

**THE EFFECT OF NATURAL RESOURCE SCARCITY ON HOUSEHOLD'S AND
WOMEN'S TIME ALLOCATION DECISIONS IN RURAL INDIA**

**Proposal submitted to
The South Asian Network for Development and Environmental Economics**

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Summary: This project will examine the impact of scarcity of natural resource stocks, namely, groundwater, fodder and forest on time allocation decisions by households, and by women in particular, in rural India. It will also analyze their coping strategies when faced with scarcity of resource stocks as well as the impact on coping behavior of social norms and natural resource management initiatives such as watershed development and community forestry. This will be accomplished through purpose collected primary and secondary qualitative and quantitative data and analyzing it through statistical techniques and with insights from social anthropology.

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A-B. Research Problem and Study Goals

With 1 out of every 5 people in the world living in extreme economic poverty (defined as living on less than \$1 per day), poverty alleviation continues to be one of the greatest challenges facing the world today. At the same time, closing the gender gap in access to income-generating activities has come to be widely recognized as an important tool to alleviate poverty. Increases in women's incomes are disproportionately invested in improved education, health, and nutrition, not only of themselves, but also their children (see, for example, the World Bank's 1995 report *Toward Gender Equality: The Role of Public Policy*), leading to further improvements in household incomes.

Women, though, especially in rural areas, are often not able to spend time in income-generating activities. One oft-cited reason for this is the lack of access to adequate water and firewood. In most households, women, and girls, are the primary collectors of such natural resources. In some developing countries, girls spend more than seven times as many hours collecting wood and water as compared to men and a study by the World Health Organization estimates that the energy used to carry water consumes one-third of a women's daily calorie intake (Centre for Science and Environment 2004). It is conjectured that deforestation and water scarcity force women to spend more time in the pursuit of these household necessities and less time in income-generating activities. Girls are often said to become the first casualties of resource scarcity, as they are more susceptible to be taken out of school to assist their mothers in resource collection or household chores.¹

In view of the potential impact that resource scarcity can have on women's and the household's time allocation decisions, and on their ability to spend time in income-generating activities, we propose to examine whether resource degradation in fact causes women to spend more time in resource collection and, the household as a whole, less time in income-generating activities. If say households, in response to resource degradation, increase the amount of the time allocated to resource collection, then we propose to understand what activity the extra time is drawn from, and whether this results in the household spending less time in income-generating activities. To the extent that natural resource degradation causes households to spend less time in income-generating activities, policies to improve the stock of natural resources in the village will enable the household to spend more time in income generating activities with subsequent welfare implications.²

¹While we recognize that men and children are also involved in resource collection, in this study we have chosen to focus on the impact of natural resource degradation on women because women tend to be the primary collectors.

²Ideally we would want to know the welfare implications for the household that result from a change in the stock of natural resources. This in turn requires one to estimate the impact of a change in the stock of natural resources on household incomes. While in this project we are looking at one process of adjustment, via labor allocations, through which changes in natural resources affect income, we are ignoring adjustments made through changes in the household's asset holdings. Furthermore, we are not taking into account constraints that the household may face that the village level, in the form of governance structures, and prices, that also affect household incomes. A rigorous analysis of the impact of village level constraints on household incomes in fact would require panel data and we are therefore not able to undertake such an exercise at this time.

A priori, though, it is hard to know how resource degradation will impact a household's time allocation decisions. Specifically, four possible coping strategies may be visualized—as is often conjectured, households may spend more time collecting the resource, or they might switch to a private supply of the resource (grow trees on their own land for example), or they may choose to buy the resource by selling their labor, or they may simply reduce the amount of the resource consumed. In practice one could see a combination of one or more of these coping strategies depending on a host of factors specific to the household and exogenous to it. For instance, planting trees would depend *inter alia* on other assets a household possesses such as land, whereas working for a wage would depend on the presence and pervasiveness of labor markets. How households and women cope with scarcity therefore might differ by income strata and/or the amount of landholding. Thus, land-rich households have the ability to switch to a private supply of fuel wood, an option not available to land-poor households. Similarly, richer households are more likely to be able to switch to the market, an option probably not available to poorer, cash-strapped households. Therefore, we also propose to examine how environmental degradation affects household's coping strategies in different income strata and landholding classes.

In this context, i.e. of coping strategies, it is also true that social roles mediate and modify these relationships—there is a large difference in the determinants of male and female time use that is not explained by economic variables (see for instance, Fafchamps and Quisumbing 2003, Kevane and Wydick 2001 and Ilahi 2000). We will supplement our analysis of coping strategies at the household level by examining how women in particular cope with changes in natural resource stocks. For instance, women may effect changes in their lifestyle like cutting back on the use of a particular product, say water (not bathing for days, etc.), or substituting a scarce resource by another (e.g., using more polluting leaf litter or dung cakes for cooking rather than fuel wood). Some of these measures may be triggered by their social role as homemakers. Furthermore, all household decisions are taken in accordance with existing social norms, which find expression in differential allocation of tasks as well as resources. Allocation of certain tasks may constrain other options of practice (Roy and Bencrow 2004). Women's role as caregivers and home makers and men's role as decision makers may affect coping strategies. For example, if there is scarcity of water then there might be options available to buy it from the market but the male members of the household may not be willing to do so thus forcing the womenfolk to travel long distances to fetch water. On the other hand, another way of coping can also be a shift in roles. For example, in northern Jhabua due to scarcity of drinking water, men fetch water from long distances over bicycles or bullock carts. Here the women then have more time to spend in market activities or agricultural tasks.

Two other related objectives will be addressed through our study. First, we will examine the ways in which culturally determined rules or social norms affect the use of materials and of knowledge in a tribal society. For instance, if societal norms forbid collection of a certain plant due to its medicinal, ecological or ceremonial value then that plant will not be collected for firewood use and the total amount of wood available for firewood will be reduced. One such example is the Mahua tree (*Madhuca Indica*). In our study area, the Mahua tree is never lopped for firewood or timber due to its multifarious uses (such as mahua fruit used to make dyes, local liquor, medicines and as supplementary fodder for cattle).³ We will examine

³ This practice is not uncommon—we can observe similar models of conservation at all scales, from individual banyan and peepal trees and small sacred ponds and groves to larger protected areas dispersed throughout the countryside. Not only banyan (*Ficus bengalensis*) and peepal (*Ficus religiosa*), but many other species of the fig genus *Ficus* are venerated and protected over much of India. Ecologists now recognize *Ficus* as a keystone

whether changes in resource availability affect social norms. Are tribal households in deforested area likely to abandon such norms? This analysis will inform the question of how households cope with resource degradation, though from an anthropological point of view.

Second, we will examine the impact that state policies such as Joint Forest Management (JFM) and the Rajiv Gandhi Watershed Mission (RGWM), policies that are intended to improve the stock of natural resource, have had on a household's and a women's time allocation decisions. We will examine the extent to which these policies have enabled women to cope with resource degradation and the possible increase in time devoted to resource collection. Bandyopadhyay and Shyamsundar (2004) conjecture that whether or not a household participates in such state policies affects that household's access to the natural resource base and presumably the household's ability to cope with changes in the resource base. Given this relationship, we will examine whether women are more likely to participate in JFM and RGWM in areas where resources are scarce and whether there are any barriers to their participation.

An important goal of our analysis is to inform the policy debate on whether, and to what extent, improved natural resource management—e.g., reforestation, regeneration of grasslands, building water-conserving structures, can alleviate poverty by increasing the time that households and women spend in income-generating activities. This analysis will be enriched and contextualized by an interdisciplinary and qualitative approach that incorporates anthropological perspectives and a focus on local institutions.

C. Policy Focus

The research problem stated above is particularly relevant in the context of the Millennium Development Goals (MDGs) established by the United Nations, specifically MDG 3 (gender equality). MDG 3 aims to promote gender equality by educating women and integrating them into the monetary economy. It states that women have an enormous impact on the well-being of their families and societies – yet their potential is not realized because of discriminatory social norms, incentives, and legal institutions. A corresponding target of the MDGs is to eliminate gender disparity in primary and secondary education by 2005 and for all levels of education by 2015. In the context of our study if households in general, and women in particular, spend more time collecting natural resources as a result of their scarcity then improved natural resource management can alleviate poverty by making more time available for income-generating activities. It can also promote gender equality by giving women more economic power. Further, an increase in the collection time may force girls to drop out of school to assist their mothers in household and other chores, thus hindering their education. Hence, it is possible that improvement in the natural resource base may give girls more time for education. Thus, our study contributes to achieving the above stated MDG.

The study additionally focuses on some aspects of the effectiveness of local policy initiatives such as JFM and Watershed Development programmes. In Madhya Pradesh (M.P.), where our study site is located, these initiatives have been implemented under the aegis of the Rajiv Gandhi Watershed Mission (RGWM) and the related schemes of Food Security Mission and 'Shiksha Abhiyan' (education schemes) (GoMP 2002). The district of Jhabua in M.P., our study site, has seen the largest expenditure of public funds for watershed programmes among all 48 districts in the state. In this context, it is important to examine the impact of these programs in terms of the improvements in the lives of rural households. We propose to do so by

resource; i.e., a living resource that supports the continued persistence of a large number of other species (Gadgil 2002, Malhotra et al. 2001).

considering the extent to which these programs have enabled women to cope with changes in the stock of natural resources.

D. Literature review

The economic literature on a household's time allocation decisions was first developed by Becker (1965) and then later by Gronau (1977, 1986). In the Becker model preferences are represented by its utility function. In order to fully understand the concept of time allocation we need to look at the literature on the household economy, specifically on intra household resource allocation (Rosenzweig and Wolpin 1982). Any policy initiative that is designed for a single objective can have multiple consequences often unanticipated by policy makers (Haddad et. al 1997). The model of intra household resource allocation has proven to be a powerful policy tool and can readily be adapted to explain complex patterns of intra household inequality (Pitt, Rosenzweig and Hassan 1990). In view of the implications for intra household resource allocation, household bargaining models hypothesize that maximization of aggregate welfare of the household can in fact increase gender inequalities (Dasgupta, 1993). Therefore, the literature on intra household resource allocation gives a better insight into the roles played by household members that subsequently affects the time allocation decisions at the gender level. The policy implications of this are that persons, not households should be the targets of public policy. Looking at the evidence provided by the intra household literature, women and children form vulnerable groups whose needs might not be addressed if the public policies focus on household and not individual welfare.

Becker and Gronau extended the conventional labor supply model of consumption and leisure by incorporating home production as another activity that requires human labor. They argued that women's work at home should be valued in a similar way as market work, and that work-at-home responded to economic incentives such as changes in market wage, unearned income and productivity of work at home, much the same way as work in the market. This basic model has, in recent years, been used in a handful of studies to analyze the issue of how resource degradation affects women's and the household's time allocation decisions.⁴

One of the first studies was done by Kumar and Hotchkiss (1988) using data from the Nepal Energy and Nutrition Survey (NENS 1982-83), a year-long survey of 120 households in three hill districts of rural Nepal. Kumar and Hotchkiss examine the effects of deforestation (measured in their study by the time spent collecting fuel) on time allocation decisions, agricultural output, food consumption, and nutrition. The study finds that when deforestation increases by 1.0 percent, fuel wood consumption decreases by 0.3 percent, and the time allocated to resource collection increases by 0.6 percent. Assuming a similar response for other essential forest products, the collection time for fuel wood, leaf fodder, and grass was found to increase by 1.13 hours per day per woman due to deforestation. As a result of this, women's farm labor declined by 1.4 hours per day per person, or by nearly 50 percent. The study found that this decrease was not compensated for by an increase in wage labor or by men's labor, which was also likely to decrease.

Also using data from the Nepal Energy and Nutrition Survey (NENS 1982-83) Cooke (1998a) seeks to determine whether collection time is higher when environmental products are scarcer and whether there are gender differences with regard to time allocation. Scarcity of

⁴More generally, studies such as Bluffstone (1995), Amacher et al. (1996, 1999) and Pattanayak et al. (2004) examine related issues like fuel wood collection, labor markets and household time allocation decisions. For a survey of empirical literature on intra-household allocation of time in general see Ilahi (2000).

environmental products collected by households, mostly by women--namely, fuel wood, cut grass, fodder and water--is captured through an increase in their respective shadow price. This variable is defined by Cooke as the ratio of market wage to the marginal product of time spent in environmental good collection. Cooke finds that when environmental products become scarce (that is, when their 'shadow price' increases) households spend more time in their collection. Furthermore, she finds that increases in household time spent collecting environmental products come predominantly from women's time--increases in women's collection time account for over 80% of total collection time increase. The conclusion holds after accounting for seasonal variation.

In a companion paper Cooke (1998b) examines the impact of resource scarcity on time spent in agriculture by men, women and the household as a whole. The paper finds that households (women in particular) do not necessarily spend less time in agricultural tasks as the cost of environmental products goes up and as more time is spent collecting them. In fact, for one such good (water) the study finds an increase in the shadow price of water leads to an increase in female, male and household agricultural labor input. With regard to environmental products Cooke argues by corollary since women in particular reallocate their time when these goods are more costly—they spend significantly more time collecting when shadow prices are higher--most of the reallocated time must come from another productive activity (other than agriculture) or from leisure.

Finally, a study by Ilahi and Grimard (2000) of rural Pakistan households, using data from the Pakistan Integrated Household Survey of 1991 investigates how access to water in infrastructure affects the time women allocate to market oriented activities, water collection, and to leisure. The authors find that as access to water deteriorates, on the one hand the probability that women collect water from a common source decreases but on the other the time devoted to collection by women who continue to collect, due to lack of alternatives, increases. Furthermore, deterioration in the access to water induces women to reduce their market-oriented work and thus implicitly their contribution to household income. The study, however, is unable to say anything about the effect of access to water on poverty because the countervailing effects on labor supply of male household members are not assessed by the study.

Our study hopes to build on, but also to improve on, the above studies in the following respects. First, both Kumar and Hotchkiss (1988) and Ilahi and Grimard (2000) focus on a single resource stock (forest biomass and water infrastructure, respectively) whereas our study will consider stocks of three inter-related resources, namely, water, forests and fodder biomass. Second, studies using the Nepal dataset may not be representative of rural settings in developing countries—it is more a special case of a peasant agricultural system with little hired labor. It is not clear *a priori* whether the conclusions would hold in settings where labor markets function well such as our study area. Third, all four studies are marred by their reliance on a highly indirect (and clearly endogenous) right-hand side measures of resource availability. Kumar and Hotchkiss (1988) use the time needed to collect a fixed quantity (20 kilograms) of fuel wood as their measure of timber scarcity. This measure is clearly endogenous and is used to explain the time allocated to firewood collection by the household. Similarly, Cooke (1998a and 1998b) uses the time it takes a household to collect a unit of the product (reciprocal of the marginal product of time) multiplied by the wage rate as the measure of resource availability. The indirect right hand-side measures of resource scarcity used in the above mentioned studies lead to the problem of endogeneity. As a result of this, the estimates obtained are biased and inconsistent. Our study, on the other hand, will be able to use direct,

physical measures of resource availability.⁵ Fourth, previous studies, with the exception of the study by Ilahi and Grimard, have been unable to look at the question of whether households are able to supplement their needs from private sources, say supply firewood from their own land. Our study on the other hand enables us to explore this dimension. Finally, the studies mentioned above are unable to distinguish the impact of resource degradation on women's time in different income strata. Our data permits us to examine how women in different income strata as well as varying landholding sizes are affected by scarcity of natural resources.

Traditional economic theory and Becker-Gronau type models, however, do not fully explain the allocation of male and female time—social roles and norms also play an important role (Ilahi 2000).⁶ In addition, ethnicity can influence social norms that, in turn, determine allocation of women's time, as Kevane and Wydick (2001) show in their study of the Mossi and Bwa tribes in Burkina Faso. Women in southwestern Burkina Faso divide their labor time between working on their husbands' fields, working in independent income-generating economic activities, and working at home. Normally, one would expect a woman to respond to higher levels of her husband's farm capital by allocating more time towards work on her husband's field. The study, however, finds that this responsiveness will vary across ethnic groups that have different norms. Using time allocation data from a sample of women in a large market village in southwestern Burkina Faso, it shows that work responsiveness between ethnic groups in the village differs significantly. Whereas the labor input of women on their husband's fields of the less-patriarchal (less rigid-women are at liberty to choose their marriage partners etc.) Bwa ethnic group is quite responsive to the level of their husbands' farm capital, the labor input on a husband's field of women from the more-conservative Mossi ethnic group is relatively invariant with respect to the farm capital of their husbands.

In our study site too, we hope to determine such social norms that influence allocation of women's time. Jhabua tribal society comprising largely the Bhil tribe is egalitarian and decentralized in essence as is reflected in the large scope for love and choice in the Bhil marriage institution- the Bhagoria⁷. Given such a situation, the social norms among Bhils may offer women more choices when it comes to coping strategies like giving them a choice to buy the resource etc. On the other hand the concept of sacred groves⁸ may affect time allocation decisions adversely by restricting their choice.

As with time allocation, the role of social norms in regulating household coping strategies, that include changes in time allocation but also go beyond time allocation and consider changes in

⁵ Ilahi and Jafarey (1998) treat fuel scarcity as endogenous and conduct an instrumental variable analysis. Distance to firewood source is the crucial identifying exclusion restriction that enters the fuel scarcity function but not the time allocation equations. Further, their sample is drawn from all regions of rural Pakistan, thus it includes regions where markets for rural labor exist and function reasonably well. Their results indicate that while a worsening access to firewood increases the time women have to allocate to collection activities, there is no countervailing drop in time allocated to income generating work.

⁶ Fafchamps and Quisumbing (2003) use dummies for the status of an individual within the household hierarchy—or relationship to head (daughter-in-law etc.)— to isolate the effects of roles. Thus, they find daughters-in-law work systematically harder than daughters of comparable age, height and education.

⁷ Bhagoria is a yearly event held at the time around the Hindu festival of *Holi*, wherein a couple may elope with the intention to get married. The marriage is then fixed by the elders of their respective families and bride price is decided in the marketplace in the presence of village elders.

⁸ A patch/stretch of vegetation (trees) dedicated to the local deity where no one is allowed to extract even a blade of grass.

resource allocation and consumption patterns, has been accorded importance in many interdisciplinary studies. Many anthropologists emphasize the role of culture in the management of common pool resources (CPRs) (see for instance, McCay and Acheson 1987). While a community may define resources in economic terms, it could also define them in cultural terms, e.g., regard some trees or animals as sacred. The sacred tree species then, may not be utilized for firewood or timber even in times of scarcity, thus forcing women to look for alternatives like traveling long distances to collect firewood.

The paper by Hunter (2004) also highlights that cultural gender roles shape household and particularly women's strategies with regard to water collection. She finds that collection of drinking water is more likely to be seen as a primary development need if men (specially the head of the household) are forced to help in collection and not otherwise. This has important implications for women who are primarily responsible for water collection. In cases where men folk are not involved in water collection, they do not emphasize on the availability of better water infrastructure in the area vis-à-vis the government. In these places women are forced to travel long distances to fetch water. A TERI study (1994) in three agro-climatic zones of India, found intricate links between coping strategies and social roles a.k.a. gender roles. Since women did not have a say in the property rights regime (village level management of common land) they had no control over resource use. In the Rajasthan case, while the women continued to struggle to collect inferior quality fuel wood (affecting their health) due to restrictions imposed under the CPR control regime, the better quality fuel wood continued to be exploited for local commercial market and local industries by the village level common property management structures.

With regard to the gender dimension of natural resource regeneration programmes such as JFM and RGWM, it has been argued that these schemes have inadequate participation by women and this has led to significant gender inequalities in the distribution of costs and benefits (Agarwal (2000, 1997), Kumar (2002), Beck and Nesmith (2001), Beck and Ghosh (2000)). A study on the tribal women of Andhra Pradesh by Yadama (1997) shows that in spite of being the main collectors and processors of forest products; women are left out of the decision-making process. This has a negative impact on the very survival of the households because restrictions on the local use of forests for purposes of fuelwood and fodder collection are put in place but exploitation for commercial purposes goes on unhindered. If women were to be included in establishing norms of behavior governing community resources they can avoid a situation where they are subjected to norms of use that are untenable and show them as offenders. A notable exception to the studies cited above is a recent study of the impacts of community forestry using data from 524 villages across 5 states. It shows that fuel wood consumption and participation in community forestry are linked, and that participation has a significant positive impact on fuel wood consumption (Bandyopadhyay and Shyamsundar 2004). Assuming that the presence of community resource management institutions has a significant impact (whether positive or negative) we will examine how participation in JFM, etc. affects the coping strategies of women. Specifically, we will look at whether the JFM regime makes resources more accessible to the women, does it help women in meeting their requirements? Or does it make matters worse?

Our study will build upon the existing literature and will add to it as well. In looking at the role of social norms in mediating coping strategies, its relation to time allocation by women and the role of community institutions in mediating women's behavior in conjunction, we will be presenting a more composite picture of the determinants of time allocation decisions and the effect of social norms on time allocation with respect to natural resource degradation. While the Kevane and Wydick study looks at effect of social norms on time allocation decisions of

women, they do not take natural resource degradation into account. Similarly, the paper by Hunter looks at coping mechanisms with respect to single resource stock- water. Our study, on the other hand, looks at three inter related resources of forest, fodder biomass and water. The studies on community management institutions look at whether these bodies have a positive or negative effect on collection of resources from the commons in terms of the amount collected and accessibility. Our study takes into account the effects of formal institutional arrangements like JFM on coping behavior of women in terms of their possible effects on the change in time allocated to resource collection.

E. Research methods

E.1. Hypotheses/research questions

As stated earlier, our study will examine how households in general and women in particular respond when natural resources become scarce. We will both examine how households allocated labor between income generating and non-income generating activities in response to changes in the natural resource base and also how households cope with shortages in natural resources. The first hypothesis we hope to test is do households increase the amount of labor devoted to resource collection and decrease the amount devoted to income-generating activities, in response to a change in the natural resource base? Four coping strategies may be visualized in response to resource degradation—households may spend more time in collecting the resource, or they might switch to private investment in the resource (grow trees on their own land or dig a well for instance), or they may buy the resource, or they may simply reduce consumption of the resource (e.g., bathe less often). In practice, we could see a combination of one or more of these coping strategies depending on a host of factors specific to the household and exogenous to it (such as the amount of land a household owns and the presence or absence of labor markets). Thus, the second hypothesis that we hope to test is, do households cope with natural resource degradation by decreasing their collection from common lands? Or alternatively, do households cope with shortages by increasing home production or market purchase?

Our third research question follows from our hypothesis that as resources degrade, women are affected the most since they are mainly responsible for their collection and processing as well as their use. Specifically, we will examine whether time spent by women in collecting various environmental products increases when they become scarce in absolute physical terms. But going beyond this we are also interested in other ways women cope with scarcity of these products. For instance, they may effect changes in their lifestyle like cutting back on the use of a particular product say water (not bathing for days, etc.) or substituting a scarce resource by another (e.g., using more polluting leaf litter for cooking rather than fuel wood). Some of these measures may be triggered by their social role as homemakers. In any event, these changes could have repercussions on their health (through greater exposure to indoor air pollution) and nutrition and in turn affect their economic and social status. With regard to the latter, the 'bride price' may decrease⁹ and/or spending on the girl child in terms of food and education might be further reduced. While the data we have already collected allows us to examine coping strategies at the household level and the time spent by women collecting environmental products, we need to collect additional socio-economic data in order to gauge qualitatively how women in particular respond to resource scarcity. This will enable us to answer our fourth research question, namely, do social norms influence time allocation decisions of women?

⁹ This is the reverse of dowry and is common in tribal societies.

Our fifth research question is based on the hypothesis that culturally determined rules (social norms) affect the manner in which the CPRs are used and managed. This follows from the anthropological notion of ‘embeddedness’ as discussed in section E.2. Thus, our research question is to uncover these rules/norms and to examine how and whether they are affected/modified by resource scarcity. Do social norms affect coping strategies of women? Alternatively, do households abandon norms that otherwise sustain the natural resource base, in times of resource scarcity?

The final research question (or set of questions) pertains to local-level institutions like women’s thrifts groups, Village Forest Committees (VFCs) and Watershed Development Committees (WDCs) whose goal, *inter alia*, is to help people manage resources better and cope with adverse conditions. In this context, we will examine whether, *ceteris paribus*, in villages where these institutions exist, households (and women in particular) are better able to cope with natural resource scarcity. In particular, do local-level institutions that try to improve the natural resource base better enable women to cope with natural resource scarcity?

E.2. Theoretical ideas underlying the study

To conceptualize the effect of environmental degradation on time allocation by households and by women, we use the model of home production and time allocation proposed by Becker (1965), and later developed by Gronau (1977)¹⁰. In this model, the representative household or individual i chooses optimal levels of consumption (c_i) and leisure (t_i^l). Consumption is generated through a home production function

$$c_i = c(b_i, x_i, t_i^h; \mathbf{g}), \quad (1)$$

where x_i is a numeraire, market-purchased good, t_i^h is time allocated to home production and γ_i is a home production technology parameter. b_i is the amount of a generic environmental product (say ‘biomass’) used by the household in the production of c . b_i is generated by a biomass production function

$$b_i = f(t_i^q; \mathbf{q}_i, \mathbf{f}_i), \quad (2)$$

where t_i^q is the time allocated to biomass collection. The parameter \mathbf{q}_i denotes the village-level availability of biomass (e.g., per household volume of biomass available in a village), and \mathbf{f}_i is the household-level counterpart (e.g., trees planted by the household on its own land). A representative household with tastes denoted by \mathbf{a}_i maximizes its utility function

$$u_i = u_i(c_i, t_i^l; \mathbf{a}_i), \quad (3)$$

subject to time and budget constraints,

$$t_i^m + t_i^q + t_i^h + t_i^l = T, \quad (4)$$

and

$$x_i = w_i t_i^m + v_i, \quad (5)$$

¹⁰The version presented below is adapted from Ilahi and Grimard (2000).

where t_i^m is time allocated to market-oriented activities, T is time endowment, w_i is market wage and v_i is unearned income. Equations (4) and (5) can be combined to obtain the Beckerian ‘full income’ constraint:

$$x_i + w_i (t_i^q + t_i^h + t_i^l) = w_i T + v_i \quad (6)$$

The first-order conditions show that time inputs are chosen so as to equate the marginal rate of substitution between leisure and consumption to the shadow wage of biomass collection

$(\frac{\partial c_i}{\partial b_i} \frac{\partial b_i}{\partial t_i^q})$, the shadow wage of market time $(\frac{\partial c_i}{\partial x_i} w)$, and the shadow wage of home time

$(\frac{\partial c_i}{\partial t_i^h})$. Solving the first-order conditions yields a set of optimum (reduced form) time and

goods demand functions. Of these we will be estimating the time demand functions given by:

$$t^{j*} = t^{j*}(w, v, \mathbf{a}, \mathbf{q}, \mathbf{f}, \mathbf{g}) \quad (7)$$

where, $j = m, q, h, l$.

Our study aims to investigate the influence of changes in village and household level availability of biomass - \mathbf{q} and \mathbf{f} , respectively, on time allocated to biomass collection, market work, and leisure for the household.

The qualitative part of the study draws from the notion that economic transactions are ‘embedded’ in social life and in constructs of culture (McCay and Jentoft 1998). According to these theories the human economy as a rule is embedded in its social relationships (Polanyi 1957). Economic action is socially situated—it is enmeshed in economic and non-economic institutions and in a network of social relations. Environmental substances or phenomena become natural *resources* only when someone attaches a value to them. From this perspective follows the methodological prescription that analysis of seemingly economic behavior should also focus on the social dimensions of this behavior. In the light of this we will analyze the role of social behavior, cultural norms, inter personal relations etc. in the decision making process pertaining to time allocation among women. Here, qualitative data collection using structured and open ended interviews will inform our understanding of the nature of community interactions and how people relate to one another. Also, case studies collected will provide a personalized context and texture to our statistical work with anecdotes and excerpts from conversations (Rao, 1998). Econometrically we are trying to estimate how time allocation decisions change as a result of natural resource scarcity and qualitatively we will ascertain the reasons behind these changes. In this the theoretical model looks at how preferences are formed and how non-economic aspects play an important role in influencing economic behavior. For example, once property rights on common land are well defined with the help of formal institutional arrangements like JFM committees it is bound to have implications on the movement and allocation of labor among members of a community. With the coming up of these institutional arrangements in Jhabua in the last 10-15 years, a look at the rights regime is bound to throw up helpful insights regarding the resource use pattern and time allocation decisions of people.

We will use qualitative data in conjunction with the quantitative part. The methodological concepts of validity and reliability provide a common foundation for the integration of quantitative and qualitative techniques. For example, Caldwell and Caldwell (1977) point out that demographers examining African birth histories were aware of the limitations of their

quantitative approach. They found they were unable to tell whether long birth intervals represented a real social constraint on fertility, defective sampling, or inaccurate reporting. Anthropologists, studying the same situation (using ethnographic methods—formal and informal interviews, conversations, observations and participant observations), established that these intervals were in fact due to institutionalized postpartum abstinence, a cultural pattern with important consequences for total fertility rates (Page and Lesthaeghe, 1981). Similarly, in our study, as discussed in section D, in order to grasp why women take the decisions they do (coping behavior), we need to look at how women perceive degradation and availability of resource. On what basis do women decide where to go for collection of resources, what substitute will work in the face of a shortage of a resource and what will not, how do they allocate their labor in a group if they go out with other members of the community for collection, etc are all questions that will throw a light on the decision making regarding time and task allocation. For instance, one *Falia* (hamlet within a village¹¹) may have greater access rights to a natural resource than others of the same village due to its proximity to the resource or a patch of forest may be protected due to religious reasons etc. This might be an unspoken rule in the village, which might force women from other *Falias* to go to more distant places in search of firewood. Such an occurrence can come out clearly in the qualitative analysis of the kind we propose that seeks to look at the underlying cultural currents that dictate people's behavior.

E.3. Site description

Our study is based in Jhabua district of Madhya Pradesh, India. Jhabua is a predominantly tribal district located at the western border of the state. It is typical of agro-climatic conditions in the semi-arid tropics, namely, rainfed, subsistence agriculture and extensive dependence on natural resources. Of the total land area in the district 54% is classified as agricultural land, 19% is forestland and the rest is degraded land. Jhabua is one of the poorest districts in the state with a Human Development Index of only 0.356, the lowest among 48 districts in the state. 30% of the district's rural and 41.6% of its urban population is poor (as measured by the Head Count Ratio). Only 37% of the men and 20% of the women in the district are literate. The under-5 mortality rate for Jhabua is among the highest in the state (193.2 per thousand live births) and that for female children is even higher at 213.6. Agriculture is the main occupation with 90.4% of the work force employed in this sector. Households in the region usually supplement their incomes through non-market activities like livestock rearing as well as selling various products—wood for fuel, *tendu* leaves and *mahua* flowers and fruit, to name a few— from the forests.

Tribal society (with reference to Jhabua in particular) being egalitarian in nature (see Deliege 1985, Aurora 1972), the district of Jhabua has open access CPR regimes. This is uniform across the sample and does not differ even in areas with significant presence of Hindu caste society.

E. 4. Variables to be measured

Secondary data collected for the study is described in the following section. In addition, we will gather qualitative data on the following (conditioned on varying levels of per capita and per household availability of natural resources, namely groundwater, fodder and forest): (i) coping strategies of households in general and women in particular by looking at change in resource use, shift towards a cash economy, migration, small-scale household enterprises, role of education, growth of tertiary employment, change in cropping pattern, changes in social roles of men and women, changes in lifestyle- switching to other resources, reducing the use of

¹¹ In Jhabua district, one *Falia* may be quite distant from another within a village.

a particular resource, change in the food basket, etc (ii) cultural rules and social norms for the use of environmental products. We will also gather data on the effect of local policy institutions such as RGWM and JFM, particularly on women in terms of their effect on coping behavior of women.

In our model, the utility function of any representative household depends on technology and preferences. These in turn are affected by several fixed household characteristics such as size of the household, ethnic background and educational level of the household head; village characteristics such as distance to market, presence of resource management committees and various indicators of effective village governance; and characteristics of physical environment such as rainfall and elevation.

As for the measure of natural resource availability, we have time series data on groundwater depth in the sampled villages collected from the Madhya Pradesh Groundwater Department. We also determine the appropriate measures of biomass availability at the village (θ) level and at the household (ϕ) level (See section E.5). The measure of θ is per household volume of biomass available in a village (in tons). The household may also have planted trees on its private land in the past, which can affect the current household-level availability of biomass (ϕ).

Other determinants of household and women's time allocation are the opportunity cost of time (w) and unearned income (v). The average daily wage is used to compute the opportunity cost of time. Our study assumes completeness of labor markets in Jhabua. This assumption is quite justifiable. In all 60 villages, at least 1 sample household reported deriving part of its income from either migrant labor or non farm jobs (private or public sector), and in 53 villages, this was true of half or more of the households sampled. Hiring and/or exchanging farm labor was also extremely widespread, and wage rates for such labor were readily obtained in all 60 villages.

Unearned income is an integral part of labor supply model. An increase in unearned income confers an income effect on leisure. The measures of unearned income are income from financial transactions (interest income on financial assets such as deposits at bank or post office, women's savings group, loans given to friends and relatives), rental income and income from transfers (sum of cash and in kind payments received by household from its family, friends, the state and any NGO in area).

E.5. Methods for data collection

We have access to a clean set of household- and village-level data from 550 households in 60 villages in Jhabua for the period June 2000 to May 2001. The data was collected for the Environment and Poverty project, jointly undertaken by the Center for Development Economics (CDE), Delhi School of Economics and Resources for the Future (RFF), Washington DC. The use of and dependence on natural resources by households has already been analyzed using this data (Gupta, Narain and van 't Veld 2004). The dataset, however, contains additional information on time allocation that has not been analyzed so far. We will use this information in our study to answer the first three of our six research questions (see section E.1 above). This data will be supplemented with additional data from a subset of sample villages and households to enable us to answer our remaining research questions. Below we first describe the data that has been collected so far and then discuss the additional data we propose to collect.

Apart from information on household incomes, household assets, time allocation decisions, and village-level information on prices, governance structures, we have information on timber and fodder biomass from remote sensing and information on groundwater levels from the Madhya Pradesh Groundwater Department. Fodder biomass and timber volume have been estimated using remote sensing.¹² Satellite images were used to construct the Normalized Difference Vegetation Index (NDVI)¹³ for the areas within and around the 60 sample villages. The NDVI data was combined with data from the Madhya Pradesh Forest Department's forest inventory of 1998 to develop a regression model that uses the NDVI as a predictor of tree biomass (Arroyo-Mora et al. 2001). Since there were no actual ground measurements of grass fodder biomass for the sample villages, firstly biomass in a subset of the sample villages for 2002 was estimated. This was done by combining estimates of grass cover in 0.1-hectare plots of forest and grasslands with measures of grass biomass on a dry-weight basis. As with forest biomass, these ground measurements of grass biomass were combined with the NDVI data to develop a predictive model. The Madhya Pradesh Groundwater Department has, since 1973 monitored, and continues to monitor, the groundwater level thrice yearly (pre-monsoon, post-monsoon, and winter) in about 89 villages in the district of Jhabua. Each of these villages represents a micro watershed and covers the entire district. The sample of 60 villages for the Environment and Poverty project were chosen from this list of 89 villages.

At the household level, a random sample was selected from three strata--BPL (landless, owning no land), land-poor (owning less than 3 hectares of land) and land-rich (owning more than 3 hectares of land), with over sampling of BPL and land-rich households. Following the survey, the distribution of *de facto* landholding by sample households is shown below:

Total landholding	No. of households	% of households
0 hectare	49	9
> 0 - 0.5 hectares	108	20
> 0.5 - 3 hectares	316	58
> 3 hectares	74	14

As stated above, data already collected will be complemented with additional in-depth data gathered from a subset of our sample villages and households. This will allow us to answer our last three research questions that are somewhat qualitative in nature, namely, coping mechanisms by women, cultural rules and use of CPRs, and the functioning of local level institutions. Supriya Singh will take the lead in field work and data collection. In order to probe these aspects in detail and incorporate variability in the natural resource regime, we have tentatively selected three of our sample villages (table A1 in annex). These villages represent the range of biomass availability per household in our overall sample¹⁴. In the selected villages we will be approaching the same households that had been studied in the previous survey (see

¹² We have collected time series data on groundwater levels for our sample villages from the Madhya Pradesh Groundwater Department. Daily rainfall data is also available at the block level for the 12 blocks in Jhabua.

¹³ The NDVI is equal to the difference in near infra-red (NIR) and red (R) light reflectance divided by the sum of these reflectances, that is, $(NDVI) = (NIR - R)/(NIR + R)$ and is commonly used to assess or predict vegetation biomass from remote sensing data.

¹⁴ Biomass availability per household is defined as total fodder and tree biomass in tons for a village for the year 2000 (estimated from remote sensing data) divided by the number of households in the village. This figure is not adjusted for household size and composition.

Narain et al, 2004 – study sample), since the socio-economic data for these households is already available. The total number of households to be interviewed would be approximately 30.

A pilot study will be conducted to test the questionnaire in the field following which 2-3 round trips will be undertaken to complete the research. The trips will be of around 20 days duration each so as to assess the collected data and remove any discrepancies/ look for missing information etc. This way additional/missing information for the area surveyed would be collected in the next round. Dr. Gupta will visit the field in supervisory capacity a couple of times. Singh will conduct the study with the help of a local enumerator who will act as a facilitator and interpreter between the respondents and Singh. Interviews will be conducted mostly among the women of the household (men would also be contacted in some cases) so as to get at the changes (if any) in the availability of resources from the commons and changes in the collection time of resources (before and after the setting up of the JFM and WDC committees) etc. We will be exploring the functioning and effectiveness of local policy institutions by looking at how these institutions affect availability and time allocation decisions of women in particular and household in general. If need be then data will be collected from additional households from the village(s), in which case a list will be drawn using stratified random sampling based on the size of landholdings.

Data will be collected using established techniques in anthropology. Qualitative data is usually collected using triangulation – using several data collection techniques to assess the authenticity of findings (see Chung 2000, Sarantakos 1998). Systematic data collection will be carried out using an open-ended interview cum questionnaire schedule (see annex) to catch resource perception and use, role of JFM institutions in influencing coping mechanisms, relationship between rules and norms and natural resource use. We will be looking at both formal (governmental rules regards JFM, WDC etc.) and informal rules and norms (community's own set of rules to govern their natural resources- if they have any, if they do then of what kind, were there any rules that were followed in the past, the existing rules and their effect on use presently etc.).

Intensive investigation of fewer and purposively chosen cases will be conducted using a structured interview schedule (this would be on similar lines as the questionnaire with some additions). The case studies will help us to examine the operationalization of larger social forces in a micro context of the household and women. In this the broad topic of research will be contextualized to 10-15 women (cases) by looking at how these women in particular perceive and cope with resource scarcity and time allocation decisions. This will help in catching some of the behavioral dimensions/patterns. These case studies would help in catching patterns of behavior like cooperation among women in times of need and social group formation, roles performed in the family and outside the household, role of kin group in adverse conditions, etc This knowledge would in turn inform our study by explaining why women behave the way they do. Further key informant interviews and observation of some tasks will also be employed to get a sense of what is actually happening in the field. (Chung 2000).

E. 6. Methods for data analysis

Our data on time allocation has problems of *censoring* of the dependent variable and individual *self-selection* into activities that have to be addressed to estimate a set of reduced form time allocation equations. Censoring occurs when the dependent variable corresponding to known values of independent variables is not observed for part of the sample. For example, in modeling the demand for tickets for a cricket match, all demands above the capacity of the

stadium are translated into k , the capacity of the stadium (Kennedy 2003). In our dataset, households that do not collect natural resources report zero hours for that activity. Therefore, the dependent variable is zero for a significant proportion of the sample. Individual self-selection refers to the fact that individuals can choose whether to participate in a particular activity. For instance, there are households in our dataset who do not collect natural resources. We now consider these problems in detail and outline how they might be addressed.

Censoring can be addressed by using a Tobit model or a censored regression model (Amemiya 1984). While OLS parameter estimates for a Tobit model are biased and inconsistent, maximum-likelihood estimates are unbiased and consistent (Maddala 1983).

In addition to censoring our data is also prone to heteroscedasticity since we are dealing with a cross-section of households¹⁵. In this situation maximum likelihood estimates are inconsistent. This can be overcome by estimating heteroscedastic version of Tobit model after making a reasonable assumption about the nature of heteroscedasticity (Greene 2003).

Now turning to *self-selection*, recall one of our objectives is to explore the determinants of time allocation between market and non-market activities including collection of natural resources, and to investigate the association between collection time (the dependent variable) and physical availability of forest, fodder and water. The determinants of the decision to collect (or not) may differ from those that determine the time allocated to collection. If this were indeed the case, then a Tobit model that assumes determinants of the decision to collect are identical to determinants of the time spent in collection would be a misspecification. Following Glick (1999) and Skoufias (1993, 1996), we will apply Heckman's two-step estimation method to control for sample selection (Heckman 1976, 1979). The advantage of this approach over Tobit is that it also controls for individual self-selection into various activities. The so-called Heckit model differs from the Tobit model in that it specifies two separate equations—one for the probability of observing an observation above the zero-time-in-collection threshold, and another for the time spent in collection for those above the threshold. In the presence of heteroscedasticity, the second stage estimation is done by WLS (weighted least squares) instead of OLS. This procedure gives consistent estimates of the determinants of collection time.

Although estimates obtained by the Heckman procedure are consistent they are not as efficient as maximum likelihood estimates (Kennedy 2003)—while the former corrects for selectivity bias there is loss in precision due to high mean square errors (MSE) of Heckit estimates. This is due to collinearity between the explanatory variables in the regression equation and the inverse Mills ratio (IMR) obtained from the first stage selection equation. This degree of collinearity is greatest for small sub samples (the portion of the sample with nonlimit observations). The Heckman procedure also introduces a measurement error problem, because an estimate of the expected value of the error term, that is, IMR is used in the second stage of regression. In this context, a recent survey favors using maximum likelihood estimation as compared to Heckit (Puhani 2000).

We will be using both procedures (Tobit and Heckman's two step) to estimate the time allocation equations. Each method has its own advantages and disadvantages. Therefore, this will enable us to check for the robustness of the results.

¹⁵ Any of the three standard tests—Lagrange Multiplier (LM), Likelihood Ratio (LR) or the Wald test—may be used to test for the presence of heteroscedasticity.

Qualitative data analysis will involve establishment of causal networks i.e. building a logical chain of events/evidence in order to display the most important independent and dependent variables and the relationship between them. For instance time allocation is our dependent variable and natural resource scarcity, cultural norms and effect JFM institutions on coping behavior are the independent variables that explain time allocation. We will try to display the causal relationship between these through standardized techniques using cross case comparisons, scatter plots, variable by variable matrix, clustering etc. (for details see Miles and Huberman 1994). As for the case studies, standard techniques like within case analysis will be used. The general strategy is to build descriptive display formats designed to answer the research questions. In these the data is coded and entered and conclusions of a descriptive sort are drawn. With these conclusions explanatory displays will be built, coded data entered and explanatory conclusions drawn. This will be repeated for all the cases to draw cross-case conclusions. These conclusions will then feed into the report. We are basically trying to corroborate qualitative analysis on coping strategies with our econometric results. We will also be looking at JFM institutions in our qualitative analysis as we believe they are important in determining the time allocation decisions of the household, examined econometrically.

E. 7. Links between hypotheses, research design, data variables, and data sources

Hypothesis	Research Design	Data variables	Data sources
Whether the household changes its time allocation decisions in response to resource scarcity?	Econometric estimation using Heckman's two-step procedure (and perhaps MLE as well)	Time spent in collection of environmental products Time spent in market activities Landholding Holding of livestock Unearned income Wage rates Farm Capital Age of the household head	Secondary data (for details see section E.5) Secondary data (for details see section E.5)
Do households cope with natural resource scarcity by buying it from the market/restricting its use/investing in private sources or opting for alternative resources?		Per household availability of biomass Groundwater (data at village level) Rainfall (data at block level)	
Do women spend more time in the collection of resources in case of scarcity/			Secondary data (for details see section E.5)
Do social norms influence time allocation decisions of women?	Systematic data collection using a structured interview, key informants, participant observation and case studies.	Socio-economic indicators of degradation (change in resource use, shift towards a cash economy, migration, small-scale household enterprises, role of education, growth of tertiary employment, change in cropping pattern)	Primary (data to be collected)

Do social norms affect coping strategies of women?	Systematic data collection using a structured interview, key informants, participant observation and case studies.	Changes in social roles of men and women Changes in lifestyle- switching to other resources, reducing the use of a particular resource, change in the food basket, etc.	Primary (data to be collected)
Do local-level institutions that try to improve the natural resource base better enable women to cope with natural resource scarcity?.	Systematic data collection using a structured interview, key informants, participant observation and case studies.	Participation of women in these institutions Authority regime Changes in the availability of resource before and after the establishment of JFM	Primary (data to be collected)

F. Results and Dissemination

F. 1-2. Expected results and policy implications

By addressing our research questions our study will contribute to a better understanding of the linkages between poverty and environment from a gender perspective. For instance, it is believed that as the environment gets degraded, women being primarily responsible for resource collection will spend more time in this activity that could have been otherwise used in income-generating activities. Hence, gender studies in this sphere have significant theoretical, empirical, and policy implications.

Our analysis seeks to inform the policy debate on whether, and to what extent, improved natural resource management—e.g., reforestation, regeneration of grasslands, building water-conserving structures can alleviate poverty by affecting the time allocation decisions by households and by women. If households in general and women in particular spend less time in market activities due to scarcity of natural resources, then an improvement in the natural resource base is necessary to free labor for market activities. A more complete and interdisciplinary understanding of intra-household behavior with respect to time allocation decisions can increase the likelihood that policies will reach the people they are intended to affect—leading to better policies in areas such as food production, consumption, nutrition, and natural resource management.

In addition to contributing to the policy debate and furthering academic knowledge, the process of implementing the project is for us an end in itself. Specifically, we view capacity building of junior female researchers (Chopra and Singh) through training in the theory and practice of applied policy-oriented research as a vital project outcome. This project will enhance their training in environmental economics, sociology and anthropology and in research techniques and methodology. They will also acquire work experience in cleaning and analysis of primary data, in fieldwork and in academic and policy writing that should be of immense benefit to them in their careers.

F. 3. Dissemination strategy

We will present our findings to a wide domestic audience comprising scholars and development practitioners (policymakers and NGOs). Given the interdisciplinary nature of our

study, we will engage with economists, sociologists, anthropologists and those working on crosscutting issues of gender. In particular, Chopra and Singh will participate in the Indian Sociological Conference as well as in meetings of the Indian Econometric Society and the Indian Society for Ecological Economics. We will also organize a one-day workshop at the Delhi School of Economics where scholars from economics, sociology, anthropology, and women's studies as well as development practitioners will discuss our research and present their views. Finally, we will organize a session on gender and environment at the next biennial meeting of the International Society of Ecological Economics at New Delhi in 2006.

G. Researchers' skills

The work will primarily be undertaken by Neetu Chopra and Supriya Singh who are, respectively, registered in the M.Phil programmes at the departments of Economics and Anthropology at the University of Delhi. They have recently completed their coursework and are embarking on their dissertations to which this study will contribute. Shreekant Gupta and Urvashi Narain will provide oversight and supervision in an honorary capacity. Gupta is also Chopra's M.Phil dissertation supervisor and Narain has been proposed as her co-supervisor. Both Gupta and Narain have worked closely on the CDE-RFF poverty-environment project mentioned earlier. Some of the data collected under that project will be used for part of this study.

This is a multidisciplinary project where the junior researchers bring a set of different but complementary skills. Not only will this enable the team (including Gupta and Narain) to learn from one another, but we also hope to exploit the synergy between complementary skill sets to our collective benefit. In addition to her formal training as a sociologist and anthropologist, Singh was extensively involved with the fieldwork and data collection and data cleaning in the CDE-RFF project. She has intimate knowledge of the study area and has interacted extensively with policymakers in the district such as the collector and the additional collector. The latter heads the district rural development agency (DRDA), which is responsible for implementation of development projects in the district including watershed projects. Singh is also familiar with several other district officials like the divisional forest officer (the nodal person in the forest department which implements JFM projects) as well as NGOs who are active in Jhabua. Therefore, Singh will be responsible for fieldwork and data collection for our study. She will also undertake analysis of some of the anthropological aspects of the study. The extraction and handling of data using Stata (version 8) will be done jointly since both researchers are conversant with this statistical package. With a master's degree in economics from the Delhi School of Economics, Chopra is grounded in micro-theory and econometrics and will take the lead in the econometric estimation of time allocation decisions. Finally, both researchers will collaborate on writing of reports and papers and will also be actively involved in outreach activities such as participation in conferences as well as in arranging the workshop at the Delhi School of Economics.

H. Timeline

We envisage the project will last for 14 months. We will conduct a pilot survey followed by 1-2 rounds of pre-testing of the survey instrument. This process should take about 3 months followed by data collection for about the same number of months. We anticipate data estimation and data analysis to last for 6 months and the final writing of the report will take about 2 months.

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Annexure

Table A1. Profile of villages selected for in-depth data gathering

Village name	Area (hectares)	No. of households	Biomass per household in 2000 (tons)	WDC	VFC
Pitol	49	494	424.63	Y	Y
Kanwada	904.8 (acre)	250	9,140.75	Y	Y
Karelimahudi	277.6 (acre)	90	60,101.36	Y	Y

WDC Watershed Development Committee

VFC Village Forest Committee

Financial information

		<i>Months</i>	<i>Rate (Rs.)</i>		<i>Rs.</i>	
1	Salaries	Junior researchers (Chopra, Singh)	28	12,000		336,000
2	Travel	Average monthly local travel (in Delhi)	14	500		7,000
3	Fieldwork		<i>Trips/days/months</i>			90,000
		Round trip train fare to Jhabua (6 trips)#	6	3000	18,000	
		Jeep rental (per day)	60	600	36,000	
		Daily subsistence allowance	60	400	24,000	
		Local enumerator (per month)	2	6000	12,000	
4	Dissemination					45,000
		Neetu Chopra-Indian Ecotrix Society			10,000	
		Supriya Singh-Indian Sociological Conf.			10,000	
		One-day workshop at D. School			25,000	
5	Computing					50,000
		PC (Pentium IV) & consumables (toner, floppies, paper etc.)			50,000	
6	Communication/Books/Contingency		<i>Months</i>			42,000
		Xerox, phone, fax, postage, office supplies	14	3000		
	Sub total					570,000
7	Institutional overhead @ 20%					114,000
	TOTAL					684,000
		# 4 trips by Singh and 2 by Gupta				

Biographical information

Shreekant Gupta (male, 44) received his Ph.D. in Economics from the University of Maryland at College Park in 1993 where he majored in environmental and resource economics and public economics. He is an Associate Professor (Reader) in economics at the Delhi School of Economics, University of Delhi since 1997. Prior to this he was Fellow and Head, Environmental Policy Cell at the National Institute of Public Finance and Policy, New Delhi (1995-97) and an environmental economist at the World Bank, Washington DC (1993-95). He has also been Shastri Fellow at Queen's University, Canada (2001) and Fulbright Fellow at the Massachusetts Institute of Technology (MIT), USA (2001-2002). His research has focused on environment and development, market-based instruments for pollution abatement and climate change.

Urvashi Narain (female, 36) received her Ph.D. in Agricultural and Resource Economics from the University of California at Berkeley in 1998 and has, since 1999, worked as Research Fellow at the Washington DC-based environmental think tank, Resources for the Future (RFF). Her Ph.D. focused on issues of community forestry in India and on uncertainty and irreversibilities in global climate change. At RFF, her research has focused on issues at the intersection of environment and development, with one project looking at the role of developing countries in short-term and long-term climate change policies and another looking at the impact of natural resource availability on household incomes in rural India.

Neetu Chopra (female, 27) received her Masters degree in Economics from the Delhi School of Economics, University of Delhi in 2001. She lectured in undergraduate honours courses in economics at the same university during 2001-03. Since July 2003 she is enrolled as a full time M.Phil student at the Delhi School of Economics where upon successful completion of one year of coursework with a first class, she is now writing her dissertation.

Supriya Singh (female, 26) received her Masters degree in Sociology from the Delhi School of Economics, University of Delhi in 2001 and a diploma in environmental law from the Center for Environmental Law, Worldwide Fund for Nature, New Delhi in 2004. She has extensive field experience on natural resource management projects with the Indian Institute of Public Administration (IIPA), Ashoka Trust for Research in Ecology and Environment (ATREE) and the Centre for Development Economics (CDE). Since July 2003 she is enrolled in the M.Phil. programme at the department of Anthropology, University of Delhi where she has successfully completed the coursework with the highest marks in her class.

Annexure

Questionnaire

(subject to change after the pilot study)

Section 1

HOUSEHOLD IDENTIFICATION INFORMATION

Date of Interview: _____

Survey No. _____

Village Name: _____

Name of the household Head

Ethnicity

Religion

Members of the household

S. No.	HH Member	Age	Sex	Education	Occupation
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Occupation:

Agriculture = 1 Business = 2 Public Service = 3 Private Service = 4

Cottage Industry = 5 Agriculture + Business = 6 Agriculture + Service = 7

Wage Labour = 8 Other = 10 (Please Specify...)

INDIGINOUS VIEW OF THE HOUSEHOLD

1. Who all constitute a household?

() People, who eat at the same hearth

() Those who stay together in the same household for more than 9 months including servants.

() Any other (Specify)

2. What is the definition of well-being/ household welfare/ riches for the tribals?

() enough to eat

() spend in the market

- () possession of certain things like- metal utensils, electric devices etc.
- () Other (Specify)

3. What constitutes the “minimum” for household welfare ? (in Other words)

Section 2

NATURAL RESOURCES- DEFINITION AND USE

1. How are natural resources defined-
 - a. Do you see them as a part of the culture ()
 - b. Or as economic goods (as contributions to household income) ()
 - c. As subsistence goods (essential for the survival of the household)()

2. What all resources do you collect from the commons?

	Resource	Who usually goes to collect	Why is that person sent for collection	Does this division of labor remain same for all the Year round?
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				

3. Classify the resources collected according to use.

Resource	Household use (edible products etc.)	Economic Use (used in construction of implements, fencing, construction/repair of the house, selling in the market, agricultural use, use for livestock etc.)	Ceremonial/Religious use	Others (specify)
Water				

Wood				
Fuelwood				
Fodder				
Mahua				
Flower				
Mahua				
Seed				
Tendu				
Taad				
Other				

4. Consumption Pattern

a.) Who is primarily responsible for the allocation of resources within the household, or has a say in how the resources are utilized?

- () The one who Collects
 () The head of the Household
 () Other (Specify)

b.) Do the members who go to collect have a say in the distribution and use of the resource?

COLLECTOR	YES	NO	REMARKS
Men			
Women			
Children			

c. What are the differences in the consumption preferences of men and women? Are resources distributed or used differently by them if they are controlling the distribution and use of the resources? (Maybe this has to be asked for all the resources separately- fodder, fuel, tendu, mahua, taadi, others)

d. How is the income generated from resource collection handled? Do women prefer payments

- () in cash
 () or kind (barter 'ber' for salt etc).

Section 3

WORK-

a. Local concept of work-

1. What is "work" and what are leisure activities? How are these defined?

2. Are the leisure activities also income generating? What are those? (Maybe making bead necklaces that are sold in the 'haat')

3. What is typical “men work” & “women work”. Criteria for defining work by gender (if any).

Work done by Male	
Work done by female	

4. How does age come into play- like is work divided according to age as well?
5. How are members compensated (if at all) for their contributions to the household welfare/income (collection of resources, wage labor, market activities etc.); is the income divided or do they get some share etc.

b. Work and time

6. What is the cultural conception of time- do they see the day divided into parts
 According to work time (When they start for work, time intervals between activities etc.)
 Leisure time (When they are free or meal time)
 According to something else (Specify- like according to the position of the sun etc.)
7. How is work defined in terms of time? I.e. is specific time allotted to specific tasks, does that vary according to season? Is there any specific time during the day that is best suited for a particular kind of work?

Section 4

CHANGES DUE TO DEGRADATION OF RESOURCES (LAND, WATER, BIOMASS)

1. Is degradation of the resources taking place? How do they (tribals) perceive (define) degradation-

- In terms of availability of the resources
 Time spent in collection of resources
 Any other (Specify- lack of trees, low rainfall etc.)

Resource	Time spent in collection		Amount collected		changes	
	10-25yrs ago	Now	10-25yrs ago	Now	10-25yrs ago	Now
Water						
Fire wood						

Fodder						
Timber						
Mahua						
Tendu						
Taad						
Herbs						
Other						

2. Is agriculture affected due to more time spent in the collection of resources?

Yes (Then answer the following in 'Y' and 'N') No

Is there a change in crop preferences. If Yes then specify the changes ?

Is there a shortage of family labor due to more time spent in the collection of resources

Any other Changes

3. According to you, what is the changing trend in the following indicators in the last 10 years?

INDICATORS	TRENDS			REMARKS (list of species of trees lost etc.)
	Increasing	Constant	Decreasing	
Crop production				
Area under forest				
Area under pasture				
Tree species				
Number of water spring				
Time to collect fuel, fodder and leaf litter				
Tree on private land				
Flooding/landslides				
Time to Fetch water				

4. Are income generating activities affected-

ACTIVITY	AFFECTED (if 'Y' then go to column 4)	NOT AFFECTED	HOW ARE THEY AFFECTED		
			in terms of labor	time put in	Availability (restrictions on extraction etc.)
Basket making					

Rope making					
Bidi Making (selling Tendu)					
Other					

5. How has means of transaction altered? (change over time)
 More cash exchange now
 Barter exchange preferred
6. Is there a shift from traditional income generating activities to others? Why?
 Yes
 No
7. What is the role of education in all this- do the educated children prefer to move away from the traditional occupational structure? Is that good or bad?
 Yes
 No
8. Does educating children prove to be strenuous for the household in terms of less number of working hands? Is that bothersome?
 Yes
 No

9. Who takes the important decisions in the house?

DECISION	HEAD OF THE HOUSEHOLD	COLLECTIVE DECISION (all members or spouse consulted before taking the decision)	OTHER
What work to do			
Whether to migrate or not			
What investment/savings to make (in form of Jewellery, cash in PO or bank)			
Who handles cash			
Do women migrate along with men			

10. Do you have any household enterprise?
 Yes (Specify)

() No

11. What is the role of women in the household enterprises-

() Do they go to the market for purchases related to enterprise

() Can they take important decisions related to the enterprise (what to buy and when, alter the nature of the enterprise etc.)

12. Ceremonial/ Religious standing of women. Its relation to Economic standing.

a. What is the traditional standing of women in society? (equal to men?) ()

Equal to men

() > men

() < men

b. How has it changed over the years?

c. Does the standing of women have anything to do with their

() economic contribution?

() Or is it more cultural than economic?

13. Changes in the food basket due to environmental degradation and related effects in agriculture

a. What is the traditional staple food? (preferred food)

b. Has the staple diet undergone a change over the years? If so what list the changes (If 'No' skip to the next section)

No.	Changes

c. Do you think that the changes have been positive/beneficial? Why?

() Yes (-----)

() No (-----)

Section 5

COPING STRATEGIES

1. What are the emergency strategies- in case of shortage of resources like firewood, water, work etc.

Resource	Buy from the market	Reduce consumption of the resource	Spend more time in collection	Develop the resource at home (pvt. Supply)	Others
Water					
Fire wood					

Fodder					
Timber					
Mahua					
Tendu					
Taad					
Herbs					
Other					

2. How have the coping strategies undergone a change over the years?
 What were the fallback mechanisms earlier (say 15 years ago) and what are they now?
 do they buy from the market, take debts, help from neighbours? Etc.)

3. Is there a taboo on the collection of certain species of plants?

Species/Local name	Not collected	Not collected in a particular season	Reason/remarks

Reasons: Religious taboo=1 (explain), Economic reasons=2, Other=3,

4. In case there are rules for collection and use of resources, are these followed during adverse conditions of scarcity?
 Yes
 No

Section 6

LOCAL POLICY LINKS (RELATED TO THE ENVIRONMENT)

Information on **Village forest committees**

1. Name of Village Forest Committee: _____
2. Area under the VFC: _____
3. Number of User/Member households: _____
4. Female membership of the committees- (number/percentage): _____

5. Number of VFCs in the village:_____

6. What is the composition of VFC Executive Committee in terms of gender?

() Number of female () Number of male

7. Date of VFC Formation:_____

8. How are the user groups formed?

() Initiative from Forest Department () Community's own initiative

9. Functions of VFC:

S.N.	Function
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

10. Membership Criteria: Fee, Resident of the village, Size of the household etc.

S.N.	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

11. Governance:

a. How are the decisions taken by the executive committee?

() Consensus () Majority () By the head of the committee

b. How are the products from common lands distributed?

() Family size/equity () Equality () Other (Specify)

c. Do members have to pay a fee?_____

d. At what stage do general members participate in organizational activities?

() Planning and decision-making () Implementation () benefit sharing () Evaluation

e. List the income generating activities of the committee

	Activities
1	
2	
3	
4	
5	
6	
7	
8	
9	

f. How often do VFC members gather for a meeting?

Once a month Once in two months As and when required

g. How often is the meeting of the executive committee held

Once a month Twice a month As and when required

h. What is the percentage of user household who attend last 4 meetings?

i. What is the parentage of user committee members who attended last 4 meetings?

j. How do you evaluate the institutional performance of Forest User Group? (1= Least satisfactory and 5=Highly satisfactory)

S.N.	Name of committee Member	Rating
1		
2		
3		
4		
5		
6		
7		

k. What are the female perception of the committees?

Good

Average

Unsatisfactory

l. What are he changes in the resource availability before and after the setting up of the CBNRM institution (VFC) ?

Resource	Time spent in collection	Amount collected	changes

	Before VFC	After VFC	Before VFC	After VFC	Before VFC	After VFC
Water						
Fire wood						
Fodder						
Timber						
Mahua						
Tendu						
Taad						
Herbs						
Other						

Section 7

LOCAL POLICY LINKS (RELATED TO THE ENVIRONMENT)

Information on Watershed Development Committees

1. Name of Watershed Development Committee: _____
2. Number of User/Member households: _____
3. What is the composition of WDC Executive Committee in terms of gender?
() Number of female () Number of male
4. Date of WDC Formation: _____
5. How user groups were formed?
() Initiative from Government Department () Community's own initiative
6. Area: _____

7. Functions of WDC:

S.N.	Function
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

8. Membership Criteria:

S.N.	
1.	

2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

8. Governance:

a. How are the decisions of the executive committee made?

() By Consensus () By Majority () By the head of the committee

b. Number of WDCs in the village: _____

c. List the income generating activities of the committee

d. What is the female membership of the committees- (number/percentage): _____

e. What are the female perception of the committees

f. How often do WDC members gather for a meeting?

() Once a month () Once in two months () As and when required

g. How often is the meeting of the executive committee held ?

() Once a month () Twice a month () As and when required

h. What is the percentage of user household who attend last 4 meetings?

i. What is the parentage of user committee members who attended last 4 meetings?

j. How do you evaluate the institutional performance of the committee? (1= Least satisfactory and 5=Highly satisfactory)

S.N.	Name of committee Member	Rating
1		
2		
3		
4		
5		

6		
7		

k. What are the changes in the resource availability before and after the setting up of the CBNRM institution (WDC) ?

Resource	Time spent in collection		Amount collected		changes	
	Before WDC	After WDC	Before WDC	After WDC	Before WDC	After WDC
Water						
Fire wood						
Fodder						
Timber						
Mahua						
Tendu						
Taad						
Herbs						
Other						

Section 8

LOCAL POLICY LINKS (RELATED TO GENDER)

Information on **Women's Thrifts And Savings Groups (Bairani Kuldi)**

1. What are the various Women's Thrifts and Savings group in the village?

- () Bairani Kuldi
 () Others

2. What is the total number of such groups in the village? Please give their names.

1.	
2.	
3.	
4.	
5.	

3. What are the reasons for the establishment of these groups?

1.	
2.	
3.	
4.	
5.	

4. Is there any interface between the women's groups and the environment committees- WDC and VFC? If Yes then what kind.

5. From the angle of the environment committees what role do women play- in terms percentage of collection time (because they go out to collect resources more often). How does it affect their participation in these gender groups ?

COMMITTEE SPECIFIC INFORMATION

1. Name of Bairani Kuldi : _____

2. Number of Members: _____

3. Date of committee formation: _____

4. How was the group formed?

() Initiative from Government Department () Community's own initiative

5. Area: _____

6. Functions of the committee:

S.N.	Function
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

8. Membership Criteria:

S.N.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

9. Governance:

a. How decision of executive committee is made?

() Consensus () Majority () By the head of the committee

b. List the income generating activities of the committee

c. What are the perceptions of the members about the committee? (is it helpful or not)

d. How often do members gather for a meeting?

() Once a month () Once in two months () As and when required

e. How often is the meeting of the executive committee held?

() Once a month () Twice a month () As and when required

f. What is the percentage of user members who attend last 4 meetings?

g. What is the parentage of user committee members who attended last 4 meetings?

i. How do you evaluate the institutional performance ?

(1= Least satisfactory and 5=Highly satisfactory)

S.N.	Name of committee Member	Rating
1		
2		
3		
4		
5		
6		
7		

