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An estimation of willingness to pay for asparagus (*Asparagus racemosus* Willd.) collectors in Makawanpur District, Nepal

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ABSTRACT: The collection and sale of asparagus (*Asparagus racemosus* Willd.) is a major source of income for Praja and Tamang castes around the Royal Chitwan National Park (RCNP) in Nepal. However, the forests where asparagus is harvested are becoming depleted threatening the livelihood of collectors. To address this issue, at sustainable harvesting practices, the research reported here applied the contingent valuation method (bidding game) and estimated the average willingness to pay (WTP) of collectors to two asparagus collection scenarios. In the first scenario, if forests under the Department of Forests jurisdiction were managed for sustainable harvesting at 1995 rates, the average WTP of collectors was 4.4 NR/kg. In the second scenario, if the forest in the RCNP is managed in such a way that both the current harvesting rate of asparagus is sustained and they are legally allowed to collect asparagus at the present rate, the average WTP of collectors was 8.35 NR/kg. Consequently, there is a good chance of earning revenue for the government and sustaining the livelihood of asparagus dependents by the sustainable management of the Department's and the National Park's forests and giving legal permissions to collect asparagus from the National Park, which would have happened anyway but with financial and legal risks to collectors.

Keywords: *Asparagus racemosus*; willingness to pay; contingent valuation method; Praja; Tamang

Nepal has high levels of endemism in its endogenous flora and fauna carrying high non-timber use and value. Though Nepal covers 0.1% of the earth's landmass, it ranks 25th in global biodiversity importance due to its unique bio-geographic location, altitudinal variation, diverse topography, climatic conditions and ecological habitats (BPP 1995). There are > 6,500 flowering species; > 700 species are used as Non-timber Forest Products[1] (NTFPs) with ~100 species of commercial value (BPP 1995; Edward 1996). Annually a large quantity of NTFPs (10,000–15,000 t) is exported in raw form, mainly to India (Malla 1995), worth about US$ 26.5 M a year (ANSAB 1998), or ~ 4% of the national GDP of Nepal (Kanel et al. 1999).

One of the highly traded species from Nepal in general and from Makawanpur district (Fig. 1) in particular is asparagus (Maraseni 2002; Maraseni et al. 2006). In 1998/99, Nepal exported 94.3 t of asparagus which increased dramatically by 202% to 190.3 t in 2000/01. Similarly, the Makawanpur district, one of the 75 districts of Nepal, exported 43.2 t in 1998/99 and 74.9 t in 2000/01 (DFO 2002). Of the total amount of asparagus exported from Nepal, the

[1]Definitions of NTFPs vary, but in Nepal fuelwood, fodder and timber are not regarded as NTFPs (MFSC 1988). More notably, the terms Minor Forest Products (MFPs), NTFPs, *Jaributi*, and Medicinal and Aromatic Plants (MAPs) are used interchangeably. For the purpose of this research, NTFPs refer to the traded parts of plants other than timber, fuelwood and fodder.

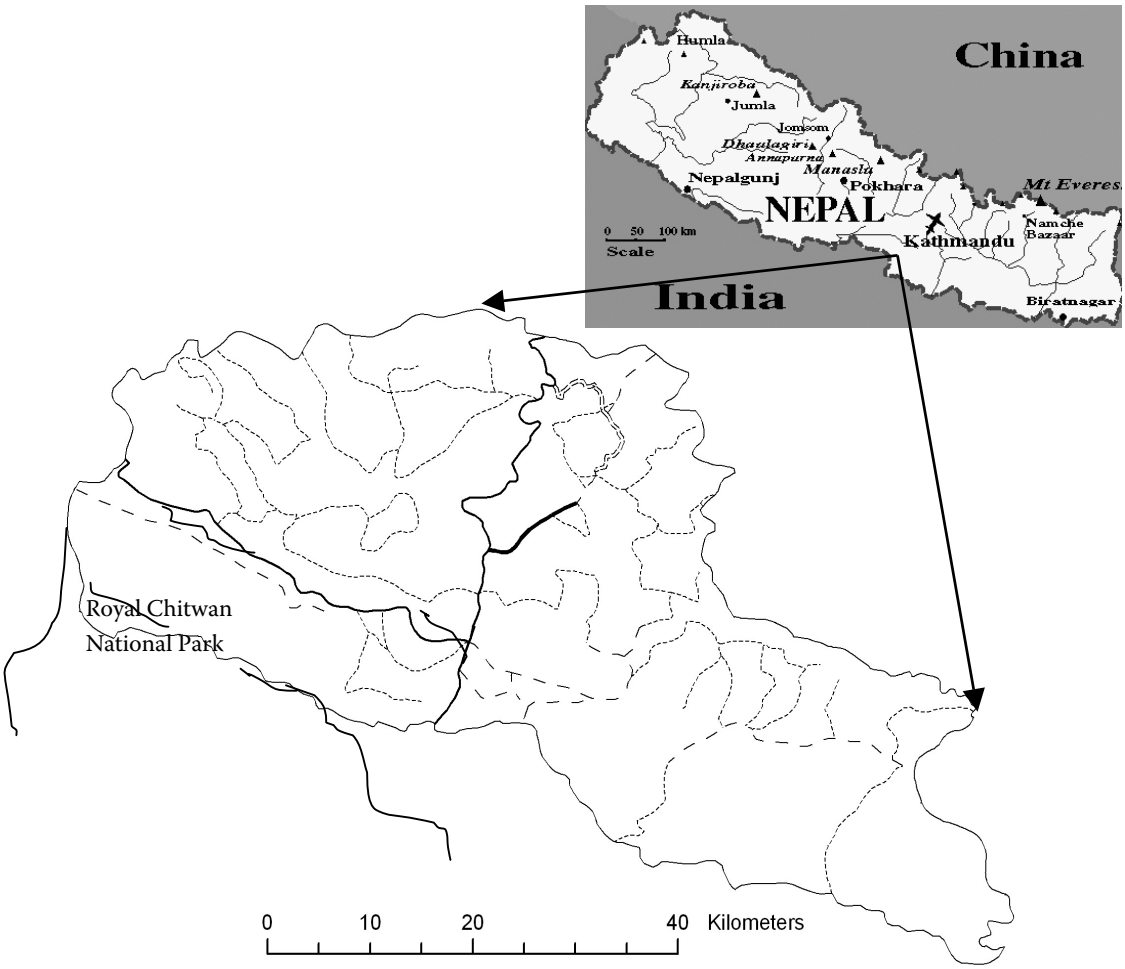

Fig. 1. Map showing Makawanpur District and the Royal Chitwan National Park (Nepal in the inset)

contribution of the Makawanpur district was 45.8% and 39.4% in the fiscal year 1998/99 and 2000/01, respectively. Although the share of the Makawanpur district to the country dropped by 6.4% from 1998/99 to 2000/01, the quantity traded from the district during the same period increased by 73%.

In Nepal, government forest ownerships and jurisdictions are either through the Department of Forests (DF) or the Department of National Parks and Wildlife Conservation (DNPWC). About 39% and 18% of the total land area is under the DF and DNPWC, respectively. In the Makawanpur district, both types of forests are found. Collection of NTFPs, by obtaining a collection permit, from the Department's forests is legal whereas collection is illegal from the National Park's forests, which may attract fines and imprisonment (MFSC 1999). In the Makawanpur district, until 1995, asparagus was readily available in the Department's forests. However, due to increasing demand in Indian markets and higher profit margins, this species has been overexploited and is becoming rarer in these forests (Maraseni 2002). While the higher profit margins remained, people around the Royal Chitwan National Park (RCNP) started to collect asparagus from within the RCNP, the oldest national park in Nepal. Despite an escalating risk of being caught and imprisoned, the exploitation has accelerated in the last few years, with collectors fearing for the depletion of asparagus, even in the RCNP (Maraseni, Shivakoti 2003).

As mentioned earlier, a collector may face two types of problems due to the illegal collection of NTFPs from RCNP: the risk of legal action and lower prices due to the higher costs of illegal transaction. In order to avoid these problems and collect NTFPs in a safe and sustainable manner, collectors may have some willingness to pay (WTP).

The objective of this study is to estimate the average WTP of asparagus collectors for two hypothetical scenarios: (1) if the government managed the Department's forest for sustainable harvesting at 1995 rates, and (2) if the National Park's forest were managed in such a way that the current harvesting rates are sustained and allowed to continue at present rates.

METHODS

An overview of the study areas

The study areas[2] are located in the Makawanpur district of Nepal, which share a south-western border with the RCNP (Fig. 1). The RCNP, established in 1973, lies in the south-central part of Nepal covering an area of 932 km^2 (Fig. 1). The RCNP has one of the few remaining undisturbed forests in Nepal and is rich in unique flora and fauna. There are more than 43 species of mammals (including single-horned rhinoceros and the Bengal tiger), over 450 species of birds, and more than 45 species of amphibians and reptiles in the park (MFSC 1999). Because of these unique features, the RCNP was World Heritage listed in 1984.

Over 65% of the total land area (244,488 ha) of the Makawanpur district is forest, which includes 6.2% of the RCNP. Another 93.8% of the RCNP lies in three other districts (Chitwan, Nawalparasi and Parsa districts). Roughly 70% of the RCNP and surrounding vegetation is sal (*Shorea robusta*) forest, a moist deciduous forest, and another 20% is grassland (MFSC 1999).

The majority of the RCNP and surrounding areas lie in the tropical zone (< 1,000 m a.s.l.). The mean monthly maximum and minimum temperatures over 34 years (1967 to 2000) at Heatuada (the capital city of Makawanpur district) are 29°C and 17°C respectively, and the mean annual rainfall is 2,125 mm. Rainfall is influenced by the southeastern monsoon and almost 80% of the rainfall occurs from June to September. The remaining months are influenced by the southwestern monsoon, which contains very little moisture resulting in relatively dry weather.

Asparagus characteristics

Asparagus (*Asparagus racemosus*) is part of the Liliaceae family and is distinguished by the absence of leaves, which are replaced by clusters of needle-like cladodes (stem performing the function of leaves). There are four species of asparagus (A. *racemosus, A. gracilis, A. penicillatus* and *A. officinali*s) found in Nepal (Department of Plant Resources 1995). The main tradable species from the Makawanpur district is *A. racemosus* and locally, it is known by different names such as *Kurilo, Satawari, Shatamuli* (in Sanskrit), *Jhijikande, Jhijhikando*, and *Jhijikare*.

Asparagus is found in Pakistan, Sikkim, India, Nepal, Southeast Asia, Australia and Africa (Department of Plant Resources 1995). In Makawanpur district, it is found up to 1,200 m elevation as a shrub, mainly under the sal forest and around the thatched grass[3]. Asparagus possesses short, tuberous rootstocks bearing numerous fusiform, succulent, tuberous roots, which are the main traded part. In the international market, they are used medicinally as a refrigerant, demulcent, diuretic, aphrodisiac, antispasmodic, anti-diarrhoeatic and anti-dysenteric (Kirtikar, Basu 1993). At the time of field survey (February 2002) the price of asparagus in Hetauda was Nepalese rupees 120 (US$ 1.56) per kg[4].

Selection of collectors for elicitation of WTP

The majority of asparagus collectors in Makawanpur district, who lived adjacent to the RCNP, belong to the Tamang and Praja castes. Both of them are underprivileged castes. Their livelihood is heavily dependent on NTFPs (Maraseni 2002). The Praja castes are renowned as 'forest dwellers' (*Bankaria* in Nepali language), with some still living within the forest. The Praja and Tamang have been involved in asparagus collection and selling since 1967 (Maraseni 2002) and thus in this study, collectors from both castes were selected for interview. There were two major selection criteria used to determine the suitability of the collectors for this study. Firstly, they were either from the Praja and Tamang castes; and secondly, as of 2002 they had at least seven years experience of asparagus collection in both the Department's and National Park forests. Collectors were identified with the assistance of asparagus buyers, to whom collectors have been selling asparagus for a long time, from the nearby market centres. In total, 38 Prajas and 41 Tamangs met both selection criteria, from which 32 Tamangs and 32 Prajas were interviewed. Even a smaller sample size may well represent the population, but a large sample size was taken from both castes (84% Praja and 78% Tamang) to apply statistical tests and find out whether there is a significant difference in various attributes of Tamang and Praja castes.

Contingent valuation for the elicitation of willingness to pay

Contingent valuation methods (CVM) are widely used for the valuation of environmental resources

[2]The study area includes three village development committees around the RCNP. For some reasons, their names are not revealed.

[3] This is a type of grass used for making roofs and walls of houses

[4]US$1 = 77 Nepalese rupees (NR), as at May 2002

in the developed world (Hanemann 1994; Portney 1994; Jakobssan, Dragun 1996; Bann 1998), however, it has suffered criticism on methodological grounds (Jakobssan, Dragun 1996; Gowdy 1997; Nunes, Bergh 2001). For instance Jakobssan and Dragun (1996) question whether the respondents respond to questions as 'consumer or citizen'; thus, it is not rational to compare 'citizen' WTP values with 'consumer' WTP values. Many concerns in CVM can be overcome if guidelines from the National Oceanic and Atmospheric Administration (NOAA) Panel (Hanemann 1994; Portney 1994; Jakobssan, Dragun 1996; Gowdy 1997), which is also accepted by the US legal system and the World Bank (Hanemann 1994), are adopted. In developing countries, the CVM has been used for estimating the existence value of biodiversity. For example, Dixon and Sherman (1990) used the CVM to estimate maximum WTP for the continued existence of the wild elephant in Khao Yai National Park, Thailand.

The CVM may be applied to estimate the value to a nation or even the world community, to the local users for a particular research issue. For this study, bidding game CVM was applied to estimate the WTP of the collectors for different scenarios.

In every step, the guidelines of NOAA panel (Portney 1994) were adhered to as follows:

(*i*) ***The scenario development.*** You have lengthy experience of collecting asparagus from both the Department's and the RCNP's forests. You know what the status of asparagus was in the Department's forests in 1995 and you also know the depleting status of asparagus from both forests, and the increasing international demand and market prices. You are more familiar than others with the legal and other related problems of collecting asparagus from the RCNP. You know how heavily you are dependent on asparagus collection. We assume that you may want to work in a risk free environment. Considering your circumstances, two hypothetical asparagus collection scenarios (given below) are designed to investigate your perceptions and WTP for each scenario.

(*ii*) ***Pre-testing of questionnaire and its final setting***. Before formulating the exact wording of the question, two meetings of collectors were organized in February 2002; one for the Tamang caste and another for the Praja caste. They were requested to remember to their problems (such as previous and current situation of asparagus supply, market demand and supply situation, legal issues and risks while collecting asparagus from RCNP). They were also briefed about the two scenarios and the general purpose of the one-on-one interview. The meeting was helpful in specifying the starting money for the bidding game. The wording of the questions was written in their own language. In each bidding game scenario, if a respondent said 'yes' for that particular amount, higher amounts were suggested till the respondent declines to any more. At the same time, the respondents were reminded that by committing payment to a certain amount their profit (per kg) will decrease by that amount. The questions for scenarios were as follows:

Scenario 1: The Department of Forests would like to restore the forest to 1995 conditions and the harvesting of asparagus at a sustainable rate for 1995 would be guaranteed. Will you pay two Nepalese rupees (NR) per kg of asparagus for the stipulated provision?

Scenario 2: The RCNP would like to manage the forests in such a way that the current harvesting rate of asparagus would be sustained, and you would have the legal right to collect asparagus from the forests. Will you pay three Nepalese rupees per kg of asparagus for that provision?

(*iii*) ***Payment vehicle.*** The vehicle of the payment will be in the form of a tax per kg of asparagus.

(*iv*) ***Elicitation methods.*** In order to make absolutely clear the understanding of the scenario, face-to-face interviews were carried out for the elicitation of WTP values.

(*vi*) ***Analysis***. Since there were no outliers, the median value was not considered but the mean value of WTP was used. Apart from these two questions, some other basic questions were also asked to overview the socioeconomic status of collectors such as gender, caste, education, occupation, age and income were noted for statistical and empirical analysis.

RESULTS AND DISCUSSION

An overview of socioeconomic status of collectors

In this study all 64 respondents were males and were formal collectors. But collectors within each household may be both formal and causal collectors. The comparative figures of asparagus collectors of both castes such as 'age at which they start collection', 'years involved in collection', 'current age of respondents', 'travelling time from home to collection point (hr)', 'number of collectors in the household in 2001/02', 'total income from asparagus collection'

Table 1. Comparative figures of general characteristics of collectors and their WTP for different scenarios

Description	Respondents	Mean	Overall mean	*t*	Sig. (2-tailed)
Age at which collectors started collection of asparagus	Praja	19.9	23.1	–3.25	0.002
	Tamang	26.3			
Number of years involved in collection of asparagus	Praja	15.7	13.8	2.34	0.022
	Tamang	11.9			
Current age of the respondents	Praja	36.6	37.4	–68	0.498
	Tamang	38.2			
Percent of total income contributed by asparagus	Praja	73.7	67.2	3.93	0.000
	Tamang	60.8			
Income from asparagus collection (Nepalese rupees)	Praja	9,895.9	8,820.0	2.50	0.015
	Tamang	7,743.8			
Sustainable harvesting at 1995 rates in the Department's forests	Praja	5.2	4.4	3.52	0.001
	Tamang	3.6			
Sustainable harvesting at 2002 rates in the RCNP forests	Praja	8.8	8.4	1.86	0.068
	Tamang	7.9			

The number of Praja and Tamang respondents was equal: 32 from each group. Degrees of freedom for *t*-test were 62 (32 + 32 – 2)

and 'percent of total income contributed by asparagus' are given in Table 1.

The average household income of both Praja and Tamang collectors (13,125 NR) was less than one sixth of the national average. The average per-capita landholding of the collectors was low (0.055 ha) relative to the national average (0.176 ha). The basic occupation of both types of collectors was agriculture but 87% of collectors suffered food shortages for at least six months in the year. The total income from asparagus and the percentage of the total income contributed by asparagus for Praja were higher than for Tamang caste. On average, the asparagus contributed 67.2% of the total income (8820 NR) of collectors (Table 1). Therefore, the income from asparagus is vital to their livelihood.

Collectors' Willingness to Pay (WTP) for the two scenarios

Sustainable harvesting from the Department's Forests at 1995 rates: In the question are you willing to pay two Nepalese rupee per kg of asparagus if the Department's Forests were managed for the sustainable harvesting at 1995 rates, only two Tamang respondents said 'no' to this question. The remaining Tamang respondents said 'yes' and successively committed to higher amounts (> 2 NR). The average WTP of the remaining Tamang respondents was 3.6 NR/kg. Considering zero NR/kg for those who said 'no' then the average of Tamangs' was 3.39 NR/kg. On the other hand, all the Praja responded 'yes' and committed to higher amounts. The average WTP of Praja was 5.2 NR/kg. The average WTP of both castes was 4.4 NR/kg with a reasonable range (0–10 NR/kg) and standard deviation (2.1 NR/kg).

Sustainable harvesting at present rates from the Royal Chitwan Park (RCNP): This scenario asked whether they were WTP three Nepalese rupees per kg asparagus if the RCNP's forests were managed in such a way that both the current harvesting rate of asparagus was sustained and they were legally allowed to collect asparagus at the present rate. All respondents said 'yes' and agreed to even higher amounts. The average WTP for Praja and Tamang collectors was 8.8 NR/kg and 7.9 NR/kg, respectively with an average of 8.35 NR/kg. The range (4–15 NR per kg) and standard deviation (2.0 NR/kg) of WTP of all collectors were reasonable.

DISCUSSION

The average WTP of Praja collectors in both scenarios was found to be slightly higher than the average WTP of Tamang collectors. However, the mean WTP of Praja was not statistically different from the mean WTP of Tamang collectors in the second scenario ($P > 0.05$) (Table 1). In the first scenario, the mean WTP of Praja was significantly higher than the

mean WTP of Tamang caste ($P < 0.05$). The higher WTP of Praja was not due to differences in gender, occupation and education level because all collectors of both castes were males, they have the same basic occupation (agriculture) and similar education level (only up to grade five). The higher WTP of Praja is linked with their longer experience in asparagus collecting and the higher dependency on asparagus (Table 1); mean experience for Praja (15.7 years) was significantly higher ($P < 0.05$) than Tamangs' (11.9 years). Similarly, the total income from asparagus and the percent of total income contributed by asparagus for Praja were significantly higher than for Tamang ($P < 0.05$). This shows that the livelihood of Praja caste is more heavily dependent on the asparagus than that of Tamang.

Finally, the difference in WTPs in both scenarios indicates the relative status of asparagus in two forests to both castes. The higher amount of collectors' WTP in Scenario 2 (sustainable harvesting at the present rate from RCNP) may be due to greater availability of asparagus over the RCNP. Similarly, the lower WTP for Scenario 1 (sustainable harvesting at the rate of 1995 from the Department's forests) could be due to their understanding about the extent of asparagus in 1995.

CONCLUSIONS AND RECOMMENDATIONS

Asparagus collectors represent the poorest people within the Nepalese society as they have the lowest land-holding size, per capita income and lowest educational status. Asparagus contributes a significant amount of income for these collectors and is an inseparable part of their livelihood. The amount of asparagus in both the Department's and the National Park's forests is depleting every year. However, its collection from both forests is escalating mainly due to increasing national and international demand and increasing market price, even though collection from the National Parks is legally prohibited. The overall analyses of the two scenarios show that the collectors are WTP a significant amount of money to ensure the long-term viability of this enterprise. There is a good chance of earning revenue for the government by managing the Department's and the National Park's forests, and giving legal permissions to collect asparagus from the National Park, which would have happened anyway at the financial and legal risk to collectors. It is important for the government to note that while managing the forests for the sustainable collection of asparagus, the whole ecosystems could be effectively managed, which would also promote additional the environmental services from the forests.

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Odhad ochoty platit sběračům chřestu (*Asparagus racemosus* Willd.) v oblasti Makawanpur v Nepálu

ABSTRAKT: Sběr a prodej chřestu je hlavním zdrojem obživy pro místní obyvatele pocházející z kasty Praja a Tamang v oblasti Královského národního parku Chitwan v Nepálu. Bohužel postupným ničením lesů, kde se tento chřest sbírá, dochází k ohrožení zdrojů obživy pro tyto obyvatele. Při řešení problematiky trvalého způsobu obhospodařování lesů byla použita kontingenční metoda odhadu průměrné ochoty platit sběračům při dvou různých scénářích. V prvním scénáři, kdy jsou lesy pod jurisdikcí Ministerstva lesů, je míra sběru chřestu ve výši, které bylo dosaženo v roce 1995. Pak průměrná výše ochoty platit za 1 kg byla 4,4 nepálské rupie. Ve druhém scénáři byl sběr chřestu stanoven na současnou úroveň. Potom byla výše ochoty platit odhadnuta na 8,35 nepálské rupie. Studie ukazuje, že je možné při těchto výších sběru zachovat místní lesy a zároveň zajistit sběrem chřestu dobrou obživu místním obyvatelům, ke kterému by stejně docházelo, ale s nebezpečím poškození těchto lesů.

Klíčová slova: *Asparagus racemosus*; ochota platit; kontingenční metoda; Praja; Tamang

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