

The Valuation of Biodiversity Conservation by the South African Khomani San “Bushmen” Community

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Abstract

The restitution of parkland to the Khomani San “bushmen” and Mier “agricultural” communities in May 2002 marked a significant shift in conservation in the Kgalagadi Transfrontier Park and environs in South Africa. Biodiversity conservation will benefit from this land restitution only if the Khomani San, who interact with nature more than do other groups, are good environmental stewards. To assess their attitude toward biodiversity conservation, this study used the contingent valuation method to investigate the values the communities assign to biodiversity conservation under three land tenure arrangements in the Kgalagadi area. For each community and land tenure arrangement, there are winners and losers, but the winners benefit by more than the cost that losers suffer. The net worth for biodiversity conservation under the various land tenure regimes ranged from R928 to R3,456 to R4,160 for municipal land, parkland, and communal land respectively for the Khomani San, compared to R25,600 to R57,600 to R64,000 for municipal land, parkland, and communal land respectively for the Mier. Both communities have the highest preference for the implementation of the biodiversity conservation programme on communal land. There are no significant differences in the WTP between the two communities when adjusted for annual median household income; hence, the Khomani San can be trusted to become good environmental stewards. However, in order for all members of the local communities to support biodiversity conservation unconditionally, mechanisms for fair distribution of the associated costs and benefits should be put in place.

Key Words: biodiversity, contingent valuation, Khomani San, land restitution

JEL Classification: Q01, Q53, Q57

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Introduction

In many settings, there is an ecological inter-linkage between areas inside and outside protected areas. This explains why Hansen and DeFries (2007) observed that biodiversity¹ conservation targets are not being met inside protected areas, which are in the front line of conservation, partly because of increasing adverse influence from activities carried on outside protected areas. Consequently, biodiversity conservation ought to take place outside protected areas as well.

Accordingly, the actions of local communities crucially influence the success or failure of biodiversity conservation for two reasons. First, local communities are usually in charge of some areas outside protected areas, using these outside areas to provide for their own livelihoods. In some cases, the existence of perverse incentives discourages them from prioritising activities which complement biodiversity conservation. Second, the same perverse incentives also encourage environmentally unsustainable practices by local communities whenever they get access to protected areas as a result of either land restitution or pure encroachment.

Furthermore, failure to conserve biodiversity outside protected areas will lead to more pressure being put on the protected areas, especially where local communities have resource rights inside as well. Harvesting of natural resources inside protected areas could potentially have two impacts. First, it could compromise the integrity of biodiversity as compared to regimes

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¹ According to the Convention on Biological Diversity, “biological diversity” means the variability among living organisms from all sources, including, *inter alia*, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (Abila, Diafas, Guthiga and Hatfield, 2005).

of no use. Second, it could negatively affect the ability of the protected areas to attract tourists and generate revenues to plough back into conservation.

In South Africa, land degradation is perceived to be positively correlated with distribution of communal rangelands (Department of Environmental Affairs and Tourism, 2010). Many communal lands in four provinces are severely degraded. For example, the main challenge in the Kgalagadi area of the Northern Cape province is that the current levels of harvesting of medicinal plants, wood collection, grazing, and hunting are highly likely to result in the depletion of the resources. Such a situation is generally bad for the area's conservation because of the inter-linkages between the broader Kgalagadi area and the Kgalagadi Transfrontier Park. Given the intimate connection between the land inside and outside the Kgalagadi Transfrontier Park, conservation of biodiversity needs to be undertaken in the broader Kgalagadi landscape and not just inside the park. The Khomani San "bushmen"² are important stakeholders in this regard.

The Kgalagadi Transfrontier Park, located between Botswana and South Africa, encompasses part of the ancestral site of the Khomani San. As part of South Africa's land restitution programme, the Khomani San community was awarded land inside and outside the Kgalagadi Transfrontier Park in May 2002, together with the adjacent Mier community.³ South African National Parks (SANParks) was tasked with co-managing the acquired land inside the park on behalf of the local communities as contractual parks⁴.

It is clear from the way land restitution claims within protected areas have been handled so far in South Africa that sustainability and biodiversity conservation are critically important. The government has taken the view that land claims by individuals and groups must be achieved in the national interest by "taking into consideration the intrinsic biodiversity value of the land, and seeking outcomes which will combine the objectives of restitution with the conservation and

² The term "bushmen" is generically used to refer to the Khoisan. Culturally, the Khoisan are divided into the hunter-gatherer San and the pastoral Khoi (Barnard, 1992).

³ In addition, the Khomani San people were awarded additional and special rights in the remainder of the park because they lost more land in comparison to the Mier community during the establishment of the Park (Bosch and Hirschfeld, 2002).

⁴ A contract park is a protected area developed on land belonging to the government, private individuals, or a community. These parks are co-managed by the park authority in conjunction with the private individuals or community through a joint management board (JMB). Contractual parks are common in South Africa and Australia (see Reid et al., 2004).

sustainable use of biodiversity” (Callicott, 1986; De Villiers, 1999; Wynberg and Kepe, 1999; Hall-Martin and Carruthers, 2003). This notion of intrinsic value implies that biodiversity has a value in and of itself.

Thus, the challenge facing the Kgalagadi area is how the landscape can be managed as a whole in a manner that enhances conservation and complementary land-use practices (e.g. medicinal plant harvesting), and discourages conflicting practices (e.g. excessive stock farming). The implication of such an approach is that conservation also needs to spread to the communal and municipal lands adjacent to Kgalagadi Transfrontier Park.⁵ To ensure success of such an approach, there is a need to identify and deal with any factors that militate against sound conservation in the whole area.

The primary objective of this paper is to investigate the value that the Khomani San assign to modern conservation under various land tenure arrangements and to assess whether they may generally be expected to be good environmental stewards. This is done by determining the economic value assigned by the Khomani San to biodiversity conservation on communal land, municipal land, and park land, in a contingent valuation study of a plant conservation programme in the Kgalagadi.

Another objective of this study is to investigate the factors which influence the values assigned. From a policy point of view, the identification of such factors sheds some light on the type of appropriate compensation incentive schemes that may be suitable for enhancing biodiversity conservation in the landscape in question.

Lastly, the paper seeks to compare the valuation of biodiversity conservation by a typical pristine indigenous⁶ community to that of an average South African rural community, the adjacent Mier community. This paper is important because the Khomani San’s attitudes towards modern conservation have not been evaluated until now. Furthermore, there is a dearth of literature comparing the values of environmental resources between indigenous people and the

⁵ Communal and municipal land importance is not limited to its indigenous biodiversity; this is where the local community lives, harvests resources, and undertakes game and livestock farming (Norton, 2000). It is for this reason that communal and municipal lands can make a significant contribution to conservation of biodiversity (Kaval, Yao and Parminter, 2007).

⁶ In South Africa, the term “indigenous people” refers to all African ethnic groups. In this paper, the term “indigenous people” is used to refer to vulnerable indigenous communities in South Africa. The exposure of the Khomani San to the cash economy and external factors, particularly the influence of western value systems, is likely to have resulted in changes to their value systems, resource use, and cultural preferences

general population. Based on the economics of hunter-gatherer literature, we hypothesize that: *“The value assigned to biodiversity conservation by the Khomani San people differs from valuation by the adjacent Mier community.”* This paper will test whether such a hypothesis is supported by evidence from the Kgalagadi area in South Africa.

In the next section of this paper, we discuss the economic rationale for valuing biodiversity. The third section presents the study area and the survey, while the fourth section presents the descriptive statistics and results. We discuss our findings in the final section.

Economic Valuation of Biodiversity

Ecosystems provide provisioning services, regulation services, support services, and cultural services (MEA, 2005). These services directly enter into economic processes (WCMC, 1992). As such, it is economically rational to conserve biodiversity because of its contribution to human well-being (Clough, 2000). According to Cooper et al. (2004), biodiversity is considered an asset.

Successful conservation outside protected areas usually requires the integration of the protected land with other land uses, rather than its separation (Hartley, 1997; Kneebone, 2000; Kneebone et al., 2000; Norton, 2000). There is a need to accommodate the most economically beneficial use of the land and minimise the negative impact on biodiversity (Kneebone, 2000). However, landowners often lack information and evidence about the correct value to assign to biodiversity when making land-use decisions (CBD, 2010). Therefore, in order for biodiversity conservation to be successful outside protected areas, landowners should become informed about the correct value of biodiversity and subsequently use this information in land-use decisions.

One of the main concerns raised by policymakers is that, although they are aware of the importance of conserving biodiversity, their efforts are undermined by its undervaluation or lack of valuation, which ultimately results in overexploitation. The estimation of the value of biodiversity is an essential precondition to the internalisation of this value in decision-making (CBD, 2010). This is worthwhile because it may assist in convincing decision-makers of the need to conserve biodiversity (Vorhies, 2010). This study provides this value by taking into consideration both winners and losers from the implementation of a proposed biodiversity conservation project.

The rationale behind environmental valuation is to understand people's preferences about environmental goods and services. In addition, by raising awareness of the value of biodiversity among societal actors, valuation can also act as an incentive measure in its own right (CBD,

2010). Thus, understanding the values of biodiversity is a critical step forward, as these values illustrate the economic benefits of conservation and therefore justify funding for biodiversity conservation programmes.

The estimation of the value of biodiversity conservation does not only provide this particular value, but also highlights issues that need to be addressed to achieve sustainable resource use. Inadequate or nonexistent economic incentives have been identified as the main reasons for biodiversity loss.⁷ Economic incentives refer to mechanisms that change the behaviour of actors with respect to economic choices by altering their economic conditions (Knowler, 1999). Economic incentives play a pivotal role in nature conservation at all levels of society, particularly at community levels (Emerton, 2001).

The use of economic incentives is an attempt to induce effective and sustainable use of natural resources. It is highly likely that local communities, particularly those that live within close proximity to national parks, will be willing and able to use natural resources in a sustainable way only if they were to have significant tangible economic benefits accruing to them. Economic incentives require identifying and overcoming broader economic conditions and forces that influence people to degrade the environment.

Most environmental valuation techniques entail the elicitation of willingness to pay (WTP). This is commonly done using the contingent valuation method (CVM), in which respondents are asked about their WTP for a hypothetical good or service. The use of dichotomous choice (binary or closed-ended) questions has gained popularity over open-ended questions following the NOAA panel recommendations (Arrow et al., 1993).

However, there are circumstances where some variant of the open-ended question format might perform better, for example when the sample size is limited. The payment card method seems to be a good compromise between the closed-ended and open-ended formats. According to Mitchell and Carson (1989), the payment card method gives respondents some assistance in searching for their valuation. It avoids the starting-bid bias of the closed-ended format and maintains the positive features of an open-ended format. A recent study by Hanley et al. (2008) used the payment card to elicit the WTP for landscape change in a national park.

⁷ The tools of institutional economics are highly applicable to the problems involved in the present analysis. Future research should explore that approach in greater detail.

Most CVM studies deal with environmental public goods. As a result, they restrict WTP to being non-negative. However, some environmental amenities manifest themselves as costs to some and benefits to others. When valuing an increase in the quality of a public “bad,” an appropriate consumer surplus measure must be chosen which can measure the loss of utility due to an increase in its provision (Clinch and Murphy, 2001).⁸

There exist two measures when the policy change decreases utility, namely Compensating Variation (CV) and Equivalent Variation⁹ (EV) (Hicks, 1939; Hicks, 1943). The CV measures the agents’ maximum WTP for carrying out a proposed measure, the payment that would cause them to remain on their original indifference curve (original welfare level) although the measure they approve is carried out. The EV measures how much the agents who do not approve of the proposed measure would be prepared to pay for its prevention, a payment that transfers them to the same (lower) indifference curve to which the undesired proposed measure would have transferred them.

A given welfare level is maintained in the first notion, but not in the second, so there is an asymmetry. On normative grounds, the second case could be justified by the assumption that the people concerned do not deserve the former higher welfare level, so their levels should be reduced. This suggests that they have no property right to enjoy the situation without the suggested measure.

Ordinarily, those who lose from an increase in the environmental good provision would want to be compensated and would expect to be asked about their willingness to accept (WTA) compensation. However, the NOAA panel strongly recommends against the use of WTA scenarios in CVM studies (Arrow et al., 1993). It is widely noted in the contingent valuation literature (Mitchell and Carson, 1989) that, in comparison to WTP, WTA appears more prone to producing inaccurate estimates of value. In cases where the WTP-WTA gap is closed through repetition and learning, most of the changes occur in the WTA estimates (Shogren et al. 1994). According to Munro (2007), this implies that the estimates obtained from a one-shot WTP measure may be a better estimate of true WTA than a one-shot WTA estimate.

⁸ The most commonly used approach to account for welfare losses in a contingent valuation study has been to make assumptions concerning the negative tail of the WTP distribution, after eliciting the WTP for a change in the provision of a public good/bad.

⁹ Compensating variation is measured by WTA, while equivalent variation is measured by WTP.

Thus, the elicitation format should allow respondents who experience a welfare loss because of the proposed environmental change to state a negative WTP (Hanley et al., 2008; Muchapondwa et al., 2008), in a manner that we will show later. Otherwise, the exclusion of negative WTP may result in an erroneous conclusion with regard to the net social benefits of the proposed change when the total values are estimated (Hanley et al., 2008).

Allowing respondents to state a positive WTP (their EV) is one way to include the negative WTP (Clinch and Murphy, 2001). An assumption is that WTP to prevent the proposed changes can be considered as a proxy of the negative WTP (cost in the welfare terms) for the proposed changes. Thus, WTP to prevent the proposed change is assumed symmetric to the WTA to tolerate the proposed change (in the sense of the minimum compensation payment needed to restore people to their utility levels prior to the introduction of the project). Of course, this can only hold as a workable approximation for marginal changes, when the environmental good of interest is easily substitutable and income effects are marginal (Clinch and Murphy, 2001; Hanley et al., 2008).

Conservation of biodiversity, particularly on communal and municipal lands in a developing country such as South Africa, is likely to be viewed as good by some people and bad by others; i.e., it produces both winners and losers. The current study will allow respondents to state their EV as a way to include the negative WTP. One potential shortcoming in our study is uncertainty about whether the asymmetry between WTP and WTA is negligible. The fact that nature is so vital for indigenous people implies that considerable income effects are imaginable upon different assignments of property rights. Moreover, one might doubt that natural resources such as pasture grounds are easily substitutable for money, particularly in traditional societies. Thus, there may be differences in WTA and WTP for the same quantity of resources. Nonetheless, determination of the value of biodiversity from the perspectives of various stakeholders will assist in establishing the best policy response where biodiversity is under threat (OECD, 1999). Given appropriate and adequate economic incentives, landowners can become effective stewards of land as well as the biodiversity linked with it (Kneebone et al., 2000).

The Study Area and Survey

The Study Area

The Kgalagadi area in question lies in the Siyanda District Municipality (comprising six local municipalities) of the Northern Cape province of South Africa, bordering Botswana and Namibia. The district is approximately 120,000 square kilometres and includes large areas in the

Kgalagadi desert. The Mier Local Municipality (one of the six local municipalities) is located next to the Kgalagadi Transfrontier Park (see figure 3.1).

The Mier Local Municipality region is semi-arid and has infrequent rainfall, mostly during summer (Seymour, 2001). The region is used predominantly for sheep and game farming, although an increasing number of cattle and goats are being introduced, despite the area not being best suited to such livestock.

While the Kgalagadi desert, including the area inside South Africa, has a physically harsh environment, the region has a rich biodiversity. The Kgalagadi area, including areas outside the park, is characterised by variety, from red sand dunes, saltpans, and open plains to flat bushveld, grasslands, Camelthorn trees, scrub bush, and woodlands.

According to the Department of Environmental Affairs and Tourism (2008), because of the sparse vegetation and concentration of animals in the dry riverbeds of the Auob and Nossob Rivers, the Kgalagadi Transfrontier Park offers premium mammal viewing. More than 58 mammal species are found in the area. Furthermore, it is renowned for predator viewing (cheetah, leopard, brown and spotted hyena, and black-maned lion), which is the park's main attraction. The park also has a wide variety of birds, particularly birds of prey.

The total area of the park is 387,991 square kilometres, of which approximately 75 percent is on the Botswana side (Swatuk, 2006). On the South African side (the Kalahari Gemsbok National Park section), the Kgalagadi Transfrontier Park has five segments: (i) belonging to SANParks and with no local community access, (ii) belonging to SANParks but with Khomani San access for symbolic cultural use, (iii) belonging to SANParks but with Khomani San access for commercial joint venture use, (iv) belonging to the Khomani San but managed as a contract park with SANParks, and (v) belonging to the Mier community but managed as a contract park with SANParks. SANParks has the obligation to maintain infrastructure related to conservation and the integrity of nature inside the Transfrontier Park on the South African side (Bosch and Hirschfeld, 2002).

There is a need for more conservation in the highly fragile Kgalagadi ecosystem. The Mier Local Municipality has agreed in principle to expand the amount of their land under conservation. The Khomani San have also agreed to use two of their farms (namely, Farm 24 and 26), which are adjacent to the park (near the Twee Rivieren entrance gate – see figure 3.1), for conservation purposes in addition to their cultural activities. Thus, these farms will act as a buffer zone protecting the Mier contract park, Khomani San Contract Park, and the rest of the Kgalagadi Transfrontier Park (Bosch and Hirschfeld, 2002).

The Survey

A contingent valuation survey was conducted in the Mier Local Municipality. The data were gathered through face-to-face interviews from August to October 2009 and March to April 2011¹⁰ respectively. Sample size determination took into consideration the elicitation format, as well as the budget constraints. One hundred randomly selected households, divided equally between the Khomani San and the Mier communities, were interviewed.

The respondents initially were given background information on biodiversity and the possible costs and benefits associated with biodiversity conservation. The potential benefits include: a) raw materials that directly enter the economic process as inputs; b) other resources such as food (wild fruits) that are directly consumed; c) non-food resources such as medicinal plants; d) culturally determined services such as the fulfillment of demands for aesthetic services; g) improved scenery. The direct and indirect costs include: a) maintenance costs such as wages, running costs, monitoring, and policing costs; b) costs to other livelihood options such as traditional hunting and gathering; c) opportunity costs in the form of alternative land uses.

The biodiversity conservation programme proposal was as follows: “The government proposes to introduce a biodiversity conservation programme where as many native trees, shrubs and grasslands as necessary would be planted and protected with the aim of achieving a reduction in the current biodiversity loss by 10% in terms of the quantities of each of the species under threat¹¹. The conservation programme would entail increasing the total amount of land under conservation in the Kgalagadi area. The proposed programme can be undertaken on either communal land or municipal land or park¹² land with similar successful outcomes. In view of budget constraints, the programme will be undertaken on only one type of land.”

Thereafter, a two-stage approach was used. First, respondents were asked how their households weighed the costs and benefits of the proposed programme on each land type, by considering only those benefits and costs applicable to them. On the one hand, those respondents who indicated that the potential benefits were greater than the potential costs ($B > C$) were expected to have a non-negative WTP for the biodiversity conservation programme. On the other

¹⁰ The figures in our analysis are not deflated across the survey periods because we do not believe that there was significant inflation in the study area.

¹¹ Respondents were also told about the trends of biodiversity loss: Biodiversity will continue to be lost for a variety of reasons; of all the potential loss, we aim to prevent only 10% and let the other 90% of the loss go on.

¹² In this context, park land refers to either of the contract parks.

hand, those respondents who indicated that the potential benefits were exceeded by the potential costs ($B < C$) were expected to have a non-positive WTP for the biodiversity conservation programme. Our approach so far enables the respondents to be classified into distinct categories based on their perceived assessment of the potential benefits and costs associated with the introduction of a biodiversity conservation project in their area.

Secondly, depending on their preferences for the programme on each land type, the respondents were asked about the highest amount their household was willing to pay as an annual conservation levy to ensure that such a programme was undertaken, in the case of those for whom $B > C$, or avoided, in the case of those for whom $B < C$, on the communal, municipal, or park land. The permissible highest amount the household was willing to pay in respect of each programme structure had to be chosen from a predesigned payment card with 13 random amounts carefully selected following a pilot study in the study area.¹³ The respondents had to give three WTP answers relating to three types of land. On the one hand, for those for whom $B > C$, the type of land with the highest stated WTP is the type of land on which the respondents would most like the proposed project to be implemented. On the other hand, for those for whom $B < C$, the type of land with the highest stated WTP is the type of land on which the respondents would least like the proposed project to be implemented. The logic behind the willingness to pay of those against the proposed programme is that, by paying to prevent the biodiversity conservation programme, they would continue to undertake their current land use activities without any restrictions, as effective biodiversity conservation would require some restrictions on their use of land. In fact, the respondents were told that, if they did not want the proposed biodiversity conservation programme, it would have to be undertaken elsewhere and that they would contribute to the costs of its implementation there (i.e. preventing its adoption in their area). Thus, they would be paying for remote conservation, as it were, as opposed to local conservation.

Willingness-to-pay questions were followed up with debriefing questions to understand the motives behind the chosen amounts. In particular, the debriefing questions were intended to identify protest bids for omission from the analysis, as is standard procedure in CVM studies; this refers to all zero bids that are cited for reasons other than budget constraints.

¹³ As is standard with this method, the 13th slot gave provision for respondents who had WTP amounts not shown on the card.

Descriptive Statistics from the Survey

The descriptive statistics of the surveyed households are presented in tables 3.1 and 3.2.¹⁴ Where the respondents were household members other than the heads, their responses were interpreted as coming from the heads themselves.

The livelihoods of the majority of the Khomani San are based on the natural environment and on social grants from the government. Given their general lack of access to electricity, it is not surprising that all Khomani San respondents are involved in the collection of firewood. The most harvested tree is the Camelthorn tree, which is the only large tree in the area. Even though harvesting of this tree for commercial purposes is prohibited, some locals continue to harvest it for such purposes due to unemployment or lack of alternative income-generating activities in their area.

The Khomani San do not pay entrance fees to the Kgalagadi Transfrontier Park because of their possession of special “resource” rights inside the park. In fact, they have their own gate into the park to enable them to easily attend their meetings and other activities inside the park. About 77% of the Khomani San respondents had visited the park sometime in the past. This is important because it means that most respondents had an idea of what biodiversity conservation aimed to achieve. Their main reason for visiting the park was to undertake traditional and cultural activities. Harvesting of medicinal plants was the second most popular activity that took place in the area. The traditional doctors were the major harvesters of medicinal plants in the contract park portion of the Kgalagadi Transfrontier Park.

In contrast to the Khomani San, the Mier community has access to electricity. This explains why only 33% of Mier respondents were involved in firewood collection. Given their heavy dependence on livestock farming, lack of grazing land was their major challenge.

Unlike the Khomani San, the Mier pay an entrance fee whenever they visit the park. About 73% of the Mier respondents had visited the park sometime in the past. Their reason for visiting the park was mainly for recreational reasons. It is clear from the discussions above that both ethnic groups are to varying degrees dependent on nature for their livelihoods.

¹⁴ This sub-section splits the analysis by ethnic groups, namely the Khomani San people and the Mier Community. The reason for splitting by ethnic groups was due to the two groups being distinct. Splitting will therefore give us valuable insights into the kind of economic incentives schemes that may be appropriate to each group.

Results and Discussion

For Whom Is the Proposed Biodiversity Conservation Programme Good or Bad?

We would naturally want to know who consider themselves winners ($B > C$) or losers ($B < C$) from the proposed biodiversity conservation programme. Unravelling the characteristics of the people in each of these two categories requires a discrete choice model. The logit and probit models are the two most used discrete choice models (Capps and Cramer, 1985). For example, a number of studies have used the probit model to model winners and losers in non-market valuation studies similar to the current one (e.g., Clinch and Murphy, 2001; Muchapondwa et al., 2008). Knowledge of the characteristics of the people who consider the proposed biodiversity conservation programme good ($B > C$) or bad ($B < C$) could assist in designing appropriate incentive schemes to enhance biodiversity conservation in the Kgalagadi area.

A binary decision of whether the respondents considered the proposed biodiversity conservation programme good or bad is used as the dependent variable. Because we have respondents at a household level, household characteristics such as income and household resource use activities are expected to be vital in explaining the households' attitudes towards the proposed biodiversity conservation programme.

Table 4.1 sets out the binary probit model results of whether the proposed biodiversity conservation programme of planting trees, shrubs, and grasslands to avert a 10% biodiversity loss in the Kgalagadi area is good or bad.¹⁵

The two variables related to resource use are (1) the collection of medicinal plants, bush food, and wild fruits from communal land, and (2) grazing and harvesting activities on municipal land. Both variables are significant in all three models. Given the heavy dependence by local communities on nature, it is not surprising that households that collect medicinal plants, bush food and wild fruits from communal land are more likely to view the proposed biodiversity conservation programme as good.

¹⁵ The problem of multicollinearity occurs when a strong linear relationship exists among the explanatory variables. A strong association between the explanatory variables makes it increasingly difficult to assess the impact of individual variables on the dependent variable. There are various techniques to check for the presence of multicollinearity. We checked for multicollinearity using the Variance Inflation Factors for each of the models, and it was not found to be a problem.

Households that undertake grazing and harvesting activities on municipal land are less likely to support the proposed programme on any land type. Perhaps those involved in activities on municipal land have experienced restrictions, especially on the harvesting of Camelthorn trees. It would therefore be rational for them to have a negative attitude toward the proposed biodiversity conservation programme, as it brings with it some restrictions about resource use.

The other variables which are only significant in the municipal land and contract park models are income, the household practice of farming, respondent's belief that the community has primary responsibility for conservation, and the household's intention to stay in the area despite substantial reduction in biodiversity. Households with higher incomes have a higher probability of viewing implementation of the proposed biodiversity conservation programme on municipal land and in contract parks as bad. This result seems to suggest that households with higher incomes are relatively less reliant on nature, hence their lower incentives to support the proposed biodiversity conservation programme.

Those households that practice livestock or game farming are more likely to support implementation of the proposed programme on municipal land and contract park. This result is plausible, as livestock and game farmers tend to have a symbiotic relationship with nature and therefore have a long-term incentive to conserve it.

The households that will stay in the area despite substantial reduction in biodiversity have a higher probability of supporting the implementation of the proposed programme on municipal land and in contract parks. Such households reveal their preferences to stay in the area in the long run and therefore naturally prefer to see sustainable biodiversity conservation into the long run.

Households that believe that the community has primary responsibility for conserving biodiversity have a higher probability of seeing the proposed programme as desirable on the municipal land and in contract parks. This result is logical, as it shows that those who identify themselves as conservationists would support conservation.

The motivation for having the Mier dummy variable is to check for any systematic differences between the preferences of Khomani San and the Mier over biodiversity conservation. The results show that the Mier people are more likely than the Khomani San to support the implementation of the proposed programme on both municipal land and contract park land. The result is plausible, as the Mier community tends to be more integrated into municipal activities than the Khomani San, who tend to focus on their communal activities and interaction.

Given that respondents in the sample were interviewed in two different time periods, we also included a dummy variable to check whether there are systematic differences between first and second wave respondents. Our results show that respondents interviewed in the second wave have random differential preferences over the proposed biodiversity conservation programme. They have a lower likelihood of supporting its implementation on communal land, while they have a higher likelihood of supporting its implementation on municipal land when compared to respondents from the first wave. However, they are equally indifferent to the implementation of the proposed biodiversity conservation programme in the contract parks.

The Determinants of Willingness to Pay for Implementing the Proposed Biodiversity Conservation Programme of Planting Trees, Shrubs, and Grasslands in the Kgalagadi Area

The objective of stated preference surveys is to elicit respondents' valuation of the projects described to them in scenarios. The reliability of each survey is typically measured through the estimation of a bid function relating WTP responses to a variety of covariates collected in the survey. The goal is to assess the extent to which expectations from (i) economic theory, (ii) prior intuition, and (iii) observed empirical regularities are fulfilled. The analysis of those variables that can potentially affect WTP can shed light on the robustness of the survey design and implementation of the study (Hanley and Splash, 1993; Köhlin, 2001; Muchapondwa et al. 2008). Accordingly, the determinants of willingness to pay for implementing the proposed biodiversity conservation programme of planting trees, shrubs, and grasslands in the Kgalagadi area are presented in Table 4.2.¹⁶

The reported willingness to pay (WTP) amounts for implementing the proposed biodiversity conservation programme are at least zero. The Tobit model is more efficient for such circumstances. Household income and the dummy for the respondents interviewed in the second wave are significant in the models of all the three land types. As expected, household income positively influences WTP for the proposed biodiversity conservation programme, and this is the same for all the land tenure arrangements (communal, municipal, and park). It is logical that households with higher income are willing to pay relatively higher amounts. However, the marginal effects of income on WTP fall as one moves from communal land to

¹⁶ Ordinarily, we would have wanted to run a separate set of models for the determinants of willingness to pay for preventing the proposed biodiversity conservation programme on the three land types in the Kgalagadi area. However, the number of observations for that set of models is unlikely to produce credible results.

municipal land to parkland. The result with respect to the dummy for the respondents interviewed in the second wave indicates that respondents in the second wave have relatively lower WTP. This implies that the level of benefits they envisage from the proposed biodiversity conservation programme is consistently lower than that expected by their peers interviewed earlier. Perhaps this also points to increasingly unfulfilled expectations regarding access to natural resources in the area.

The results of the set of tobit models also show significant marginal effects for the gender of the household head, education years of the household head, and respondents' knowledge about the effects of biodiversity loss. Male-headed households have a higher WTP than female-headed households for the proposed biodiversity conservation programme in the contract park. Education years of the household head positively influence the WTP for both the communal land and contract parks. Perhaps highly educated households heads participate more in platforms where communities have more land rights, i.e. communal land and contract parks, and therefore benefit more. Those who are knowledgeable about the effects of biodiversity loss have higher WTP in both the municipal land and contract parks.

Most importantly, the results demonstrate that there is no systematic difference between the WTP of the Khomani San and the Mier communities. Thus, the drivers of the value that Khomani San attach to modern conservation across the three land types are statistically not different from those of other indigenous communities such as the Mier.

The Welfare Measures of Willingness to Pay for Implementing or Preventing the Proposed Biodiversity Conservation Programme of Planting Trees, Shrubs, and Grasslands in the Kgalagadi area

The WTP results are presented in Table 4.3 according to the community group, the attitude towards the proposed biodiversity conservation programme, and the land tenure arrangement.

Ninety-two percent of the Khomani San respondents supported implementation of the proposed biodiversity conservation programme (i.e. B>C) on communal land while 79% of the respondents supported implementation of the same programme (i.e. B>C) on either municipal land or inside the park. In contrast, 83% of the Mier respondents supported implementation of the biodiversity conservation programme (i.e. B>C) on municipal land, while 88% of the respondents supported implementation of the programme on communal land, and 74% of the respondents supported implementation of the programme (i.e. B>C) inside the park. Therefore, the overall ranking of preferred implementation location is communal land, municipal land, and

parkland in decreasing order of preference. This seems to point toward a preference for carrying out programmes in locations where respondents have greater control; local communities generally have greatest control on communal lands.

The Khomani San's mean WTP amounts for implementing the proposed biodiversity conservation programme on communal land, municipal land, and inside the park, for those for whom $B > C$, are R60.60, R38.42 and R30.89 respectively. These amounts represent about 0.23%, 0.15%, and 0.12% respectively of Khomani San mean annual income. For those Khomani San for whom $B < C$, the mean WTP amounts for preventing the proposed biodiversity conservation programme in their area on communal land, municipal land, and inside the park are R70.63, R7.31 and R7.00 respectively. These amounts represent about 0.27%, 0.03%, and 0.03% respectively of Khomani San mean annual income. Given that more Khomani San respondents support than oppose the implementation of the proposed biodiversity conservation programme on any one of the land types, the above figures imply that the Khomani San people generally derive net positive benefits from the proposed biodiversity conservation programme and that, as a result, the majority of them would vote for its implementation.

The median WTP figures for the Khomani San are lower than their mean WTP figures for all land types. However, the general message still carries through, even on the basis of the median WTP figures: the Khomani San people generally derive net positive benefits from the proposed biodiversity conservation programme. The median WTP amounts for implementing the proposed biodiversity conservation programme on communal land, municipal land, and inside the park, for those for whom $B > C$, are R15.00, R5.00, and R15.00 respectively. These amounts represent about 0.05%, 0.02%, and 0.05% respectively of Khomani San median annual income. For those for whom $B < C$, the median WTP amounts for preventing the proposed biodiversity conservation programme in their area on communal land, municipal land, and inside the park are R10.00, R5.00, and R5.00 respectively. These amounts represent about 0.04%, 0.02%, and 0.02% respectively of Khomani San median annual income.

As for the Mier, the mean WTP amounts for implementing the proposed biodiversity conservation programme on communal land, municipal land and inside the park, for those for whom $B > C$, are R146.45, R70.06, and R40.27 respectively. These amounts represent about 0.34%, 0.16%, and 0.09% respectively of Mier mean annual income. For those Mier for whom $B < C$, the mean WTP amounts for preventing the proposed biodiversity conservation programme in their area on communal land, municipal land, and inside the park are R85.59, R15.83, and R55.96 respectively. These amounts represent about 0.20%, 0.04%, and 0.13% respectively of Mier mean annual income. We can reach a similar conclusion for the Mier as we did for the

Khomani San. Thus, given that more Mier respondents support than oppose the implementation of the proposed biodiversity conservation programme on any one of the land types, the Mier people generally derive net positive benefits from the proposed biodiversity conservation programme. Consequently, the majority of them would vote for its implementation.

Even though the median WTP figures for the Mier are lower than their mean WTP figures for all land types, they point to the same conclusion as the mean WTP figures. The median WTP amounts for implementing the proposed biodiversity conservation programme on communal land, municipal land, and inside the park, for those for whom $B > C$, are R25.00, R5.00, and R15.00 respectively. These amounts represent about 0.03%, 0.01%, and 0.02% respectively of Mier median annual income. For those for whom $B < C$, the median WTP amounts for preventing the proposed biodiversity conservation programme in their area on communal land, municipal land, and inside the park are R75.00, R10.00 and R15.00 respectively. These amounts represent about 0.09%, 0.01%, and 0.02% respectively of Mier median annual income.

Comparing the Khomani San and Mier, it is clear that the majority of respondents from both communities support the implementation of the proposed biodiversity conservation programme on communal land, municipal land, and inside the park. Both communities have the highest preference for the implementation of the biodiversity conservation programme on communal land, i.e. the mean and median WTP and numbers supporting implementation (as opposed to prevention) are highest for the communal land. The Mier generally have higher WTP than the Khomani San. This is likely an effect of differences in incomes between the two communities, as the Mier generally have higher incomes. For example, the Mier respondents have almost a double median WTP (R25) than the Khomani San (R15) in the category of those in favour of the proposed biodiversity conservation programme on communal land. However, when adjusted for annual median household income, there are no significant differences in the WTP between the two communities. Thus, the Khomani San “bushmen” equally care about modern biodiversity conservation as other indigenous communities in their area.¹⁷

The results discussed above are encouraging, as they show a desire for intimate involvement in biodiversity conservation by the two indigenous communities. Given the

¹⁷ For those for whom $B < C$ when the proposed programme is implemented on communal land, the Mier’s median WTP as a proportion of Mier median income is two and a half times that of a similar measure for the Khomani San. This implies that the proposed biodiversity conservation programme potentially imposes a larger negative externality on the Mier’s livestock activities than on the Khomani San hunter-gatherer activities.

ecological symbiosis between the land inside and outside the park, if the local communities are good environmental stewards, as the results suggest, then the land restitution that took place in the Kgalagadi area will not necessarily be detrimental to biodiversity conservation.

The nature of the proposed biodiversity conservation programme is such that it has winners ($B > C$) and losers ($B < C$). Thus, winners will enjoy net benefits with its implementation, while losers would suffer net costs with its implementation. It is therefore important to balance out the net benefits of winners against the net costs of losers to determine the net worth of implementation of the proposed biodiversity conservation programme. A decision needs to be made first about which summary WTP values to use from the mean and median WTP figures reported above.

The median WTP values are preferred because of the presence of outliers in the data. As Hanley and Splash (1993) suggest, the problem of outliers is often addressed by using the median WTP rather than mean WTP. On the basis of median WTP, we estimate the total WTP for respondents in support and against the implementation of the proposed biodiversity conservation programme. Using this information as well as population statistics, we conducted a cost-benefit analysis to determine the net worth of the proposed biodiversity conservation programme for each community under the various land tenure arrangements (see Table 4.4).

For each community and land tenure arrangement, the results in Table 4.4 suggest that the winners benefit from the proposed biodiversity conservation programme by more than the cost that losers suffer. Thus, the net worth of the proposed biodiversity conservation programme is positive for both communities and all three land types. For both communities, the net worth of the proposed biodiversity conservation programme is highest when implemented on communal land, followed by implementation inside the park, with implementation on municipal land in third place. It is not surprising that the net worth of the proposed biodiversity conservation programme for both communities is significantly less for municipal land than for other land types, as neither community has any substantial rights in municipal land.

Overall, when considering the Khomani San and Mier jointly, significantly more people benefit than lose from biodiversity conservation programmes in the Kgalagadi area, irrespective of land tenure arrangements. The fact that the majority of households in this area are in favour of the proposed biodiversity conservation programme is a good outcome for the prospects of biodiversity conservation in the Kgalagadi landscape as a whole. However, the presence of people who stand to lose from the proposed programme points toward the need for incentive

schemes which address the potential conflicts between biodiversity conservation and other livelihood activities of local communities.

Conclusion

The Khomani San “bushmen” and Mier “agricultural” communities in the Kgalagadi area are heavily dependent on natural resources, but their area is threatened by biodiversity loss due to natural ecological causes and the overexploitation of natural resources. There have been changes in land ownership in the Kgalagadi area following land restitution to the local communities in 2002. Biodiversity conservation will benefit from the land restitution only if the local communities, especially the Khomani San who interact more with nature, are good environmental stewards. To assess their attitudes towards biodiversity conservation, this study used the contingent valuation method to investigate the values assigned by the Khomani San and Mier communities to biodiversity conservation under three land tenure arrangements: communal land, municipal land, and parkland.

The study was designed in a way that allows the identification of winners and losers from the proposed biodiversity conservation programme, in which as many native trees, shrubs, and grasslands would be planted and protected as necessary to achieve a reduction in the current biodiversity loss by 10% of each of the species under threat. For each community and land tenure arrangement, there are winners and losers from the proposed programme. However, in each case, the winners benefit by more than the cost that losers suffer. The net worth for biodiversity conservation under various land tenure regimes by the Khomani San ranged from R928 to R3,456 to R4,160 for municipal land, parkland, and communal land respectively, compared to the Mier’s R25,600 to R57,600 to R64,000 for municipal land, parkland, and communal land respectively. The majority of respondents from both communities support the implementation of the proposed biodiversity conservation programme on communal land, municipal land, and inside the park. Both communities have the highest preference for the implementation of the biodiversity conservation programme on communal land.

The findings also suggest that South Africa’s Khomani San, whose attitudes toward modern conservation have not been evaluated until now, and the adjacent Mier community, generally attach a significant economic value to biodiversity in their area. The Mier generally have higher WTP than the Khomani San. For example, the Mier respondents have almost a double median WTP (R25) than the Khomani San (R15) in the category of those in favour of the proposed biodiversity conservation programme on communal land. However, when adjusted for annual median household income, there are no significant differences in the WTP between the

two communities. Thus, the Khomani San care about modern biodiversity conservation as much as other indigenous communities in their area and can therefore be trusted to be good environmental stewards. However, in order for all members of the local communities to support biodiversity conservation unconditionally, mechanisms for fair distribution of the associated costs and benefits should be put in place.

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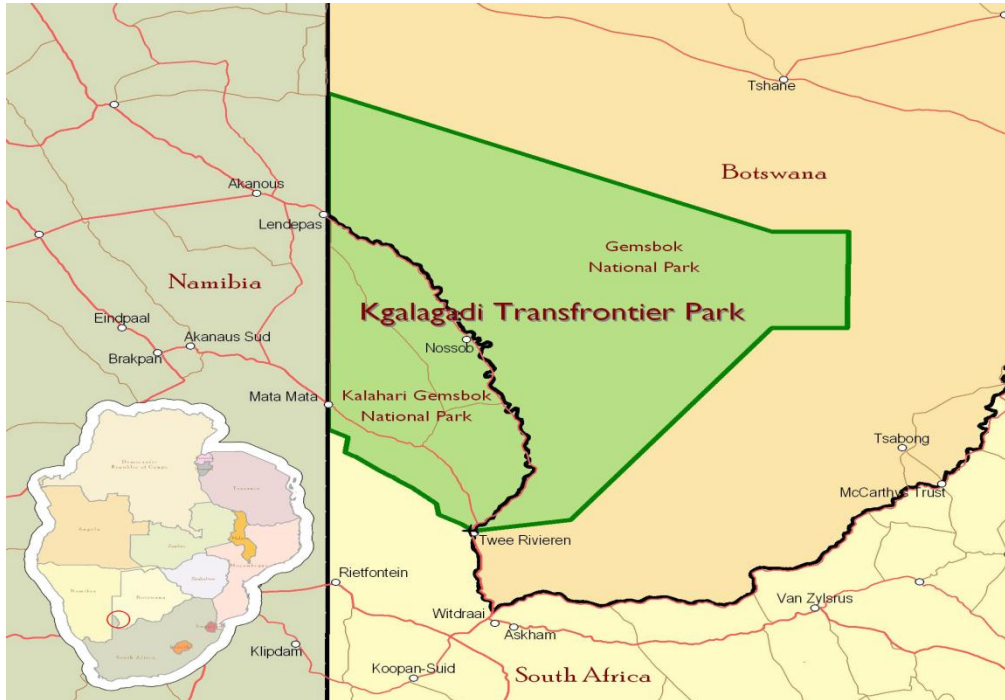
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Figures and Tables

Figure 3.1. Map of the Kgalagadi Area



Source: SANParks, 2012.

Table 3.1. Descriptive Statistics from the Survey (Socio-Economic Profile)

	<i>Khomani San</i>	<i>Khomani San</i>	<i>Mier</i>	<i>Mier</i>	<i>Full Sample</i>	<i>Full Sample</i>
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Household size	5.37	3.09	5.59	3.03	5.48	3.057
Age of household head	46.84	15.15	47.79	14.35	47.32	14.73
Gender of household head (1=M, 0=F)	0.60	0.49	0.63	0.49	0.62	0.49
Years Lived at Property	10.10	9.14	16.49	12.83	13.30	11.57
Education Years of Household Head	4.98	3.62	5.9	3.97	5.44	3.82
Household Head works for wages ¹⁸ (1=Y, 0=N)	0.32	0.47	0.21	0.41	0.27	0.44
Household Head Self Employed (1=Y, 0=N)	0.23	0.42	0.54	0.50	0.39	0.49
Household Income (R ¹⁹)	26 400.00	28 462.98	43 500.00	80 977.30	34 950.00	61 144.84
No. of Observations	100	100	100	100	200	200

¹⁸ Codes; 1 = yes & 0 = no (applies to Table 3.1 and Table 3.2).

¹⁹ R = South African Rands; US1 = R8.2980 at the time the paper was revised.

Table 3.2. Descriptive Statistics from the Survey (Other Information)

	<i>Khomani San</i>	<i>Khomani San</i>	<i>Mier</i>	<i>Mier</i>	<i>Full Sample</i>	<i>Full Sample</i>
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ever visited the park (1=Y, 0=N)	0.77	0.42	0.73	0.45	0.75	0.43
Knowledgeable about the effects of biodiversity loss (1=Y, 0=N)	0.58	0.50	0.67	0.47	0.63	0.48
Believes primary responsibility for conservation rests with (1 = Government, 2 = SANParks, 3 = community, 4=donors, 5 = all stakeholders)	3.44	1.39	3.25	1.388	3.33	1.37
Collects firewood from communal land (1=Y, 0=N)	0.80	0.40	0.33	0.47	0.57	0.50
Uses medicinal plants from communal land (1=Y, 0=N)	0.77	0.42	0.25	0.44	0.51	0.50
Collects bush food from communal land (1=Y, 0=N)	0.54	0.50	0.20	0.40	0.37	0.48
Involved in Livestock Farming (1=Y, 0=N)	0.46	0.50	0.96	0.21	0.56	0.50
Involved in Game Farming (1=Y, 0=N)	0.06	0.24	0.13	0.34	0.10	0.29
Undertakes activities on municipal land (1=Y, 0=N)	0.14	0.35	0.41	0.49	0.28	0.45
Undertakes activities inside the Contract Park (1=Y, 0=N)	0.65	0.48	0	0	0.33	0.47
Will stay in area despite substantial reduction in biodiversity (1=Y, 0=N)	0.75	0.44	0.76	0.43	0.76	0.43
No. of Observations	100	100	100	100	200	200

Table 4.1. Binary Probit Model on the Determinants of Supporting the Proposed Biodiversity Conservation Programme on Different Land Types

VARIABLES	Communal Land	Municipal Land	Contract Park
Household is from the Mier community	-0.0776 (0.311)	1.203*** (0.369)	0.773*** (0.296)
Log of income	-0.0971 (0.146)	-0.277* (0.144)	-0.230* (0.131)
Undertakes collection activities on communal land	1.148*** (0.307)	0.781** (0.355)	1.126*** (0.270)
Practises livestock or game farming	0.290 (0.281)	0.595** (0.269)	0.418* (0.235)
Undertakes activities on municipal land	-0.965*** (0.306)	-0.637** (0.299)	-0.789*** (0.270)
Believes community has primary responsibility for conservation	0.0210 (0.340)	0.645** (0.274)	0.754*** (0.268)
Will stay in area despite substantial reduction in biodiversity	0.317 (0.301)	0.638** (0.274)	0.705*** (0.257)
Household was sampled in the second wave during 2011	-1.356*** (0.294)	0.525** (0.259)	0.261 (0.235)
Constant	2.269	1.575	0.849
Observations	200	200	200

***, **, * indicate 1%, 5% and 10% levels of significance respectively

Robust standard errors in parentheses

Table 4.2. Marginal Effects of the Tobit Model on the Determinants of WTP for the Proposed Biodiversity Conservation Programme on Different Land Types

VARIABLES	Communal Land	Municipal Land	Contract Park
Household is from the Mier community	37.03 (50.74)	35.32 (30.10)	-0.533 (10.79)
Household size	-10.24 (8.423)	3.683 (4.958)	-0.298 (1.760)
Gender of the Household Head	15.55 (54.09)	8.574 (33.29)	22.79** (11.44)
Education years of the Household Head	21.63*** (6.733)	4.636 (4.016)	2.534* (1.441)
Log of income	150.9*** (27.15)	28.96* (16.04)	12.03** (5.764)
Respondent is knowledgeable about the effects of biodiversity loss	67.30 (55.31)	67.24** (33.20)	20.97* (11.45)
Household was sampled in the second wave during 2011	-112.9* (57.31)	-138.2*** (35.60)	-26.94** (12.23)
Observations	174	163	153

***, **, * indicate 1%, 5% and 10% levels of significance respectively

Robust standard errors in parentheses

Table 4.3. Annual WTP for Implementing and Preventing Proposed Biodiversity Conservation Programme on Communal Land, Municipal Land, and Parkland

	(B>C) Support Conservation				(B<C) Against Conservation			
	WTP for implementing Proposed Biodiversity Conservation Programme				WTP for preventing Proposed Biodiversity Conservation Programme			
	KHOMANI SAN		<i>MIER</i>		KHOMANI SAN		<i>MIER</i>	
	Mean WTP	Median WTP	<i>Mean WTP</i>	<i>Median WTP</i>	Mean WTP	Median WTP	<i>Mean WTP</i>	<i>Median WTP</i>
Communal Land	60.60 (n=92)	15.00 (n=92)	146.45 (n=83)	25.00 (n=83)	70.63 (n=8)	10.00 (n=8)	85.59 (n=17)	75.00 (n=17)
Municipal Land	38.42 (n=79)	5.00 (n=79)	70.06 (n=88)	5.00 (n=88)	7.31 (n=21)	5.00 (n=21)	15.83 (n=12)	10.00 (n=12)
Contractual Parkland	30.89 (n=79)	15.00 (n=79)	40.27 (n=74)	15.00 (n=74)	7.00 (n=21)	5.00 (n=21)	55.96 (n=26)	15.00 (n=26)

Note: The absolute numbers above are in South African Rands.

Table 4.4. The Benefit-Cost Analysis for Implementation of the Proposed Biodiversity Conservation Programme for 320 Khomani San and 8,000 Mier households

	<i>Programme Preferences</i>	<i>Sample Size (N)</i>	<i>Sub-population</i>	<i>Median WTP</i>	<i>Benefit-Cost Analysis</i>
KHOMANI SAN					
Communal Land	B>C	92	$0.92*320= 294.4$	15.00	R 4,416.00
	B<C	8	$0.08*320= 25.6$	-10.00	-R 256.00
	Overall	100	320.0		R 4,160.00
Municipal Land	B>C	79	$0.79*320= 252.8$	5.00	R 1,264.00
	B<C	21	$0.21*320= 67.2$	-5.00	-R 336.00
	Overall	100	320.0		R 928.00
Contractual Park	B>C	79	$0.79*320= 252.8$	15.00	R 3,792.00
	B<C	21	$0.21*320= 67.2$	-5.00	-R 336.00
	Overall	100	320.0		R 3,456.00
MIER					
Communal Land	B>C	83	$0.83*8000= 6640.0$	25.00	R 166,000.00
	B<C	17	$0.17*8000= 1360.0$	-75.00	-R 102,000.00
	Overall	100	8000.0		R 64,000.00
Municipal Land	B>C	88	$0.88*8000=7040.0$	5.00	R 35,200.00
	B<C	12	$0.12*8000= 960.0$	-10.00	-R 9,600.00
	Overall	100	8000.0		R 25,600.00
Contractual Park	B>C	74	$0.74*8000=5920.0$	25.00	R 88,800.00
	B<C	26	$0.26*8000=2080.0$	-15.00	-R 31,200.00
	Overall	100	8000.0		R 57,600.00