THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTION, WELFARE AND FOOD SECURITY IN TAJIKISTAN

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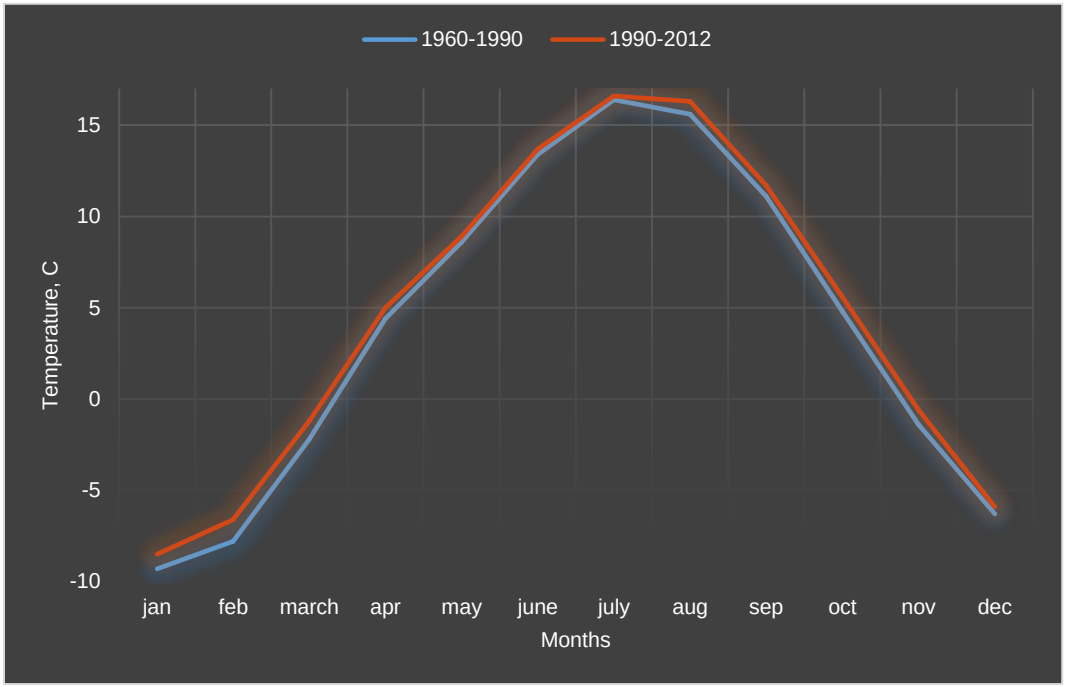
OUTLINE

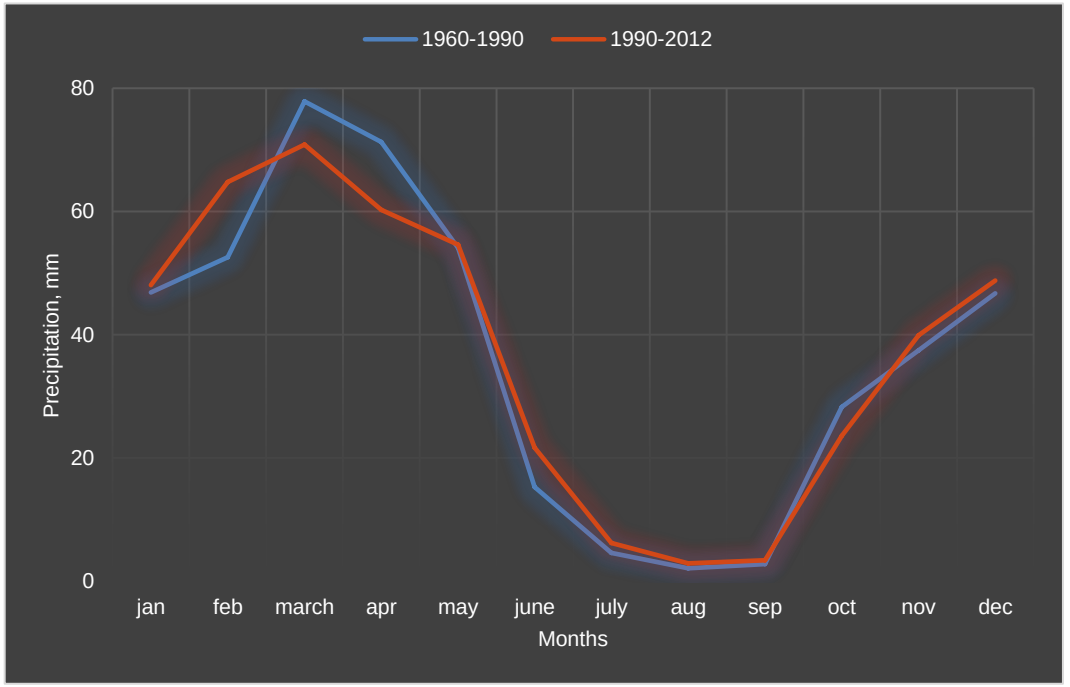
- Tajikistan climate: current trends and projection of future;
- Overview of the agriculture sector;
- Objective and methodology of the research;
- Assessment of future climate change impact on agriculture and population:
  - *Crop yields and area;*
  - *Supply and demand;*
  - *Welfare effects;*
  - *Effects on population;*
- Conclusions and policy implication.

TAJIKISTAN CLIMATE: CURRENT TRENDS

Monthly temperature change, 1990-2012 compared to 1960-1990



Monthly precipitation change, 1990-2012 compared to 1960-1990



Source: World Bank, World Development Indicators (2015)

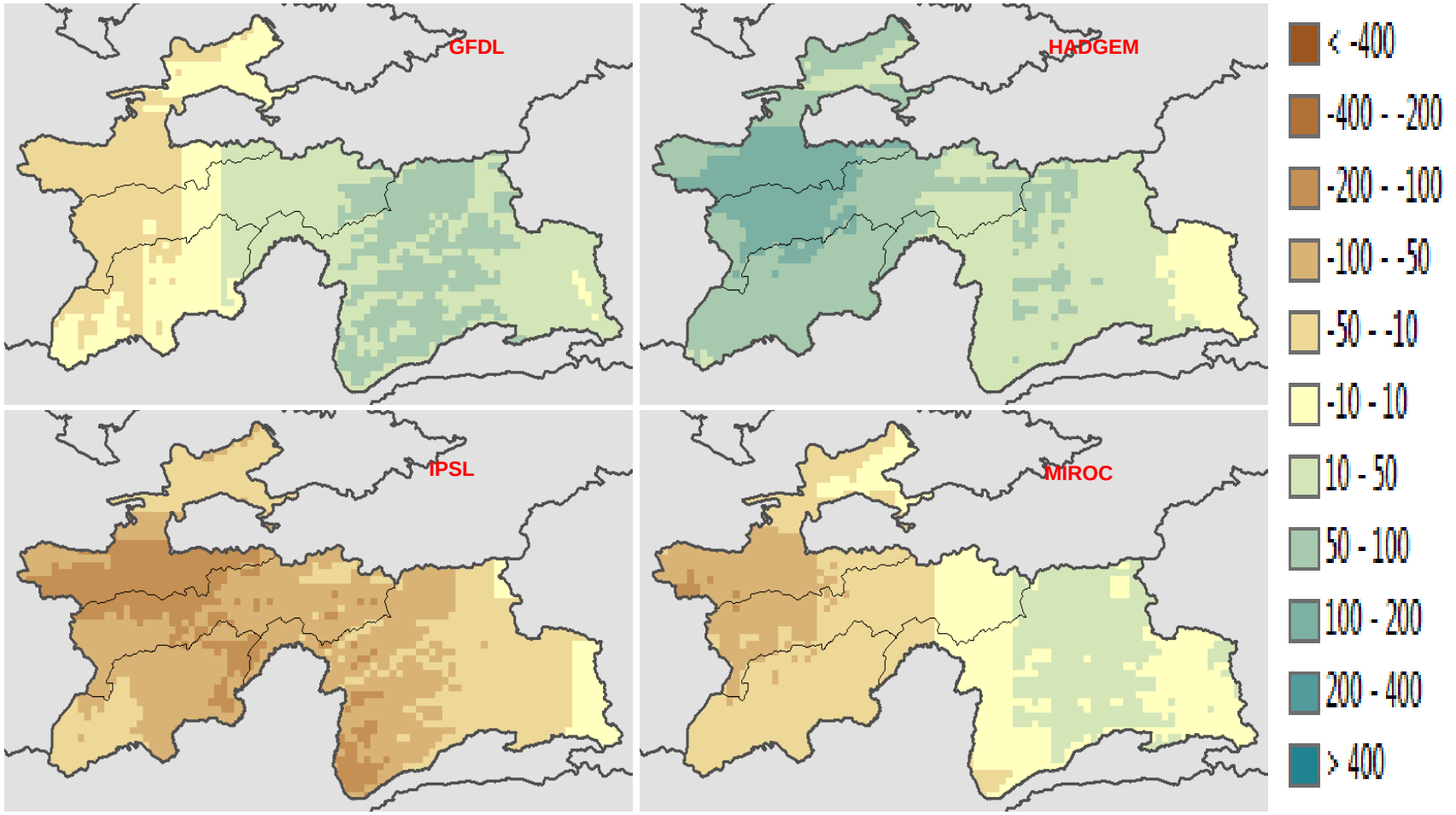
TAJIKISTAN CLIMATE: PROJECTION OF FUTURE

GLOBAL CLIMATE CHANGE MODELS CONSIDERED:

- **GFDL:** Geophysical Fluid Dynamics Laboratory, Princeton University Forrestal Campus;
- **Hadgem:** Climate Change Model developed by Hadley Centre Global Environment Model, UK;
- **IPSL:** Institute Pierre Simon Laplace Global Climate Modeling Centre, France;
- **MIROC:** Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

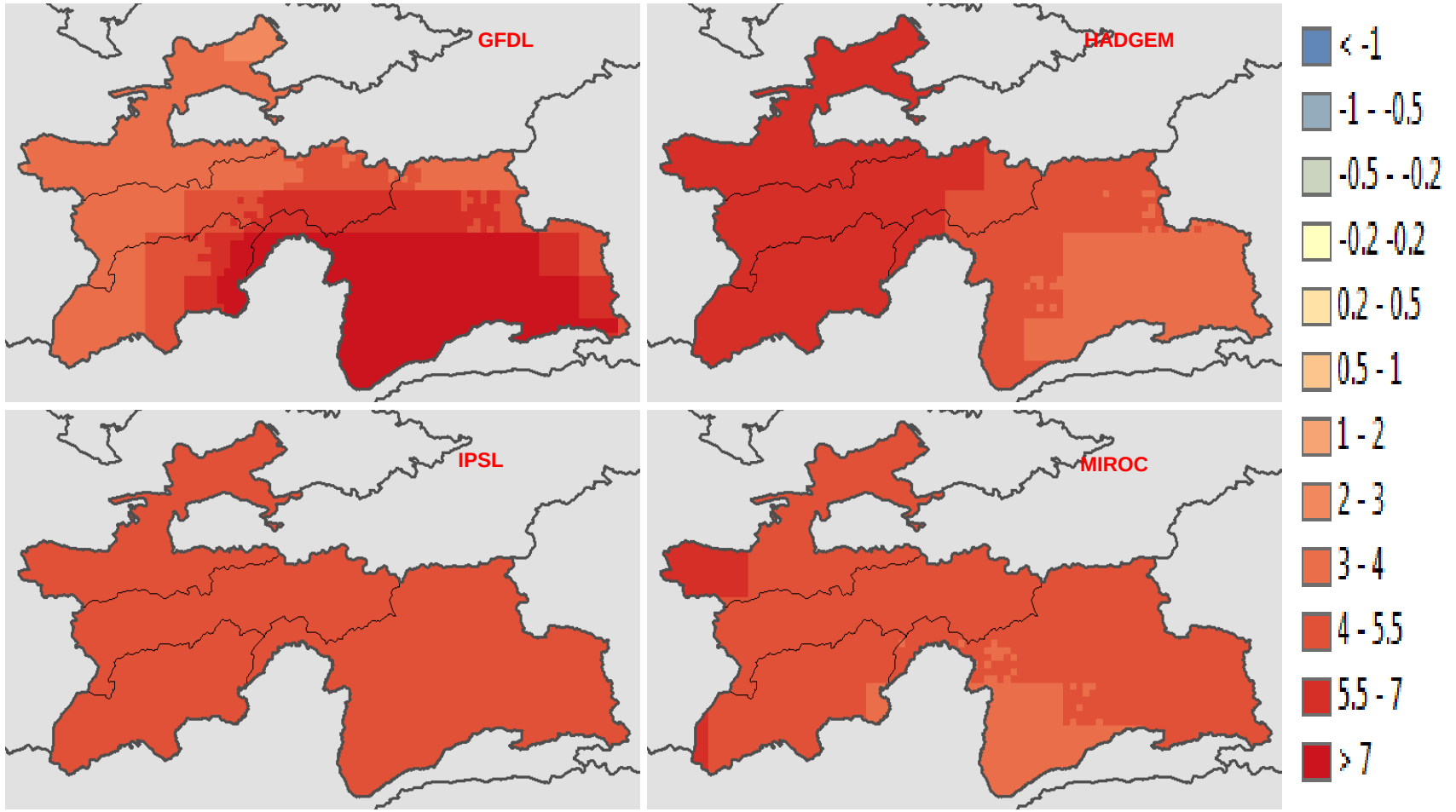
TAJIKISTAN CLIMATE: PROJECTION OF FUTURE

PRECIPITATION CHANGE, 2050 COMPARED TO 2000, MM.



TAJIKISTAN CLIMATE: PROJECTION OF FUTURE

TEMPERATURE CHANGE, 2050 COMPARED TO 2000, ^{o}C



TAJIKISTAN AGRICULTURE

- Share of Agriculture in GDP is ~22% (2010-2015);
- Agriculture GDP growth rate is ~7% (2010-2015);
- ~75% of population live in rural areas;
- Share of employment in agriculture sector is >50% of total employment;
- Number of farms is 175000 smallholders farms;
- Tajikistan is the most vulnerable country to climate change among 28 countries in Europa and Central Asia region: (Fey et al, 2010)

OBJECTIVE AND RESEARCH QUESTIONS

The objective is to examine the future effects of climate change on agricultural sector and population of Tajikistan.

The specific research questions are:

- How will climate change influence production, consumption and trade of various agricultural products?
- Which agricultural crops are more vulnerable/resilient to climate change?
- What is the welfare cost of climate change?
- How will climate change affect country's population?

METHODOLOGY OF RESEARCH

IMPACT – International Model for Policy Analysis of Agriculture Commodities and Trade

- developed by **International Food Policy Research Institute (IFPRI);**
- is a global partial equilibrium model;
- Is an analytical tool to research impact of demographics, trade, investment, climate change, water etc. on agriculture, food security, welfare.

The modules of IMPACT:

- Water simulation;
- Food;
- Crop;
- Malnutrition;
- Welfare;
- Cost benefit.

IMPACT covers:

- 56 - Agricultural commodities;
- 159 - Countries;
- 154 - Water basins;
- 320 - Food production units*.

*(*FPU, the intersection of a country and a river basin)*

Source: Rosegrant et al. (2012)

SIMULATED SCENARIOUS

Five scenarios, one baseline scenario and four climate change scenarios are simulated using **IMPACT**:

Baseline scenario: i. e. business as usual scenario with constant 2005 climate conditions with no further climate change effects, serves as reference scenario

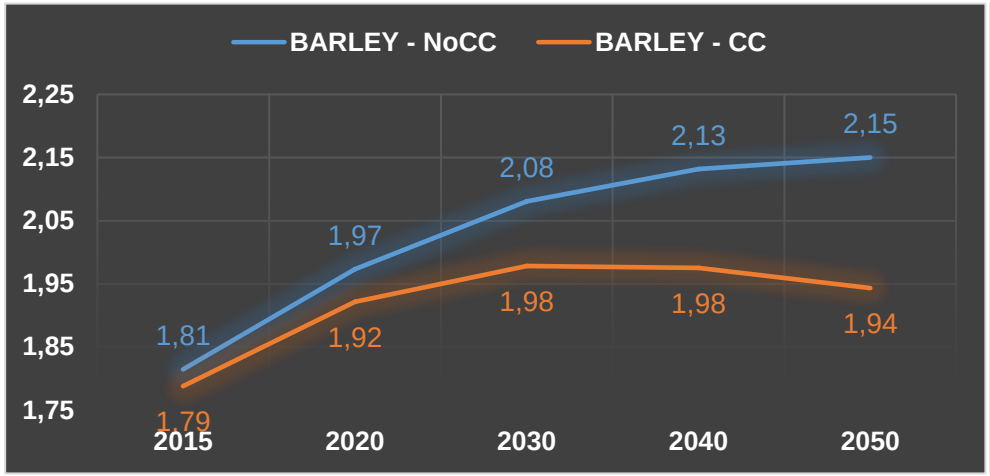
Climate change scenarios:

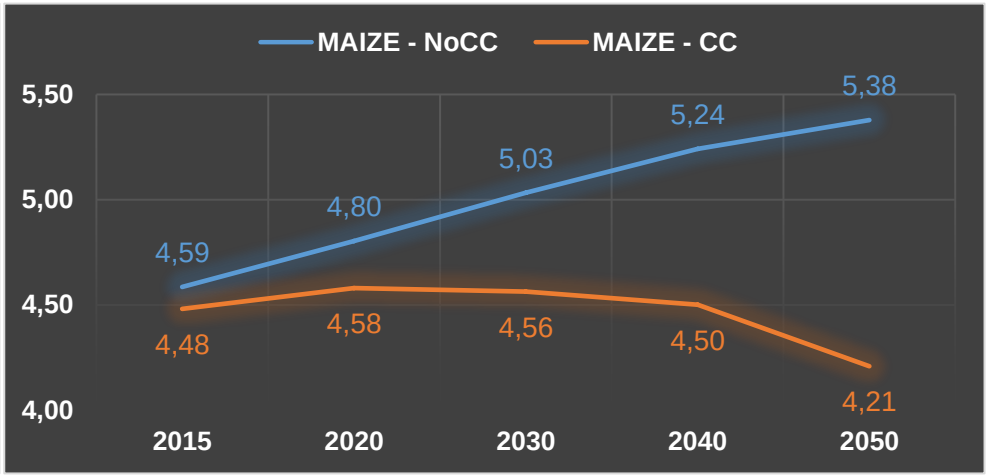
- **GFDL Climate Change Scenario** (Geophysical Fluid Dynamics Laboratory GFDL, Princeton University Forrestal Campus);
- **Hadgem Climate Change Scenario** (Climate Change Model developed by Hadley Centre Global Environment Model, UK);
- **IPSL Climate Change Scenario** (Institute Pierre Simon Laplace Global Climate Modeling Centre, France);
- **MIROC Climate Change Scenario** (Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research).

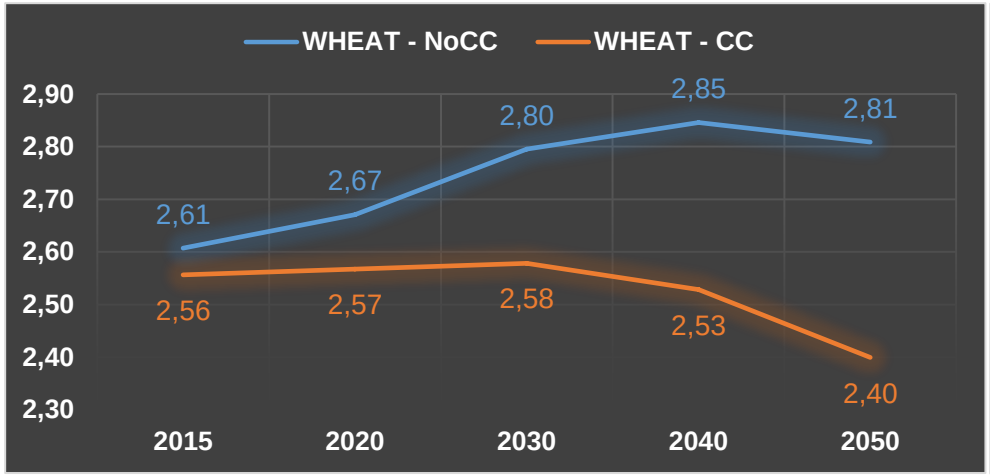
NoCC = baseline scenario

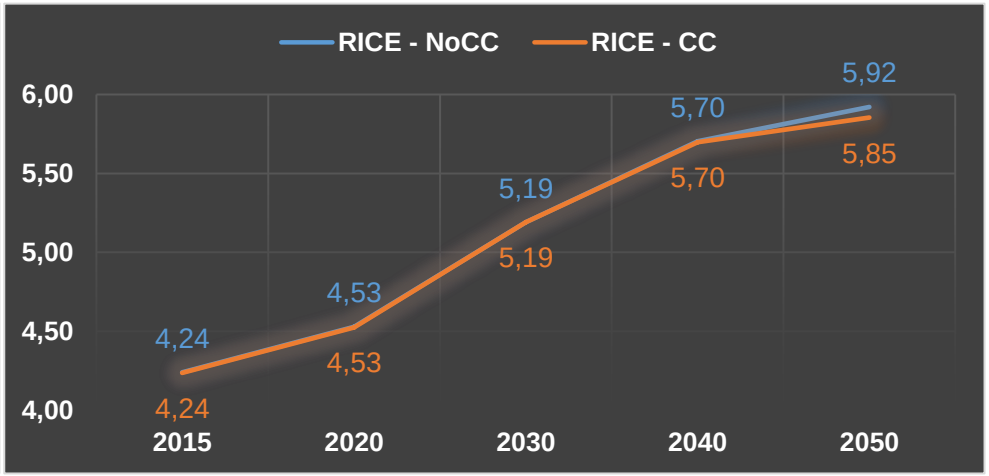
CC = mean of 4 climatic scenarios

CROPS YIELDS IN CC VS NoCC, MT/HA



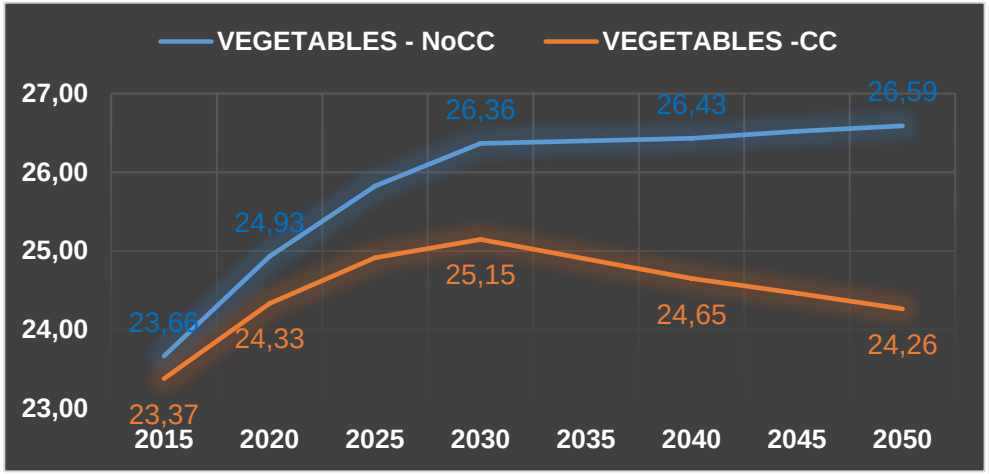


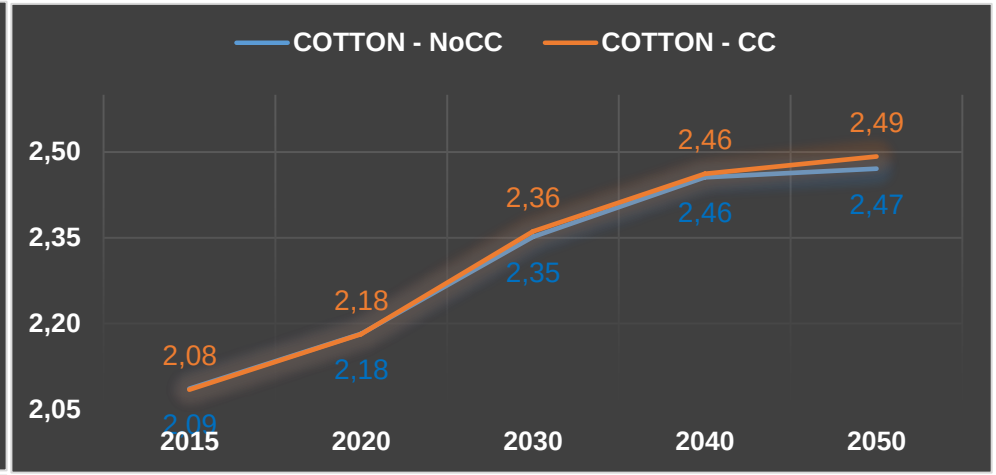


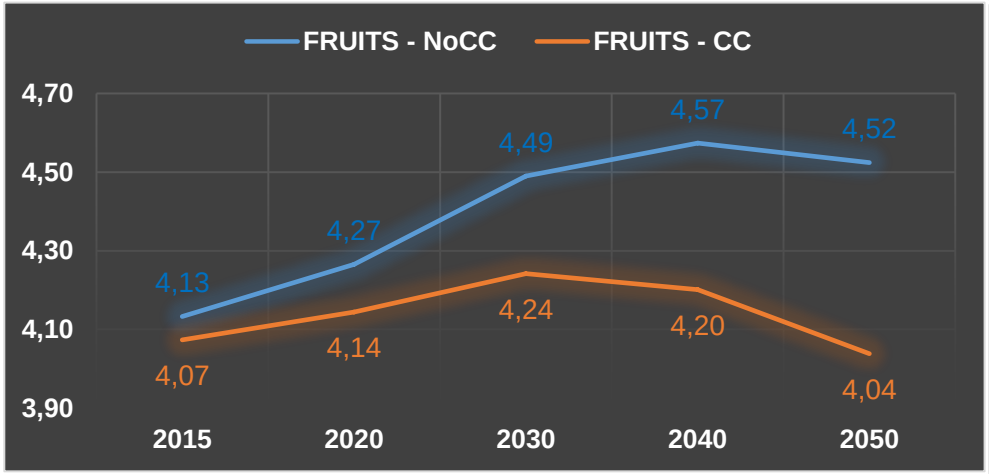


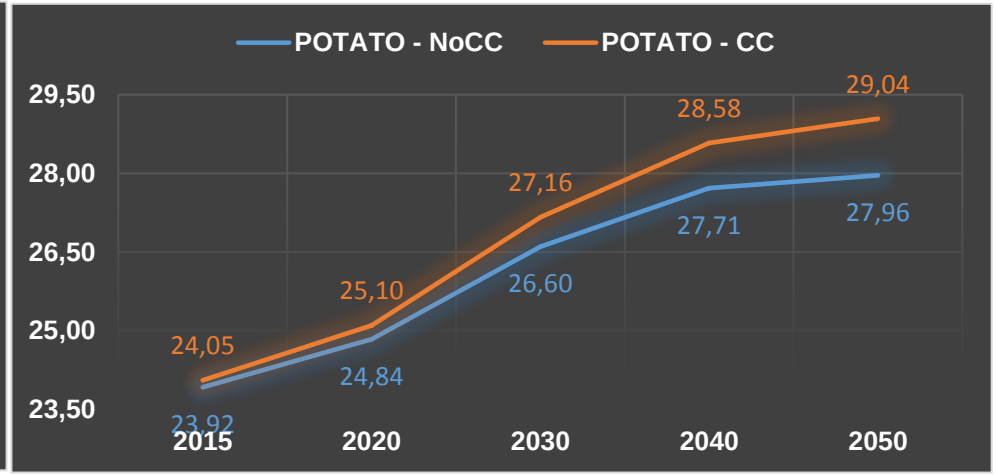
Source: Own compilation based on IMPACT model results

CROPS YIELDS IN CC VS NoCC, MT/HA



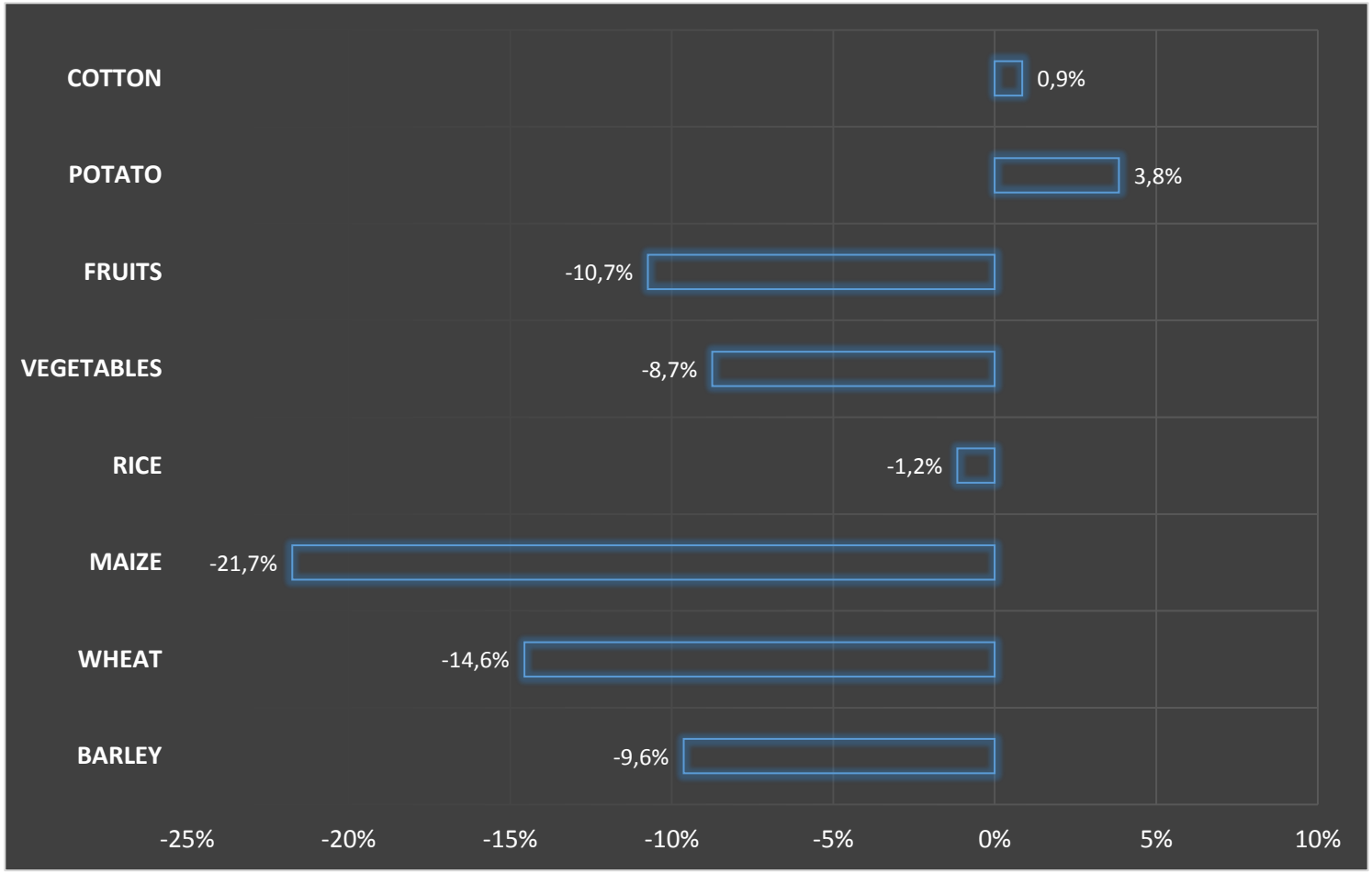






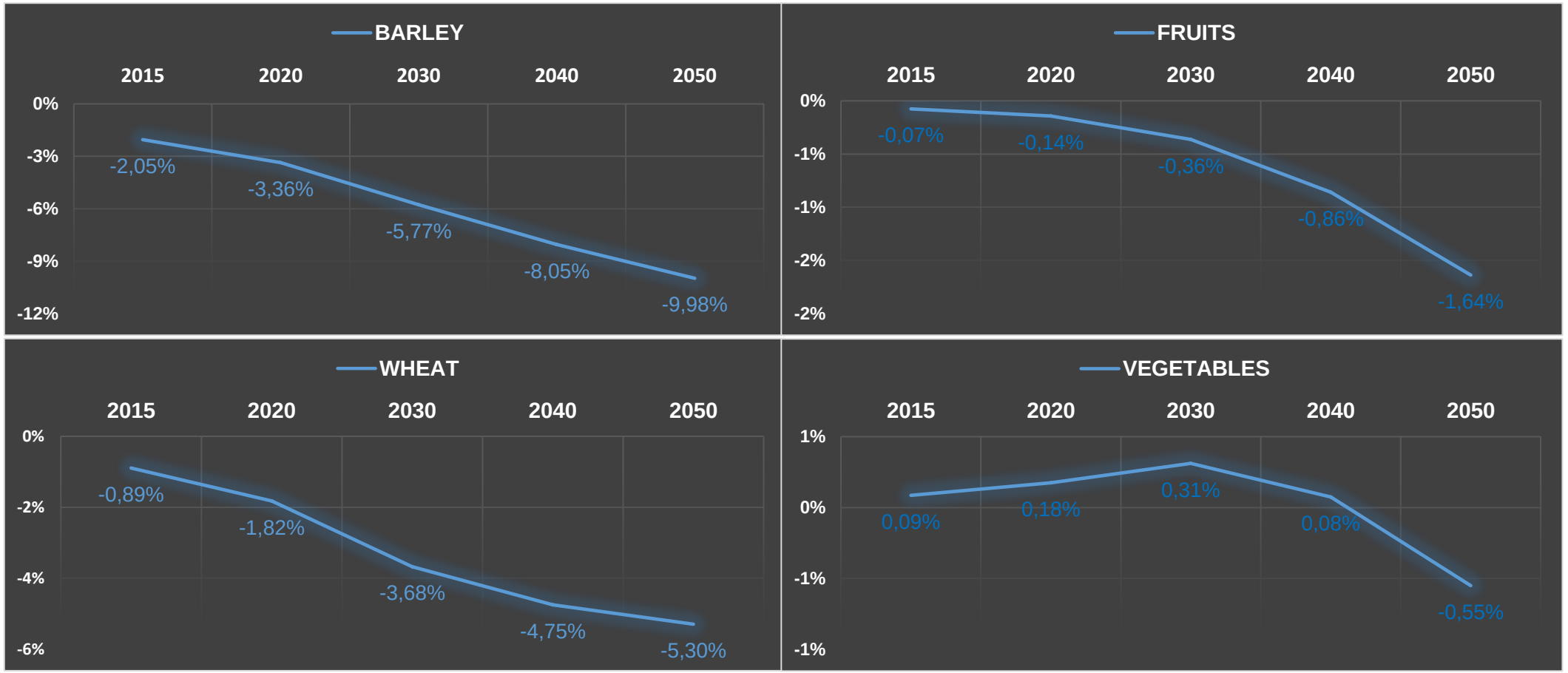
Source: Own compilation based on IMPACT model results

CHANGES IN CROPS YIELDS IN CC VS NoCC, % (2050)



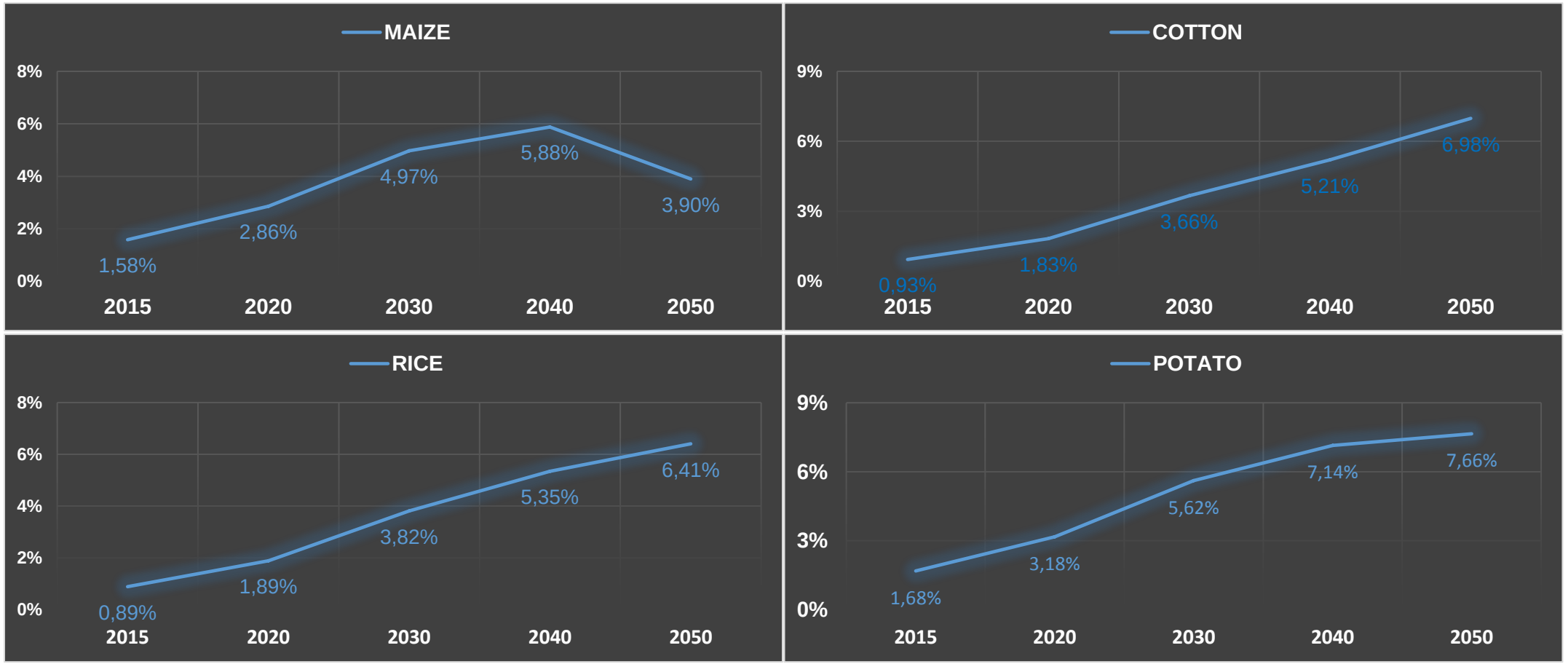
Source: Own compilation based on IMPACT model results

CHANGES IN CROPS AREAS IN CC VS NoCC, %



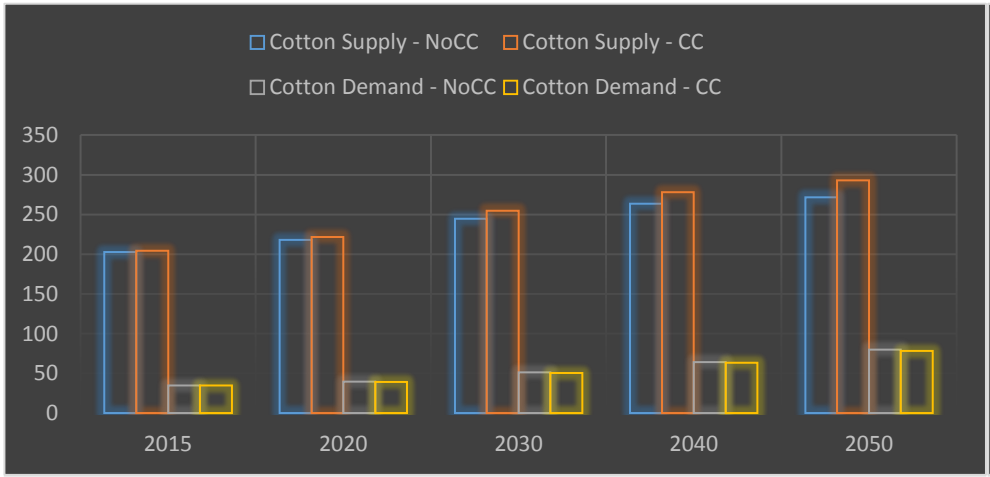
Source: Own compilation based on IMPACT model results

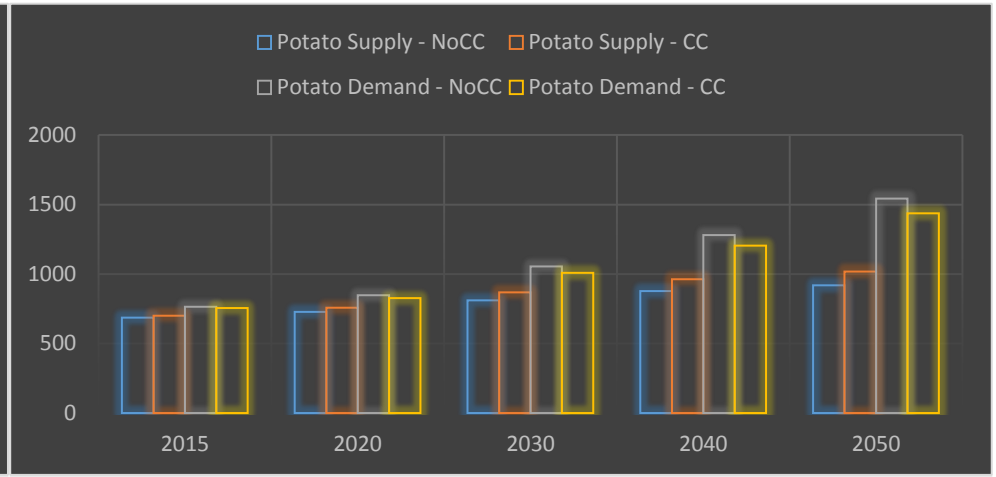
CHANGES IN CROPS AREAS IN CC VS NOCC, %

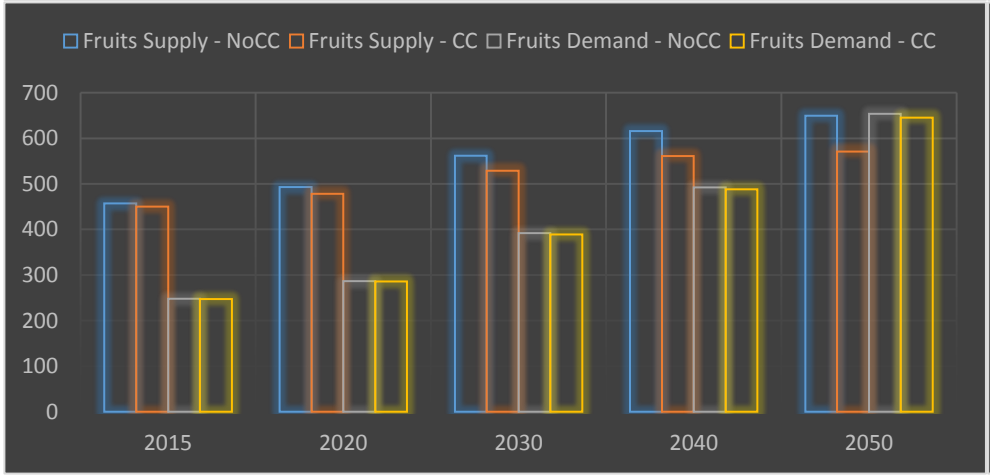


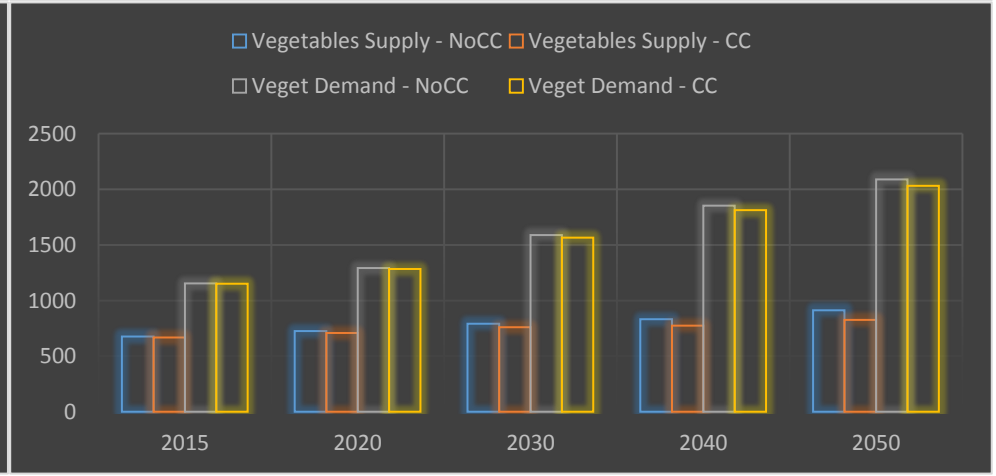
Source: Own compilation based on IMPACT model results

SUPPLY AND DEMAND IN CC VS NOCC, MT



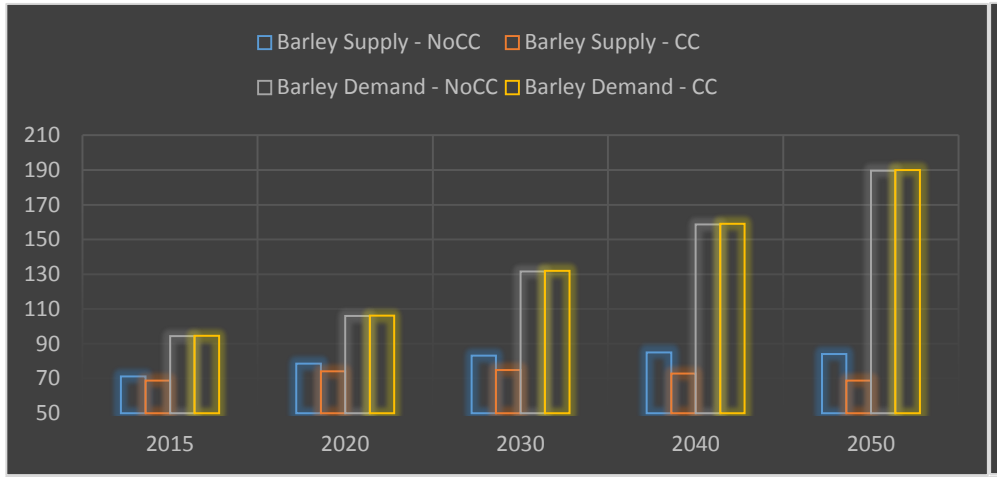


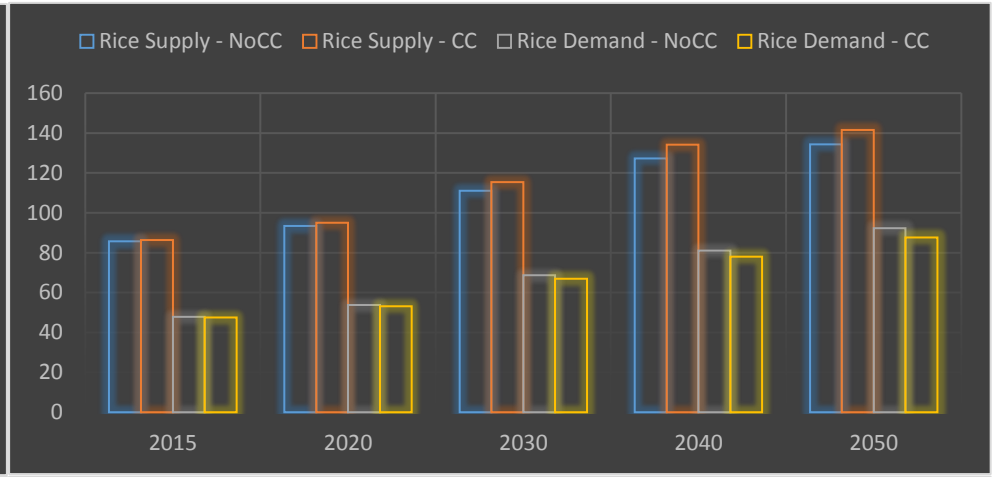


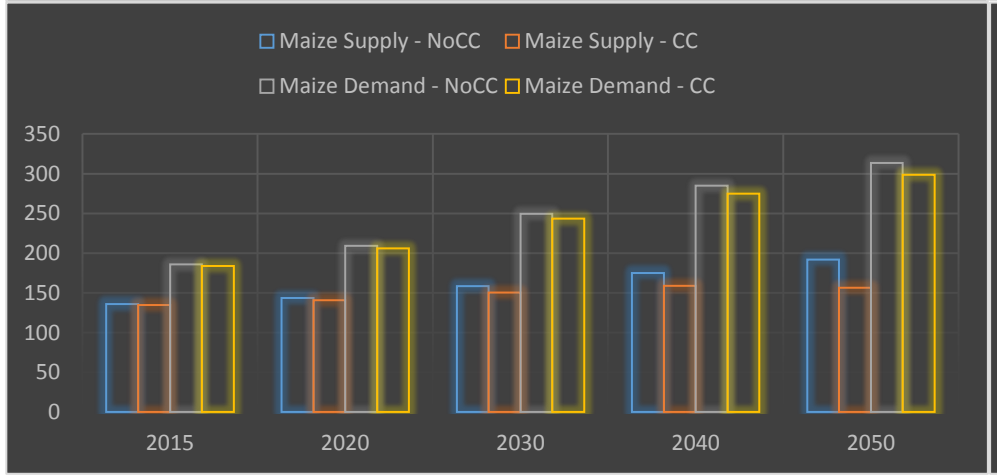


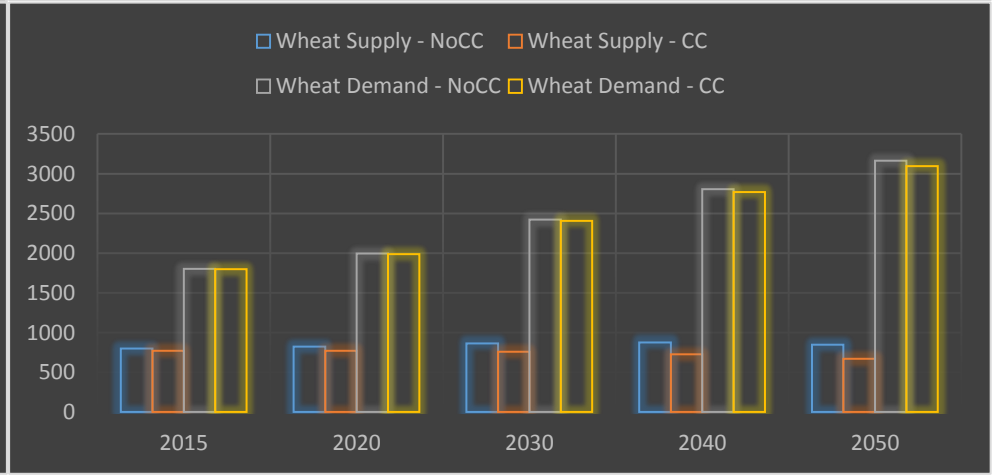
Source: Own compilation based on IMPACT model results

SUPPLY AND DEMAND IN CC VS NoCC, MT





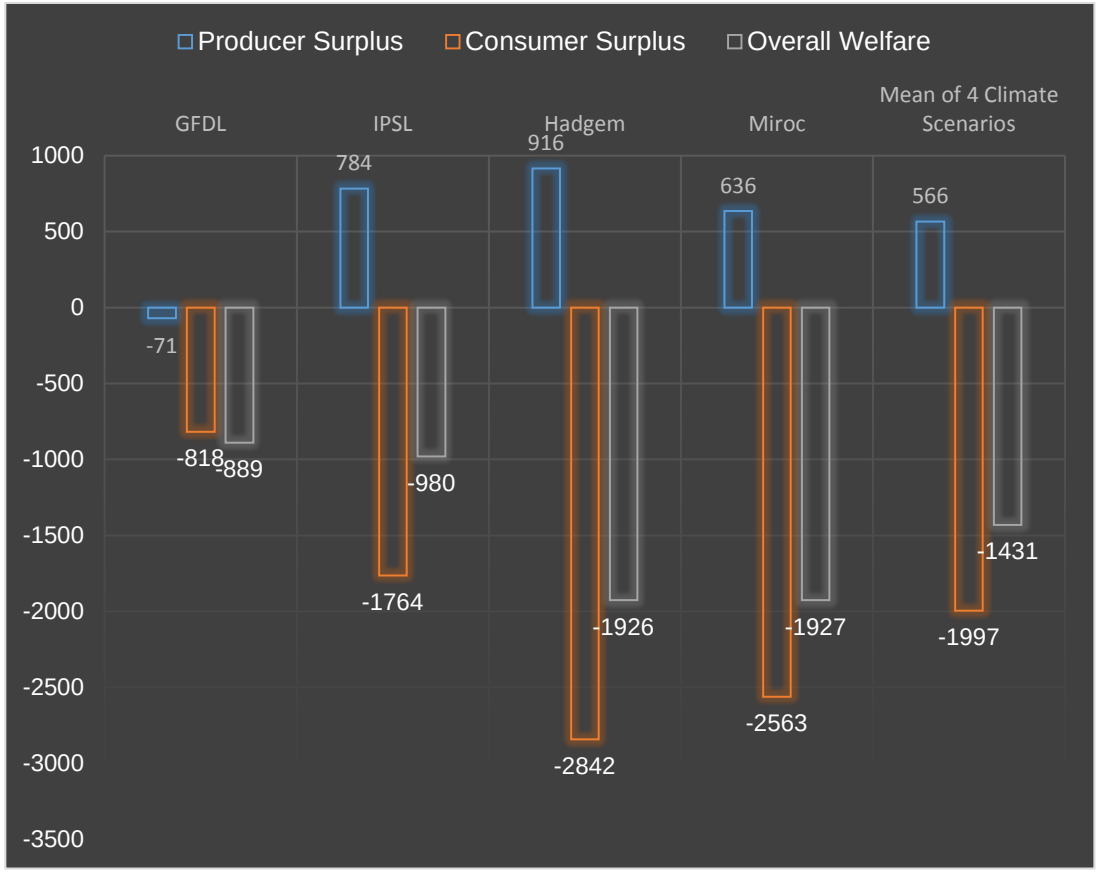




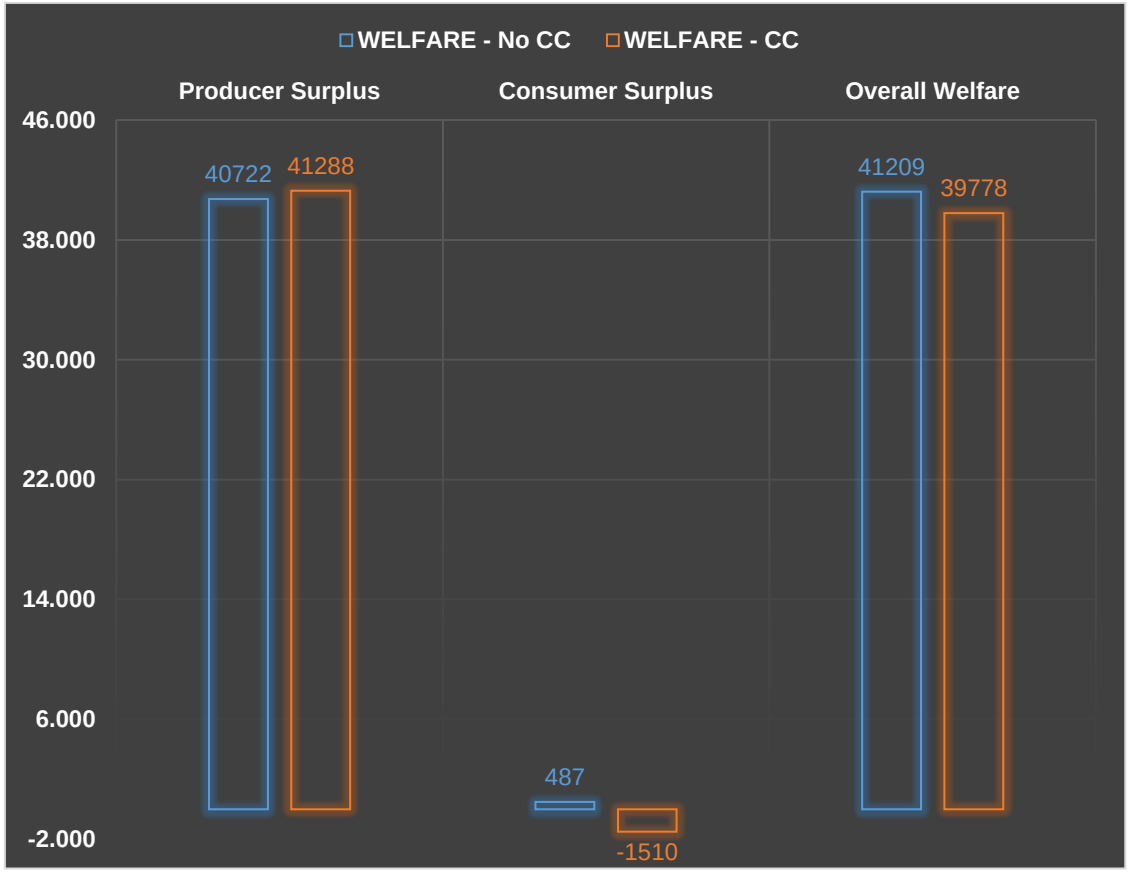
Source: Own compilation based on IMPACT model results

WELFARE EFFECTS OF CLIMATE CHANGE

Welfare change in CC vs NoCC , million USD

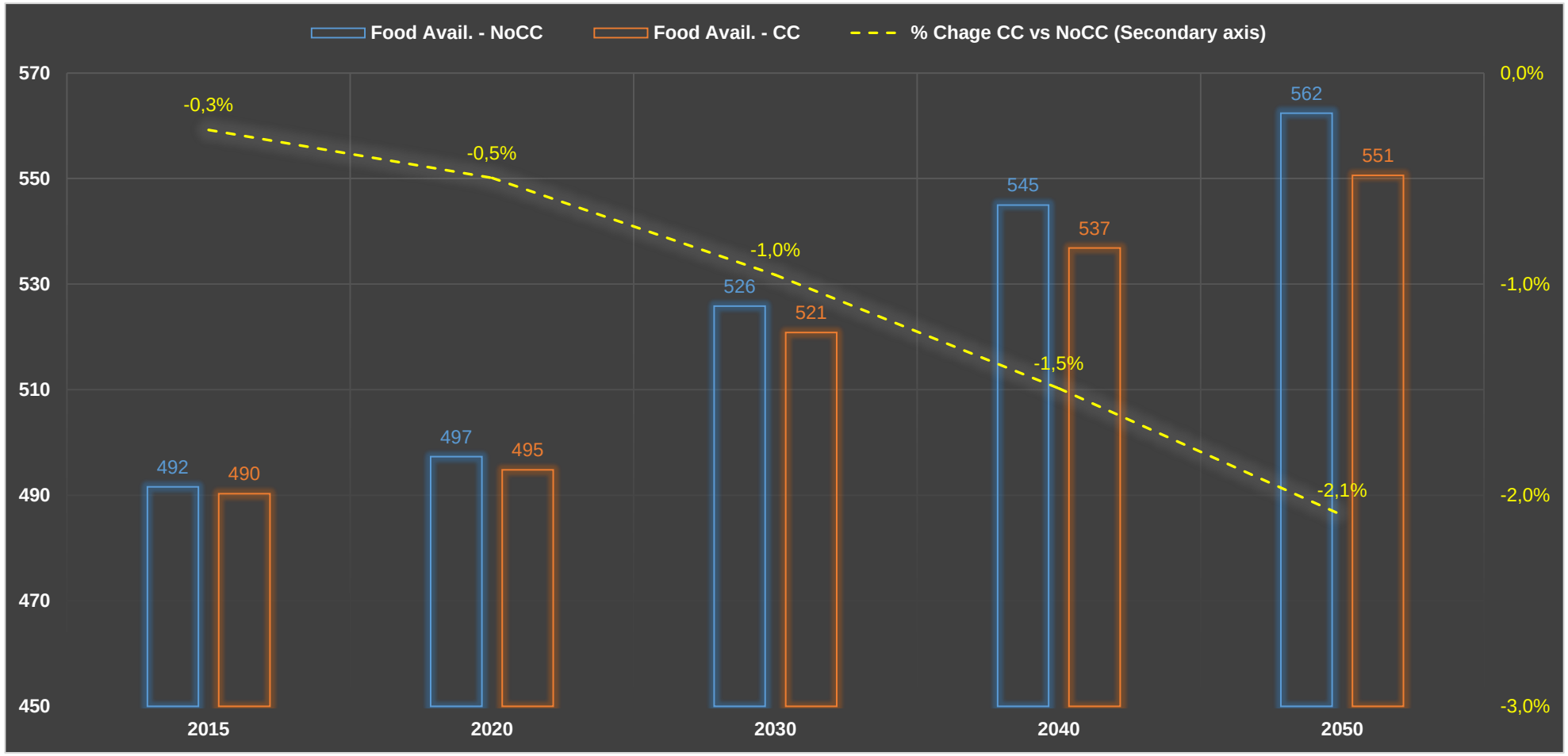


Overall welfare CC vs NoCC, million USD



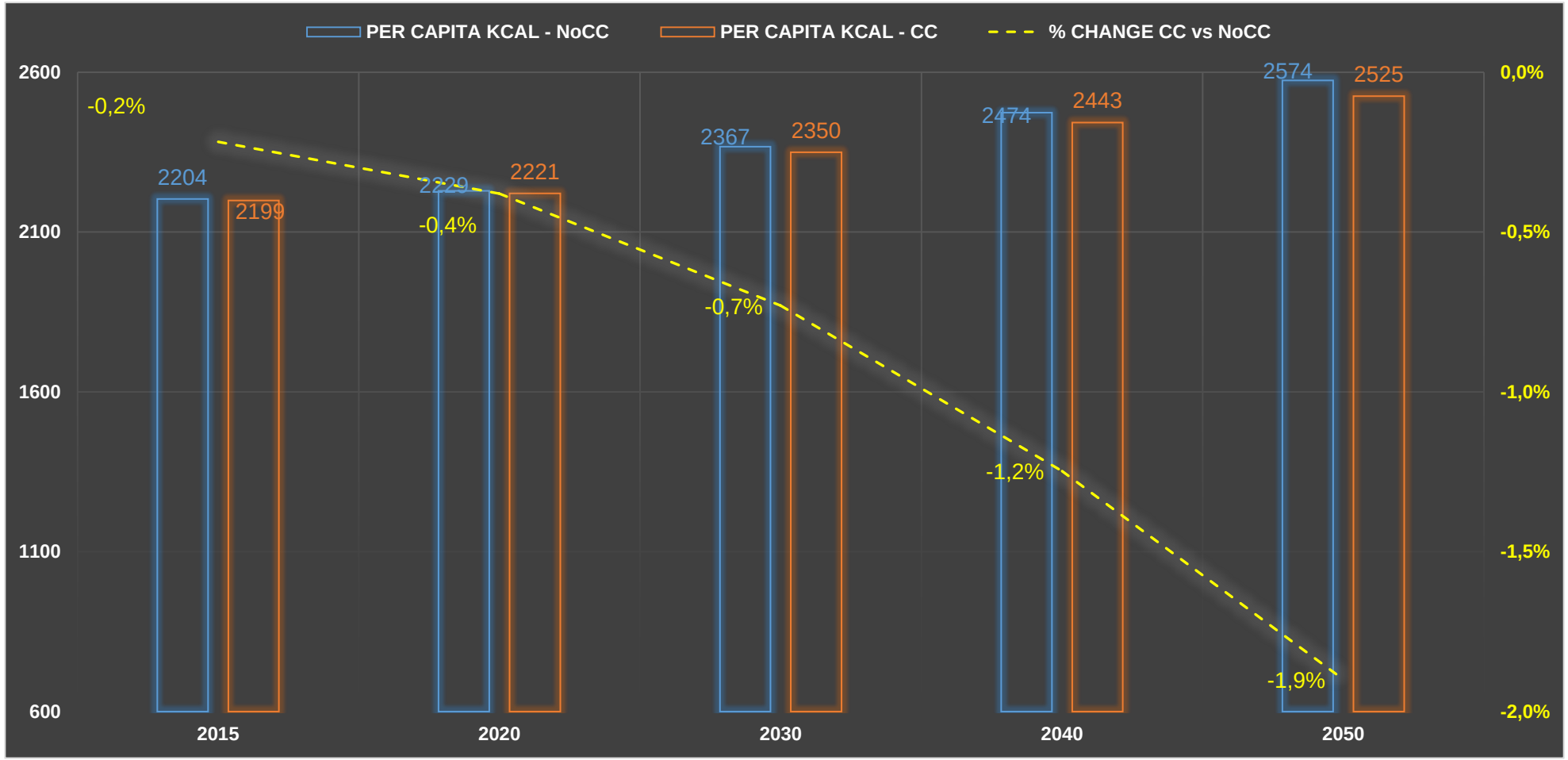
Source: Own compilation based on IMPACT model results

FOOD AVAILABILITY PER CAPITA IN CC VS NoCC, KG



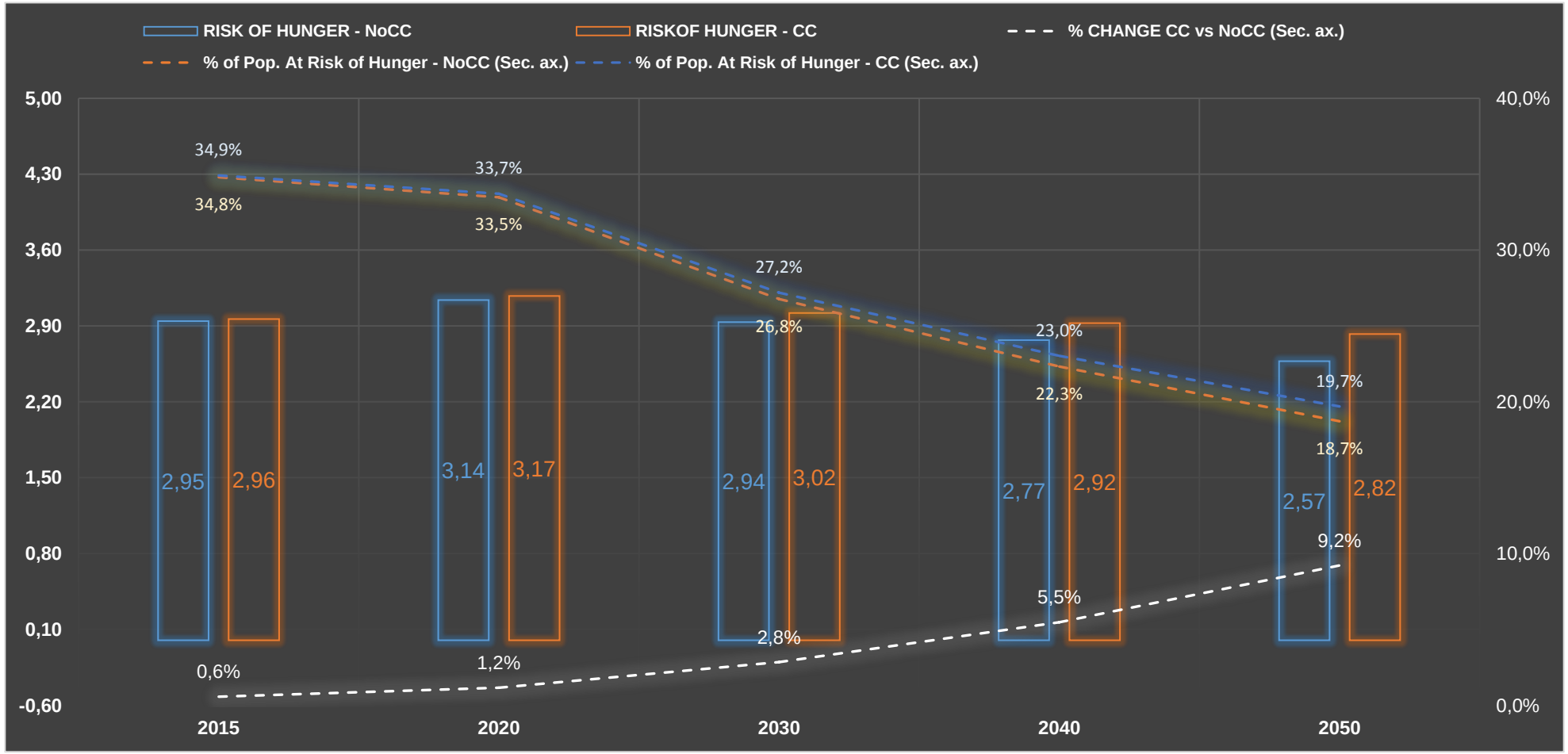
Source: Own compilation based on IMPACT model results

CALORIES PER CAPITA IN CC VS NoCC, KCAL



Source: Own compilation based on IMPACT model results

POPULATION AT RISK OF HUNGER IN CC VS NOCC, MLN



Source: Own compilation based on IMPACT model results

CONCLUSIONS

- Negative impact on yield for most crops (except cotton and potato);
- Supply of agriculture commodities will decrease (with exception on commodity levels for cotton, potato and rice);
- Demand for agriculture commodities will decrease;
- Overall welfare loss;
- Negative impact on food security:
  - Decline of food availability and calories per capita;
  - Increase of number of population at risk of hunger.

POLICY IMPLICATION

- Climate change mitigation and adaptation as a key strategic priority;
- Overcome of fragmentation and duplication of climate change related activities;
- Regional cooperation on mitigation and adaptation measures, research and development;
- Introducing of water saving technologies;
- Introducing dry tolerant and hot tolerant varieties of crops;
- Expansion of area under the crops which gain in yield due to climate change.

THANK YOU!

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