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Title of the Paper: Non-Market/Contingent Valuation of Medicinal Plant Conservation in the protected forest of Anshi National Park in Western Ghat Region of Karnataka

Abstract: *Given the present threat to medicinal plant biodiversity and the presence of conflicts between the state authorities and local people in the protected areas over the use and management of forest resources, the biodiversity conservation polices and programmers seek people's participation in various conservation activities. Therefore this paper considers various consumers' preferential approaches to value medicinal plant biodiversity in protected forest of Anshi National Park in Karnataka. The study estimates the economic value of people's preferences to avoid further loss of MPs biodiversity at local level. The non-market/Contingent Valuation Method (CVM) typically 'Willingness to Accept (WTA)' and 'Willingness to Pay (WTP)' were used to elicit the values on the basis of de-facto (bonafide) access rights to MPs collection. The Logit model has been adopted to understand the variables influencing the demand for medicinal plants and factors responsible in conservation of medicinal plants. The study finds that the majority of the sample households were not willing to accept compensation for forgoing the benefits of MPs collection that support their livelihoods. On the other hand, the average WTP is estimated to be off Rs. 355/household/annum for avoiding the species loss in the National Park. The study suggests that 'attributing sustainable sources of medicine and livelihoods' as an important reason for their payment for medicinal plants biodiversity conservation in the park.*

Keywords: Medicinal Plants, Protected Forest, Property Rights, Biodiversity Conservation, Contingent Valuation, Willingness to Accept & Willingness to Pay, livelihood.

1. Introduction

The concept of conservation implies the use of a resource without diminishing its stock (Pearce 1993). Hence the conservation of medicinal plants implies the use of various indigenous plant species for human and veterinary purposes without diminishing its stock. According to "World Health Organization, more than four billion human population (80 %) relies primarily on animal and plant based medicines (Lee, 1999). The Indian System of Medicine primarily relies on plant-based medicine. In India, millions of people residing in and around forests rely on Medicinal Plants (MPs) for their primary health care as well as subsistence and more than half of the employment generated in the forestry sector is through Minor Forest Produces (MFPs, Jain, 2000). The ethnic utilisation of the plant-diversity for traditional medicine in Indian villagers is perhaps more than the value of medicinal plants utilised by industry in India as well as the value of plants that are exported (Shanker *et al* 1997). Plants used in traditional medicine, therefore, have an important role to play in the maintenance of health in all parts of the world and in the introduction of new treatments. The importance of plants in providing healthcare remedies to both man and animals is increasing day by day. Moreover, the commercialisation and exports of herbal medicine had triggered the demand for herbs and thus pose severe threat[1] to their existence in the wild and some of them have already been extinct in the wild due to over exploitation. This has resulted in decreasing the original stock of plant diversity. Moreover, the rate at which the medicinal plants have been lost is a matter of concern. Prof. Dasgupta (2000) believes that the Medicinal Plants are a good source of supplementing the incomes of the rural poor and provide meaningful inputs for drugs their loss through extinction could lead to considerable loss to the society. In this regard, there is an urgent need for emphasizing on the conservation and sustainable management of plant resources. Solbrig (1993) pointed out the role of species in system resilience[2] that permits the persistence of ecosystem through time in a constantly changing environment. Thus, the ecological importance of medicinal plant biodiversity lies in its role in preserving ecosystem resilience. The economic implications of medicinal plants loss are concerned with their impact on human and animal health and health care systems, which is motivated by two different sets of questions. First, it asks about the optimal level of medicinal plant biodiversity conservation for a given set of social preferences; and the second, about how the obligations of the present generation in terms of intergeneration resource allocation should be accommodated in the decision–making process[3]. While answering

the above questions, it is found that, the proximate cause of medicinal plant biodiversity loss is in terms of the direct and indirect destruction of the resilience of the ecosystems that constitutes the 'habitat' of species.

The underlying cause for the loss of Medicinal Plants is found in the divergence between private and social values of resources use (Barbier et al 1995). Thus, studies on the economics of medicinal plant biodiversity are concerned, in order to identify the correct 'prices' (value) of such biological goods and services with a view to reduce the difference between private and social values. But, the central focus of environmental economics is how to value non-market environmental benefits and costs in monetary terms? This concern is based on the fact that many of the environmental goods and services are either not-marketed in nature or traded in imperfect markets, eventually leading to inefficient resource allocation pattern and therefore, their true value needs to be estimated for the re allocation to be pareto optimal. The need for such an allocation arises from the fact that, not only environmental degradation but also any policy decision to reverse it usually results in a trade off in welfare between different users. Hence, the valuation of medicinal plant biodiversity assumes greater significance since medicinal plants have been considered as sources of substance used in traditional systems of health care as well as in livelihoods of the local poor's.

The reason why valuation is important is that unless a resource is given a value, it tends to be mismanaged by way of overexploitation (Maler et al, 1994). On the other hand the non-market valuation of environmental benefits and costs plays a crucial role in environmental decision-making both at the micro and at the macro levels (Venkatachalam, 2003). Moreover, valuation is essential even from the policy point of view in safeguarding the threatened medicinal plant biodiversity by inducing individuals to take into account the social cost of their action in the future (Perrings et al, 1995). In other words, policy should be concerned with the scope for species conservation given the existing rate of habitat loss, and with the scope for modifying the structure of incentives governing the decision of individual users. Against this background this study focuses on the non market valuation of medicinal plants biodiversity conservation in the protected forest of ANP from Western Ghat Region of Karnataka, India

1.1. Conservation Needs of Indian Medicinal Plants: The studies done in the context of medicinal plants conservation are deficient, especially those attempting an economic valuation of

biodiversity for medicinal uses in the protected areas. Moreover, the studies, which have focused on economic valuation of medicinal plants hardly considered traditional/local use and non use values for medicinal plants, which are not revealed in market prices. Most of the studies have concentrated on the value of medicinal plants for the pharmaceutically active substances for example Principe (1991), Ballick et al (1992), Pearce and Puroshothaman (1995), Simpson et al (1996). This value is now being cited as one of the many arguments for conserving natural habitats and, in particular, tropical forests, which contain the largest number of plant species. These analysis, however, ignore the additional role of these medicinal plants as sources of medicines in the form of herbal treatments used by the majority of people in developing countries. As Shanker and others (1997) notify the value of plants used by the Indian villagers is perhaps more than the value of medicinal plants utilized by industry in India as well as the value of plants that are exported. It is in this connection plant resource that occurs within or in the vicinity of the habitats (Anshi National Park), which are collected and used by the local forest dwellers as well as occupants for the purpose of consumption and sale do not reflect their true values due to the market failure conditions. 1) Because of the absence of market, values of goods and services are not revealed. For instance, there are no markets for ecosystem services such as nutritional cycle, carbon sequestration, watershed functions, temperature control, soil conservation etc. 2) Even if there are markets, they do not do their job well. For instance, market may be a regulated one, there may be restrictions on one's entry into it either to buy or sell. Good examples are licensing or rationing introduced by the government. There may be restrictions on one's entry into it either to buy or sell. An example of entry barrier is the example of regulated market is *kendu* leaves prices fixed by the cooperatives in Madhya Pradesh (Tiwari, 2004). So, valuation biodiversity for medicinal use (in protected area) becomes very important to capture the true value of resources. In this regard proper valuation of this resource is essential.

Further, it is generally argued that the local benefits of conservation fall far short of local opportunity costs (wells 1992) since, only a fraction of the direct value of associated goods and services accrue to the local population. Therefore, the issue becomes one of appropriating the value of biodiversity at the local level and the designing of proper incentive, which would raise local benefits from biodiversity conservation, and lower the local opportunity costs. Therefore, valuation of biodiversity by taking into account the nature and characteristics of the protected area and the nature of property rights that exist at the local level merits attention. In other words,

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the study helps to identify aspects that need to be considered at the local level, while designing policies for medicinal plants biodiversity conservation at macro level.

Therefore, the proposed study will consider and analyzes, after taking into account the rights that one should have over the utilisation of forest produce at micro level in the protected area forest management system. It is in this connection plant resources that occur within the habitat, which are collected by the local residents as well as occupants for the purpose of consumption and sale do not reflect their true value in the market due to absence of proper markets. It is noted that for many environmental resources markets simply do not exist. For example, in the case of biodiversity, ill-specified or unprotected property rights prevent the existence of market or make them function wrongly even when they do exist (Perrings et al 1994; Swanson 1994). In the case of medicinal plant, the various benefits associated with medicinal plants use and their conservation can be external to the markets. Therefore, the market prices fail to reflect their (plants) true economic value to the society. Therefore, non-market valuation of medicinal plant biodiversity in protected forest area becomes very important to capture the true value of resources. Hence, the present study focuses on 'estimating non market value of medicinal plants conservation within the ANP in the Western Ghat Region of Karnataka. The Contingent Valuation Method (CVM) is used to elicit local people's preference and estimate the "Willingness to Accept" (WTA) and "Willingness to Pay" (WTP) for medicinal plants conservation in the study area. The valuation has been carried out to provide economic information on the resources while, designing conservation policies in the protected area management.

1.2. Research Issue: The human pressures on the protected areas, which are designated for *in situ* biodiversity conservation, reconcile the need for conservation with the concern for development raise many issues. Although it is a well-known fact that forests are a source of livelihood for many people such as for the collection of non-timber forest products (NTFP), it is pertinent to ask whether the protected areas are under pressure only for such livelihood purposes. A related question is whether all the people living in the protected areas depend on forests for their daily health requirements to the same extent or can the local communities be considered as a homogeneous group in terms of their forest dependence. Another important question is regarding the type of economic value that the forest dwellers derive from the forest. Similarly, it

is also important to ask whether the forest dwellers place any economic value on NTFPs that they collect and use as source of their health remedy so as to conserve the stock of resources in the form of protected areas/National Parks for the use of both present and future generations in a sustainable manner. In this connection it is also important to ask about the type of value that the forest dwellers place on protected area to avoid or prevent further medicinal plant biodiversity loss and its determinants. Addressing these questions will provide important indication whether the involvement of forest dwellers for conservation of medicinal plant diversity in the protected area management would be a better alternative policy implication or give important clues about the welfare implications of the various policy measures on the local people.

Thus, addressing these issues is important as most of the protected areas in India are under threat due to the over exploitation. Probing into these issues will help in identifying the various aspects that must be taken into account at micro or local level while designing conservation polices at the state and national levels.

Considering the above, this study investigates into the present state of affairs of a protected area in terms of medicinal plant biodiversity conservation and examines the economic value that people place to avoid further loss of medicinal plant biodiversity or degradation of protected areas. Further, the study seeks to provide information for designing or formulating economic incentives for effective medicinal plants biodiversity conservation in protected areas, especially, at the local level. While carrying out the economic valuation, the factors which influence, for instance, property rights that local people perceive on the protected area are also being taken into account. This is very important for providing signals to the policy makers for prioritizing funding for biodiversity conservation by governments or donor agencies as funds or capital are scarce. Thus, there are strong moral and ethical grounds to justify medicinal plant biodiversity conservation; there is also a strong economic case for medicinal plant conservation. This study proposes to explore these local level dimensions of medicinal plant biodiversity conservation in this context.

2. Methodology

2.1.Data Sources: Are from both secondary and primary sources. Although, the broad objective of this study is to estimate the non market value for medicinal plants diversity in the ANP, in order to provide a proper understanding about the study area, the profile and characteristics of

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the Western Ghats Regions and Uttarakannada district in the state of Karnataka have been examined by collecting related literature from various state departments and forest statistics. The information was collected for the purpose by surveying related literature from National and State Forest Departments. National and State Medicinal Plant Boards and from Foundation for Revitalisation of Local Health and Traditions (FRLHT). After analysing the secondary data. Rapid Rural Appraisal was carried out to get detailed information about the forest dependency of the people and other types of interactions that people are having with protected forest.

2.2. Sample Procedure: The survey has been conducted within/Near ANP after discussion with the village officials/leaders. A total of 26 villages/Hamlets have been covered under 3 Grama Panchayats limits. In the absence of reliable information about user population 'Random Walk Method' has been adopted to collect the requisite data for the study. The Researcher himself has randomly selected forest dwellers by moving in different directions in a systematic manner until predetermined size of sample is reached. All the households which were present at the time of survey were interviewed because of the scattered household's structures in the study area. The survey had covered a total of 200 households involved in gathering medicinal forest produces.

2.3. Method of data collection: The information collected for the study are both from secondary and primary sources. Primary data were collected using formal and Informal methods, structured interview schedules were prepared to elicit a wide range of information from various stockholders (Medicinal plant gatherers). The schedules have been divided into two parts. In the first part of the structured schedules the information on Demographic details of the respondents, Socio-economic structure of the respondent's household, information on MPs collection, quantity of collection, consumption, sales, seasons of collection, time spent for collection, labour involved in collection, income generated from the sale of MPs etc are collected and analyzed. The second part of the schedules was constructed purely to elicit the local people (forest dwellers) preference and willingness to pay and willingness to accept (WTP and WTA) for medicinal plants conservation within/near the Anshi National Park.

2.4. Contingent Valuation Method (CVM): As a first step towards valuation, under the present state of affairs (business as usual scenario) of the reserve was assessed. Then, we

estimated the non market value of medicinal plant conservation in ANP using non market valuation method to elicit the values (demand). The constructed market valuation tool has been used to generate the value or demand for an environmental good using both types of constructed market such as stated preference (Hypothetical valuation) or most commonly contingent valuation and the second type of constructed market is an experimental market. This technique is used to value the improvement or deterioration in the environmental good. It is generally agreed that this valuation method is the most complete and comprehensive among its alternatives (Opschoor, 1987). It has broadest range of application and comprehensive in the sense that the method can measure total economic value (Pearce *et al,*1989*)* of environmental goods[4]. Therefore, this technique helps us to elicit people's preference and 'Willingness to Accept' to forego the benefit derived from the medicinal plants and 'Willingness to Pay' to retain the benefit that they are already enjoying from the forests. The typical way those preferences are represented is through demand functions-relationships that give the amount of a good an individual at a given income level will desire, when facing a particular set of prices. A demand curve shows how important a particular good is to an individual. Since every individual has a limited income, the demand curve tells us how much money the individual devotes to a specific good, out of many choices available (Kolstad, 2002). The people's preference for a good has been assumed to be stated as the minimum sum of money that they are willing to accept to give up the good or to be stated as the maximum willingness to pay to retain the good. In other words, the willingness to pay or willingness to accept converts people preferences into a measurable monetary term.   In stated willingness to accept and willingness to pay represent the total economic value of a good (Hoevenagel, 1994). Since every individual is assumed to maximize the satisfaction or utility that they get from the consumption of a good/ service with his limited income.

While estimating demand for environmental good, the methods like hedonic price and household production are the two methods based on revealed preferences. The demand for many environmental goods cannot be completely estimated using revealed preference methods (Kolsted, 2000). These methods may not reflect the existence value of an environmental good. There are many goods for which there is no logical market through which value can be reflected. For the medicinal plants those do not have market prices, the non market valuation method that

is 'Contingent Valuation Method' involving both Willingness to Accept (WTA) and Willingness to Pay (WTP) were used to elicit the value of these produces within the park. Since forest dwellers have perceived right (*de-facto* rights. i.e., only for bonafide consumption[5] of forest produces) over the resources the appropriate method for eliciting their value was to ask the minimum 'Willingness to Accept' to forego the withdrawal of resource from the Anshi National Park[6].

As against, we have also used 'Willingness to Pay' question for the dwellers, because, it is mentioned that all uses are not irrelevant in protected areas, e.g., non-timber forest product collection (Chopra, 1998). The non timber forest produces have been perceived as a joint product of biodiversity conservation at the local level, which support the livelihood of the people. Since the dwellers collect and sale the produces more than the withdrawal right assigned to them, controlling the collection of medicinal plant for sales purposes in the ANP is also relevant. As an alternative hypothetical scenario, that is, if they have completely stopped from collection and use of medicinal plants as an opportunity cost they may need to spend money on other substitute good or bet their life at the cost of health risks. So, to retain the bonefide access and the benefits from the use of medicinal plants what could be their 'willingness to pay' question have been posed and tried to elicit whether these forest dwellers are willing to pay for retaining the benefits from ANP for present use that they are already enjoying and for future use[7]. The rationale for asking 'willingness to accept or pay' in the case of public good can be seen in two monetary welfare measures, which includes the compensating variation and equivalent variation(Brookshire et al, 1980; Johansson,1993); the compensating measures relate to the initial level of utility that is maintaining the utility prior to change. The equivalent measures relate to the level of utility subsequent to any change.

Hence, Contingent Valuation Method has been adopted in the study to estimate the local willingness to accept and willingness to pay for medicinal plants to arrive at the value of people's preference towards medicinal plants conservation. This was to value or estimate their preferences/demand to derive appropriate policies for conservation of medicinal plants biodiversity in ANP. For the CVM study, the dichotomous method or discrete choice method which seeks simple YES or No replies were used. The open ended questions are also used wherever needed to elicit the responses for which the dichotomous or discrete choice questions

are not suitable. The discrete choice method is preferred over other methods (e.g. open ended methods) since this method would be easier for villagers to react to the question. Dichotomous choice methods require the use of parametric (typically Logit or Probit) probability models relation yes or no responses to the computation of relationship between WTA or WTP response to relevant socio-economic and other variables. The Logit model has been adopted to understand the variables influencing the demand for medicinal plants and factors responsible in conservation of medicinal plants. The detailed explanation of the Logit model has been presented in the para 4.2 below.

2.5. Study Site: Anshi National Park located in an eco-sensitive part of the Western Ghats, Approximately 250 sq km, of the erstwhile Dandeli Wildlife Sanctuary was notified as Anshi nationl Park in 1987. The park lies in the Western Ghats, adjoining the state of Goa on the Karwar- Londa highway and is part of the Dandeli wildlife sanctuary. The ANP is an evergreen tropical rainforest. The forests of Anshi and Dandeli are rich in rare species of flora and fauna. A Location map of this park given in figure 1.
(Figure 1 Location map of Anshi National park Should be here).

Even though the ANP is a state owned and managed property, different types of stakeholders, both at individual and organizational levels exist with respect to the use and management of the park. At the organizational level, the state forest department and other non-governmental organizations are involved. At individual level, it is the people (tribals) living inside and the fringe areas. Besides, there are the other (outside) actors who are not directly interacting with the park but have a stake over it. Together these stakeholders perceive different types of property rights over the park. It has been noted that many of the activities undertaken in the park at individual stakeholder's level threaten the biodiversity of the park. For instance, the local people who are staying within/nearby the park are involved in illicit collection and marketing of many resources including Medicinal Plants. The grazing and fuel wood collection are the common problems in the park. The biodiversity of the park is facing threats due to several anthropogenic, economic and ecological reasons. Since the individual level stakeholders perceive different types of property rights, the scope of the study is limited to Anshi National Park.

3. Results and Discussions

3.1 Forest Dweller's Preferences and Attitudes

In this study, we have tried to elicit the views of the forest (ANP) dwellers in broader perspective before getting into the in depth elicitation of preferential values on the Medicinal Plants diversity in particular. It has been attempted to present/elicit the attitudes of the respondents in sample villages of ANP towards the MP Biodiversity conservation. This is important while soliciting the participation of the local people in the MP Biodiversity conservation measures. It has been pointed out that the elicitation of environmental preferences is found to be very important in contingent valuation interviews since individuals act according to their attitude (Kitchen and Stephen, 2000). Kotchen and Reiling (2000) observe that those who have strong pro-environmental attitudes are more likely to be supportive of environmental conservation and provide legitimate Yes/No responses in contingent valuation surveys, while those with weaker attitudes are more likely to protest hypothetical Contingent Valuation Scenarios. In this survey, the preference elicitation was carried out to know the respondent's preference towards MP Biodiversity conservation.

We elicited the views of the forest dweller's awareness on Medicinal Plants diversity and the reasons for their importance to them. It was intending to know that the knowledge of sample households whether the households were aware of medicinal plants or not. It was overwhelming to state that almost 98 percent of the sample households (200) were aware of plants being used for medicinal purposes. Then to know whether they have any positive attitude towards Medicinal Plant conservation and to obtain more reliable answers, we explained and enlightened the respondents about the status of Medicinal Plants and Plants with medicinal property in south India, in the state of Karnataka and Uttara Kannada districts in particular. They were asked whether they think it is important to conserve the medicinal plants, in such a situation. A brief explanation/example of loss of medicinal plant diversity was presented to the respondent which reads as follows:

☞   *"In south India several medicinal plant species are under various degrees of threat in wild. Their threat assessment has been carried out by Foundation for Revitalization of Local Health Traditions (FRLHT) through "Conservation Assessment and Management Plan (camp) Workshops" for the medicinal plants, designed under IUCN guidelines. For southern and northern India has already listed around 200 species of medicinal plants which are under various degrees of threat. It is however, estimated that around a 1000 species of medicinal*

plants must actually be facing threat to their existence in the wild. Of the 112 medicinal plants of South India, considered threatened, about 60 are found in Uttara Kannada district alone". Some of the lists of important/Threatened medicinal plant species that are available/found and their threat status in the locality are listed (table no 1.) and read out to the respondents.
(Table No. 1. List of threatened Medicinal plants. should be here)

The respondents were asked whether in such situations was it important to conserve our wild Medicinal Plants and their habitat. The respondents were asked to exercise their option by indicating 'YES' or 'NO' responses to the question posed above. It is heartening to know that out of 200 sample households surveyed the majority of the households (98 %) have said in favour of conservation of Medicinal Plants. A small percentage (2%) have opined that the Medicinal Plant conservation as unimportant to them. The land holding wise information on the responses of sample households towards importance of medicinal plants conservation is presented in figure No. 2.

(Figure No. 2 Percentage of Households who said that Medicinal Plant Conservation is Important. Should be here)

We further probed to find out the reasons for both YES/NO answers. From those who answered 'YES', medicinal plants conservation as perceived by the respondents were elicited by presenting a set of ten (10) reasons in a sequential order. 'Three Scaling Technique' was used to derive their preferences. The reasons were then ranked in the order of importance as stated by the respondents. Based on the analysis of the collected data from the sample households, it is important and interesting to indicate that 99 percent of the sample households offered top (Ist Rank) importance as they considered plants as the primary sources of medicine. 'Medicinal plants to be conserved for future generation' has been assigned second most important reason with 98 percent and about 94 percent of the sample households gave importance to the reason 'medicinal plant give meaningful input to medicine' followed by the 92.8 percent for the reason for 'medicinal plants have ritual, cultural and spiritual values' and for the reasons 'own rights to exist' and 'may find new drugs in future' have given importance with 87.8 percent and 87.3 percent, respectively. Please see table no 2 for more details. On the other hand, the reason 'medicinal plants are livelihood for them because, they generate income', was given somewhat less importance with 73.9 percent and for the same reason 13.3 percent of respondents stated as not important and 12.8 percent of the sample households were indifferent to state either

important or not important. 'Medicinal plants have education value' is given little importance by the sample households. (see table No. 2).

(Table- No. 2. Reasons for the importance to conserve Medicinal Plants. should be here)

 It is interesting to reveal that the forest dweller's agrees that, it is important to conserve medicinal plants as a source of their primary health care and livelihood purposes for present and future generations.

3.2. Contingent Valuation of Medicinal Plants Conservation

3.2.1. Estimates of 'Willingness to Accept' (WTA): From the survey, it has been found that, out of 200 sample households; more than 90 percent (181 HHs) are involved in collection of medicinal plant and among the collectors 50.28 percentage (91 HHs) are primarily using plants and plant based derivatives as source of traditional medicine to treat various diseases like Cough, Cold, Fever, High Temperature, Blood Pressure, Jaundices, Asthama (TB) Head heck, Gastric, Stomach pain, Indigestion, Loose motion, Ulcer, Wounds, Skin related diseases, Snake bites, Bone fractures and many other illnesses at local level in the study area (ANP). For those households, who agreed that they were collecting Medicinal Plants from forest and utilizing them for the medicinal purposes; the contingent questions using dichotomous choice was posed to generate forest dwellers preference to estimate the traditional use value of medicinal plants. The important advantage of this dichotomous value elicitation method is that respondents may find it easier to determine whether they hold any economic value for the medicinal plants that they use regularly. It is argued that this method may obtain more accurate answers (Seller et al 1985). The value elicitation was done with open-ended format. The direct open-ended question method is the most obvious one to reveal the economic value of an environmental good which asks respondents directly for their willingness to accept or willingness to pay compensation and recorded the stated amount. The advantage of this method is that it is amenable to personal interviews (Hoevenagel, 1994). The disadvantage of this method includes low response rates and protests, due to the respondent's unfamiliarity with the good under valuation. However, open-ended method has been adopted in the present study context, as the respondents are familiar with the good. We used this question only to those who were aware and use the good (medicinal plants) personally, after confirming whether the respondents were aware and use the good under

valuation, than we posed the questions. The value elicitation scenario for 'Willingness to Accept' compensation, presented to the forest dwellers reads as;

☞ *"Since the Medicinal Plants are collected by you/your family members for your primary health requirements; the produce collected by you is purely from protected forestland (ANP) and prohibited from all the collections. Since the forest are the public property, if it is strictly prohibited from collection of (restricted from collecting) any forest produce for treating your primary health requirements, you will be losing certain benefits, as an alternate you may need to go for hospitals for medicating your health, for this you may have to incur some cost for which at present you are not incurring in fact".*

Will you expect any compensation for foregoing the medicinal benefits from the forests of Anshi National Park? Please tick YES/NO

For this contingent question, out of 91 sample households who use plants as a means of medicine, the majority that is 52 respondents expressed unwillingness to Accept Compensation for foregoing the medicinal plants benefits that they collect and use primarily from the study area. Of the sample households about 39 respondents among the medicinal plant user households were willing to accept compensation for foregoing benefits that they collect for consumption purposes. According to the size of the land holdings of the sample households, the responses towards willingness to accept, the highest percentage from marginal (63.3%) and semi medium(58.3%) land holders were reluctant to accept compensation to forego benefit/access to the Medicinal plants use. Please see Figure no 3 for details.

(Figure No. 3. Percentage of Households preferred Willing/Not Willing to Accept Compensation for Forgoing Medicinal Plants benefits. Should be here)

Logit Model; 'Willingness to Accept' Function: The continued existence and improvement of biodiversity and forest ecosystems provides various goods and ecosystem services to the human society. It could be both direct and indirect benefits to the society. For instance, a high biologically diversified area provides various benefits for forest dwellers, such as livelihood benefits from Medicinal Plants collection and sale, use of various plants as source of medicine and health care repository. These benefits of the ecosystem encourage people not to accept any alternative to forego these benefits and to retain the benefits for continuous use. Therefore, the conservation or improvement of medicinal plants diversity of the ANP can have a positive impact on the welfare of the people living inside the park. Hence, people may value their

preference for the continuous use of this diversity. Further, Medicinal Plants acts as insurance to forest dwellers, sometimes medicinal plants are the life insurance to the local people.

Therefore, the forest dwellers may be less inclined to accept a compensation to forego the benefits of medicinal plant use. This indicates that the forest dwellers fear about losing their medicinal benefits if they accept compensation. Consequently, we decided to model the "NO" response of the medicinal plant collectors to accept a compensation to forego the benefits of medicinal plant use. It is hypothesized that those who have a higher use value for medicinal plant do not accept compensation but continue to collect the plants. Therefore in the analysis, the elicited 'Yes' or 'No' responses in terms of their willingness to accept compensation to forego the medicinal plant use were coded to generate a dummy dependent variable. The dummy variable represents '0' if the respondent said 'No'; it is coded as '1' if the respondent said 'Yes' or agreed to accept compensation.

It is important to point out that more than 57 per cent categorically said 'No' or that they were not willing to accept any compensation for foregoing the benefits of medicinal plants. Only 43 per cent of the 91 respondents were willing to accept compensation to forego the medicinal plants benefits by preferring 'Yes', that is they were willing to accept compensation, and   Since the response of the respondents is a discrete variable, we used a logit model to analyze the data to find out the socio economic characteristics of the respondents who said 'No'. Following Gujarati (2003), the logit model has been specified as:

$$P_i = E(Y = 1 | X_i) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_i)}} \quad \text{.......................................} 1$$

where $Y = 1$ means the respondent decides not to accept compensation given X_i; X_i is a vector of explanatory variables and e is the base of natural logarithm. Equation 1 can be written as

$$P_i = \frac{1}{1 + e^{-z_i}} \quad \text{...} 2$$

where $Z_i = \beta_1 + \beta_2 X_i$. Equation 2 represents a cumulative logistic distribution function. Since P_i, given in equation 2 gives the probability that the respondents decide not to accept compensation, then $(1 - P_i)$, the probability that the both owner decides to accept compensation

$$1 - P_i = \frac{1}{1 + e^{z_i}} \quad ....3$$

Therefore, we can write

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad ....4$$

$\frac{P_i}{1 - P_i}$ is the odds ratio that the respondent decides not to accept compensation. The natural log of equation 4 is given as follows:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i ....5$$

Here L, the log of the odds ratio is linear in X as well as in parameters. The estimable logit equation can be specified as follows:

$$Li = \left(\frac{P_i}{1 - P_i}\right) = \alpha + \beta_1 Age + \beta_2 Caste + \beta_3 Sex + \beta_4 Education + \beta_5 Land + \varepsilon$$

Where α is a constant, βs are co-efficient of each variable and ε is the error term.

Choice of variables Included in the Logit Model: The descriptive statistics of the variables used to model valuation function is presented in the table no 3. The variables were selected in such a way that it captures various aspects of the respondents' individual or household characteristics. First, we will explain, reasons for the selection of variables and the expected signs of their coefficients in the regression. Caste of the respondent represents the social status of

the household. In this case 'caste' is defined as a dummy variable which it takes value 1, if the respondent belongs to Kunabi[8] community and zero otherwise. It is assumed that the Kunabi community which is the largest homogenous group engaged in medicinal plant collection will be more reluctant to accept compensation as compared to other tribal communities. During informal discussions with the respondents, plant collectors from Kunabi community expressed the importance of medicinal plant in maintaining their health needs.

Table No 3.   Descriptive Statistics of the Variables used in 'Willingness to Accept' Compensation of the Logit Model. Should be here)

Based on this observation, we expect the coefficient of the variable to have a positive sign while modelling "No" response. In the case of variable "age", we expect a positive sign because it is generally argued that older people have relatively high awareness about the use of medicinal plants as compared to young people. Therefore, there is a high likelihood of responding 'NO' to the willingness to accept compensation. Education of the respondent also can influence the "NO" responses function positively because educated people might be more aware of the use value of medicinal plant resources. Since the size of landholdings and income has a positive correlation, the size of landholding may influence the "NO" function positively. Finally, to capture the gender dimension, we put the variable "sex" as a proxy to gender.

Results of Logit Analysis and Discussion: Table no. 4 presents the maximum likelihood estimates of the Logit regression[9]. The coefficients of the variables that found to be statistically significant are 'Caste, Age (at a higher level), and landholding. These variables also have the expected signs. For example, it has been found that those respondents who belong to Kunabi community are less willing to accept the compensation to forego medicinal plant use. This means that they are not having the confidence to forego the use value of medicinal plants.

(Table No. 4.   The Estimated Logit Model of 'Willingness to Accept' for Medicinal Plants . should be here)

The analysis shows that, the use value of medicinal plants in the study area is very high, in other words the demand for plants and plant derivatives for medicine is high. This implies that, the probability of the respondent to say 'NO' to the WTA question will be higher when the

respondents are mainly depending on the forest plants to treat their day to day health related problems. Vis-à-vis, if the probability of the respondent to say YES to the WTA question is less, then the respondent is not really/depending on plants to treat day to day health related problem using plants and plants parts from the protected forest. This is significant when these preferences YES or NO responses are regressed with the socio economic characteristics of the respondents, such as Age, Education, Sex, Caste, landholding with these variables, we have estimated the valuation function using Logit maximum likelihood estimation, modeling willingness to accept responses as 'NO'.

The study had hypothesized that the Willingness to accept compensation is less among Kunibi tribal communities as compared other tribal communities. This hypothesis has been accepted by the statically significant caste variable influencing WTA responses in the Logit model. From the analysis it appears that the Kunabi tribal community' places more value for the medicinal plants and plant derivatives than the other tribal communities though the other tribal communities are also depending on these resources.

Validity of Willingness to Accept Responses: The amount stated as willing to accept has been analyzed to find out degree of value that they accept as compensation. The analysis shows that, the average acceptance per household per year works out to be Rs. 2648 per household per year. The minimum money stated by the sample households as acceptable was Rs. 200 as against to the maximum of Rs. 15000 per annum. On the other hand the responses (39 households) of willingness to accept money as compensation to foregoing medicinal plant benefits were cross checked by further probing the respondents a question like in case, you prefer other than money as compensation what kind of compensation you expect? For this question, out of 39 accepted responses, about 17 families (43.5%) were even ready to accept other kinds of compensation in terms of other than money (kind) as a compensation to forego the medicinal plants collected from the forests have been in the form of opportunity cost of medicinal plants that they substitute only if, other similar benefits are provided to forego the present one, the respondents were ready to accept other mode of (kind) compensation in the form of 'free medical treatment/facilities or opening health center/hospitals nearby their villages' (82.4%) and 'rising medicinal garden/plantation/cultivation in the forest areas (11.8), so as to ensure the health risks, that may

rise due to foregoing medicinal plants utilisation/benefits from the forests of ANP (see Table -5). These inferences also substantiate the forest dweller's high value towards medicinal plants.

(Table No. 5. Willing to accept other mode/kinds of compensations along with money. Should be here)

Further, we tried to identify the reasons for those who said 'No' (51) to accept compensation to forego medicinal plant benefits. The questions kept as open and they were asked to identify around 4 reasons out of the 'No' responses, about 66.7 percent of the respondents were rigid in their view that 'they need the plant for medicine and bring them for daily use, don't accept compensation', therefore, we do not forego the medicinal plant collection/benefits. This is statistically significant when we modeled WTA response as 'NO'. About 7.8 percent of the 'NO' respondents, themselves regret that 'they are not legally eligible to ask compensation', because they are aware of the collection of medicinal plant from the protected forests are illegal. From the table no. 6 about 17.6 percent have said that 'they bring medicinal plants from nearby/roadsides or they stop collection of medicinal plants, but don't accept any compensation.

(Table No. 6. Reasons for not willing to accept compensation for foregoing Medicinal Plants benefits. Should be here)

3.2.2. Estimates of 'Willingness to Pay' (WTP): As earlier stated, for value elicitation we have used dichotomous responses which seek YES or NO responses and also the open-ended method is followed to get the willingness to pay responses. We used willingness to pay question only to those who were aware of the use of the good (medicinal plants) at the individual and household level to derive the responses. To elicit the reliable willingness to pay responses. We changed the scenario just opposite to the earlier scenario and presented to elicit the dwellers responses. That reads as;

> ☞ *"Suppose you are allowed to collect Medicinal plants for treating primary health requirements (rights given for domestic consumption) you will be gaining benefits out of the plants use for your health requirements and at the same time you will be saving the amount that had to go for alternate medical treatments including traveling, consultancy fee for doctors medicines costs etc."*
>
> *In this case are you voluntarily ready to pay some amount for the benefit from medicinal plants, that, you are using now? Tick YES/NO*

For this question about 37 (40.7%) households have showed their maximum willing -ness to pay money for retaining the use of medicinal plants. About 59.3 percent of the households who use plants as a source of medicine were reluctant to pay for medicinal plant benefits. Figure no. 4.

(Figure No. 4.   Percentage of households' preferred willing/Not Willing to Pay for retain the medicinal plants benefits. Should be here)

Theoretical Justification and WTP: The contingent valuation method is used to value people's preferences towards conservation of medicinal plants biodiversity, in the present case, it is applied to estimate the willingness to Pay of the forest dwellers, so as to retain the benefits from medicinal plants that they are enjoying presently. Theoretically, it is argued that the amount of money the respondents would be willing to pay to avoid a reduction in the provision of an environmental good assumes that the individual either has to accept the less preferred situation or has to pay to avoid it. In the context of medicinal plants, the respondent/beneficiary would be willing to pay to retain the medicinal benefits presently being enjoyed from the collection and use, otherwise should be ready to lose the benefits. Thus, in Hicksian terminology, the reference level of welfare is not the less preferred situation, but the proposed welfare level. Therefore, it can be considered as a Hicksian equivalent measure (Brookshire et al, 1980). It has been observed that the willingness to pay can arise due to various motives of the individual towards the retaining or conservation of resource (Hoevenagel, 1994).

In the present study, the respondents were asked whether they were willing to pay for retaining the benefits of medicinal plants use in their personal health. It is assumed, that the respondents payment not only prevents further loss of medicinal plants in the park, but also improves the medicinal plants diversity.   It is also assumed that a respondent would be willing to pay if he perceived a welfare improvement by supporting conservation activities aimed at avoiding further loss of medicinal plant diversity in the park. Since, the stated willingness to pay to avoid the less preferred situation (losing the benefits of medicinal plants diversity in the Anshi National Park) has been converted into monetary terms; it can be interpreted as an equivalent variation measure of welfare arising out of their risk averting behavior. Therefore, the value to avoid the uncertainties involved in the supply of goods and services from medicinal plant diversity of the Anshi Nationl Park as a result of loss of plant species that are available for

present and future medicinal uses. In other words, it can be the value for maintaining the existing stock and continued availability of goods and services of medicinal plants biodiversity.

Willingness to Pay Function: Tribal derives considerable medicinal plants benefits from the Anshi National Park. For instance, a high biologically diversified area provides various benefits for forest dwellers, such as livelihood benefits from medicinal plants collection and sale, and the use of various plants as source medicine and health care repository. Because of these benefits of the ecosystem also influence forest dweller's or more encourage people to retain the benefits even if, it costs, the dwellers are rational and seek to maintain and improve their welfare levels, that they presently enjoying, therefore, they would be willing to pay to retain the benefits of medicinal plants for continuous use. Therefore, the conservation or improvement of medicinal plants diversity of the ANPcan have a positive impact on the welfare of the people living inside the park. Hence, people may value their preference for the continuous use of this diversity through the payments. This indicates that, the use value of plant diversity to forest dwellers is much higher. If they, loose these benefits, they may have to incur high cost to substitute the same benefits, as a result, the forest dwellers would be willing to pay for medicinal plants that they are using presently. Consequently, we decided to model the "YES" responses to 'Willingness to Pay' for the benefits of medicinal plant use.

It is hypothesized that those who have a higher use value for medicinal plants are ready to 'willing to pay' for them for continued access and for collection of the plants. Therefore in the analysis, the elicited 'Yes' or 'No' responses in terms of their 'willingness to pay' to retain the medicinal plant use were coded to generate a dummy dependent variable. The dummy variable represents '1' if the respondent said 'Yes' for 'Willing to Pay' and '0' if the respondent said 'NO' that is not willing to pay for retaining the benefits. The zero values occurred mainly due to various income and time constraints of the individual and not because of any protest. Treatment of these zero values is an important aspect in the analysis of 'willingness to pay' function. It is important to point out that about 40.7 per cent medicinal plants users responded as 'YES' or other word, they are willing to pay to retaining the benefits of medicinal plants use. 59.3 per cent of the 91 respondents were not ready to pay to retain the medicinal plants benefits by preferring 'NO' responses (figure. No. 4) Since, the respondent's response is a discrete variable,

we have used a logit model to analyze the data to find out the socio economic characteristics of the respondents who said 'YES' . The estimable logit equation can be specified as follows:

$$L_i = \left(\frac{p_i}{1-P_i}\right) = \alpha + \beta_1 \text{Family Size} + \beta_2 \text{Caste} + \beta_3 \text{ Income from MPs} + \beta_4 \text{Education} + \varepsilon$$

Where α is a constant, βs are co-efficient of each variable and ε is the error term.

Choice of variables Included in the Logit Model; The descriptive statistics of the variables used to model valuation function is presented in the table no 7. The variables were selected in such a way that it captures various aspects of the respondents' individual or household characteristics. First, reasons for the selection of variables and the expected signs of their coefficients in the regression. 'Caste' represents the social status of the household. In this case 'caste' is defined as a dummy variable which takes value 1, if the respondent belongs to Kunabi community and zero otherwise. It is assumed that the Kunabi community which is the largest homogenous group engaged in medicinal plant collection are willing to pay to retain the benefits of medicinal plants. During informal discussions with the respondents, plant collectors from Kunabi community expressed the importance of medicinal plant in maintaining their health needs. The other variables include are, Income of medicinal plants and family size of the sample households are also considered in the WTP function. Based on Rapid Rural Appraisal and discussion with forest official and village leaders, the income received from collection/consumption/sales of medicinal plants may significantly influence WTP function; we expected positive sign for this variable. Therefore, there is a high likelihood of responding 'YES' to the willingness to pay for the benefit of medicinal plants. Because the medicinal plants provide meaningful input to their health related problems and even supports livelihoods of the forest dwellers.   Education of the respondent also can influence the "YES" responses function positively because educated people might be more aware of the use value of medicinal plant resources.

(Table No-7. Descriptive Statistics of the Variables used in 'Willingness to Pay Function' of the Logit Model. Should be here)

Results of Logit analysis for Willingness to Pay: Table No.8 Presents the maximum likelihood estimates of the Logit regression. The Logit Model explains the variations in the responses to the contingent valuation questions. From the model, Income from Medicinal plants is statistically

significant and the coefficient of the variable shows a positive relationship with the 'willingness to pay'. The coefficients of the variable that found to be statistically significant at higher level, is only the variable 'income from the medicinal plants', this variable meets the expected sign. For instances, it has been found that those sample households extract more quantity of medicinal plant products as a means of medicine as well as an incentive to secure their livelihoods were willing to pay to retain the benefit of these plants and plants products from the forest of Anshi National Park. The analysis shows that, there is high use value of Medicinal plants in the study area, in other words the demand for plants and plant derivatives for medicine is high.

Further, it would be right to assume that the willingness to pay and willingness to accept are mutually exclusive. The decrease in willingness to accept can influence on the increase in willingness to pay. But in reality it is not case, the benefit that the forest dweller derive from collection medicinal plants would not allow them to accept the compensation.

(Table No. 8. Maximum Likelihood Estimates of Willingness to Pay to Retain Access to Medicinal Benefits by the Sample Households of Anshi National Park. Should be here)

On the other hand due to income constrain and free rider attitude, the respondents will not pay for good, though they get income. In the present study both the WTA and WTP responses the 'income from medicinal plants' variable influenced positively. That is, those households derive more income from collection of these medicinal plants will not obviously accept the compensation for foregoing the benefit of medicinal plants. As against, they will be willing to pay to retain the benefits of medicinal plants. Finally, the income from collection of medicinal plants is the major variable that influences WTA/WTP responses positively.

The analysis shows that income derived from the collection of medicinal plants is an important factor influencing willingness to pay to retain the benefit derived from the collection and use of medicinal plants. This cuts across the communities indicating that both tribal and non tribal communities are willing to pay when the income from these sources is high. The hypothesis that willingness to pay increases with increase in the income from collection of medicinal plants has been accepted with the statistically significant coefficient of income in the logit model.

The Mean Willingness to Pay: The estimation of the 'willingness to pay' for the retaining the present use benefits of medicinal plants of the ANP indicates that out of 91 medicinal plant users

37 (40.7%) households preferred 'YES' response. As per the estimations, the average willingness to pay per household per annum works out to Rs. 355, ranging a minimum of Rs. 25 to a maximum of Rs. 3000 per household per year. Theoretically, this value can be interpreted as an equivalent variation measure, since it is a payment with an intention to avoid a less preferred situation (species loss) that is the respondents were not willing to lose the medicinal plants benefits hence, they prefer to pay for the good. In other words the respondents would be willing to retain the present benefits that they are already enjoying.

Indicators for high Willingness to Pay: The willingness to pay has been re-examined that what would have been the indicator behind their high willingness to pay. From the Table No. 9 the most obvious and important reason given by the respondents was to requirement/oopportunity cost of getting Medicine is high(62.2%) and 'No side effects with the use of Medicinal plants (5.4 %), these are the main reason why the respondents were ready to pay for medicinal plants. For both of these two reasons about 27 percent of the sample households were ready to pay money to retain the existing benefits that they are availing from the forest. From the analysis it is clear that the willingness pay for medicinal

(Table No. 9. Major Indicators for high Willingness to Pay for foregoing Medicinal plant benefits. Should be here)

plants is mainly due to "Opportunity Cost of getting Medicine outside forest is high, and "No Side effects of the use of Medicinal Plant ", based on these benefits, the forest dwellers were ready to pay for Medicinal Plants that they are already using" in the study area. Another reason is 'difficulty in accessing modern medicine (Primary Health Centres /PHCs)". Apart from all the above, there is an important indicator that is income generated from collection and sale of medicinal plants that is statistically proven.

Reasons for not willing to pay for medicinal plants benefits: The reasons for those who were not ready to pay for the benefits were also identified. According the responses they claimed that, the collection of medicinal plants is as their own right. (29.7%) if so, there is no question of payment for collection. Therefore, the respondents were not ready to pay for medicinal plants. About 20.4 percent of them have said that they are not collecting plants for the sales purpose, but collect only for the consumption purpose, therefore it is said that they will not pay for the rights (bonafide consumption is permitted) that they are already enjoying. See Table no. 10.

(Table No. 10. Reasons for not-willing to pay for medicinal plants benefits. Should be here)

4   Summary and Conclusion:

The human pressures on the protected areas, which are designated for *in situ* biodiversity conservation, reconcile the need for conservation. Thus, addressing this issues is important as most of the protected areas in India are under threat due to the over exploitation. Thus, probing into these issues will help in identifying the various aspects that must be taken into account at micro or local level while designing conservation polices at the state and national levels. Keeping in view of the above the present study had made an effort to value medicinal plants diversity within the Anshi National Park in the Western Ghat Region of Karnataka. The valuation has been carried out to provide economic information on the resources while, designing conservation policies in the protected area management.

The study considers various consumer's preferential approaches to the value medicinal plant biodiversity in Anshi National Park, Uttara Kannada district of Karnataka after due consideration of the rights of the forest dwellers and biodiversity conservation of the park.   This study has been carried out mainly to estimate the non market value of medicinal plants (MPs) that are utilised by forest dwellers of protected forest as means of primary medicine and as well as livelihood options. The study finds that Anshi National Park is under pressure even though it has declared as protected area (the rights given to dweller's is de-facto access rights-bone fide use) and the biodiversity of park is deteriorating is mainly because of destructive harvesting and illegal sale of medicinal plants. The majority of the people living in Anshi National Park involved in collection of medicinal plants in an illegal manner due mainly generating additional income from the sale of these produces. Kunibies are the single major homogeneous group in terms of their forest dependence/medicinal plant collection in the park and they were reluctant to accept compensation as they scared of losing the present benefits that they are getting from being inside the Prak .

The study also examined the economic value that people place (Willing to Pay) to avoid further loss of medicinal plant biodiversity or degradation of protected areas. The analysis shows that income derived from the collection of medicinal plants is an important factor influencing willingness to pay to retain the benefit derived from the collection and use of medicinal plants. This cuts across the communities indicating that both tribal and non tribal communities are willing to pay when the income from these sources is high. The hypothesis that willingness to

pay increases with increase in the income from collection of medicinal plants has been accepted with the statistically significant coefficient of income in the logit model. From the analysis it is also clear that the willingness pay for medicinal plants is mainly due to "Opportunity Cost of getting Medicine outside forest is high, and "No Side effects of the use of Medicinal Plant ", based on these benefits, the forest dwellers were ready to pay for Medicinal Plants that they are already using" in the study area. Another reason is 'difficulty in accessing modern medicine (Primary Health Centres /PHCs)". Apart from all the above, there is an important indicator that is income generated from collection and sale of medicinal plants that is statistically proven.

With above findings it is to conclude that, since there is conflict between the state authorities and local people in the protected areas over the use of forest resources, the biodiversity conservation polices and programmers seek people's participation in various conservation activities. Therefore, recognizing the rights of the forest dwellers and biodiversity conservation of the park the involvement of forest dwellers in biodiversity conservation activities becomes essential as the study finds that the forest dwellers have placed high value (willingness to pay) to retain the present and futuristic benefits of medicinal plants collection. Thus, involvement of forest dwellers in biodiversity conservation activities would be a better alternative option before policy makers for the sustainable management of medicinal plants biodiversity in the park along with protecting the livelihoods (well-being) of the forests dwellers.

Tables in the Text

Table No. 1. List of threatened Medicinal plants

Kannada Name of plant	Botanical name of the plants	Threat status
Ashwagandha	*Withania Somnifera*	EN
Amla/Nelli	*Emblica Officinalis*	VN
Glory Lily,Akka Tangi Balli,Gouri Adde, Huliuguru, Shivashakthiballi	*Gloriosa Superba L.*	VN
Tapping Halmaddi, Hagada (Dhopda) Mara (Collection Banned)	*Vateria Indica L. Ailanthus Malabaricum*	VN
Murgala Gida, Dhupada Mara, Kokum	*Garcinia Indica*	VN
Alale Kaayi	*Terminalia Chebula*	
Sarpagandha	*Rauvolfia Serpentina*	EN
Vaividang, Vaayu Vilanga	*Embelia Ribes*	VN
Maradarshinia, Arishina Balli	*Coscinium Fenestratum.*	CR
Kodampuli, Ardala, Uppage Mara	*Garcinia Cambogia*	NT

Note: CR- Critically endangered, EN-Endangered, VU-Vulnerable, EX/EW-Extinct in Wild, EX-Extinct, NT-Near Threatened.
Source: FRLHT database, Bangalore.

Table- No. 2. Reasons for the importance to conserve Medicinal Plants

sn	Reasons as to why Medicinal plants are important to the sample households. because;	Impor tant	Indiffe rent	Not Import ant	Total	Rank Position
1	Plants are the primary sources of medicine, They provide medicine to treat our health related problems.	194 (99.00)	2 (1.0)	(0.0)	196 (100.0)	1
2	Medicinal plants give meaning full input to medicine (drugs)	184 (94.00)	11 (5.6)	1 (0.5)	196 (100.0)	3
3	We may find new drugs in future	171 (87.3)	19 (9.7)	6 (3.1)	196 (100.0)	5
4	They are the lively hoods for us. They generate income for us.	145 (73.9)	25 (12.8)	26 (13.3)	196 (100.0)	7
5	They have their own right to exist regardless of their use to us.	172 (87.8	17 (8.7)	7 (3.6)	196 (100.0)	6
6	They have the ritual, cultural and spiritual value in our lives.	182 (92.8)	13 (6.6)	1 (0.5)	196 (100.0)	4
7	They have an esthetic and recreational value	133 (67.9)	55 (28.1)	8 (4.1)	196 (100.0)	8
8	Medicinal plants has education value	67 (45.2)	59 (30.1)	47 (24.0)	196 (100.0)	10
9	Medicinal plants has timber value and non timber value	105 (53.6)	49 (25.0)	42 (21.5)	196 (100.0)	9
10	We have to conserve medicinal plants for future generation	192 (98.0)	1 (0.5)	3 (1.5)	196 (100.0)	2

Source: Primary Survey

Table No 3.   Descriptive Statistics of the Variables used in 'Willingness to Accept' Compensation of the Logit Model

Variables	Mean	Std. Deviation
Willingness to Accept to forego medicinal plants benefits. Where Yes =1; No=0	0.43	0.50
Age of the respondents	39.40	13.16
Caste of the respondents Dummy, where tribes=1, others=0	0.74	0.44
Total land (in acres)	5.38	6.53
Education of the respondents Dummy, where literate=1, illiterate=0	0.91	0.28
Sex of the respondents Dummy, where male=1, Female =0	0.97	0.18

Source: Primary Survey

Table No. 4. The Estimated Logit Model of 'Willingness to Accept' for Medicinal Plants

WTACMP	Co-Efficient.	Standard. Error.	t-ratio z	P Value P>|z|	[95% Conf. Interval]	
Constant	-4.00	1.92	-2.08	0.04	-7.76	-0.24
Caste of the respondents Dummy, where Kunabi =1, others=0	1.31	0.56	2.35	0.02	0.22	2.41
Age of the respondents (in Years)	0.03	0.02	1.54	0.04	-0.01	0.06
Education of the respondents Dummy, where literate=1, illiterate=0	0.44	0.69	0.63	0.53	-0.92	1.80
Total land (in acres)	0.08	0.04	1.89	0.06	0.00	2.17
Sex of the respondents Dummy, where male=1, Female =0	1.46	1.36	1.07	0.29	-1.21	4.13

Number of Observations   =   91
Likelihood Ratio chi2(5)   =   10.91
Prob > chi2   =   0.05
Pseudo R2   =   0.08
Log likelihood   =   -56.69

Source: Primary Survey

Table No. 5. Willing to accept other mode/kinds of compensations along with money

Land Holding sizes	Give us free medical treatments / open hospitals near village	Rising garden/plantation in/cultivation of medicinal plants inside the forest patches.	Others	Total
No land	0.0	0.0	0.0	0
Marginal holdings (0.01 to 2.47 acre)	85.7	0.0	14.3	7
Small holding ((2.48 acre to 4.94 acre)	100.0	0.0	0.0	2
Semi medium holdings (4.95 acre to 9.98 acre)	66.7	33.3	0.0	6
Medium holding (9.99 acre to 24.70 acre)	100.0	0.0	0.0	2
Large holding (24.71 acre &above)	0.0	0.0	0.0	0
Total	82.4	11.8	5.9	17

Source; Primary Survey

Table No. 6. Reasons for not willing to accept compensation for foregoing Medicinal Plants benefits.

Land Holding Size	We are not legally eligible to ask compensation	we not using MP,s for sales purpose	we need plant for medicine don't accept Compensation	others (we bring from road side, not from forest, we stop collection)	Total
No land	0.0	0.0	100.0	0.0	7
Marginal holdings (0.01 to 2.47 acre)	9.1	9.1	63.7	18.2	11
Small holding ((2.48 acre to 4.94 acre)	7.1	0.0	64.3	28.6	14
Semi medium holdings (4.95 acre to 9.98 acre)	20.0	20.0	40.0	20.0	10
Medium holding (9.99 acre to 24.70 acre)	0.0	14.3	71.5	14.3	7
Large holding (24.71 acre &above)	0.0	0.0	100.0	0.0	2
Total	7.8	7.8	66.7	17.6	51

Source: Primary Survey

Table No-7. Descriptive Statistics of the Variables used in 'Willingness to Pay Function' of the Logit Model.

Variables	Mean	Std. Deviation
Willingness to Pay to retain the medicinal plants benefits. Where Yes =1; No=0	0.41	0.49
Caste of the respondents Dummy, where tribes=1, others=0	0.74	0.44
Income from Medicinal plants (in Rupees)	6914.29	8635.134
Family Size (in numbers)	6.55	3.854
Education of the respondents Dummy, where literate=1, illiterate=0	0.91	0.28

Source: Primary Survey

Table No. 8. Maximum Likelihood Estimates of Willingness to Pay to Retain Access to Medicinal Benefits by the Sample Households of Anshi National Park

WTPMP	Co-Efficient.	Standard. Error.	t-ratio z	P Value P>|z|	[95% Conf. Interval]	
Constant	0.22	0.84	0.26	0.79	-1.42	1.86
Caste of the respondents Dummy, where Kunabi =1, others=0	-0.18	0.52	-0.35	0.73	-1.21	0.84
Income from medicinal plants (in Rs.)	0.00	0.00	2.99	0.00	2.00	0.00
Family Size (in numbers)	-0.13	0.08	-1.66	0.10	-0.28	0.02
Education of the respondents Dummy, where literate=1, illiterate=0	-0.78	0.69	-1.13	0.26	-2.12	0.57

Number of Observations   =   91
Likelihood Ratio chi2(4)   =   16.18
Prob > chi2   =   0.0028
Pseudo R2   =   0.1316
Log likelihood   =   -53.39142

Source: Primary Survey

Table No. 9. Major Indicators for high Willingness to Pay for foregoing medicinal plant benefits.

Land Holdings	Opportunity Cost of Getting Medicine is high we Pay for MP	No side effects with MP use, ensured relability On plant for medicine	Others (easy Accecs to forest based Medicine, etc.)	total
Marginal holdings (0.01 to 2.47 acre)	66.7	25	8.3	12
Small holding (2.48 acre to 4.94 acre)	50	50	0	8
Semi medium holdings (4.95 acre to 9.98 acre)	69.2	23.1	7.7	13
Medium holding (9.99 acre to 24.70 acre)	50	50	0	4
Large holding (24.71 acre &above)	0	0	0	0
Total	62.2	32.4	5.4	37

Source: Primary Survey

Table No. 10. Reasons for not-willing to pay for medicinal plants benefits.

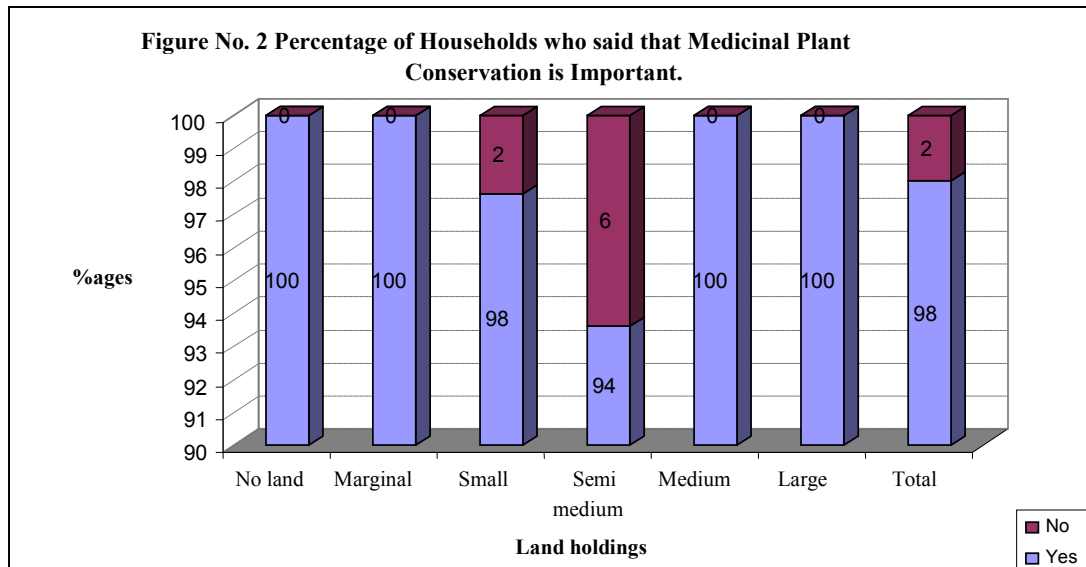| Size of Land holdings	MP collection is our right don't pay	Don't have money and time	we don't sale MPs	Others	Total
No land	0	14.3	14.3	71.4	7
Marginal holdings (0.01 to 2.47 acre)	35.3	0	29.4	35.3	17
Small holding (2.48 acre to 4.94 acre)	11.1	0	0	88.9	9
Semi medium holdings (4.95 acre to 9.98 acre)	45.5	0	18.2	36.4	11
Medium holding (9.99 acre to 24.70 acre)	42.9	0	42.9	14.3	7
Large holding (24.71 acre &above)	33.3	0	0	66.7	3
Total	29.7	1.9	20.4	48.1	54

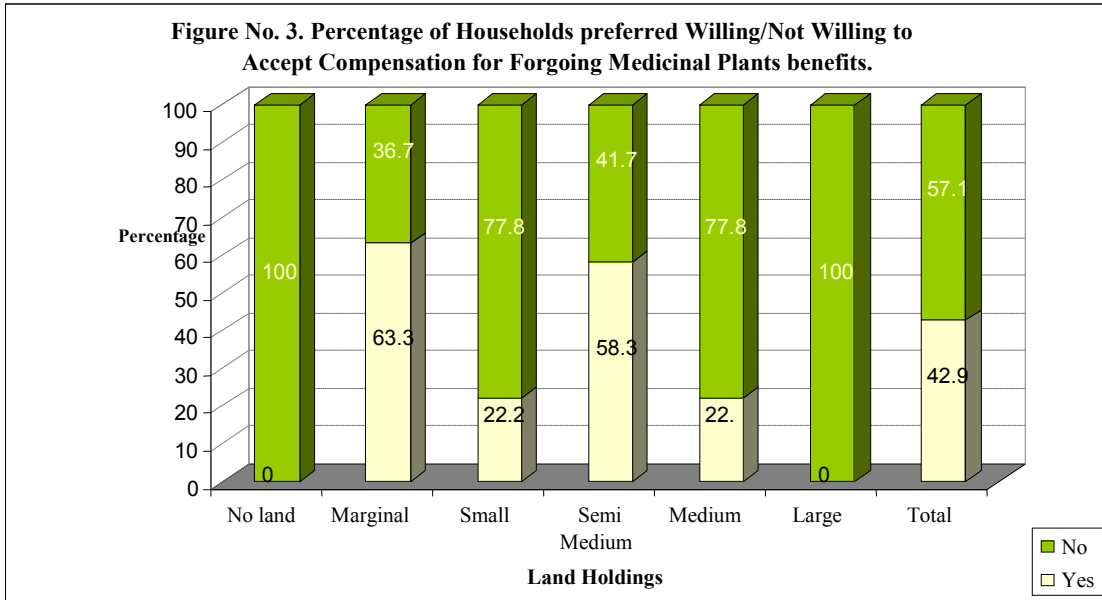Source: Primary Survey

Figures in the Text
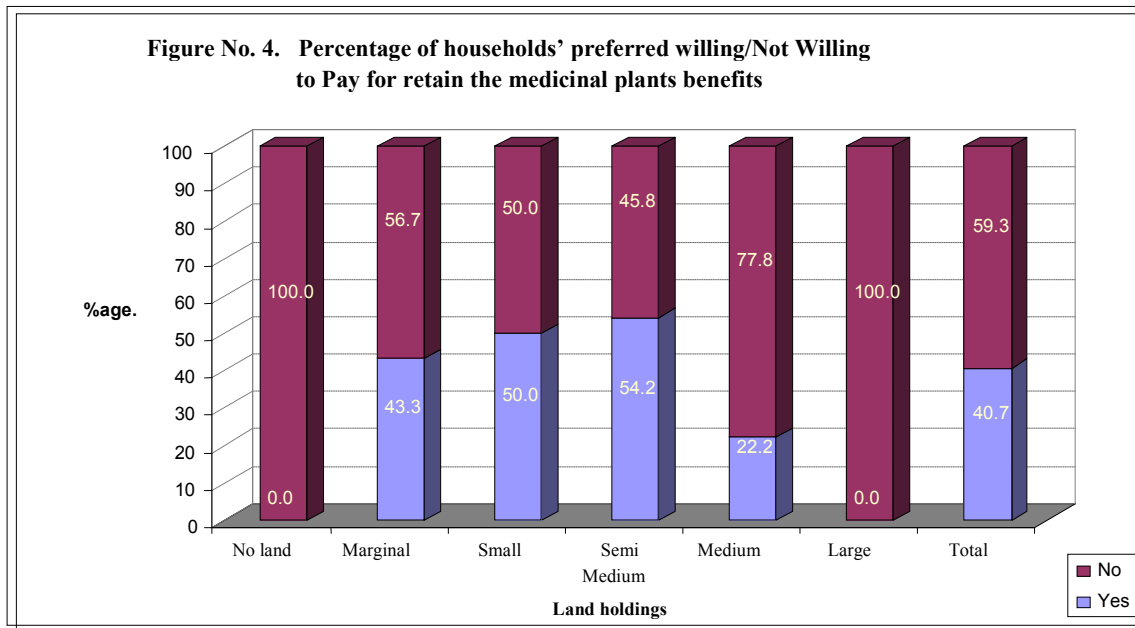
Figure 1. Location map of Anshi National Park

Source; Divisional Forest Office, Dandeli.

Source: Primary Survey.

Figure No. 3. Percentage of Households preferred Willing/Not Willing to Accept Compensation for Forgoing Medicinal Plants benefits.

Source: Primary Survey

Figure No. 4.   Percentage of households' preferred willing/Not Willing to Pay for retain the medicinal plants benefits

Source: Primary Survey

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Notes:

[1] According to the IUCN (2000) Red Data list, 8000 plants species have identified as medicinal values in India and out of them about 200 plants have been red listed. It is however estimated that around a 1000 species of medicinal plants must actually be facing threat to their existence in the wild (IUCN, 1997). About 112 Red listed medicinal plants are found threatened in southern India, out of them 58 (60%) of the endangered medicinal plant species are in Uttara Kannada alone (Subhash, 2000).

[2] Resilience means what Holling (1973) defines as the capacity of the system to recover from prturbations, shocks and surprises, through absorbing them.

[3] Dasgupta (1996;9) gives a theoretical argument with respect to the intergeneration resource allocation problem. It is mentioned that the problems arising from an absence of forward markets in the distant future are no doubt ameliorated by the fact that we care about our children's well-being and know that they, in turn. Will care for theirs. And soon. Down the generations.

[4] Mitchell and Carson (1989) also argue that people enter into contingent valuation with a holistic value judgment on environmental good rather than with explicit decomposed value judgment.

[5] State Forest Deportment, Government of Karnataka, 1969.

[6] The most important criterion for choosing between the 'wiliness to pay' and 'willingness to accept' is that of property right. 'Willingness to Accept is the appropriate format if the surveyed population holds the rights of the good under consideration. Mitchell and Carson (1989) suggest that perceive property right may be more important than actual right. Since the withdrawal right is perceived as de-facto in nature, the appropriate format would be 'wiliness to accept' rather than 'willingness to pay'

[7] In order to maintain the forest and to ensure the continued availability of goods and services form the forest, some part of the total economic value of the forest must be set aside that would yield the same income during the expected life of the resource and after the current stock of the resource is used up. This sets aside portion that is the cost of maintaining the option of continued availability of goods and services. i.e. the option value of forest resources (Chopra 1993)

[8] In the study area Kunabi's are considered as tribes (based on their ethnic composition period of origin settlement, occupation, behavior, as the residence of the forests etc).and all other castes are not.

[9] Data have been analyzed using the software 'STATA'.