

PROJECT CLIMATE RISK ASSESSMENT AND MANAGEMENT REPORT

I. Basic Project Information

Project Title: Karnataka Integrated and Sustainable Water Resources Management Program
Project Budget: \$150,000,000
Location: Karnataka, India (Figure 1)
Sector: Agriculture and natural resources
Theme: Not applicable under the new PCS
Brief Description: The impact of the program will be enhanced availability of water resources in selected river basins in Karnataka. Its outcome will be improved IWRM in selected river basins in Karnataka, as a result of the two main outputs: (i) state and basin institutions strengthened for application of integrated water management (IWRM), and (ii) modernized irrigation system infrastructure and management.

II. Summary of Climate Risk Screening and Assessment

A. Sensitivity of project component(s) to climate/weather conditions and sea level	
The predicted impacts of climate change for Karnataka include increased temperatures and increased mean annual rainfall, and decreased and more variable monsoon rainfall. ¹ Overall, the investment program area is found to be vulnerable to increased incidence of seasonal droughts. ² This will heighten the requirement for a well-planned and methodical approach to water resources management. An integrated approach to water resources management is a means to reconcile varied and changing water uses and demands since it provides greater flexibility and adaptive capacity than conventional water resources management approaches.	
Project component 1. Modernization of irrigation canals 2. Expansion water efficient land and water management practices	Sensitivity to climate/weather conditions and sea level 1. Fluctuations in rainfall intensity and frequency affecting canal diversions 2. Increased frequency of droughts affecting cropping patterns and intensities;
B. Climate Risk Screening	
Risk topic: 1. Flood 2. Drought	Description of the risk: 1. Flood embankment heights and drains capacity calculated with current climate statistics may be insufficient with project increase in flood discharge 2. Disturbed rainfall distribution, reduced rainfall and temperature increase may cause unbalance between irrigation water demand and water availability and lead to reduce irrigated area and crop production.
Climate Risk Classification: Low	
C. Climate risk assessment	
Climate change assessments were based on two studies, namely: (i) Strategy and methodology for improved IWRM (STRIVER), 2006-2009; and (ii) Bangalore Climate Change Initiative (BCCI), 2011.	
The STRIVER study applied a river basin model to the Tungabhadra basin to assess present and future water, nutrients and sediment. The study included a statistical assessment of water quality and quantity monitoring data to identify pollution levels and events. A detailed continuous semi-lumped model, SWAT, was used to assess the spatial pattern of contributions to runoff and pollutant within the basin to generate and compare different environmental and management scenarios. ³ The SWAT model utilized several geo-referenced databases including information on geomorphology (digital terrain model, hydrology, geological features), land use, weather (temperature, rainfall, wind, radiation), management practices, point sources in the area, surface and groundwater flow and water quality monitoring data. Stakeholders were involved in all the phases of the modeling process including the development of the scenarios and discussion of the simulation outcomes.	

¹ Bangalore Climate Change Initiative—Karnataka. 2011. *Karnataka Climate Change Action Plan*. Bangalore.

² The United Nations Convention to Combat Desertification defines drought as the “the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.” (UNISDR, 2009. Drought Risk Reduction Framework and Practices: Contributing to the Implementation of the Hyogo Framework for Action. United Nations secretariat of the International Strategy for Disaster Reduction [UNISDR]. Geneva, Switzerland.)

³ <http://swatmodel.tamu.edu/>

The BCCI study: (i) reviewed observed climate variability; (ii) data from the HadCM3 global climate model downscaled by PRECIS model for the SRES A1b. The combination of HadCM3 and PRECIS models is referred to as the HadRM3 model; and (iii) estimated impacts of projected climate change on water resources, forestry, agriculture, and socio-economic vulnerability.

The Project is located in the seven districts of northeastern Karnataka (Bellary, Chikmagalur, Chitradurga, Davangere, Gadag, Haveri and Shimoga) which the BCCI study found to be vulnerable to increased incidence of seasonal droughts⁴ (Figure 2). These outputs of these studies have been used during the PPTA to assess climate change adaptation requirements and compatibility of the proposed investments with the Karnataka Climate Change Adaptation Plan.

III. Climate Risk Management Response within the Project

The project will:

1. Support capacity development for application of integrated water resources management to improve inter-sector management of water resources and as a front-line adaptation response
2. Upgrade irrigation infrastructure and management systems
3. Establish basin models for development of basin management plans, including climate change impacts
4. Establish river basin organizations to lead development of adaptive basin management plans
5. Capacity building of water users in efficient land and water management practices

⁴ Droughts are absence of rainfall (daily rainfall < 2.5 mm) with a period of 40 or more contiguous days defined as “an incidence of severe drought”.

Figure 1: Location Map

Map of Karnataka, India

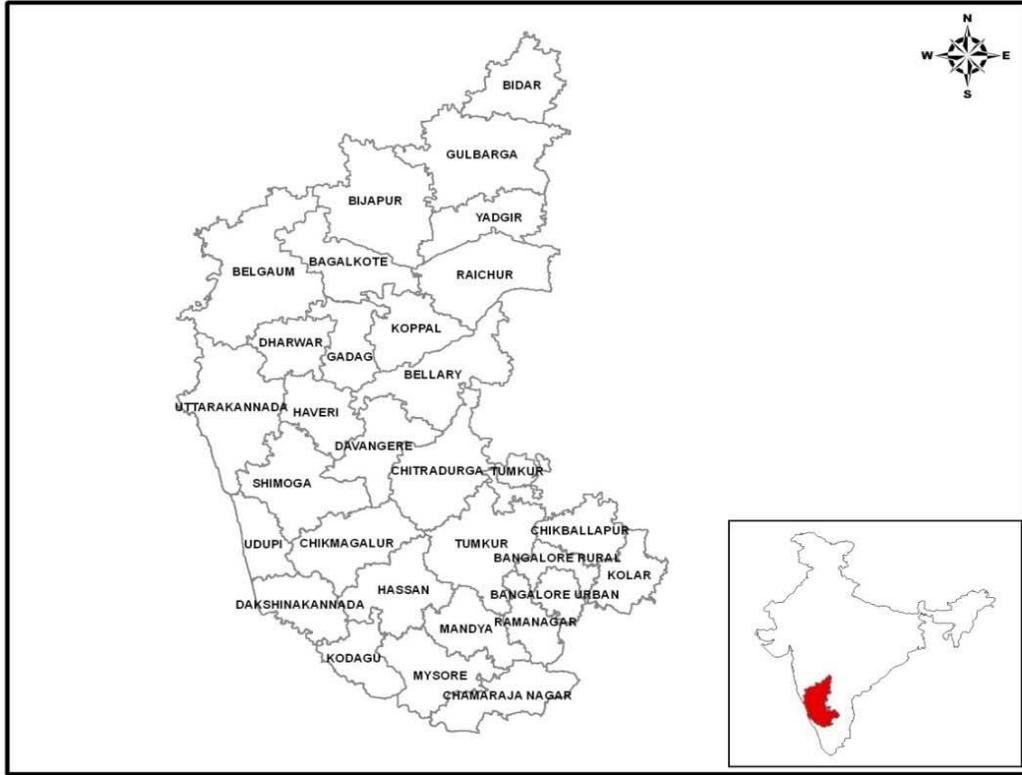
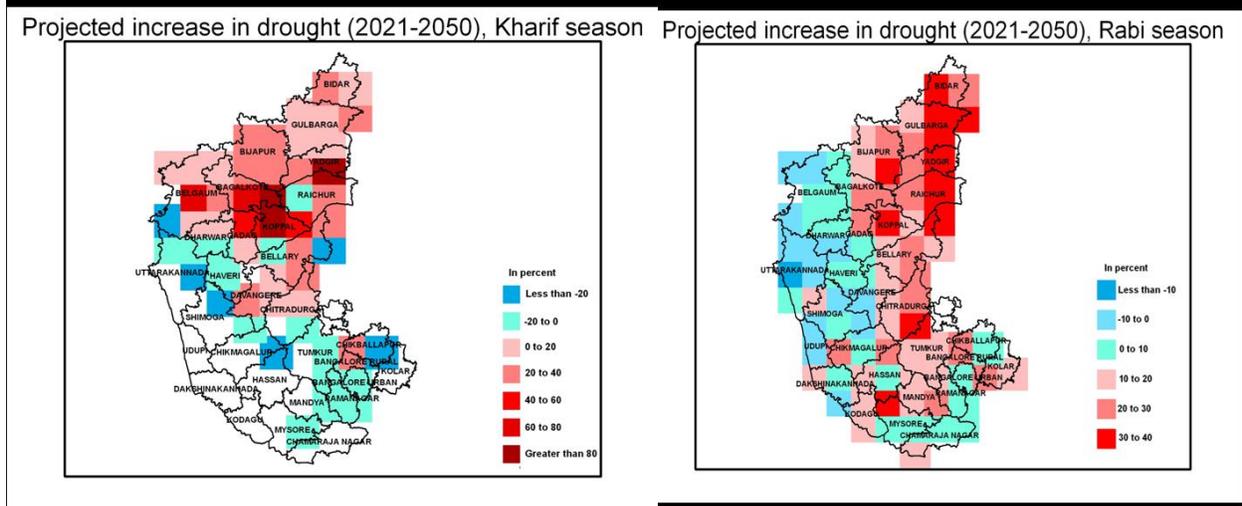


Figure 2: Seasonal Drought Incidence Projections for Karnataka (2021-2050)



Notes: Projections of drought incidences compared to the baseline (1961-1990) for Kharif and Rabi season. Blue indicate grids with decreasing drought incidence, red with increasing drought incidences.

Source: Bangalore Climate Change Initiative, 2011 Karnataka Climate Change Action Plan, May 2011