Long-Term Sustainability of Cooperative-Wide Coffee Yields in San Miguel Escobar, Guatemala

INTRODUCTION

The overarching goal of this study was to investigate the long-term sustainability of the San Miguel Escobar coffee cooperative associated with the non-governmental organization *As Green As It Gets*. A computer simulation determined that while coffee yields are projected to increase at a positive rate over the next five years, long-term sustainability would be a challenge as a result of the timing of coffee tree growth cycles.

The focus of the study was to analyze the efficacy of various strategies aimed at leveling major crop yield fluctuations projected by the simulation. This investigation was conducted to aid sustainable economic development for the Guatemalan coffee farmers in the cooperative.

METHODS

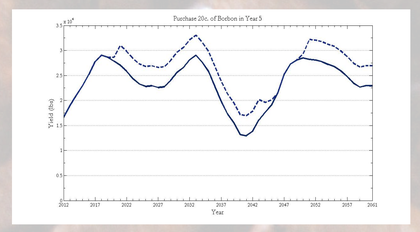
A simulation written in the linear programming language MATLAB was used to forecast future cooperative-wide coffee yields of green coffee that has been stripped of its fruit and dried, ready for roasting.

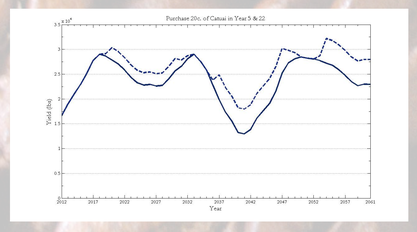
Using available data on the land holding of each farmer in the cooperative, the type of coffee trees planted, and conservative estimates of likely yield per unite of land for each species, the simulation was able to project yields for each plot of land, sum the result and graph the annual yield for any number of years specified by the user. Originally, the projection was run for only ten years, but upon seeing the decline at the end of the decade, it became evident that a longer-term projection was necessary to visualize the interaction of harvesting cycles, thus a fifty-year time frame was chosen.

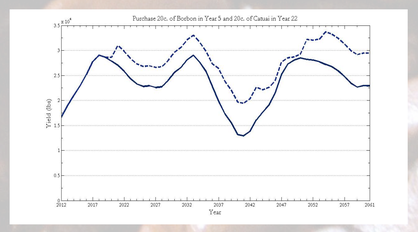
RESULTS

With no changes to current farming practices, the computer simulation output a graph (the solid line) that forecast major yield fluctuations which needed to be addressed. Possible strategic responses were discussed with cooperative management and factored into the simulation to investigate their efficacy (the dotted line). The Borbon species accounts for 55.34% of the cooperative's, and Catuai trees account for 41.91%. These two have different life cycles and yields, which was considered when analyzing strategies.

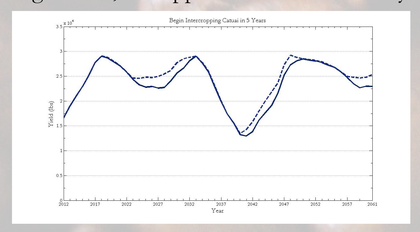
The most direct and intuitive solution—though certainly the most expensive—would be to purchase more land to even out the inconsistencies. From an analysis of different periods of time, the simulation demonstrated that a short-term strategy of buying land was definitively most effective when made in five years (2017). A second purchase of land in the future was also considered. The goal was to mitigate the large dip in the center of the graph while taking care to not to exaggerate differences elsewhere. The following purchases were considered for combination with other strategies:

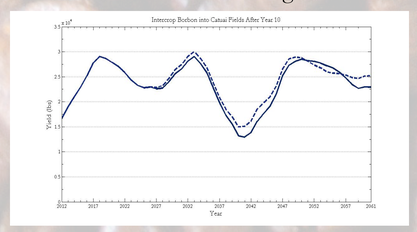




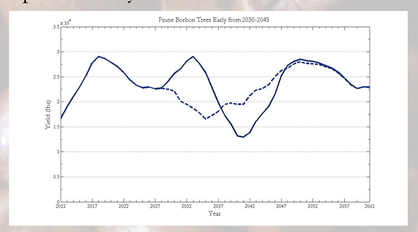


The Intercropping Strategy involves planting young saplings between the rows of trees that are reaching or are about to reach the end of their lives. Doing this shortens the time a plot of land would not be producing coffee by at least two years. The benefit of intercropping is that implementing it incresases yields in the periods of cooperative-wide decline without additional capital investment, only a change in planting strategy. While improvements in crop yield are not very significant, this approach should definitely be considered in combination with strategies.





Pruning trees while their yields are still substantial can help mitigate fluctuations. The disadvantage is the inevitable difficulty of implementation, as many farmers are bound to be unreceptive to sacrificing years of productive yields.

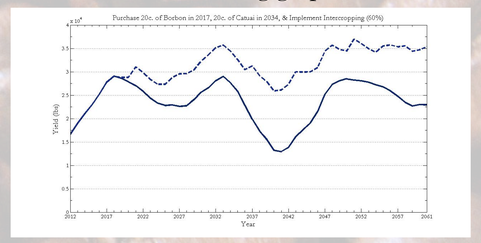


CONCLUSION

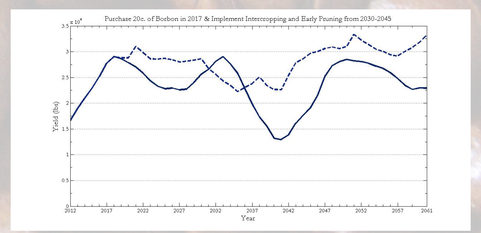
It is the suggestion of this study that the cooperative should enact changes if it wishes to maintain steady and sustainable growth in order to continue providing developmental aid to rural coffee farmers in and around San Miguel Escobar, Guatemala.

The simulation demonstrated that "Intercropping Strategy," which involves everyone intercropping—with approximately half of farmers switching species when they do so is highly beneficial, and implementing it should be relatively simple in practice.

In addition, a purchase of twenty cuerdas (approx. six acres) of land in 2017 will likely be necessary, as it would cushion both dips in yield. A second purchase of twenty cuerdas in 2034 would go a long way in maintaining the cooperative's growth in the fifty-year time frame if combined with the aforementioned purchase and Intercropping Strategy. This optimal combination of strategies results in the following graph:



The less appealing alternative to a second purchase of land would be pruning Borbon trees five years earlier than they would normally be pruned. This strategy combined with a purchase in 2017 and the Intercropping Strategy is sufficient to sustain the cooperative's growth, but it would likely not be well-received by farmers for the reasons mentioned earlier.



The simulation and resulting graphs demonstrated that long-term sustainability and maintainable economic development is absolutely feasible for the San Miguel Escobar cooperative if the strategies discussed in the final section of the report are taken into consideration and implemented.

Independently organized research by Michael Pilosov in cooperation with As Green As It Gets