Valuing the Communal Resources of Paulshoek, Namaqualand, South Africa.

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Abstract.

Communal areas have been accused of being unproductive; most of these accusations have been based on comparative studies of livestock and crop production between communal and privately owned farms. A case study is presented, determining the cash value of all the communal resources used in Paulshoek, a communal area in Namaqualand. This value represents a direct-use value that was obtained using market prices and quantity data where markets existed and replacement and production cost methods when market price data was not available. The cash value of medicinal plants, firewood, construction materials, donkeys, a tourist campsite, crops and livestock resources were obtained and shown to have a total annual value of R269 756 and a per hectare annual value of R13.5. This value is just below the private farm per hectare value of R15 and it was therefore concluded that the communal lands are not unproductive. The distinction between efficiency and productivity was highlighted and it seems unlikely that these resources will maintain this value over time.

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Introduction.

The economic study of production processes and the profits they derive has traditionally focussed on those enterprises that are firmly located in a market setting. This has allowed for the valuation and analysis of inputs and outputs that are traded in market places and that therefore have a market value. Natural resources are often used as inputs into these production processes and markets therefore exist that determine the prices of these resources. Furthermore any use of a natural resource is a production process as it contains inputs and outputs. However markets do not exist for all natural resource production processes and this is particularly true for rural communities who rely heavily on natural resources. For example the use of firewood requires that wood be collected (labour input) and used for energy (output) but often there is no market for the sale of wood and hence no traditional way of determining its value. Over recent years the development of environmental and resource economics has resulted in attempts being made to value non-market associated natural resource production processes (Shackleton *et al* 2000). The recent development of valuation techniques has resulted in the ability to value goods with no market value (Campbell 1993). This paper uses these valuation techniques to examine the value of the communally owned natural resources used by a community in Paulshoek, Namaqualand, South Africa.

A great deal of research has been done on the community of Paulshoek and the natural resources they use. May *et.al* (1997) and Rodkin (2001) examined the socio-economic conditions in the area. Natural resource use practices and the ecological implications of these practices have been investigated for firewood plant species (Solomon 2000), plants used for construction (Evans 2001) and medicinal plants (Archer 1996, Goldberg 1998). The production of crops (Allsopp 2001) and livestock (Hoffman 2001) have been well documented as have the conditions of the natural flora (Hoffman 2001) and the effects donkeys (Vetter 1996) are having on this flora. The only economic work done have been comparative studies of the communal livestock (Hoffman 2001) and crop (Allsopp 2001) production processes with privately owned farms crop and livestock production processes. The results concurred with Tapson (1991), who argued that communal farm systems are less productive than privately owned farm systems. Scoones (1992) however argued that this is not a valid comparison as communally and privately owned lands have different production objectives. He argued that a fair comparison could only be made when values for all the natural resources used in a communal area are included in the comparison. Once this is done communal areas are at least as productive as privately owned areas. No attempt has been made at valuing all the natural resources used in Paulshoek, it is therefore this papers aim to do so.

The question asked here is: if the resource in question is not available to the community what is the next best alternative that they would use? The value of the replacement cost is determined by multiplying the quantity of the resource used by the commercial price of the next best alternative. This paper examines the annual value of the natural resources in Paulshoek therefore when replacement costs are estimated for fixed assets the yearly replacement cost of that fixed asset is determined by linearly depreciating that asset over its lifespan. Depreciation is defined as the reduction in asset value over time. It can also be viewed as the allocation of a proportion of the initial cost of the fixed asset to a certain time period. This is done for as many time periods as it takes for sum of the allocated proportional costs to equal the initial investment cost (Gittenger 1982). Linear depreciation is the allocation of equal proportions of the total cost to yearly time intervals for the life span of an asset. Another method used was the production cost method (van Zyl 1988). He argues that if a product does not have a market value its value can be represented by the total cost it took to produce that product. The production cost methods used in this report require that a cost is put on the labour. This labour cost is estimated by determining its opportunity cost. Nicholson (1994) defines opportunity cost as the "cost of a good or service as measured by the alternative uses that are forgone by producing that good or service". For example if an individual can potentially earn R100 by selling tea but decides that today he/she will stay home and watch television. The opportunity cost of watching television is R100, as this is the income forgone by not selling tea. If however it is raining today and no one will buy tea the forgone income is zero and the opportunity cost of watching television is zero.

Before any direct-use value can be attained quantity and price data need to be attained. For each resource the quantity data was obtained from previous reports on that resources and from interviews with individuals living in Paulshoek. Price data was obtained through interviews with residents or from the retailers where the relevant products are purchased.

Through valuing the natural resources in Paulshoek this paper aims to prove Scoones (1992) assertion that communally owned lands are not necessarily less productive than privately owned lands and Shackleton *et.al* (2000) claim that communally owned natural resources represent a significant value that is often over looked by more formal analyses.

This is done by firstly describing the methods of valuation and how data was obtained to use in these valuation procedures. Following this is a discussion on the socio-economic and physical environmental conditions in Paulshoek. This is done in order to contextualise latter discussions and arguments. Thereafter the resources used and the values derived for each of them are discussed. The final section of the report presents the total cash value for the communal resources of Paulshoek and discusses these values with reference to current literature on natural resource valuation.

Methods.

This section is divided into two sections. Firstly, the valuation techniques used are described. It is important to understand which techniques were used and why they were used as it holds a direct bearing on the final value obtained for the resource. Second, the sources of the data used in this report are described.

Shackleton *et al* (2000) and Campbell (1993) argue that there are three classes of values that are important for determining the value of natural resources used by rural communities. Firstly, direct-use value, this is the value individuals gain through using the resource consumptively (firewood for energy) or non-consumptively (tourism, other people use the resource and convey benefit to the community through payment). Second, indirect-use value, this value accrues to individuals through benefits provided for by the ecological functions of that resource. For example, the existence of sufficient vegetation cover to prevent erosion. Third, passive or non-use values this includes existence values (benefit associated with knowing a resource exists) and option values (benefit related to potential future use). This report analyses the direct-use value of the natural resources in Paulshoek.

Numerous methods were employed to obtain the direct-use value of the natural resources in Paulshoek. The simplest method was to obtain the amount of the resource or resultant products used and multiply this by the most localised price residents obtain when they trade the resource. This method can however only be used when a market for this resource exists. If there is no market price the value of the resource can be estimated by determining the replacement value of that resource.

Paulshoek: A brief physical and socio-economic description.

Before any attempt at valuing the resources used in Paulshoek is made it is essential that the physical and socio-economic settings within the area be described. This is done for two reasons; firstly, the type and way resources are used are often a direct consequence of the physical environment. Hence understanding the physical conditions is the first step toward understanding how resources are used. Second, assumptions around labour costs are made during the resource valuation procedures that are a direct consequence of the socio-economic conditions in the village.

Socio-Economic Conditions in Paulshoek.

The socio-economic discussion that follows, attempts to illustrate three things. Firstly, that the general living standard in Paulshoek is low. Second, that employment opportunities within Paulshoek are limited. Third, that there is a distinction between households in Paulshoek and that most of the income that households rely on, originates outside of Paulshoek.

Paulshoek is a communally owned area located in Namaqualand, South Africa (figure 1.). It is 52km from the nearest town, Garies and forms part of the greater Leliefontein communal area. The name Paulshoek refers to the village of Paulshoek and 20 000 ha of communally owned land surrounding the village.

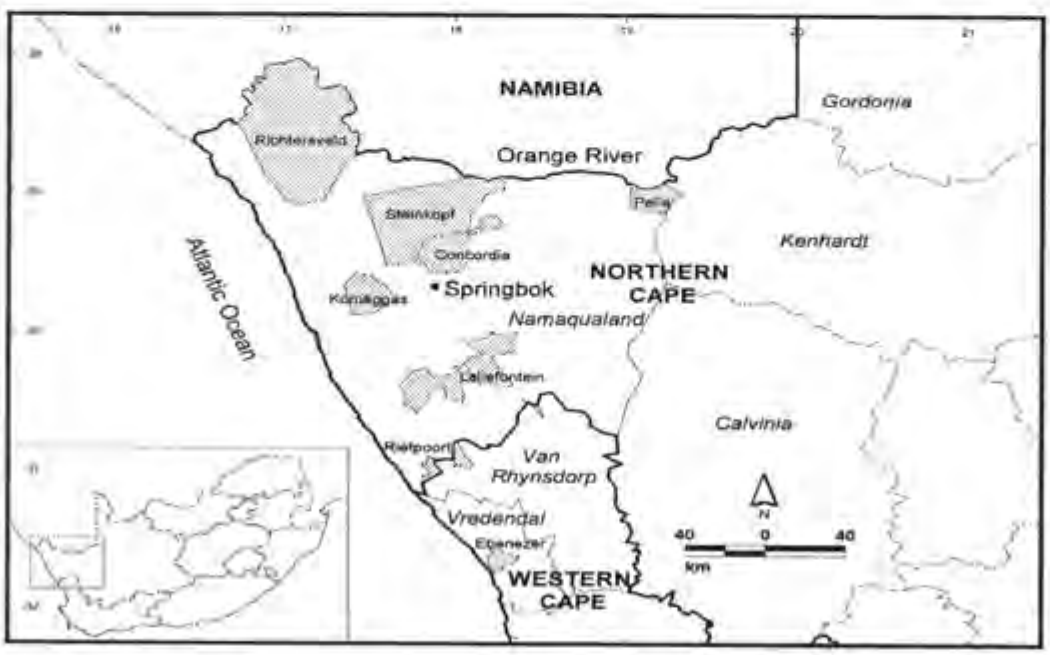

Figure 1. Map showing the location of Leliefontein within Namaqualand, South Africa (the shaded areas indicate communal areas within Northern and Western Cape provinces).

The Paulshoek communal land contains 138 households, 28 stock posts[1] and approximately 800 individuals, the population can however increase dramatically at the end of each month and during holidays when migrant labourers return home. The World Bank's Human Development Index (HDI) for the "coloured"[2] population in Namaqualand is 0.340, as Paulshoek's population is predominantly "coloured" it can be assumed that this figure is applicable to the village. This falls into the World Banks category of "least developed nations" and provides the first impression of the poverty evident in this area (May *et.al* 1997).

Data from Rodkin (1999) indicates that only 28% of Paulshoek's population were employed. Of this employed total, 63% were employed inside Paulshoek and 37% outside the village. Furthermore only 51% were permanently employed, 41% were occasional workers and the remaining 8% were self employed or had multiple jobs. Hence only 133 individuals had secure permanent work. The male to female ratio within Paulshoek is 46% / 54% and for individuals between the ages of 15-39 there are 30% more women. This is a direct result of the migrant labour system in operation in the community where women are often left in the village to look after children. Furthermore 48% of the population is under the age of 18 and a large proportion of the remaining population is over the age of 65 (May et al 1997). The above discussion highlights that the average resident of Paulshoek is either not employed or unemployable (too old or young) at present.

Although the monthly average household income is low (R1 245, Rodkin 1999) there are large differences in income between the wealthiest and poorest households. Rodkin (1999) and the SPP (1995) identified five distinct households groups within the village. These households are distinct from one another in terms income source and quantity, education and age. The table below gives a brief summary of the characteristics of each group using Rodkin's (1999) data that was based on a sample of 30 households. This data concurs with May *et al* (1997) (n = 72) findings but is more current.

[1] Stock posts are camps that generally consist of a sleeping shelter, cooking shelter and kraal. They are located away from the village and inhabited by the herders

[2] It is important to note that that the word "coloured" is a social construct and implies a certain social, political and economic situation.

Table 1. The five household groups in Paulshoek (Rodkin 1999)

	Number of Households	Average Household Size	Monthly Per Capita Income	Average Age	Primary Source of Income
Group 1.	33	6.1	R570	28	Primary Sector Wages and local permanent work (90%)
Group 2.	29	6.8	R191	35	Pensions (74%) and remittances (16%)
Group 3.	39	4.6	R273	41	Pensions (99%)
Group 4.	25	7	R282	28	Permanent wages (44.2%) and Casual Labour (16%)
Group 5.	12	7	R80	36	Casual Labour (46%) and Remittances (25%)

Table 1 shows that group one is far better off than the other groups. This is the youngest group and relies on permanent work in and outside of Paulshoek for income. The remaining groups rely heavily on governmental support, non-permanent employment and remittances. It is therefore clear that the bulk of the income earned in all groups, originates outside of Paulshoek.

Paulshoek's Physical Environment.

Paulshoek is situated in the southeastern corner of the Leliefontein reserve in the Kammiesberg mountain range and lies between 1000-1400m above sea level. Summer temperatures seldom exceed 35°C but winter temperatures can fall below zero. Annual average rainfall is between 150 and 200mm. Other sources of water include three boreholes and two dug wells that supply the village and approximately 32 dug wells or fountains that supply the stock posts with water. Rainfall and temperature are the two most important variables affecting resource use in the area. Neither of these variables are constant through time and space. Annual rainfall varies between years and between areas within Paulshoek, with annual rainfall levels highest in the northwest and decreasing along a gradient toward the southeast.

Resource use practices have evolved with these macro and micro climatic variations such that their affects can be mitigated or capitalised upon. For example stock farmers move herds in accordance with temperature and rainfall events.

In terms of topography the communal lands are dominated by steep sided hills that make up more than 60% of the surface area. The remainder of the area is comprised of uplands (narrow valleys and convex summits) and flatter low-lying areas (less than 15% of total surface area). Hoffman (2001) classified the vegetation of Paulshoek into four distinct communities. Firstly, lower elevation Succulent Karoo. This is found in the lower lying areas of the communal lands (980m-1150m) and is the most degraded of the three vegetation types. This is due to fact that this area is frequently used as grazing, contains water points, stock posts and is the area where crops are grown. Hence the most degraded area comprises only 15% of the total communal area. Second, higher elevation Succulent Karoo, found on the lower and mid elevations of the mountain slopes (1000m-1200m). It is frequently grazed but is not as degraded as the first community. Third, the lower elevation Mountain Renosterveld, which is found on the upper slopes of the mountains (1050m-1300m). This community contains many palatable species but due to the rockiness and inaccessibility of the area the impact of grazing is relatively low. Fourth, the higher elevation Mountain Renosterveld, found on the upper slopes and crests of the mountains (1150m-1400m). This community is the least degraded of all vegetation communities.

The 20 000 ha's of communal land around Paulshoek supplies the community with numerous resources. These include: firewood, construction materials, medicinal plants, land for agriculture and grazing and water for livestock. These resources are not used in isolation of one another; rather there is a system of resource use within Paulshoek that must be understood, before it can be valued. The discussion below discusses the system and values of Paulshoek's natural resources.

Natural Resource Use and Values.

The resources used in Paulshoek can be divided into two distinct groups according to their uses. Firstly, resources that are used and accessible to the majority of Paulshoek's population. These include: firewood, the campsite and medicinal plants. Second, resources that are used as inputs into other production processes and the produced good itself. These include; construction materials for cooking shelters, donkeys, crops and livestock (goats and sheep).

This section deals with each of these three groups and with each resource separately. For each resource, the system of use and method of valuation are discussed. The final value for each resource is then presented.

Resources Used by the Majority of Paulshoek's Population.

Firewood: Use.

Firewood is the chief source of energy for the village of Paulshoek and the 28 stock posts surrounding the village, it accounts for 75% of the net energy consumed by the village (Solomon 2000). Firewood collection in Paulshoek is unrestricted and any resident may collect as much of any species as they wish. Furthermore it is a necessity for daily living and its collection is an integral part of household activity in Paulshoek and other communal areas in Namaqualand (Solomon 2000, Archer 1996).

Firewood is not seen as a homogenous product and both Archer (1996) and Solomon (2000) note that fuel wood users distinguish between "good" and "bad" firewood. Where the amount of coals formed and the length of time they burn for determine firewood quality. Both authors note that individuals would prefer to use good quality firewood for all functions but due to the scarcity of better quality wood, different species are used for different functions. Two types of wood are used in Paulshoek, namely sold and collected firewood. The former category is comprised solely of *Rhus undulata* (taaibos) that is the wood of preference and is very rare in areas surrounding the village. Hence most of the *Rhus undulata* used is collected approximately 10km away, 2-3 times a month by 8 individuals (4 own "bakkies" and 4 own donkey carts) who sell it to the villagers. The remaining wood type category consists of the 11 other plants species Solomon (2000) identified as "important" fuel wood species in Paulshoek. All 11 species are not sold and are collected by the villagers (this category is referred to as the "other" category).

Furthermore Solomon (2000) showed that the quantity of fuel wood used varies in proportion to household size and season. But it was shown that the average quantity of firewood used on a daily basis by households in each of the four seasons was 7.1kg, 5.9kg, 2.5kg and 3.6kg for winter, spring summer and autumn respectively. Solomon (2000) has also shown that the quality of firewood used is influenced by household income and season. "Relatively wealthy" households (group one in this report) used more *Rhus undulata* than "relatively poor" households (groups 2 to 5) and the proportional contribution of *Rhus undulata* to total household firewood use decreased with the onset of warmer conditions. This is due to the fact that *Rhus undulata* is the primary energy source used for heating in colder months. Table 2 below illustrates the amount of both wood types consumed in the village.

Table 2. The quantity of *Rhus undulata* and "other" firewood species used by "relatively wealthy" (n=32.6), "relatively poor" (n=105.4) and stock posts (n=28) (Data from Solomon 2000).

Season	**Quantity of *Rhus undulata* used (Kg per group)**			**Quantity of "other" wood species used (Kg per group)**		
	"Relatively Wealthy" Households	"Relatively poor" Households	Stock Posts	"Relatively Wealthy" Households	"Relatively poor" Households	Stock Posts
Winter	13 726	16 079	0	6 863	50 534	17 693
Spring	5 680	6 653	0	11 359	48 475	14 643
Summer	978	1 145	0	6 358	22 590	6 305
Autumn	4 612	5 401	0	5 802	28 287	8 948
Total	**24 996**	**29 280**	**0**	**30 382**	**149 885**	**47 589**

No distinction is made between the two firewood categories for Stock post dwellers as they collect all the firewood they consume. Hence the entire quantity of firewood they use is placed in the "other" category. Although the "relatively wealthy group" uses less firewood than the "relatively poor" group fewer households are contained in the "relatively wealthy" group. Hence their individual *Rhus undulata* consumption is significantly higher (table 2).

Firewood: Value

There is a small proportion of *Rhus undulata* that is collected by individuals but for the purpose of valuation it is assumed that all *Rhus undulata* is sold. It was shown that the number of collection trips made by donkeys and bakkies was equal. Furthermore a donkey cart of wood weighs approximately 70kg and a bakkie load weighs approximately 112kg.

Hence it was possible to determine the number of trips and total kilograms of wood that donkeys and bakkies sold in each season. *Rhus undulata* prices vary with respect to the type of transport used for its collection (bakkies collect more wood than donkeys per trip, hence bakkie per kilogram prices are lower) and the season (prices fall with the onset of warmer weather). It was there for possible to determine the total revenue generated from *Rhus undulata* sales by multiplying the seasonal price by the seasonal quantity for bakkies and donkeys (table 3).

Table 3. The total revenue generated from *Rhus undulata* sales.

Season	Quantity of *Rhus undulata* Sold (Kg)		Price (Rand per Kg)		Total Revenue. (Rand)		Total Cost		Net Income	
	Bakkie load	Donkey Cart	Bakkie load	Donkey Cart	Bakkie load	Donkey Cart	Bakkies	Donkey Carts	Bakkies	Donkey Carts
Winter	18 628	11 177	1.07	0.73	13 639	11 975				
Spring	7 708	4 625	1.1	0.76	5 850	5 087				
Summer	1 328	797	0.9	0.73	972	717				
Autumn	6 258	3 755	1.07	0.73	4 582	4 023				
Total	**33 922**	**20 354**			**25 043**	**21 803**	**10 992**	**6 561**	**14 050**	**15 242**

There are two costs incurred through wood collection and these were estimated for bakkie and donkey cart sellers separately. Firstly, labour costs, these were estimated as R22 per day (includes wages, food and tobacco) multiplied by the number of wood collecting trips made by donkey cart and bakkie owners (298 each). Hence labour costs were R6 561 for each of the two selling groups. Second, transport costs, these were only calculated for bakkie owners as there are no costs associated with owning donkeys and little to no costs associated with maintaining donkey carts. There are however transport costs associated with bakkies and these were estimated as the AA's per kilometre rate for a 2.5l bakkie (R0.743) multiplied by the total number of kilometres (20km per trip multiplied by the number of trips). Running costs were thus estimated at R4 432 for the year 2000. The net income from *Rhus undulata* or the value of the resource is R29 292.

The second part of the analysis of firewood concerns the total quantity of "other" wood the village consumes. There is no market price for this resource but the value can be estimated using two methods. Firstly, the production cost method was used and found that the only cost associated with "other" firewood production is the opportunity cost of wood collection.

However as most of the people in the village are unemployed or unemployable, it is not likely that the time spent collecting firewood could be used in another income earning enterprise. Hence there is no opportunity cost (foregone income) associated with firewood collection and the value of this resource is zero.

The second valuation method is the replacement cost technique. In this case it is assumed that villagers next best option would be to buy all the firewood they needed from wood sellers. Using the prices and methods discussed for *Rhus undulata* above, the value of this resource was estimated at R120 729. Deciding which valuation method is more correct is a difficult task, the best outcome that can be attained is to state that the value of the fuel wood resource for Paulshoek is between the lower limit value of R29 292 (productive cost method) and the upper limit of R150 021 (replacement cost).

Medicinal Plants: Use.

Goldberg (1998), May *et al* (1997) and Archer 1994 state that rural communities in Namaqualand rely heavily on medicinal plants as part of their health care and that there are distinct groups of medicinal plant users. These groups are distinguished on the basis of the level of medicinal plant knowledge they possess. Archer (1996) classifies them into four groups, these include general knowledge users, herbalists (better knowledge than the average user), herbalist healers or "bossiesdoktors" (high level of knowledge and considered to have a "gift" for healing) and midwives (apt at curing illness relating to pregnancy, conception problems and birth).

The sustainability of medicinal plant use and the state of the local knowledge around medicinal plants in Paulshoek was investigated by Goldberg (1998). She found that 70% or 560 people made regular use of medicinal plants and that two distinct user groups existed in this population. Of the 560 people who used medicinal plants 557 are considered to have a general knowledge and 3 are "bossiesdoktors". Even though this distinction exists it was shown that only 15 plants species were considered important for medicinal purposes and that both user groups had the knowledge and skill required to collect and use these plants. Furthermore the "bossiesdoktors" were shown to have a limited number of patients from Paulshoek and that most of the plants they harvested, other than the 15 species known to all users, were found in fynbos vegetation outside the communal area.

Goldberg (1998) estimated that each species would be used approximately twice per person per year and that the quantity used would equal one dose or treatment. Hence for each species this translates to 1120 doses per year. Appendix one shows a complete list of the plants used, the symptoms they treat and the medical facility community members would have to visit to obtain a pharmaceutical alternative.

Medicinal Plants: Value.

As with "other" firewood resource there are two valuation methods. Firstly, the production cost method that for medicinal plant use includes collection cost (time spent collecting) and human capital cost (a premium on the skills needed to collect the plants). Goldberg (1998) showed that 80% of those individuals collecting medicinal plants were over the age of 50 and none were younger than 40. It is therefore possible to assume that there is no labour opportunity cost. Furthermore the skills or knowledge needed to harvest these plants is not scarce. Hence a premium on knowledge cannot be charged and there is no human capital cost. The production cost method thus estimates the value of this resource at zero.

Second, the value of the medicinal plant resource in Paulshoek can be calculated by estimating the replacement cost of this resource. In Paulshoek a general store sells common pharmaceutical products like Panado and Disprin. More serious problems are treated by a mobile clinic that visits the village every two weeks. In cases of emergency the nearest hospital is in Garies. As the 15 medicinal plant species found in Paulshoek are used for minor ailments (appendix 1) it is reasonable to assume that residents would either buy painkillers or visit the mobile clinic. A doctor was consulted and prescribed painkillers as the best pharmaceutical alternative for 5 of the 15 medicinal plant species (appendix 1). This translates to 5 600 doses of painkillers per year, each dose costs R1. 20, the total annual replacement cost for those 5 species is therefore R6 720. The symptoms associated with the remaining 10 species would require a visit to the clinic (appendix 1). The mobile clinic charges R23 per visit (regardless of the prescription) for employed people and charges nothing for unemployed people. If 560 people use medicinal plants and employment is 28%, only 157 people will be paying for visits to the clinic. For the 10 medicinal plants 157 people require 3140 doses or treatments. As each treatment costs R23 the total cost of 3140 treatments is R72 220. Hence the replacement cost or the value of the medicinal plant resource is R78 940.

Campsite: Use.

A campsite was established in Paulshoek in 1996, it consists of four matjieshutte, one cooking shelter and a toilet. The campsite offers accommodation at R20 a night per person and meal at R50 per person. For the year 2001 there were 126 over night guests 32 of which ate dinner. The money generated from the campsite is goes to the tourism committee and is used to pay for the costs of running the campsite and 20% of the profits are invested in future projects. Hence this resource theoretically benefits the entire community of Paulshoek.

Campsite: Value.

The matjieshutte are constructed from 40 mats that cost R140 each, wooden frames incur no costs other than labour as they are collected free of charge from neighbouring commercial farms. It was estimated that the collection of wood and the construction of a matjieshut took 20 person days (two workers working for two weeks). The total cost of the 4 matjieshutte was estimated as the cost of the mats (R5600) plus the labour cost of 80 person days at R22 per day (R3 520) and came to R9 120. The annual cost was determined by linearly depreciating this cost over a huts life span of ten years. Hence the annual cost of the matjieshutte was R912. The annual cost of a cooking shelter was shown to be R22 (see construction material section). The toilet's annual cost was determined by linearly depreciating the initial cost (R2000) over its lifespan (15 years) and came to R133. Finally one individual is paid R1200 per year to ensure that the campsite is clean and that the guests are taken care of. Total annual cost was therefore R2 267.

The total revenue from accommodation was R2520 and assuming a 100% profit on the meals the value of the meals was R788. Total revenue was therefore R3308 and total annual profits or the value of this resource was R1 113.

Livestock Production and the Resources Used as Inputs in this Production Process.

Construction Materials: Uses

Archer (1996) classifies a group of plants as having utilitarian purposes. This classification excludes firewood and includes plants used for constructing reed-huts (locally known as "matjieshutte") and cooking shelters and plants used in leatherwork, soap making and as utensils. Within Paulshoek the reed species (*Scirpus inanis, Scirpus nodosus* and *Tamarix usneoides*) that are used for making "matjieshutte" are no longer found in sufficient quantities to make the mats required in hut construction.

Purchased products have replaced plants used in leatherwork, soap production and as utensils. Hence it is only the cooking shelters (kookskerms) that are constructed from plant materials in the communal area. The cooking shelters are however only found at the stock posts and in the campsite as village households use cooking houses constructed out of zinc and wood. Each of the 28 stock posts and the campsite has one cooking shelter; which are generally circular in shape and constructed by packing bushes on top of one another within a wooden framework (see figure 2).

Figure 2. A "full" cooking shelter located at a stock post in Paulshoek.

Evans (2001) notes that there are three distinct cooking shelter types: full shelter (dome shaped), half shelter (dome shaped but with half a roof), and open (with no roof). The total number of each cooking shelter type is 12, 11 and 6 respectively. Furthermore Evans (2001) showed that *Polymita albiflora* (muisoor) was the most commonly used plant but that *Euphorbia mauritanica, Galenia africana, Ruschia fredericii* and *Ruschia robusta* were also commonly used. Plants used for constructing cooking shelters have a duel purpose in this analysis. Firstly, they provide a value because if they did not exist an alternative material would have to be used in their stead. Second cooking shelters represent a cost to stock farmers. Stock farmers have to pay the labour required to build the shelters (investment cost) and they have to pay the labour required to maintain the shelters (annual maintenance cost).

Construction materials: Value.

The value of the cooking shelters was obtained by estimating the annual replacement cost of a cooking shelter with zinc cooking houses. This was done by obtaining the average surface area for each of the three cooking shelter types and calculating the number of 1.8m by 1m zinc panels and 1.5m by 50mm poles that would be needed to build a structure with the same volume. Zinc and pole prices were obtained from the Namakwaland Landbou Koperacie (NLK) and were R19.45 and R13.23 for the zinc and wood poles respectively. Furthermore it was estimated that it took five days to build a zinc cooking house and this was charged at the going labour rate of R22 per day. Finally all the equipment had to be collected in Garies and the cost of this trip is R160. The replacement cost of each type of cooking shelter is presented below.

Conclusions

It is clear from the above discussion that the resources provided by the communal lands in Paulshoek have a significant value and that the communal lands are not unproductive as was previously thought. This paper has highlighted a few areas of research that should be addressed. Firstly, an accurate labour transfer payment model needs to be developed. Second, the long-term effects of current resource use on firewood and livestock need to be established. Finally, the non-use and indirect-use values for the communal resources need to be established.

This result concurs with Tapson (1990) who argues that communal lands are less productive than privately owned lands. However once Scoones (1992) method of evaluating all the resources produced in an the communal area against livestock farming in private lands was carried out the gross margin per hectare for communal lands was R13.5, which was slightly lower than the gross margin of R15 for commercial lands. It is therefore possible to conclude that the communal lands are not unproductive.

The problem however is that because private costs and social costs are not aligned resources will be over utilised until controls are put in place to align these costs. If the alignment of these costs does not occur it is feasible to assume that while the communal land may be productive it is not producing this output efficiently or sustainably. Here in lies the biggest challenge to managers, if the communal lands are not conserved the community is at risk of loosing R269 756 per annum.

It can also be argued that the communal lands are not as productive as they could be and that one possible reason for this is the feral donkey population. According to Vetter's (1996) caveat the feral donkey population represents 600 goats, this represents 33% of the current goat population, if we assume that over the next year the total number of goats will produce approximately the same level of income as they did for 1999/2000 season, these donkeys are costing the community R34 979 a year. The removal of the feral donkey population could theoretically increase communal resource yields and livestock farming in particular.

The final point that needs to be made is that the labour assumptions made in this paper are at best an approximation of the value of the transfer payments occurring between individuals in Paulshoek. As labour represents the biggest cost associated with most of the resources used the final value obtained from this report is at best and approximation.

It is beyond the scope of this paper to address the validity of this argument it is however sufficient at present to understand that this is the theoretical framework in which the discussion below takes place.

From table ten it is clear that the assumptions that govern the valuing of the resources have a profound affect on the final value of the resource. The upper limit value corresponding to the replacement cost method is four times greater than the lower limit value corresponding to the production cost method. Both methods are valid, hence the safest conclusion that can be reached is that the natural resources of Paulshoek have and annual value of between R70 087 and R269 756. However the value of construction materials was determined using the replacement cost method. Hence in order to remain as consistent as possible it can be argued that the upper limit should be followed. Furthermore the replacement cost method provides a more realistic approach to valuing the resources used as the contribution firewood and medicinal plant resources make toward household consumption would be expensive to replace. This is concurred by Shackleton (1993) who used the replacement cost method to estimate the value of fuel wood in the lowveld. The remainder of this discussion therefore focuses on the upper limit value.

Table 10. The upper and lower limit annual values for the natural resources in Paulshoek.

Natural Resource	**Upper Limit Value**	**Lower Limit Value**
Firewood	R150 021	R29 292
Construction Materials	R951	R951
Medicinal Plants	R78 940	R0
Campsite	R1 113	R1 113
Donkeys	R6 993	R6 993
Crops	R3 132	R3 132
Livestock	R28 606	R28 606
Total Value	**R269 756**	**R70 087**
Per Hectare Value	**R13.5**	**R3.5**

The upper limit value is R269 756, this high value corresponds to findings of Shackleton (1993) who determined the cash value of indigenous natural resources in central Mpumalanga, South Africa and Campbell (1993) who valued the tree based resources in Zimbabwe. Both authors noted that the resources had previously been viewed as over exploited, unproductive and contributing minimal amounts to household incomes. However once the personal consumption and other non-market values were estimated these resources proved to hold a great deal of value. Hence it is clear that the resources of Paulshoek are a significant source of value for the community. In terms of productivity the livestock farming in Paulshoek has a per hectare gross margin of R1.4 this is far lower than the gross margin of R15 for privately owned farms.

Table 9. The costs and profits associated with livestock production.

Costs	Unit Price	Quantity	Total Cost
Feed			R30 867
Veterinary Costs			
Dipping	R0.42	38	R15.94
Injections	R0.26	629	R163.5
Dosing	R1.44	3 515	R4 745
Total Veterinary Cost			R4 925
Cooking shelter	R22	28	R616
Houses	R40	28	R1 120
Labour	R3000 (per year)	30	R90 000
Total Cost			**R127 527**
Total Profit from Livestock Production			**R28 606**
Per Hectare Profit			**R1.4**

Total cost were therefore R109 527 resulting in a total profit or net value of R46 606 or R2.2 per hectare.

Discussion

Before discussing the results presented above it should be understood why privately owned or commercial farms are used as a benchmark against which communal farms are to be compared. The concept of economic efficiency, often called Pareto efficiency, is defined as the allocation of resources such that it is impossible to make one person better off without hurting anybody else (Varian 1996). In order for this outcome to occur markets must be perfectly competitive and resources must used up to a point where the marginal benefit (MB) from using one more unit of that resource is equal to the marginal cost (MC) of using that resource. According to Hardin (1968) communally owned resources will never be used at a point where MB=MC due to the fact that the cost of using a resource is shared between all users. Hence the MB will always be greater than the personal MC and over utilisation will occur. Furthermore if profit maximisation is the goal of a producer the amount of resource used will be that amount that corresponds to the MB=MC allocation. This is due to the fact that consuming one more unit of a resource will result in MC being bigger than MB and hence profits will decrease. Hence private farmers are viewed as having an efficient resource use system and according to economic theory provide the optimal or ideal example against which to compare communally owned land.

Table 8 below depicts the same results for sheep production. As with goats the sheep slaughtered for own consumption contribute most toward total sheep value. Sheep production yields roughly half the amount goat production does and total livestock production generated R156 133 for the year August 1999 to July 2000.

Table 8. The total revenue generated from sheep production.

	Lambs	**Weaner**	**Ewe**	**Wethers**	**Rams**	**Total**
Local Sales						
Quantity	4	5	44	3	1	57
Price	R80	R100	R235	R200	R250	
Revenue	R320	R500	R10 340	R600	R250	**R12 010**
Market Sales						
Quantity	16	7	15	5	1	44
Price	R100	R175	R250	R250	R350	
Revenue	R1 600	R1 225	R3 750	R1 250	R350	**R8 175**
Slaughtered						
Quantity	2	15	85	33	2	137
Price	R80	R100	R235	R200	R250	
Revenue	R160	R1 500	R19 975	R6 600	R500	**R28 735**
Total Potential Revenue from Sheep Production						**R48 920**
Total Potential Revenue from Goat and Sheep Production						**R156 133**

This value is however a gross value, hence costs must be subtracted to yield net value or profits. The costs associated with livestock production are presented in table 9 below. It is here that the cost of crop production and maintenance of cooking shelters is transferred to. Furthermore there were veterinary costs incurred for dipping (against ticks), dosing (against worms) and injections (against pulpy kidney). Furthermore stock farmers must provide houses or sleeping shelters for the herders, as there were 28 stock posts it was assumed that there were 28 sleeping shelters, the annual cost of a sleeping shelter was calculated as the replacement cost of a zinc house depreciated over 25 years. The size of the sleeping shelter was assumed to be the same size as a "full" cooking shelter. Hence the replacement cost for an individual sleeping shelter was estimated as the same replacement cost for a "full" cooking shelter. This was the same method used for cooking shelters and it was assumed that sleeping houses would be the same size as the largest cooking shelter. The final cost was labour, it was estimated that labour costs approximately R250 per month including food and tobacco. This was the largest contributor to total cost at R90 000 per year.

Hence two groups own almost all the livestock in Paulshoek, this represents 72 out of 138 households and therefore shows that access to livestock and the natural resource inputs associated with its production are not evenly distributed throughout the community.

Livestock Production: Value.

The benefits from livestock production are gained through local sales, market sales, slaughtering stock for household consumption and consuming the milk produced by goats. Table 7 below depicts the number of each class of goat that was sold or slaughtered, the average price obtained for that goat (prices obtained from interviews) and by multiplying price and quantity total revenue was obtained. Milk value was calculated using the method described above.

Table 7. The total revenue obtained from goat production.

	Kids	**Weaner**	**Ewe**	**Wethers**	**Rams**	**Total**
Local Sales						
Quantity	6	12	59	11	4	92
Price	R70	R100	R220	R200	R250	
Revenue	R420	R1 200	R12 980	R2 200	R1000	**R17 800**
Market Sales						
Quantity	14	4	93	11	4	126
Price	R100	R150	R250	R225	R300	
Revenue	R1 400	R600	R23 250	R2 475	R1 200	**R28 925**
Slaughtered						
Quantity	7	12	156	43	2	220
Price	R70	R100	R220	R200	R250	
Revenue	R490	R1 200	R34 320	R8 600	R500	**R45 110**
Milk						
Quantity						6151
Price (per litre)						R2.5
Revenue						**R15 378**
Total Revenue from Goat Production						**R107 213**

Goats that are slaughtered are valued at the same price as goats sold locally, this is due to the fact that if the individual did not farm goats he/she would have to buy the meat and the price they would pay would be the local market price. Own consumption or slaughtered goats is the largest value obtained from goat production. Milk production contributed R15 378 to total goat production value of R107 213.

Meat and milk are produced for household consumption, sales within the community and sales on the national agricultural markets. Furthermore livestock represents a capital storage facility where funds can be created if the need arises (Shackleton *et.al* 2000). This has been noted for other communal areas, where Lyn and Niewuodt (1990) argue that the decision to sell livestock by communal farmers in Kwazulu Natal is not made on the basis of favourable prices but on the need for emergency funding. As the farmers in Paulshoek have multiple production objectives farmers aim to maximise herd size subject to the quality of grazing, itself a function of the climate. Hence climatic variation results in herd size variation (Hoffman 2001).

This paper analyses the livestock production in Paulshoek for one production year (August 1999 to July 2000) the total number of goats and sheep that were present after this year are presented in table 6 below. There were a total of 2667 sheep and goats that converted to 2498 SSU and 416 LSU. Furthermore there are twice as many goats as there are sheep. The stocking rates for the 20 000ha of communal land are roughly 2.5 times the carrying capacities recommended by the Department of Agriculture (Hoffman 2001).

Table 6. The quantity of Goats and Sheep in Paulshoek in July 2000 (SSU and LSU were converted using Meissner's (1982) conversion factors) (data from Hoffman 2001)

	Lambs	Weaner	Ewe	Wether	Ram	Total	SSU	LSU
Number of Goats	418	40	1 145	210	26	1 839	1 766	294
Number of Sheep	189	18	532	63	26	828	732	122
Total	**607**	**58**	**1 677**	**273**	**52**	**2 667**	**2 498**	**416**

Livestock in Paulshoek are kept in a total of 30 herds that are located at 28 stock posts around Paulshoek. Herd size varies between 13 and 173 SSU with a mean herd size of 82 animals. Not only does herd size vary between herds but also approximately one third of all herds are made up of multiple owners (Hoffman 2001). For most livestock farmers the income they receive from livestock represents a small proportion of income. May *et.al* (1997) show that for the entire village livestock sales contribute only 2% to total village income. Livestock therefore act as insurance against unforeseen income shortages or as a source of emergency funding. Approximately half of the households in Paulshoek own livestock, with those households owning livestock receiving on average 34% more monthly income than those not. In terms of the household groups discussed above group 1 owns 34% of all livestock and group 3 owns 60% of all livestock, group 3 are predominantly pensioners and rely heavily on the state pensions for their income (Hoffman 2001).

This report assumes that there are 100 feral donkeys as all interviewees stated that there were at least this many feral donkeys. This converts to 65 LSU or 392 SSU or 600 goats using Vetter's (1996) ratio.

Donkeys: Value.

All the values for donkeys were obtained using the replacement cost method. For transport, individuals would have to pay for transport if they did not own donkeys. Transport to Garies costs R160 per trip, or R1 .54 per kilometre, this is considerably higher than the AA's per kilometre rate and indicates that transport is a scarce service. Using the local per kilometre rate and a total per trip distance of 58km the cost per trip was attained (R89), as there are four donkey carts making monthly trips the total annual value was R4 283.

The next value determined was for wood collection; it was shown that four donkey carts make an average of ten 20km trips every month. Over a year donkey carts collecting wood make 120 trips or travel 2400km. As the next best alternative for wood collectors would be to buy a bakkie each kilometre was charged at the AA's per kilometre rate of R0.743. The total replacement cost or value of donkey transport for wood collecting was therefore R1 783 per year.

If farmers did not own donkeys they would have to rent a tractor for ploughing. It was shown that the cost of renting a tractor to plough 5ha was R180. The total number of hectares used in 2000 was 25.71; hence the total replacement cost or value of donkeys for ploughing was R927. The combined annual value of the domestic donkeys was R6 993 or R129.5 per donkey.

The cost of donkeys has two components, feral donkeys and domestic donkeys. Both these populations effect on livestock farming can only be attained through expressing them in stock units. These effects are discussed later.

Livestock Production and Use.

Livestock production in Paulshoek occurs in the form of goat and sheep production. It is easiest to understand this production process when it is compared to privately owned livestock farms. Privately owned farms produce sheep for meat that is sold in national agricultural markets. The optimal or efficient stocking rate occurs when maximum growth per animal during the first year of its life, predictable lambing rates, low mortality and maximum high quality meat yield are achieved (Hoffman 2001). The communal farmers on the other hand have multiple productive objectives.

Firstly, wages are paid at R15 a day plus food and tobacco (assumed to be R22 total). Second, help from friends and relatives where payment occurs through crops being used to feed the herds of all those involved in cereal production. The final and largest form of payment is through sharecropping. It was impossible to estimate these transfers, it was therefore assumed that regardless of how labour is paid the market price of R22 per day captures the value of the land owners labour, payment through share cropping or through the transfer of crops and other products. Therefore all labour is valued at R22 per day. Total labour costs were calculated by multiplying the daily wage (R22) by the number of days worked (25.73 50kg sacks sown multiplied by 50 person days). Total labour cost was estimated at R28 325. The total cost of production for the five farmers was therefore R30 867 and net loss wasR27 735 and the loss per hectare was R1 078.

Donkeys: Use

The donkey population in Paulshoek is divided into two groups. Firstly, domestic donkeys, these are used for transport, threshing, ploughing and wood collection. Second, there is a large feral donkey population that conveys no benefit to the community and through grazing results in losses for stock farmers.

Within Paulshoek four individuals use donkey carts with 6 donkeys per team to provide transport to surrounding villages in the communal area. Each team of donkeys makes on average one trip per month and as the nearest village is Leliefontein that is 27km away it was assumed that on average a team of donkeys travelled 58km per month. Similarly for firewood collection, four individuals use teams of 6 donkeys to collect firewood 2-3 times per month. For the year 2000 five farmers grew crops and all of them used their teams of donkeys for ploughing and threshing. Each farmer used 6 donkeys and a total of 30 donkeys were used in this function. It is assumed that the donkeys used for firewood collection are also used for transport. Hence the total domestic donkey population is 54. In terms of large stock units (LSU) one donkey represents 0.65 LSU (this estimate is an average of all categories of donkeys taken from Meissner 1982); hence the domestic donkey population of Paulshoek represents 35.3 LSU and as1 LSU equals 6 small stock units (SSU) this total can be expressed as 211.8(SSU). Vetter (1996) however showed that one donkey ate the equivalent of six goats, using this ration the number of goats the domestic population represent is 324.

In light of the above discussion the feral donkey population of Paulshoek presents a serious threat to livestock production as it competes with livestock for grazing. Vetter (1996) noted that general perception amongst Paulshoek's inhabitants was that there were between 150-200 feral donkeys on the communal lands.

Crop Production: Value.

As crops are used to feed livestock the value of crop production can be determined through multiplying the quantity farmers produced by the market price, thus determining total value or the amount stock farmers would have to pay to feed their livestock this much cereal (table 5).

Table 5. The total revenue and cost of crop production in Paulshoek (data from Hoffman 2001)

Crop	Hectares of Land Sown	Kilograms Sown	Kilograms Reaped	Price (per kg)	Revenue	Total Cost	Net Loss
Oats	15	750	1 450	1.2	R1 740		
Wheat	6.75	337	600	1.62	R972		
Rye	0.75	37	25	1.15	R30		
Barley	3.25	163	300	1.3	R390		
Total	**25.75**	**1 287**	**2 375**		**R3 132**	**R30 867**	**R27 735**

The most popular crop is oats, followed by wheat, barley and rye. A total of 1 287kg of seed were sown, resulting in a harvest of 2 375kg and a total revenue of R3 132. Allsopp (2001) showed that 50kg of seed, regardless of the type, was enough to sow 1 ha of land. Hence the total area utilised was 25.75 ha and the revenue yield per hectare was R121. 6. If all 356ha of land were utilised the potential revenue yield is R43 301.

The cost of cereal production is a transferred cost as it belongs to the stock farmers who own the cereal lands used during 2000. The costs incurred are the costs of grain, fungicide, equipment and labour. For 2000 only two farmers bought grain (300kg of oats and 100kg of wheat) and the total cost was R462. The cost of sulphur and fungicide was R412 (R16 for 200g that was enough for 1 sack or 50kg of seed). The annual equipment costs for each farmer came to R150, this included grease for ploughs, sickles and the cost of maintaining the plough. As there were 5 farmers this came to a total of R750. The cost of ploughing and threshing was assumed to be zero as donkeys perform these functions and there is no personal cost associated with owning donkeys. The total cost of renting was R4 488 per annum if all renters are included and R940 if only the farmers who sowed in 2000 are included. The final and largest cost associated with crop farming is the cost of labour.

Allsopp (2001) showed that the average number of person days required to clear land, plough, sow, check on the land and harvest, thresh and pack the crop was 50 for every 50kg sack of seed sown. Furthermore she stated that labour is paid for in three ways.

Crop Production: Uses.

Agricultural production in Paulshoek occurs in the form of cereal production. Four crops are sown (wheat, barley oats and rye) and there are 26 separate cropping areas (saaipersele) all of which are located in the low-lying areas of the communal lands. The cropping lands vary in shape and are often not continuous but on average are approximately 13.7 ha in size. The total area available for crop production is approximately 356.ha.

The quality of croplands varies and those located in the northwestern regions receive more rain and are considered better farming lands. This report values crop production for the year 2000 when five farmers sowed a total of four different types of crops (oats, wheat, rye and barley). Each of the 26 croplands is rented from the Transitional Local Council for R188 per year and access to them is subject to availability. This rental is applicable regardless of whether crops were sown or not. Of the 26 crop farmers 77% own stock and all crops are sown for livestock feed. Hence crop production represents an input cost to livestock production. The resource does however convey a value to livestock farmers because if it were not produced they would have to buy feed.

Crop production begins in autumn (March to May) when lands are manually cleared and ploughed (using donkeys) after the first rains. Seeds are kept from the previous years crop but 2 out of the 5 farmers who sowed in 2000 did not sow in 1999 and no crops were harvested in 1998. Hence it is assumed that these farmers bought seed and that the other farmers sowed seeds from the previous years harvest. Seeds are treated with sulphur to prevent fusarium, wilt, smuts or rust. The sowing of seeds is done by hand and during the growing season farmers' check on the crops to make sure that livestock and donkeys are kept away from the crops. In late November and December the crops are harvested using sickles, threshed using donkeys and stored in 50kg bags. Cereal crop production in Paulshoek is therefore an immensely labour intensive enterprise.

Table 4. The replacement cost or value of cooking shelters in Paulshoek (data from Evans 2001).

Cooking Shelter Type	Full	Half	Open
Total Number	12	11	6
Volume	25 m^3	14.8m^3	12.2m^3
Surface area	41. m^2	27m^2	21m^2
Number of 1.8m x1m zinc panels needed	23	15	12
Total cost of zinc panels	R442	R292	R227
Meters of Poles needed	33.6m	18m	12.2m
Total Cost of Poles	R297	R237	R161
Labour Cost	R110	R110	R110
Transport Cost	R160	R160	R160
Total Cost for One Cooking shelter	R1008	R799	R659
Total Cost for All	R23 774		
Annual value of all cooking shelters in Paulshoek	R951		

The total value for all cooking shelters was R23 774. This gives the value of the capital investment required to replace the cooking shelters. The annual replacement cost for these cooking shelters was estimated by calculating the linear depreciation of the cooking houses. Van Zyl (1988) states that all farm buildings, houses and sheds have a life expectancy of 25 years. Hence dividing the total replacement cost of the cooking shelters by the life expectancy of 25 years yields the proportion of total cost attributable to one year. This amount (R951) is the yearly replacement cost for cooking shelters and therefore the yearly value of the plants used in constructing cooking shelters in Paulshoek.

The costs associated with cooking shelters that accrue to stock farmers are the yearly maintenance costs, where herders have to collect more bushes and repair the cooking shelters. It was estimated that this enterprise took one day per shelter per year. If labour is valued at R22 per day this comes to a total of R616 per year for all stock farmers.

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Appendix 1. The 15 medicinal plant species used in Paulshoek (Archer 1996, Watt and Berger 1962)

Species	**Common Name**	**Treatment For.**	**The Degree of Medical Attention the Ailment Required**
Ballota Africana	Kattekruie	Influenza, aches, pains and stomach ailments.	Painkiller, Panado
Chrysocoma microphylla	Vuurhouthie	Billiousness, stomach ailments	Visit Clinic
Crassula muscosa	Akkedisstert	Heart burn, diaoreaha, headaches	Visit Clinic
Diospyros austro-africana	Kraaibos	Coughs and lung infections	Visit Clinic
Dodonaea viscose	Ysterhout	Stomach disorders, skin rashes	Visit Clinic
Galenia africana	kraalbos	Sore throats, venereal diseases and tooth aches	Visit Clinic
Mentha longifolia	Balerja Kruistement	Influenza, aches, pains and stomach ailments.	Painkiller, Panado
Pentzia grandiflora	Stinkkruid	Tonic, stomach problems (used after eating)	Visit Clinic
Pteronia incana	Krakrakie	Tonic, and skin infections.	Visit Clinic
Rhus undulata	Taaibos	Influenza, aches, pains and stomach ailments.	Painkiller, Panado
Salvia dentata	Salie	Influenza, aches, pains and stomach ailments.	Painkiller, Panado
Salvia sp.	Koorsbos	Influenza, aches, pains and stomach ailments.	Painkiller, Panado
Sceletium emarcidium	Kougoed	Anaesthetic and psychoactive, mildly narcotic.	Visit Clinic
Senecio cinerascens	Vieroulap	Emetic, chest colds	Visit Clinic
Sutherlandia frutescens	Kankerbos	Stomach ailments.	Visit Clinic

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