



Vulnerability of Iran to Climate Change and Future Projections

(Key findings from IPCC AR5)

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Climate Change - a global concern

- The very existence, survival, and well-being of humans and all other living beings depend on the existence of favourable climatic conditions on our planet;
- Global Climate has a profound effect on a number of physical and biological systems;
- Natural variability is slow and long drawn with time scale of several hundred to several thousand years;
- There is now evidence that humans are responsible for climate change. The recent GHG emissions are highest in the history, unprecedented in at least 800,000 years.



Regions of Asia

North Asia

Russia, Mongolia,

Central Asia

Northwest China

West Asia (Middle East)

Iran

East Asia

China, Japan, Korea

South Asia

India, Nepal, Pakistan, Bangladesh, Sri Lanka

Southeast Asia

Indonesia, Philippines

Regional Risks of Climate Change - Asia

- Climate change will cause declines in agricultural productivity in sub-regions of Asia, for crops such as rice and wheat. Such declines may be due to direct effect of rising temperature, increased water demand but lesser or timely availability of water, or both.
- The inter-annual variability of crop yields will be progressively increased in many regions necessitating steps to ensure food security.
- Low food availability will lead to undernutrition, ill health, increased poverty, loss of work hours and livelihood.



Vulnerability to CC - Food & Agriculture Sector

- Iran - the largest economy in Middle East
- Rising demand for food and feed
- Demand for wheat growing
- Wheat, barley, rice, corn main crops; horticultural crops: Pistachios and walnuts
- Self-sufficiency in agriculture main objective
- Upward rising trend of temp has stressed production
- Average precipitation 200-300mm/y ranging from <50 mm in the interior desert to >1000mm near Caspian Sea



Vulnerability - Food & Agriculture

- Food & agriculture Sector in Iran is highly vulnerable to CC impacts (High confidence)
- Moisture availability is the greatest limitation for crop production in Iran. Due to low rainfall, groundwater is also used with surface water to irrigate which is putting strains on the aquifers.
- Plants and animals are more vulnerable than humans. With changing climate the entire ecosystem is forced to move, with risk of substantial species extinction.
- Increased frequency of droughts and floods are affecting local production negatively especially in subsistence sectors.



Vulnerability - Water Resources

- Highly vulnerable in Iran, with very high confidence (9 out of 10 chances of being correct)
- By mid-century, annual river runoff and water availability will decrease by 10-30% in some dry regions in tropics and subtropics, some of which are already water scarce.
- Dry seasons are growing longer and drier, and crops are withering. More heatwaves are expected with lethal summer temperatures.
- Excessive groundwater extraction to meet crop water requirements will affect water quality and put the underground aquifers at risk of depletion.
- Drought affected areas will increase in extent.
- Water supplies stored in glaciers and snow cover will decline reducing water availability.



Vulnerability - Coastal systems

- Moderately vulnerable in Iran, with low confidence.
- Risk of coastal erosion will increase due to increase in sea surface temperatures and sea level rise, and is exacerbated by human pressure and changing climate.
- Coral reefs are vulnerable to thermal stress and ocean acidification both of which are increasing globally.
- Regional changes are expected in distribution and production of particular fish species due to continued warming with adverse impacts projected for aquaculture and fisheries.
- Salinization due to seawater intrusion, especially in Lake Urmia, is polluting drinking water supplies and affecting crop yields.



Vulnerability - Human health

- The health sector is highly vulnerable, with medium confidence.
- There has been increase in malnutrition and related disorders with implications for child growth and development. It is goal of the Iranian government to to improve child nutrition and reduce infant mortality.
- Increases in death, disease and injury due to heat waves, droughts, floods, storms and fires.
- Increased burden of diarrhoeal and water-borne diseases.
- Increased frequency of cardio-respiratory diseases due dust storms
- Altered spatial distribution of some infectious disease vectors.



Vulnerability - Biodiversity and Ecosystems

- Biodiversity in Iran moderately vulnerable, with medium confidence.
- Temperature increase above 2.5C will negatively affect biodiversity and ecosystem goods and services, e.g. water and food supply.
- The resilience of many ecosystems will be compromised by a combination of climate change associated disturbances, e.g. droughts, floods, wildfire, insect pests, ocean acidification, and other drivers, eg. Land use change, pollution, overexploitation, etc.
- About 20-3-% of plant and animal species are likely to be at the risk of extinction if temperature exceeds 1.5 - 2.5C.
- Progressive ocean acidification due to increasing CO₂ will have negative impacts on marine shell forming organisms, e.g. corals and their dependant species.

Future Projections of Climate Change

Effect of Temperature : Global temperature increases of 4⁰C or more over late 20th century levels combined with increasing food demand, would pose large risks to food security globally and regionally, especially in low-latitude countries.

Effect of CO₂: Changes in temperature and precipitation, without considering the effect of CO₂, would contribute to increased global food prices by 2050, with estimated increase ranging from 3-84%.

Projections that include effect of CO₂ but ignore O₃ and pest and disease impacts indicate gradual price increases, as likely as not, ranging from -30% to +45% by 205

Future Climate Outlook in MENA Region

- Summer temperatures in the Middle East and North Africa (MENA) will rise twice as fast as the global average.
- In 2017, Iran came close to breaking the highest recorded temperature of 54⁰C which Kuwait recorded the year before. In Pakistan, record temperature of 53-5C was recorded in Moenjo Daro in Sindh province, on 26 May 2010.
- Extreme temperature of 46C will be 5-times more likely by 2050 than at beginning of the century.
- By 2100, temperature and humidity (measured by wet bulb thermometer) could rise to the extent to make the Gulf region inhabitable, if emissions are not abated.

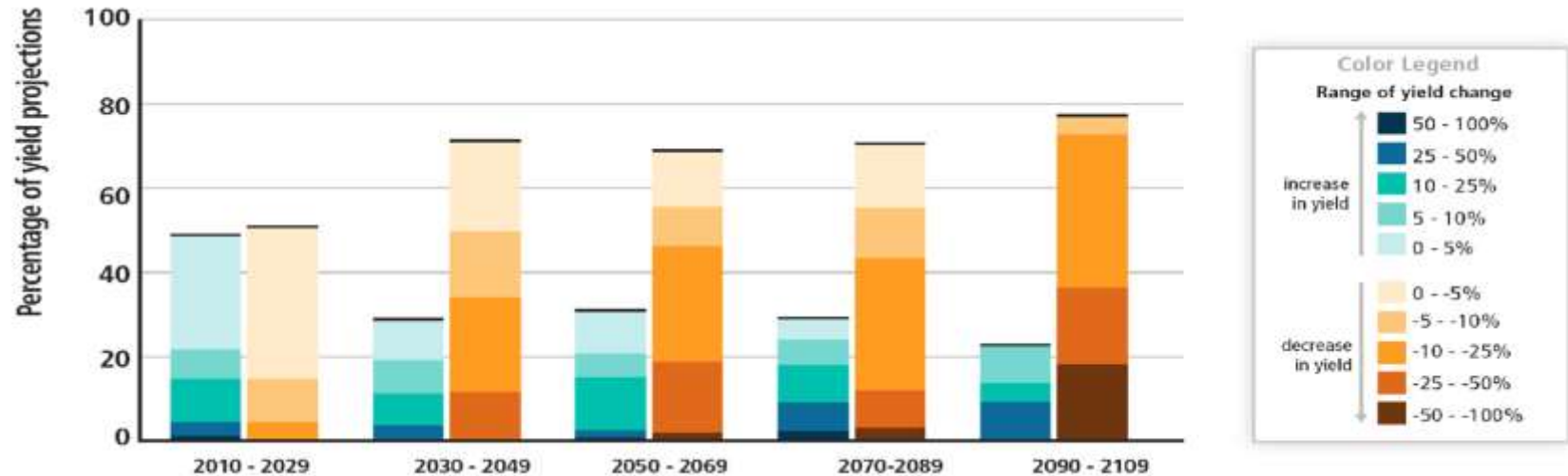
(Source: The Economist, May 31, 2018)

Future Integrated Impacts (contd)

Crops and Regions: In tropical and temperate regions, climate change without adaptation may impact yield of major food crops (wheat, rice and maize) negatively for local temperature increases of 2⁰C or more above late 20th century levels, although individual locations may benefit.

- About 10% of projection for the period 2030-49 show yield loss of >25% and about 10% show yield gain of >10%.
- After 2050, the risk of more severe impacts increases, especially in low-latitude countries.
- In Iran, upward temperature trend, little rainfall and high evaporation rate will add new stresses to already challenging production environment.

Projected changes in crop yield due to climate change over 21st century (IPCC, 2014)



Future Integrated Impacts – (Contd.)

Livestock: Impacts include (i) effects on forage and feed, (ii) direct impacts of changes in temperature and water availability on feeding, growth rates, conception, mortality, and productivity of animals, and (iii) indirect effects via diseases and host-pathogen ranges.

Fisheries and Aquaculture: The natural and human processes involved differ from mainstream agriculture. The growing human population is already driving heavy exploitation of capture fisheries and trend will continue over next 20-30 years. Changes in water temperature, temp. extremes, hypoxia, and ocean acidification will affect productivity of caught and cultured species.

Future Integrated Impacts – (Contd.)

Marine System: Sustained production of fisheries and other ecosystem services will be challenged by global marine species redistribution and marine biodiversity reduction in sensitive regions. The progressive expansion of oxygen minimum zones and anoxic ‘dead zones’ will further constrain fish habitat.

Invasive Weeds: The distribution and competitiveness of invasive weeds will be enhanced by climate change. Rising CO₂ may reduce effectiveness of some herbicides and may change geographical ranges of pests and diseases.

Adaptation Strategies

- Adaptation can reduce adverse impacts of ongoing and unavoidable climate change hazards. Techniques are available. If we take action now, economic growth will not be strongly affected.
- A risk-based approach can assist in adaptation planning.
- Addressing current vulnerabilities/exposure is the first step to adaptation.
- Substantial and sustainable reductions in greenhouse gas emissions are needed to reduce climate change related losses and damages.
- Effective mitigation will not be achieved if individual agents advance their own interest independently. For this, regional and international cooperation is highly desirable.

Conclusions

- Climate change is making the region more volatile with the spectre of droughts and extreme water shortages hovering overhead.
- Like other Asian countries, Iran's socioeconomic sectors of water resources, food, agriculture, livestock, human health and coastal areas are facing adverse impacts of climate change.
- Adaptation measures such as altered cultivation techniques, changes in sowing times, development of heat and moisture stress tolerant crop cultivars and animal breeds can provide some relief.
- Reducing emissions from agriculture and other sources can mitigate the changing climate.



Thanks