with, monetary economics. All three (and especially the third) need to avoid polemics and focus on their pieces of the scientific information puzzle that, when placed in complementarity with monetary economics, help produce a more complete picture for environmental decision negotiators. And, to the polemicists who would elevate themselves by rejecting monetary economics, we say again that monetary economics is an important tool that can answer very important questions when properly applied. Those answers are absolutely necessary but certainly not sufficient for well-informed and well-guided public and private policy.

Summary and Conclusion

Environmental decision negotiators need to hear and understand messages provided by several important information systems, including political activism and conflict resolution, economic analysis, scientific analysis of human dependence on environmental states and processes, ethical propositions, and technical assessments of public perceptions, values, preferences, and expectations. The economic information system can provide important advice about financial and economic efficiency and distribution, but the spectrum of human values involved in environmental decisions goes far beyond the domain of monetary economics. Economists and decision negotiators need to use the tools of economics to address economic questions. Other kinds of questions require other tools. Even in the domain of economic questions, however, state-of-knowledge limitations may prevent good answers, and where the state-of-knowledge is adequate, cost may prevent rigorous application. Where economics can't effectively answer its own questions, economists and other participants in the environmental decision process need to invite the help of other disciplines. And, non-economic questions require non-economic answers. Economic information is but one part of the complex informational puzzle that environmental decision negotiators need to solve. Well-informed environmental policy requires well-orchestrated partnership among multiple scientific disciplines and political processes.

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Spatial Analysis in Economic Evaluation of Landscape Management

Esa Ärölä, Aki Nalli and Markku Penttinen

Abstract

The roundwood sales decisions of non-industrial private forest (NIPF) owners produce more than 80 % of the roundwood supply, as well as creating potential landscape and biodiversity losses in Finland. Sustainable forestry has been essential, and regeneration has been required by the forest law for nearly 100 years. However, the new legislation protecting biodiversity, and the quality and certification requirements have restricted the owner's freedom to manage his/her property. This has raised concerns among forest owners that their income will suffer through greater regulatory intervention under the new laws, silvicultural recommendations, and other restrictions.

Traditionally, Finnish forest management planning (FMP) and practices have sought to attain (i) sustainable wood production that would assure the availability of raw wood for industry. Where possible, (ii) increasing the volume of growing stock was a secondary goal. Nowadays, the emphasis in FMP is being placed not only on timber production but also on landscape, recreation, and biodiversity. The institutional framework includes the new forest and nature conservation laws, silvicultural recommendations, quality requirements and certification according to PEFC (Pan-European Forest Certification) or the FSC (Forest Stewardship Council). However, from the individual forest owner's point of view, maintaining biological diversity poses a dilemma. While it may add recreational value to the area, it may also mean a loss of income to the owner.

The purpose of this research is to describe an approach that incorporates the economic impact on the NIPF owner caused by these requirements of the FMP system, and to create a method and a program supported by a geographical information system (GIS) to implement this. The method is based on the combination of a GIS and an FMP system that generates several treatment schedules for compartments and selects optimal schedule combinations using linear programming.

The GIS is used to impose silvicultural treatment restrictions on the compartments and to create management zones (MZ) (= a group of compartments). The MZ is based on the production potential of the area, the preferences of the forest owner, the preferences of the local people and the requirements set by society. The GIS is also used to collect and formulate preferences so that the planning problem

can be solved in the FMP system. Finally, the GIS program is used in the analysis of the alternative forest management plans.

Normally, the management goals in the FMP are presented to the whole planning area and the location of the stands has no role in the mathematical programming based planning system. In the combined use of GIS and FMP it is possible to emphasize different production goals in various MZs and certain types of stands and their location are taken into account in constructing the MZ.

Keywords: GIS; forest management planning; spatial analysis; economic evaluation; multiple use

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Background

This paper is based on the project that formed part of a Swedish-Finnish program supported by the European Commission's Environmental Fund, LIFE. The participant organisations were the Swedish Board of Forestry, and the County Forestry Boards of Södra Götaland, Mälardalen and Västerbotten in Sweden, and in Finland, the Forestry Development Center Tapio and the Coastal Forestry Center.

The overall objective of the project was to develop proficiency in the participating organisations in working from a **landscape perspective** in order to better integrate **environmental considerations** and **biodiversity** with sustainable production of forestry.

The project was focused on activating the **general public to participate** in planning together with forest-owners. Another goal of the project was to design sustainable **planning models** and **tools** for forest planning and decision-making. However, the quantum jump and qualitative improvement of this EU research and development project was the construction and implementation of the **user interface** for the day-to-day practice of forest management planning (FMP). The geographical information system (GIS) is based on Xforest customised by Tekla Inc. for FMP. The simulation and optimization is built on the MELA (MEtsäLAskelma = FOrestCAlculation) system of the Finnish Forest Research Institute (Siitonen et al. 1996). The optimization benefits from a special linear programming algorithm JLP (Lappi 1992). The key notion is **interactive forest planning**, in which the communication and learning of the forest-owners is based on the control of already-prepared planning proposals (see e.g. Pykäläinen & Kangas 1996).

Introduction

Forests provide timber for industry, welfare and work for forest-owners, fuel for rural areas and habitat for diverse flora and fauna. They are also places for worship and recreation. The objective of forest management is to maximize the utility[1] from available forest resources. Forest management planning seeks to determine the combination of treatment proposals for stands that produces maximum utility for the forest as a whole (Kilkki 1987). The key task for the forest planner is to describe the expected production potential of forest, and to allocate the forest area to produce the commodities and services when and where they are wanted.

Forest management plans have traditionally been compiled by aggregating the treatment proposals for a particular stand for the following 10-year period. Pro-

1. Some sources use the term economic value to include both the economic impornce to an individual owner and values of public "goods" mainly in terms of socity (Saastamoinen 1997).

posals are based on stand assessments and are made according to silvicultural instructions aimed at maximizing timber production at the stand level. Another approach utilizes mathematical programming (MP) techniques to select optimal treatment schedules for individual stands from the simulated treatment schedules according to the production goals of the whole forest area (Kilkki 1987).

Nowadays, the emphasis in forest management planning is being placed not only on **timber** production but also on **landscape**, **recreation** and **biodiversity**. The institutional context includes new **forest, financing of sustainable forestry** and **nature conservation laws** (Forestry Nature Program 1994), **silvicultural recommendations** (Forestry Regulations 1997) and **certification** (Forest Certification Committee 1997) according to PEFC (Pan-European Forest Certification) or FSC (Forest Stewardship Council). Because forest products other than timber have increased importance, their production should be taken into account in forest planning. The planning method using forest simulation and MP can in principle take into account, all forest products if various forest functions can be included in the simulation (Kilkki 1987). However, poor-quality data and the lack of production functions have restricted this application for integrated forest management planning. Production functions such as those of the Cobb-Douglas type are multiplicative , i.e. the products do not compensate for each other. Multiple-criteria decision-making in FMP has applied linear programming in particular, sometimes even in the form of goal programming and the analytic hierarchy process (AHP) (Tarp & Helles 1995, Kangas 1992). The AHP requires preference evaluations from the forest-owners. Moreover, it is based on the additivity assumption as is usual in the whole multiple attribute utility theory (MAUT) (Tarp & Helles 1995).

This paper introduces a planning method of incorporating several forest products and functions, including landscape, into MP-based forest planning. The production of forest products other than timber is expressed by site-specific constraints. The preference information is then achieved after a "what if " type of analysis and based on alternative already-prepared FMP outcomes, not on trade-offs of variables.

The method applied is based on the combined use of the geographic information system (GIS), computer simulation and mathematical programming. The GIS techniques are used to classify a forest area into management zones (a group of compartments) according **to production potential**, the **preferences** of the decision-maker and **external requirements**. Management zone production goals are expressed as constraints on timber production variables in linear programming (LP) problem formulation, which reduces the number of actual objective variables of LP and allows a very specific and "customer oriented" interactive tailoring of the plan. The outcomes can be produced and improved iteratively using a PC. Typically a FMP expert of the forest center runs the software and may sit down and plan together with the forest owner – even employing the premises of the forest owner.

Planning system

Elements of the planning process

Forest management planning assumes that sufficient information on the forests and advanced tools for the computations are available. The planning process designed in the project is illustrated in Fig. 1.. The final plan is a function of: (i) the **production potential** of the area, (ii) the **preferences** of the decision-makers, (iii)

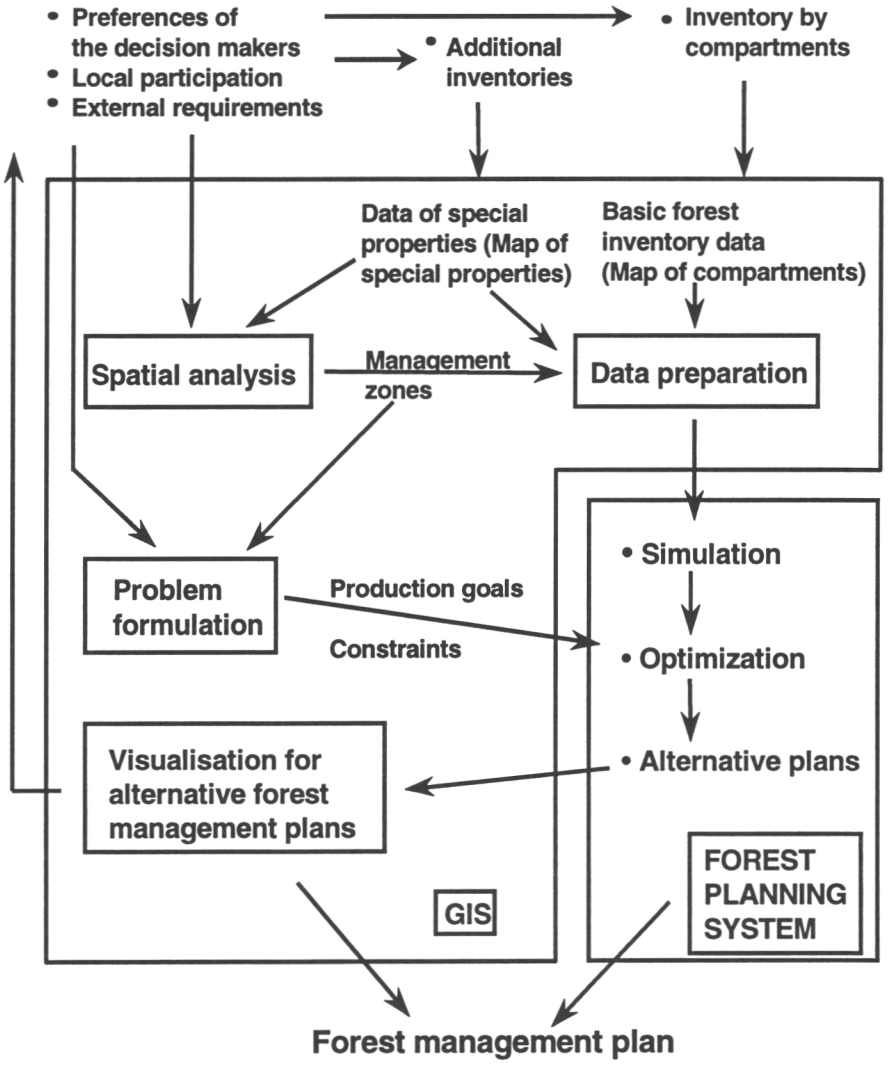


Figure 1. The combined use of GIS and a forest planning system.

the **external requirements** set by society and (iv) the available **elements of production** (machines, labour, etc.).

In Finland a compartmentwise inventory is used in the fieldwork for forest management planning. Thus the forest area is divided into smaller units, called compartments. A compartment is a homogenous unit in which tree cover, site class and treatment proposals are about the same. The forest inventory data (see Paananen et al. 2000) forms the major component of the estimation of the timber production potential of the area. The estimates of production potential of other products are usually based on the experience and heuristics of the planners, and additional inventories such as surveys of habitats of special importance[2] (see the Forest Act 1996) and individual flora survey carried out by experts in various fields.

The preferences of the decision-maker and the requirements set by society direct the planning process. Spatial analyses are used to discover areas suitable for various forest products, to determine and construct management zones (MZs) and to place silvicultural treatment restrictions on the compartments. The preferences of a decision-maker and external requirements are also taken into account in the form of restrictions for each MZ. Global, MZ and compartment level restrictions underpin the selection of a set of viable alternatives in the simulation and in the formulation of the linear programming problem

Data preparation

The basic method of forest data acquisition in Finland is the forest-stand-based inventory (see Paananen et al. 2000), which produces stand maps and tables of related stand characteristics. The inventory describes the growing stock of the stands only by mean variables. Stem-diameter (see e.g. Maltamo 1998) and height distributions are derived from the inventory data by separate models to provide data for treewise volume and increment functions used in the simulation (examples of local growth and yield models appear in Pukkala & Miina 1997).

Recreation services, landscape, game, timber, etc. can be produced at many locations within the forest area. If the production functions for all products are

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2. Habitats of particular significance referred to in the Finnish Forest Act, 1996:
1) Immediate surroundings of springs, brooks, permanent rivulets and small lakes;
2) Herb and grass birch-spruce swamp woods, fern-rich spruce swamp woods, thin-peated, herb-rich spruce swamp woods and quaking bogs south of the Province of Lapland;
3) Fertile patches of herb-rich forest;
4) Small heathland islets in undrained wetlands;
5) Gorges and ravines;
6) Steep bluffs and the underlying forest; and
7) Sandy soils, exposed bedrock, boulder fields, wetlands with sparse tree stand and meadows which are less productive than nutrient-poor heathland forests.

available, the optimal sites for multiple-use forestry can be determined by the optimization. If not, as is usually the case, recreation forests or valuable forest habitats can be determined using a priori information, which includes map information, survey of habitats of special importance and individual flora survey (see Tenhola & Yrjönen 2000). The non-wood products are integrated into the planning in the form of restrictions.

In the project, the GIS techniques are used to divide compartments at the management category groups, impose treatment restrictions (such as no regeneration fellings) on the compartments (Fig. 2) and construct MZs, which can even overlap (Fig. 3). These also include protection zones around lakes, streams, rare biotopes, etc., and even zones for other forest products such as amenities, game and timber.

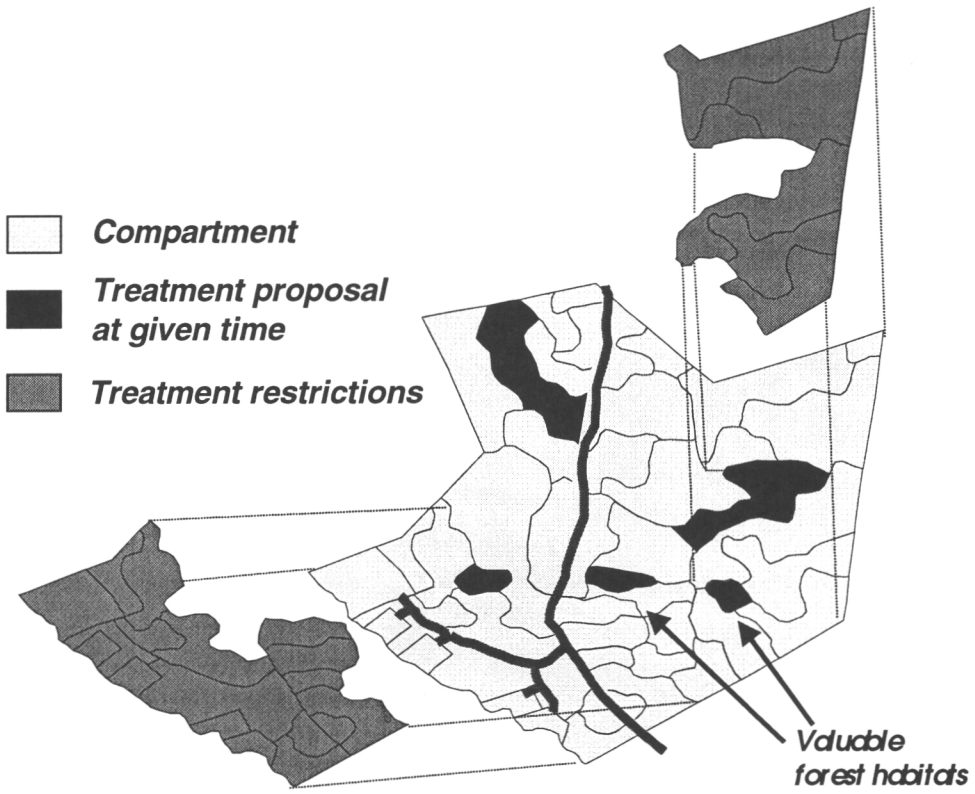


Figure 2. Spatial analysis and the simulation of possible management schedules.



Figure 3. The established management zones.

Forest management planning calculations

The MELA system (Siitonen 1993, Siitonen et al. 1996) is used in the forest management planning calculations. It was originally designed at the Finnish Forest Research Institute for analyzing long-term timber production potential at regional and national levels, based on the sample plot data of the Finnish National Forest

Inventory. Nowadays, it is also used for forest management planning at the estate level.

MELA is a forestry model and an operational decision support system for solving problems related to managing forest stands in order achieve the goals for forestry in each particular decision situation (Siitonen et. al. 1996). It consists of two principal parts: (i) the individual tree level **simulation** of possible management schedules for forest stands over a desired calculation period, e.g. 50 years, and (ii) the **optimization,** i.e. the simultaneous selection of the production program for the forestry unit and stand management. The optimization is based on the user-supplied goals such as net income of the first planning period and the linear programming (LP) model at the forestry unit level.

Simulation

The simulation predicts the future development of each compartment and a large number of possible treatment schedules is generated for each compartment in the form of a branching decision tree. The simulations of the management schedules consist of events, which are either natural processes, e.g., ingrowth, tree growth and mortality, or human activities such as thinning, clear-cutting, natural regeneration, seed-tree removal, shelter-tree removal, clearing, cultivation, planting, seeding and tending. The MELA models are based on individual trees describing natural processes, treatments, timber prices, costs, management instructions, etc. These models are utilized in the simulation, which also produces information on the results attained if the treatment schedule is applied.

The GIS techniques are used both to supply treatment proposals for the compartments and to establish silvicultural treatment restrictions for the group of compartments (Fig. 2). Thus, the computer simulation does not generate forbidden treatments in those compartments with treatment restrictions. Restrictions are needed, for example, at the simulation of the viable, sound and acceptable, treatment proposals for forest habitats for diverse flora and fauna of special importance, shore-line or roadside stands.

Optimization

Optimization is used to select planning area level solutions and one treatment schedule for each compartment from the simulated schedules simultaneously. Normally, one of the management goals (e.g. net income) has been offered as an . objective function in a linear programming (LP) problem formulation, and other management goals are described by constraints applying to the entire planning area (Kilkki 1987). The state and change variables of the compartments produced by the simulation system have been available for LP formulations (Siitonen et al. 1996).

Traditionally the location of the stand has no significance in the mathematical programming based planning system. In the current version of MELA (Siitonen

et al. 1996) it is possible to emphasize different production goals in different management zones or certain stand types (Fig. 3). The JLP software package (Lappi 1992), that is used in the optimization allows defining constraints for any subset of stands. These domain constraints concern only the subset of the planning area, one forest block or a set of compartments scattered around the forest (see the mathematical formulation of the problem in Lappi 1992).

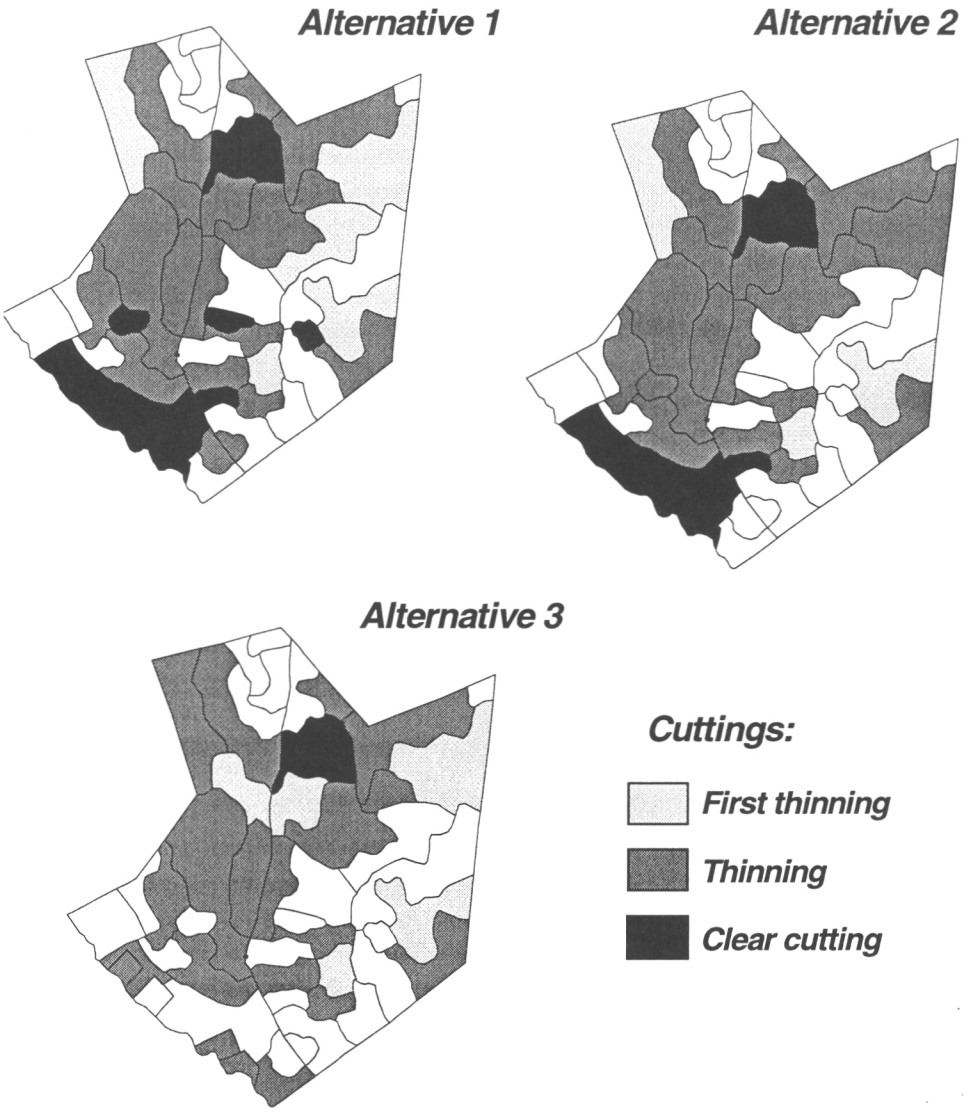


Figure 4. Alternative forest management plans.

Two types of constraint are used in solving the optimization problem. The higher-level constraints reflect the production goals for the **whole planning area**. This is the conventional way of setting constraints on the LP problem. The domain constraints are utilized to describe the requirements for a specific **management zone** (MZ).

A preference editor is used in the GIS program to give the planning area level objective and constraints and constraints on the management zones. The geographical information system formulates preferences and requirements for the mathematical form so that the planning problem can be solved in the MELA-based forest planning system (Siitonen et al. 1996) and JLP (Lappi 1992) (Fig. 1)

Visualisation

The GIS program is used in visualising and analysing the alternative plans created in the forest management planning system and based on different production goals, silvicultural treatment restrictions and constraints on the management zones or particular stand types. Finally the GIS program is applied to producing maps in color on screen or printer (Fig 4) and printouts in volumes (m^3) and currency (FIM/year) needed (Table 1).

Table 1. The alternative plans.

Variable	Alternative 1	Alternative 2	Alternative 3
Total volume			
Present	4929	4929	4929
After 10 years	6018	6102	6810
after 20 years	6539	6854	8489
After 30 years	7125	7551	9502
Volume increment			
1 st 10 years	367	369	372
2 nd 10	345	353	394
3 rd 10	357	363	385
Cutting removal			
1 st 10 years	239	232	162
2nd 10	265	255	203
3rd 10	270	260	254
Net income			
1st 10 years	17 800	14 900	5 300
2nd 10	17 900	17 800	12 800
3rd 10	22 100	20 700	20 600

Discussion

This paper concerns the development of interactive forest planning. A user interface has been implemented and tested even using the system and PC on forest-owners' own premises. An approach to integrated forest planning is introduced and a pilot GIS program designed. The GIS program is applied to divide a forest planning area into management zones. Simulation is used to generate treatment schedules for compartments and linear programming with domain constraints applied to handling the management zone production goals.

The method presented enables integration of diverse forest products into the forest planning process even where production functions for non-wood commodities are not available. The method therefore provides more realistic estimates of the production potential of forest areas than previous methods. The model can be used to calculate and analyze the economic influences of public participation and the requirements set by society at landscape and estate level. The approach can be applied also to measuring the economic impact of biodiversity legislation on a NIPF owner (a measurement trial in Penttinen 1999) in the spirit of sensitivity analysis. Moreover, shadow prices of various constraints and constraint groups were considered in order to inspire iterative planning. Various economic objective variables have been tested, applying some multiple criteria methods (Penttinen 1995).

The implementation of new planning systems and approaches turned out to be a success as well as coping with the needs of forest-owners. However, further development of the system is needed. The forest planning system applied is designed for timber production planning and there are no models describing the production of non-wood benefits, although some attempts have been made. Obviously, it would be easy to adapt the system when the appropriate production functions become available.

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Evaluating the Impact of Farm Woodlands on the Landscape: a Case of Blending Perspectives

Colin Price and Alun Ll. Thomas

Abstract

Several disciplines bring their own perspectives on valuation to aesthetics. Landscape architects enunciate descriptive principles for design and arrangement of landscape elements. Planners quantify the relative merit of landscapes seen holistically. Perceptual psychologists analyse individuals' responses to landscapes. Economists do not consider landscape as fundamentally different from other public goods, so incline to value it by their willingness to pay criterion. Using this, they may seek to displace the contributions of other disciplines: hedonic pricing attempts directly to place a cash value on landscape elements; contingent valuation of a given landscape change condenses citizen preferences with consumer purchasing decisions; but both methods suffer disabling limitations. It is more constructive to integrate the insights of other disciplines than to compete with them. By such a combined process a farm woodlands programme in Wales has been evaluated. Hypothetical planting schemes were designed for representative landscapes, using received design principles. A single assessor evaluated, subjectively, impact on landscape quality, judgements being calibrated by reference to a larger assessor group. Landscape change was given a monetary scale via differential willingness to pay for travel to Welsh landscapes of different quality. The resulting value of aesthetic gain was similar to the expected cost of the programme.

Keywords: landscape design, evaluation, farm woodlands

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Introduction

Over the past twelve years government forestry and agricultural agencies in the UK have supported a programme of tree planting on farms. In addition to reducing agricultural surpluses, supporting farm incomes and contributing to long-term timber supplies, the schemes have had an objective of improving the environment (Ministry of Agriculture, Fisheries and Food 1987). Surveys of farmers, and records of the size and kind of planting (Gasson and Hill 1990, Appleton and Crabtree 1991, Parry 1992) suggest that this objective has indeed been an important motivation for planting.

But, given the pressure for accountability in public programmes, how is success in meeting the environmental objective to be judged? Most environmental effects of woodland mature in decades or centuries, so some prediction is needed. Moreover, environmental effects are difficult to measure, particularly in relation to the metric of cost, or to the revenue achieved by other farm and forest products.

This paper reviews several perspectives on landscape design and evaluation, including 'pure' economic approaches. Then, using a survey of farm woodlands as an example, it explores how the different approaches may provide mutual support, rather than conflicting contentions. The resulting valuation of farm woodland schemes suggests that, undertaken with flair and discrimination, the schemes can deliver landscape benefits commensurate with cost.

A landscape architect's perspective

There is a strong British tradition of aesthetic design, on a large scale and in a naturalistic manner (Miles 1967). In the eighteenth and nineteenth centuries, it particularly influenced the layout of country estates belonging to wealthy families. Recently, the tradition has been increasingly applied in designing commercial forests, (Crowe 1978, Lucas 1993), and more recently still to farm woodlands (Price 2000).

For much of the twentieth century, rapid and aesthetically insensitive afforestation – large-scale and mostly using exotic conifers – brought a reaction against commercial forestry. With this came a perception that good design could be expressed by rather rigid and simplistic guidelines: 'small is beautiful' and 'broadleaved species are best'.

Such guidelines, however, themselves lack sensitivity to context: exotic conifers may be aesthetically appropriate to mountain landscapes: on the other hand, small plantations may be aesthetically destructive, especially in relation to their area. More general concepts are needed as a basis for context-relevant design.

A minimum set of seven principles can be conceived as underpinning the more detailed prescriptions for forest (and other) design.

- **The principle of naturalness** is founded equally in an article of faith that designs conforming with ecological principles will also look good; and in a palpable desire to escape the ordered geometrical elements that circumscribe urban citizens' world, and that all too often threaten to invade rural areas: plantations have not always 'blended imperceptibly into the background'.
- **The principle of integrity** asserts the wholeness of things, and that a landscape looks most satisfying when its elements share a common character – as for example the rounded outlines of beechwoods reflecting the landform of chalk downland.
- On the other hand, **the principle of contrast and variety** emphasises the value of mental stimulation and even surprise. Humphrey Repton, for example, urged that the character of architecture should be emphasised by setting it amid trees of contrasting outline: the flat restraint of classicism against conifer spires; the exuberance of gothic pinnacles against rounded broadleaves.
- But variety can degenerate into disorder: in neurotic landscapes where trees rush about like headless chickens.... Variety of a strees-relieving kind is expressed within **the principle of pattern**, whose components relate to repetition, development, and climax or focus.
- According to **the principle of equilibrium**, the search for composed, relaxing landscapes is also served by landscapes in which woodlands do *not* appear as tottering uneasily on one leg, or perched unsupported at the top of steep slopes, but rather are stably balanced, for example, on either side of a river valley.
- **The principle of honesty** proposes that what exists should be truthfully revealed – that tension arises from evident attempts at concealment, as when 'commercial' species are unsuccessfully screened by 'amenity' species.
- **The principle of pleasantness** asserts that, for whatever reason, certain proportions – classically, the golden section ratio – as well as textures and other characters are simply more pleasing than others.

But these principles are not agreed upon: different commentators offer different lists of principles and give different priorities among principles, and sometimes the prescriptions derived from different principles are in conflict. For example, in a wide, flat landscape like the English Fenland, is small-scale planting in incoherent conflict with the principle of integrity, or does it interestingly comply with the principle of contrast?

Aesthetic principles thus may provide a vocabulary for discourse about the merits of designs, but not a set of mechanical guidelines for producing the unarguably 'best' scheme for any particular site. Nor do they offer a quantitative scale on which conformity with all principles is integrated, and by which the merit of alternative schemes can be evaluated.

A planner's perspective

Over the past 30 years a number of scales for overall landscape value have been discussed, especially that of K.D. Fines (1968), presented in table 1. Although the concept of attaching a number to aesthetic quality is initially alien to most people, experience has shown that judgements that at first seem perverse and intractable can in fact be made: most participants agree afterwards that the numbers do seem to have some significance (Thomas 1999)

Table 1. Some scales of landscape value.

Fines (descriptive)	Fines (numerical)	Harding & Thomas	Price
Unsightly	0–1	0–5	–V–0
Undistinguished	1–2	5–10	0–V
Pleasant	2–4	10–15	V–X
Distinguished/attractive	4–8	15–20	X–XV
Superb/Excellent	8–16	20–25	XV–XX
Spectacular/Exceptional	16–32	25–30	XX–XXV

Fines's conversion of descriptive categories to a geometrical scale reflects his presumption that larger value intervals exist in the higher-quality categories. However, experience has demonstrated that the evenly-distributed Harding and Thomas modification (Harding pers.comm.) is easier to work with. A further modification by Price (1991) incorporates the judgement that scenes at the bottom of the scale cause distress rather than delight.

The purpose of making such evaluations has not always been clear: sometimes they are used to map landscape quality as part of a resource base appraisal; sometimes to identify supposedly 'less sensitive landscapes' for location of intrusive developments. In the Welsh context Thomas (1999) has established a tenuous relationship between landscape score and physical land class.

A perceptual psychologist's perspective

Judgements on such scales are based entirely on an individual's subjective impression. They may be unrepresentative of the judgements of the wider community, and they express no explicit relationship to objectively measurable features of landscape.

In search of a broader consensus and an explanatory account of preference, psychologists have attempted to model response to landscape in terms of both psychological characteristics of the viewer, and the visual characteristics of the scene viewed. Such models may establish consistency both among evaluators (in terms of the scenes preferred), and among the scenes evaluated (in terms of features that consistently enhance ascribed value – for example, presence of water). If consistency among evaluators exists, that may underwrite the strategy of leaving evaluation to a single, expert evaluator, and it obviates the need to find case-by-case consensus on the merit of designs. If consistency among scenes exists, that enables a good design to be identified mechanically by its component feature.

There is a long history of such preference measurement and explanation in forestry (Shafer and Mietz 1970, Lee unpubl.).

Even such studies, however, do not in general reveal *by how much* one view or design is preferred to another. And, critically, the scale of preference does not align with any monetary scale: it offers no means of trading off aesthetic and other objectives.

An economist's perspective

Economists do not consider landscape as fundamentally different from other public goods. Thus their predisposition is to value it by their regular willingness to pay criterion. Using this, it might be argued, the contributions of other disciplines become superfluous: economics provides the complete connection between a woodland design and its cash value.

In practice, of course it is more problematic.

Hedonic pricing

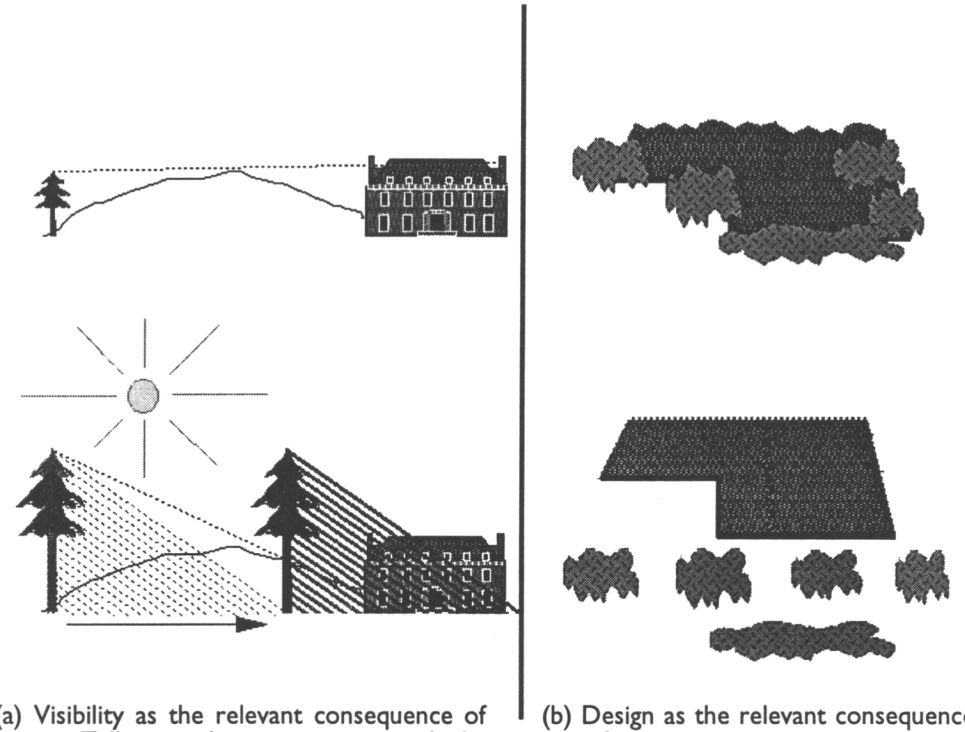
Like the psychological studies, the hedonic pricing method seeks to explain aesthetic value in terms of features in a landscape: unlike the psychological studies, its dependent variable is willingness to pay, not preference. Typically, house price or travel cost giving access to a portfolio of aesthetic, and other, qualities is the source of willingness to pay, as for example in figure 1.

But a fundamental problem in applying hedonic pricing to aesthetics is this:

> ... landscape value depends not just on a collection of positively-signed ingredients (steep topography, varied land uses, presence of water bodies) but also, crucially, on the combination or composition of these elements. It is the former collection that hedonic pricing aims to quantify, on the premise that the value of each component is separable from that of components with which it is conjoined. ... In practice, however, aesthetic composition is a subtle and plastic concept, which effortlessly defies attempts to reproduce it in additive or other form intelligible to computers. (Price in press)

Dependent variable	House price = a [constant] +
Structural variables	$b_1 \times$ [number of rooms] + $b_2 \times$ [garage: yes/no] + ... +
Locational variables	$c_1 \times$ [distance to schools] + ... +
Demographic variables	$d_1 \times$ [% population > 60 years] + ... +
Market variables	$e_1 \times$ [sale year] + $e_2 \times$ [quarter] +
Landscape variables	$f_1 \times$ [river: yes/no] + $f_2 \times$ [pylon: yes/no] + ... + $g_1 \times$ [% woodland cover] + $g_2 \times$ [woodland view: yes:no] + $g_3 \times$ [woodland cover > 20%: yes/no]
	+ [error]

Figure 1. An hedonic house price model.



(a) Visibility as the relevant consequence of age.Tall or nearby trees cast more shade

(b) Design as the relevant consequence of age: arrangement, not quantity, yields quality

Figure 2. Hedonic interpretations.

Moreover, to be useful the model must identify correctly the relevant determinants of value. Using such models, Willis and Garrod (1992) confirm the expectation that indigenous broadleaved species in the vicinity of a house increase its price (just because it accords with expectations we are little inclined to investigate the meaning of that result). However, contrary to the widely recorded preferences for mature trees (Hanley and Ruffell 1993, Lee unpubl.) in the same model old conifers have a more adverse impact on price than young ones. Only then do we seek alternative causal mechanisms, such as that the older the tree, the more likely is it that it will intrude on the view, or that it will cast an unwelcome shade in northerly latitudes (Tyrväinen, 1999) or that it would have been planted in a forestry era when design input was less than it is today.

All these factors are illustrated in figure 2. The implication of each explanation design of woodland is quite different.

Contingent valuation

LikeFines's appraisal, contingent valuation seeks an holistic assessment of the worth of an integrated environmental condition, and thus evades the compositional problems of hedonic pricing: however, it does so in cash terms, asking directly questions such as 'what would you be willing to pay to visit a landscape with woods like this' [show computer-generated image of farmscape with ideal planting] 'rather than in its present condition?' In theory, the resulting value is comparable with what respondents would be willing to pay for ordinary market goods.

The technical problems of contingent valuation, and some possible solutions, have been widely discussed. In the context of farm woodland evaluation, major difficulties appear to be:

- conceiving an unfamiliar trading situation – some respondents refuse 'to play the game', others play it to an ill-defined set of rules of their own conceiving;
- embedding – that is, ambiguity about whether the question concerns only the presently visible landscape, or a general class of landscapes;
- sufficient sampling, at many locations and from many aspects, of a programme which is geographically dispersed through a large area where potential respondents are sparse on the ground.

Blending perspectives

An alternative to seeking complete evaluation from any single perspective is to combine the best information available from each perspective. In the following sequence, an approach to valuing a farm woodland expansion programme is outlined.

Design phase

From a stratified sample of land classes found within Wales (Bunce *et al.* 1981) a few were selected for 'farm woodland design' treatment. Designs were created in accordance with the principles listed earlier, combined with a degree of experience and artistic flair. However, landscapes of the highest quality (superb/excellent) were sometimes difficult to improve by realistic planting schemes. However, these form a small proportion of the Welsh landscape – the top-ranking land class 23 occupies only 0.2 % of the land surface.

Landscape evaluation phase

A value on the Harding/Thomas variant of the Fines scale was assigned by a single evaluator to the existing landscape, and to the landscape as it was expected to become when the woodland design had matured. A mean improvement of 2.5 points on the scale was recorded.[1] However, when notional woodland schemes without explicit aesthetic input were added to the landscape, the score often went down.2

Calibration phase

A sequence of 89 slides of the Welsh landscape sample was shown to a group of ten students with both interest in rural landscape, and familiarity with evaluation on the Fines scale. The correlation matrix of their evaluations of slides with the original field valuation is shown in table 2.
Scores of every pair of observers showed positive and significant correlation. The field score gives an accurate, almost one-for-one prediction of the mean score.

$$\text{Mean score}] = 0.82 + 0.916 \times [\text{Field score}] + [\text{Error}] \quad (R^2 = 0.753)$$

Written comments on reasons for scoring were also solicited, and used to identify reasons for 'deviant' scores (Thomas, 1999).

Overall, the factors underlying preferences appear to be well explained. The agreement is all the more gratifying, given that photographic evaluations are being compared with ones from the field. Even stronger agreement has emerged from local all-field evaluation exercises (Price 1995)

Monetising phase

As argued above, hedonic regression equations do not account for the subtleties of aesthetic composition. However, the compositional aspect is automatically inte-

1. This change on a 30-point scale compares interestingly with the independent assessment made in Cobham Resource Consultants and Price (1990), that urban tree planting on average improves townscapes by one point on a 12-point scale. In both cases the improvement wrought by tree planting increases the score by 8 % of the whole range of the scale.

Table 2. Correlation coefficients for regressions between pairs of scores.

	Field	r1	r2	r3	r4	r5	r6	r7	r8	r9	r10
r1	0.642										
r2	0.829	0.664									
r3	0.776	0.604	0.735								
r4	0.754	0.572	0.746	0.664							
r5	0.825	0.654	0.769	0.722	0.795						
r6	0.666	0.708	0.650	0.608	0.804	0.744					
r7	0.713	0.575	0.717	0.744	0.765	0.714	0.729				
r8	0.668	0.450	0.633	0.536	0.732	0.706	0.671	0.685			
r9	0.620	0.538	0.577	0.578	0.632	0.542	0.591	0.615	0.453		
r10	0.790	0.657	0.795	0.713	0.765	0.784	0.680	0.763	0.700	0.657	
Mean	0.868	0.754	0.868	0.818	0.901	0.885	0.863	0.863	0.794	0.737	0.895

grated by holistic evaluation of landscape. It is then possible to apply hedonic pricing to the holistic landscape score (Price 1978).

Bergin and Price (1994) have attempted this by applying the travel cost method (Clawson, 1959) to recreational visits made to landscape of diverse quality within Wales. Figure 3 shows the resulting relationship between quality (as assessed by Thomas (1999)) and willingness to pay per visitor group.

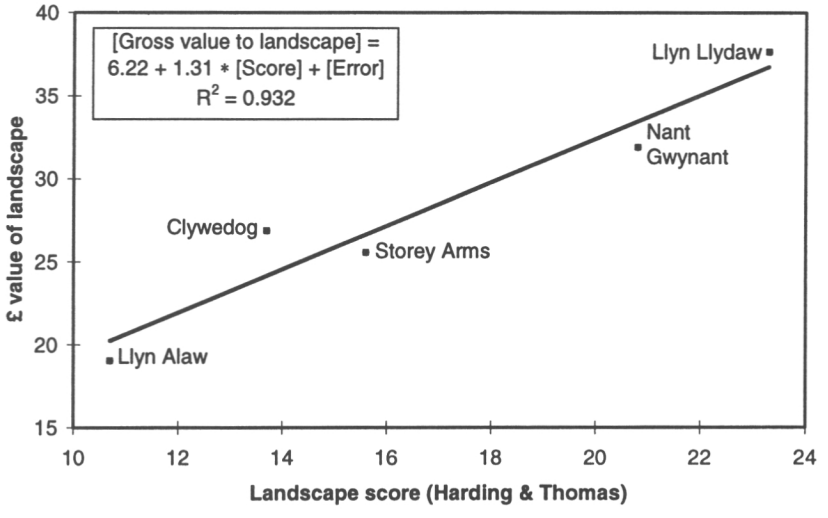


Figure 3. Willingness to pay for landscape quality.

There is no visual or statistical evidence here of the geometrical relationship hypothesised by Fines (1968), nor does the value intercept confirm speculation about negative values at the bottom of the scale. However, greater landscape quality does seem to evoke a greater willingness to pay for travel to experience it. Each point's improvement on the aesthetic scale is worth £1.31.

Scaling-up phase

Had visitor data been available at a micro scale, it would have been possible to evaluate the designed woodland schemes individually. In their absence, an heroic countrywide guesstimate was made instead. This was legitimised by two key factors:

- absence of evidence for a geometrical landscape-score/money-value relationship, which justified applying the same value for each point added to scores, across the whole Welsh landscape;
- the fairly consistent improvement by 2–3 points brought about by designed schemes in a range of landscapes.

Had the expected geometrical relationship of value with landscape quality been found, then this would have been to an extent balanced by the greater difficulty in designing to achieve a 2.5 points increase of value in landscapes of highest existing quality.

Further discussion of this scaling up phase is given by Thomas and Price (1999).

Such a pervasive increase in landscape quality could perhaps be achieved by planting about 10% more of the land surface – this would bring the forest cover of Wales into the 20–30 % band suggested by Whiteman (1995) as the one preferred aesthetically. The annual number of beneficiaries from a 'pervasively improved rural landscape' is estimated as in table 3, which shows the number of tourist-days by unitary authority area, for the largely rural areas to which farm woodlands are relevant.

On the basis of the site surveys, there are on average three visitors in a visitor group. This implies an overall incremental benefit from landscape-enhancing farm woodlands of

[visitor numbers] ÷ [visitors per group] × [value per point increase] × [points increase]

22 million ÷ 3 × £1.31 × 2.5 = £24 million per year

The designs were evaluated as in their mature state. In practice their contribution to landscape would develop slowly, perhaps requiring 20 years to reach half their mature value (see figure 4). Also, conventionally, discounting gives successively less weight to their value as time moves on. Assuming this

Table 3. Visitor days to rural unitary authorities' areas.

Unitary authority	Visitor days (000s)
Anglesey	523
Carmarthenshire	1850
Ceredigion	1997
Conwy	4130
Denbighshire	3725
Gwynedd	1553
Monmouthshire	1779
Pembrokeshire	2487
Powys	4165
Total	22209

slowly developing value, a 100-year expected life and a discount rate of 6 % means that the discounted lifetime value is only 6.1 times the annual mature value (Cobham Resource Consultants and Price, 1990). This gives a lifetime landscape benefit of £146 million. On the other hand, if it is considered inappropriate to discount environmental values conventionally (Price, 1993), but only to make

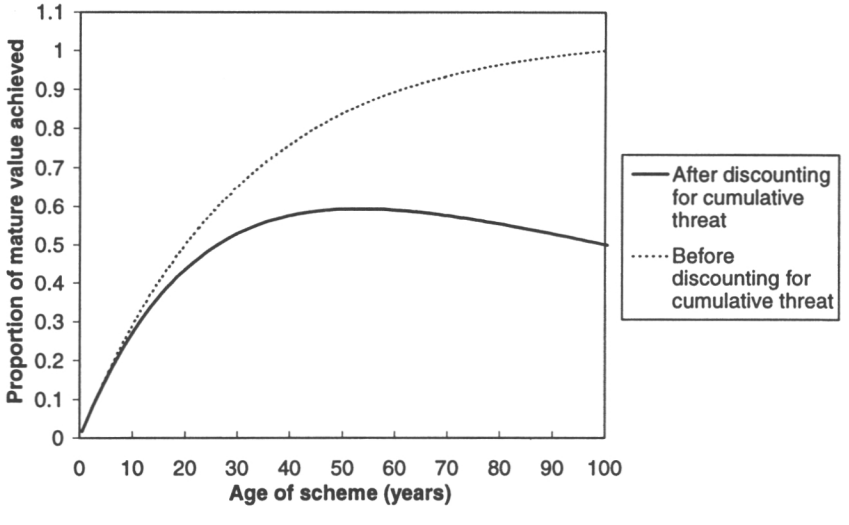


Figure 4. Development of aesthetic value through time.

some small 'discount' to allow for cumulative threats to woods' survival, the multiplier is 49, and the lifetime benefits are £1176 million. This sum is of similar magnitude to the likely cost of establishing and maintaining the 200 000 ha of new woodland needed to achieve this pervasive influence

Conclusions

Taken individually, none of the various monetary and non-monetary approaches to valuing landscape can make all the necessary links between a landscape design, and its value in comparison with cost or other kinds of benefit. The economist's approach in theory comes nearest to it, but in reality its results have been 'disappointing', as even its own practitioners acknowledge (Hanley and Ruffell, 1993).

Taken together, however, each fills in weaknesses in the capabilities of other approaches, and so makes possible a logical, stepwise progression from design to monetary value. The result will not please purists. Neo-classical economists will be affronted by its reliance on subjective judgement (as though values generally were *not* based on such judgements): aesthetes will no doubt revile the taint of money impinging upon matters of the soul. Pragmatists, however, may welcome the possibility of bringing a range of relevant expertise to bear on a real problem, which requires an implementable solution.

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Exact Values and Vague Products? Contingent Valuation and Passive Use Value

Colin Price

Abstract

Contingent valuation of passive use values faces problems of defining both the baseline of value, and the actual product supplied. Grossly exaggerated values may arise because non-passive use values are included, because values are created by the questionnaire, and because most of the population remains unaware of many issues. It can be clearly demonstrated that much of the value is symbolic, or concerned with self-image. A pilot questionnaire about conserving the red squirrel in Britain indicated that passive use yielded some genuine satisfaction, but also some negative values and several neutral ones. These values are more likely to persist, and, in part, to affect a wider population, simply because the red squirrel is a widely known symbol of wildlife.

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Introduction

Passive use values of the environment – that is, values arising from mental rather than physical experience of some environmental condition – became a fashionable matter of discussion during the 1990s. The debate distinguished, not always clearly and often confusedly, option value (which is not the same as quasi-option value), vicarious value (which includes more than bequest value) and existence value (which is utterly different from intrinsic value) (Price 1997). There seems to be a view that the contingent valuation method (CVM) is the only means of deriving passive use values. This is not exactly true: actual voluntary subscriptions offer another window into these recesses of the mind and soul (Price 1994): however, it is hardly to be questioned that contingent valuation is the most intensively exploited approach to the problem.

Two main types of question are debated about CVM of passive use values.

1. How do you do it? This is the question that economists committed to CVM tend to discuss, research and publish; and very interesting it is too. Its concern is essentially quantitative, focusing on biases, appropriate metrics, appropriate instruments and so on. No-one in this field needs to be told nowadays about the technical problems that CVM has encountered in its efforts to elicit a considered and truthful willingness to pay. Nor will they be ignorant about the intensive research which is establishing means of circumventing these problems.
2. Does it give a meaningful answer? This is the question that tends to be asked by decision theorists hostile to economics, economists hostile to CVM, and CVM practitioners hostile to misuse of the technique. Its focus is on qualitative matters.

The paper presented here takes up the second question in an open frame of mind. It seeks to establish what it is that people express a willing to pay for, when asked about passive use values. Further, it asks whether those who pose the questions are in fact in a position to deliver, not what they ostensibly offer, but whatever 'product' is in the respondent's mind.
The issues are:

- What is the product? to whom can we deliver it (respondents; others in the population aware of the specific conservation problem; those not aware)? and what is its shelf-life?
- What is the baseline of value against which change is measured? CVM proposes alternative scenarios and seeks willingness to pay for the difference between a baseline scenario and one or several specified deviations from it. Randall (1994) gives a clear account. Passive use value provides a particular

problem, in that in many cases what is to be valued was unknown to the respondent, and so no definite baseline existed, prior to the interview.

- Does the programme *need to succeed* in its stated aims, or even *to be seen to succeed*, in order to deliver the product?

This is presented as a discussion paper. There are surely views out there on these difficult but important matters, and I would not begin to claim that I have resolved the problems for myself.

Is it a passive use value? who benefits? what is the product really like?

Contingent estimations of passive use values can easily generate implausibly large values. In response to one such evaluation of the Flow Country of North Scotland and its population of greenshank (*Tringa nebularia*), I have previously argued (Price 1999) the following cases.

Passive use value questions get answers about non-passive use value matters.

The questionnaire, concerning the preservation from commercial afforestation of an important wetland, offered respondents a number of categories of benefit over which to distribute whatever willingness to pay they had expressed. Most respondents to the questionnaire allocated most of their willingness to pay to instrumental and intrinsic values, or values resulting from active use of the resource: such values typically are – and in some cases can only legitimately be – included in cost–benefit analysis by other means. A CVM study which specifically targets non-users is liable to double-count, as well as to mis-count, these components of value.

Passive use values which did not previously exist are created by the act of questioning.

When the CVM is applied to willingness to pay for moose hunting, or for enjoyment of watching moose in the field, the product is usually familiar to a clearly defined set of respondents. These individuals are, moreover, likely to be accustomed to the idea of making decisions with some economic content, in order to experience the product – decisions on whether to make the trip, on how long to stay in a locality, in what type of accommodation.

When we seek passive use values, on the other hand, we introduce a product which is not part of routine decision making: it – the entity to be conceived – just exists. Typically, the product is not particularly or not at all familiar to the re-

spondent: an endangered species, or a habitat threatened with destruction. To acquaint the respondent with the object we probably have to – and are certainly urged by other practitioners to – describe it and its circumstances, in some detail and in a context that makes clear the need of urgent action. Under these unusual and asymmetrical conditions, the respondent has to construct, rapidly, a product image that may owe little to the difference between a long-term future in which the product exists, and one in which it does not. The value elicited may, in fact, be almost entirely an artefact of the questionnaire.

These created values are irrelevant to the population not sampled, and who hence are not made aware of 'the problem'.

If it is the questionnaire and attendant information that constructs the reported passive use value, then those not interviewed and informed do not share this value: the interviewed sample becomes a complete enumeration of the category that is itself, but is no longer a sample of the large not-interviewed population. That population, unaware that any change in the environment is planned – or indeed implemented – simply has no passive use value for that which it neither senses nor contemplates.

Which all adds up to ...

... a massive curtailment – in this case it was by a factor of 250 – in the legitimately claimable passive use values of the Flow Country – and this was a suggested *upper* limit.

The result of this downward revision was, perhaps predictably, a hostile and puzzled response from regular purveyors of passive use value CVMs. There is, of course, an issue in democracy, which might be expressed as:

1. There is a democratic right to know about potential degradation and extinction
   (a) as an ethical statement.
   (b)to avoid political problems of 'being found out afterwards'
2. We should inform our sample, so we may know what the value *would come to be* if people became informed.

If 1(a), then *all* people *should be* informed, by public information. However, we should inform them of the risks to everything. This would reduce the effect of 'headlining' one issue.

If people are *not* informed, their predicted informed values are irrelevant, even if *they ought to be informed.*

Smelly flowers, fabulous dragons and public images

In these days of sophisticated expertise and refined analysis, undertaking a CVM study is no light matter: if, that is, the objective is to give a precise and unbiased cash valuation of the environmental condition. But if the purpose is to explore potential misconceptions about the meaning of CVM results, small and non-representative surveys are quite adequate.

In one such experiment, a small group of respondents was asked what they would be willing to pay to ensure the conservation of just one species, *Rafflesia arnoldii*. No information about the species was given. Respondents were willing to pay sums specified as between 50p and £20.

The species is actually a parasitic plant. It has the largest flower in the world, and is famous for it in the South-east Asian countries where it grows. Its smell, of rotting flesh, attracts insect pollinators, and it is locally notorious for it. Giving information about the subject of questionnaires normally increases willingness to pay (Hanley and Craig 1991, Bishop and Welsh 1993). In this case, however, most respondents kept the same willingness to pay or even reduced it: perhaps they expected it to be an interesting large mammal or a beautiful bird, and were disappointed to find that it was 'only' a flower; perhaps the bad smell made it seem less worthy of conservation effort.

Respondents were asked whether they had known of this species, by this name, before. Their statements were verified by referring to their descriptions of the species made prior to information being given: the two claims to know the species seemed genuine (both respondents normally lived in South-east Asia).

So on what basis had respondents been prepared to offer positive willingness to pay for a product which, mostly, they knew nothing about? They were asked to tick which, of the reasons in table 1, most closely influenced their evaluation: ticking more than one answer was permitted.

Table 1. Reasons for expressing a passive use value for *Rafflesia arnoldii.*

Reason for giving this value for the species		Number of responses
I	I knew about the importance of this species	2
II	I believe that genetic resources should be maintained intact	9
III	I suspected that this species does not really exist	6
IV	I thought you would not have asked these questions if it wasn't important	4
V	I want to be seen as someone who is concerned about nature conservation	2
VI	I didn't know anything about it	13

It is apparent from response II that many respondents were not valuing the specific resource that the questioner is asking about, but are treating the resource – and most of them did not know what it was – as symbolic of nature conservation generally (see Blamey, 1996). Response III also supports the symbolic interpretation: if the species does not in reality exist, then its only worth can be for what it symbolises. In somewhat the same sense the red dragon is valued by the people of Wales, but there is (here I merely speculate) no implication that dragon sanctuaries should be financed by the Welsh Assembly.

Response IV reveals the bias introduced by the very fact of implementing a questionnaire. Research interest is a cue for people who have been given no other information, that *someone* cares about this species. If the person, by their very involvement, appears to have authority on the subject, that gives weight to this implicit valuation.

Response V is not even to do with conservation as such, but with individuals' desire for status in the eyes of others (and of themselves). As this response is effectively a declaration of a self-serving, rather than a 'good citizen', view of value, more respondents may have been motivated by such reasoning, but were unwilling to admit it. Kahneman and Knetsch (1992) term the motivation for this mode of response 'the purchase of moral satisfaction'.

Nature conservation generally may be a good thing, but evidently most of the responses do not tell us how valuable *this particular part of nature* is. So, returning to the key issue, it is likely that respondents value a product other than the one offered. To the extent that the product *is* commonly understood by questioner and respondent, imparting information – or even posing questions – is likely to change the perceived importance of the issue raised. Even for those who have honestly nailed their symbolic colours to the mast of this particular species, the premium is perhaps transient: another day comes, another conservation issue, another questionnaire, more information, and a redirection of conservation priorities.

Preserving red squirrels or pickling red herrings?

A questionnaire is currently being piloted which seeks to test some of the speculations offered above. No statistical analysis would be appropriate for the small number of responses so far received to the pilot: they nonetheless suffice as a basis for qualitative discussion of the issues arising. Numbers of responses are shown in square brackets. Because of missing values and multiple answers, the sum of alternative responses is not always the same.

Unlike the two previous questionnaires reported on, this one concerns a species familiar at least by proxy to most respondents. The red squirrel (*Sciurus vulgaris*), native in British forests, has been in decline for many decades, suffering competition from the North American grey squirrel (*Sciurus carolinensis*). It has been retreating northwards and westwards, and, despite some programmes to support

it, it has disappeared from many of its former sites in Wales. The red squirrel is part of the British idyll of rurality, figuring in hundreds of children's books and films. Nonwithstanding the familiarity of its image, like the subjects of previous questionnaires the species is not often seen, and no longer seen at all in the intended location of the main survey. Passive use values are likely to be important.

The questionnaire sought responses to a programme to improve the conditions for survival of the squirrel.

What is the baseline?

The baseline is not the status quo, but the survival prospects of the red squirrel if the programme is not implemented. The majority [13] assumed that the red squirrel would probably become extinct in Wales in the absence of the programme.

Support for the programme

With £10 set as a price for the programme, [12] would be willing to pay for it: of the remainder, [4] could be identified as protest votes. If a positive decision on the programme was taken politically or by experts, [6] would support it even at a cost of £10, and [3] would not. It was explicitly 'not worth that much' to only [2].

In the context of this questionnaire, the stated amount of willingness to pay is not very important, except as an indicator of relative intensity of feeling among the motivation classes.

What is the product?

The product actually tendered by the questioner is a preservation programme, *not* retention of the red squirrel as a significant part of the Welsh fauna: its valuation should be interpreted accordingly. Success was assumed by [7] respondents, whose valuation is therefore overstated *as a value for the red squirrel programme*. Taken together with the baseline assumptions only [5] assumed that the programme would make the definitive difference between success and failure of preservation.

However, the *subjective* importance of the programme is a complex matrix of the different personal results of its implementation.

Upside products

Not all the reasons given in favour of a conservation programme related to passive use value. In particular [8] valued the squirrel's ecological functions, and [4] expected to see it in the field.

A genuine and specific increase in satisfaction was implied for:

- [3] who expected 'to feel good' about keeping the squirrel for the enjoyment of others;
- [7] out of the [8] prepared actually to pay money who 'would be happy to do something practical for conservation'. This is of course only a product if the option of making a real contribution is implemented. On the other hand, people always have the option of making a voluntary donation to wildlife funds, so perhaps the only additional product this joint programme would offer is the chance to express a consonance of words and actions – not far removed from the 'purchase of moral satisfaction';
- [1] who was motivated to support the programme by feeling 'satisfaction in that I had discharged my responsibilities to the world';
- [3] who would feel satisfaction in making a positive gesture of support.

The questionnaire itself (as opposed to the programme) creates benefits to the extent that it provides the opportunity to show support for and solidarity with wildlife conservation.
Nobody claimed that the red squirrel had special significance to them, so in a sense all the responses were symbolic of a more general concern for nature. More explicitly symbolic responses were:

- [4] supported this programme because the red squirrel was perceived as a threatened species, on which general support for conservation was focused,
- [1] because it acted as a symbol for conservation support,
- [1] because the fact of the questionnaire's being arranged implied its conservation importance,
- [8] because a desire to keep wildlife resources intact would cause them to support 'any reasonable conservation programme that was proposed'.

But just because support is 'only' symbolic, it does not mean the programme does not deliver the desired product. In reality, there is no prospect of wildlife resources being kept intact, but, of those who were motivated by a desire to do so, [4] would explicitly feel satisfaction that they had done what they could to slow down depletion of the resource.

No-one declared that they wanted 'to be seen as a person who is concerned about the environment'. As the questionnaire was administered anonymously, there was no motivation to impress the interviewer: but it remains possible that people avoid such answers because, paradoxically, to declare self-image as a motivation undermines the virtue of the self-image.

Flatside products

Some products of the programme appear decidedly neutral, creating neither joy nor sorrow. In particular,

- [14] felt that humans had a duty to support conservation for the benefit of others – particularly future generations – without themselves attaining any satisfaction;
- [9] felt that each species had a right to exist,
- [2] would be willing to pay money in actuality, simply to honour the implicit commitment they had made in response to the hypothetical willingness to pay question, and
- [1] would support a democratic decision to go ahead with the programme, even at cost, because 'although I disagree with it personally, I believe democratically made decisions should be implemented'.

These solemn motivations require compliance with ethical imperatives which, if infringed, would engender unhappiness. Compliance merely avoids this downside outcome. In terms of positive satisfaction, the ethical deal is a more general one: for positive reasons, you sign up to 'acting properly', and there may be little incremental satisfaction in carrying out the contract in whatever the required detail might be. It is therefore debatable whether 'creating the opportunity to be dutiful or righteous' could be a positive product of either the programme, or of the questionnaire. The may, however, be legitimate human pleasure in the animal's rights' being upheld.

That the red squirrel might find pleasure in being alive was accepted by [3] respondents (a major shift in favour of this kind of perception has taken place in the past 20 years). In interpreting this value, it is relevant that a sub-plot exists: that of the red squirrel being displaced by the 'foreign' grey squirrel. Whatever the human view of the merit of this invasive species, there is no reason to suppose that it takes less pleasure in life, is there? Thus to the extent that this answer is taken to imply intrinsic value, it is misconceived. An alternative interpretation, however, is that humans take pleasure in the supposed pleasure obtained by 'favoured' species: no matter how ill-conceived may be dismissive treatment of the grey squirrel's pleasure, it does create a differential of human good. Whether a certain metaphysical demerit attaches to ethically questionable judgements is not pursued here.

Downside products

Among the [2] who would not support the programme at a cost, neither confessed that any guilt would result from discovering that the programme had not been implemented and that consequently the red squirrel had become extinct in Wales.

For those who would support it, guilt was nonetheless possible [1] for not doing 'something more positive to encourage support for this programme'.

'Downside avoidance' could be seen as the strategy behind the [1] respondent who 'would feel guilty if I made a conscious choice *not* to support this conservation programme': depending on where the baseline is perceived to be, this is arguably an upside product created by the avoidance of a downside product.

The [4] protest bids could also be interpreted as downside avoidance, by distancing the bidder from the decision.

For most other respondents, discovery that, despite the programme, the red squirrel had become extinct in Wales would provoke some negative feelings:

- sadness for the impoverished resource [12];
- sadness for the squirrel [7];
- anger at human apathy [4].

The extinction cannot, of course be considered as a bad outcome of the programme (unless its actions were misconceived and its effects – e.g. by encouraging competing species – perverse). But to the extent that the programme is *advertised*, by public information or by the questionnaire, it focuses attention on this particular conservation issue, and genuinely intensifies the sadness. We all know the unsettling effect of seemingly capricious media decisions to concentrate on a particular tragic news item.

There is in all this a clear importance in defining the baseline, and its implication for whether good is created, or whether harm is proposed and the illusion of good created by restoring the initial position.

What is its time-track?

By contrast with the assumption made in Price (1999), only [3] respondents felt that in time their 'concern about nature conservation would move on to something else', and thus cease to be a cost of extinction: [14] thought they would continue to feel the same way. But this 'continuing commitment' might be a result of the difficulty – as with any sorrow – of conceiving a time when things will get better. A more reliable general indicator of the time track of downside feelings would be a retrospective questionnaire about how many people were still aware of or made unhappy by past extinctions.

This raises the question: when an extinction occurs, is it the *ongoing difference of states* or the *one-off transition of states* that matters? A sensed difference of states in active use values (visiting the forest and seeing what is there) is continually reinforced by repeated experience. Passive use values, on the other hand, ex-

isting as they do in the mind rather than the senses, persist only as long as remembrances are active or reminders are supplied.

In this sense the red squirrel is clearly different from the greenshank. The red squirrel is familiar in culture and its loss will be continually reinforced by reminders of the extinction (for example, as we read squirrel stories to our grandchildren (Potter undated)).

To the extent that values are symbolic rather than specific, they might nonetheless be expected to move on. To the extent that the questionnaire provides or renovates a specific creature as a symbol, or rearranges the budget of our conservation concern, it creates no new values; to the extent that the loss of the symbol is the more regretted because of its being brought to the public notice, the questionnaire is responsible for the loss; to the extent that the symbolic content of concern shifts to other creatures, the time track of downside feeling will be a declining one.

Some comments on other creatures are offered in the conclusions.

Does the programme *need to succeed* in its stated aims (or even *to be seen to succeed*) in order to deliver the product?

It is implicit in the discussion above, that we need to distinguish the products:

- of success of the programme;
- of the implementation of the programme;
- and of the application of the questionnaire.

By informing respondents and moving the baseline, the questionnaire may shift focus onto a threatened species, and create and extend possibilities for downside feelings (potential sadness, guilt). On the positive side, the questionnaire itself creates benefits to the extent that it provides the opportunity to show support for and solidarity with wildlife conservation.

The successful implementation of the programme at first sight appears to be the composite product that a CVM attempts to value. In fact, expression of support and solidarity create benefits which may be quite persistent, even if extinction ensues. Explicitly, several respondents stated that even in the event of extinction they would feel some satisfaction that they had at least made their gesture of support [3], or done what they could to slow the process down [4].

As for whatever elements of value are ascribed to ecosystem functions or pleasure in life of the red squirrel, as already hinted, these are values outside the strict purview of the respondents, and might in the absence of the red be perpetuated by the grey squirrel.

Cui bono?

However many people are interviewed in the main survey, it will only be a tiny fraction of the residents of and visitors to Wales. The values which are attributable to the questionnaire apply to this tiny fraction alone. Because of the cultural standing of the red squirrel, its extinction in Wales would not go unmarked. But the 'products' attendant on that are not really the same as those understood by the respondents.

Conclusions

Note that this is a discussion paper, not a final statement. One thing that became clear from impressionistic analysis of responses was that evidence about the state of a particular product could be found under an unplanned variety of questions, making statistical analysis problematical. The mental structures within which people express their support for conservation are often not as tidy as is assumed when a questionnaire is constructed!

The three examples discussed above make clear that the product for which people are willing to pay may be very different from the collection of benefits (often unhelpfully termed 'total economic value') that flows from actual conservation of wildlife resources. But, no matter what the disparity is between our perceptions and theirs, the real issue is whether we can deliver to the relevant public, however inadvertently, the product ('knowing the species is safe', status, feeling good about oneself) that they actually desire. If the conservation of wildlife resources mediates a process of which the consequence *is* an increased supply of valued moral satisfaction, or a sense of having helped to keep genetic resources intact, then good has been done, to the small proportion of the population engaged in the questionnaire, or incorporated in the social enterprise of 'saving nature'.

A discussion could be raised on whether moral satisfaction is a demeritorious, 'corrupting' good, and hence actually a bad. But this is altogether a different argument, howsoever it may often seem to flourish, unacknowledged, in the barely-suppressed contempt accorded to those who admit to seeking moral satisfaction. Somehow, finding satisfaction in 'having done one's best for nature' is found more praiseworthy.

It is clearly relevant to expected passive use values, whether the species concerned is already a cultural emblem, or merely attains that status, probably briefly, in response to a crisis. The red squirrel is already a star: the greenshank had to be raised to stardom.

There are, however, species that, in the wake of their extinction became posthumous stars. Such was the dodo (*Didus ineptus*): its loss is felt, not because we miss its presence as such, but because its extinction remains as a sensed affront to natural justice. Thus retrospective conservation value can become a social con-

struct. The dodo sneaked into our cultural awareness. Even 100 years ago, it was familiar enough to feature in a children's story book (Carroll, 1907).

If another similarly distinctive extinction took place, would its loss be additional to that of the dodo, or would it compete for a unique place as an emblem?

To what extent is there a 'budget of conservation concern' which we distribute over the species we know about? And if it exists, is the only effect of CVM questionnaires about passive use value to transfer value around?. If the red squirrel is saved, we can reallocate its positive values to the next species in crisis: if it is lost, we can sigh for a period of mourning, and then there will be another 'cutest mammal in Northern Europe'. Maybe?

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IUFRO Units

IUFRO Unit 6.01.00
Forest recreation, landscape and nature conservation

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Research Group 6.01.00 deals with research issues on outdoor recreation, ecotourism, landscape planning and management, and nature conservation in the multiple use management. The main focus of research interests and discussion themes in the group is integration of different uses of natural resources, particularly recreation, tourism and nature conservation from socio-economic and ecological points of view. The ecological approach in use of natural resources is emphasised in landscape management and preservation. Recreation and ecotourism in a wide spectrum is included, from urban forest recreation to nature-based type of recreation. Nature conservation has played an important role in the program. Nature conservation is considered as a holistic approach in land use planning and multiple use of forests.

IUFRO Unit 6.11.04
Economic evaluation of multifunctional forestry

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Research Economic evaluation of multifunctional forestry aims to promote international co-operation in forestry research related to the economic valuation of forest benefits. The valuation of these benefits and the trade-offs between competing, complementing and substituting outputs and services will be emphasised.

IUFRO Unit 6.14.00
Urban forestry

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The ongoing urbanisation of society has led to the increasing importance of urban green spaces as contributors to the quality of the urban environment and urban life.

Forest and tree resources have a wide range of socio-cultural, economic and environmental values. In order to optimise these values in a sustainable way, within the

framework of a range of urban pressures and problems, integrated approaches and research for the planning & design, selection & establishment, and management of urban forests and trees are asked for.
Urban forestry offers considerable potential to meet this demand. It can be defined as the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide to society (Helms 1998). It study topic, the urban forest, ranges from urban and periurban forests to parks, private gardens and street trees.



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