Network Project on Impact, Adaptation and Vulnerability of Indian Agriculture to Climate Change

Indian Council of Agricultural Research
New Delhi

To meet the challenges as posed by climate change on the agricultural system, ICAR accorded high priority in understanding the impacts of climate change and developing adaptation and mitigation strategies through its Network Project on Climate Change (NPCC) during X Plan with a plan layout of Rs. 9.11 crore and 15.15 crore in XI Plan with the following objectives:

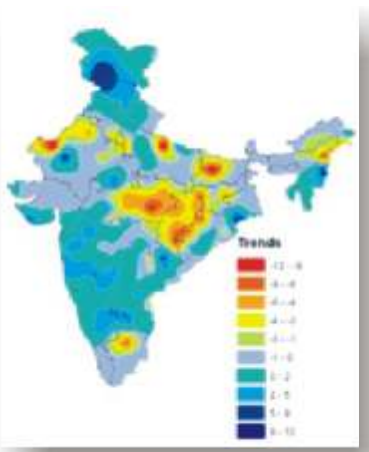
- To review the current state of understanding of the climate change and its probable impact on Indian agriculture.
- To analyze the feasibility of scientific, technological, economic and policy adaptation options in agriculture.
- To quantify the mitigation potential in Indian agriculture, and associated costs.
- To identify research and development priorities and policy imperatives for climate change.

Climate Change Research Network

Achievements during X plan

Climate

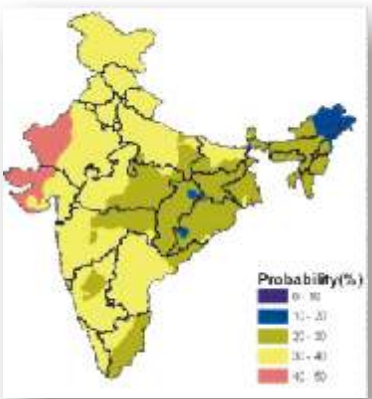
- Analysis of long-term annual rainfall data (~100 years) showed significant negative rainfall trends over the Eastern parts of Madhya Pradesh, Chhattisgarh and parts of Bihar, Uttar Pradesh, parts of northwest and NE India and also a small pocket in Tamil Nadu. Significant increase in rainfall has also been noticed in Jammu and Kashmir and in some parts of southern peninsular.



- The maximum and minimum temperature (1960-2003) analysis for northwest region of India showed that both the maximum and minimum temperature have increased at annual, *kharif* and *rabi* seasons. However, sharp rise was observed from the year 2000 onwards. The rate of increase of minimum temperature during *rabi* period is much higher than during *kharif* season.

- Overall, mean temperature showed increasing trend across the country. Central and western parts showed decreasing trend in maximum temperature. Where as minimum temperatures have showed increasing trend in East, North and southern parts of the country

- All India drought probability maps were developed. 3 to 4 years of drought out of every 10 years observed in most parts of rainfed dry lands









Agriculture

- It was observed from the experiments on impact of high temperature on pollen sterility and germination in rice, maximum temperature above 35°C and minimum temperature 23°C at flowering stage increased the pollen sterility in two normal and three basmati varieties of rice. The effect is more profound in basmati cultivars.

- Rice yields were reduced drastically with elevated ambient temperature, which was mainly attributed to maximum reduction in number of panicles/m^2 and 1000 grain weight.

- High thermal stress during post-flowering duration manifested 18, 60 and 12 percent reduction in economic yield of wheat, mustard and potato crops, respectively.

- Coconut yields were not affected with temperatures up to 44°C but higher temperatures beyond this value reduced the yield.

- Enhanced CO_2 significantly improved the Grain yield of Castor crop, however the content and quality of castor oil has not changed.

- Under elevated CO_2 castor semi looper, *Achaea janata* consumed higher amount of castor foliage than ambient with 2 days of extended larval duration.

- In early and late sown varieties of wheat, the reproductive phase (days to flowering) and maturity phase shortened by 5 and 15 days due to increased temperatures at Palam Valley of Himachal Pradesh.

- Shift of apple belt to higher elevations in Himachal Pradesh was observed as increase in maximum temperatures during November to April reduced chilling hours required for Apple cultivation.

Forests

- Deodar, Kail and Kharsu are drying and dying (yellowing) at (1700-2300 m) elevation, whereas at higher elevation (2500 m) Insect attack in oak was observed in Shimla region.

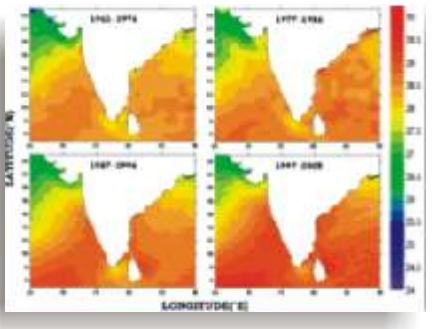
Livestock

- A rise in 2-6°C temperature above normal effects the growth, puberty and maturity of cross breeds and buffaloes. The time to attain puberty prolongs from 1 to 2 weeks because of the slow growth rates at higher temperature.
- Milk production in Holstein Friesian cross breed cows was affected due to rise in maximum and minimum temperatures above 22°C. Decrease of milk production in Murra buffaloes was also observed with increase in temperature above 2°C.
- The extreme events like heat wave (> 4°C above the normal and cold wave (<3°C of the normal) reduced the milk yield by 10-30 percent in first lactation and 5-20 percent in second and third lactations in cattle and buffaloes. The results were in situ and not observed after the events.
- Total methane emission due to enteric fermentation and manure management of 485 million heads of livestock was worked out at 9.32 and 9.36 Tg/annum for the years 2003 and 2006 respectively.
- The emission contribution of indigenous cattle to enteric emission was 38 percent during 2006 as against 41 percent in 2003 due to decline in unproductive indigenous cattle and oxen. The contribution of buffaloes to enteric methane emission was 43 percent in 2006.
- Reduction of methane emission in cattle (cross breed steers) was achieved by modifying the diet by supplementing fenugreek seeds (*Trigonella foenum-graecum*).

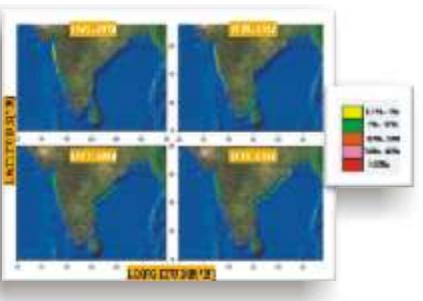
Fisheries

- Trends in Sea Surface Temperature (SST) showed significant increase at the rate of 0.045°C per decade along the southwest, northwest and northeast coasts whereas the rate of increase of 0.095°C per decade was observed along the southeast coast.

- The oil sardine fish once restricted to southwest coast along 8°N to 12°N was extended along the other coastal areas and also extended into Bay of Bengal upto Orissa and West Bengal coast due to congenial environment prevailed with the increasing SSTs.



- A shift in lower stretch fish species like *Puntim ticto, Xenentodon cancila, Mystus vittatus and Glossogobius giuris,* etc. to the cold water rithron zone of the river Ganga at Haridwar due to rise in average temperature condition of the river from 17.5°C to 25.5°C.



Future Thrust for XI plan

- Major thrust areas in the XI Plan are towards developing adaptation and mitigation strategies to cope up the climate change. More thrust on socio-economic impacts as influenced by climate change are being given priority.
- Monitoring of Green House Gas (GHG) emissions from agricultural systems and preparation of inventories.
- Impact assessment of all major crops including horticulture, plantation and weeds under elevated CO_2 and temperature conditions.
- Identification of microbes for developing mitigation strategies.
- Identification of Agroforestry potentials in climate change research and development of strategies for CDM technologies.
- Developing decision support systems for impact assessment on agriculture and other allied sectors by linking socio-economic constraints.
- Development of strategies for reducing the negative impacts of climate change and increasing the agricultural, livestock and poultry production.
- Intensification of research programs on migratory behaviour and their growth pattern of both marine and inland fisheries.

For further details contact :
Dr.P.K.Aggarwal
National Co-ordinator (NPCC)
pkaggarwal.iari@gmail.com
OR
Dr.G.G.S.N.Rao
Project Coordinator (Agromet)
ggsnrao@yahoo.co.in
OR
Dr.B.Venkateswarlu
Director
vbandi_1953@yahoo.com

Central Research Institute for Dryland Agriculture (CRIDA)
Santosh Nagar, Hyderabad 500059
Website: www.crida.ernet.in
Phone: 040-24530177
Fax: 040-24531802
climatechange.crida@gmail.com
Brouchure design: A.V.M. Subba Rao

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