Pertanika J. Trop. Agric. Sci. 22(2): 147-160 (1999) ISSN: 1511-3701

Economic Valuation of Forest Goods and Services of Ayer Hitam Forest, Puchong, Selangor

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Keywords : Economic valuation, stumpage value, recreation benefits, non-market goods and services, land use options

ABSTRAK

Penukaran tanah hutan kepada kegunaan lain telah menyebabkan kehilangan kepada kepelbagaian biologi dan lain-lain nilai ekonomi kepada komuniti. Bagaimanapun, potensi nilai ekonomi sumber-sumber hutan tidak diambilkira sewajarnya oleh pembuat polisi dan perancang pengguna tanah. Satu kajian penilaian ekonomi sumber hutan dijalankan di Hutan Ayer Hitam (AHFR), Puchong Selangor untuk menentukan nilai ekonominya dan kesannya ke atas perubahan guna tanah. Kajian ini memberi tumpuan kepada penilaian sumber kayu, rekreasi, peranan ke atas komuniti dan pemuliharaan hidupan liar. Keputusan menunjukkan bahawa nilai ekonomi Hutan Simpan Ayer Hitam adalah tinggi dan jika kita tidak mengambilkira nilai tersebut dalam pembangunan guna tanah boleh menunjukkan petanda yang salah kepada pembuat polisi. Perancangan penggunaan tanah pada masa depan hendaklah mengambilkira bukan sahaja pulangan berasaskan kepada pasaran tetapi juga lain-lain faedah alam sekitar.

ABSTRACT

The conversion of forestland to other land uses has resulted in substantial loss of biodiversity and other potential economic values to the community. However, the potential economic values of forest resources have been largely ignored by policy makers and land use planners. An economic valuation of forest resources of Ayer Hitam Forest (AHFR), Puchong, Selangor was carried out to determine its economic value and its impact on land use changes. The study focused on valuation of timber resources, recreation, community roles and wildlife conservation. The results show that the economic value of AHFR is substantial and ignoring this value in land use development would provide a wrong signal to policy makers. Future land use planning should consider not only market-based economic returns but also its non-market and other environmental benefits.

INTRODUCTION

Malaysian tropical forest is well known for providing valuable timber resources to the state governments and the community in terms of direct and indirect monetary and non-monetary benefits. Forests also provide a source of food and genetic resources of many agricultural crops, materials used in medicine, eco-tourism and recreation opportunities, and help in maintaining favourable environmental conditions as well as 'research labs.' In the past, however, the forest has been viewed mainly as a source of timber to feed the wood-based industries, which produce a variety of products for domestic and export consumption. The other equally important components of the forest ecosystem such as environmental services, however, have not attracted much attention until very recently. This is indeed an unfortunate situation knowing the fact that tropical forests are very rich in flora and fauna.

The natural products that come from the forests include latex, steroids, edible oils, rattans, bamboo, spices, pesticides, and dyestuffs while some of the consumer goods made from forest products are coffee, lubricants, glue for postage stamps, golf balls, chewing gums, toothpaste, shampoo, mascara and lipstick. The market in these industrial products is worth billions of dollars per year.

The full potential of the biologically diverse tropical forests has never been completely quantified in economic or monetary terms. While it is relatively simple to determine the economic value of timber because of its readily available market price, it is not as simple to calculate the economic value of recreation, wildlife conservation, medicinal plants species or biological diversity. This could be an important factor for the past neglect on the non-timber components of the forest ecosystem in the decision to convert forest to non-forest uses. The economic potential of these resources has not been very much appreciated. Since the economic value of these resources is difficult to determine, their real potential as income generators has not been fully explored. There is a strong need for studies to be carried out to quantify to the fullest extent the economic value of all forest goods and services. Only then we would have a complete view on the costs and benefits of comparing alternative forestland use options.

This paper discusses the economic value of Ayer Hitam Forest, Puchong, Selangor with emphasis on timber resources, recreation, benefits to community and wildlife conservation. The implications of the study on land use options are discussed in the final section of the paper.

VALUATION OF FOREST GOODS AND SERVICES: THE NEED AND APPROACH

Economists generally depend on market prices to indicate the value of goods and services. For goods and services exchanged in a well-defined market, information on prices and quantities are readily available. This information can be used to estimate the value of certain goods and services by constructing a demand curve. Unfortunately, not all forest goods and services have market prices. This is particularly true for most of the non-timber forest products or services such as water, recreation, wildlife, wild fruits and genes. One characteristic of such goods or services is the occurrence of 'free riders', in which case consumers refuse to express their true willingness-to-pay (wtp), but could obtain utility from the good or service. As such, prices might be distorted leading to inappropriate estimation of the true economic value of the resources. The major role of valuation is, therefore to assign the value to goods and services with distorted or non-existent market prices or to value them in terms of their opportunity cost.

Typically, the benefits derived from forest resources are to be measured in terms of market price or willingness-to-pay of users or consumers for using and experiencing the goods and services. An approximation of users' wtp for certain recreational opportunities, for instance, can be developed from a demand curve, which indicates the quantity of use that users in a market would be willing and able to purchase at each price. Other estimates could be in terms of the expenditures on preventive measures taken by consumers or users to avoid a future loss. Thus, conservation of forest resources could be seen as a form of wtp for current, as well as, future benefits.

Resource economists have yet to agree on a taxonomy of economic values. There are many classifications of values and benefits given in the literature (Barbier 1992, Munasinghe 1993, Pearce 1993). In general, the following category of economic values are used:

(i) Direct use values refer to the productive or consumptive values of ecosystem components or functions. Direct uses may be marketed or non-marketed, with some of the latter activities often being important for the subsistence needs of local communities. An example of a marketed direct use is timber resources, which can be harvested and sold to consumers. The use of medicinal herbs collected from the forest resources by local communities is an example of non-marketed direct use. Marketed uses may be important for both domestic and international markets. In general, the value of marketed goods and services is easier to measure than the value of non-marketed and subsistence direct uses.

(ii) Indirect use values refer to the value of environmental functions that support or protect an economic activity. For instance, a tropical forest protects watersheds and store carbon dioxide. Tropical forests also include many plant species, which in turn may have ecological functions. The values of environmental functions can be derived from the supporting or protecting economic activities that have directly measurable values.

(iii) Option values relate to the amount that an individual or society would be willing to pay to conserve an ecosystem for future uses. For example, preservation of biological diversity can preserve wild genes for future uses such as improvement of a fruit species. Wild fruit and fish may prove to be extremely valuable genetic stocks in the future, because many of these wild plants and fish have genes that can help resist some kind of diseases.

(iv) Existence values refer to society's willingness-to-pay to conserve biological resources for their own sake, regardless of their current or optional uses. For instance, many people reveal their wtp for the existence of biological resources such as wildlife and landscape without participating in the direct use of the wildlife and landscape through recreation.

The method employed to determine each value mentioned above depends on the nature of forest goods and service in question. For the direct use value, the methods available include market-based technique, changes in productivity approach, relocation cost, and damage cost avoided. The contingent valuation approach can be used to value the indirect use, option and existence values. This method requires good understanding of forest goods and services production system. It is not the intention of this paper to discuss each method used in valuing a good or service. A good literature on the methods used can be found in IIED (1994) and Mitchell and Carson (1989).

MATERIALS AND METHODS

Location of the Study Area

The study area is the Ayer Hitam Forest (AHFR), Puchong, Selangor, which is located in a strategic place in a rapidly developing urban community. Some of the development projects that have been completed in the vicinity include an agriculture project, world class sports complex, a multi-million dollar housing project, incineration plant and waste disposal area, and an equestrian park. The forest reserve has also been excised for the highway linking Seri Serdang and Damansara Puchong Highway. The new administration city, Putrajaya, is just a short drive away and so is the capital city of Kuala Lumpur. The forest area, therefore, could provide excellent recreation and eco-tourisn opportunities for urban dwellers.

The forest belongs to the Lowland Dipterocarp forest type. It is classified as a secondary disturbed forest because it has been logged and treated several times since 1930's. Currently, the forest comprises six compartments, namely, compartments 1, 2, 12, 13, 14 and 15. These compartments make up a total area of 1,248 ha. According to the Forestry Department record, the area of AHFR has decreased substantially from the original forest area of about 4,267 ha in 1965. The extent of forest area and the percentage of area loss as compared to the original area are shown in Table 1.

The AHFR is the only remaining lowland forest reserves left in the Klang Valley. It is an excellent demonstration area for students to learn about various aspects of forestry. In addition, the forest area offers research opportunities for scientists interested in the working of a tropical lowland forest ecosystem. It also serves as an important 'green lung' for the urban city of Kuala Lumpur.

Considering the factors mentioned above, a general function of AHFR is to promote the protection of a lowland forest ecosystem that would serve the needs for education, research, and recreation not only for UPM community but also the urban areas (Petaling Jaya, Subang Jaya, Kelang, Kuala Lumpur) and dwellers surrounding the forest reserve (Seri Serdang, Seri Kembangan, Puchong, Kajang and Bangi). Thus, the management objectives of AHFR are as follows:

- to promote systematic and coordinated research into the working of a lowland rainforest ecosystem;
- to provide training areas in forest biology, forest production, forest management,

environment, medicinal plants, microclimate, and other related disciplines; and
- to offer opportunities for forest recreation and eco-tourism for local as well as the surrounding urban communities.

TABLE 1.
Extent of Ayer Hitam Forest, Puchong, Selangor and area loss (1965-1997)

Year	Forest area (ha)	Percentage of area loss (compared to base year 1965)
1965	6267.56	
1980	4006.00	36.08
1983	4006.00	36.08
1993	2198.00	64.90
1994	1964.00	68.66
1997	1082.701	82.72

Source: Annual Report, Selangor State Forestry Department (various years) and District Forest Office Selangor Tengah, Cheras.

Economic Valuation Method

In this study, the economic valuation was carried out for the following goods and services:

- timber resources
- recreation
- local dependence of non-wood resources
- wildlife

It should be noted that the total economic valuation of AHFR is still on-going, and the results presented here are not comprehensive. The economic value of wildlife was based on physical unit, not the economic value per se. The following section describes the methods used and results of economic valuation quantified for each of the goods and services of the Ayer Hitam Forest Reserve.

Valuing Timber Resources

The residual value method was used to estimate stumpage value of AHFR. The value of standing timber is calculated as the difference between the selling value of the products made from it and the stump-to-market processing costs (including margin for profit and risk). Stumpage value per hectare for a compartment was calculated using the following formula:

$$sv_{ij} = v_{ij} * (p_{ij} - c - pm_{ij})$$

where:

sv = stumpage value, (RM/ha)
v = volume, (m^3/ha)
p = price, (RM/m^3)
c = average logging cost, (RM/m^3)
pm = profit margin, (RM/m^3)

i,j are index for species and diameter class, respectively.

pm is calculated as follows:

$$pm_{ij} = (p * PR)/ (1+PR)$$

where PR is profit ratio.

The subscripts i and j indicate that stumpage value (sv_{ij}) varies due to variations in log price (p_{ij}) at each diameter class j. Since average cost is constant, it is not subscripted.

Data on timber volume were obtained from the records of a post-felling inventory conducted by the Faculty of Forestry, UPM. The inventory data were used to estimate timber volume for each species in the compartments by using the one way volume formula. Data on log prices were obtained from previous study by Awang Noor and Mohd. Shahwahid for Negeri Sembilan (Table 2). Data on logging costs were also obtained from the study by Awang Noor and Mohd. Shahwahid (1997). The average logging cost used in the analysis was RM75 per cubic meter. Data collected were analysed to determine the total stumpage value for Compartments 1, 2, 12 13, 14 and 15.

RESULTS AND DISCUSSION

Valuing Timber Resources

The taxonomic composition from the enumeration of trees of 5 cm and above in a one hectare plot in a lowland forest at Ayer Hitam Forest, Selangor is shown in Table 3. Results showed that the plot contains 177 tree species belonging to 92 genera and 44 families.

The various estimates of stumpage value were calculated and presented in Table 4. The results show that the estimated stumpage value is substantial, comparable to other estimates in the hill forest. In fact, all the estimated stumpage values are relatively higher to the estimated stumpage value for other hill dipterocarp forests. This indicates that that the AHFR is fully

TABLE 2.
Log price by species and species group (ex-matau), RM/m^3

Species/ Species group, I	Diameter class, j				
	15-30 (j=1)	30-45 (j=2)	45-50 (j=3)	50-60 (j=3)	60+ (j=4)
Group 1					
Dark red meranti (I=1)	233	332	384	451	472
Light red meranti (I=2)	224	313	358	423	443
White meranti (i=3)140	212	282	333	343	
Yellow meranti (i=4)94	142	187	229	243	
Meranti melantai (I=5)	157	247	331	386	394
Group 2					
Mersawa (I=6)	192	322	442	511	537
Merawan (I=7)	108	143	162	192	200
Gerutu (i=8)	108	143	162	192	200
Group 3					
Oily keruing (i=9)	272	344	412	466	476
Non-oily keruing (I=10)	86	110	134	213	228
Kapur (i=11)	86	110	134	213	228
Group 4					
Balau (i=12)	196	287	381	479	503
Cengal (i=13)	249	376	528	649	697
Giam/resak (i=14)	115	152	174	214	230
Other HHW (i=15)	115	152	174	214	230
Light hard wood (I=16) (Group 5)	107	135	159	189	201
Medium hard wood (i=17) (Group 6)	86	110	134	213	228
Heavy hard wood (i=18) (Group 7)	115	152	174	214	230
Half commercial species (i=19) (Group 8)	108	143	162	192	200
Podo/Agathis (i=20) (Group 9)	108	143	162	192	200

Source : Awang Noor and Mohd. Shahwahid (1997)

regenerated in terms of economic sustainability. The stumpage values for trees above 30 cm dbh and above range between RM5,279 per hectare and RM30,318 per hectare. Another study on economic valuation of tree species in a one hectare plot showed that the stumpage value was about RM26,222. The results from this one hectare plot was higher than the estimated value of the two compartments using the inventory data. This is not surprising because this value include trees 15 cm and above compared to that of the 30 cm and above. The present value of sustainable timber harvest was calculated at 10 percent interest rate and 55 years cutting cycle using the following formula:

$$PV = SV(0) + SV(t)^* \, 1/[(1+1.10)^{55}-1],$$

where SV(0) is stumpage value from current harvest and SV(t) is stumpage value at t=55. Since forestry involves long term gestation period, the present value of sustainable harvest of AHFR

is not much different from the current harvest (range from RM5,307 to RM30,479 per hectare).

TABLE 3
Taxonomic composition of trees at Ayer Hitam Forest Reserve

Family	Genera	Species
Anacardiaceae	4	6
Annonaceae	4	4
Apocynaceae	1	1
Bombacaceae	1	1
Burseraceae	3	14
Celastraceae	1	1
Combretaceae	1	1
Cornaceae	1	1
Crypteroniaceae	1	1
Dipterocarpaceae	1	3
Ebenaceae	1	2
Elaeocarpaceae	1	3
Euphorbiaceae	12	18
Fagaceae	1	1
Flacourtiaceae	3	6
Guttiferae	3	9
Icacinaceae	1	1
Lauraceae	5	12
Leguminosae	1	1
Linaceae	2	2
Melastomataceae	2	2
Meliaceae	3	3
Moraceae	2	6
Myristicaceae	4	14
Myrtaceae	2	19
Myrsinaceae	1	3
Ochnaceae	1	1
Olacaceae	1	1
Oxalidaceae	1	1
Polygalaceae	1	4
Proteaceae	1	1
Rhizophoraceae	2	2
Rubiaceae	6	6
Rutaceae	3	4
Sapindaceae	2	5
Sapotaceae	3	5
Simaroubaceae	1	1
Sonneratiaceae	1	1
Sterculiaceae	2	2
Theaceae	1	1
Thymelaeaceae	1	2
Tiliaceae	1	2
Ulmaceae	1	2
Verbenaceae	1	1
TOTAL 44	92	177

Source: Pius (1995)

Valuing Recreation Benefits

The AHFR is also used by the local population for recreational activities. A study was conducted by Mohd. Shahwahid *et al.* (1998) to determine the recreational value of AHFR. A Zonal Travel Cost (TCM) was used in this study. The objective was to determine a demand function relating the number of visit/population of a zone with average zonal values of travel cost. The data were collected using a structured questionnaire, which contained questions pertaining to socio-economic characteristics of visitors, distance travelled and location of origin, mode of transportation, travel expenditure to the site and frequency of visit. A total of 80 respondents were interviewed over a three week period in March 1997. The respondents from the survey were mainly from the District of Petaling (46.3%), followed by the District of Gombak (20%), the District of Hulu Langat and Kuala Langat (11,.2%), the District of Sepang (7.5%), and the remainder 3.8% were from the District of Klang.

The average expenditures of RM12.36 per visitor made by the respondents in making the trip to experience the recreational services are for transportation, expenditure for foods and recreational services and recreational materials (Table 5).

Demand for recreation of Ayer Hitam Forest Reserve was estimated by estimating the number of visits from each zone and the average travel costs per visit. A demand curve is then fitted to each zone average points. The total consumer surplus for each zone was calculated as the product of the average consumer surplus per visit and the total number of visits. The net social benefit provided by the area being valued is indicated by the sum of the consumer surpluses in all zones. The average consumer surplus per individual visit across all zones was estimated at RM1.23 (Table 6). This estimate is comparable to the values estimated by Awang Noor and Mohd Shahwahid (1997) for six forest recreational areas in Negeri Sembilan with estimated values ranging from RM0.58 to RM2.26, with the average of RM1.49. Benson et al. (1996) obtained a similar result from a study on 20 forest recreational areas in Peninsular Malaysia with the values ranging from RM0.78 to RM3.74, an average of RM2.30. The lower estimates obtained for AHFR could be due to the relative superiority in terms of outdoor attributes of the other sites and lower visit per month. The average monthly recreational users of the AHFR

TABLE 4
Total stumpage value of AHFR, Puchong, Selangor (RM/ha)

Year of assessment	Compartment	Stumpage value (trees > 30 cm) (RM/ha)	Present value (RM/ha) $SV+SV*1/\{(1+0.10)^{55}-1\}$	Source
1995	1 ha plot	26,222	26,361	Pius (1995)
1998	C1	5,279	5,307	Norsahikin (1998)
1998	C2	9,521	9,572	Norsahikin (1998)
1998	C12	30,318	30,479	Norsahikin (1998)
1998	C13	25,260	25,394	Norsahikin (1998)
1997	C14	17,169	17,260	Johnny (1997)
1997	C15	14,500	14,577	Johnny (1997)

was estimated at 300 users. The annual value of recreation benefits for AHFR was therefore RM4,428. Using a 10% discount rate and assuming a constant visitation rate in the future, the net present value (NPV) of AHFR was estimated at RM44,280. It should be pointed out that the estimated value is site specific and subject to existing conditions. If new facilities and accessibility are improved and developed, the estimated economic value of recreation benefits found in this study would be altered.

Valuing the Benefits to Local Community

A study was carried out to determine the extent of use of AHFR by the indigenous or Orang Asli community (Rusli et al. 1997). The main objectives of the study were to estimate the quantity of timber and non-timber forest produce collected by the Orang Asli as well as the revenue that could have been generated by collecting these produce.

TABLE 5
Travel cost incurred by respondents to Ayer Hitam Forest Reserve

Items	Average expenditure (RM/visitor)	Percentage
Petrol	4.15	33.6
Food	3.55	28.7
Recreational kit	3.63	29.4
Books and magazines	0.52	4.2
Others	0.51	4.1
Total	12.36	100.00

Source: Mohd. Shahwahid *et al.* (1998)

Using a structured questionnaire, interviews were held with each of the household heads of two Orang Asli communities residing at Sungai

TABLE 6
Estimation of value with the zonal travel cost method (TCM) for Ayer Hitam Forest Reserve

Zone	Population (number of family)	Number of family visits	Average number visits per '000 population	Average cost per visit (RM)	Consumer surplus per visit (RM)	Total consumers surplus (RM)
1	54,653	19	0.35	3.85	0.19	3.61
2	633,144	120	0.19	4.10	0.83	99.60
3	129,696	21	0.16	5.00	0.90	18.90
4	542,906	37	0.11	6.07	1.65	61.05
5	410,491	28	0.068	8.11	3.59	100.52
6	406,832	6	0.015	14.00	0	0
Total	2,177,722	231				283.68

Source: Mohd. Shahwahid *et al.* (1998)

Rasau Luar and Sungai Rasau Dalam during the months of November and December, 1996. The main aim of the interview was to gather data and information on the volume of forest produce collected by the Orang Asli. Data on price of various forest products were obtained by surveying market outlets in the vicinity as well as in the city of Kuala Lumpur. The household heads were also asked about the prices of some of the produce in cases where these are not obtainable from the markets.

The results show that, in terms of species collected, the Orang Asli communities are more dependent on the forest reserve for food and fruits than for other purposes like housing construction, handicraft-making and medicine. While all the 24 animal species mentioned by the Orang Asli were hunted for their meat, 48% (10 species) of the plant species are for fruits. Birds and small mammals comprise 75% of the animal species collected.

The revenue that could have been generated and/or saved by collecting the timber and non-timber produce amounted to nearly RM110,000.00 for the year 1996. The revenue generated by plant species was about seven times more than that of animal species. The greatest source of revenue came from housing construction followed by handicraft-making and fruits. The Orang Asli commented that they are less dependent on the forest now than before. According to them, the forest now provides lesser number of useable species of plants and animals than before. Also, the Orang Asli are now economically better off than before and they can depend more on markets than the forest for their daily necessities.

Valuing Wildlife Resources

So far, no studies have been done to determine the economic value of wildlife species at AHFR. The studies, thus far, have only looked at the distribution and composition of bird species in the forest (Mohamed Zakaria 1997). The studies also reported the characteristics of the microhabitats of the various bird species found in the forest area. The results presented here are based on a study conducted only in Compartment 15 (southern part) of the forest reserve.

Preliminary results show that there are altogether 153 species of birds from 38 families in the study area. The three largest families are Timaliidae (Babbler species), Cuculidae (Cuckoo species) and Pycnonotidae (Bulbul species) (Table 7).

The Ayer Hitam Forest Reserve is a secondary forest and yet it is very rich in bird species. Most primary forests contain, on the average about 200 to 220 species of birds. The number of species that has been recorded is 153 and it is predicted that there are at least another 40 species. The diversity of families recorded is also comparable to other primary forest areas. Almost all of the families recorded in other forest areas are also found here.

The study has only covered the southern part of the forest reserve. This particular area has been logged quite extensively. The area is dominated with secondary plant species such as *Macaranga*. This could be the reason why there are abundant bird species associated with secondary forest.

Implications on Land-use

The estimated economic value and other indirect benefits of AHFR are substantial and play important roles for socio-economic development of the area. The point of interest is how the benefits of conserving AHFR would be accrued to different social groups, including state, national, and global community. This requires the need to calculate incremental net benefits between the costs and benefits in the alternative land use options and those of the baseline (forest conservation).

Future land use in the surrounding areas will be determined based on population growth and the need of population for various services and other facilities such as housing, industries, recreation, and so forth. Projection made in the structure plan of Petaling District and parts of Klang District showed that the need of land use for housing is the highest, followed by recreation, community facilities and industries. As such, the pressure of AHFR for alternative land uses is very tremendous. With regards to forestland, it was suggested in the structure plan that the forest reserve should be conserved for its ecological function and watershed protection. Only some parts of the forest should be used for passive recreational purposes such as jogging track, camping ground, and research.

In order to evaluate the economics of forest conservation against other alternative land use options, there is a need to carry out comparative valuation. This is basically the application of benefit cost analysis (BCA), where the net

TABLE 7
List of bird species recorded for each family at Ayer Hitam Forest Reserve

No.	English Name	Scientific Name	Malay Name
ARDEIDAE (2 species)			
1	Little Heron	*Butorides striatus*	Pucong Keladi
2	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Pucong Bendang
ACCIPITRIDAE (3 species)			
3	Black-shouldered Kite	*Elanus caeruleus*	Lang Bahu Hitam
4	Crested Serpent-Eagle	*Spilornis cheela*	Lang Berjambul
5	Japanese Sparrowhawk	*Accipiter gularis*	Lang Sewah
PHASIANIDAE (2 species)			
6	Crested Fireback	*Lophura ignita*	Ayam Pegar
7	Great Argus	*Argusianus argus*	Kuang Raya
RAILLIDAE (1 species)			
8	White-breasted Waterhen	*Amaurornis phoenicurus*	Ruak-ruak
COLUMBIDAE (5 species)			
9	Little Green Pigeon	*Treron olax*	Punai Daun
10	Pink-necked Pigeon	*Treron vernans*	Punai Gading
11	Spotted Dove	*Streptopelia chinensis*	Merbok Balam
12	Peaceful Dove	*Geopelia striata*	Merbok Aman
13	Green-winged Pigeon	*Chalcophaps indica*	Punai Tanah
PSITTACIDAE (2 species)			
14	Long-tailed Parakeet	*Psittacula longicauda*	Bayan Nuri
15	Blue-crowned Hanging Parrot	*Loriculus galgulus*	Bayan Kecil
CUCULIDAE (12 species)			
16	Moustached Hawk-Cuckoo	*Cuculus vagans*	Sewah Tekukur Kecil
17	Hodgson's Hawk-Cuckoo	*Cuculus fugax*	Sewah Hantu
18	Indian Cuckoo	*Cuculus micropterus*	Sewah India
19	Plaintive Cuckoo	*Cacomantis merulinus*	Sewah Mati Anak
20	Drongo Cucukoo	*Surniculus lugubris*	Sewah Sawai
21	Common Koel	*Eudynamys scolopacea*	Sewah Tahu
22	Black-bellied Malkoha	*Phaenicophaeus diardii*	Cenok Perut Hitam
23	Raffles' Malkoha	*Phaenicophaeus chlorophaeus*	Cenok Kerak
24	Red-billed Malkoha	*Phaenicophaeus javanicus*	Cenok Api
25	Chestnut-breasted Malkoha	*Phaenicophaeus curvirostris*	Cenok Birah
26	Greater Coucal	*Centropus sinensis*	But-but Carik Anak
27	Lesser Coucal	*Centropus bengalensis*	But-but Kecil
STRIGIDAE (4 species)			
28	Collared Scops-Owl	*Otus bakkamonea*	Hantu Reban
29	Reddish Scops-Owl	*Otus rufescens*	Hantu Merah
30	Common Scops-Owl	*Otus scops*	Hantu Kuang Kuik
31	Brown Wood-Owl	*Strix leptogrammica*	Hantu Punggor
PODARGIDAE (1 species)			
32	Large Frogmouth	*Batrachostomus auritus*	Segan Besar
CAPRIMULGIDAE (2 species)			
33	Malaysia Eared Nightjar	*Eurostopodus temminckii*	Tukang Malaysia

Table 7 (continued)

34	Large-tailed Nightjar	*Caprimulgus macrurus*	Tukang Kubur
APOPIDAE (3 species)			
35	Silver-rumped Swift	*Rhaphidura leucopygialis*	Layang-layang Kecil
36	Fork-tailed Swift	*Apus pacifus*	Layang-layang Ekor Cabang
37	Brown Needletail	*Hirundapus gigantea*	Layang-layang Besar
HEMIPROCNIDAE (2 species)			
38	Whiskered Treeswift	*Hemiprocne comata*	Layang-layang Jambu Kecil
39	Grey-rumped Treeswift	*Hemiprocne longipennis*	Layang-layang Jambu Kelabu
TROGONIDAE (1 species)			
40	Scarlet-rumped Trogon	*Harpactes duvaucelii*	Kesumba Puteri
ALCEDINIDAE (8 species)			
41	Common Kingfisher	*Alcedo atthis*	Pekaka Cit-cit Kecil
42	Blue-eared Kingfisher	*Alcedo meninting*	Pekaka Bintik-bintik
43	Black-backed Kingfisher	*Ceyx erithacus*	Pekaka Rimba
44	Rufous-backed Kingfisher	*Ceyx rufidorsus*	Pekaka Api
45	Stock-billed Kingfisher	*Pelargopsis capensis*	Pekaka Paroh Pendek
46	Black-capped Kingfisher	*Halcyon pileata*	Pekaka Kopiah Hitam
47	White-throated Kingfisher	*Halcyon smyrnensis*	Pekaka Belukar
MEROPIDAE (3 species)			
48	Blue-tailed Bee-Eater	*Merops philippinus*	Berek-berek Carik Dada
49	Blue-throated Bee-Eater	*Merops viridis*	Berek-berek Tadah Hujan
50	Red-bearded Bee-Eater	*Nyctyornis amictus*	Berek-berek Janggut Merah
CORACIIDAE (1 species)			
51	Dollarbird	*Eurystomus orientalis*	Tiong Batu
BUCEROTIDAE (2 species)			
52	White-crowned Hornbill	*Berenicornis comatus*	Enggang Jambul Putih
	53Black Hornbill	*Anthracoceros malayanus*	Enggang Gatal Birah
	CAPITONIDAE (6 species)		
54	Gold-whiskered Barbet	*Megalaima chrysopogon*	Takor Jambang Emas
	55Yellow-crowned Barbet	*Megalaima henricii*	Takor Mahkota Kuning
	56Red-throated Barbet	*Megalaima mystacophanos*	Takor Raya
57	Blue-eared Barbet	*Megalaima australis*	Takor Akar
58	Brown Barbet	*Calorhamphus fuliginosus*	Takor Dahan
PICIDAE (9 species)			
59	Rufous Piculet Sasia abnormis	*Belatok Kecil*	
60	Rufous Woodpecker	*Micropternus brachyurus*	Belatok Biji Nangka
61	Checker-throated Woodpecker	*Picus mentalis*	Belatok Ranting
62	Banded Woodpecker	*Picus miniaceus*	Belatok Merah
63	Common Goldenback	*Dinopium javanense*	Belatok Pinang Muda
	64Buff-rumped Woodpecker	*Meiglyptes tristis*	Belatok Awan
65	Buff-necked Woodpecker	*Meiglyptes tukki*	Belatok Tuki-tuki
66	Grey-and-Buff Woodpecker	*Hemicircus concretus*	Belatok Punggoh
67	Maroon Woodpecker	*Blythipicus rubiginosus*	Belatok Punggor
EURYLAIMIDAE (3 species)			
68	Banded Broadbill	*Eurylaimus javanicus*	Takau Rimba
69	Black-and-Yellow Broadbill	*Eurylaimus ochromalus*	Takau Hitam Kuning

Table 7 (continued)

70	Black-and-Red Broadbill	*Cymbirhynchus macrorhynchus*	Takau Rakit
71	Green Broadbill	*Calyptomena viridis*	Takau Selawit
HIRUNDINIDAE (1 species)			
72	Pacific Swallow	*Hirundo tahitica*	Sualo Batu
CAMPHEPAGIDAE (2 species)			
73	Black-winged Flycatcher-Shrike	*Hemipus hirundinaceus*	Rembah Batu
74	Lesser Cuckoo-Shrike	*Coracina fimbriata*	Sewah Kecil
75	Pied Triller	*Lalage nigra*	Sewah Kapas
76	Fiery Minivet	*Pericrocotus igneus*	Mas Tulin
77	Scarlet Minivet	*Pericrocotus flammeus*	Mas Belukar
CHLOROPSEIDAE (4 species)			
78	Green Iora	*Aegithina viridissima*	Kunyit Bakau
79	Common Iora	*Aegithina tiphia*	Kunyit Kacat
80	Lesser Green Leafbird	*Chloropsis cyanopogon*	Daun Kecil
81	Greater Green Leafbird	*Chloropsis sonnerati*	Daun Besar
PYCNONOTIDAE (10 species)			
82	Black-headed Bulbul	*Pycnonotus atriceps*	Merbah Siam
83	Puff-backed Bulbul	*Pycnonotus eutilotus*	Merbah Coklat Berjambul
84	Yellow-vented Bulbul	*Pycnonotus goaivier*	Merbah Kapor
85	Olive-winged Bulbul	*Pycnonotus plumosus*	Merbah Belukar
86	Cream-vented Bulbul	*Pycnonotus simplex*	Merbah Mata Putih
	87Red-eyed Bulbul	*Pycnonotus brunneus*	Merbah Mata Merah
	88Spectacled Bulbul	*Pycnonotus erythropthalmos*	Merbah Kecil
89	Finches Bulbul	*Criniger finschii*	Merbah Rempah
90	Yellow-bellied Bulbul	*Criniger phaeocephalus*	Merbah Perut Kuning
	91HAyery-backed Bulbul	*Hypsipetes criniger*	Merbah Bulu Panjang Tengkok
92	Buff-vented Bulbul	*Hypsipetes charlottae*	Merbah Riang
DICRURIDAE (4 species)			
93	Bronzed Drongo	*Dicrurus aeneus*	Cecawi Keladi
94	Crow-billed Drongo	*Dicrurus annectans*	Cecawi Sawai
95	Lesser Racket-tailed Drongo	*Dicrurus remifer*	Cecawi Hamba Kera
96	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Cecawi Anting-anting
ORIOLIDAE (2 species)			
97	Black-hooded Oriole	*Oriolus xanthornus*	Dendang Belukar
98	Asian FAyery Bluebird	*Irena puela*	Dendang Gajah
CORVIDAE (3 species)			
99	Crested Jay	*Platylophus galericulatus*	Gagak Jerit
100	Black Magpie	*Platysmurus leucopterus*	Gagak Kambing
101	Large-billed Crow	*Corvus macrorhynchos*	Gagak Paroh Besar
	SITTIDAE (a species)		
102	Velvet-fronted Nuthatch	*Sitta frontalis*	Patok Baldu
TIMALIIDAE (13 species)			
103	Short-tailed Babbler	*Trichastoma malaccense*	Rimba Ekor Pendek
	104Ferruginous Babbler	*Trichastoma bicolor*	Rimba Sampah
105	Abbot's Babbler	*Trichastoma abbotti*	Rimba Riang
106	Sooty-capped Babbler	*Malacopteron affine*	Rimba Tinjau Belukar
107	Scaly-crowned Babbler	*Malacopteron cinereum*	Rimba Tua Kecil

TABLE 7 (continued)

108	Rufous-crowned Babbler	*Malacopteron magnum*	Rimba Tua Besar
109	Chestnut-rumped Babbler	*Stachyris maculata*	Rimba Rembah Besar
110	Chestnut-winged Babbler	*Stachyris erythroptera*	Rimba Merbah Sampah
111	Rufous-fronted Babbler	*Stachyris rufifrons*	Rimba Api
112	Striped-tit Babbler	*Macronus gularis*	Rimba Berjalor
113	Fluffy-backed Tit-Babbler	*Macronus ptilosus*	Rimba Pong-pong
114	Brown Fulvetta	*Alcippe brunneicauda*	Rimba Murai Coklat
115	White-bellied Yuhina	*Yuhina zantholeuca*	Yuhina Perut Putih
TURDIDAE (5 species)			
116	Siberian Blue Robin	*Erithacus cyane*	Murai Siberia
117	Magpie Robin	*Copsychus saularis*	Murai Kampong
118	White-rumped Shama	*Copsychus malabaricus*	Murai Rimba
119	Chestnut-naped Forktail	*Enicurus ruficapilus*	Murai Cegar
120	White-crowned Forktail	*Enicurus leschenaulti*	Murai Cegar Belukar
SYLVIIDAE (4 species)			
121	Yellow-bellied Warbler	*Abroscopus superciliaris*	Cekup Paroh Kuning
122	Arctic Warbler	*Phylloscopus borealis*	Cekup Artik
123	Common Tailorbird	*Orthotomus sutorius*	Perenjak Pisang
124	Dark-necked Tailorbird	*Orthotomus artogulais*	Perenjak Belukar
MUSCICAPIDAE (7 species)			
125	Grey-chested Flycatcher	*Rhinomyias umbratilis*	Sambar Batu
126	Asian Brown Flycatcher	*Muscicapa latirostris*	Sambar Asia
127	Tickell's Blue Flycatcher	*Cyornis tickelliae*	Sambar Kelicap Ranting
128	Pied Fantail	*Rhipidura javanica*	Sambar Murai Gila
129	Black-naped Monarch	*Hypothymis azurea*	Sambar Uban Hitam
130	Maroon-breasted Flycatcher	*Philentoma velatum*	Sambar Ungu
131	Asian Paradise Flycatcher	*Terpsiphone paradisi*	Sambar Ekor Panjang
MOTACILLIDAE (1 species)			
132	Richard's Pipit	*Anthus novaeseelandiae*	Pipit Tanah
LANIIDAE (1 species)			
133	Brown Shrike	*Lanius cristatus*	Tirjup Tanah
STURNIDAE (4 species)			
134	Philippine Glossy Starling	*Aplonis panayensis*	Perling Mata Merah
135	Common Myna	*Acridotheres tristis*	Tiong Gembala Kerbau
136	Jungle Myna	*Acridotheres fuscus*	Tiong Hutan
137	Hill Myna	*Gracula religiosa*	Tiong Mas
NECTARINIIDAE (7 species)			
138	Plain Sunbird	*Anthreptes simplex*	Kelicap Kelabu
139	Purple-naped Sunbird	*Hypogramma hypogrammicum*	Kelicap Rimba
140	Little Spiderhunter	*Arachnothera longirostra*	Kelicap Jantong
141	Long-billed Spiderhunter	*Arachnothera robusta*	Kelicap Jantong Paroh Panjang
142	Yellow-eared Spiderhunter	*Arachnothera chrysogenys*	Kelicap Jantong Telinga Kuning
143	Spectacled Spiderhunter	*Arachnothera flavigaster*	Kelicap Jantong Besar
144	Grey-breasted Spiderhunter	*Arachnothera affinis*	Kelicap Jantong Bukit
DICAEDAE (4 species)			
145	Yellow-breasted Flowerpecker	*Prionochilus maculatus*	Sepah Puteri Raja

TABLE 7 (continued)

146	Crimson-breasted Flowerpecker	*Prionochilus percussus*	Sepah Puteri Pelangi
	147Orange-bellied Flowerpecker	*Dicaeum trigonostigma*	Sepah Puteri Bukit
	148Plain Flowerpecker	*Dicaeum concolor*	Sepah Puteri Bongsu
	PLOCEIDAE (5 species)		
149	Eurasian Tree-Sparrow	*Passer montanus*	Ciak Urasia
150	Baya Weaver	*Ploceus philippinus*	Ciak Tempua
151	White-bellied Munia	*Lonchura leucogastra*	Pipit Padi
152	Chestnut Munia	*Lonchura malacca*	Pipit Rawa
153	White-headed Munia	*Lonchura maja*	Pipit Uban

Source: Mohamed Zakaria (1997)

benefits of any pair of alternative land use options (for instance, forest conservation and housing) should be compared. Under the current situation, the net benefits of forest conservation must exceed the forgone net benefits of housing:

$$NB^C - NB^H > 0,$$

where NB^C is net benefits of forest conservation, NB^H is net benefits of housing (alternative land use option.) In comparing these two options, it is again important to include not only the net direct or production benefits of each option, but also their net external environmental impacts. This can be shown as:

$$(NB^{DC} + NB^{IC}) - (NB^{DH} + NB^{IH}) > 0.$$

The implication of the study is that the estimated economic value can be used to determine the opportunity costs of losing sustainable timber earnings, recreation, wildlife, research, local community dependence on forest, research, environmental education programme, and other environmental benefits (such as carbon sequestration). In this study, however, we were unable to compute the economic loss of forest conversion to other land uses since data are still limited. Future efforts will be made to collect more information not only on economic value of AHFR but also the benefits and costs from other land use options in the surrounding areas.

CONCLUSION

The role of economic valuation is important because it provides information on the benefits of various forest goods and services in a particular forest ecosystem. Throughout we have presented results of some economic values of forest goods and services of AHFR. The values estimated from this study could be used in the economic valuation of alternative forestland use options. The future challenge is to obtain reasonable monetary estimates of non-market benefits, especially external environmental impacts. The estimation of these values should be given due consideration if one considers that forest conservation or protection is an investment for future generations. The economic approach to determining investment in forest conservation requires a comparison of the rate of return from conservation with the rate of return from the alternative use of forestland. Conservation is justified if the net benefits of conservation are greater than the net benefits from alternative land use options. Thus, from the perspective of the society as a whole it is very important to value the benefits and costs net of all economic distortions in the marketplace. Ignoring all potential benefits and costs of forest conservation provides a wrong signal to the policy makers. This might bias against forest conservation and converting forest areas to other land use options will result in opportunity cost to the society.

ACKNOWLEDGEMENTS

The authors are grateful to IRPA 08-02-04-0089, IRPA 01-02-04-0183 and 08-02-02-0009 for funding this project.

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