WPS3337

Do Households Gain from Community-based Natural Resource Management? An Evaluation of Community Conservancies in Namibia

Sushenjit Bandyopadhyay[a], Michael N. Humavindu [b], Priya Shyamsundar [a], and Limin Wang [a]

Abstract: Community-based natural resource management is an important strategy to conserve and sustainably use biodiversity and wildlife in Namibia. This paper examines the extent to which conservancies have been successful in meeting their primary goal of improving the lives of rural households. It evaluates the benefits of community conservancies in Namibia by asking three questions: (a) Do conservancies increase household welfare? (b) Are conservancies pro-poor? (c) And, do participants in conservancies gain more relative to those who choose not to participate? The analysis is based on a 2002 survey covering seven conservancies and 1,192 households. The results suggest that community conservancies have a positive impact on household welfare. This impact is poverty-neutral in some regions and pro-poor in others. Further, welfare benefits from conservancies appear to be some what evenly distributed between participant and non-participant households.

Acknowledgements

We are grateful to Jon Barnes for providing us with the survey data and for his comments, John Katjiua for his helpful discussion on land ownership in Kunene, and to Hanan Jacoby for advice on methodology. We thank the participants of the survey analyses workshop held in August 2003 at the Ministry of Environment of Namibia, and other World Bank colleagues who have commented on this paper. We would like to thank Kirk Hamilton, team leader, Policy and Economics Team, World Bank, who provided valuable guidance and support. We sincerely thank our donors from the Trust Fund for Environmental and Socially Sustainable Development. Funding for the survey was contributed by the Swedish government through Sida, and the UK government through DFID as well as the Namibian government.

World Bank Policy Research Working Paper 3337, June 2004

[a] Environment Department, World Bank. [b] Directorate of Environmental Affairs, Ministry of Environment and Tourism, Government of Namibia.

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1. Introduction

Over the last two decades community-based natural resource management (CBNRM) has become an important strategy to conserve and sustainably use biodiversity and wildlife in Africa. Projects such as CAMPFIRE in Zimbabwe and ADMADE in Zambia are well known examples and have motivated other programs in Africa (Newman and Webster 1993). Namibia's community conservancy program is somewhat different. It was largely shaped by the presence of successful commercial conservancies that form a multi-million pound wildlife industry (Jones and Murphree 2001). Nonetheless, in the last 10 years, Nambia's conservancy program has developed into an important road map for sustainable rural development.

Most community-based wildlife management programs try to meet at least two complex goals: conservation of nature, and economic empowerment of rural households. The underlying premise is that communities can profit from wildlife management if they are given sufficient authority and control over wildlife resources. Thus, such programs invariably involve some devolution of state authority over wildlife management to either community or district government organizations, increased community involvement in protection of fauna and flora, new jobs created through increased tourism, protection, or NGO activities, and benefits to rural households either directly or indirectly through community projects. The community conservancy program in Namibia shares some of the same characteristics. It accords communities with rights over wildlife resources if they are able to identify conservancy boundaries, have a well-defined membership, choose a representative committee to implement programs and develop an acceptable constitution (Jones 2001). The local villagers benefit by being able to negotiate contracts with tourism agencies, manage guards and game-hunting activities, and make decisions about revenue sources and uses.

In our paper, we seek to evaluate the impacts of Namibia's conservancy program. We focus on one of its primary goals, i.e., improving the lives of rural households. Community conservancies in Namibia are still evolving. Thus, evaluating impacts at this stage should provide some useful insights for planning and further development of the conservancy program.

We assess the benefits of community conservancies by asking three specific questions: (a) Do conservancies increase household welfare? (b) Are conservancies pro-poor i.e. do they improve the welfare of poorer households relative to the less poor? (c) And, do self-defined conservancy participants gain more from conservancies relative to those who

choose not to participate? Our analysis is based on a survey of approximately 1,000 households in seven conservancies within the Kunene and Caprivi regions of Namibia.

We use quantitative program evaluation techniques to determine the impacts of conservancy creation. We first assess whether households in established conservancies are better off relative to households in new conservancies. Thus, our control group is comprised of households in recent conservancies while our treatment group is made up of households in more established conservancies. We evaluate household income and three other income-expenditure measures of household welfare and ask whether differences in these measures can be attributed to the presence of conservancies. By analyzing impacts on four indicators of household welfare, we examine the robustness of our results. Our results suggest that community conservancies have a positive impact on household welfare. We also conclude that this impact is poverty-neutral in Kunene and pro-poor in Caprivi.

The second part of our paper focuses on households that report that they are participants in conservancies. We restrict our analyses to established conservancies and ask whether there are significant welfare gains to participating households. While a simple perusal of data suggests that participants are indeed better off, statistical analysis (controlling for differences amongst households) leads to more ambiguous results. We find that there is little difference in welfare gains between participants and non-participants. Thus, welfare benefits from conservancy appear to be evenly distributed between participant and non-participant households.

In interpreting our results, we need to consider whether household income-expenditure measures are reasonable indicators of overall well-being. Conservancy benefits accrue in the form of communal public goods as well as household income. To the extent that these public goods impact income, household welfare measures are adequate. However, to the extent that household income measures do not fully capture all the benefits created by conservancies, our analyses may be underestimating the returns from community management. Our results suggest that households living in established conservancies gain relative to comparator groups, yet participants themselves may not see noteworthy benefits. We interpret these results to mean that the community benefits of conservancies dominate individual benefits and these community benefits are beginning to have an indirect and positive impact on households.

2. Background on Community Conservancies in Namibia

CBNRM in Namibia illustrates the nature of the challenge such activities pose and the role of historical artifacts in shaping community efforts. In 1968, Namibian colonial authorities granted white commercial farmers conditional rights over certain wildlife species, and allowed them to use and exploit wildlife for game and trophy hunting and tourism (see Jones and Murphree (2001) for a detailed account). These rights were reinforced through the passage of the Nature Conservation Ordinance of 1975 (Barnes and De Jager, 1996). Individual farmers pooled their land to provide wildlife with the required habitat, and created large *private* conservancies. There are currently 24 private

commercial conservancies, covering an area of around four million hectares. These commercial conservancies include 900 farms and make up 42% of total conservation areas in Namibia.

In 1995, the post-independent government laid out a set of progressive access rules for communal lands.[1] Under a new 'Policy on Wildlife Management, Utilization and Tourism in Communal Lands,' *communal* conservancies or areas where communities could economically exploit and gain from wildlife resource management were created (Jones and Murphree 2001). The first communal conservancy, the Torra Conservancy, was created in 1998. Several others have since been established, resulting in 29 registrations by 2003 and encompassing a total area of more than 74,000 square kilometers of wildlife habitat.

Community conservancies complement the ecosystem and biodiversity benefits provided by Namibia's protected area system. Namibia has a total area of 110,000 square kilometers designated as proclaimed state land for conservation. Out of the 29 registered conservancies, 17 of these either border or are located between conservation areas. This implies an additional 47,515 square kilometers of land adjacent to protected areas for cooperative conservation management. Wildlife, as a result, is presented with more opportunities for mobility and flexibility between seasons. This is of particular significance during times of drought or poor rainfall distribution.

So far, few studies have quantitatively assessed the impact of Namibia's community programs. However, Brian Jones (1999b), in a review article of community conservation in Namibia, is able to provide detailed anecdotal evidence. He concludes that conservancies have had a positive impact on natural resource stocks. For example, wildlife numbers in the Kunene region improved significantly through the late 1990s. Poaching appears to have declined in Kunene as well as parts of Caprivi. In terms of welfare benefits, Jones determines that communities have benefited in cash and kind. These rewards accrue at the community-level as well as household level. For example, at the end of 1998, the Torra conservancy had gained some $40,000 from profit-sharing agreements with a tourist lodge. Meat distribution is another important benefit. Other monetary revenues include cash for services to lodges, bed-night levies, wages for guards and other employment, and income from sale of skins (Jones 1999b).

Barnes and others (2002) analyze the financial and economic returns to investments in five conservancies, including some studied here. Several years of financial records and future conservancy management plans were combined into 10 year cost-benefit models, measuring the merits of conservancy investment from the perspectives of the project, the national economy, and the communities themselves. The results showed that, at least collectively (at the conservancy level), communities which invest in conservancy development can expect high returns on their investment. The study did not examine the distributional patterns associated with, or planned for, these returns.

[1] Communal land refers to areas where property is commonly held and with some form of Traditional Authority in place. However all communal land in Namibia belongs to the state.

2. Data

For our analysis, we use data from a household survey conducted in 2002 by the Wildlife Integration for Livelihood Diversification (WILD) project and the Environmental Economics Unit of the Directorate of Environmental Affairs, Ministry of Environment and Tourism. The survey includes 1,192 households in seven conservancies from two regions, Kunene and Caprivi.

The survey does not include any households living outside the seven conservancies. As a result, we cannot evaluate conservancies by comparing household living outside conservancies with those living within conservancies. To overcome this data limitation we utilize the fact that the full benefits from a conservancy can be achieved only after the conservancy has been in operation for several years. Thus, we distinguish between two types of conservancies, "established" and "comparator." We then evaluate differences in income measures between these two types of conservancies.

Established conservancies include those that were started on or before 1998.[2] These comprise Torra and ≠Khoadi //Hoâs in Kunene, and, Salambala in Caprivi. In contrast, the comparator conservancies were started in or after 1999. Thus, Sorris Sorris, and Ehi-Rovi Puka in Kunene and Mayuni and Kwandu in Caprivi are comparator conservancies. The difference in the starting date for comparator and established conservancies is one year in Caprivi, and 3 to 4 years in Kunene. As a result, we expect the differential impact of conservancies to be underestimated in Caprivi. We present the Caprivi results for completeness.

Table 1 summarizes household income, education, and other characteristics for each conservancy in the sample. The three high household income conservancies are Torra, Salambala, and Kwandu. These are also the three conservancies with a higher proportion of households with education of grade 10 or above. Table 1 also indicates that the dominant occupation in the two regions is subsistence agriculture and livestock rearing. Approximately 40% of the surveyed households are female-headed.

Table 2 shows the relationship between households and conservancies. This includes information on participation, income from conservancies, conservancy awareness, and benefits.

The WILD survey recorded the number of persons in a household who were conservancy members. Some households reported all infants and children as well as adults to be members of the conservancy, while others reported only adults to be members. To avoid problems from such data inconsistency, we define participant households as those with at least one member. The highest participation is in the oldest conservancy – 75% of households in Torra conservancy are participants. Overall, 34% of the households

[2] While conservancies were formally registered only in the mid-nineties, community conservation activities had started in some of the conservancies in the 1980s.

consider themselves as participants in all conservancies. On average, 26% of the households reported that they knew about conservancy constitutions.

The average household income from conservancies is derived from total income reported by household members and their corresponding occupational status related to the conservancy (Type B). Type B occupation includes direct employment as well as wage and enterprise income indirectly arising from the conservancy. Individual conservancy incomes are added to obtain household conservancy income.[3] Except for *Torra*, average incomes from conservancies are lower than average household income. This shows that households who obtain income from conservancies also have other sources of income. On average only 12 percent of the households sampled reported any income from conservancies.

Table 2 also shows that there are non-income related benefits that accrue from conservancies. In Kunene region, a majority of the households in established conservancies considers distribution of meat as a key conservancy benefit. For example, 76% of households in Torra and 62% of households in ≠Khoadi //Hoâs indicated meat distribution to be a conservancy related gain. We were unable to include such non-income assistance in our analyses.

Table 3 compares households in established versus comparator conservancies. The average income of households in established conservancies is higher than that of comparator conservancy households. Thus, it may appear that the differences in household income are a result of the conservancy influence. However, the average level of male and female education in the established conservancies is also higher. It is also appears that established conservancies may have access to slightly better infrastructure. A larger percent of households in established conservancies have electricity relative to the comparator group.

This table also shows the differences in the sources of livelihood in the two regions. In *Kunene,* most households reported agriculture as the primary source of livelihood. In *Caprivi,* households were divided between livestock, formal and informal employment.

3. Methodology

The 2002 Socio-Economic Household Survey (SEHS) was designed primarily to evaluate the impact of conservancies on household incomes and assess how such impacts vary among households with different socio-economic characteristics. Based on our initial assessment of the data, we focus on three specific questions:

[3] Conservancies provide wage employment and self-employment opportunities, income through hotel levies, meat to households and community level income through tourism related contracts and agreements (Jones 1999a and 1999b). Unfortunately, the household survey data does not collect information on community related benefits.

(1) Do conservancies significantly increase household welfare?
(2) How does the change in a household's welfare resulting from a conservancy vary by household socio-economic characteristics?
(3) Does participation in the conservancy increase household welfare relative to those who choose not to participate?

A key concern with the 2002 SEHS is that it collected household information only after the implementation of CBNRM programs. Thus, we do not have the baseline data that is particularly useful for conducting program evaluation. Because of this and other information limitations related to data inconsistencies, we try to evaluate the impact of conservancies by using different methods to cross-check robustness of results.

We measure household welfare using four different indicators: household income and expenditure, and per capita income and expenditure. It is often argued that income measures are subject to larger measurement errors and more volatile, in particular, in countries where agricultural and informal sectors constitute the major part of the economy (Deaton, 1997). In contrast, household expenditure yields a more accurate measure of living standards. In the following program evaluation, we employ both measures.

Evaluation of conservancy impact

Method (1): Simple comparison without controls

This method essentially involves comparing the mean income/expenditure between two groups of households: those living within conservancies (in our case, established conservancies within the region) and those residing outside conservancies (the newly established ones). The differences in the mean income (or expenditure) between the two groups of households are expected to capture the impact of the conservancies. A significant t-test suggests that the existence of conservancies increases household welfare.

It should be noted that the simple-comparison-without-controls method is only valid when the conservancy is randomly assigned among different localities, i.e. localities with and without conservancy programs should have similar observable and unobservable characteristics. In reality, such random experiment design is often not possible simply because public programs are often intended to improve the welfare of targeted groups. Also it is often impossible to randomly assign programs across localities because of institutional or political constraints. Another problem is that households may selectively migrate to areas where conservancies are more successful, in which case, this method will lead to a biased estimate of the conservancy effect. Given the data available and limited evidence of selective migration, we assume that the selective migration is less of a concern.

Method (2): Multivariate analysis of welfare impacts of conservancies

To control for differences in observable characteristics, we use a model of household income determination to evaluate the effect of conservancies. Household welfare is treated as a function of household characteristics, and whether that household is residing in an established conservancy.

The household income/expenditure equation can be written as:

$$\ln y = \alpha + \beta X + \gamma C + \varepsilon \qquad \textbf{(1)}$$

where y is household income or expenditure. X is a vector of covariates, including a dummy for households with highest education between seventh and ninth grade; a dummy for households with highest education above tenth grade; a vector of dummies for the occupational classification of the head of the household; the number of persons in the household between the age of 15 and 65; total crop area of the household, the number of months the households harvested fuelwood in past year, a dummy if the household reported crop or livestock damage by wildlife; female headed household dummy; and livestock and asset indices, which are constructed using the principal component method. C is a dummy variable taking the value one for households that reside within an established conservancy and zero, otherwise.

The estimated coefficient of C reflects the conservancy impact on household welfare. The coefficient can be interpreted as the proportion of household income increase (in the semi-log specification) for households living in an established conservancy compared with those not living in established conservancies, after controlling for other factors.

It should be noted that estimates of the conservancy effect using cross-sectional data can be seriously affected by omitted variable bias and selection bias.[4] There could exist geographical and infrastructural characteristics that make certain areas more suitable for conservancies as well as affect welfare indicators of households. For example, better roads may result in better access for tourists as well as access to markets. Thus, better existing roads in one area may make it more suitable for conservancy development and better access to market stemming from the same road may imply higher income for the

[4] To correct the omitted variable bias, we need panel data from before and after establishment of conservancies. Unbiased conservancy effects can be obtained from estimating conservancy impact changes in household incomes assuming unobserved area characteristics remain constant over time, i.e. the difference-in-difference method (Heckman and Smith, 1999). While the collection of panel data can substantially enhance the power of program evaluation, the costs of data collection can also be considerably higher. Another way of dealing with omitted variable bias is the instrumental variable method (Heckman, 1997). However, we do not have any conservancy level area characteristics data and no suitable instrument variable that may influence establishment of a conservancy in one location but does not influence household welfare. As a result we are unable to use this method to the measure the conservancy effect on household welfare.

households. This is unlikely in our study area, but since we do not have the infrastructure data, we cannot control for these village / conservancy level characteristics.

It can be argued that even within a program such as a conservancy, the economic benefit households derive may differ (Jalan and Ravallion, 2002). For example, better educated households may reap more economic profits relative to less educated households. We test for differential conservancy benefits by using a set of interaction dummy variables in equation **(2)**

$$\ln y = \alpha + \beta X + \beta_1 C * yZ + \beta_2 C * nZ + \beta_3 nC * yZ + \varepsilon \qquad \textbf{(2)}$$

where X includes all the covariates specified in equation **(1)**, *C* is the established conservancy dummy, *nC* is the dummy for comparator conservancies, yZ is a social characteristics dummy such as high education, female-headed households, asset-rich, and livestock-rich. *nZ* represents either low education, male-headed households, asset-poor, or livestock-poor. Thus, the coefficient β_1 where *yZ* is high education, for example, tells us the additional income gain accruing to higher educated households within established conservancies, compared to less educated households within comparator conservancies. Households with education attainment of grade 10 and above are defined as high education households. Households in the third quintile or above with respect to asset index are defined as asset-rich. Livestock-rich households are similarly defined in terms of livestock index. The reference group is the *nC***nZ* (for example, comparator conservancy low education).

The differential welfare benefit from established conservancies to households with high education is given by ($\beta_1 - \beta_2 - \beta_3$). That is, if ($\beta_1 - \beta_2 - \beta_3$) = 0, households with high education do not enjoy any extra benefit from established conservancies. If ($\beta_1 - \beta_2 - \beta_3$) > 0, then high education households gain more from conservancies than low education households. Conversely if ($\beta_1 - \beta_2 - \beta_3$) < 0, the conservancy benefits may be accruing more to low education households. The interpretation of ($\beta_1 - \beta_2 - \beta_3$) for female headed households, asset-rich households, and livestock-rich households are similar.

Evaluation of economic impact of participation in conservancies

The 2002 survey (table 2) shows that among the 7 conservancies, the proportion of household participation in conservancy programs ranges from 16 percent in Mayuni to 75 percent in ≠Khoadi //Hoâs. To evaluate the impact of participation, we first analyze the determination of participation.

Determinants of Participation

We use the following probit model to analyze the determination of participation.

$$\text{Prob}(\text{Participation} = 1) = \varphi(\beta X + \gamma VP) \quad \textbf{(3)}$$

Where X includes all the household level covariates as specified in equation **(1)**. The *VP* is the proportion of households reporting to be member of the conservancy at the village level. *VP* captures the peer pressure effect of other participating villagers on a household. The function φ(.) is a commonly used notation for the standard normal distribution. We use the maximum likelihood estimation method to estimate **(3)**.

Evaluation of the impact of participation

Method (1): Simple comparison without controls

The basic idea of this method is outlined in the section on evaluation of conservancy impact. To evaluate the participation effect, we use a sub-sample (households who live within conservancies) and compare the mean income/expenditure between participating and non-participating households.

Method (2): Multivariate analysis

To control for observable household characteristics, we use a income determination model, similar to that of equation **(1)**, to evaluate the impact of household participation in conservancies.

Household income equation can be written as:

$$\ln y = \alpha + \beta X + \beta P + \varepsilon \quad \textbf{(4)}$$

Where X has the same set of covariates as in **(1)**. *P* is a dummy variable, taking value 1 for participants, and 0 for non-participants. We assume that participation decision is exogenous, rather than a choice variable.[5] This is a strong assumption, and we relax this assumption in the next step and test its validity in the analysis.

Similar to the conservancy dummy *C* in equation **(1)**, the estimated coefficient of *P* reflects the impact of participation in conservancy on household welfare. The coefficient can be interpreted as the proportion of household income increase (in the semi-log specification) for participants compared with non-participants after controlling for other factors.

[5] One such situation may be, when all households within a village are automatically made members of the conservancy and households are not allowed to opt out of participation. Another case where this assumption is true is where participant households are selected randomly by an outside organization.

As with the conservancy analysis, the multivariate estimates of the program effect of participation using cross-sectional data can be also be biased due to omitted variables. There could exist a correlation between the participation decision and unobserved household characteristics, which affects outcome variables. For example, households who are better informed about potential benefits from conservancies are more likely to participate in these programs. Very often, such better-informed households also tend to be more able to generate higher income. But household characteristics, such as the ability to get access to information, are unavailable from the survey, hence the estimation can suffer from self-selection bias.

One way of dealing with selection bias (i.e. correlation between the participation decision and unobserved household characteristics) is the instrumental variable method (Heckman, 1997).

Method (3): Instrument variable method

This method depends crucially on the availability of a valid instrumental variable. We argue that the proportion of village-level participation is a potentially valid instrument. This variable is correlated with household participation, but does not affect household income directly. The instrumental variable method involves an estimation of a two-equation system: the household's income equation and the participation decision equation.

The two estimated equations are equation **(3)** and **(4)**, where *VP* is the instrument variable as it measures the peer pressure effect of other participating villagers on a household. The peer pressure influences the participation decision but has no impact on the household welfare measures. We test the hypothesis that participation is endogenously determined by each household along with their income and consumption decisions.[6]

The estimated coefficient of the participation dummy from the two-equation system is expected to provide an unbiased estimate of the impact of participation in conservancies on household incomes.

[6] The distribution of the error terms **(3)** and **(4)** have zero means and standard deviation and correlation coefficients of $\begin{bmatrix} \sigma & \rho \\ \rho & 1 \end{bmatrix}$. The two equations are simultaneously estimated by Maximum Likelihood method. We test the hypothesis that the coefficient of participation in the income equation is significantly different from zero. We test the hypothesis that $\rho = 0$.

Method-(4): Propensity Score Matching method

The propensity score matching method is regarded as one of the best alternative when random experiment design is not possible (Rubin, 1973). This method is particular appealing in circumstances where only cross-sectional data are available.

A propensity score is an index that is based on the probability of a household participating in the established conservancy programs. Thus, in this paper, the propensity scores are based on estimations of equation **(3)**. The propensity score is used to match the non-participants (i.e. the comparator group) with the participants (i.e. the treatment group) on the basis of a set of observed characteristics summarized in the propensity score.[7] A significant difference between the mean incomes (expenditures) of the two matched groups indicates the existence of participation effects on household welfare.

It should be noted that none of the above listed methods is perfect. Our intent in using several methods to evaluate the impact of conservancy programs or participation is mainly driven by data availability and the potential for checking consistency and robustness of results.

4. Results

The Conservancy effect

Table 4 summarizes the impact of established conservancy programs on household welfare (measured by household income, per capita income, household expenditure and per capita expenditure) relative to comparator conservancies. We report results from the simple comparison without controls and multivariate methods. The second part of table 4 shows the differential impact of socio-economic characteristics on household welfare in established conservancies. As reported earlier, while our focus here is on household income and expenditure measures as indicators of conservancy benefits, these may not fully account for other community-level benefits that also occur as a result of conservancies.

In Kunene, the simple comparison method indicates, that households in established conservancies enjoy significantly higher household and per capita income. However, the expenditure measures do not suggest any robust differences in welfare.

In Caprivi, except for per capita income, all the measures of welfare show significant differences in standards of living between households in established and comparator conservancies. For example, mean household incomes are 24% higher for households in

[7] We used Gaussian kernel matching for households within common support in this analysis. In kernel matching each participating household is matched with the weighted average of all nonparticipating households. The weights are based on the difference in propensity score between the participating and each non-participating households. The standard errors are bootstrapped.

established conservancies in Caprivi region. However, because the difference between the established and comparator conservancies in Caprivi is only one year, we are less confident about these results.

In general, multivariate analysis confirms the results obtained by comparing simple means. The impact (where statistically significant) of established conservancies as compared with the comparator group is much smaller compared with the simple comparison method. For example, households in established conservancies Kunene enjoy 29% higher per capita income when the multivariate analysis is used, as opposed to 44% with the simple comparison. Similarly in Caprivi, established conservancies enjoy 58% greater per capita expenditure when multivariate analysis is used as opposed to 105% with the simple comparison. The simple comparison results are expected to be biased upward as not all the differences in simple comparisons can be attributed to conservancy related gains.

Differential impacts of various groups

Here we focus on the differential impact of various socio-economic household characteristics on the income of households living in established conservancies. The second part of Table 4 shows results of the tests of hypotheses $(\beta_1 - \beta_2 - \beta_3) = 0$ for education, gender, assets, and livestock. These hypotheses test whether there are differences in welfare benefits from established conservancies to households with high education, female heads, more assets and more livestock.

For education the differential effect, where statistically significant, is negative. This implies low education households stand to gain more in welfare from established conservancies. In other words, high education is not always translated into bigger welfare gains from conservancies. This may be because most employment opportunities created by conservancies are for low skilled workers.

The gender bias hypothesis -- that male-headed households enjoy higher benefits from conservancies as compared to their female headed counterparts is rejected in most cases in part B of table 4. Only for household income in Kunene, is $(\beta_1 - \beta_2 - \beta_3)$ negative and weakly significant. In contrast female-headed households in Caprivi enjoy higher net expenditure benefits from conservancies.

Similarly part C of table 4, which focuses on asset-poverty, shows that $(\beta_1 - \beta_2 - \beta_3) = 0$ cannot be rejected for any of the welfare measures in Kunene and two income measures in Caprivi. That is asset-rich households do not enjoy higher net benefits from conservancies when compared with their asset poor counterparts. For expenditure based measures in Caprivi, $(\beta_1 - \beta_2 - \beta_3)$ is negative. That is, asset-poor households are likely to gain more from conservancy benefits than their asset-rich counterparts in Caprivi. This suggests that benefits from conservancies are pro-poor in Caprivi and poverty neutral in Kunene when poverty is measured in terms of assets. However, the situation for livestock-poor households is ambiguous for the two regions.

Determinants of Participation

In this section, we focus on the impact of participation within the established conservancies. Participation by households is defined as those reporting that they are members of the conservancy. Membership may have direct and indirect welfare implications for households who choose to participate.

Table 5 shows the results of determinants of participation in the two regions. Most factors are not statistically significant in either region. The peer effect on participation measured by the village participation ratio is statistically significant in both regions. This shows that if a household resides in a village with a larger proportion of participants, then that household is more likely to be a participant as well.

In Kunene, two other factors show a significant statistical relationship with participation. First, households with at least seventh grade and higher education have higher probability of participation. Second, a household with crops or livestock damaged by wild animals is more likely to participate in the conservancy. This suggests that households with predation or crop damage problems may view conservancies as a mechanism for lobbying for some changes or compensation.

In Caprivi, we find the probability of participation is dependent on household ownership of assets, other than livestock. Households with more assets are more likely to participate.

Participation and Welfare

Table 6 summarizes the impact of participation on household welfare in the *established* conservancy programs.

The simple comparison method indicates that participant households in established conservancies of Kunene enjoy a significantly higher standard of living by all welfare measures, except for per capita income. In Caprivi, only income measures are significantly different among participant and non-participant households.

However, multivariate analysis, instrumental variable and propensity score methods suggest that the difference in welfare between participant and non-participant households is not statistically significant for most of our indicators of welfare.

To summarize our main results on welfare impacts, we find that conservancies have an impact household welfare but self-reported participants do not seem to benefit. Our first set of analyses focuses on the conservancy effects. There are positive welfare gains to households in established conservancies relative to new conservancies in both regions. Further, households with lower education gain more from conservancy establishment. Benefits from conservancies are poverty neutral in Kunene and pro-poor in Caprivi.

Our second set of analyses focuses on the effects of household participation within the context of established conservancies. Our multivariate, instrumental variable and propensity score analysis do not indicate that participation has a noteworthy effect on household welfare within established conservancies.

6. Conclusions

This paper fills an important gap in improving our understanding of households residing in conservancy areas in Namibia. By obtaining information on households in seven different conservancies, it allows us to gain useful insights into awareness of and perceptions about conservation, household participation in conservancy activities and the direct and indirect benefits that accrue as a result. However, because households that reside outside conservancies are excluded from this survey, analysis of the impact of conservancies is somewhat difficult.

Survey data reveal that a majority of households have limited knowledge about conservancies and their activities. Only about 23% of surveyed households knew about conservancy plans and some 26% of households had some knowledge about conservancies and their constitutions. Thus, there appears to be is a need for awareness creation and education about the role of conservancies and their potential benefits.

Approximately 34% of households report that they are conservancy participants. Our analysis of the determinants of participation indicates that participation is mainly influenced by peer-pressure. Over time, with increased awareness and development of the conservancies, participation may become more widespread. This could potentially lead to greater ownership and control over conservancy activities among members.

Households gain from conservancies either through cash income, non-cash rewards and community level benefits. Our survey data show that only a small number of households obtain cash income -- some 12% of the surveyed households report conservancy related income. While there is likely to be underreporting of income, it is also clear that conservancies have not been a source of cash revenues for most households. It should be noted that conservancies also provide non-cash income. For example, some 21% of all survey households viewed meat distribution as a benefit of conservancies. We are unable to capture the monetary value of such food subsidies.

The largest percentage of households reporting conservancy-related cash income was from the Torra conservancy (27%). Torra was the first conservancy to be established and conservancy income is the major source of income for reporting households. Thus, as conservancies grow into maturity, it is possible that more households will directly benefit.

Living within conservancies and close to wildlife also comes with its costs. Over 50% of the households surveyed reported that they suffered crop or livestock damage from wildlife. Thus, conservation of wildlife can also result in signficant expenses to households. This makes it all the more important for households to gain direct income

from conservancies. Without this, households may increasingly choose alternate land uses over wildlife management.

The main part of our analysis focused on three key questions: (1) Do conservancies increase household welfare? (2) How do changes in households' welfare resulting from conservancies vary by household socio-economic characteristics? (3) And, does participation in conservancies increase welfare?

Despite data limitations, we are able to conclude that conservancies have an overall beneficial effect on household welfare. This result is supported by a simple comparison of indicators of welfare as well as multi-variate analyses. We find that a majority of household welfare indicators are higher for established conservancies relative to comparator groups.

Our results suggest that the improved welfare effects of conservancies are poverty neutral in Kunene and pro-poor in Caprivi. There is little evidence to show that the higher educated or the asset-rich are gaining more from conservancies relative to their less educated or poor counterparts. Thus, we conclude that conservancies, if not pro-poor, are at least not being captured by the elite. This is an important finding because a potentially negative effect of decentralized natural resource management is increased power to traditional hierarchies. Community conservancies in Namibia are doing well on this score.

Our multivariate analysis suggests that participants in conservancies do not necessarily enjoy higher levels of income or expenditure relative to non-participants. This does not mean that individual household level benefits from conservancy development are small. Rather, our analysis suggests that the welfare benefits from conservancy development may be more evenly distributed between participant and non-participant households than expected.

There is both anecdotal evidence, and, evidence from the cost-benefit analysis, of significant community level benefits from conservancy creation (Barnes and others 2002). While cash benefits are limited, participants and non-participants also enjoy other non-cash benefits such as meat, community infrastructure, etc. These community-wide benefits may be the reason why we find that conservancies have a positive impact on the average household's welfare but conservancy participants themselves do not significantly gain.

There are several remaining issues that require further research. There may be specific resource or infrastructural characteristics that contribute to welfare gains in the consevancies studied in this paper, but our data do not allow us to control for these effects. Further, there is little known about whether conservancy creation has indirect welfare effects (positive or negative) on areas outside conservancies. Finally, wildlife tourism contributes not just to households within conservancies, but also has other national benefits. Our study does not document these.

Community-based natural resource management faces many other challenges in Namibia. The presence of veterinary barriers, such as the foot and mouth disease red line is one such challenge. The somewhat limited high-level government support for wildlife management, as evidenced by discrepancies in budget allocation between agriculture and natural resource conservation and management (Weaver and Skyer, 2003) is also source of concern. Community conservancies are still in their growth phase. Our results provide some evidence that they have a positive impact on rural welfare. Thus, it is likely that they will survive and gain support despite these challenges.

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Table 1: Key characteristics of conservancy by region

	Kunene				*Caprivi*			
	Torra	*≠Khoadi //Hoâs*	*Sorris-Sorris*	*Ehi-Rovi Puka*	*Salam-bala*	*Mayuni*	*Kwandu*	*Total*
Year Started	1998	1998	2001	2001	1998	1999	1999	
Total Number of Households	84	210	175	150	206	183	184	1192
Number of Participant	63	80	52	87	53	30	38	403
% Participant	75	38	30	58	26	16	21	34
Average Income	11234	8054	8307	6090	8953	6540	8410	8046
% households with education								
Grade 9 and below	52	71	70	77	34	54	51	58
Grade 10 and above	48	29	30	23	66	46	49	42
% households with electricity	6	7	5	1	9	0	1	4
% female headed households	43	42	41	39	40	42	36	40
% Households with main occupation of head								
Formal employment	35	8	13	8	9	5	5	10
Informal employment	14	15	10	4	12	11	3	10
Subsistence agriculture (includes livestock)	39	65	66	72	50	63	84	64
Cash crop farming	0	0	0	0	14	14	3	5

Table 2: Households and conservancy characteristics

	Kunene				*Caprivi*			
	Torra	*≠Khoadi //Hoâs*	*Sorris-Sorris*	*Ehi-Rovi Puka*	*Salam-bala*	*Mayuni*	*Kwandu*	*Total*
Average income from conservancy	11921	5771	3214	3000	4970	5373	1978	5689
# households with conservancy income	26	12	24	6	37	28	14	147
Average wage income from conservancy	2615	1850		967	2541	3866	3136	2578
# households with conservancy wage income	15	8	0	18	26	20	17	104
% households with conservancy payment (1)	27	15	0	9	14	10	8	11
% households with damage by wildlife (2)	35	50	30	31	69	74	86	56
% household with conservancy interaction								
Contributed to Conservancy (q49)	11	20	4	30	7	4	2	11
Know about the Conservancy Plan (q50)	29	18	11	25	25	18	29	21
Consulted with plans (q50a)	39	18	14	27	26	19	28	23
Know the Conservancy Constitution (q51)	49	30	17	32	26	16	24	26
Household's benefit from conservancy (% household)								
Provides jobs to the household members	6	0	0	15	13	8	11	8
Distribute meat to the households	76	62	7	26	2	0	0	21
No advantages	13	37	79	48	44	58	55	49

Note: 1. The average household income from conservancies are derived from total income reported by household members and their corresponding occupational status related to the conservancy (Type B). Type B occupation includes both direct employment by the conservancies as well as wage and enterprise income indirectly arising from the conservancy. If a person reported his / her occupation to be of type B and no secondary occupation, then the total income reported by that person is assumed to be from conservancy. If the person reported primary occupation of type B and another secondary occupation not related to conservancy, then 75 percent of his / her income is assumed to be from conservancy. If a person reported type B to be his / her secondary occupation, then 25 percent of his / her income is assumed to be from conservancy. Individual conservancy income are added to obtain household conservancy income.

2. Households reporting conservancy payments as top three contribution to livelihood or cash income are included.

3. Households reporting damage to both crops and livestock are included.

Table3: Household characteristics by control and treatment conservancies

	Kunene Conservancies		Caprivi Conservancies	
	Comparator	**Established**	**Comparator**	**Established**
Number of households	325	294	367	206
Income	7284	8963	7477	8953
Selected monthly expenditure	715	762	570	1492
Female 16-55	1.6	1.5	1.4	1.6
Male 16-55	1.5	1.4	1.3	1.4
Dependency ratio	1.2	1.0	1.1	1.3
% Household education				
Grade 9 and below	72.9	66.0	52.0	34.0
Grade 10 and above	27.1	34.0	48.0	66.0
% Female education				
Grade 9 and below	72.6	71.8	74.1	51.0
Grade 10 and above	27.4	28.2	25.9	49.0
% households with electricity	3.1	6.5	0.3	8.7
% female headed households	40.3	42.2	39.2	40.3
Most important source of livelihood reported by % households				
Arable production (own use)	2.5	0.0	70.0	46.1
Arable production (cash cropping)	0.3	0.0	1.9	3.4
Livestock production (own use)	41.2	16.3	1.9	6.3
Livestock production (sales)	10.8	24.2	0.3	1.9
Formal employment	10.8	17.4	3.5	6.3
Informal employment	7.1	13.6	2.5	6.3
Pensions	18.8	21.4	7.6	9.7

Note: Comparator conservancies in Kunene are: Sorri-Sorris and Ehi-Rovi Puka. The established conservancies are: Torra and ≠Khoadi //Hoâs. The comparator conservancies in Caprivi are: Mayuni and Kwandu. Salambala is the established conservancy in Caprivi.

Table 4: Key results, impact of conservancy by region

	Kunene	*Caprivi*
1. Simple Comparison Without Control, Mean Differences in:		
a) Mean Household Income	1299.83*	1702.36**
(Changes in proportion)	(0.20)	(0.24)
b) Mean Per Capita Income	589.50**	45.53
(Changes in proportion)	(0.44)	0.03
c) Mean Household Expenditure	-15.77	757.41**
(Changes in proportion)	(-0.02)	(1.32)
d) Mean Per Capita Expenditure	17.01	143.13**
(Changes in proportion)	(0.12)	(1.05)
2. Multivariate Analysis, (changes in proportion):		
Overall Effects of Conservancy Program		
a) Household Income	0.18	-0.12
b) Per Capita Income	0.28**	-0.18
c) Household Expenditure	-0.05	0.63**
d) Per Capita Expenditure	0.04	0.58**
Interaction Effects Between Conservancy Program and:		
A. High Education on:		
a) Household Income	-0.41**	-0.21
b) Per Capita Income	-0.51**	-0.24
c) Household Expenditure	0.19	-0.35*
d) Per Capita Expenditure	0.07	-0.37*
B. Female headed households:		
a) Household Income	-0.30	0.21
b) Per Capita Income	-0.23	0.14
c) Household Expenditure	-0.04	0.32*
d) Per Capita Expenditure	0.00	0.23
C. Asset-Rich households:		
a) Household Income	0.03	0.19
b) Per Capita Income	-0.07	0.14
c) Household Expenditure	0.13	-0.44*
d) Per Capita Expenditure	0.03	-0.48*
D. Livestock-Rich households:		
a) Household Income	-0.03	-0.15
b) Per Capita Income	-0.22	-0.20
c) Household Expenditure	0.44**	-0.37*
d) Per Capita Expenditure	0.24	-0.41

Note:

1. Extreme values of income and expenditure were excluded. Households with annual income above 50,000 Namibian dollars and monthly expenditure above 10,000 Namibian dollars were excluded as extreme values. Households reporting zero income or expenditure were also excluded.
2. Statistical significance of the coefficients are indicated by * for 5 percent and ** for 1 percent.

Table 5: Determinants of probability of participation in conservancy

	Kunene	*Caprivi*
Constant	-2.38**	-2.89**
	(0.36)	(0.45)
Grade 7 to 9	0.56**	0.52
	(0.19)	(0.45)
Grade 10 and above	0.73**	0.68
	(0.21)	(0.37)
Formal employment	0.01	0.31
	(0.33)	(0.45)
Informal employment	-0.28	-0.06
	(0.33)	(0.45)
Cash crop farming		0.02
		(0.37)
Retired	0.09	0.07
	(0.33)	(0.42)
Self employment		-0.33
		(0.51)
Young adults:16-35	-0.07	0.02
	(0.05)	(0.05)
Village Participation ratio	3.40**	3.49**
	(0.33)	(0.46)
Livestock: Principal Components	0.07	-0.06
	(0.04)	(0.27)
Assets: Principal Components	0.07	0.29**
	(0.21)	(0.07)
Access to Electricity	-0.20	0.00
	(0.19)	(0.29)
Months Fuelwood Harvested	0.02	0.04
	(0.03)	(0.03)
Crop/Livestock damaged by wild	0.42*	-0.14
	(0.19)	(0.23)
Female Headed Households	0.09	0.04
	(0.16)	(0.21)
N	236	189
Log likelihood	-123.94	-77.59
Pseudo R squared	0.24	0.29

Note:

1. In Kunene some variables did not have sufficient variation between control and treatment and were dropped.
2. Numbers in the parentheses are standard errors.
3. Statistical significance of the coefficients are indicated by * for 5 percent and ** for 1 percent.

Table 6: Key results, impact of participation by region in established conservancies

	Kunene	*Caprivi*
1. Simple Comparison Without Control:		
a) Mean Household Income	1667*	5110**
(Changes in proportion)	(0.24)	(0.69)
b) Mean Per Capita Income	177	849**
(Changes in proportion)	(0.10)	(0.60)
c) Mean Household Expenditure	286**	218
(Changes in proportion)	(0.49)	(0.17)
d) Mean Per Capita Expenditure	54**	7
(Changes in proportion)	(0.41)	(0.03)
2. Multivariate Analysis (Changes in proportion)**:**		
a) Household Income	0.08	0.20
b) Per Capita Income	0.10	0.25
c) Household Expenditure	0.11	-0.21
d) Per Capita Expenditure	0.15	-0.13
3. Instrumental Variable Method (Changes in proportion)**:**		
a) Household Income	-0.69	0.50
b) Per Capita Income	-0.34	0.50
c) Household Expenditure	0.29	-1.21**
d) Per Capita Expenditure	0.45	-1.31**
4. Propensity Score Matching:		
a) Household Income	2961	1238
b) Per Capita Income	656	16
c) Household Expenditure	206	28
d) Per Capita Expenditure	55	9

Note:

1. Extreme values of income and expenditure were excluded. Households with annual income above 50,000 Namibian dollars and monthly expenditure above 10,000 Namibian dollars were excluded as extreme values. Households reporting zero income or expenditure were also excluded.
2. Statistical significance of the coefficients are indicated by * for 5 percent and ** for 1 percent.