Impacts of Land Use Land Cover and Climate Change on Streamflow in Netravathi Basin, Karnataka, India

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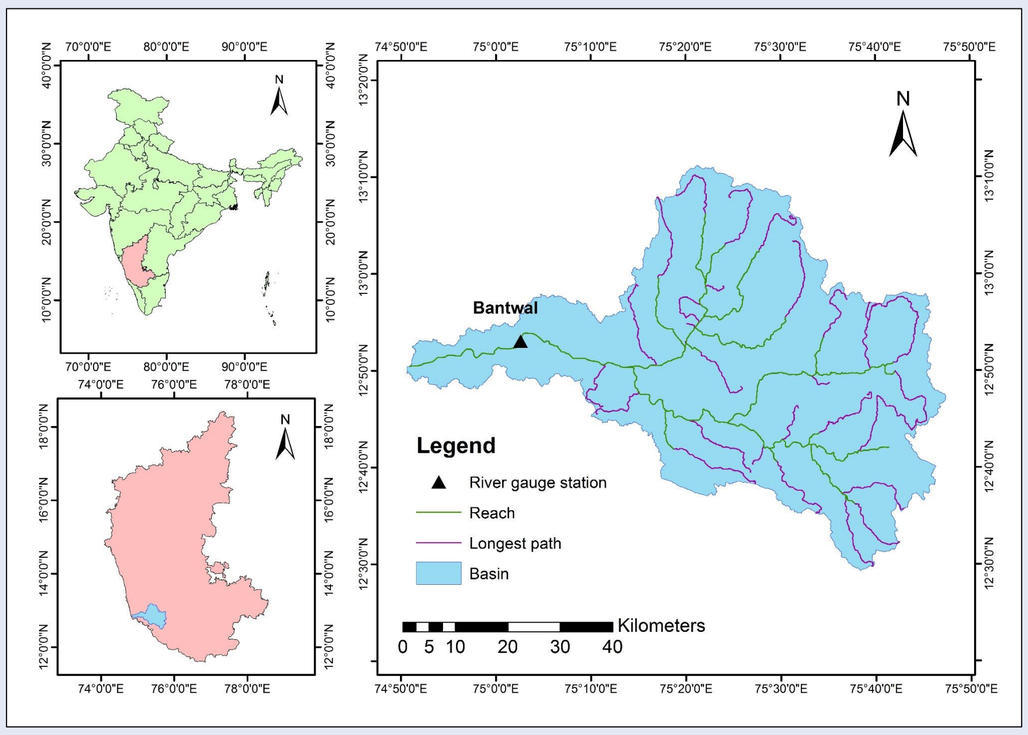
HS2.2.1 "Models and Data: Understanding and representing spatio-temporal dynamics of hydrological processes"

Introduction

- Water is necessary for the sustenance of life, but its availability at sustainable **quantity and quality** is often intimidated by numerous factors.
- A considerable increase in **population, migration and socio-economic activities** have led to drastic changes in the environment over the last few decades.
- These changes have in turn affected the **stationarity of climate**, that is climate change is beyond the past variability.
- Massive **land use/land cover change** (LULCC) is a result of human activities.
- Studies indicate the effect of LULCC on hydrological regime and mark the **necessity** of its timely detection at appropriate scales for efficient water resource management.
- **Netravathi River basin** is of great **socio-economic** importance in the region.
- The river water is used for **religious, industrial, domestic** and **irrigation** purposes.
- Hence detailed spatial-temporal assessment of impacts of **climate change and LULCC** on streamflow and sediment yield of the basin is crucial for watershed management.

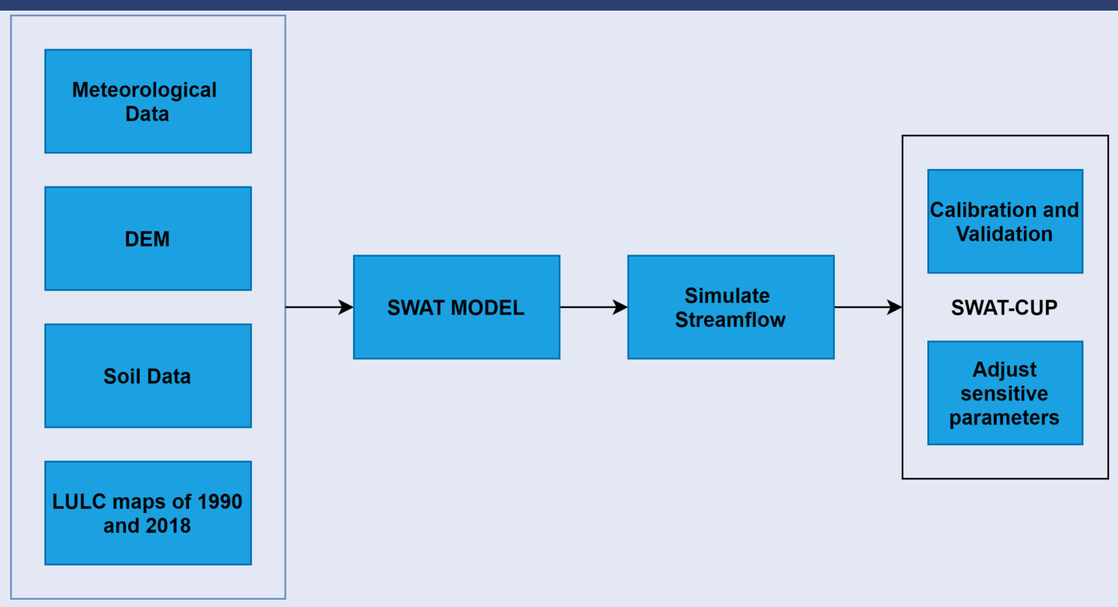


Study area

Objectives

To obtain the effect of LULC and climate changes on streamflow of Netravathi basin using SWAT.

Methodology

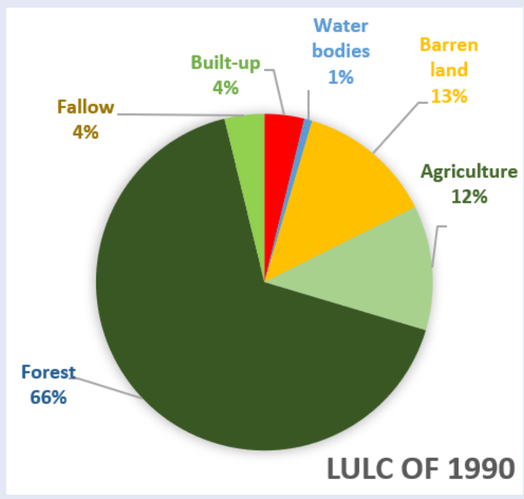


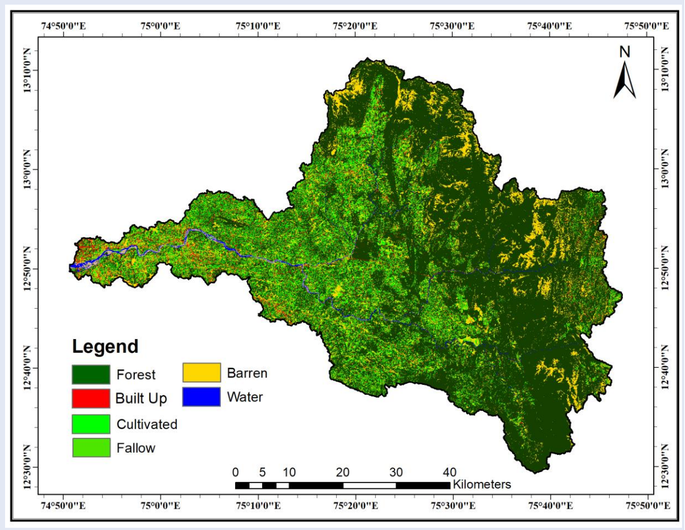
Data

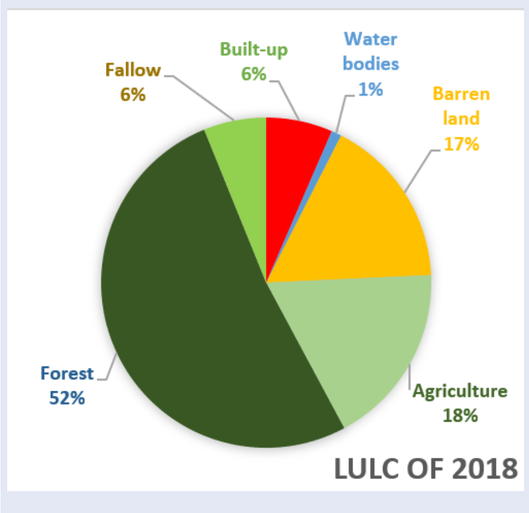
Data	Time period	Description	Source	Purpose
Conventional Data				
Streamflow Data	1990-2018	Daily Data	Central Water Commission, India	For calibration and validation of SWAT
Meteorological Data	1990-2018	Daily Data	Indian Meteorological Department, India	Input for SWAT
Soil data	2012	Description of soil types (1 km×1 km)	Food and Agriculture Organization (FAO 2012)	Input for SWAT
Remote Sensing Data				
Land use	04-03-1990	Landsat (30 m × 30 m)	https://earthexplorer.usgs.gov/	For LULC classification and and change analysis
	06-03-2018	Landsat (30 m × 30 m)	https://earthexplorer.usgs.gov/	For LULC classification and and change analysis
DEM	-	ALOS PALSAR 12.5 m	www.asf.alaska.edu	For watershed Delineation

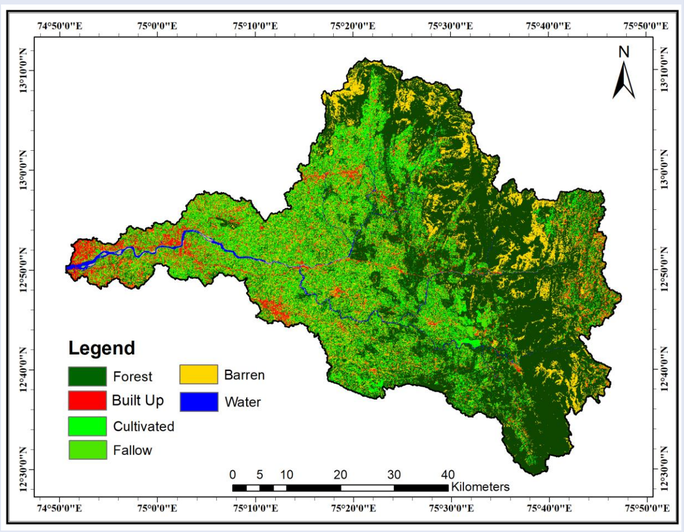
Results

- The streamflow increased steadily (5.02%) with changes in LULC from 1990 to 2018.
- the spatial extent of the LULC classes of built-up (3.82%–6.51%), water bodies (0.76%–0.99%), and agriculture (11.96%–17.89%) increased, whereas that of forest (66.56%–51.7%), fallow (3.82%–6.13%), and barren land (13.07%–16.76%) decreased from 1990 to 2018.









Model performance indicators	1990		2018	
	Calibration	Validation	Calibration	Validation
NSE	0.75	0.74	0.76	0.75
PBIAS	10.26	22.13	4.07	6.51
R^2	0.88	0.86	0.89	0.88

Conclusions

- The results indicate that LULC changes in urbanization and agricultural intensification have contributed to the increase in runoff, in the catchment during this period.
- Thus, hydrological modelling integrating climate change and LULC can be used as an effective tool in estimating streamflow of the basin.

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