Assessment of current and future suitability of cocoa agroforestry systems for resilient land use planning in Cameroon

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Introduction

Cocoa is a major income-generating cash crop in Cameroon and therefore of **high importance** for the **economic growth** of the agricultural sector (Coulter and Abena, 2011).

Climate change is projected to become **very limiting** for **cocoa production** in Cameroon which can increase drastically the pressure on forest land as cocoa is already now a major driver for **deforestation**. Thus, a comprehensive understanding of change in **suitability** due to climatic changes is key for future **resilient land use planning**.

This study assesses the suitability of cocoa in a common agroforestry system for current and future time periods under **two IPCC scenarios** (SSP1-RCP2.6 and SSP3-RCP7.0) to point out potential need for sustainable adaptation.

Fig 1: Cocoa tree (Theobroma cacao) with cocoa fruit in an agroforestry system in Yoko, Cameroon (Source: Gloy, 2022)

Preliminary results

Currently an agroforestry system of cocoa and African pear is suitable for 55% of the country, mostly in the bimodal forest zone, the highlands and parts of the high savannah zone (a).

Under **SSP1-RCP2.6,** only minor changes are projected (b,c), **most of the area (91,2%) remain suitable** until 2070 (d).

Under SSP3-RCP7.0 no minor changes projected in the next decades (e,f), 36% of the area remain suitable until 2070, suitability for the **African pear tree decreases for 38% of the area** mostly in the high savannah zone, and for **23% of the area suitability for cocoa increases** while for African pear decreasing (g).

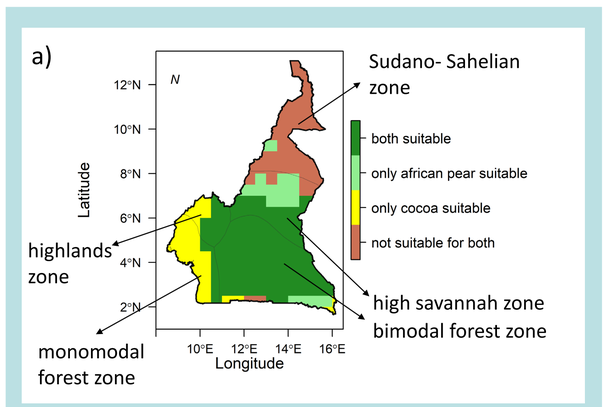

Fig. 3: Current suitability of cocoa tree and African pear for the five agroecological zones in Cameroon

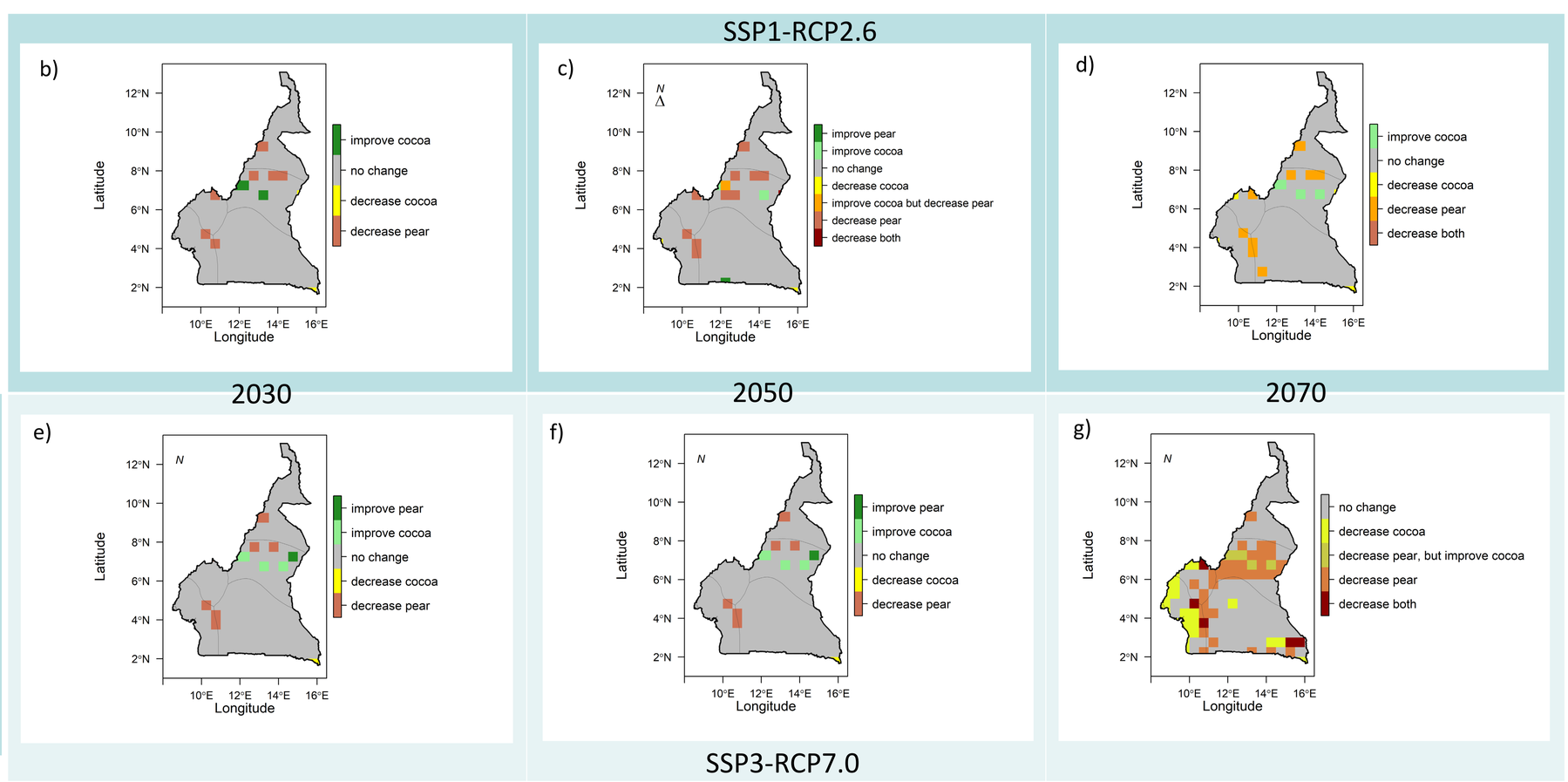

Fig. 4 Projections of cocoa and African pear (agroforestry system) suitability for the scenario SSP1-RCP2.6 (above) and SSP3-RCP7.0 (below, light blue) for three time slices: 2030, 2050 and 2070.

Fig. 5: African pear tree (Dacryodes edulis) with fruits in Cameroon (Source: Tchindjang, 2022)

Methods

- We used the EcoCrop model (Hijmans et al., 2001; FAO, 2000) for assessing the suitability based on climatic and biophysical parameters (e.g. pH).
- Input climate data were derived from the ISIMIP3 project and soil data from the ISRIC database.
- Combining the suitability for cocoa and African pear followed the approach by Chemura et al. (2020).

Discussion

With changing climate, also **areas in the high savannah zone seem to become suitable** for cocoa growing which can **foster afforestation** as cocoa needs the association with shading trees (Jagoret et al. 2011). However, the suitability for the African pear tree will decrease, therefor other trees could be considered such as avocado, citrus trees or trees with medical benefits.

From focus groups and experts interviews during field visits we found that besides climatic factors, **other aspects highly influence the cocoa production** and are therefore important for a resilient system: age of trees, management, correct application of good practises (distance between the trees, phytosanitary products), access to the market. These factors need to be considered through a process-based modelling approach.

Outline

- Integrating more parameters, such as max. T, SOC, radiation into the assessment for a more complex simulation
- Considering various biophysical parameters such as shading and micro-climate regulation through a process-based model approach and linking it with qualitative data about management practises
- Considering different tree species such as Avocado, Baobab, Citrus, Mango, forest species

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