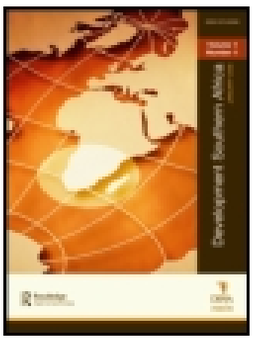

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Benefits to local communities from community conservancies in Namibia: an assessment

Sushenjit Bandyopadhyay, Michael Humavindu, Priya Shyamsundar & Limin Wang

This article evaluates the benefits of community-based activities in wildlife conservancies in Namibia by asking three questions: Do community conservancies contribute to an increase in household welfare? Are such programmes pro-poor; that is, do they improve welfare more for poorer households than for the less poor? Does participation in conservancy increase household welfare more for participants than non-participants? This study bases the analyses on a 2002 survey covering seven conservancies and 1192 households. The results suggest that community conservancies have a positive impact on household welfare. The authors also conclude that this impact is poverty-neutral in some regions and pro-poor in others. Further, welfare benefits from conservancies appear to be fairly evenly distributed between participant and non-participant households.

Keywords: *Community-based natural resource management; wildlife; conservancies; welfare; Namibia*

1. INTRODUCTION

Community-oriented conservation gained ground in the 1980s and 1990s in response to increasing local and international resistance to strict protected area programmes, and as a result of greater awareness of the difficulties of implementing state-run conservation. Communities in many parts of the developing world have engaged in natural resource management. Africa, in particular, has been fertile ground for experiments in community-based tourism and wildlife management, with substantial investments by donors and international organisations (IUCN Regional Office for Southern Africa & Southern Africa Sustainable Use Specialist Group, 2000; US Agency for International Development, 2003; Emerton et al., 2005; Shyamsundar et al., 2005).

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Community-based natural resource management (CBNRM) programmes are complex constructs that seek to meet multiple objectives of economic development, empowerment, and conservation (Kellert et al., 2000). They also involve some degree of devolution of property rights (and power) from a bureaucratic state organisation to a community organisation. As a result, a successful CBNRM programme has to meet a triple bottom line while simultaneously resolving stakeholder conflicts that are endemic to any shift in property rights regimes. This is particularly difficult in developing countries where rights are typically contested and ambiguous.

Worldwide, there is a whole spectrum of rights and responsibilities along which community conservation programmes that practise CBNRM lie. In some cases there is true devolution of authority over management decisions, and in others it is nominal, with communities remaining beneficiaries of the state's economic development plans. Thus, CBNRM is a far from perfect conservation and development instrument, and there are many critics who question its ability to serve community needs (Barrett & Arcese, 1995; Agrawal & Gibson, 1999; Sullivan, 2002). Some scholars argue that other mechanisms, such as payments for ecosystem services, may be a better alternative (Ferraro & Simpson, 2002).

In Africa, CBNRM has become a core conservation and economic development strategy for many donor agencies and governments. Projects such as the Communal Areas Management Plan for Indigenous Resources (CAMPFIRE) in Zimbabwe and Administrative Management Design (ADMADE) in Zambia are well-known examples of community-oriented conservation and have motivated other programmes elsewhere (Newman & Webster, 1993). The question is how effective are these programmes in their achieving their goal of rural development? This article contributes to the policy discussion on the effectiveness of CBNRM by assessing the impact of community-based conservancy programmes in Namibia.

In 1995 the post-independence government of Namibia established a new set of policies that resulted in the establishment of communal conservancies, These are areas where communities can economically exploit and gain from wildlife resource management (Jones & Murphree, 2001). Since then, community-oriented conservation has developed into an important road map for sustainable rural development. The Namibian Government has invested over US$74 million in conservancies and related programmes (Namibian Association of CBNRM Support Organisations, 2005; Humavindu & Barnes, 2006). Some 90 per cent of this funding came from international donors and non-governmental organisations (NGOs). The US Agency for International Development alone contributed some US$40 million to Namibia's conservation efforts (Stefanova, 2005).

Using data based on a survey of approximately 1000 households in seven conservancies in the Kunene and Caprivi regions of Namibia, we attempt to answer the following three questions:

(a) Do community conservancies contribute to an increase in household welfare?
(b) Are such programmes pro-poor; that is, do they improve welfare more for poorer households than for the less poor?
(c) Does participation in the conservancy increase household welfare more for participants than non-participants?

2. BACKGROUND

Community conservancies are an important rural development strategy in Namibia.[1] The first, the Torra conservancy, was created in 1998. Since then some 50 conservancies have been created. They now encompass an area of more than 105 000 km^2 of wildlife habitat and include some 185 000 rural residents (MET, 2006a).

Communities in Namibia are given the rights to create conservancies if they are able to identify conservancy boundaries, have a well-defined membership, choose a representative committee to implement programmes, and develop an acceptable constitution (Jones, 2001). Once the conservancy is established, the community gains limited rights to consumptive and non-consumptive use of the wildlife on the basis of a management plan approved by the MET, which normally includes an institutional structure, a plan for resource management zones, and tools and policies to enable the conservancy to achieve its goals. These plans are expected to stimulate income, which goes directly to the conservancy. Numerous CBNRM activities – such as training in conservancy management and tourism, income-generating projects, tourism enterprises and infrastructure development – have been ongoing in many conservancies, supported by donor and private-sector and development-partner funding and NGO interest (Humavindu & Barnes, 2006). The major income sources are joint venture tourism levies, trophy-hunting income and game for own use. Households may benefit in various ways: employment, cash payouts, insurance schemes as compensation for wildlife damage, meat distribution, soup kitchens and communal infrastructure such as waterpoints, schools and clinics.

What do we know about the impact of community conservancies thus far? There is evidence to suggest they have contributed to the health of Namibia's wildlife. Brian Jones (1999), for example, concluded that wildlife numbers in the Kunene region had improved significantly through the late 1990s. The Integrated Rural Development and Nature Conservation, a noted NGO in Namibia, indicated that elephant populations in Kunene doubled from 1982 to 2001, mountain zebra increased from 450 in 1982 to over 13 000 in 2002, and the springbok population grew tremendously (Integrated Rural Development and Nature Conservation, 2005). It was also reported that oryx and springbok numbers in northwest Namibia were at some 15 000 and 30 000 in the year 2000, a dramatic increase from the low levels of stock in 1985 (US Agency for International Development, 2004). Some of this improvement is because wildlife has been introduced into the conservancies, and some may be due to conservation, a decline in poaching, and good rains (Jones, 2003; Namibian Association of CBNRM Support Organisations, 2005; Weaver & Skyer, 2005).

In terms of welfare benefits, conservancies have provided employment, dividends and, importantly, meat distribution. Jones (1999) determined that communities have benefited in cash and kind, at community as well as household levels. For example, at the end of 1998 the Torra conservancy had gained some $40 000 from profit-sharing agreements with a tourist lodge. Monetary revenues include income from services to lodges, bed-night levies, the sale of skins, and guard duties and other employment (Jones, 1999). In another study, Barnes et al. (2002) found that communities which invest in conservancy development can expect high returns on their investment.

[1]Other natural resource management efforts are Namibia's National Programme to Combat Desertification, the Namib Coast Conservation and Management Project, and the National Biodiversity Programme (Ministry of Environment and Tourism [MET], 2005).

Namibia's conservancy programme is not without controversies, however. Researchers such as Sullivan (2002) have argued that conservancy programmes are biased towards the conservation of large mammals, emphasise local participation in policing and anti-poaching activities, and offer people in communal areas only limited development choices. Other studies, for example Long (2004), have found that wealthier groups tend to have greater access to tourism employment, and there are also concerns about equity in meat and cash distribution. Long's findings also identify the need to strengthen participation within conservancies.

3. DATA

This study examines conservancies in two regions of Namibia, Kunene to the northwest and Caprivi in the northeast (for map, see MET, 2006b). It uses data from a Socio-Economic Household Survey (SEHS) of 1192 households in seven conservancies in the two regions, conducted by the WILD project and the Environmental Economics Unit of the Directorate of Environmental Affairs, MET, over a period of 6 weeks during May and June 2002.

Table 1 presents background information on these seven conservancies. The Kunene region is dry with almost desert conditions. Rainfall is low and variable, but the barren landscape is visually spectacular (Integrated Rural Development and Nature Conservation, 2005). There is a high presence of game such as springbok and a certain number of big mammals – lion, elephant, giraffe and black rhino. Three of the Kunene conservancies (Torra, ≠Khoadi //Hoâs, and Ehirovipuka) share a border. The fourth, Sorris-Sorris, is slightly south and east (see MET, 2006b). Torra is mainly desert, while the other three have desert-savanna features. Kunene is a sparsely populated area dominated by traditional pastoralism, with a few larger settlements around perennial springs and administrative centres with government established schools or clinics.

Caprivi is a narrow strip of land to the northeast of Namibia, characterised by woodlands and floodplains and enjoying high rainfall in the rainy season. Buffalo, elephant and many bird species are of major conservation interest. The three conservancies studied here are in eastern Caprivi – Mayuni and Kwandu in the western part, sharing a border, and Salambala further east (see MET, 2006b). Caprivi has a population of approximately 78 000 people from six dominant groups. Most households here depend on subsistence agriculture, complemented by some cash crops and forest products.

Table 2 summarises household income, education, and other characteristics for each conservancy, based on the SEHS data. About 40 per cent of the surveyed households are female-headed. The three conservancies with a high household income are Torra, Salambala and Kwandu – the same three that have a higher proportion of households with an education of Grade 10 or above. Overall, 34 per cent of the households consider themselves as participants in all conservancies. The highest participation rate is in the oldest conservancy – 75 per cent of households in Torra conservancy are participants.

Table 3 shows the relationship between households and conservancies. Except for Torra, average incomes from conservancies are lower than average household income (i.e. households have multiple sources of income). On average, only 12 per cent of the households sampled reported any income from conservancies. There are also non-income-related benefits that accrue from conservancies. In Kunene, a majority of the households in established conservancies consider distribution of meat to be a key conservancy benefit.

Table 1: Key characteristics of conservancies by region

	Kunene				Caprivi		
	Torra	**≠Khoadi //Hoâs**	**Sorris-Sorris**	**Ehirovipuka**	**Salambala**	**Mayuni**	**Kwandu**
Start year and month	June 1998	June 1998	October 2001	January 2001	June 1998	December 1999	December 1999
Approximate population	1200	3200	1300	2500	7700	2400	4300
Population/area	0.34	0.95	0.57	1.27	8.28	15.89	22.63
Registered members (end of 2003)	450	1600	380	500	3500	900	1800
Vegetation	Semi-desert and savanna	Dry savanna	Grass and trees	Savanna woodland	Mopane woodlands and grasslands and swamps	Grasslands and swamp	Grasslands and swamp
Climate	Arid	200–300 mm rainfall	Arid	Arid	600 mm rainfall		
Some wildlife resources	Elephant, leopard, rhino, cheetah, mountain zebra, kudu, ostrich, giraffe, duiker, steenbok, warthog				Lion, leopard, hippopotamus, elephant, roan, duku, duiker, crocodile, steenbok, lechwe		
Enterprises	Lodge, trophy hunting, sale of springbok, own-use hunting	Trophy hunting, campsite, own-use hunting	Sale of live game, own-use hunting	Lodge, trophy hunting, craft centre, own-use hunting, traditional homestead	Trophy hunting, campsite, craft centre, craft production	Lodge, trophy hunting, campsites, craft centre, thatching-grass sale	Trophy hunting, campsite, crafts, thatching-grass sale
Operating costs covered (%)[a]	100	65	15	20	100	60	60
Conservancy financed staff (*n*)[a]	8	7			12	7	

[a]Data from 2004.

Sources: MET (2005, Registered Conservancies Table), Integrated Rural Development and Nature Conservation (2005) and Namibian Association of CBNRM Support Organisations (2005).

Table 2: Key characteristics of households in conservancies by region

	Kunene				Caprivi			
	Torra	**≠Khoadi //Hoâs**	**Sorris-Sorris**	**Ehirovipuka**	**Salambala**	**Mayuni**	**Kwandu**	**Total**
Total number of households	84	210	175	150	206	183	184	1192
Number of participants	63	80	52	87	53	30	38	403
% participant	75	38	30	58	26	16	21	34
Average income	11 234	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 3: Households and conservancy characteristics

	Kunene				Caprivi			
	Torra	**≠Khoadi //Hoâs**	**Sorris-Sorris**	**Ehirovipuka**	**Salambala**	**Mayuni**	**Kwandu**	**Total**
Average income from conservancy[a]	11921	5771	3214	3000	4970	5373	1978	5689
Number of households with conservancy income	26	12	24	6	37	28	14	147
Average wage income from conservancy	2615	1850		967	2541	3866	3136	2578
Number of households with conservancy wage income	15	8	0	18	26	20	17	104
% households with conservancy payment[b]	27	15	0	9	14	10	8	11
% households with damage by wildlife[c]	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

[a]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 both direct employment by the conservancies and wage and enterprise income indirectly arising from the conservancy. If a person reported his or 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% of his or her income is assumed to be from conservancy. If a person reported type B to be his or her secondary occupation, then 25% of his or her income is assumed to be from conservancy. Individual conservancy income is added to obtain household conservancy income.

[b]Households reporting conservancy payments as top three contributions to livelihood or cash income are included.

[c]Households reporting damage to both crops and livestock are included.

Table 4: Household characteristics by control and treatment conservancies

	Kunene		Caprivi	
	Comparator conservancies	**Established conservancies**	**Comparator conservancies**	**Established conservancies**
Number of households	325	294	367	206
Income	7284	8963	7477	8953
Selected monthly expenditure	715	762	570	1492
Female 16–55 years old	1.6	1.5	1.4	1.6
Male 16–55 years old	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

In Kunene the comparator conservancies are Sorri-Sorris and Ehirovipuka, and the established conservancies are Torra and ≠Khoadi //Hoâs. In Caprivi the comparator conservancies are Mayuni and Kwandu, and Salambala is the established conservancy.

This article compares two types of conservancies, 'established' and 'comparator'. The former are those that were started in 1998 or earlier[2] (Torra and ≠Khoadi //Hoâs in Kunene, and Salambala in Caprivi); the latter are those started in 1999 or later (Sorris-Sorris and Ehirovipuka in Kunene, and Mayuni and Kwandu in Caprivi). The differences between starting dates for established and comparator conservancies are 3−4 years in Kunene, but only 1.5 years in Caprivi. However, background information suggests that Salambala is a more mature conservancy than Mayuni and Kwandu and has a history of CBNRM activities, which allows us to treat it as an 'established' conservancy.

Table 4 compares households in established conservancies with those in comparator conservancies. The average income of established conservancy households is higher than that of comparator conservancy households, which suggests that the differences in household income can be attributed to the conservancy. However, the average level

[2]While conservancies were formally registered only in the mid-1990s, community conservation activities had started in some of the conservancies in the 1980s.

of male and female education in the established conservancies is also higher, and it appears that established conservancies may have access to slightly better infrastructure. A larger percentage of households in established conservancies have electricity than those in the comparator group.

4. METHODOLOGY

Information collected in the 2002 SEHS is used to answer the three questions posed at the end of Section 1 above. However, since the SEHS data were collected after the implementation of CBNRM programmes, there are no baseline data showing the condition of the households before the conservancies were established. Ideally, we need this kind of baseline information to assess the impact of any form of intervention or policy change. Lacking 'before and after' data, our analytical strategy is therefore to compare 'established' and 'comparator' conservancies, using different methods to analyse the differences in welfare between the two types of conservancies in order to assess whether welfare gains have accrued to residents in established conservancies.

We use two methods to answer questions (a) and (b): simple mean differences, and the multivariate dummy variable regression approach. The first is simple, transparent and easy to understand; the second, a superior method, allows us to control for factors other than conservancies that have been observed to have an effect on welfare, and thus to isolate the effects of conservancy creation and CBNRM activities.

Addressing question (c) is more challenging, since many factors – such as the number of adults in the household, education, access to information and household capacity to generate incomes from diversified activities – determine a household's propensity to participate and also affect income. If these factors are not taken into account, the simple multivariate dummy variable regression approach will give biased estimates of the impact of participation. This is important because some factors may be unknown or unobservable and we may inadvertently omit these from our analyses. To make sure the results are robust, we therefore use four different methods: Method 1, simple mean differences between participants and non-participants; Method 2, multivariate dummy variable regression; Method 3, instrumental variable estimation; and Method 4, propensity score matching method.

Method 3 is superior to Method 2 and in theory can address the unobservable omitted variable problem if valid instrumental variables can be established. It is designed to provide unbiased estimates of impacts by matching participating and non-participating households based on household characteristics and then comparing simple mean differences between them, and can be compared with Method 1 to check the potential bias when failing to control for omitted variables.

Although none of the above listed methods is perfect for programme evaluation, they are used in this study because of data availability and the potential for checking consistency and robustness of results. Data needed to answer many burning policy questions are often unavailable and almost never fully adequate, and this is true for conservancy-related data. However, we feel there is merit in getting an initial understanding of conservancy impacts by examining the available SEHS data in several ways.

The impact of conservancies is assessed on the basis of four different measures of welfare: household income, household expenditure, per-capita income and per-capita 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. Using four different welfare indicators also allows us to check for verity of results.

Finally, we are interested in whether conservancies affect the rich and the poor differently. To check these effects, households are defined as asset-rich and asset-poor. Data from the household survey were used to create an index of household assets based on a method developed by Filmer and Pritchett (1998). All of the households in the data-set were ranked according to this index, the top 60 per cent being referred to as asset-rich and the bottom 40 per cent as asset-poor. This is a relative ranking and is not linked to the national poverty line or measures external to the community. Benefits from conservancies are considered to be 'poverty neutral' if there is no significant difference between the benefits enjoyed by the (asset) poor and (asset) rich. Benefits are defined as 'pro-poor' if the poor gain relatively more from conservancies.

4.1 Evaluation of conservancy impact

Since conservancies have few programmes other than CBNRM activities related to income generation and tourism development, the presence of conservancies affects household welfare through CBNRM. This section considers two different methods of assessing the impact of conservancy creation and CBNRM activities on household welfare.

4.1.1 Method 1: simple comparison without controls

Here the mean income/expenditure of two groups of households – those living in conservancies (in this case, established conservancies) and those outside conservancies (the newly established ones) – is compared. The differences in the mean income (or expenditure) are expected to capture the impact of the conservancies. A significant *t*-test suggests that the conservancies increase household welfare.

It should be noted that this method is only valid when the conservancy is randomly assigned among different localities; that is, localities with and without conservancy programmes should have similar observable and unobservable characteristics. But in reality, random assignment is often impossible because of institutional or political constraints, or simply because public programmes are often intended to improve the welfare of targeted groups. We use this method because it is transparent and gives us an initial indication of what we may find using more sophisticated tools.

4.1.2 Method 2: multivariate analysis of welfare impacts of conservancies

The second method identifies the impact of conservancies on welfare by controlling for other factors. Using multivariate regression, the method asks what the impact of conservancies is on welfare when the effect of other 'observable' factors is accounted for and removed from the estimation. We use a simple model where household welfare is treated as a function of household characteristics and whether that household is in an established conservancy.

The household income/expenditure equation can be written as:

$$\ln y = \alpha + \beta X + \gamma C + \varepsilon \quad (1)$$

where y is household income or expenditure. X is a vector of covariates, including a dummy for households with highest education between the seventh and ninth grades; a dummy for households with highest education above 10th grade; a vector of dummies for the occupational classification of the head of the household; the number of persons in the household between the ages of 15 and 65 years; 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; a female-headed household dummy; and livestock and asset indices, which are constructed using the principal component method (Filmer & Pritchett, 1998). C is a dummy variable taking the value 1 for households in an established conservancy, and 0 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 in an established conservancy compared with those not in an established conservancy, after controlling for other factors.

This method also has problems. Estimates using cross-sectional data can be seriously affected by omitted variable bias and selection bias.[3] There could be geographic and infrastructural characteristics that make certain areas more suitable for conservancies as well, which could also affect welfare indicators. For example, better roads could improve access for tourists, making an area more suitable for conservancy development, and give better access to markets, offering higher income to households. This kind of situation is unlikely in the study area, but since there are no infrastructure data we cannot fully control for these village-level or conservancy-level characteristics. In general, however, we would argue that this method captures the welfare effects of CBNRM activities in established conservancies. Some CBNRM activities were started by NGOs or the private sector in conservancies before the actual registration of the conservancy. Thus, the results are likely to be picking up the cumulative effect of CBNRM-type activities and their benefits to conservancy residents.

Question (b) asks whether conservancies are pro-poor or poverty neutral; that is, whether conservancies affect all households equally or have different effects on rich and poor. In some cases, households may derive different economic benefits from the various conservancy programmes (Jalan & Ravallion, 2003). For example, the better educated households may reap more economic profits than the less educated ones even though they both live in established conservancies. Is there this kind of socio-economic difference in how conservancies benefit households? Do the educated and rich do better than the uneducated and poor? We test for this difference using the following set of interaction dummy variables:

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

[3]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 that unobserved area characteristics remain constant over time; that is, the difference-in-difference method (Heckman et al., 1999). While panel data can substantially enhance the power of programme evaluation, the costs of collecting it can 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 the establishment of a conservancy in one location but not household welfare. We therefore cannot use this method to measure the effect of the conservancy on household welfare.

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 – and 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 in established conservancies, compared with less educated households in comparator conservancies. Households with Grade 10 education and above are defined as high-education households. Households in the third quintile or above are defined as asset-rich. Livestock-rich households are similarly defined in terms of the livestock index. The reference group is nC^*nZ (e.g. 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 interpretations of $(\beta_1 - \beta_2 - \beta_3)$ for female-headed households, asset-rich households, and livestock-rich households are similar.

4.2 Evaluation of economic impact of participation in conservancies

The study data, however, show that not all households (whether in new or old conservancies) participated in conservancy programmes. The 2002 survey (Table 2) shows that the proportion of participation ranges from 16 per cent in Mayuni to 75 per cent in Torra. Thus, the next question is whether participating households are better off than non-participating ones. The impact of participation is evaluated by following a two-step process – analysing first the factors that determine participation, and then whether participation affects welfare – using multiple methods, as in the previous section.

4.2.1 Determinants of participation

A probit model is used to analyse the factors that determine participation:

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

where X includes all the household level covariates as specified in Equation (1). VP is the proportion of households reporting to be members of the conservancy at the village level; VP captures the peer pressure effect of other participating villagers on a household. The function $\varphi(\ldots)$ is a commonly used notation for the standard normal distribution. The maximum likelihood estimation method is used to Estimate Equation (3).

4.2.2 Evaluation of the impact of participation

To evaluate the impact of participation on welfare, we again use simple mean differences and multivariate dummy variable regression, and to address omitted variable bias we use instrumental variable estimation and propensity score matching.

4.2.2.1 Method 1: simple comparison without controls

To evaluate the participation effect, we use a subsample (households in conservancies) and compare the mean income/expenditure of participating and non-participating households.

4.2.2.2 Method 2: multivariate analysis

To control for observable household characteristics, we develop an income determination model, similar to that of Equation (1), to evaluate the impact of household participation in conservancies. The household income equation can be written as:

$$\ln y = \alpha + \beta X + \beta P + \varepsilon \tag{4}$$

where X has the same set of covariates as in Equation (1). P is a dummy variable, taking value 1 for participants and 0 for non-participants. It is assumed that the decision to participate is exogenous, rather than a choice variable.[4] This is a strong assumption, and we relax this assumption in the next step and test its validity in the analysis.

Like the conservancy dummy C in Equation (1), the estimated coefficient of P reflects the impact of participation in a 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.

As with the conservancy analysis, the multivariate estimates of the programme effect of participation using cross-sectional data can be also be biased because of omitted variables. There could be a correlation between the decision to participate and unobserved household characteristics that affects outcome variables. For example, households that are better informed about potential benefits from conservancies are more likely to participate in these programmes. Very often, such better informed households also tend to generate higher income. But household characteristics such as the ability to access 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), which we use below.

4.2.2.3 Method 3: instrumental variable estimation

This method involves an estimation of a two-equation system – the household's income equation and the participation decision equation – since participation may be endogenously determined by each household along with its income and consumption decisions.[5] The two estimated equations are Equations (3) and (4), where VP is the instrument variable[6] as it measures the peer pressure effect of other participating villagers on a

[4]For example, this assumption would be true if all households in a village are automatically made members of the conservancy and not allowed to opt out of participation, or if participant households are selected randomly by an outside organisation.

[5]The distributions of the error terms of Equations (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 the maximum likelihood method. We test the hypothesis that the coefficient of participation in the income equation is significantly different from zero. We also test the hypothesis that $\rho = 0$.

[6]This variable is correlated with household participation, but does not affect household income directly.

household, which influences the decision to participate but not the household welfare measures. 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.

4.2.2.4 Method 4: propensity score matching

The propensity score matching method is regarded as one of the best alternatives when random experiment design is not possible (Rubin, 1973) and is particularly 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 programmes. 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 established group) on the basis of a set of observed characteristics summarised 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.

5. RESULTS

5.1 The conservancy effect

Table 5 summarises the impact of established conservancy programmes 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 5 shows the differential impact of socio-economic characteristics on household welfare in established 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 of the measures of welfare show significant differences in standards of living between households in established conservancies and comparator conservancies. For example, mean household incomes are 24 per cent higher for households in established conservancies in Caprivi.

In general, multivariate analysis confirms the results obtained by simple mean differences. The estimated welfare impact (where statistically significant) is much smaller using this method than the impact using the simple mean differences method. For example, households in established conservancies in Kunene have a 28 per cent higher per-capita income according to the multivariate analysis, compared with 44 per cent higher using the simple comparison; and in Caprivi, established conservancies

[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 non-participating households. The weights are based on the difference in propensity score between the participating and non-participating households. The standard errors are bootstrapped. ('Common support' excludes participating households whose propensity score is higher than the highest propensity score of the non-participating households *and* non-participating households whose propensity score is lower than the lowest propensity score of the participating households.)

Table 5: Key results, impact of conservancy by region

	Kunene	Caprivi
Method 1. Simple comparison without control (mean differences)		
Mean household income	1299.83*	1702.36**
(Changes in proportion)	(0.20)	(0.24)
Mean per-capita income	589.50**	45.53
(Changes in proportion)	(0.44)	0.03
Mean household expenditure	−15.77	757.41**
(Changes in proportion)	(-0.02)	(1.32)
Mean per-capita expenditure	17.01	143.13**
(Changes in proportion)	(0.12)	(1.05)
Method 2. Multivariate analysis (changes in proportion)		
Overall effects of conservancy programme		
Household income	0.18	−0.12
Per-capita income	0.28**	−0.18
Household expenditure	−0.05	0.63**
Per-capita expenditure	0.04	0.58**
Interaction effects between conservancy programme and		
A. High education on		
Household income	−0.41**	−0.21
Per-capita income	−0.51**	−0.24
Household expenditure	0.19	−0.35*
Per-capita expenditure	0.07	−0.37*
B. Female-headed households		
Household income	−0.30	0.21
Per-capita income	−0.23	0.14
Household expenditure	−0.04	0.32*
Per-capita expenditure	0.00	0.23
C. Asset-rich households		
Household income	0.03	0.19
Per-capita income	−0.07	0.14
Household expenditure	0.13	−0.44*
Per-capita expenditure	0.03	−0.48*
D. Livestock-rich households		
Household income	−0.03	−0.15
Per-capita income	−0.22	−0.20
Household expenditure	0.44**	−0.37*
Per-capita expenditure	0.24	−0.41

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. Statistical significance of the coefficients: *5% and **1%.

have a 58 per cent greater per-capita expenditure according to the multivariate analysis, compared with 105 per cent greater using 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.

5.2 Differential impacts of various groups

Here the focus is on the differential impact of various socio-economic household characteristics on the income of households in established conservancies. The second part of Table 5 shows the 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 (see part A of Table 5). This implies that 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 than their female-headed counterparts – is rejected in most cases in part B of Table 5. In contrast, female-headed households in Caprivi enjoy higher net household expenditure benefits from conservancies.

Similarly part C of Table 5, 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 than 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. By this we simply mean that the poor households (defined as the asset-poor) gain more than the less poor in Caprivi, while in Kunene there is no difference between the poor and non-poor in terms of conservancy benefits. The situation for livestock-poor households (part D) is ambiguous for the two regions.

5.3 Determinants of participation

This section focuses on the impact of participation in 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 that choose to participate. Table 6 shows the 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 in the conservancy. First, households with at least Grade Seven and higher education have a higher probability of participation. Second, households whose crops have been damaged or livestock taken by wild animals are more likely to participate, suggesting that they may view conservancies as a mechanism for lobbying for some changes or compensation. In Caprivi, the probability of participation depends on household ownership of assets other than livestock. Households with more assets are more likely to participate.

Table 6: Determinants of probability of participation in conservancy

	Kunene	Caprivi
Constant	−2.38** (0.36)	−2.89** (0.45)
Grade 7−9	0.56** (0.19)	0.52 (0.45)
Grade 10 and above	0.73** (0.21)	0.68 (0.37)
Formal employment	0.01 (0.33)	0.31 (0.45)
Informal employment	−0.28 (0.33)	−0.06 (0.45)
Cash crop farming		0.02 (0.37)
Retired	0.09 (0.33)	0.07 (0.42)
Self-employment		−0.33 (0.51)
Young adults: 16−35 years old	−0.07 (0.05)	0.02 (0.05)
Village participation ratio	3.40** (0.33)	3.49** (0.46)
Livestock: principal components	0.07 (0.04)	−0.06 (0.27)
Assets: principal components	0.07 (0.21)	0.29** (0.07)
Access to electricity	−0.20 (0.19)	0.00 (0.29)
Months fuelwood harvested	0.02 (0.03)	0.04 (0.03)
Crop/livestock damaged by wildlife	0.42* (0.19)	−0.14 (0.23)
Female-headed households	0.09 (0.16)	0.04 (0.21)
n	236	189
Log likelihood	−123.94	−77.59
Pseudo R^2	0.24	0.29

In Kunene, some variables did not have sufficient variation between control and treatment and were dropped. Data in parentheses are standard errors. Statistical significance of the coefficients: *5% and **1%.

5.4 Participation and welfare

Table 7 summarises the impact of participation on household welfare in the established conservancy programmes. The simple comparison method indicates that participant households in established conservancies in Kunene enjoy a significantly higher standard of living by all welfare measures, except for per-capita income. In Caprivi, only the income measures differ significantly between participant and non-participant households. However, the multivariate analysis, instrumental variable and propensity score methods indicate that the difference in welfare between participant and non-participant households is not statistically significant for most of the indicators of welfare. This suggests that conservancy benefits are somewhat evenly distributed between members and non-members.

To summarise the main results on welfare impacts: conservancies have an impact on household welfare, but self-reported participants do not seem to benefit. We find that there are more welfare gains to households in established than in new conservancies in both regions. Further, households with lower education gain more from conservancy establishment. Benefits from conservancies are poverty neutral in Kunene (i.e. there is no significant difference between the benefits enjoyed by the poor and non-poor or less poor), but they are pro-poor in Caprivi (i.e. the poor gain relatively more from conservancies).

The second set of analyses in Table 7 focuses on the effects of household participation in established conservancies. The multivariate, instrumental variable and propensity score analysis do not indicate that participation has a noteworthy effect on household welfare in established conservancies.

Table 7: Key results, impact of participation by region in established conservancies

	Kunene	Caprivi
Method 1. Simple comparison without control		
Mean household income	1667*	5110**
(Changes in proportion)	(0.24)	(0.69)
Mean per-capita income	177	849**
(Changes in proportion)	(0.10)	(0.60)
Mean household expenditure	286**	218
(Changes in proportion)	(0.49)	(0.17)
Mean per-capita expenditure	54**	7
(Changes in proportion)	(0.41)	(0.03)
Method 2. Multivariate analysis (changes in proportion)		
Household income	0.08	0.20
Per-capita income	0.10	0.25
Household expenditure	0.11	−0.21
Per-capita expenditure	0.15	−0.13
Method 3. Instrumental variable method (changes in proportion)		
Household income	−0.69	0.50
Per-capita income	−0.34	0.50
Household expenditure	0.29	−1.21**
Per-capita expenditure	0.45	−1.31**
Method 4. Propensity score matching		
Household income	2961	1238
Per-capita income	656	16
Household expenditure	206	28
Per-capita expenditure	55	9

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. Statistical significance of the coefficients: *5% and **1%.

6. CONCLUSIONS

This article seeks to fill a gap in the understanding of CBNRM and some of its implications for households in conservancy areas in Namibia. Most of the analyses focus on understanding whether conservancies have had an impact on household welfare, whether the poor have gained as much as the rich, and whether households that participated in conservancy activities have gained more than non-participants.

The study builds on a survey of over 1000 households living in seven conservancies in two regions of Namibia. A simple review of the summary statistics from these data suggests that a minority of households were informed about the conservancy activities or were beneficiaries. The largest percentage of households reporting conservancy-related cash income was from the Torra conservancy (27 per cent). Torra was the first conservancy to be established, and conservancy income is the major source of income for reporting households.

Nonetheless, the analyses suggest that, on the whole, conservancies have a beneficial effect on household welfare. Multivariate analysis shows that in both regions households were

better off in the established conservancies by at least one measure of welfare. In Kunene, households in established conservancies enjoyed a 28 per cent higher per-capita income than those in comparator conservancies; and in Caprivi, per-capita household expenditure was 58 per cent higher in established than in comparator conservancies.

We would argue that these positive impacts reflect the cumulative impacts of all CBNRM and tourism activities associated with established conservancies. It is possible that people participate in these activities but do not necessarily associate them with the conservancies. Our findings simply suggest that the set of activities undertaken in established conservancies, whether they emerge from households, the government, private sector or donors, are having a positive effect on people's well-being.

These findings do not support the evidence of elite capture (Long, 2004). This study defines elites as those with either higher education or more household assets. The results suggest that the improved welfare effects of conservancies are poverty neutral in Kunene and pro-poor in Caprivi. By this we mean that the benefits the asset-poor and the asset-rich enjoy from conservancies in Kunene do not differ significantly, while in Caprivi the asset-poor gain more from conservancies than their richer counterparts. Thus, this article concludes 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 decentralised natural resource management is that it gives increased power to traditional hierarchies.

The multivariate analyses suggest that participants in conservancies do not necessarily have higher levels of income or expenditure than non-participants. This does not mean that individual household-level benefits from conservancy development are small; rather, the analysis suggests that the welfare benefits from conservancy development may be more evenly distributed between participant and non-participant households than expected.

There is evidence, both anecdotal and from the cost−benefit analyses, of significant community-level benefits from conservancy creation (Barnes et al., 2002). While cash benefits are limited, participants and non-participants also enjoy non-cash benefits such as meat distribution and community infrastructure. These community-wide benefits may be the reason why this study finds that conservancies have a positive impact on the average household's welfare but conservancy participants themselves do not gain significantly. Our understanding also is that participants who earn from CBNRM often support their family and social networks directly or indirectly. One person's income gets distributed more widely, hence the lack of a 'participant' effect. Further, there are NGO and private-sector projects operating in conservancies. While these projects contribute to the 'conservancy' effect found in this study, they may not contribute to the 'participant' effect because the participation question was specific to whether or not the household was a member of the conservancy.

There are several remaining issues that require further research. Collection of data 'before and after' conservancy creation would be most appropriate for evaluating benefits. There may also be specific resource or infrastructural characteristics that contribute to welfare gains that could be more carefully examined. Our data do not allow us to control for some of these effects. Further, little is known about whether conservancy creation has any indirect welfare effects (positive or negative) on areas outside conservancies. Also, participation in conservancy activities could be improved considerably and this could bring different types of benefits. This study did not examine concerns related to rights associated with participation, ownership and benefit sharing.

Conservancy creation is a rural development strategy. Thus, it is appropriate to ask questions about alternative mechanisms for increasing income to communities such as payments for environmental services and other development strategies that reduce the costs of wildlife damage. These issues, however, are beyond the scope of this paper – as are the macro implications of wildlife tourism. Further work is required to examine these aspects more carefully.

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