COMACO, from snares to plowshares: A conservation and human wellbeing success story

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Abstract
Community Markets for Conservation is a private sector, not-for-profit social enterprise in Zambia. It was established in 2003 to halt wildlife poaching and illegal tree cutting for charcoal by helping poor rural families to increase their food and income security through improved farming practices and marketing of value-added agricultural commodities. COMACO supports 178,891 farmers in the Luangwa Valley, providing them with improved farming skills, seed loans, a premium price for their crop surplus, and a dividend if they comply with sustainable farming and wildlife, and forest conservation best practices. Maize yields using COMACO methods increased by 63% and net income was 37% higher than for farmers who purchased inorganic fertilizers. Between 2012 and 2018 the number of food secure families increased from 67–84%. Elephant poaching has declined in all but one COMACO district, poaching is now primarily conducted by nonlocal hunters, and leg-hold snare detections by community game scouts have decreased significantly in COMACO areas. Increasing food and income security while reducing deforestation and unsustainable hunting for ~$US10 per farmer per year is cheap and can be replicated in Zambia and other nations in Africa.

KEYWORDS
conservation farming, livelihood security, market incentives, wildlife conservation

1 | INTRODUCTION

Conservation is needed when a natural resource valued by a group is being depleted by the self-interested actions of individuals at the expense of the welfare of the group (Almeida et al., 2015). Local people have been organizing themselves to ensure that biodiversity and ecosystem functions vital to their wellbeing are used with the long-term interests of the group in mind since well before the modern concept of protected areas existed (Hames, 1991; Kelly, 2013; Smith & Wishnie, 2000). Today, strategies to conserve nature and the value of the ecosystem services derived from nature fall into three major categories (IUCN-CMP, 2006). These are: (a) establishment and sustainable management of state, community or private parks and reserves; (b) direct payments for conservation actions, including payments for ecosystem services schemes where users of regulatory services such as flood control or carbon sequestration provide a series of payments to the providers of these services in exchange for the management actions they take to guarantee a sustained flow of these services; and (c) enterprise-based
“payments” for conservation actions where access to the enterprise brand and its market is typically conditional on compliance with conservation practices.

Examples of the latter are numerous and include companies in the Wildlife Friendly Enterprise Network, Ibis Rice, and COMACO (Community Markets for Conservation). This paper documents how the COMACO model works to increase sustainable agricultural production, strengthen household food and income security, and use conditional access to a brand and its consumers as an incentive to reduce deforestation and unsustainable wildlife hunting.

2 | THE COMACO MODEL

Since 1960s, the human population of Zambia grew from 3 million to over 18 million. Lack of investment in agricultural practices that sustain soil fertility forced farmers into an expanding cycle of abandoning unproductive farmland and converting native forests into farms. Throughout the Luangwa Valley of eastern and central Zambia, cash crops such as cotton and tobacco had out-competed staple food crops for farmland but failed to produce enough income to feed farmers’ families. Many supplemented their food supply and revenue by hunting, eating, and selling wildlife. Others cut trees to make and sell charcoal, the primary cooking fuel in the country.

COMACO was launched in 2003 (Lewis et al., 2011) and legally registered as a not-for-profit social enterprise in Zambia in 2009, to turn poachers into farmers by offering farm-based economic incentives to give up hunting (Figure 1). The COMACO model is simple, at least in principle if not in practice (Bie, Kuntashula, & Mughogho, 2009). When farmers become members of COMACO they gain access to valuable training (see supplemental materials), technical services, and higher farm-gate prices if they comply with a relatively small set of conservation farming and natural resource conservation rules (Hou-Jones, Franks, & Chung, 2019). To gain membership each farmer must: (a) sign a pledge to uphold the COMACO conservation standards and (b) join a Producer Group that consists of 15–20 farmers who typically live in the same area and know each other as neighbors.

Compliance is founded on the principal of collective culpability. If a member fails to comply with COMACO rules, all members in the Producer Group risk losing their membership privileges. Farmers understand the value of COMACO membership and that the benefits are conditional on compliance with COMACO rules. Not surprisingly, Producer Groups apply social pressure to encourage one another to comply with the COMACO rules.

By 2009, the number of Producer Groups had increased and COMACO began encouraging geographically proximate groups to merge into cooperatives that with time and training would assume many of the crop purchasing logistics, farmer training, and compliance auditing roles played initially by COMACO staff. Forming and legally registering cooperative took time but by 2016, 81 cooperatives were formally constituted (see supplemental materials).

COMACO buys raw goods directly from cooperative members, stores what it purchases to avoiding flooding the market at harvest time and depressing the price, and further adds value by processing, packaging, and selling to both local and export markets under the It’s Wild! brand. In this way, COMACO can offer members crop prices that are often 3–5% above the prevailing market price. Currently, COMACO only has sufficient capital to purchase crops from 31,000 of the 178,891 farmers who are currently cooperative members. It is important to note that many cooperative members currently produce crops to meet their food security needs and do not generate a surplus available for sale to COMACO, though they may barter what surplus they have in some years with other cooperative members.

Initially, COMACO raised capital from donors but now generates sufficient funds from the sale of It’s Wild! value-added products (see supplemental materials) to cover over 85% its commercial activities. The balance is met from grants and the sale of carbon credits.

Each year all cooperatives are audited to assess their compliance with COMACO conservation standards. The audit assesses a cooperative’s performance in four areas that include sustainable agricultural practices adopted by cooperative members, wildlife conservation, forest management, and community leadership and governance. Audit teams are composed of COMACO employees and government staff from forestry, wildlife, and agriculture agencies, and from the cultural affairs department at the district level.

In 2017, COMACO began to offer a dividend payment, as an additional conservation incentive, to each cooperative (90% directly to the cooperative and 10% to the local chief) that was compliant with COMACO conservation rules and standards of environmental governance. In 2018, dividend payments for Eastern Province cooperatives, totaled US$44,400.

3 | LEARNING FROM FAILURE

In South Africa’s relatively stable economy over 50% of businesses fail (Ladzani & Van Vuuren, 2002). More
generally in African countries, five out of seven new businesses fail in the first year (Muriithi, 2017).

COMACO initially thought that community leaders would be the right people to serve on its governing board to ensure that the business was focused on meeting community needs and was built from the bottom up with as much transparency as possible. However, community members lacked the experience to evaluate management suggestions and provide critical input into board deliberations. Moreover, community members found it all but impossible to provide the unbiased and essential checks-and-balance required of a well-functioning board of directors. After about a year COMACO management had to hire a lawyer to dissolve the board and reconstitute it with experienced Zambian business people and others from outside of Zambia who had experience as board members of commercial companies.

Another challenge is unfortunately one that is all too common when staff of an NGO attempt to establish a business. At first COMACO staff underestimated the scale the business would need to attain to be self-sustaining and the capital needed to reach that scale. They also started with a “how hard can this be” mentality and did not, at least, initially see the need for rigorous commercial operations systems run by experienced financial and business managers. In response, COMACO hired experienced Zambian business managers to run the company and used the credentials of its founder, with support from a large international NGO (WCS) to raise the capital it needed to keep going in the early years.

**FIGURE 1** Operational area of COMACO in Zambia
Given the highly hierarchical nature of social and political life in Zambia from the village to national government, balancing, respecting and engaging local chiefs and other political leaders is essential. The challenge is avoiding elite capture. Having a reconstituted board of directors with experience in setting up and managing business enterprises in Zambia helped immensely, as did establish cooperatives with paid business and financial managers who were independent from but reported to the local chief.

Lastly, the founders of COMACO did not initially understand that relying on anecdotal information as a basis to evaluate progress was insufficient to convince investors, cooperative farmers, and consumers that COMACO was doing what it promised. As a result, COMACO began to invest in more rigorous monitoring, evaluation and learning systems undertaken by trained staff, and reviewed periodically by third parties.

4 | OUTCOMES

In 2003 when COMACO was established it had 7 full-time, salaried staff, and less than 2000 farmers were involved. By 2019 the company had 168 paid staff, and 178,891 farmers had become members of 81 cooperatives in 76 chiefdoms in the Luangwa Valley (LTS-International., 2019). COMACO farmers are now implementing sustainable farming practices over 281,940 ha of land. This is 49.6% of the farmland within chiefdoms working with COMACO.

Today COMACO does not have sufficient capital nor storage and manufacturing capacity to purchase crops from all member farmers who have a surplus to sell. In 2019, COMACO was able to purchase 7,800 tons of farm commodities from 31,000 members (16.8%), representing a total value of ZMW 27.5 million (approx. US$2.5 million). From this, COMACO generated US$4.7 million in sales of It’s Wild! products. COMACO expects to buy from ~45,000 farmers in 2020 with investment plans in the pipeline for crop purchases to exceed 70,000 farmers over the next several years.

COMACO cooperatives are at an early stage of development and most have been in existence for less than 5 years. While employment levels are low, some cooperatives employ as many as 10–15, while most employ less than 6, with an average income of $300–$400/year—which is an average real wage in Zambia (Koyi, 2020). Cooperatives are playing a critical role in improving supply chain logistics to increase the value and volume of commodities for driving smallholder commitment to sustainable agriculture practices. Evidence of this is the increasing number of cooperatives that bulk, grade and sell commodities sourced from their farmers directly to COMACO on contract (12 in 2018 and 23 in 2019).

4.1 | Sustainable food production

A two-year (2017 and 2018) study conducted by the Zambia Agriculture Research Institute and the International Maize and Wheat Improvement Center was commissioned by COMACO to compare maize yields under conventional farming (i.e., no fertilizer or improved soil management practices), farming with fertilizer, and sustainable farming as promoted by COMACO (i.e., minimum tillage, crop residue retention, compost, and agroforestry). Results show that farming with fertilizer produced the greatest yield over 2 years (7,547 kg/h), followed by COMACO methods (6,547 kg/ha), with conventional farming a distant third (4,011 kg/ha). Though the COMACO method yield was 14% lower than yields with fertilizer, after deducting the cost of fertilizer, net income for farming with fertilizer was 37% less than for COMACO farmers’. So not only does the COMACO farming method increase yield by 63% compared to conventional farming, it generates more net revenue than farming with inorganic fertilizer.

Adoption of SRI increased COMACO farmers’ average rice yields between 2012 and 2018 by 44% compared with the national average (1,695 vs. 1,175 kg/ha), and dramatically reduced the cost of seed as SRI only uses 5–7 kg/ha compared with 160 kg/ha where seeds are broadcast.

COMACO’s seed multiplication program enables cooperatives to produce, certify, store and distribute quality seeds to their farmer members. Unlike the past when farmers lacked reliable access to quality, affordable seeds, cooperative members today are assured of such seed inputs to grow important crops that offer both food and cash to meet family needs. In 2018, 1,260 seed growers within 34 cooperatives produced 128 metric tons of groundnut, soya, cowpea, and rice seeds that were sold to COMACO farmers through their cooperatives at 35% of the price of seeds available on the open market.

To assist farmers further, COMACO cooperatives allow farmers to take seed loans from their community seed banks either on a credit or on a cash basis. Credit payments are repaid in kind with an equivalent value of a crop commodity plus 10% top up in crop by weight.

By 2017, 35% of all COMACO farmers were alley-cropping with Gliricidia sepium. Over 32 million trees, covering 41,500 ha of farmland, were producing 4,000 kg/ha/yr of leaf and woody stem biomass for compost, green manure, and fuel wood for home cooking. In addition, ~1000 Gliricidia wood lots have been established to produce seed and construction poles.
By 2017, 5,394 cooperative farmers had been trained in beekeeping and supplied with subsidized beehives. Honey yields are variable but in years with normal rainfall, farmers produce up to 65 tons of comb honey per year for sale to COMACO at $0.95 per kg at the 2019 price. In addition, COMACO initiated wild mushroom buying in 2019 and purchased ~9 tons from 453 farmers at $0.81/kg. Both honey and mushroom buying is being scaled up as an additional incentive for reducing deforestation.

Prior to COMACO, household poultry production contributed only marginally to families as a source of protein and income because the Newcastle virus cause high mortality, keeping flock size small and discouraging families from owning birds. Today, COMACO cooperatives support para-veterinarians who provide vaccination services to members for a fee. As a result average flock size of local chickens has doubled, as have the number of families that raise chickens for their meat and eggs.

COMACO cooperatives also provide training on other livelihood skills such as goat-rearing, carpentry and brick-laying as alternative sources of income for people that once were solely dependent on illegal hunting and charcoal production.

### 4.2 Socioeconomic outcomes

COMACO conducts an annual post-harvest survey to assess household income and food security based on random selection of 8–10% of registered farmers. These time series data can be compared with a survey in 2001 of 1,200 randomly selected farmers living in the Luangwa Valley and covered five chiefdoms believed to be representative of the Valley socioeconomics at the time. Within 3 years of the start of COMACO farmer income had increased from $US100 to $US350/household/year and 49% of farmers were growing three or more key food crops. Between 2012 and 2018 the number of food secure families increased steadily from 67 to 84%.

From the inflow of crop revenues and resulting cash flow in the community, COMACO helped to establish 270 Savings and Internal Lending Communities (SILC) with a total membership of 6,213, of which 91% are women. Lacking collateral, poor rural families are typically unable to secure loans from the formal financial sector. SILCs are user-owned, self-managed savings and lending mechanisms, built on concepts of transparency and trust. Members contribute an initial amount (~$40) to establish the SILC fund, and then add approximately $2 per month. Members can request loans from the SILC subject to approval by the members and are expected to repay the principal and 10–15% in interest. The SILCs have allowed women to invest in vegetable gardening, poultry production, selling of second-hand clothes, setting up grocery shops and dry fish trading. Members also use the loans to install metal roofing on their houses, to pay school tuition fees for their children, and buying small livestock such as goats and sheep.

In 2012 COMACO began a new initiative to sell avoided carbon emission credits on the voluntary market to help expand and diversify the revenue streams for its members. Discussions with local chiefs led to the establishment of Community Conservation Areas to safeguard forests and wildlife of Zambia’s Eastern Province. By 2018, 38 Community Conservation Areas had been established that covered 1.1 million hectares of forestland. The Areas are patrolled by teams of COMACO-trained community forest guards. In 2015, COMACO partnered with The World Bank on Zambia’s first large-scale Reducing Emissions from Deforestation and Forest Degradation (REDD+) carbon project. Under a pilot initiative with nine chiefdoms, COMACO estimated the quantity of CO₂ that would not be released into the atmosphere as a result of avoided deforestation within the Community Conservation Areas and carbon retention from sustainable agricultural practices. In 2017, it verified 214,965 tCO₂-e (equivalent carbon credits) on behalf of these communities and transferred to community accounts a total of $US 489,369 for the sale of these credits to the World Bank. A second verification was successfully completed in 2018 for the same chiefdoms generating a further 525,371 metric tons of avoided CO₂ emissions credits that are now available for purchase.

COMACO is currently working with 28 additional chiefdoms to expand the carbon market for a growing number of communities across the Luangwa Valley. Many of the chiefdoms targeted for this expansion are important wildlife corridors that will help connect fragmented forests and aid in the effort to rebuild Luangwa Valley's wildlife populations.

In 2013, COMACO began working with CQuest Capital (https://cquestcapital.com/) to distribute to cooperative member families 50,000 fuel efficient Rocket Stoves designed by Total Land Care (https://tinyurl.com/y36an6qf). The stoves burn wood more efficiently (50–60% lower fuel use) with much reduced levels of smoke than traditional three-stone fires and aid in the reduction of CO₂ emissions and respiratory disease from the inhalation of smoke. Using the woody stems from Gliricidia trees that are planted in farm fields as an alley-crop reduces the cost of collecting fuelwood from over 30 days to 1–2 days per year. By the end of 2018, 70,393 cooperative families were actively using a simple fuel efficient stove.
4.3 Wildlife conservation

By 2019, 1769 wildlife poachers had surrendered their guns to COMACO and were handed over to Zambia’s Department of National Parks and Wildlife (DNPW). Through a special training program to learn alternative livelihood skills, these local hunters have become registered members of their local farmer cooperative. Of these, 210 volunteered to provide actionable information to DNPW when they learn of poaching incidents within their area. This local informant network, complemented by an additional number of informants recruited by DNPW, resulted in 154 actionable reports of wildlife crimes within six districts. These resulted in multiple arrests and a decline in illegal hunting and trafficking of wildlife. COMACO and the DNPW strictly maintain the anonymity of each informant to avoid the risk that they or their families might be subject to retribution by the accused or socially sanctioned by others in the community.

Three years of wildlife crime data (2016–2018) available from the DNPW show a decline in illegal hunting and trafficking of wildlife. Forty-two elephants were killed during this period. Though the majority were killed within the Mambwe District where COMACO supports four cooperatives, DNPW data show that non-residents were responsible for 89% of ivory poaching in 2016 in Mambwe and 100% in 2018.

Based on these recent DNPW data it appears that: (a) local residents are increasing their cooperation with DNPW to report wildlife crime, (b) illegal hunting of elephants has shifted toward non-resident hunters, and (c) the incidence of local people being arrested for wildlife poaching is decreasing.

Snare encounter data collected by community game scouts who accompany and monitor trophy-hunting tourists on their hunts shows a favorable trend similar to those reported by DNPW. From 2008 to 2017 the snare encounter rates in each of four trophy hunting concessions in the Luangwa Valley (Chikwa, Chifunda, Kazembe, and Chitungulu) declined from an average 51 per hunt to 0.5. As the average number of clients increased slightly over the same time period (9.25 to 10) it appears that hunting effort (client days hunting) was relatively stable and thus observed reductions in snare encounters was a real phenomenon and not a reduction in game scout search effort.

A 2015 aerial survey carried out by the Nature Conservancy (unpublished report by DNPW) showed elephant numbers in COMACO areas were stable relative to previous surveys. It also found buffalo numbers were increasing suggesting a decline in illegal hunting as buffalo are a, preferred species of commercial bush meat poachers.

Lastly, the number of elephants killed as a final resort to control crop damage in four COMACO chieftdoms dropped from 15 in 1999 to 1 in 2017. This decline appears correlated with an increase in the numbers of crop raiding elephants blasted with powdered chili by reformed poachers under the supervision of government wildlife scouts.

5 DISCUSSION

COMACO has raised and spent $30 million in overseas development assistance and from private philanthropy since 2003 to build this not-for-profit, conservation-linked social enterprise. That is an investment of just $US11/year for each of the current 178,891 members. Membership in COMACO has grown an average of 35% per year between 2003 and 2018. This suggests that farmers see value in joining COMACO. Interestingly, as COMACO currently is only purchasing commodities from ~17% of members it appears that access to training and improved crop yields and food security is the primary incentive for farmers to join COMACO and to remain members by complying with COMACO standards.

COMACO is currently a $US5.5 m/year company in terms of gross revenues. If it is going to purchase commodities from all its members it will need to have cash holdings of at least $12 million just to purchase farmers crops, and will need to increase its storage and processing facilities by six-fold to handle the estimated 50,000 metric tons of raw materials.

The market in Zambia when combined with sales to regional commodity traders is unlikely to be saturated by COMACO if it increases annual production to 50,000 metric tons of value-added agricultural-based commodities. If the It’s Wild brand had access to international markets COMACO could theoretically grow to all locations across Zambia where rainfall and soils are suitable for arable agriculture and where African plains game still exist.

Expanding COMACO to other regions in Zambia will require at least a $US 2 million investment each year for 10–15 years to reach another 200,000 farmers. But increasing the food and income security of so many farmers’ families while reducing or halting deforestation and unsustainable hunting of wildlife for ~$US10 per farmer per year is cheap, and likely an order of magnitude less than restoring rural economies and the natural systems they depend up after the environment has been degraded.
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CONFLICT OF INTEREST
The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS
Dale Lewis and David Wilkie conceived the idea and co-wrote the paper.

DATA AVAILABILITY STATEMENT
COMACO will provide access to the data after requesters sign a data-use MOU.

ETHICS STATEMENT
This study did not involve human subjects.

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SUPPORTING INFORMATION
Additional supporting information may be found online in the Supporting Information section at the end of this article.

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