



Case Study:

A Market-Based Approach to Sustainable Development, Food Security and Wildlife Conservation in Africa.

Partner Organization: Community Markets for Conservation (COMACO)

Country: Zambia

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Cornell University



1. Abstract

COMACO is a non-profit business venture started in 2003 by the Wildlife Conservation Society (WCS) that seeks to develop synergies between conservation farming, wildlife preservation and enhancement, and commodity markets for smallholder farmers in remote parts of eastern Zambia, specifically in the Luangwa Valley. A significant percentage of these farmers live on an extensive margin of impoverishment and food insecurity, with a majority earning less than \$200 per annum. Surviving on this margin, there is little incentive for these farmers to conserve their environment, and individuals often cope with shortages in food or income by poaching wildlife and using forest resources in unsustainable ways, such as cutting down trees for charcoal. Unsustainable farming practices and lack of concern for wildlife preservation concomitantly have negative impacts on the region's ecotourism industry, which takes in \$15 million per annum and has been identified as an opportunity for further industrial synergies to the COMACO project. COMACO targets these growers to change their farming techniques in exchange for a premium commodity price and handles the commodities' marketing. COMACO then uses member farmers' surpluses to manufacture the It's Wild! product line, which includes a variety of products ranging from groundnuts to honey. Profits from the sale of It's Wild! products are used to finance the sales, administration, extension, and oversight practices of the COMACO project. Given that, COMACO attempts to achieve sustainable synergies between conservation and agriculture.

2. SOCIO-ECOLOGICAL CONTEXT

2.1 Biodiversity and Poverty in the Luangwa Valley

With its vast wilderness and substantial populations of charismatic megafauna, Zambia's Luangwa Valley offers a crucial source of tourism for the nation, mainly through photographic tourism and safari hunting (Becker et al. 2013). The abutting wildlife sanctuaries, North and South Luangwa National Parks, greet more than twenty thousand tourists each year who provide over \$15 million in revenues (Lewis 2006). These premier parks harbor many species of ecologically and economically valuable large mammals, such as lions, leopards, hippos, buffalo, giraffes, wild dogs, and elephants (McShane & Wells 2004).

Despite their designation as protected areas, the two national parks continually confront threats from human activities. The community lands adjacent to the parks, from the valley floor to high plateau areas, support human populations with densities from 3 to 50+ people per square kilometer (Lewis 2006). The inhabitants of these areas face chronic poverty and food insecurity, as well high population growth rates (Lewis et al. 2011). Many communities are caught in poverty traps, defined by Barrett et al. (2011) as self-reinforcing mechanisms that cause poverty to persist. Four nonexclusive categories of these mechanisms have been described. The first category, the dependence on limited natural resources, involves a decline in human quality of life



resulting from accelerating environmental degradation due to resource extraction and use. Secondly, shared vulnerabilities among humans and wildlife to stochastic or induced events can cause “poverty, population growth, and environmental degradation [to] quickly become mutually reinforcing responses to natural perturbation” (p. 13909). Additionally the failure of governmental and economic institutions to help provide resilience to shocks and therefore not have to rely so heavily on the environment, as well as the unforeseen detrimental consequences of management efforts, facilitate the continuation of environmentally harmful behaviors. In Zambia, limited educational opportunities and the ravages of diseases such as HIV/AIDs, malaria, and tuberculosis, have also been established as supporting factors to the poverty-environment trap (Lewis et al. 2011).

Generally, soils in the Luangwa Valley region are infertile excepting alluvial strips where farming is concentrated. Agricultural productivity is both low in comparison to the adjacent plateau lands and highly variable (McShane & Wells 2004). As a means to overcome food shortages, many Zambians turn to nearby natural areas as a source of bushmeat; trading this meat, they obtain starch-based foods which compensate for their own failed grain crops (Lewis & Jackson 2005). As well, bushmeat often serves as a crucial protein source for impoverished rural villagers (Becker et al. 2013). Wire snaring enjoys popularity as a poaching method because snares are inexpensive, effective, and easy to acquire, set, and conceal (Becker et al. 2013).

Indiscriminate and wasteful, snaring stands as a particularly destructive form of wildlife poaching (Lewis & Jackson 2005). For example, since multiple snares are typically set in the same area, snared prey animals commonly engender the incidental snaring of several predators (Lewis & Jackson 2005). In the absence of economic compensation and incentives to residents for safeguarding wild animals from snares and external poaching pressures, local wildlife extinctions may be imminent (Lewis & Jackson 2005).

While the majority of Luangwa Valley farmers set wire snares for wildlife, a limited number of residents—‘professional poachers’—hunt with locally made firearms (Lewis et al. 2011). On the other hand, poaching of rhinos and elephants is typically performed as a commercial activity orchestrated by external groups (Lewis et al. 2011).

2.2. Food Insecurity and Watershed Degradation

As Lewis (2013) reports, farmers under increasing pressure to seek more fertile soils have been moving from exhausted farmlands into hilly, ecologically sensitive landscapes surrounding the Luangwa Valley. Runoff from these landscapes contributes to thousands of tons of soil loss per year. A twelve-year study of the upland watershed in the Lundazi District found a 21% reduction in forest cover, correlated with the ascension of cotton as a cash crop.

Forty-five basins comprise the Luangwa Valley watershed and capture water that sustains the Luangwa River, which in recent years has become shallower and wider



from an increased influx of soil and water runoff. Further evidence of environmental disturbance in the area includes how tributaries originating from the eastern side of the country no longer flow year-round. The western catchment area, though more intact, also faces a serious threat from land clearing for “chitimene” (slash and burn agriculture) for millet, primarily, as well as a rising demand for charcoal. Both of these products are increasingly being exported to Tanzania (Lewis 2013).

In terms of sustainability, Zambia’s charcoal production has grown decidedly out of hand: extraction rates from the Nyimba and Luangwa District alone have reached 31,500 tons per year. Few countermeasures to control this tree destruction exist, and charcoal making has already replaced farming as a primary livelihood for a significant number of people in affected areas (Lewis 2103).

2.3 Tourism and Local People

External interests control nearly all commercial tourism and agribusiness in the Luangwa Valley; these sectors operate independently and often place oppositional demands on the land (Lewis 2006). Finding themselves caught between these competing interests, residents usually favor farming over ecotourism, since tourism employs only a small portion of the population, while farming regularly offers sustenance and income to many. Consequently, as Lewis (2006) explains, “human pressure on Luangwa Valley’s less protected landscape is driven by a market environment that is poorly coordinated, not overly motivated to sustain improved rural incomes, and in many cases not responsive to the environmental and health concerns some of their production activities cause” (p. 2).

3. INNOVATIONS AND POLICIES OF COMACO

3.1 Analysis & Discussion of the COMACO Business Model

As a non-profit business venture started in 2003 by the Wildlife Conservation Society (WCS), COMACO seeks to develop synergies between conservation farming and commodity markets for smallholder farmers in remote parts of the Luangwa Valley. The majority of these farmers are financially marginalized and are characterized as food insecure. Surviving on this margin, there is little incentive or opportunity for these farmers to conserve their environment, with several resorting to poaching endangered species and unsustainable farming practices. COMACO targets these growers to change their farming techniques in exchange for a premium commodity price and handles the commodities’ marketing, thus achieving a sustainable synergy between conservation and market-based development approaches (COMACO 2013).

COMACO’s business model appropriately identifies several critical components of a business model that assist in the development of a sustainable enterprise. These components include (1) the identification of a market segment, (2) value proposition to the consumer, (3) revenue mechanisms, (4) cost structures and revenue targets, as well as (5) an efficient and valuable supply chain (Schilling 2008).



Currently, the consumer segment to which COMACO sells its It's Wild! products consists of food shoppers at popular grocery store chains in Lusaka, Zambia's capital, as well as regionally and throughout the country. The establishment of partnerships with global grocery chains such as Shop-Rite, SPAR, and Melissa's Grocery stores in Zambia (COMACO 2013), the It's Wild! business has been able to capitalize on Shop-Rite's and SPAR's half dozen stores in the capital city as well as the nearly 20 collective stores throughout northeastern Zambia. As multinational grocers, COMACO has also been able to leverage their financial and operational security as a resource for the It's Wild! operations; additionally, these connections may allow for further expansion opportunities in Zambia and internationally. International expansion presents an opportunity for COMACO to have direct access to a consumer base that thrives on sustainably manufactured items. For example, nearly 80% of US adults are positively receptive to eco-marketing when purchasing food products (Gilbert & Hebard 2012). COMACO's most recognized tagline in the country is "Good For Zambia! Good For You!" (COMACO 2013), taking advantage of a combination of messages including promotion of the environment, country, and personal health.

COMACO's initial business objectives were to achieve financial and directional oversight independence of its initial investors, such as the WCS and WFP, while simultaneously implementing a holistic approach to combating environmental and wildlife degradation resulting from activities such as poaching, unsustainable agricultural practices, etc. (COMACO 2006). Thus, COMACO structured itself as a Limited-by-Guarantee Not-for-Profit company. This nonprofit structuring allows COMACO to obtain financing from various donors but with no obligation to distribute profitable returns to the firm's initial investors (Company Law 2014). Given COMACO's objective to become financially independent, it has become necessary to obtain profitable revenue streams to reduce the firm's indebtedness to its purely financially-driven donors. COMACO's revenues are obtained from average Zambian consumers of the It's Wild! product line, which includes a variety of food products from peanut butter and honey to dried bean products. Despite growth in product sales over the period 2008-2010 (Lewis et al. 2011), an analysis of

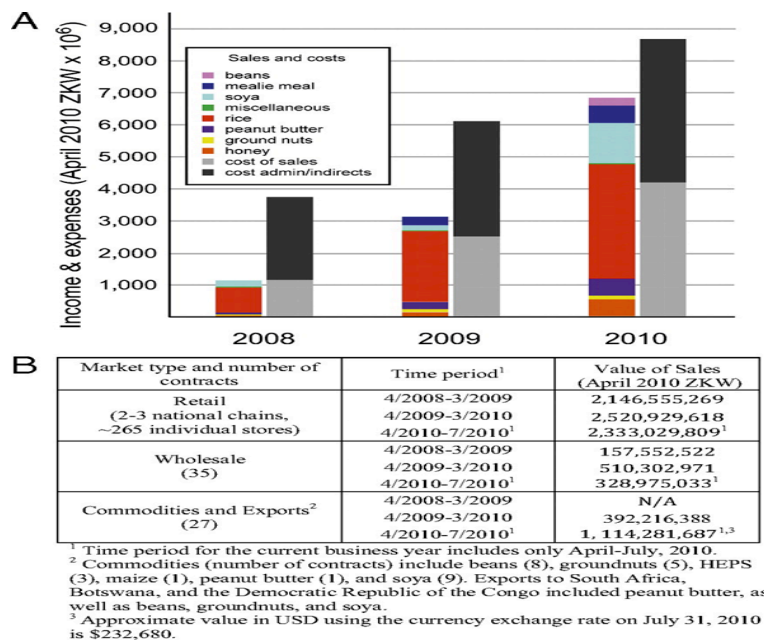


Figure 1. Analysis of Sales & Expenses of COMACO. Source: Lewis et al. (2011).



COMACO's income statements demonstrates that sales and administrative costs are the most significant hurdles to achieving financial sustainability. The majority of expenses that the It's Wild! business faces are related to the costs of obtaining surplus harvests from producer groups and the provision of extension services to member farmers. While the solution to attaining business efficiencies lies in the reduction of expenses, COMACO continues to develop partnerships with donors with continued revenue growth and \$2.6 million in 2013 sales (Travis 2014).

Efficiencies in the firm's supply chain, which are the result of COMACO's ownership of its own fleet of commodity transport vehicles as well as high-frequency communication devices, can potentially reduce COMACO's losses associated with sales and administrative costs. From an accounting perspective, these gifts become immediate assets whose depreciation have insignificant effects on the relative balance of assets and liabilities. Given the inaccessibility of many of COMACO's farmers, communication and transportation assets have significant inherent value. Walmart and General Mills were the largest donors of these assets to COMACO in its startup phases; General Mills, the world's 6th largest food processor, donated packaging & processing equipment and even helped train a food technologist who works between each of the CTCs (Lewis et al. 2011). With a supply chain consisting of over 40,000 total farmers who operate in producer groups of 10-20 people, these assets are of utmost importance. Logistically, producer groups sell to Rural Trading Depots that work in village settings, then the farm products bulked at the trading depots are trucked to a regionally-based Commodity Trading Center (CTC), which then manufactures value-added products under the It's Wild! name (Lewis et al. 2011). A spatial analysis of the geographic spread of the CTCs and the rural trading depots will demonstrate that the depots and CTCs are not equitably spread throughout eastern Zambia. Rather, with a more centralized strategy of processing in Chipata, which has more consistent utilities and access to a paved road, greater efficiencies can be achieved (Travis 2014).

3.2 It's Wild! Product Marketing

COMACO's objective of connecting commodity markets to conservation farming conveys the inherent value of the It's Wild! product line. Member farmers' improved sustainable practices lead to positive social and economic impacts that become embedded into the product's value. Advertisements for the products such as "Innovating rural markets for a 'greener', more food secure Africa" and "It's Wild! Natural Foods! Good for Zambia! Good for YOU!" touch on the social and environmental value of these products (COMACO 2013). While the rhetoric is appealing to a conscious consumer base, there is clear legitimacy to COMACO's claims, which should theoretically enhance the effectiveness of the business venture. From a theoretical perspective, it has been demonstrated that development projects that specialize on biodiversity enhancement are equally as successful as projects that specialize on development alone. That is, the successes of projects in improving socioeconomic livelihoods in developing regions can be achieved by conveying an environmental specialization, rather than through discussion of sole improvement of



socioeconomic statuses of citizens in developing countries. (Kareiva et al. 2008). COMACO's products are advertised with such emphases on the environment, which has helped the business improve its sales annually. More importantly, the products also emphasize a vision of pride in the country; and, as previously touched upon, nationalism serves as an effective demand generation tactic in Zambia (COMACO 2013).

The socioeconomic and environmental value of the It's Wild! product line clearly show the internal value of the business idea, however key internal weaknesses of the COMACO business plan also demonstrate opportunities for improvement. A principal issue with the business model that has also been internally identified is the inadequate amount of resources put forth to advertising and marketing of the products (COMACO 2013). The value of the products is clear, but in order to appeal to a wider consumer base, they must be conveyed to the consumer. Basic marketing theory and practice conveys the importance of consumer focus, and specifically on business marketing strategies focused on sustainability. With a consumer focus, the objective of COMACO's business venture to become financially and operationally viable, while simultaneously linking markets to conservation agriculture, the firm's initial objectives can still be achieved. However, financial and operational independence in the sustainable agriculture industry requires economies of scale to be achieved (Hitt et al. 2005). Clearly, the most significant hurdle to COMACO achieving scale lies in the sales and administrative costs, which severely diminish the firm's profit margins (COMACO 2013). Businesses with sustainable focuses like COMACO may not be able to operate sustainably in a competitive marketplace without appealing to a large and wide-ranging consumer base (Hitt et al. 2005).

COMACO, like any other nonprofit organization, is subject to external threats such as financial and political shocks in the country it operates, which often devastates the longevity of these ventures. Operating at a loss for the duration of its existence in eastern Zambia, it will especially be imperative for COMACO achieve enough fiscal responsibility to withstand shocks such as these. Fiscal responsibility can be achieved by assessing the sales and administrative costs at individual CTCs, and centralizing their locations to become more financially sustainable. For example, in 2009 COMACO had to relocate its Lower Zambezi CTC due to inadequate electricity and water infrastructure as well as high transportation costs (Lewis et al. 2011). A more in-depth analysis of each of the CTCs, just like in the removal of the Lower Zambezi CTC, could provide useful consultative information in trimming COMACO's inefficient costs, resulting in greater fiscal resilience in the Zambian marketplace. Politically, it has been shown that the Zambian government is one of the least effective governing bodies in sub-Saharan Africa (Yezi Consulting 2006). Ineffectiveness at the macro-level has led to Zambian citizens, especially those in the most rural parts of the country, to feel discouraged by government initiatives. COMACO's business model focuses entirely on the most marginalized rural Zambian citizens; given that, attempting to create political partnerships could have negative impacts on the effectiveness of the COMACO business venture (Yezi Consulting 2006).



3.3 Opportunities & Strategic Direction

Marketing an exported product from a developing country requires a significantly different approach than that used in the home country. In most cases, the average shopper in a developing country has less brand loyalty, whereas in developed markets like the US and UK, brand loyalty development is the objective of most consumer products companies (McKinsey & Company 2012). According to the same study, most developing country consumers are making their first purchases of historically first world consumer products. For example, 60% of Chinese consumers are purchasing their first car and between 30-40% are purchasing their first laptops (Atsmon et al. 2012). In addition, developing countries generally find a myriad of trade distortions when attempting to export to developed countries, such as excessive tariffs and a saturated market. To relate this back to COMACO, its product line is heavily skewed towards grain-based products because these products provide the most immediate value to Zambian consumers and the grains are also more valuable to the farmers from whom COMACO sources. That said, the international and developed country markets to which COMACO could export are already highly saturated by grain products. Diversification will be essential to COMACO's success, and many developing countries find diversification in unique fruits and vegetables (IMF & World Bank 2002), with which COMACO is beginning to experiment (COMACO 2013).

The spatial distribution of COMACO's CTCs allows for synergies to be developed between marketing the It's Wild! product line and the nascent ecotourism industry in eastern Zambia. With an increase in scale, and therefore efficiency, COMACO can be well poised to serve the \$15 million per annum ecotourism industry that attracts over 20,000 tourists to Zambia (Lewis 2006). In addition, more improved, sustainable farming practices near the national parks will only enhance the aesthetic value of these areas, bolstering tourism revenues. Demographically, ecotourists are also the most likely group of people to purchase value-added organic products. This demographic includes affluent men and women aged 35-54, college educated, willing to spend at least \$1,000 per trip, and motivated for new foods, nature, and experiences (Groshong 2011). Because COMACO packages the It's Wild! products at the CTCs prior to shipment to Lusaka's SPAR and Shop-Rite distribution facilities, these locations provide an excellent opportunity to test a potential first-world consumer base at a significantly lower cost than developing an export market.

Because COMACO continues to perform unprofitably as it expands its holistic business model (now involving over 80,000 households), it could be beneficial moving forward for COMACO to split its conservation agriculture and the It's Wild! products into separate ventures. This shift from a holistic business model could improve the firm's profitability because it would separate the classification of donors who have invested in COMACO's future performance. While COMACO is already a Limited-by-Guarantee nonprofit, which does not require the firm to distribute profits to investors, the firm could attract more effective and strategic investment if it achieved profitability.



Through a continuation of donations to the conservation agriculture and wildlife conservation objectives by non-governmental organizations, the yields and sustainability of COMACO member farmers can continue to improve. The It's Wild! product line and marketing could then be backed by purely financial investors seeking a return on the product's profitability. An improvement in profitability can pull-through and provide the financial backing that COMACO initially aimed to achieve in its early stages, but has yet to actually achieve. It is clear that there has been a schism created in COMACO's business model by the types of investors who wish to invest in the firm's venture, which has made management of strategic direction significantly more difficult. An interesting strategy could involve creating a tax structure for the company where conservation agriculture can remain a nonprofit venture while under the same scope of a profit-seeking It's Wild! business, to achieve the financial and directive independence of COMACO's original business idea.

4. AGRICULTURAL & SOCIOECONOMIC IMPACTS

4.1 Meeting the Needs of Zambian Farmers through Conservation Agriculture Training

To meet its objectives for rural development, COMACO trains local people in sustainable farming practices that improve soil quality while increasing crop yields and incomes. These practices center on conservation agriculture techniques, which meet crucial needs in Zambia. Conservation agriculture focuses on improving soil health and crop yields without the excessive use of expensive inputs (e.g. pesticides, herbicides, and synthetic fertilizers). It is important for Zambian farmers to conserve existing soils and find alternative ways to make up for the lack of available inputs.

Some of the specific conservation agriculture techniques that COMACO promotes involve the completion of land preparation prior to planting during the dry season by utilizing minimum or no-till planting, early-season planting, and the retention of crop residues, thereby eliminating the burning of these residues (Gatere et al. 2013). COMACO also recommends early and continuous weeding, and the maintenance of crop rotations consisting of approximately 30% nitrogen-fixing plants. Lastly, intercropping crop systems with nitrogen fixing-trees are also associated with the COMACO project. Together, these practices improve yields, increase farmers' incomes, and help achieve sustainability. Furthermore, diversification of crop production leads to more resilient communities and higher food security. Through these approaches to agriculture, COMACO has helped develop communities in eastern Zambia with an ultimate goal of natural resource conservation.

4.1.1 Reduced Tillage Farming & Weed Management Systems



The benefits of no-till farming—one of the main techniques being adopted by COMACO farmers —include increased soil health and structure, reduced erosion, improved soil moisture content, and reduced fuel and labor costs (Derpsch et al. 2010). Tilled agriculture aerates soil, leading to soil organic matter oxidation and loss of carbon dioxide to the atmosphere (“Avoid Tillage” 2011). The incorporation of more soil organic matter and nitrogen into the soil leads to better nutrient recycling, more water retention and less reliance on synthetic nitrogen or other related inputs (Derpsch et al. 2010). Therefore, COMACO discourages farmers from extensive tillage. No-till systems require less labor hours per worker and provide improved yields. Yields increase because farmers become more able to complete land preparation before the rainy season. Farmers who fail to plant their crop in a timely fashion typically see lower yields because of reduced length in growing season (Hobbs 2014).

The reduced tillage system which COMACO member farmers utilize evolved from the hand-hoe-basin system. This type of mound system involves land preparation through the digging of many mounds or holes in the dry season before the rains. Seed is planted within these holes, giving farmers an efficient system to micro-dose inputs and micro-manage crops (Hobbs 2014). Alternative reduced-tillage systems include the animal system and the mechanization system, both of which involve the use of livestock as well as various forms of biotechnological inputs in the cultivation process. One reason the animal system is rarely utilized in Zambia is that many livestock populations suffer from debilitating infectious diseases (Travis 2014). While COMACO farmers cannot afford many of the inputs involved in a mechanized reduced tillage system, such as heavy agricultural equipment, these systems provide several different and forms of weed management.

Farming with reduced tillage forces COMACO farmers to practice other, more environmentally sustainable forms of weed management. Conservation agriculture alternatives to traditional weed management systems include hand weeding, the use of cover crops, and herbicide spray applications (“Cover Crops” 2011). Thus, the mound system utilizes weeding by hand or hoe. Weeding is recommended to be completed early and continuously in order to prevent weeds from entering the seed bank. COMACO utilizes this system because the majority of its participating farmers lack access to other forms of inputs. Weeding is most effective when properly applied to a landscape through entire time frame of planting season (Gatere et al. 2013).

4.1.2 Intercropping & Maintaining Soil Cover

Intercropping with nitrogen-fixing trees, such as the species *Faidherbia albida*, is an agroforestry technique that COMACO farmers utilize to increase soil nitrogen, reduce runoff, and provide fodder for livestock. This agroforestry technique is effective because *F. albida* is a legume, which fixes nitrogen from the atmosphere using rhizobial bacteria in the soil (“*Faidherbia* Trials” 2012). Increasing nitrogen availability in a natural way is important because synthetic fertilizer is an expensive input often outside the financial means of many Zambian farmers (Travis 2014). The *F. albida* tree



also conveniently sheds its leaves during the dry season when crops are planted, reducing crops' competition for sunlight. The leaves later decompose on the ground, increasing soil organic matter. After the first twelve years, a *F. albida* tree begins producing pods which are edible for livestock ("Faidherbia Trials" 2012). Another important benefit is that trees can prevent soil erosion on farmland. Erosion prevention serves to conserve healthy soil and prevents nitrogen runoff that can damage aquatic ecosystems. The roots of *F. albida* are deep enough to access groundwater, thereby improving water-uptake efficiency for crops ("Faidherbia Trials" 2012).

Ensuring permanent soil cover through mulching and residue retention helps prevent soil erosion, increases water infiltration and also reduces early weed growth. Mulching large tracts of farmland with imported organic matter is generally beyond the means of most Zambian farmers due labor costs. Nonetheless, this can be a useful practice for small tracts of land such as vegetable gardens. A more feasible, yet sometimes problematic conservation



Figure 2. Faidherbia albida Intercropped in Conservation Agriculture System. Source: itswild.org

agriculture practice for covering soil is crop residue retention. Traditionally, many African societies burn crop residues; this practice has obvious negative environmental effects and is less beneficial than allowing the residue to decompose into the soil. Additionally, although few farmers in this region of Zambia keep large numbers of livestock, this practice may require some farmers to make tradeoffs between feeding crop residues to livestock and ensuring soil cover ("Residue Retentions" 2012).

4.2 Diversifying Crop Production and Income Sources to Improve Rural Livelihoods

One of COMACO's priorities has been income diversification through diversifying agricultural production. Important livelihood activities include beekeeping, aquaculture, goat production, poultry production, cash crops (maize, millet, soya beans), and vegetable and cassava production. One other non-agriculture livelihood activities that COMACO encourages is carpentry. Increasing crop diversity is key for combatting food security and creating more resilient communities to environmental and economic shocks ("Income Diversity" 2013).

Honey farming is an approach COMACO has specifically designed to generate dry season income and to discourage illegal poaching. This approach has been successful;



over the period of 2006-2008, the number of honey farmers in the Luangwa Valley grew from 98 to 960 farmers due to COMACO intervention. Through beekeeping, farmers can sustainably diversify incomes and increase the ecosystem services of pollination on their farms. (“Income Diversity” 2013).

Aquaculture is a practice that, similarly to beekeeping, takes up less space than conventional agricultural production. Within COMACO this project was introduced to further diversify income sources and increase the production of high-protein foods; there are roughly 970+ households currently participating in aquaculture (“Income Diversity” 2013). In integrated multitrophic aquaculture, the byproducts from one aquatic species serve as an input for another species; an example is the use of poultry manure to fertilize algae or other aquatic plants, which fish consume (Barrington et al. 2009). Creating synergistic relationships can reduce costs for fish farmers and promote improved ecosystem health.

There are 1,957 COMACO households that engage in goat keeping as a form of income diversification. During the 2008-2009 season, 187 goats were distributed by COMACO regional trading centers (“Income Diversity” 2013). Goats provide farmers goat meat and milk, as well as consumers with an additional iron and protein source. Iron is an especially important nutrient because it is the leading micronutrient deficiency worldwide (Pollott et al. 2009). Goats also provide wools and fibers, which can further diversify incomes (Pollott et al. 2009). Goats can often be kept on marginal land, which is often unsuitable for efficient crop production (IFAD, 2001). Targeted grazing systems can be implemented to prevent overgrazing and promote biodiversity in the region (“Conservation Grazing” 2009). Problematically, the East African Goat, which is kept by many COMACO farmers, does not produce much milk or meat in comparison to other breeds (Travis 2014).

Cassava and vegetables are often grown for subsistence and these crops can help ensure food security, especially in areas with problematic climate conditions. Cassava is an especially important crop because it is drought resistant and because it can remain underwater for several days without spoiling. COMACO has noted that cassava producers have increased over tenfold during the duration of the project. Many farmers do not accurately record cassava production, so it is very likely that these statistics are understated (“Income Diversity” 2013). Cassava can provide an important niche in a food insecure region because it contains carbohydrates, calcium, vitamins B and C, and other essential minerals. There is little information on other vegetables being grown by COMACO households likely because these are being used largely for subsistence (“Cassava Crop” 2009).

There are 2,526 COMACO households participating in poultry production. In 2005, COMACO introduced a poultry project that focused on teaching husbandry skills to increase poultry production and the vaccination of chickens to prevent infectious diseases such as Newcastle disease. To date, over 7,000 chickens have been vaccinated (“Income Diversity” 2013). Advances in local chicken rearing practices are



important because consumers are willing to pay higher prices for village chickens. The vaccination of chickens against infectious disease has not only led to improvements in diets but also in average levels of educational attainment in the region. COMACO member families have seen net income increases of 44% due to vaccinations, which has allowed families to afford better educations for their children (Travis 2014). As with aquaculture, one current challenge for COMACO is transportation infrastructure for meat products. Perhaps in the future, COMACO could make investments in refrigerated trucking to address this issue.

5. ENVIRONMENTAL IMPACTS

One of the five expected outcomes of COMACO, as outlined by its directors, is a stabilization of the Luangwa Valley’s wildlife populations through a reduction in poaching and habitat loss (Lewis et al. 2011). The results of COMACO’s anti-poaching efforts, including snare removal, poacher transformation programs, strengthening of the Zambia Wildlife Authority (ZAWA), on this outcome remain unclear. Moreover, a basis challenge COMACO must contend with is how, as suggested by surveys of professional poachers, even multiple arrests and convictions fail to dissuade most from resuming poaching (Lewis et al. 2011).

5.1 Assessing the Status of Wildlife Populations

Comparison of aerial wildlife surveys from 1999 and 2002 (predating COMACO) and from 2006 and 2008 (postdating COMACO), performed over the same flight transects, signaled that populations of most species were stable or increasing (Lewis et al. 2011). The authors attributed this change to reduced hunting pressure, while acknowledging that wild populations persist in a constant state of flux. The stability of populations of elephants, hartebeest, roan, kudu, waterbuck, wildebeest, and zebra reported in the study was particularly notable given the prevalence of these species as targets for poaching.

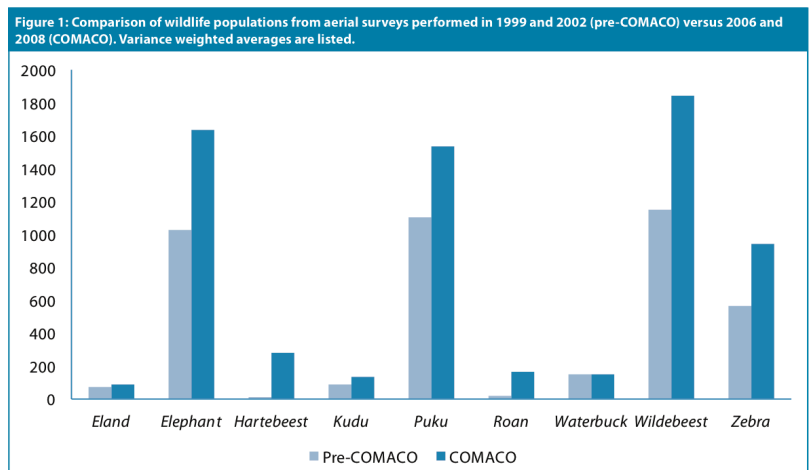


Figure 3. Comparison of wildlife populations from aerial surveys in 1999 & 2002 vs. 2006 & 2008, with data provided by Lewis et al. (2011). Source: United Nations Development Programme. (2012). Community Markets for Conservation (COMACO), Zambia. Equator Initiative Case Study Series.

5.2 Evaluation of Anti-Poaching Efforts



COMACO began training Zambians in alternative livelihoods to poaching in 2001, before the implementation of the model's market components. Within a decade more than 760 individuals had completed the poacher transformation program, and over 61,000 snares and 1,470 guns had been turned in by all COMACO participants (Lewis et al. 2011). Evaluating the true success of these measures presents major hurdles.

One challenge is differentiating between permanent and temporary removal of snares (if participants go on to replace the snares they relinquished). When researchers from COMACO cross-checked their data with independent evidence from ZAWA's patrol reports, their findings were consistent: notwithstanding seasonal and annual fluctuations, a downward trend in recovered snares from national parks and game management areas was observed (Lewis et al. 2011). Other studies, however, including those of the South Luangwa Conservation Society (2011), claim that snaring is increasing and severely disturbing wildlife populations in spite of community-based conservation and anti-poaching efforts. In part these contradictory findings have resulted from disparate methodologies; while Lewis et al. (2011) corrected for patrol effort over time in their analyses of anti-poaching trends, Becker et al (2013) note that other evaluations of these trends have neglected statistical control for confounding variables (e.g. season, patrol type, or patrolling organization). Moreover, the relative lack of data on Luangwa wildlife population characteristics and trends undermines researchers' understanding of the impacts of snaring on key wildlife species (Becker et al. 2013).

6. CONCLUSION

Moving forward for COMACO, there are clear opportunities for improvement in assisting in the development of eastern Zambian farmers as well as ecological improvement in a payment-for-ecological services based development scheme. From a business perspective, future directives will hinge on structuring the model to enable the financial viability which COMACO seeks to achieve. One potential objective could be a restructuring of the model to create a financial pull-through, due to the firm's issues with its diverse initial investors. From a conservation agriculture perspective, two important questions can be raised. For example, how effective will conservation agriculture be in securing food security in the region and helping farmers adapt to climate change? As well, could further mechanization of agriculture and use of agricultural inputs be effective in sustainably expanding agricultural production in Zambia? In addition, the effectiveness of wildlife conservation in the region remains a lingering question in the COMACO model. Just as importantly, the role of ecotourism and its position relative to COMACO's environmentally-based objectives needs to be more specifically established to give COMACO a clearer path in the years coming.

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