

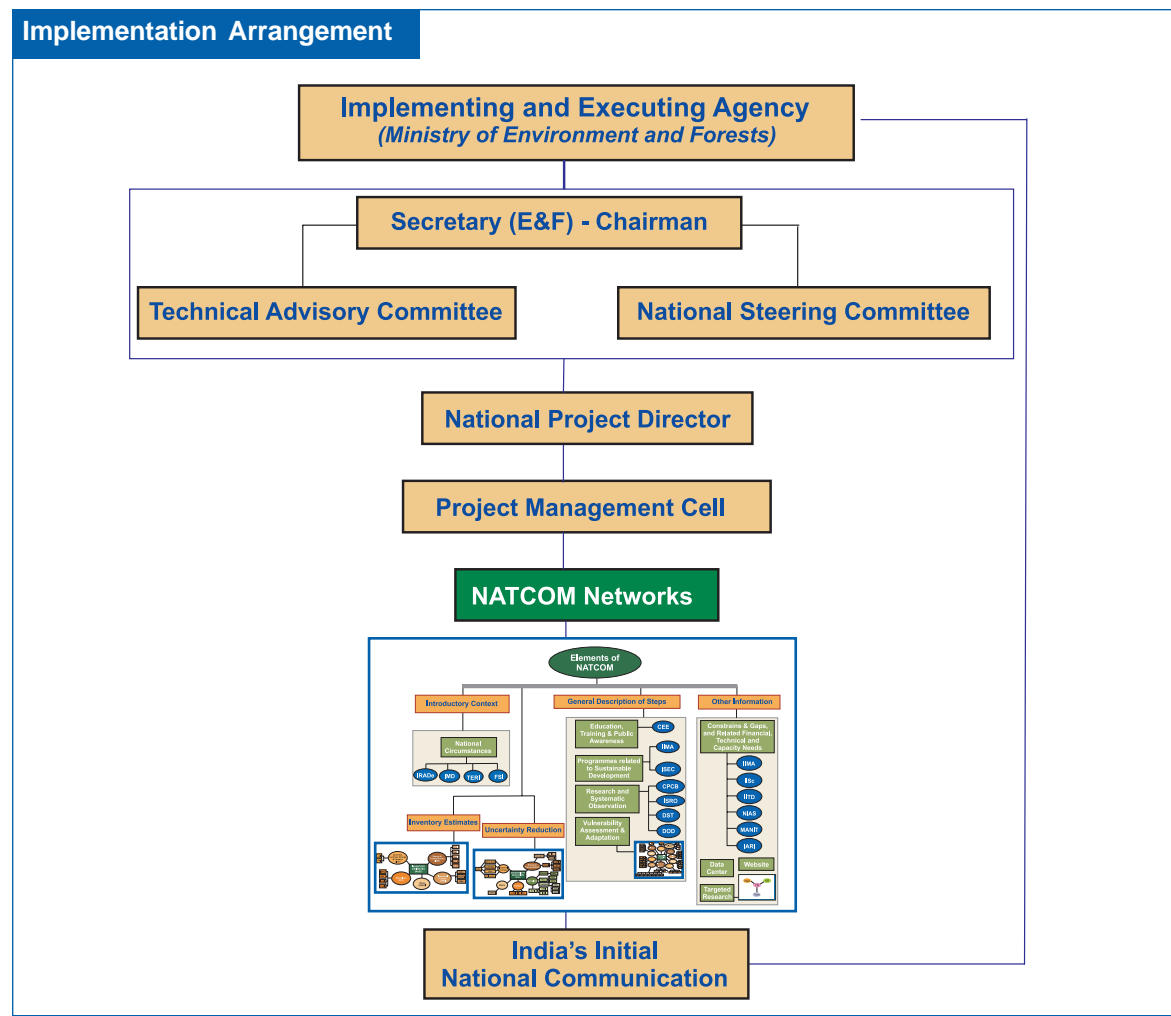
Annex-I

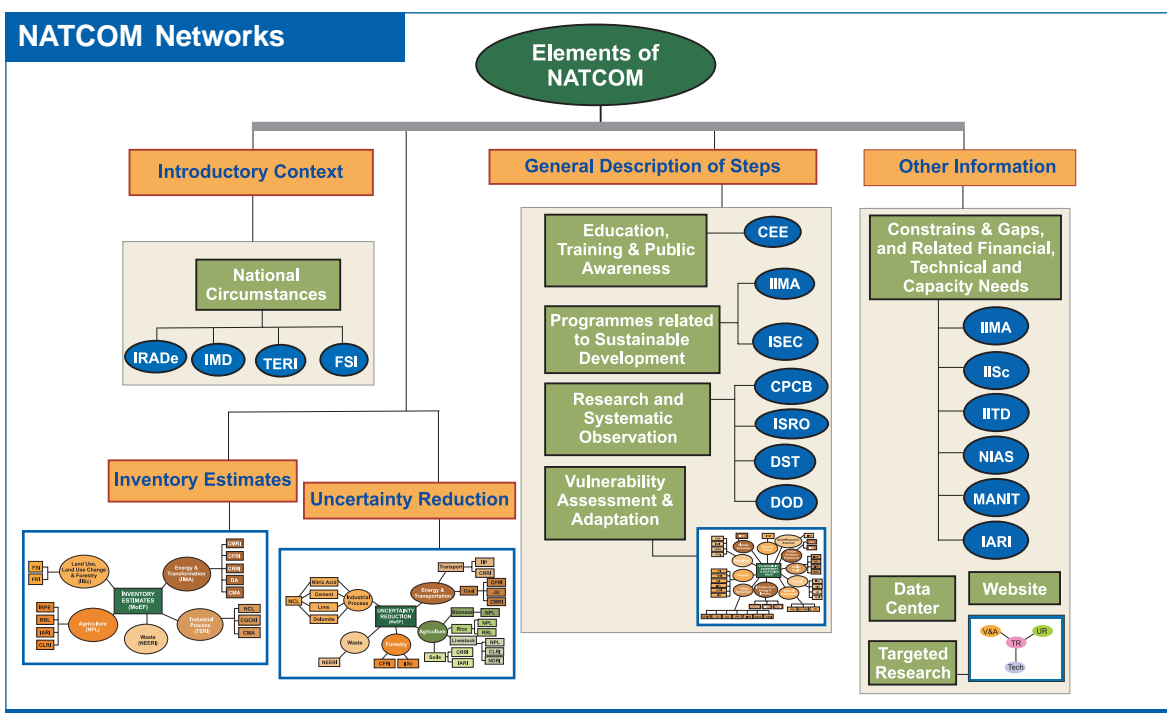
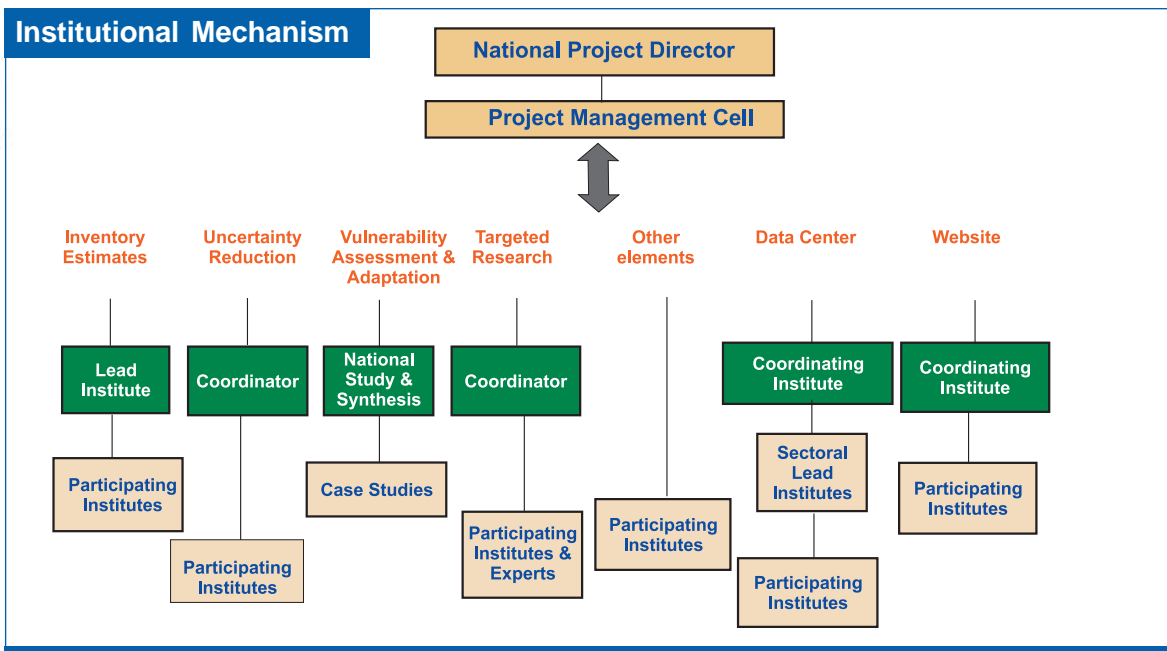
Implementation and Institutional Arrangements for the preparation of India's Initial National Communication

The project on preparation of India's Initial National Communication to the UNFCCC has been implemented and executed by the Ministry of Environment and Forests (MoEF), Government of India. A National Steering Committee under the chairmanship of the Secretary, MoEF, Government of India oversaw its implementation. A Technical Advisory Committee, advised on matters relating to the scientific and technical aspects of the various components of communication. A broad-based participatory approach involving 131 research teams from government ministries and departments, autonomous institutions and national research laboratories, universities, non-governmental organizations, industry associations, and private sector were involved in the process.

Being a Party to the Convention, India is required to furnish information in accordance with the provisions of the Convention for non-Annex-1 countries (Article 4 and 12), relating to implementation inter alia to the development of a comprehensive national inventory of anthropogenic emissions by sources and removal by sinks of all GHGs not controlled by the Montreal protocol, elucidation of a general description of steps taken or envisaged for implementation of the Convention; and any other information relevant to the achievement of the objectives of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculation of global emission trends.

Implementation Arrangement





CEE: Centre for Environment Education, Ahmedabad; **CPCB:** Central Pollution Control Board, New Delhi; **DOD:** Department of Ocean Development, New Delhi; **DST:** Department of Science and Technology, New Delhi; **FSI:** Forest Survey of India, Dehradun; **IARI:** Indian Agricultural Research Institute, New Delhi; **IIMA:** Indian Institute of Management, Ahmedabad; **IISc:** Indian Institute of Science, Bangalore; **IITD:** Indian Institute of Technology, Delhi; **IMD:** India Meteorological Department, New Delhi; **IRADe:** Integrated Research and Action for Development, New Delhi; **ISEC:** Institute for Social and Economic Change, Bangalore; **ISRO:** Indian Space Research Organization, Department of Space, Bangalore; **MANIT:** Maulana Azad National Institute of Technology, Bhopal; **NIAS:** National Institute of Advanced Studies, Bangalore; **TERI:** The Energy and Resources Institute, New Delhi

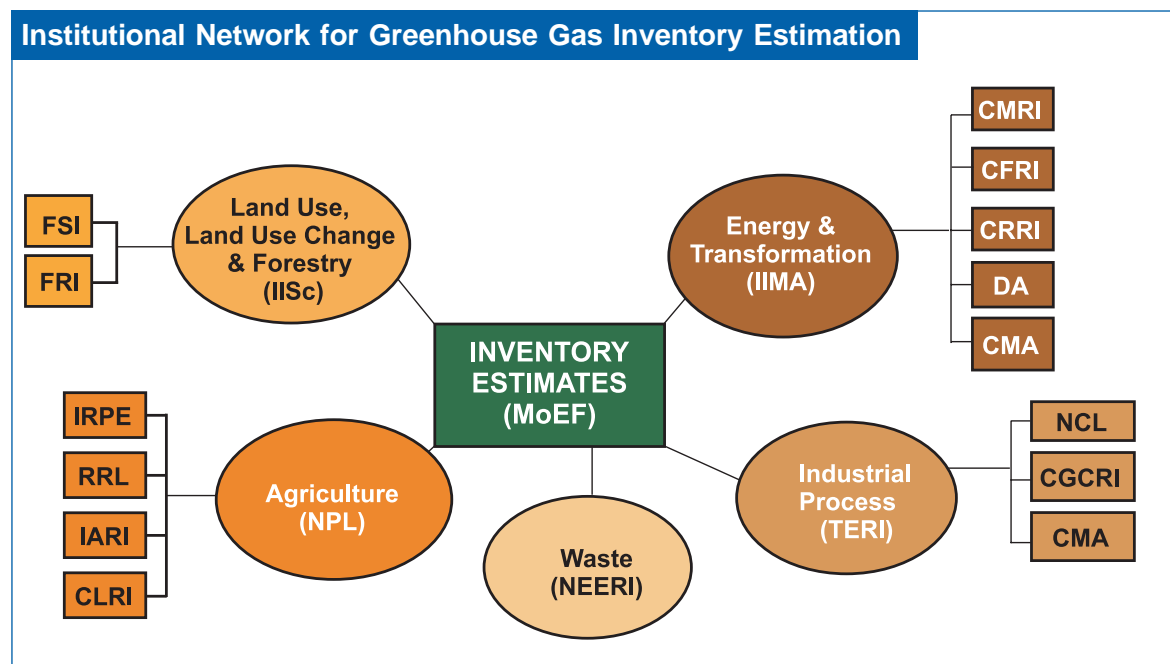
NATCOM Networks

Institutional networks were set up for GHG inventory estimation, measurement of emission coefficients, vulnerability assessment and adaptation (V&A), introductory context, general description of steps, other information including data center, website and targeted research. The institutional mechanisms for each of these were different and unique based on the requirements of the task. GHG inventory estimation required extensive sectoral data collection & validation, a framework of sectoral Lead Institutes supported by Participating Institutes was preferred. V&A required national level modeling for a macro view. These were conducted at premier national institutes under the guidance of prominent national experts. Independent case studies were also conducted to assess the broad canvas of V&A research requirements for a large country like India. For data center and website, the expertise available in the Indian software industry was used.

GHG Inventory Estimation

This component of the National Communication involved 19 research and development institutions, universities, and non-governmental organizations. The sectors considered include energy, industrial process, agriculture, landuse, land use change and forestry, and waste. Each of these sectors were coordinated by a lead institute and sub sectors under each had a number of participating institutes involved in the collection of primary and secondary activity data and preparation of GHG emission inventory for that sector.

All the participants have been trained through workshops on Inventory estimation and Good practices for reporting as per the IPCC guidelines. This includes the development of a Quality Assurance and Quality Control (QA/QC) plan. This approach was complemented by developing indigenous emission factors for some of the key sources of emissions in India. These are further expected to reduce the uncertainties in GHG estimates. Regular consultative meetings were conducted to reconcile the differences in top-down and bottom-up inventory estimates and other matters.



CMA: Cement Manufacturers' Association, New Delhi; **CFRI:** Central Fuel Research Institute, Dhanbad; **CGCRI:** Central Glass and Ceramic Research Institute, Kolkata; **CLRI:** Central Leather Research Institute, Chennai; **CMRI:** Central Mining Research Institute, Dhanbad; **CRRI:** Central Road Research Institute, New Delhi; **DA:** Development Alternatives, New Delhi; **FRI:** Forest Research Institute, Dehradun; **FSI:** Forest Survey of India, Dehradun; **IARI:** Indian Agricultural Research Institute, New Delhi; **IIMA:** Indian Institute of Management, Ahmedabad; **IISc:** Indian Institute of Science, Bangalore; **IRPE:** Institute of Radio Physics and Electronics, Calcutta University; **NCL:** National Chemical Laboratory, Pune; **NEERI:** National Environmental Engineering Research Institute, Nagpur; **NPL:** National Physical Laboratory, New Delhi; **RRL:** Regional Research Laboratory, Bhubaneswar; **TERI:** The Energy and Resources Institute, New Delhi

Uncertainty Reduction in GHG Estimation

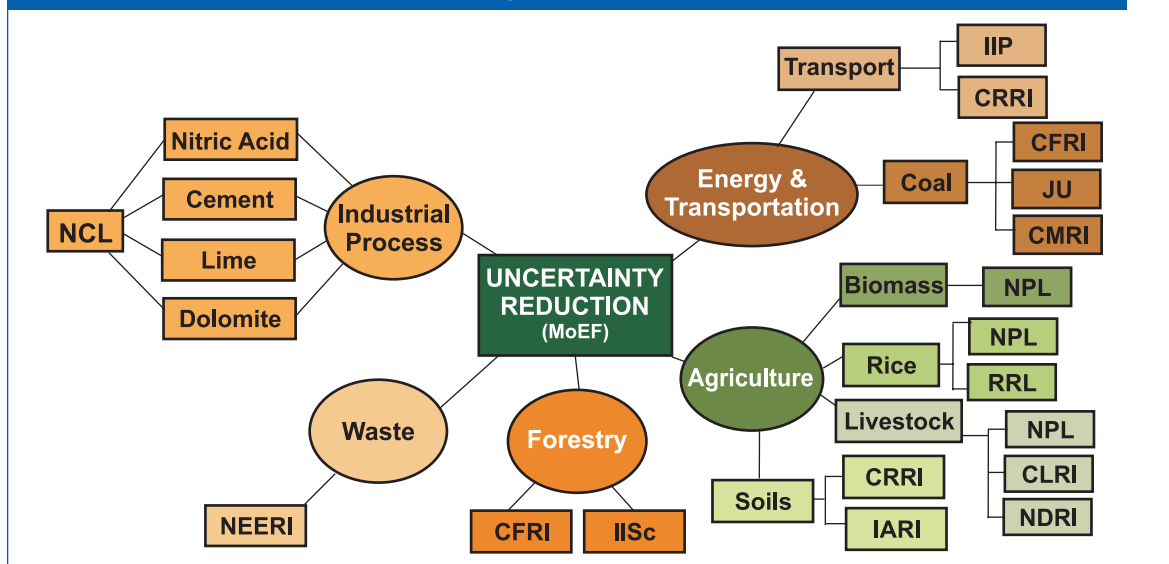
GHG emission estimates, based on IPCC default emission factors, are not usually region or natural circumstances specific, and therefore have uncertainties in the emission estimates. Uncertainties also exist in the activity data. Through this project, an attempt has been made to generate India specific emission factors by undertaking in-situ measurements for some key source categories. The efforts were to define the range in uncertainties in the estimates through statistical methods. Time and budgetary resources available under the project limited the coverage under this activity.

The activities covered under the **energy sector** include measurement of CO₂ emission coefficients from coal based power, steel and cement plants representing different technologies. Some super thermal power plants, Integrated steel plants and medium sized cement plants were targeted for CO₂ emission coefficient measurement. Central Fuel Research Institute, Dhanbad and Jadavpur University, Kolkata conducted these measurements. Indian Institute of Petroleum, Dehradun measured the emission factors of CO₂, NO_x and NMVOC released from specific road vehicle categories operating on diesel and petrol. Central Road Research Institute, New Delhi used a combination of statistical methods and secondary data sources to reduce uncertainty in road transport sector activity data for 1994. Central Mining Research Institute, Dhanbad conducted measurements for methane emission coefficients from coal mining activity, where surface mining activities were measured for the first time in India.

Industrial processes included emission coefficient measurements from cement manufacturing process, lime production, and nitric acid production. The emission factor in case of cement manufacturing process is a product of CO₂ generated from CaO and MgO content of the clinker and the correction factor for CKD losses from the plant. This emission factor multiplied by the clinker production gives the emission of GHG from each cement plant. In the nitric acid production process, ammonia is oxidized with air to result in main products NO, NO₂ and a by-product N₂O in small quantities. After nitric oxides are absorbed, nitrous oxide is left out and is vented either directly or after using abatement technologies. National Chemical Laboratory, Pune conducted these measurements.

In the **Agriculture sector**, measurements were conducted for CH₄ emission coefficient estimation due to enteric fermentation in indigenous and crossbred dairy cows for different age groups. National Dairy Research Institute, Karnal conducted the experiments and National Physical Laboratory, New Delhi provided support for data measurement in terms of standardization of measurement and instrument calibration. The Indian Agricultural Research Institute, New Delhi was involved in the measurement of N₂O emissions from soils supporting rice – wheat systems in the country. They also conducted measurements to ascertain the

Institutional Network for Uncertainty Reduction in Greenhouse Gas Emissions



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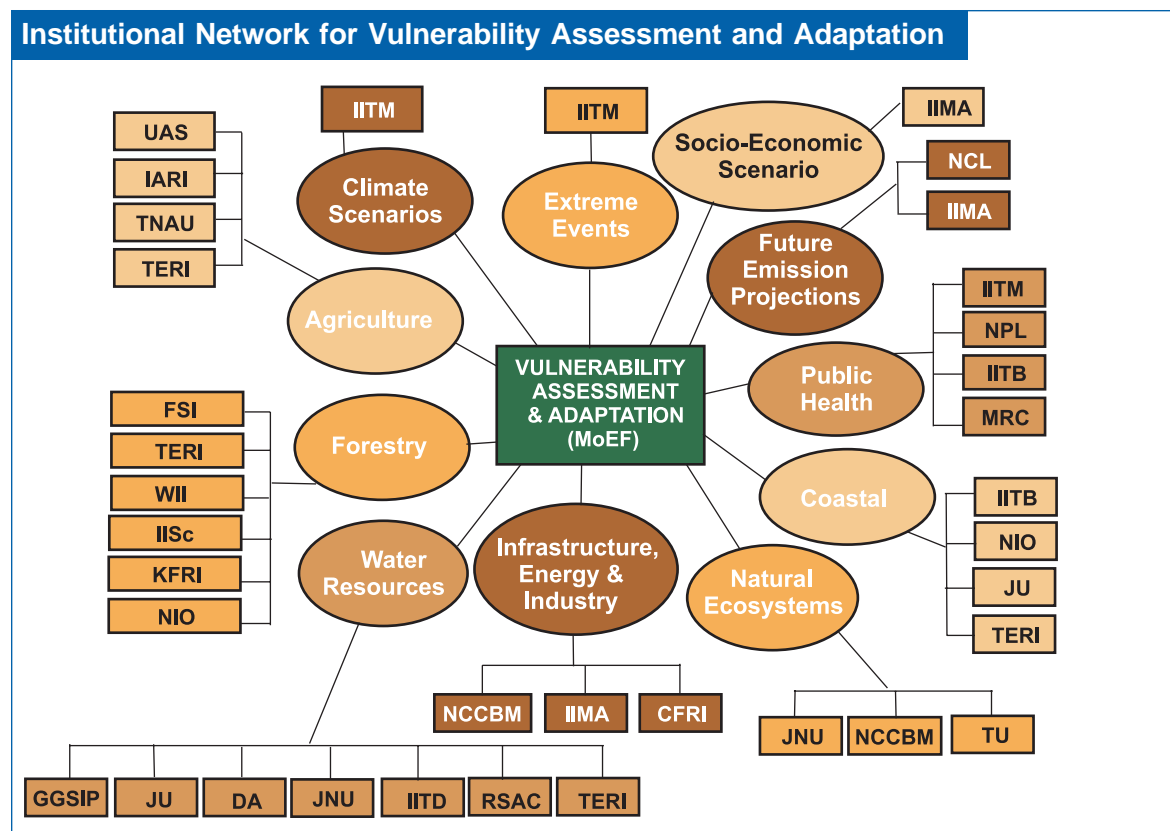
emission coefficient of N_2O due to application of nitrogenous fertilizers. National Physical Laboratory, New Delhi was involved in the measurement of N_2O and CH_4 emission coefficients from managed manure systems, CH_4 from rice cultivation under different water regimes and organic amendments, and CO_2 , CH_4 , N_2O , NO_x and CO from burning of crop residue.

In the **Land Use Land Use Change and Forestry** sector, an attempt was made to assess uncertainty associated with activity data and emission factors. This covered determination of annual growth rate of plantations and different forest types, determination of annual growth of above ground biomass and measurement of soil carbon in various soil types. Indian Institute of Science, Bangalore coordinated these. A component on measurement of uptake of CO_2 by plants was conducted by Central Fuel Research Institute, Dhanbad.

In the **waste sector**, measurements were conducted to estimate the emission coefficient of CH_4 released from municipal solid waste dumping sites in New Delhi.

Vulnerability Assessment and Adaptation

It is generally agreed that the South Asian region, dominated by the monsoons, is one of the most difficult regions to model, with considerable differences among models and high sensitivity to model parameters. Based on the model projections, it is estimated that the mean surface temperature is projected to increase by 1.5-2.5 °C in Southern India while in the north it may increase by



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2.5-3.5 °C by 2040. Given such complexities within India itself, the NATCOM project has attempted to identify regions of higher vulnerability to climate change in India, conducted a few specific studies and developed possible adaptation measures in a few sectors. However, time and budgetary resources available under the project limited the coverage under this activity as well.

Vulnerability assessments of the sectors carried out include **agriculture, water resources, forestry, coastal zones, natural ecosystems, human health, energy and infrastructure**. This exercise entailed the consistent construction of likely **climate** and **socio-economic scenarios** for India along with an assessment of **extreme events** using existing models and expertise.

Eleven activities have been identified for work under this component. Thirty-six research teams across the country have undertaken activities under the vulnerability assessment and adaptation component. Whilst the national sectoral studies were coordinated and synthesized by lead institutes, individual case studies were undertaken by different participating institutes.