

Assessment of Climate Change Impacts on Agriculture on Cayo District, Belize

Roger Rivero Jr., Roger Rivero,
Zoltan Rivero
Cuban Institute of Meteorology

Aim and objectives

To empower policy makers and stakeholders with insights of the implications of the plausible climate change expected to probably happen in a near future.

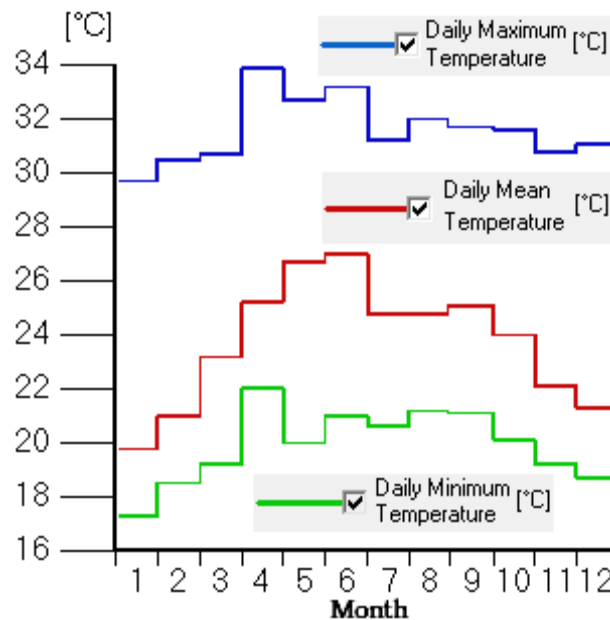
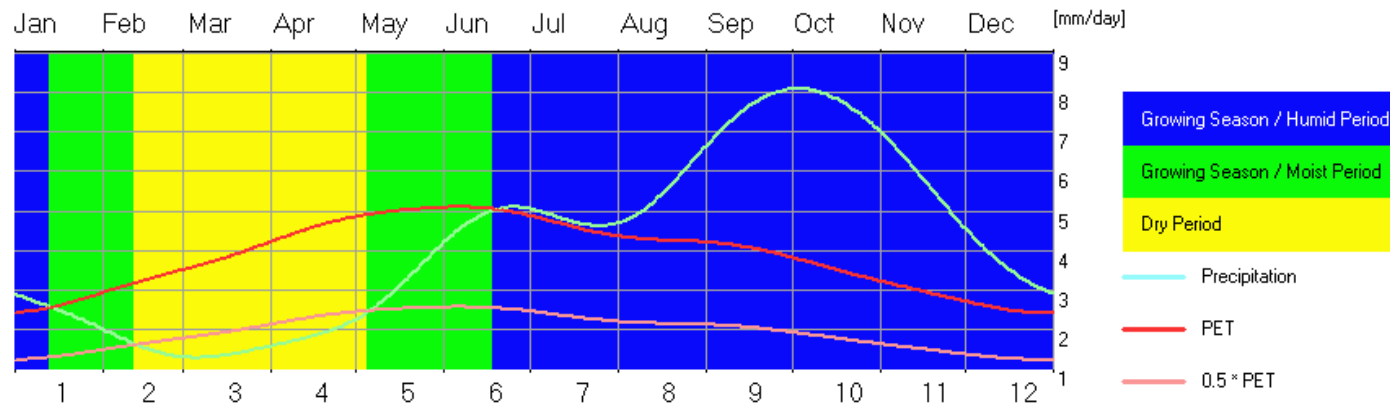
To contribute to the understanding that major agricultural research should be conducted seeking for better adapted varieties and for new or improved technology productions.

Which tools were used? How & why?

- To compute expected crop behaviour with climate change the DSSAT v4.5 suite of models was used.
- For the livestock sector, the SPUR2 v2.2 and LIFE-SIM models were used.
- Climatic input data was provided by CARIWIG upon the results of the coupled RCM (Regional Climate Model) named PRECIS with two different Global Climatic Models to enhance resolution.
- Maps were provided by the from the Ministry of Agriculture and Baseline Production was provided by the Institute of Statistics, Belize, and the Livestock National Association.
- Interviews with farmers and producers from different sectors were conducted in site.
- Further weather variability on climatic variables in the uncertain future were provided from the Weather Generator developed in the Project.
- Base climate provided by the Meteorology Office.

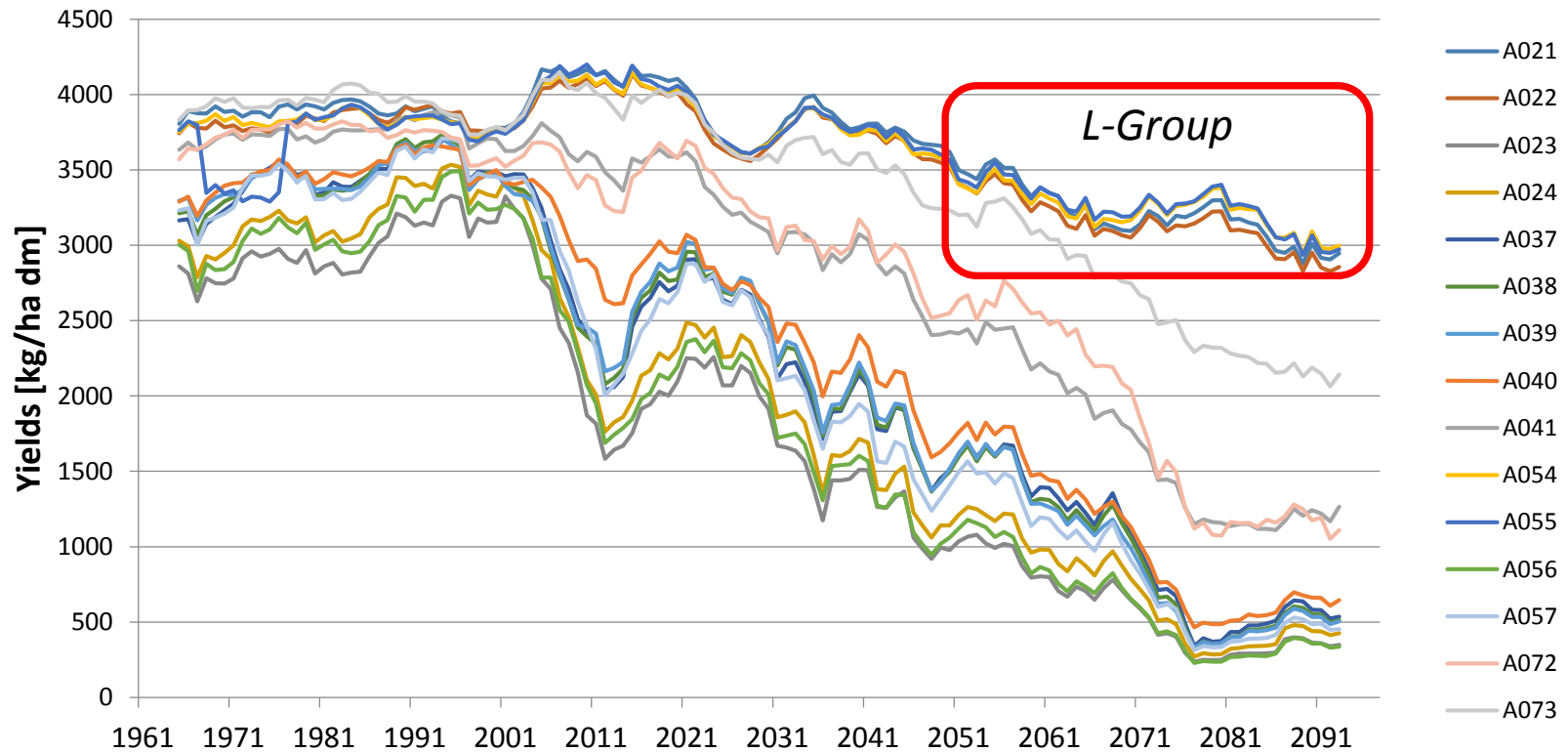
The findings

BASE CLIMATE CONDITIONS



The findings

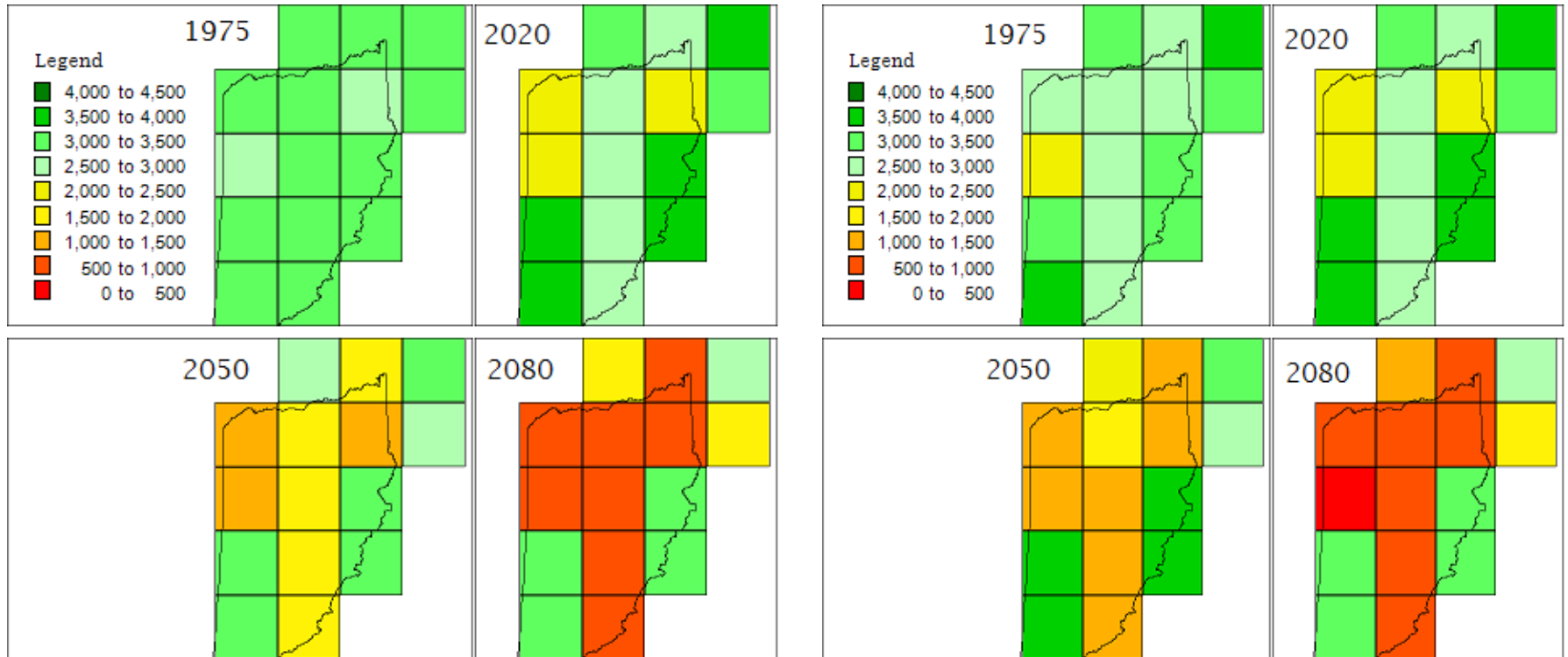
DRY BEANS



Example of top productive variety (potential)

The findings

DRY BEANS



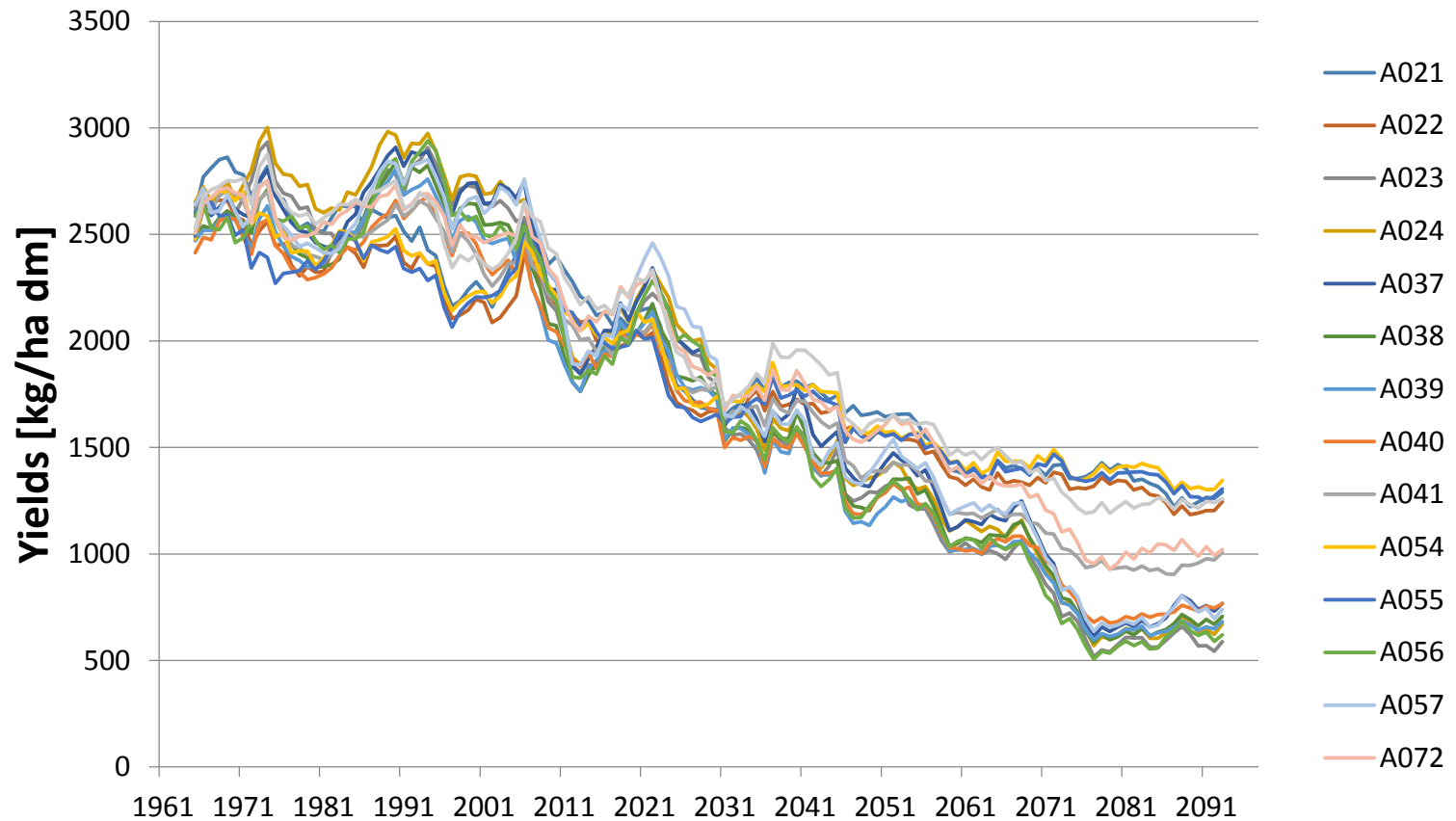
HadCM3 (aenwh) GCM

ECHAM5 GCM

Mean of potential for top 5 varieties

The findings

CORN



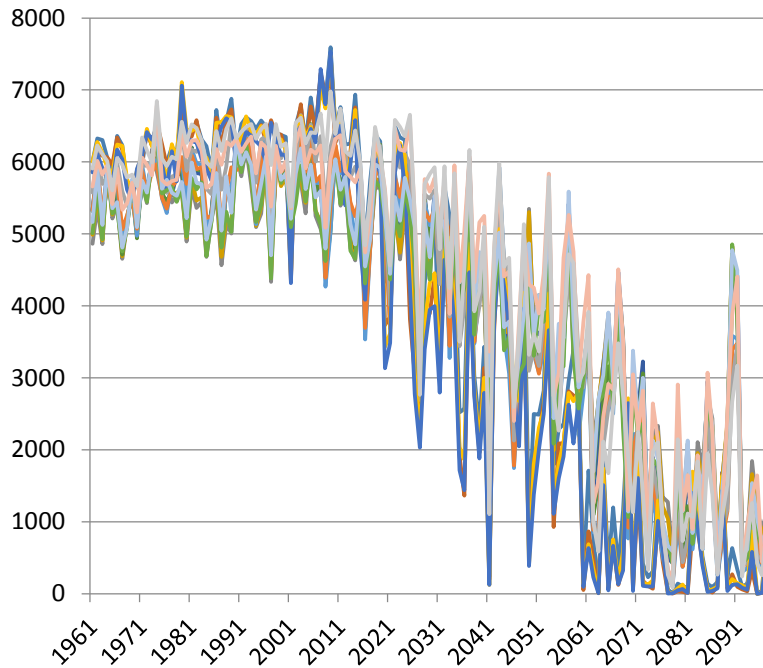
The findings

EXPECTED YIELD BY THE END OF THE CENTURY FOR
TOP, MIDDLE AND LOWER PRODUCTIVE VARIETIES
RELATIVE TO BASELINE PRODUCTION (CORN)

Variety	Name	Final Yield on L- Group	Final Yields On Lowest Yielding Cells
1	GL 482	67 %	23 %
2	PIO 3475 <u>orig</u>	70 %	22 %
3	EXCELER	69 %	23 %
4	CORN281	63 %	25 %
5	V.SHORT SEASON	52 %	26 %
6	PIO 31G98	63 %	25 %

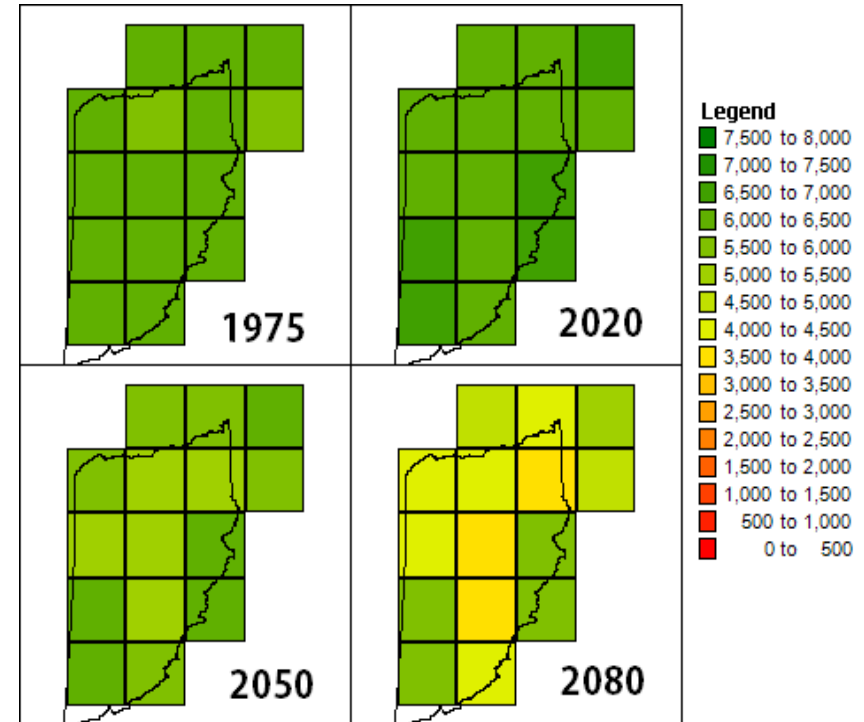
The findings

VEGETABLES



PEPPER

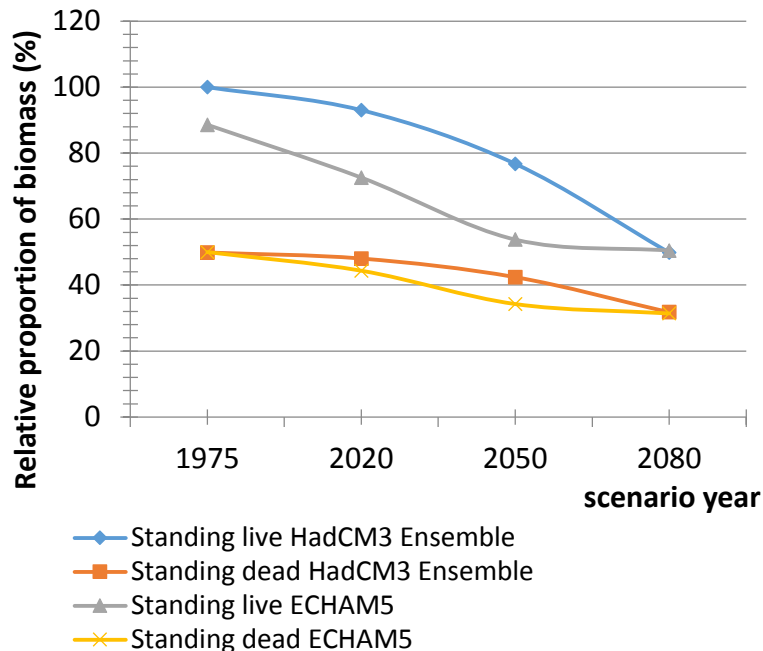
A021
A022
A023
A024
A037
A038
A039
A040
A041
A054
A055
A056
A057



TOMATO

The findings

LIVESTOCK FOOD (Pastures biomass)



*Decreasing even without
grazing animals*

- Negative impact on grassland's net primary productivity, decreasing natural food availability for grazing animals
- With a stocking rate of 1.2 animals/ha – typical of extensive management conditions – a modest 1.3% decrease in milk production was obtained at the end of the century
- Potentially, for some scenarios, the stocking rate resulting in the highest production in an isolated year was about 5 animals/ha. For a value of 6 animals per hectare surviving problems started to appear in the simulations

- Other scenarios allowed a maximum of 0.15 animals/ha to produce a minimum of 201 liters/ha-year of milk

Implications for policy & planning

All results obtained through the simulation of crop yields and grassland/livestock responses to climate change inferred from a Regional Climate Model (PRECIS) point in the direction of the decrease in land productivity during this century.

A National Program to Cope with Climate Change negative and harmful impacts should then be implemented.

This program should take into account that actions should be planned according to the fact that the entire Caribbean basin will be impacted in a similar way.



Implications for policy & planning

WORK TO IMPROVE EFFICIENCY

Modelled impact results show that there exist a so-called “yield gap” between simulated potential and water limited yields or productivity with actual ones, gap which is usually named as “technological efficiency ratio”.

- By improving technological efficiency, we could achieve higher agricultural production even if potential productivity is decreasing due to climate change.
- Seek for better adapted varieties or replace by better adapted crops.

Implications for policy & planning

LIVESTOCK

The analysis of these results and other data suggests that livestock practices and obtained yields in actual climate are very far from its potential values.

In consequence, even if climate change will strongly impact in grass yields and its nutritional values, a parallel increase in livestock production could be obtained by introducing better technological practices and management that are not applied today.

Notwithstanding this we should remark than any improvement in livestock management should be strictly assessed before introducing it and only after making thorough cost/benefits studies

Implications for policy & planning

GENERAL ACTIONS

- Support professional research
- Promote experience exchange between farmers
- Build capacities in agro management practices among farmers, especially of newbie ones

Feedback on the tools

RCM outputs look to work well for current climate, but the effect on the model outcomes implies a huge increase on variability which looks unrealistic.

Some bugs (internal issues) were found in LIFE-SIM, so the authors of this report had to work around them to solve the problems, because source code for this model is not available.

What more could be done?

- To calibrate models to simulate current varieties used in Belize instead of using built-in varieties of the models, which might resemble, or not, varieties used in Belize (research required).
- To simulate rain fed and irrigated yields on real soil profiles instead of generic built-in profiles. Time and resources were not enough to develop the require tools, which actually do not exists, thought actual soil information was collected, we still have to match soil map polygons with soil data and create a two-way interface between information layers and models.