

# FINAL REPORT ON

the creation of three interconnected sectoral simulation models on agriculture, water and energy, customized and parametrized to Cameroon, Uganda and Mozambique



United Nations  
Economic Commission for Africa

ACP/C  
African Climate Policy Centre

**WISER**  
Weather and Climate Information Services for Africa

To order copies of *Final report on the creation of three interconnected sectoral simulation models on agriculture, water and energy, customized and parametrized to Cameroon, Uganda and Mozambique*, please contact:

Publications Section  
Economic Commission for Africa  
Menelik II Avenue  
P.O. Box 3001  
Addis Ababa, Ethiopia

Tel: +251 11 544-9900  
Fax: +251 11 551-4416  
E-mail: [eca-info@un.org](mailto:eca-info@un.org)  
Web: [www.uneca.org](http://www.uneca.org)

© 2021 Economic Commission for Africa  
Addis Ababa, Ethiopia  
All rights reserved  
First printing May 2021

Material in this publication may be freely quoted or reprinted. Acknowledgement is requested, together with a copy of the publication.

The designations employed in this report and the material presented in it do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Economic Commission for Africa concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Designed and printed by the ECA Printing and Publishing Unit. ISO 14001:2015 certified.

# FINAL REPORT ON

the creation of three interconnected sectoral simulation models on agriculture, water and energy, customized and parametrized to Cameroon, Uganda and Mozambique

Prepared by Andrea M. Bassi and  
Georg Pallaske

21 July 2018



# Table of Contents

Executive summary .....	vi
1. Introduction: climate resilience and the nexus .....	1
2. Implementing the nexus approach with causal loop diagrams .....	2
2.1 Agriculture .....	4
2.2 Energy .....	4
2.3 Water .....	5
3. Documentation of the model .....	6
3.1 Data sources.....	6
3.2 Population module.....	6
3.3 Water module .....	6
3.4 Agriculture module .....	8
3.5 Food security and population affected module .....	11
3.6 Electricity generation module .....	12
4. Overview of results .....	17
4.1 Business-as-usual scenario .....	17
4.2 Climate scenario .....	23
4.3 Adaptation scenario .....	30
5. Discussion: the relevance of a nexus approach .....	38
6. Conclusions .....	39
7. Recommendations .....	40
References.....	41

# List of tables

Table 1: Climate impacts in the model by type of event.....	vi
Table 2: Causal relationships and polarity.....	2
Table 3: Strengths and weaknesses of causal loop diagrams .....	3
Table 4: Assumptions for key variables in the model .....	17
Table 5: Total GDP .....	18
Table 6: Agricultural GDP, business-as-usual scenario .....	20
Table 7: Power generation capacity, business-as-usual scenario .....	22
Table 8: Annual cost of power generation, business-as-usual scenario.....	22
Table 10: Population affected by adverse climate events (5-year annual averages).....	23
Table 9: Climate impacts in the model by type of event.....	23
Table 11: Agricultural production, business-as-usual and climate scenarios.....	25
Table 12: Water demand for irrigation, business-as-usual and climate scenarios.....	25
Table 13: Agricultural GDP, business-as-usual and climate scenarios.....	26
Table 14: Water balance, climate scenario.....	27
Table 15: Impacts on power generation capacity.....	27
Table 16: Electricity generation, business-as-usual and climate scenarios.....	28
Table 17: Integrated assessment of costs and benefits .....	29
Table 2: Physical impacts, climate scenario .....	29
Table 19: Annualized impacts over 30 years, climate scenario .....	30
Table 20: Assumptions, adaptation scenario.....	30
Table 21: Agricultural production, adaptation vs climate scenarios .....	31
Table 22: Agricultural GDP, adaptation and climate scenarios .....	32
Table 23: Net benefits of organic farming.....	33
Table 24: Break-even conditions for organic farming, adaptation scenario.....	33

# List of Figures

Figure 1: Causal loop diagram: Agriculture.....	3
Figure 2: Causal loop diagram: Energy.....	4
Figure 3: Causal loop diagram: Water.....	5
Figure 4: Causes tree: Total water demand.....	7
Figure 5: Causes tree: Water resources internally produced.....	7
Figure 6: Causes tree: Total agricultural production rate.....	9
Figure 7: Causes tree: Agricultural water demand.....	10
Figure 8: Causes tree: Total affected population.....	11
Figure 9: Causes tree: Population affected by food scarcity.....	12
Figure 10: Causes tree: Total employment energy sector.....	14
Figure 11: Causes tree: Total electricity generation rate.....	14
Figure 12: Causes tree: Conventional electricity generation.....	14
Figure 13: Causes tree: Renewable electricity generation.....	15
Figure 14: Uses tree: Total electricity generation rate.....	15
Figure 15: Causes tree: Total annual costs of power generation capacity.....	15
Figure 16: Causes tree: Electricity generation price renewable generation.....	16
Figure 17: Population trends.....	17
Figure 18: Total cropland, business-as-usual scenario.....	18
Figure 19: Total agricultural production rate, business-as-usual scenario.....	19
Figure 20: Water demand for irrigation.....	19
Figure 21: Total employment in agriculture, business-as-usual scenario.....	19
Figure 22: Baseline precipitation (left) and water resources internally produced (right).....	20
Figure 23: Water balance and water stress, business-as-usual scenario.....	21
Figure 24: Electricity generation rate, business-as-usual scenario.....	22
Figure 25: Total employment in the energy sector, business-as-usual scenario.....	22
Figure 26: Growth rate in precipitation variability (left) and relative seasonal precipitation (right), climate scenario.....	23

Figure 27: Productive cropland (left) and productive agriculture land (right), business-as-usual and climate scenarios.....	24
Figure 28: Total agricultural production, business-as-usual (left) and climate scenarios (right) .....	24
Figure 29: Total employment in agriculture, business-as-usual (left) and climate scenario (right) .....	26
Figure 30: Electricity generation, business-as-usual (left) and climate scenario (right) .....	28
Figure 31: Total employment in the energy sector, business-as-usual (left) and climate scenario (right) .....	28
Figure 32: Total agricultural production, adaptation vs climate scenarios .....	31
Figure 33: Agricultural employment, adaptation vs climate scenarios.....	32
Figure 34: Renewable capacity (left) and electricity generation (right), adaptation vs climate scenarios .....	33

预览已结束，完整报告链接和二维码如下：

[https://www.yunbaogao.cn/report/index/report?reportId=5\\_324](https://www.yunbaogao.cn/report/index/report?reportId=5_324)

