An Economic Assessment of the Deforestation of Ghana's Garden City of West Africa

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Abstract Ghana's urban population is projected to grow from the current 52% of the total population to about 65% by 2030. Such a growth rate certainly has far reaching implications for natural environments within urban centers, particularly in the face of current economic pressures. Kumasi, Ghana's second largest city was for a long time known as the Garden city of West Africa. This status seems however to have been traded in favor of policy for urban development. In the particular case of the Kumasi forest reserve this chapter assesses the total economic use value of the forest and the factors, which influence such value through a Hedonic Price Model. The total economic use value is then compared with the user cost of the forest, to draw some useful lessons for urban forestry from economic analysis. The comparison reveals that Ghana loses a net minimum of US$ 35 million per annum in carbon credits due to the deforestation of the Kumasi Forest Reserve. The chapter therefore concludes that developing economies should adopt urban forestry as a source of funding and resources for economic development and poverty alleviation.

Keywords Kumasi Forest Reserve • Total economic value • Economic use-value • Hedonic price model • Urban forestry

1 Introduction

Forests have always contributed significantly to human welfare, and will continue to do so. The usefulness of forests to people tends to create a close association between them. Such an association can cause cities to develop in close proximity to forests

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and means that urban forestry has become a reasonable and widely acceptable practice. As a result of urbanization in many developing countries, there appears to be a struggle for space between human settlements and forests. In many parts of Ghana trees have eventually been moved, but humans ended up paying the price.

A historical basis for the deforestation of the Kumasi Forest Reserve (KFR) in Ghana can be found in an ancient idea that portrayed forests as man's enemy. Overcoming the forest by pushing it as far away as possible from man's dwelling was seen as a measure of human development. The consequences of this notion for a developing economy such as Ghana, especially when compared with the realized benefits drawn by developed economies from the maintenance of urban forests, leaves much to be desired. The care and management of tree populations in urban settings should be a welcome idea for all urban communities as it improves human welfare and the urban environment.

The unsustainable nature of the traditional forestry sector in Ghana has been a source of national political debate. The excessive concentration on traditional forestry has relegated urban forestry to the background as a relatively unimportant aspect of the forestry sector. One of the costs of such neglect has been the loss of urban forests and hence the effective loss of the Kumasi, Ghana's second most urbanized city's status as "Garden City of West Africa".

Undoubtedly there has been a trade-off between the conservation of the Kumasi Forest Reserve and urban development in the region. The Kumasi Forest Reserve is currently reduced to isolated patches of trees within a site occupied by grand hotels, banks, a golf course, restaurants, road networks, workshops and other common features of urban development. To assess the cost-effectiveness and equity of such a trade-off, this chapter estimates the total economic use (developmental) value of the Kumasi Forest Reserve through a Hedonic Price Model. The value is compared with the user cost of the forest to draw some useful lessons for urban forestry from economic analysis.

2 Deforestation in Ghana

Ghana is a tropical African country located between latitudes 4.5°N and 11.5°N and longitudes 3.5°W and 1.3°E. It has a total land area of 23.85 million hectares and is divided into two main vegetation zones: a High Forest Zone, covering about a third of the land area in the South and the Savannah Zone which occupies the remaining two thirds in the North. Generally, land use activities in Ghana have been in the form of small and large scale farming, fuel wood, animal grazing, rural and urban settlements, timber extraction, cocoa production and game/park reserves (FAO 2001).

About 40% of Ghana's land area is covered by forests (9.2 million hectares), with only about 7% being of the high tropical type, all of which are found in reserves or some form of protected areas. Over the last 100 years, Ghana's forests have been under intense pressure from human and commercial activities. From 1900 to 2000 Ghana lost over 80% of its closed forest. The alarming deforestation rate of 22,000 ha per annum reported in the 1990s deteriorated to a further 115,400 ha per year between 2000 and 2005 and is now 135,395 ha per year (FAO 2011; Mongabay 2006; Tang 2010).

Deforestation and degradation of the 282 reserves and almost all non-reserve areas have been consistent. This trend has been due to a combination of factors including policy and institutional failure, urbanization, and a growing forest industry whose rate of growth the resource base cannot sustain.

The contribution of urbanization to deforestation in Ghana has not been given much attention, possibly because of the alarming nature of traditional logging and illegal causes of deforestation, which can make urban deforestation seem less significant. Another issue worth noting in this context is the almost unknown concept of urban forestry in Ghana. The next three sections provide some insight into the importance of urbanization induced deforestation in Ghana.

3 Urbanization in Ghana

Rapid urbanization has occurred in Ghana mainly due to increasing population growth, rural–urban migration and a reclassification of rural settlements as urban settlements. Working with an officially projected average urban growth rate of 3%t between 2000 and 2030, Ghana's urban population is expected to increase from 52% of the total population in 2010 to 65% of the total population by 2030 (NDPC 2010).

The implications of such an urbanization trend on Ghana are immense. Land will be needed for settlements and construction of more roads and other facilities for urban life. In 1990 the National Land use Planning Committee of Ghana estimated that each unit increase in urban population required an additional land area of 33.3 ha for additional housing, infrastructure, and related social services (FAO 2001).

This land requirement necessarily implies the clearing of substantial parts of existing off-reserve forests and forest reserves for infrastructural development, such as roads, electricity, water, schools, houses, etc. Thus more forest land stands the risk of being converted to other uses, placing more pressure on the remaining forest stock of Ghana. The next section narrows down the issue to the deforestation of Kumasi, Ghana's second largest city, and also further examines the implications for urban forestry.

3.1 Urbanization in Kumasi

Kumasi is Ghana's second largest city, located in the transitional forest zone between latitude 6.35° and 6.40°N and longitude 1.30° and 1.35°W, with a land area of about 23,415 ha. Kumasi has a population of approximately two million as indicated by national census figures of 2000. The city of Kumasi was founded in the 1680s by King Osei Tutu I to serve as the capital of the Ashanti State. Coming under British rule in 1890 and being centrally located in Ghana it became a principal transport hub and now plays a pivotal role in the distribution of goods and services in Ghana and beyond.

The Kumasi Metropolitan Assembly (KMA) is the local government authority which oversees the daily administration of the city. The city received the name

Table 1 Percentage land use change trends in Kumasi from 1986 to 2007, in hectares (derived from Tontoh 2011)

Land cover type	Forest	Wet lands	Water	Agricultural land	Urban or built up land
Percentage change	−45.30	34.20	−88.49	58.71	175.44

"Garden City of West Africa" from Queen Elizabeth II, Queen of England, when she visited the city in 1961. This was as a result of her admiration of its flora and natural beauty (KMA 2006).

The city has grown rapidly with an annual growth rate of 5.47%. Kumasi currently has about 90 suburbs, which grew from three initial communities in a concentric form to cover an area of about 10 km radius. It is estimated that 48, 46 and 6% of Kumasi are urban, peri-urban and rural respectively (KMA 2006).

3.2 Land Use and Urbanization in Kumasi

Types of land use in Kumasi include urban or built-up land, agricultural land, forested land, water and wetlands. Changes in land use and coverage from 1986 to 2007 are shown in Table 1 below. The conversion of various types of land use to urban or built-up land shows a 175.44% increase from 1986 to 2007. This increase has been mainly at the expense of forest land, which decreased by 45.3%, as well as water which decreased by 88.71%. The increase in agricultural land is symptomatic of the attempt to provide food for the soaring urban population.

As a result of rapid urbanization agriculture, which was a prominent type of land use in Kumasi, has seen dramatic changes in the last two decades (KMA 2006). Agricultural activities have been confined to the peri-urban areas where crop farming occurs. Increasing urbanization has led to increasing vegetable cultivation within most communities.

With the upsurge of demand for residential, industrial and commercial land versus agricultural land, about 80% of arable lands have been displaced by the construction of houses and other physical infrastructure within urban Kumasi (KMA 2006). The natural environment of Kumasi has thus been substantially altered as a result of the urban sprawl.

4 The Kumasi Forest Reserve

The Kumasi Forest Reserve (KFR), located within one kilometer from the central part of Kumasi, previously covered an area of about 1,600 ha. A pictorial view of the KFR is available from the Woods Consultancy Service (1999) Tourist map of Kumasi. The existence of a small patch of the reserve is acknowledged by the Golden Tulip Hotel, situated within the reserve area, as an attraction to its guests.

The KMA has indicated that the major land degradation issues in Kumasi result from encroachment on forest reserves, green belts, wetlands and open areas by many different kinds of developers. This trend has led to the loss of the Kumasi Forest Reserve.

Currently most literature on forests in Ghana does not recognize the existence of the KFR. This follows the forestry policy of 1948, which implicitly made provisions for the conversion of the KFR for developmental uses other than conservation. Records show that the Asantehene Osei Agyemang Prempeh II, King of Ashanti, in a letter to the Acting District Commissioner of Kumasi dated 20 October, 1947, asked for measures to stop further reservation of forest areas (Manshyia Archives 2007). Thus in the eyes of national and local authorities the KFR was only worth its land value after 1948. Since this time the forest has been left at the mercy of those who acquired land within the KFR for developmental purposes.

The KMA has also revealed that the site for Kwame Nkrumah University of Science and Technology (KNUST), formerly virgin forest, was rapidly downgraded into farm lands leading to the degradation of natural drainage and wetlands within the area.

The situation depicted above is a vivid summary of forest degradation in Kumasi and one that explains the loss of the title "Garden city of West Africa". The implementation of the Kumasi outline planning scheme from 1963 to 1988 did not lead to much improvement in this state of affairs. To obtain the desired impact the scheme should have emphasized the role of trees as a critical part of Kumasi urban infrastructure.

5 The Analytical Framework

The user cost of the Kumasi Forest Reserve signifies cost in terms of opportunities lost through deforesting the reserve. User cost is therefore a measure of benefits forgone because of the removal of forest to obtain land for urban projects. One aspect of this cost is the role the KFR could have played as a carbon store. The conversion of the reserve to other uses has given rise to a release of carbon dioxide, which has contributed to the risk of global warming. The seventh session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in 2001 designated carbon sinks through afforestation and reforestation, and through forest management as eligible for credits (Sasaki and Kim 2009). This meant that types of land use that avoided carbon emissions were to be credited with the value of avoided damage, while types of land use high in carbon emissions were to be debited with the value of expected damage.

Using 1 ha of the KFR (a tropical moist forested land) as a unit of analysis and adopting related exposition of Brown and Pearce (1994) but disregarding all timescales, we can see that developmental uses of the land would be preferential to conservation:

$$(Bd - Cd) > (Bc - Cc)$$

where B equals benefits, C is costs, d is developmental uses and c is conservation uses respectively. It is worth noting that B_c is formally equivalent to the Total Economic Value (TEV) of the Conservation option comprising both use and non-use values. Introducing the element of time, we can write the equation as:

$$\sum[B_{d,t} - C_{c,t}](1+r)^{-t} > \sum[TEV - C_{c,t}](1+r)^{-t}$$

where r is the discount rate and t the length of time in years.

In the presence of properly functioning land markets, the price of land P_L should reflect the present value of expected net benefits from the development option. Conservation values however will not be reflected in land prices since they include a great deal more than the use value of the forest. Also, actual use will tend to be determined by central and local economic incentives, which have not been good shadow price reflectors (Brown and Pearce 1994). Following the above explanation the modified requirement for TEV and developmental value comparison becomes:

$$P_L > PV\ (TEV - Cc)$$

where P_V signifies present value.

The test of cost-effectiveness and equity in the deforestation of the KFR is accomplished if the right hand side (RHS) of the above inequality or any positive component of it exceeds P_L. If the RHS exceeds or is sufficiently close to P_L then a case would have been made for the conservation of the KFR. The component of the RHS we wish to compute for this test is the Carbon Storage capacity of the KFR, which will be obtained by an estimation of the carbon credit and debits of the KFR in its original form before destruction.

6 The Hedonic Model

A hedonic price model attempts to evaluate the influence of environmental factors on the prices of property. If a real-estate developer builds two identical houses – one in a high-class residential area and the other near a polluted stream – each would be priced differently due to their different environments. Thus the hedonic model seeks to attribute price difference to environmental differences. In an assessment of the determinants of land prices in or close to the Kumasi Forest Reserve, demand for land becomes linked to some characteristic features of the forest.

Few studies have examined the determinants of forest land prices using the hedonic price method (Snyder et al. 2008). When evaluating the effect of a number of local and regional characteristics on the price of forest land in Vermont, Turner et al. (1991) found that factors such as the presence of road frontage, the presence of non-forested land cover and close proximity of major roads contributed to a higher price for a plot. The study of Roos (1996), found the price of forested land in Sweden to be influenced largely by factors like size and the proportion of productive forest land on the plot. Scarpa et al. (2000) provide a further example of the hedonic model in their estimation of the non-timber value of maple-birch forests in Wisconsin. Snyder et al. (2007)

examined the influence of recreational activities and proximity features associated with forested plots in northern Minnesota through a hedonic model.

The goal of using the Hedonic model in this study was to assess the extent to which the size of plot, location, presence of trees on the plot, purpose for acquiring the plot and nearness to the KFR could influence the price of land and hence the developmental use value of the KFR. Because of the varied uses of land and the inadequacy of the valuation systems across these uses, this chapter used the value of land on or near the reserve as a proxy for the value of relevant property near the reserve. It is worth noting however that the value of land in Ghana does not reflect an absolute sale price, since the laws of Ghana do not permit an outright sale of land. In Ghana land can only be leased over a maximum period of 99 years at a time, after which ownership of land reverts back to the original owner.

The dependent variable was the "price" of the land. The independent variables for the hedonic model were assessed based on their importance in the determination of the value of a plot of land being purchased. This was done by means of a 3 point Likert scale with "very important", "somehow important" and "not important" as options. The independent variables were the size of the plot of land being sold (size), location of the plot of land within Kumasi (location), the presence of trees on the land (trees), the purpose for which the land was being purchased (use) and the proximity of the land to forest. Data on these variables were collected from 18 real-estate agents all over Kumasi for all sales of land made over the past 10 years. These agents are the main avenues through which all landed properties, both residential and commercial, are sold.

7 The Total Economic Value of the KFR

The Total Economic Value (TEV) of a forest reserve in an urban area like Kumasi is an estimate of the economic worth of the various functions of the forest. Such functions include beautification and environmental conservation on top of other economic and social benefits (Bratkovick et al. 2010). The computations of TEV were done in two different phases. One phase was based on carbon storage value of the KFR as a part component of TEV for comparison with the economic use value (P_L). The other phase was done through obtaining the expressed TEV of the current occupants of the KFR. The structure of the expressed TEV is discussed below while the carbon storage value is estimated alongside the discussion in the next section.

A face-to-face questionnaire was conducted in order to assess the value assigned to the reserve by the owners of facilities on land which it formerly occupied. This was to provide some evidence as to whether occupants attached real value to the reserve they had displaced. The questionnaire requested information on (1) the compatibility of the facility's operations with the presence of trees (COMP), (2) the intentions of the facility's owner to incorporate some trees into the setup of their premises (INTEND), (3) the acceptance of a reforestation plan within the premises (REFOR), (4) the awareness of the facility's owner that the facility is located in the former

Kumasi Forest Reserve (AWARE), (5) how much the facility's owner will be willing to pay per tree to replace displaced trees (WTP) and (6) some demographic information. Forty-four locations were originally approached and in all 39 locations cooperated. All non-cooperative business entities were excluded from the survey. Among those who cooperated two were not in a position to disclose their willingness to pay for trees and so were also excluded. A follow up questionnaire was used to ascertain the readiness of the respondent to pay the stated amount of money in reality.

8 Results

8.1 Determinants of P_L

The estate agents in Kumasi indicated that in 100% of purchases the size of the plot and its location were the most important considerations. Two location factors were of premium value to buyers: proximity to the city center and to the Kwame Nkrumah University of Science and Technology (KNUST). In the case of KNUST, this is because the university provided a premium condition due to high demand for hostel facilities by about 15,000 non-residents. Table 2 below shows the details of the results.

The use or purpose for which the land was being acquired had an influence on its price in 66.7% of purchases. The most unimportant consideration in all purchases was proximity of the plot to a forest. In 83.3% of purchases this consideration was unimportant. In cases where it was important the influence was negative, due to the belief that the forest served as a hiding place for criminals.

In 50% of all purchases the presence of trees on the plot was considered irrelevant. No purchases considered the presence of trees on the plot to be very important. These results clearly show that land value within the KFR (or for that matter any forest reserve) is equivalent to the value of the land in Kumasi, since no premium was put on the value of trees within land purchasers' desired premises. This means for the residents of Kumasi the KFR did not add value to property prices and hence was not desirable in urban Kumasi.

8.2 Expressed TEV of the KFR

To ascertain the drivers of value assigned to the trees by occupants of land located in the KFR, the information in Table 3 below was obtained through face-to-face questionnaires.

Table 3 above indicates that 87.2% of the facilities located in the KFR did not find the presence of the trees incompatible with activities within their premises. Only 33.3% of these entities however intended to plant some trees/shrubs within their premises, while over 64% objected to any reforestation plan for the area.

Table 2 Factors influencing price of land in Kumasi (author's fieldwork 2011)

	Relevance in purchases (in percentages)		
Characteristics of the plot of land	Very important	Somehow important	Not important
Size	100	0	0
Location	100	0	0
Trees	0	50	50
Use	66.7	27.8	5.6
Proximity to forest	0	16.7	83.3

Table 3 Assessment of drivers of WTP for one tree in the KFR (author's fieldwork 2011)

DRIVERS	Yes (%)	No (%)
COMP	87.2	12.8
INTEND	33.3	66.7
REFOR	35.9	64.1
AWARE	23.1	76.9

Over 76% of users of the KFR were completely unaware that their premises used to be part of a forest reserve.

Certainly the above information is not a positive sign for the success of urban forestry within the KFR region. This is confirmed by a low willingness to pay (WTP) for replacing trees, relative to the international stumpage price for such trees. This chapter used the modal WTP for one tree of Ghana cedis (GH¢) 10.50 (US$ 1.00 = GH¢ 1.60) to represent value assigned to one tree by respondents. The highest WTP given (GH¢500) was not used because the respondent failed to confirm its preparedness to pay through the follow up questions, which determine the genuineness of the WTP value. Other WTP values were also not confirmed and therefore not used.

9 Discussion

The KFR used to cover about 1,600 ha of land. Clearing it for urban developmental purposes meant the release of carbon as well as the loss of the carbon sink the forest provided. Based on computations from Houghton et al. (1987) discussed in Brown and Pearce (1994), carbon released from the KFR would be 283 t of carbon per hectare of cleared forest. This implies the production of about 452,800 t of carbon emissions through the destruction of the KFR.

Using the mean shadow price of carbon based on UK official estimates of US$ 83 per ton of carbon dioxide (Ackerman and Stanton 2010) we can see that through the destruction of the KFR, Ghana has become poorer by a minimum of US$ 37.6 million per annum. It is also worth noting that this figure excludes the carbon sequestration loss per hectare, which would be quite substantial on an annual

basis. If the KFR had not been destroyed through urban policy, the forest could have earned Ghana a minimum of US$ 37.6 million per annum.

One hectare of tropical forest with the characteristic of the KFR has been estimated to contain on average about 300 individual trees belonging to a total average of about 150 different species (Oracle Educational Foundation 2011; Peters 1994). Using the modal willingness to pay (WTP) for one tree of 10.50 Ghana cedis (US$ 1.00 = 1.60 Ghana cedis (GH¢)). This brings the total WTP to GH¢ 3,150 per hectare. For the 1,600 ha of the KFR the Total WTP is GH¢ 5,040,000 = US$ 3,150,000. This means that the occupants of the KFR valued the forest much lower than the value of carbon credits the forest could have obtained for Ghana. Such a value system can be inimical to the development of urban forestry. It remains a fact however that occupants of the KFR who thought the forest close to their premises could act as a hideout for criminals may have a good point – particularly in urban areas where security networks do not function effectively due to lack of adequate resources.

The mean price of land within the reserve was GH¢18,000 per hectare. Particular types of land use however would mean that the sale of all the 1,600 ha might not be possible. Assuming an original forest coverage of about 90% (this was about 74.08% in 1986 and 40.52% in 2007, according to Tontoh 2011), from the 1,600 ha, only 1,360 ha could be offered for sale in the original state of the reserve. Land scarcity considerations would also have influenced the price of the original site of the KFR. If for the current 40.52% of forested land the price per hectare is GH¢ 18,000, signifying a scarcity of about 59.48% of the site, then the original 90% would signify the scarcity of only 10% of the land, leading to a proportional price fall, holding all other factors constant. This brings the price per hectare of originally conceived forest land within the KFR to about GH¢ 3,026.22.

The implication of this analysis is that the economic use value of the KFR (P_L) would be GH¢ 4,115,659.20, which is equivalent to US$ 2,572,287.00. Thus the main developmental gain from the economic use value for destroying the Kumasi Forest Reserve is about US$ 2.6 million. Comparing this developmental gain to the lost carbon credits of US$ 37.6 million leaves a foregone benefit of US$35 million per annum.

10 Conclusion

The deforestation of the Kumasi Forest Reserve has cost Ghana a net minimum of US$ 35 million per annum in carbon credits. Other benefits of urban forestry, namely beautification (which gave Kumasi the status of Garden City of West Africa in 1961), recreation, reduction of the urban heat island effect, reduction of storm water runoff, reduction of air pollution, reduction of energy costs through increased shade over buildings, improved wildlife habitat and the mitigation of overall urban environmental impact have also been lost through deforestation policy for urban development. Remedial measures however can be adopted to save portions of the forest, which have been legally acquired by developers (KMA 2006) but not yet destroyed.

The Achimota Forest in Accra, the capital city of Ghana, recently came to the limelight as a candidate for deforestation for urban development. Several other tropical forest areas within African cities have been targeted for destruction to create space for urban projects. A lesson must be learnt from the plight of the Kumasi Forest Reserve in the once Garden City of West Africa. Developing countries cannot afford to continue to lose money and natural resources in this way. Developing economies should embrace urban forestry as an emerging source of funding and resource for economic development and poverty alleviation.

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