FAO, Economic Analysis of the Impact of Climate Change on Agriculture in Arid Regions

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Overview

- Key Messages
- Climate Change Impact on Agriculture
- Yemen Case Study
- FAO Recommendation

Key Messages From FAO

- UNTIL ABOUT 2030, GLOBAL WARMING IS EXPECTED TO LEAD TO BOTH GAINS AND LOSSES in the productivity of crops, livestock, fisheries and forestry, depending on places and conditions.

- BEYOND 2030, THE NEGATIVE IMPACTS OF CLIMATE CHANGE ON AGRICULTURAL YIELDS will become increasingly severe in all regions.

- IN TROPICAL DEVELOPING REGIONS, adverse impacts are already affecting the livelihoods and food security of vulnerable households and communities.

- BECAUSE AGRICULTURE, LAND-USE AND FORESTRY make a considerable contribution to greenhouse gas emissions, they have significant mitigation potential.

SUMMARY OF CLIMATE CHANGE IMPACTS ON AGRICULTURE

- Increased frequency and intensity of extreme climate events such as heat waves, droughts and floods, leading to loss of agricultural infrastructure and livelihoods
- Decrease in fresh water resources, leading to water scarcity in arable areas
- Sea-level rise and coastal flooding, leading to salinization of land and water, and risks to fisheries and aquaculture
- Water and food hygiene and sanitation problems
- Changes in water flows impacting inland fisheries and aquaculture
- Temperature increase and water scarcity affecting plant and animal physiology and productivity
- Beneficial effects on crop production through carbon dioxide "fertilization"
- Detrimental effects of elevated tropospheric ozone on crop yields
- Changes in plant, livestock and fish diseases and in pest species
- Damage to forestry, livestock, fisheries and aquaculture
- Acidification of the oceans, with extinction of fish species

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SOURCES: Adapted from Tirado *et al.* (2010) and updated using Porter *et al.* (2014), HLPE (2012) and IPCC (2014).

Potential Impacts of Climate Change

CROPS AND LIVESTOCK

- Rising temperatures threaten wheat production in North Africa and maize yields region wide
- There is a general decline in water availability, but a slight increase in Sudan and southern Egypt
- In mid-latitudes, higher temperatures lead to richer pastures and increased livestock production
- Warmer winters benefit livestock, but summer heat stress has negative impacts

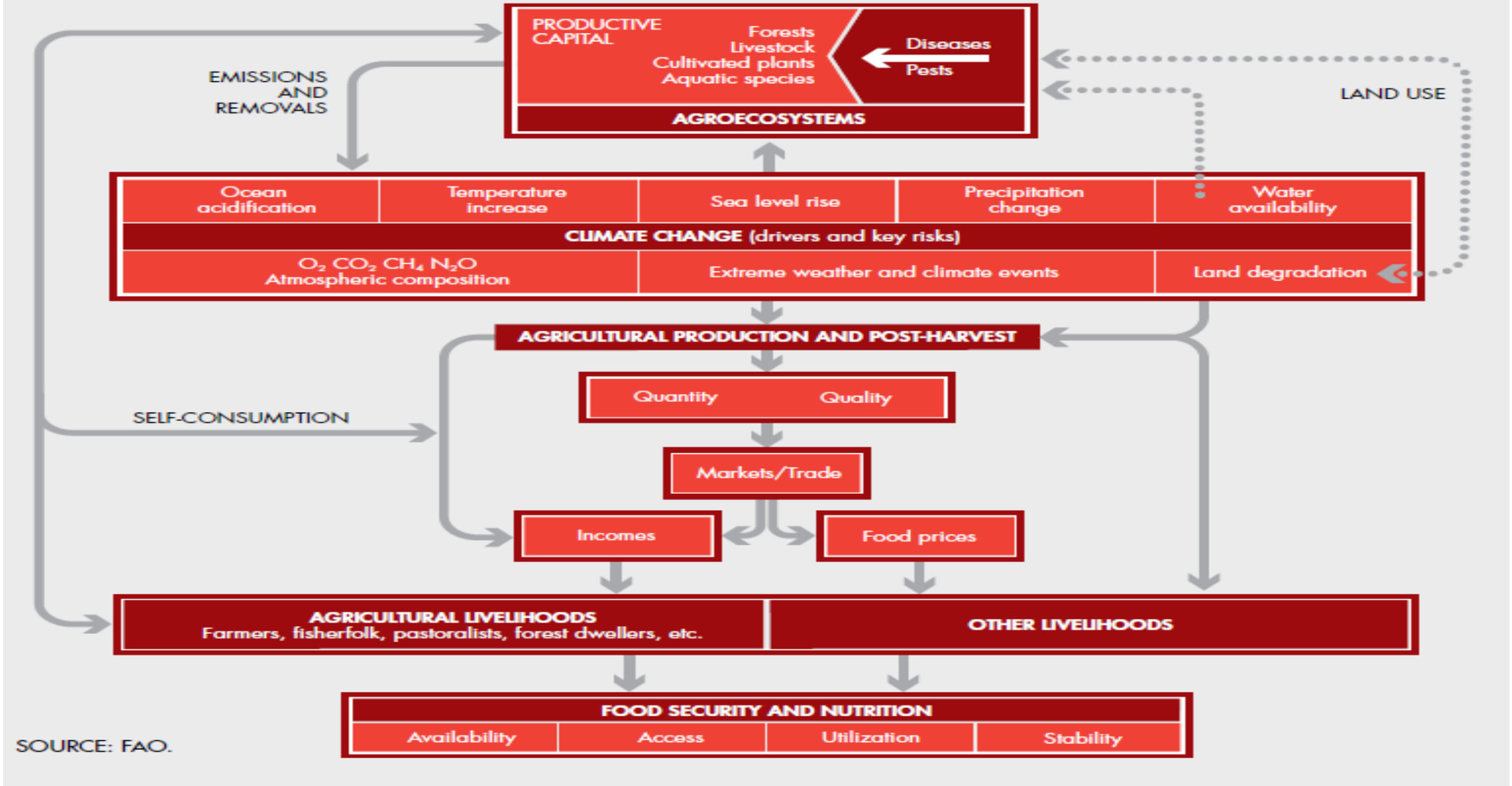
FISHERIES AND AQUACULTURE

- Usable water resources in many Mediterranean and Near East basins decline further
- Warming boosts productivity in the Arabian Sea
- Catch potential falls by as much as 50 percent in some parts of the Mediterranean and Red Seas

FORESTRY

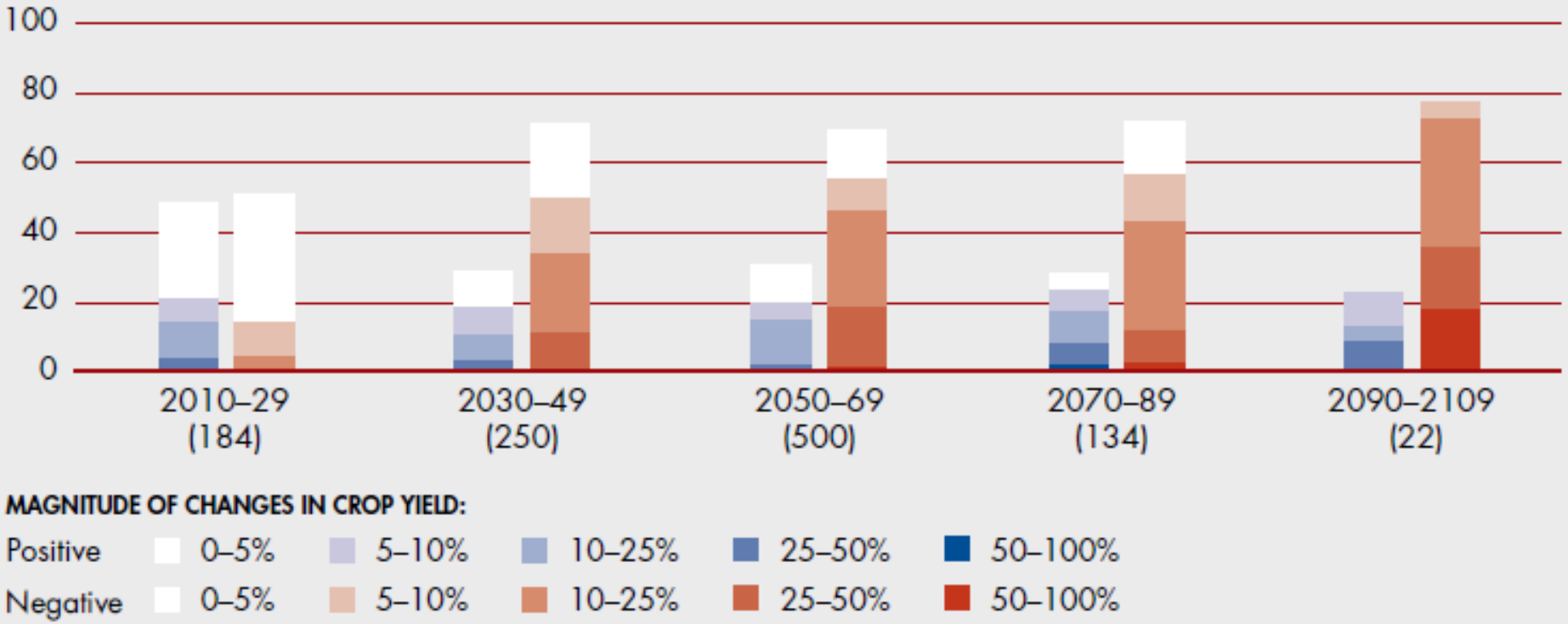
- Soil moisture depletion reduces the productivity of major forest species, increases fire risk, and changes pest and disease patterns
- In the Near East, declining summer rains lead to severe water shortages that affect forest growth

IMPACT PATHWAYS: FROM CLIMATE CHANGE TO FOOD SECURITY



SOURCE: FAO.

PROJECTED CHANGES IN CROP YIELDS FOR ALL LOCATIONS WORLDWIDE OWING TO CLIMATE CHANGE



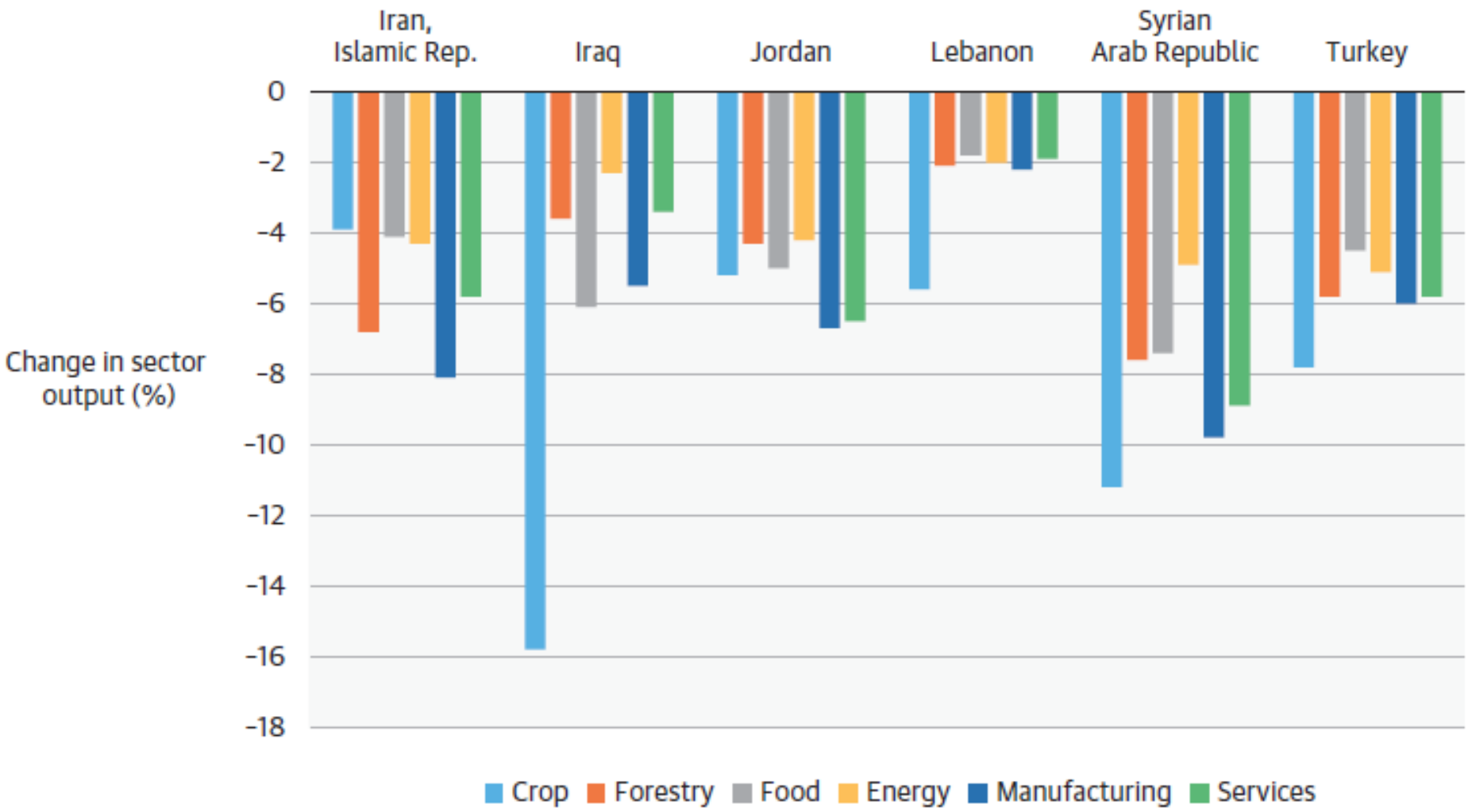
Note: Number of estimates of change in crop yield is shown in parentheses.

SOURCES: Data are the same as those used in Porter *et al.* (2014) and Challinor *et al.* (2014). See Annex table A.1 for details. An updated version of the data is available at CGIAR, CCAFS and University of Leeds (2016).

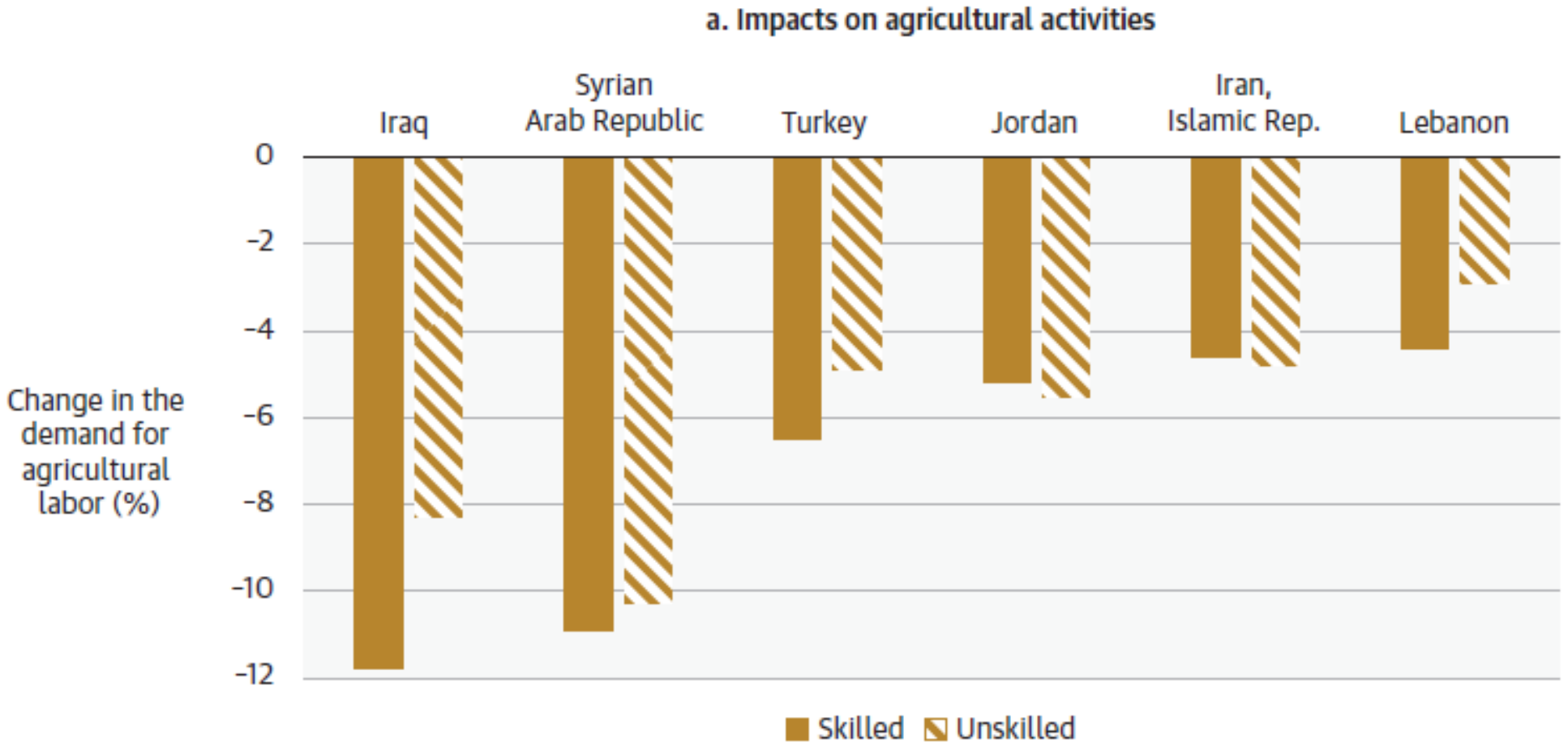
IMPACTS ON INCOMES AND LIVELIHOODS

- The effect of climate change on the production and productivity of the agriculture sectors will translate into mostly negative economic and social impacts, with implications for all four dimensions of food security.
- Climate change can reduce incomes at both the household and national levels.
- Given the high dependency on agriculture of hundreds of millions of poor and food-insecure rural people, the potential impacts on agricultural incomes – with economy-wide ramifications in low-income countries that are highly dependent on agriculture – are a major concern.
- By exacerbating poverty, climate change would have severe negative repercussions on food security.

The Impact of Climate Change-Induced Water Scarcity and Crop Yields Change on Sectoral Outputs



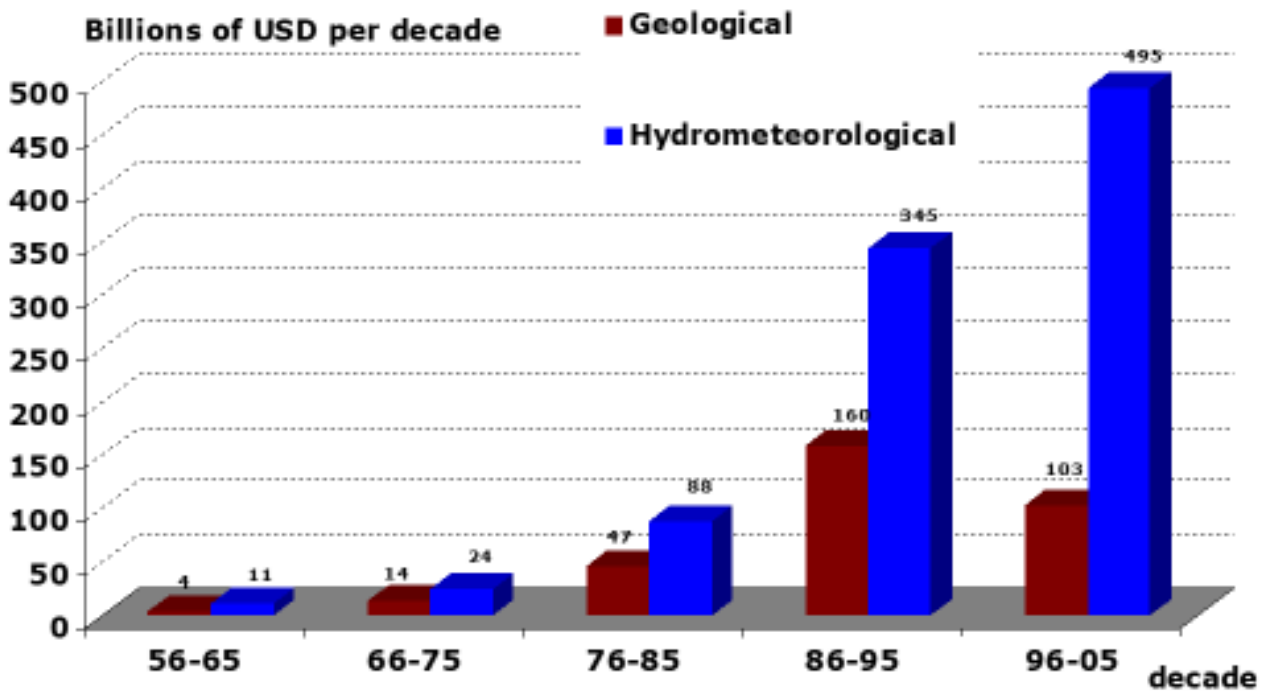
The Impacts of Climate Change-Induced Water Scarcity and Crop Yields Change on the Demand for Unskilled and Skilled Labor in Agriculture and Nonagricultural Activities



Yemen Case Study: Increasing severe weather

- Because of its geographical location (south of latitude 25 north of the equator), Yemen may experience more rain as a result of global warming.
- However, increased rainfall may cause more severe weather conditions, with storms similar to the monsoon winds emanating from the Gulf of Aden.
- In 2008, torrential rains in southeastern Yemen, the gulf of Aden, caused damage and losses estimated at $1.6 billion—equivalent to six percent of the country's gross domestic product.
- In a world where temperatures are rising by more than two degrees Celsius, heat waves can hit the low-lying coastal areas of Yemen, Djibouti and Egypt. Sea water seeps into fresh groundwater aquifers in coastal areas, which raises the degree of salinity of water and soil.

Economic Losses Related to Disasters are on the Way Up !
الخسائر الإقتصادية المتعلقة بالكوارث بتصاعد مستمر



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

Natural disaster which struck Yemen during 1973-2008

Climate Change Induced Floods in Yemen

- The floods have devastating consequences for food security and economic development, in particular in poor societies with limited availability of coping mechanisms.
- Combining a dynamic computable general equilibrium model of the Yemeni economy with a household-level calorie consumption simulation model, an assessment on the economy-wide, agricultural, and food security effects of the 2020 heavy spots of rain and flash flood that hit a lot of parts of governorates.
- The estimation results suggest that agricultural value-added, farm household incomes and rural food security deteriorated in the flood-affected areas.
- Due to economic spillover effects, significant income losses, and increases in food insecurity.

FLOOD Economic Impact

- About 40000-50000 ha of terraces damage by heavy flood
- About 40,000-60,000 HH lose their income
- About 100,000 ha have direct damage by erosion and indirect damage of the spate irrigation structure
- About 80,000-120,000 HH lose their income
- Estimated cost for Rehabilitating irrigation Canals $ 50,504,075
- Estimated cost of damages to Greenhouses $ 3,075,000.00
- Estimated cost of damages to irrigation systems $ 5,740,000.00

FAO Recommendation

- The world faces an Unprecedented Double Challenge: To Eradicate Hunger and Poverty and to Stabilize the Global Climate Before it is Too Late.
- Because Adverse Impacts Will Worsen With Time, A Global Transformation to Sustainable Food and Agriculture Must Begin Now.
- Economically Viable and Sustainable Farming Practices are Available, But Barriers to Their Adoption Must be Overcome.
- Agricultural and Climate Change Finance Need to be Linked and Leveraged to Induce Transformative Change in Agriculture
- Available estimates suggest that the aggregate cost of adaptation and making farm systems more resilient are only a fraction of the costs of inaction.
- CLIMATE CHANGE ALREADY AFFECTS AGRICULTURE AND FOOD SECURITY and, without urgent action, will put millions of people at risk of hunger and poverty.

Key policy insights:

- A limited number of studies assess the costs and benefits of climate change adaptation options for the agricultural sector in the NENA region, with a majority of these published in the last ten years.
- Adapting crop management techniques to climate risks generates a net improvement in Near East and North Africa yields. However, adaptation responses aiming to increase agrosystems resilience show context-specific effectiveness.
- Water management options, which benefit crop water use efficiency to different extents, present relatively high implementation costs.
- Integrated management options show the potential to achieve additional multidimensional benefits. Still, well-designed long-term experiments are required to evaluate these practices in the different farming systems under present and projected climate conditions.
- An urgent need is to promote adaptation research for the various farming systems in the NENA region and to estimate the cost of adaptation measures to guarantee farmer incomes and food security in the face of climate change.