SAMARKAND Conference
2-4 November 2016, Uzbekistan

Agricultural Production, Welfare and Food Security under Climate Change in Tajikistan

Jovidon Aliev

OUTLINE

- **1. RATIONALE**
  - 1.1. Tajikistan climate and agriculture overview
  - 1.2. Climate change effects
  - 1.3. Vulnerability and adaptation capacity
- **2. OBJECTIVE & RESEARCH QUESTIONS**
  - 2.1. Objective
  - 2.2. Research questions
- **3. METHODOLOGY**
- **4. RESULTS**
  - 4.1. Simulated scenarios
  - 4.2. Projection of precipitation and temperature change
  - 4.3. Crop yields and area
  - 4.4. Supply and demand
  - 4.5. Welfare effects
  - 4.6. Effects on population
- **5. CONCLUSIONS**
  - 5.1. Climate Change Challenges
  - 5.2. Policy implication

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1.1. Tajikistan climate and agriculture overview

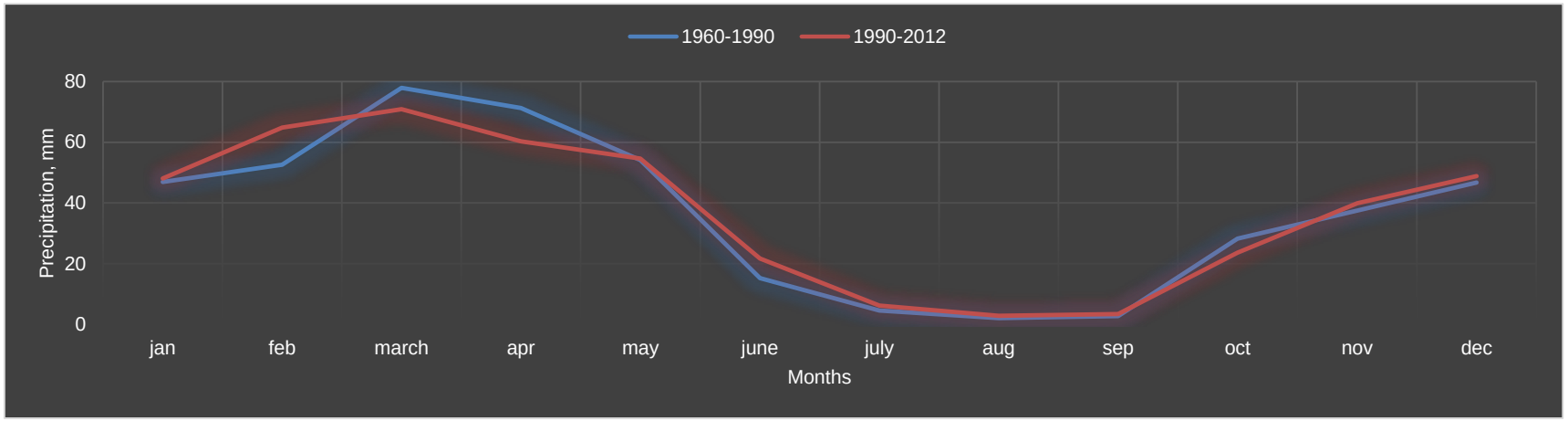
- **1. CLIMATE**
  - Continental, subtropical and semiarid
  - Average temperature:
    - July: 23…30 ^{o}C
    - January: -1…3 ^{o}C
  - Average precipitation level 760 mm, but unevenly distributed
  - Annually 64 km^3 or ~60% runoff of Aral sea basin

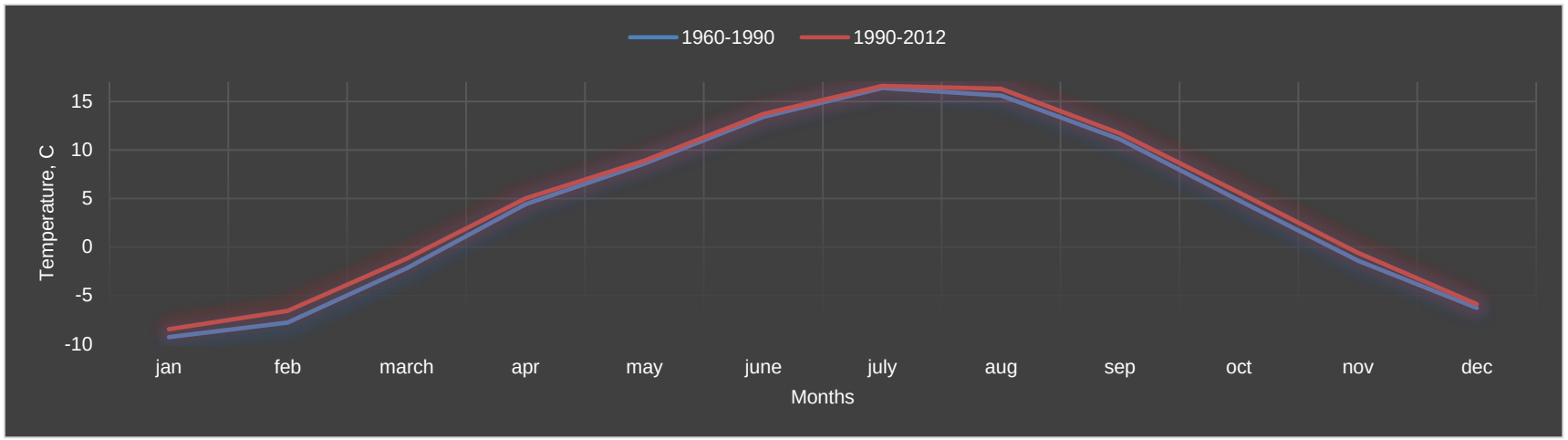
Source: Water for Life Conference, Dushanbe 8-10 June 2015.

- **2. AGRICULTURE**
  - Share of agriculture is ~22% in GDP (2010-2015)
  - Share of agriculture is ~55% of employment
  - ~75% of population live in rural areas
  - Number of farms is 175 000
  - Average farm size is ~4,5 ha of arable land

Source: Agency of Statistics, Land Committee.

1.2. Climate change effects





Source: World Bank, World Development Indicators, 2015.

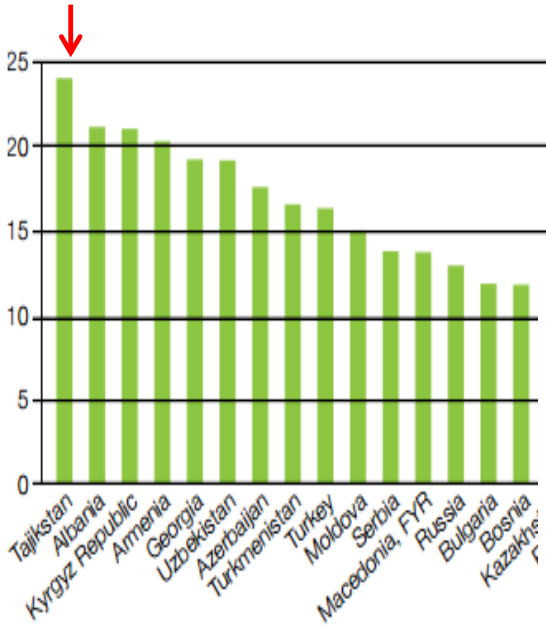
1.2. Climate change effects

- **Change in precipitation pattern (less in March-May)**
- **Annual average temperature change, 2015 against 1960:**
  - Mountains – 0.7-1.2^{0}C;
  - Highlands areas – 0.1-0.7 ^{0}C;
  - Cities – 1.2-1.9^{0}C;
- **Glaciers volume decrease – 20%;**
- **Area of glaciers decrease – 30%.**

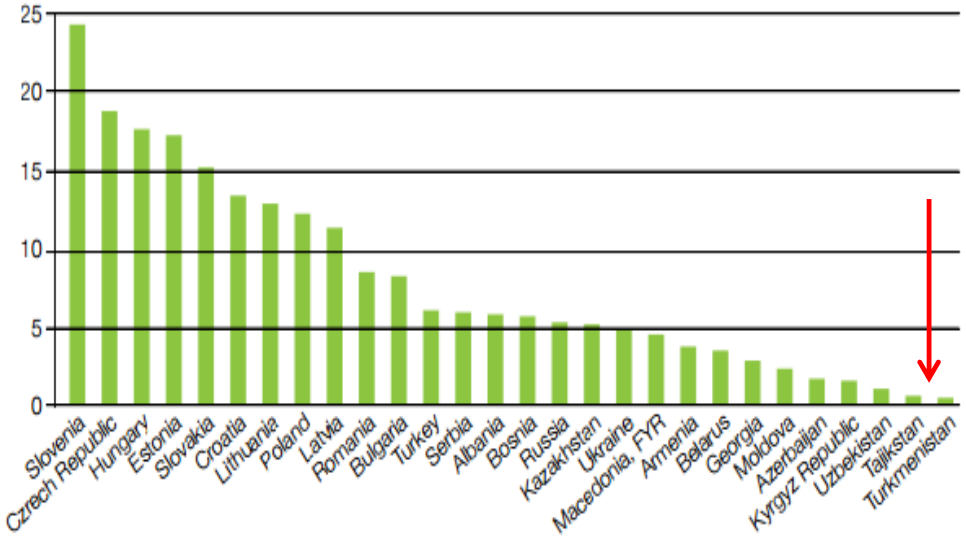
Source: Water for Life Conference, Dushanbe 8-10 June 2015.

1.3. Vulnerability and adaptation capacity

Climate change vulnerability in ECA (Europe & Central Asia) region



Capacity to adapt to climate change in ECA region



Source: Fay and Patel (2008), World Bank (2009)

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2. Objective & research questions

2.1. The objective: This study examines the effects of climate change on agricultural production, food security, consumer and producer welfare changes.

2.2. **The main research questions are:**

- How the climate change will affect agricultural production, producer and consumers in Tajikistan?
- What is the effect of climate change on food security?

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3. METODOLOGY

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

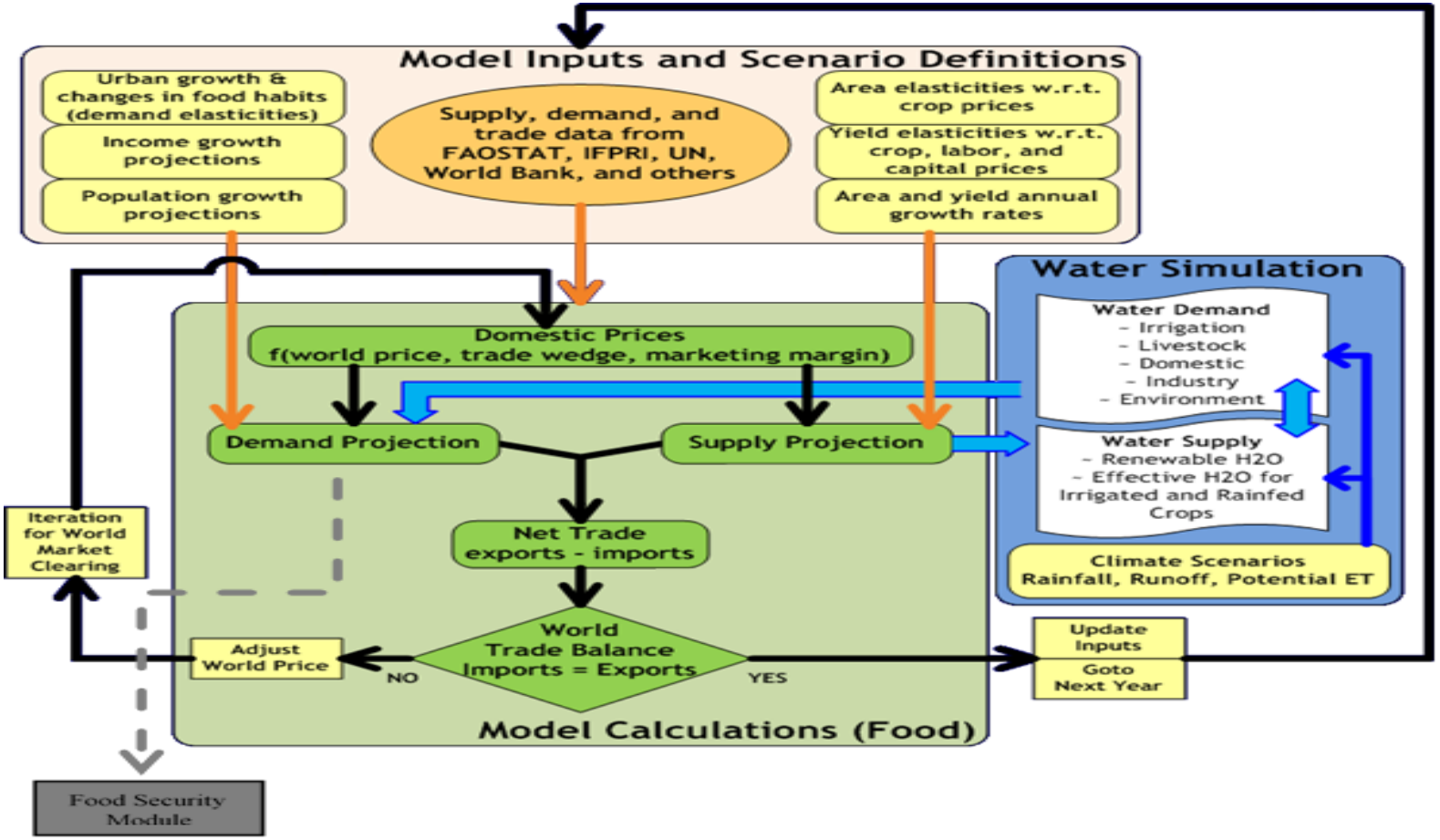
- developed by **International Food Policy Research Institute (IFPRI);**
- is a global partial equilibrium model;
- Is an analytical tool to research impact of demographics, trade, investment, climate change, water etc. on agriculture, food security, welfare.

- **The modules of IMPACT:**
  - Water simulation;
  - Food;
  - Crop;
  - Malnutrition;
  - Welfare;
  - Cost benefit.

- **IMPACT covers:**
  - 56 agricultural commodities;
  - 159 countries;
  - 154 water basins (including Amudarya and Syrdarya);
  - 320 food production units (FPU).

Source: Rosegrant et al. (2012)

3. METODOLOGY



Source: Rosegrant et al. (2012)

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4.1. Simulated scenarios

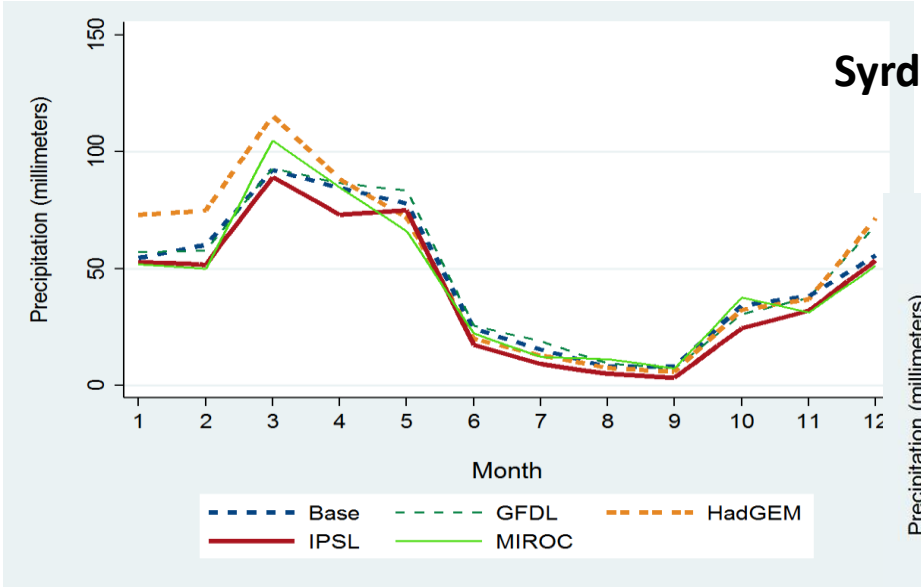
Five scenarios, one baseline scenario (**NoCC**) and four climate change scenarios (**CC**) are simulated using **IMPACT**:

- **Baseline scenario,** i.e. business as usual or no climate change scenario serve as a reference scenario;
- **MIROC Climate Change Scenario:** Model for Interdisciplinary Research on Climate (MIROC), developed at the University of Tokyo Center for Climate System Research
- **Hadgem Climate Change Scenario:** Climate Change Scenario developed by Hadley Centre Global Environment Model (Hadgem), UK,
- **GFDL Climate Change Scenario:** Geophysical Fluid Dynamics Laboratory GFDL, Princeton University Forrestal Campus
- **IPSL Climate Change Scenario:** Institute Pierre Simon Laplace (IPSL) Global Climate Modelling Centre (France)

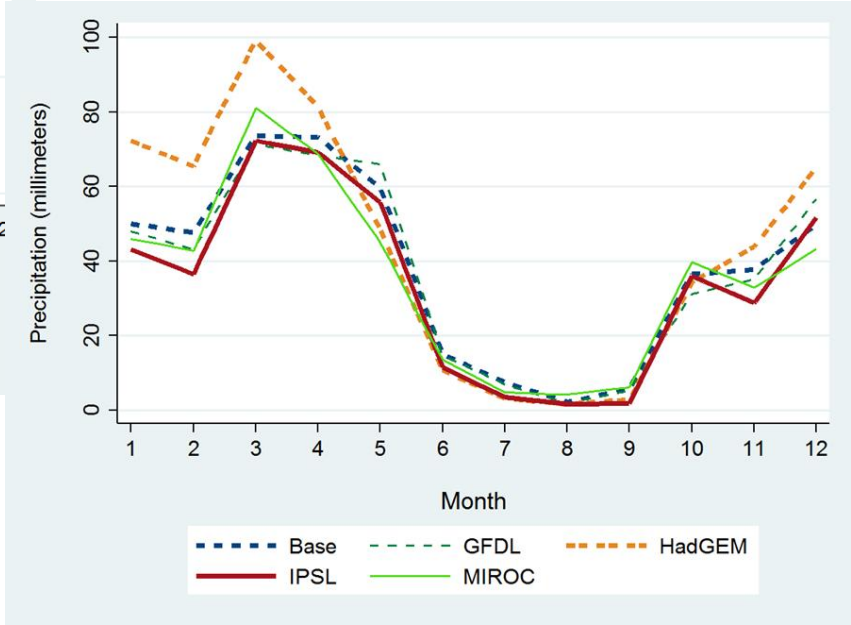
In this study mean of these four climate change scenarios used.

4.2. Projection of precipitation change

Amudarya basin monthly precipitation change



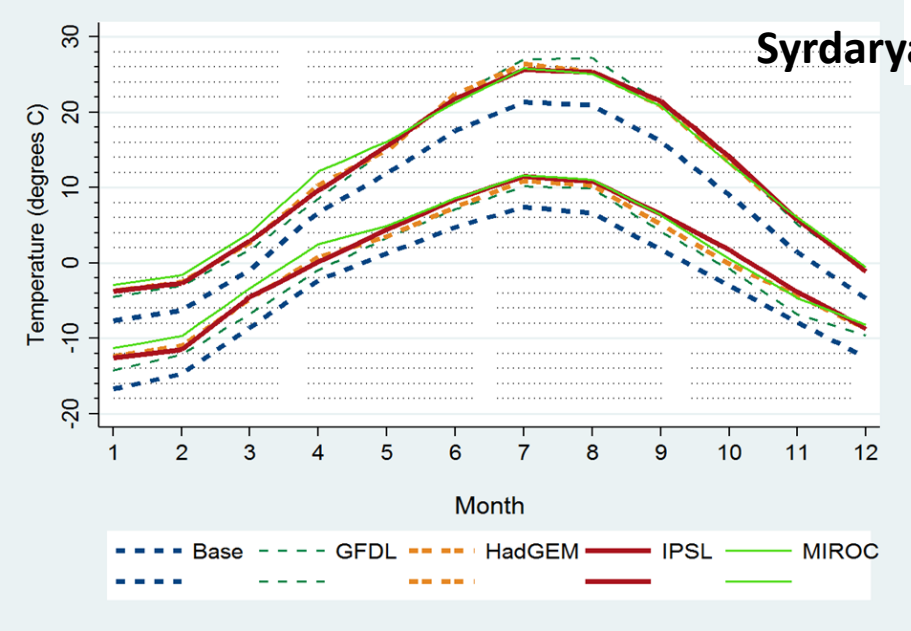
Syrdarya basin monthly precipitation change



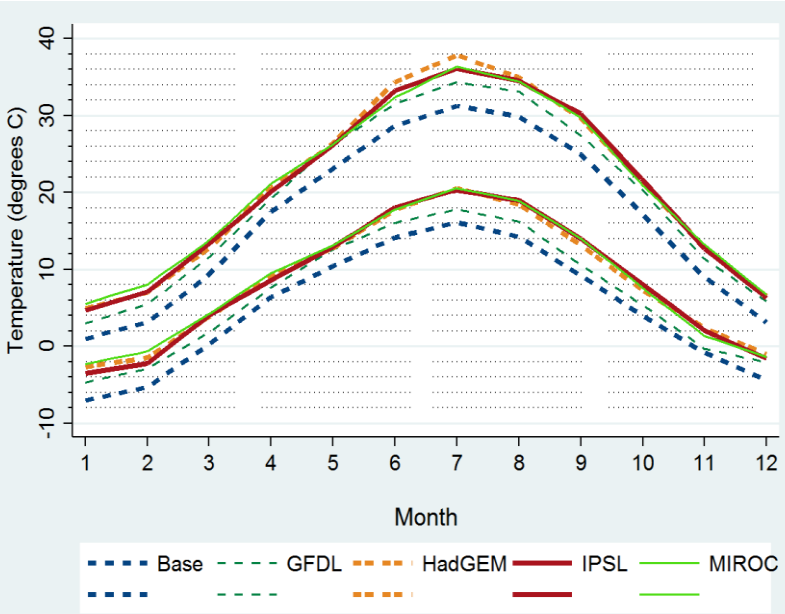
Source: SPAM data

4.2. Projection of temperature change

Amudarya basin monthly temperature change

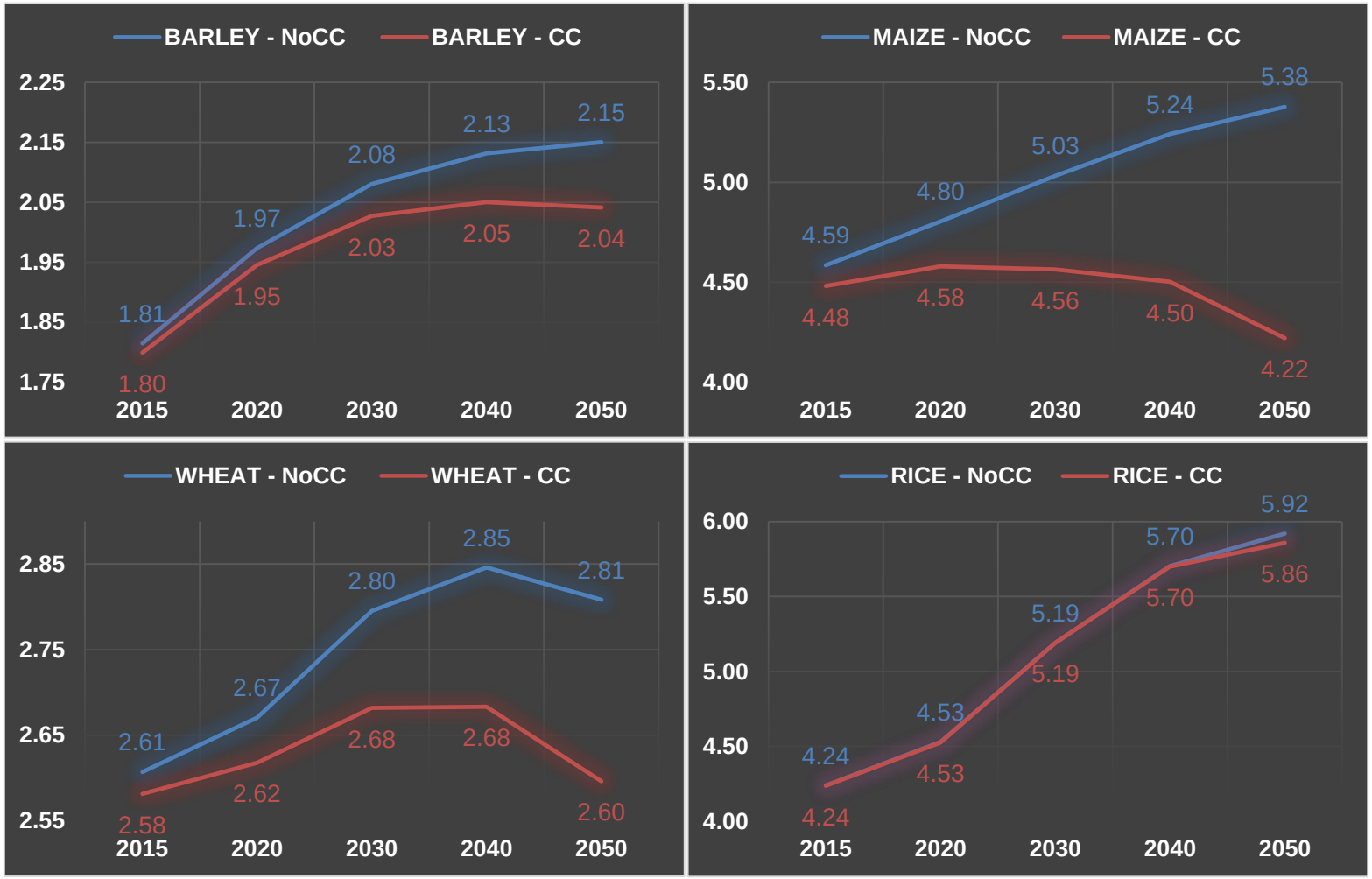


Syrdarya basin monthly temperature change



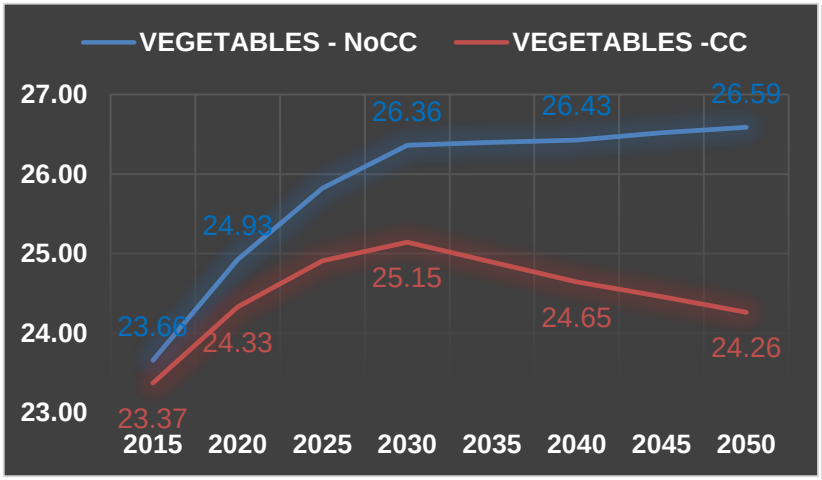
Source: SPAM data

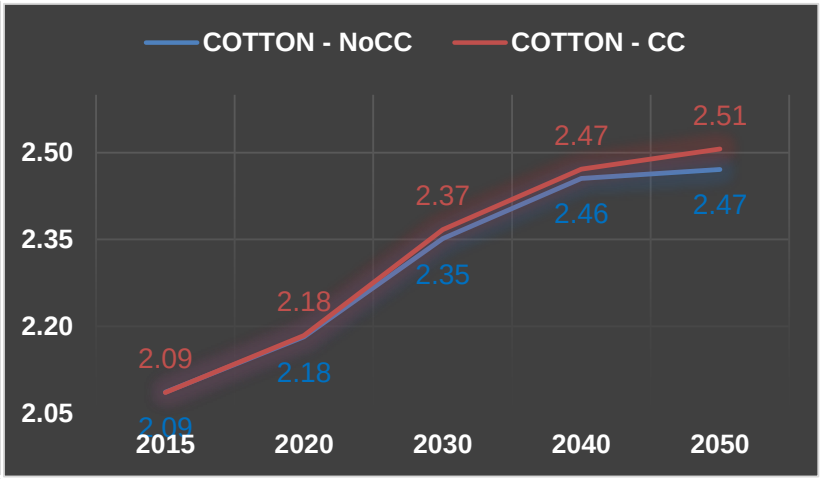
4.3. Crops yields in CC vs NoCC, Mt/Ha

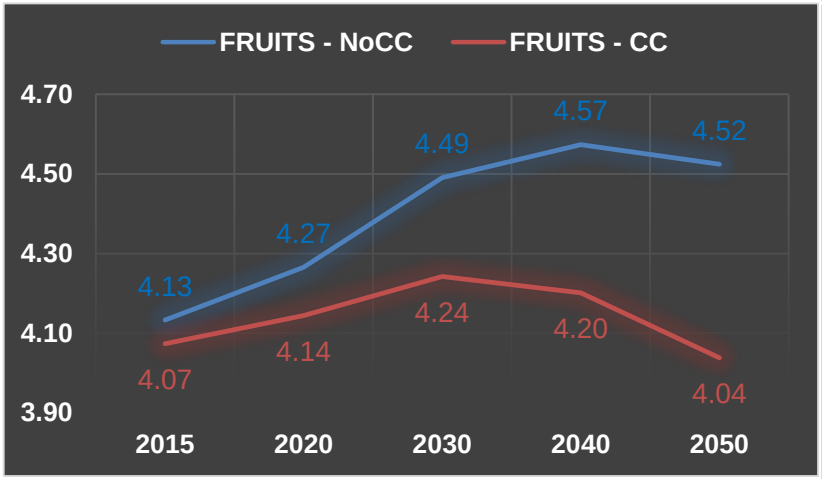


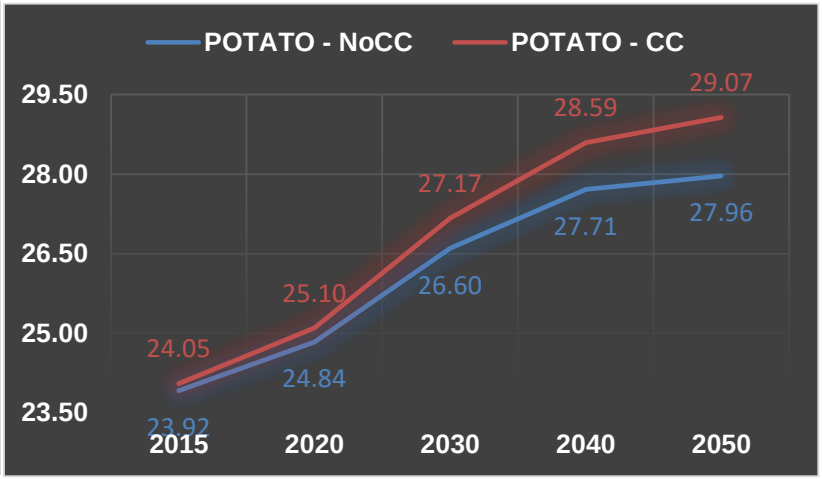
Source: Own compilation based on IMPACT model results

4.3. Crops yields in CC vs NoCC, Mt/Ha



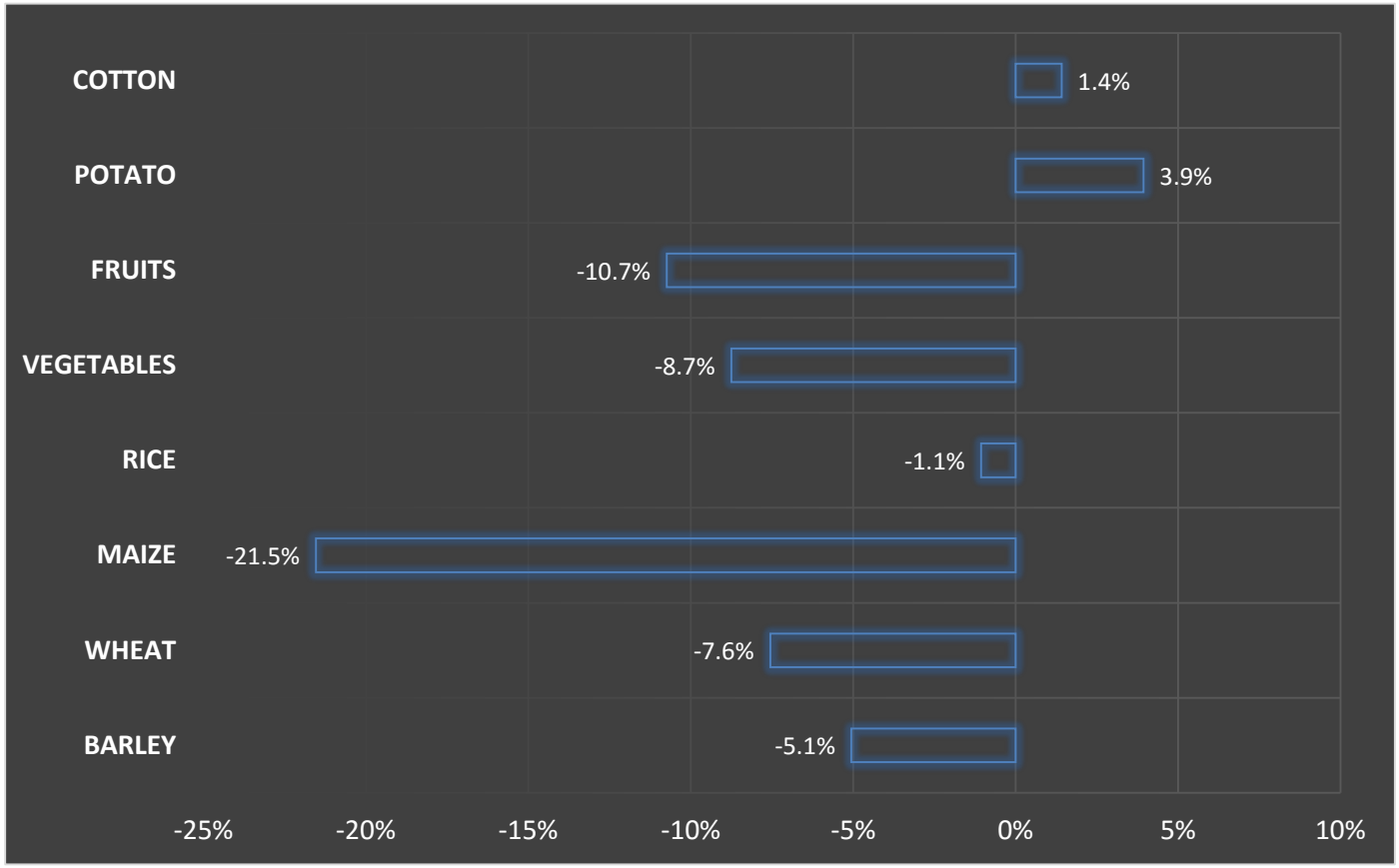






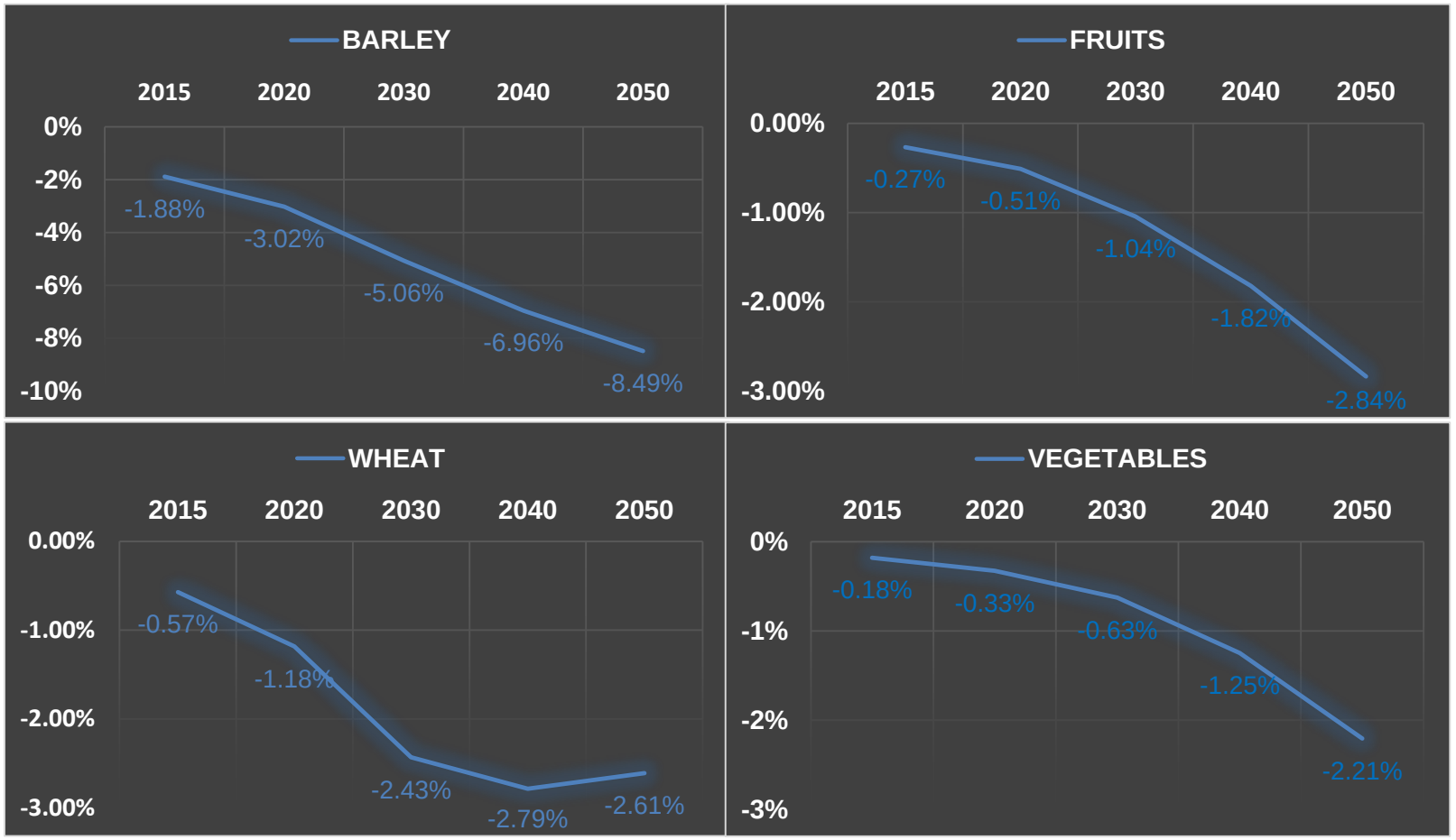
Source: Own compilation based on IMPACT model results

4.3. Changes in crops yields in CC vs NoCC, % (2050)



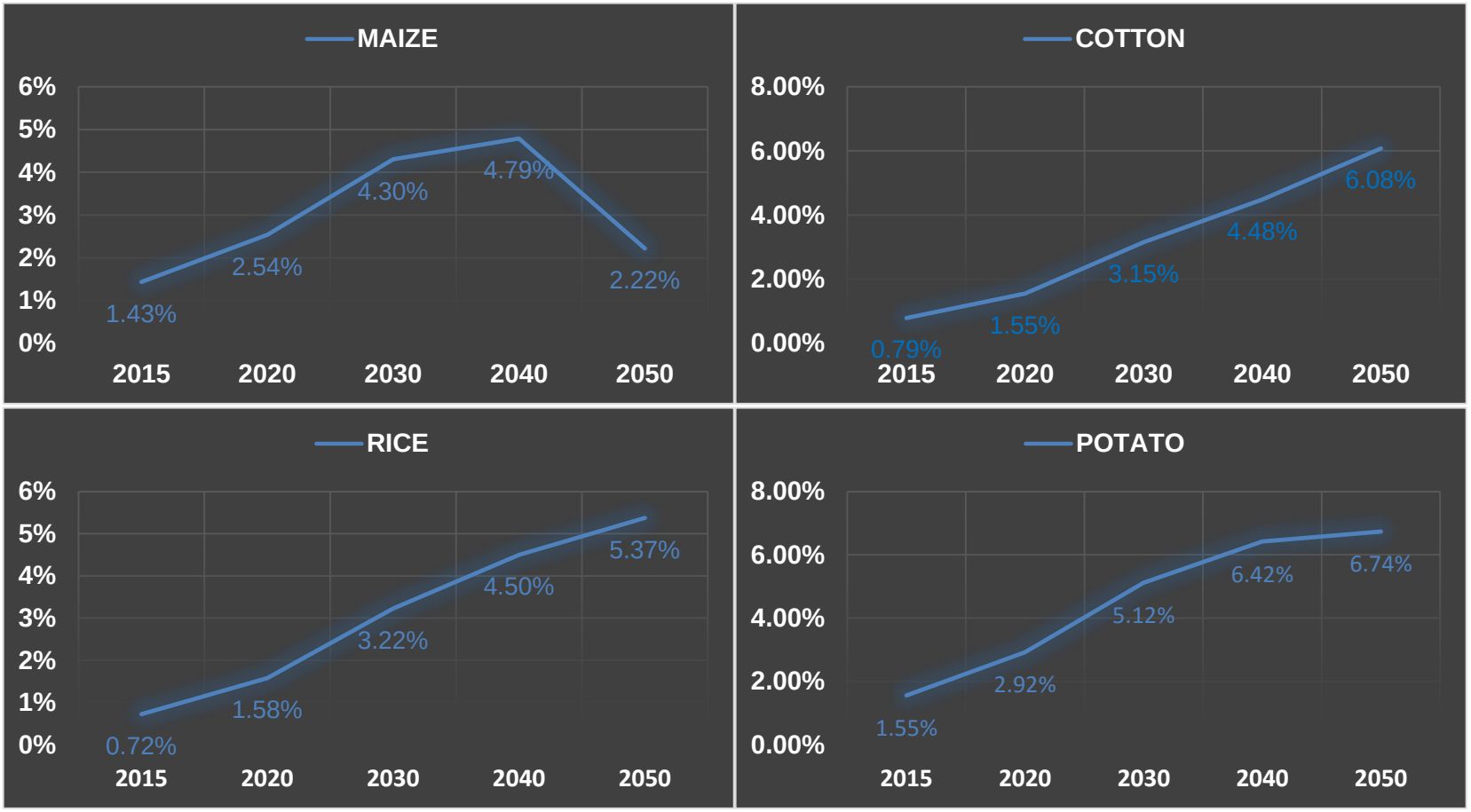
Source: Own compilation based on IMPACT model results

4.4. Changes in crops area in CC vs NoCC, %



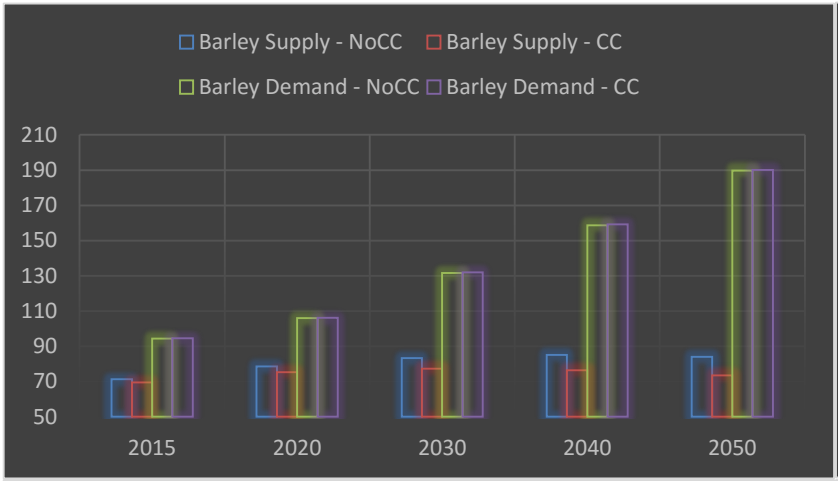
Source: Own compilation based on IMPACT model results

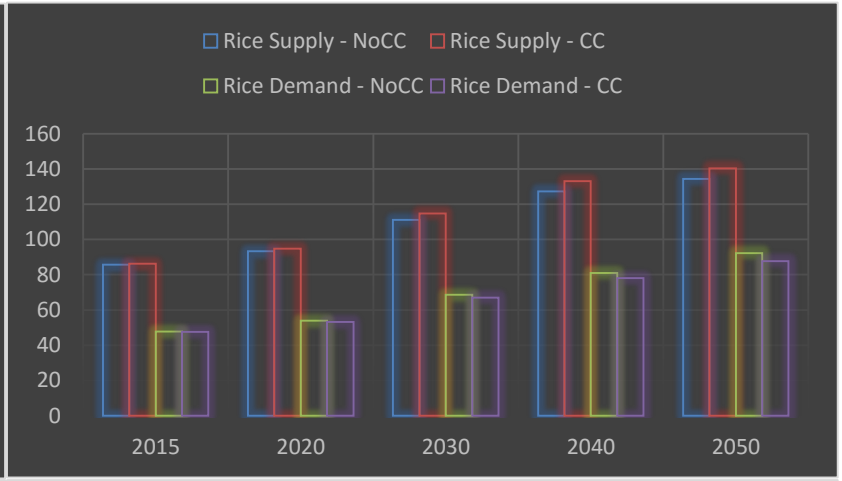
4.4. Changes in crops area in CC vs NoCC, %

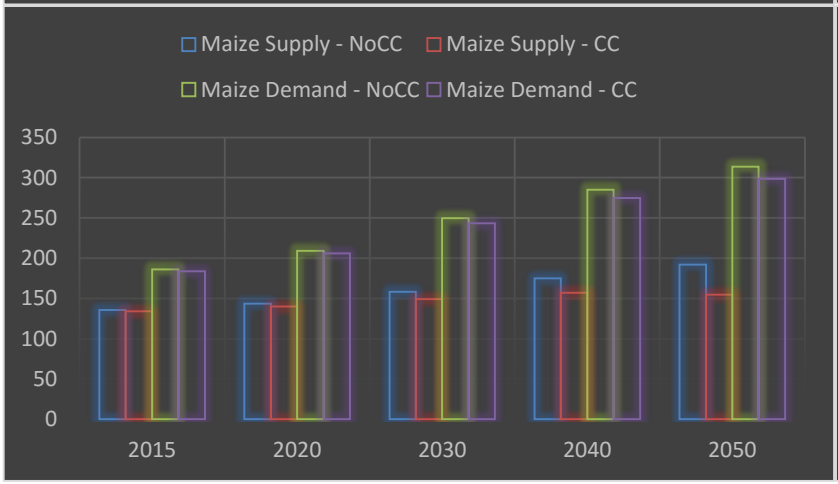


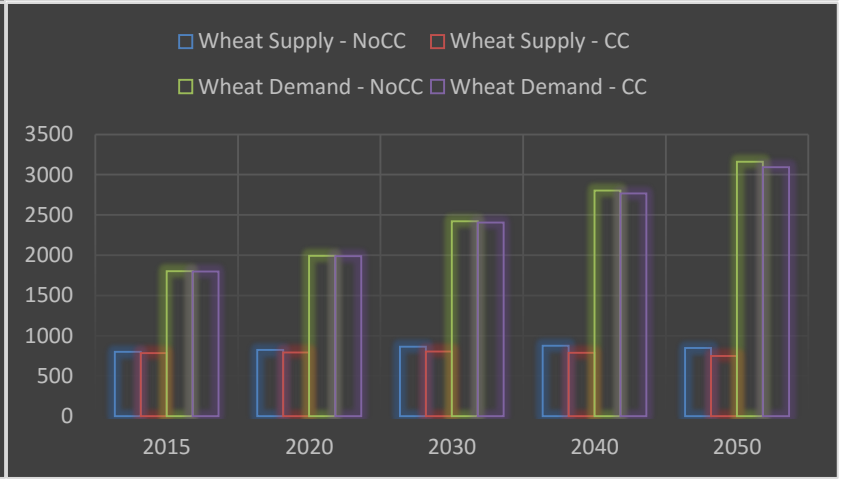
Source: Own compilation based on IMPACT model results

4.4. Crops Supply and Demand in CC vs NoCC, 000 mt



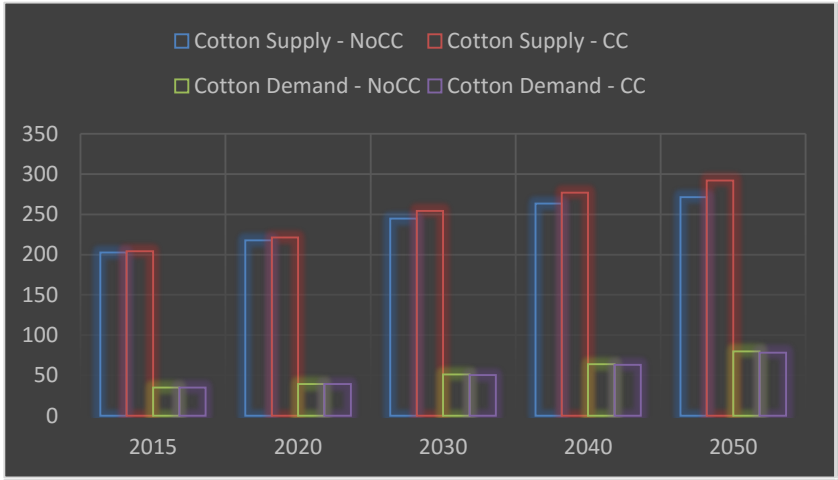


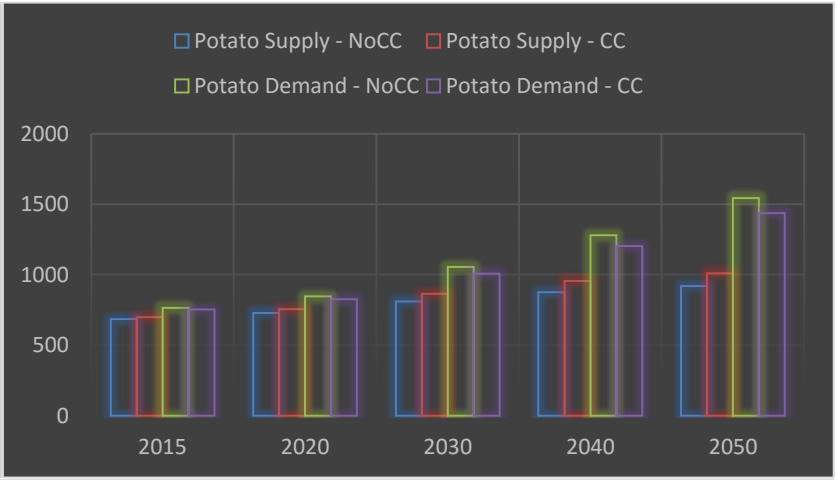


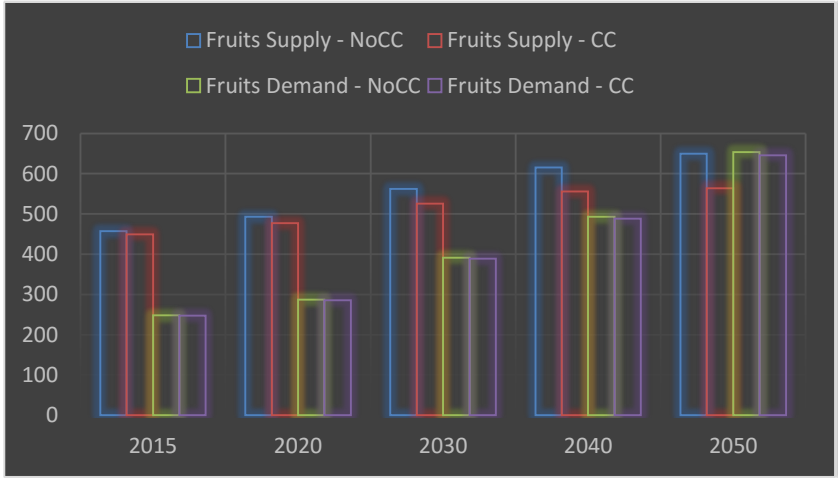


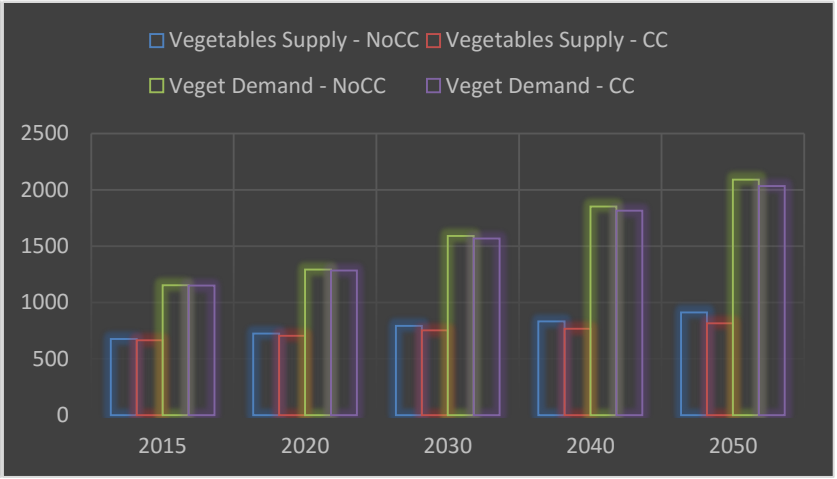
Source: Own compilation based on IMPACT model results

4.4. Crops Supply and Demand in CC vs NoCC, 000 mt



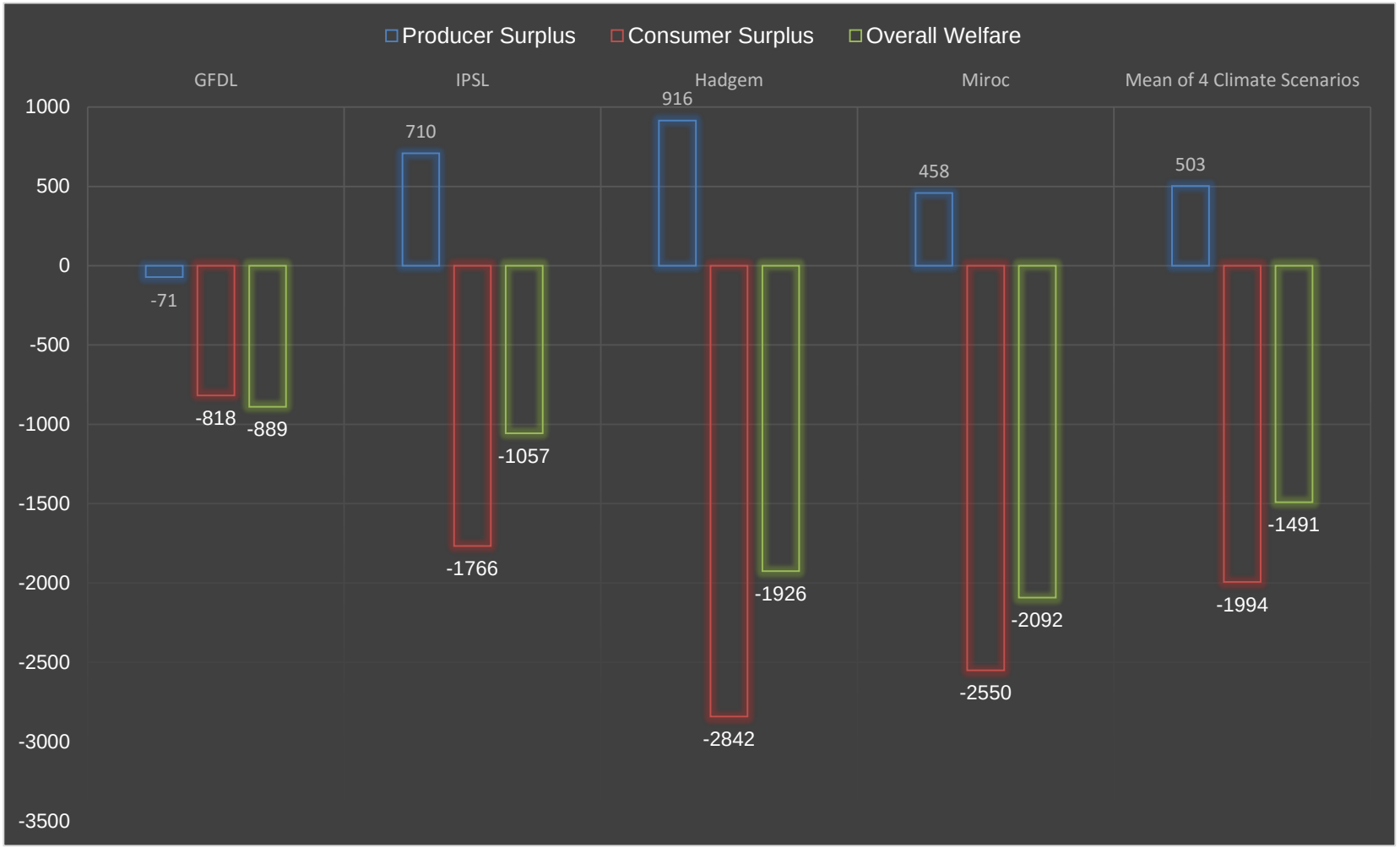






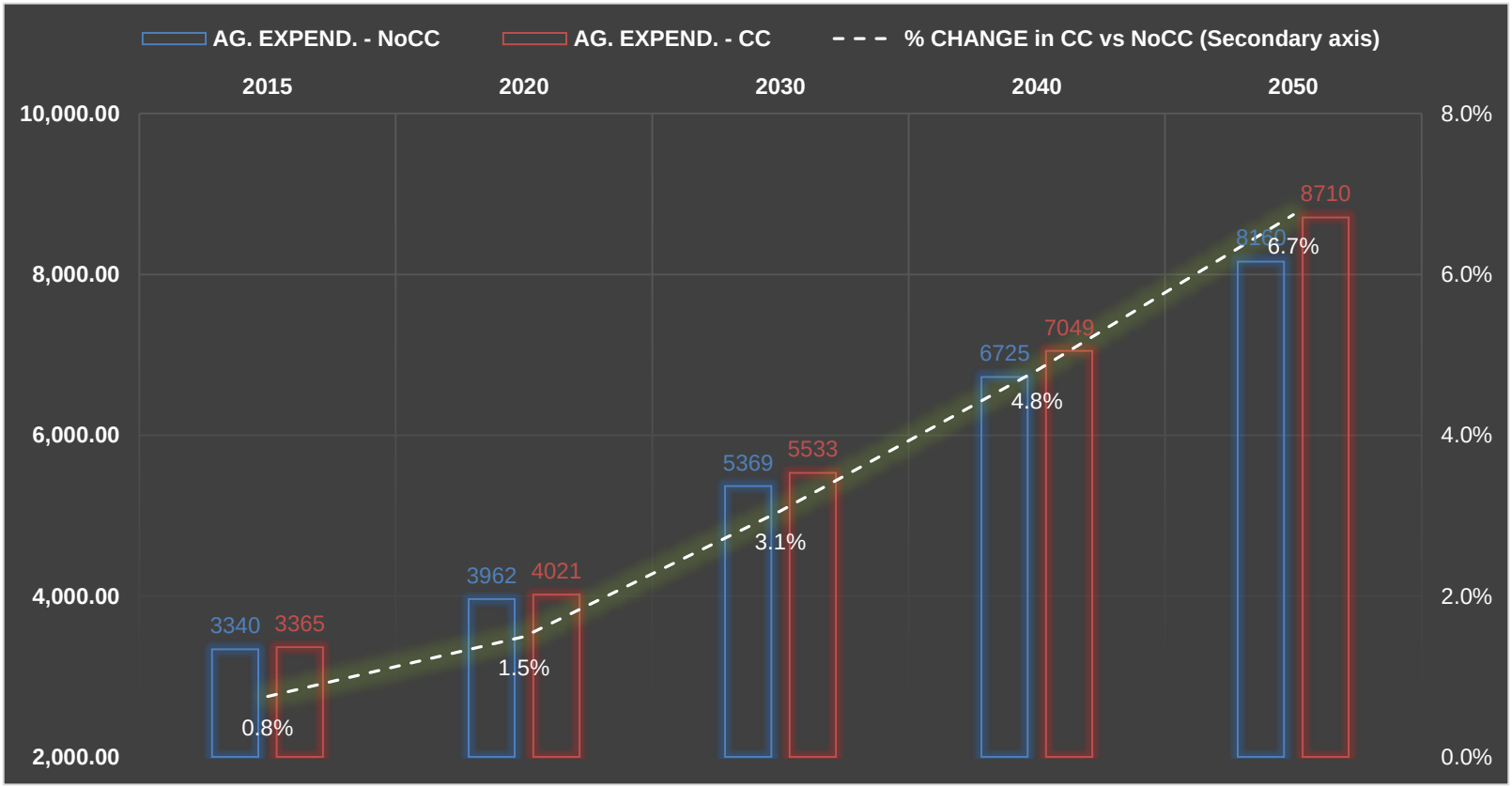
Source: Own compilation based on IMPACT model results

4.5. Welfare effects in CC vs NoCC, 000 USD



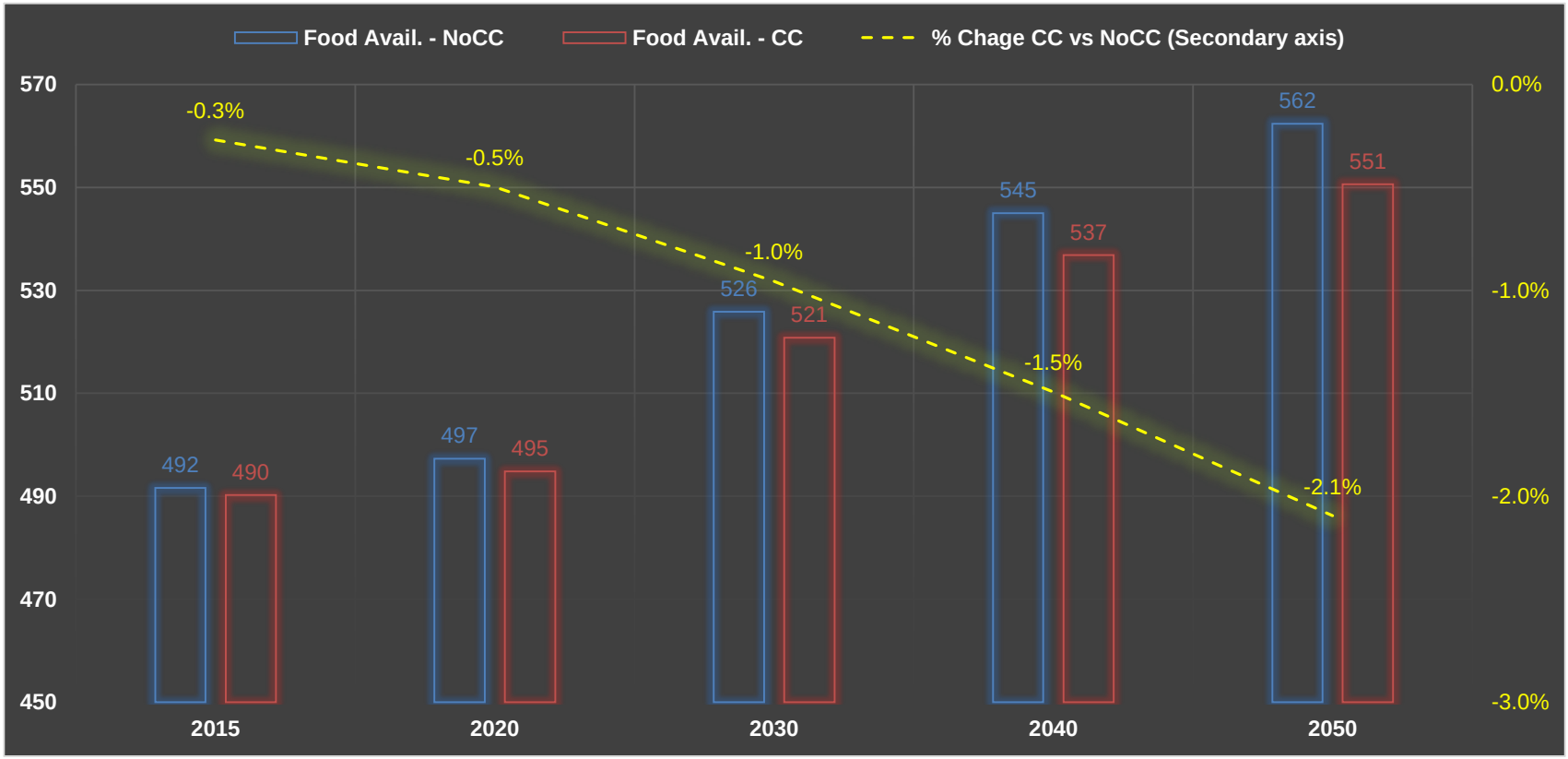
Source: Own compilation based on IMPACT model results

4.5. Agriculture expenditure in CC vs NoCC, 000 USD



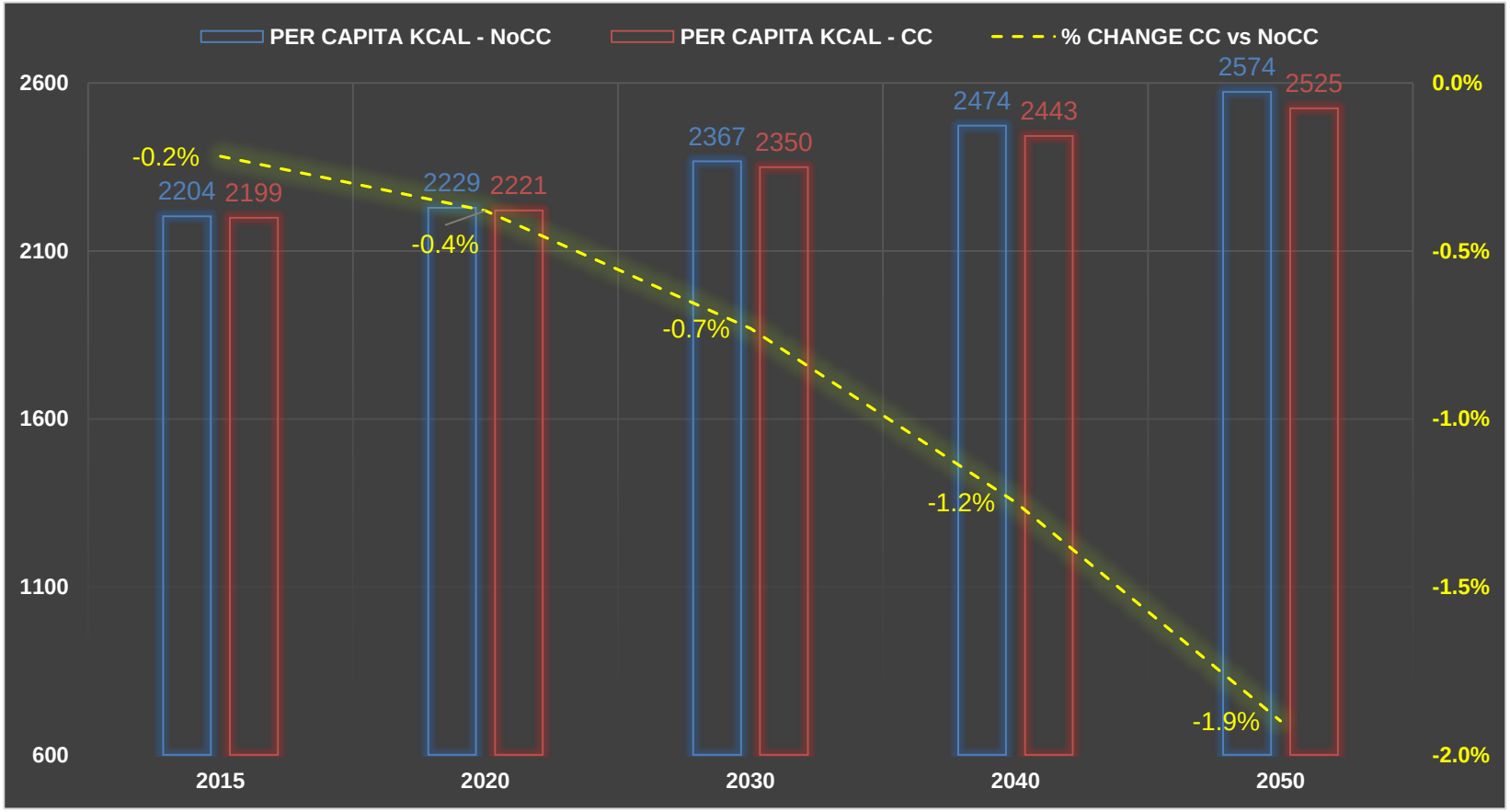
Source: Own compilation based on IMPACT model results

4.6. Food Availability in CC vs NoCC, kg per capita



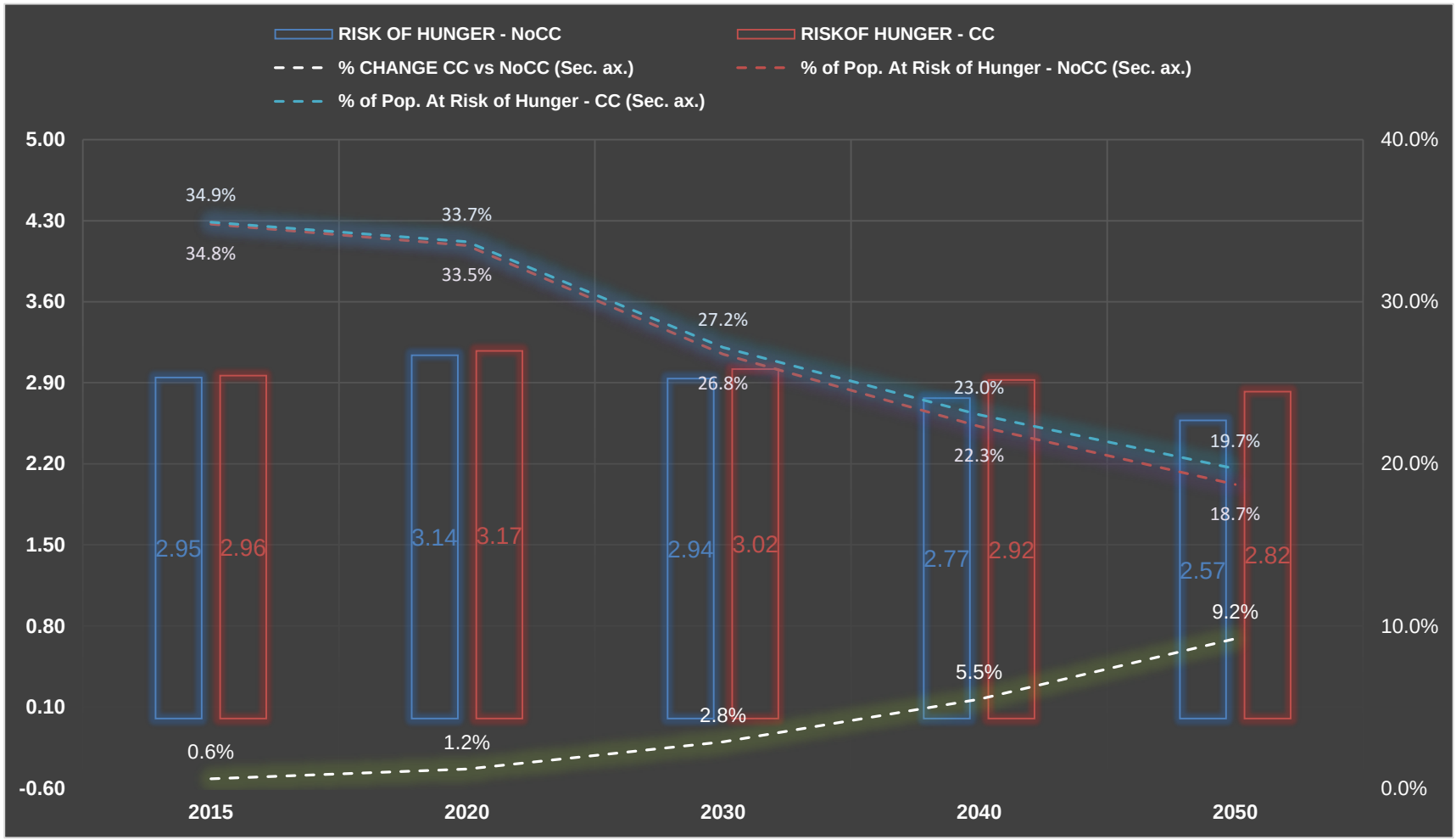
Source: Own compilation based on IMPACT model results

4.6. Per capita calories in CC vs NoCC, Kcal per capita



Source: Own compilation based on IMPACT model results

4.6. Number of people in risk of hunger in CC vs NoCC, million people



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5.1. Climate change challenges

- Negative impact on yield for most crops (except cotton and potato);
- Agriculture supply and demand decrease (except cotton, potato and rice supply);
- Welfare loss (producers gain due to high prices);
- Agriculture expenditure increase;
- Negative impact on Food Security (food availability, calories per capita, population at risk of hunger)

5.2. Policy implication

Adaptation to climate change:

- **Climate change mitigation as a key strategic priority;**
- **Overcome of fragmentation and duplication;**
- **Enhance the capacity of all stakeholders (including farmers, rural population);**
- **Introducing of water saving technologies;**
- **Introducing of varieties tolerant to low moisture or drought;**
- **Introducing of varieties tolerant to higher temperatures;**

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THANK YOU!

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