Keysheet
7

Climate Change Impacts on

Forestry in India

India's forests, which cover nearly 20% of the country's geographic area, are important for biodiversity, biomass supply, watersheds and livelihoods of forest dependent communities. Climate change is predicted to alter existing biome types, cause forest dieback, and loss of biodiversity. However, Net Primary Productivity is predicted to increase. These shifts will require adaptation of communities dependent on forest resources, as well as at the regional and national level as shifts occur in timber production.

Forestry and climate change

In India nearly 200,000 villages are located in or near forests, and depend heavily on forest resources for their livelihood activities. Industry is also a factor, as industry depends on forests for raw materials.

Climate change is likely to impact forest biodiversity through changing biome types and shifting forest boundaries. This will in turn impact the supply of forest products, as well as the livelihoods of forest dependent communities, who use forest resources for fuelwood, building materials, and incomes through the sale of forest products.

The Indian Institute of Science (IISc) Bangalore, in collaboration with the Forest Survey of India and the Indian Institute of Tropical Meteorology, undertook this study to determine how climate change will impact on forest biomes and boundaries in India.

The Indian Institute of Science

The Indian Institute of Science (IISc) is an educational and research organisation in India. Within the IISc, the Center for Ecological Sciences is conducting research and teaching programmes on ecological issues including climate change. It has actively contributed to IPCC assessments and has published extensively on climate change research topics. http://www.iisc.ernet.in

Description of methodology

As a first step, baseline data were gathered on past climate, vegetation, and soils at the regional and the national level. The assessment of projected climate change impacts on forest ecosystems was conducted using the Hadley Center Regional Climate Models (RCMs) (as developed in the climate change scenarios, Keysheet 2), and incorporating climate projections from these into a model specific to vegetation changes (BIOME3). Climate parameters were projected for 2070 and 2100. The current climate scenario was used to compute the distribution of biome types likely to occur at different locations currently under forest cover. Future climate (and CO2 concentration) was then used to obtain the biome types expected to prevail under the changed climate in these locations. A comparison of current and projected biomes provides an estimate of the expected change. As a general rule, regions showing a greater variance between the two are assumed to be more vulnerable to climate change.

The study also involved an assessment of current dependence of communities and economy on the forests of the Western Ghats and the central Himalayas, and development of a baseline socio-economic scenario specific to these forest dependent communities in the absence of climate change. While an assessment of adaptation and policy measures was not an immediate goal of the study, a preliminary assessment of potential adaptation options was made.

Predicted climate change impacts on forests

The analysis clearly demonstrates a large scale shift in forest types in India. Table 7.1 lists the changes in different biomes under current and future scenarios (B2 scenario).

Table 7.1
Biome Types in India – Current and Projected

Biome type	Number of grids (Current)	Number of grids (Projected)	% Current	% Projected	Change
Boreal evergreen	999	292	2.81	0.82	-1.99
Boreal/temperate mixed	0	859	0.00	2.41	2.41
Temperate conifer	1074	488	3.02	1.37	-1.65
Temperate deciduous	2063	2314	5.80	6.50	0.71
Temperate evergreen/warm mixed	1895	3539	5.32	9.94	4.62
Tropical seasonal forest	711	10098	2.00	28.37	26.37
Tropical dry forest	2719	13237	7.64	37.19	29.55
Moist savanna	11577	198	32.52	0.56	-31.97
Dry savanna	11771	1544	33.07	4.34	-28.73
Xeric woodland	624	2708	1.75	7.61	5.85
Xeric Shrubland	2010	254	5.65	0.71	-4.93

Dry Savanna

Moist Savanna

Tropical Seasonal Forest

Xeric Woodland

Notably, the country's dominant forest cover, characterised by Moist Savanna (32.5%) and Dry Savanna (33%) is projected to change, such that Tropical Dry Forest (37.2%) and Tropical Seasonal Forest (28.4%) become dominant. To a smaller extent, Xeric Shrubland is set to decrease in area and Xeric Woodland is expected to increase in the drier regions, while in the colder regions, Boreal and Temperate Conifer coverage decreases while Temperate Deciduous and Temperate Evergreen coverage increases.

A more detailed examination reveals extensive change, with some biomes shifting to three, four or even five different types of biomes. Under the A2 scenario, approximately 90% of forest cover shows a change in biome type.

This projected shift in vegetation type may lead to large-scale forest dieback and loss of biodiversity especially in the transition between forest types. However, the Net Primary Productivity (NPP), a measure of the amount of vegetation matter produced, is likely to increase in the majority of locations due to carbon fertilisation.

The project's case studies in the Western Ghats and Central Himalayas showed that low-income communities are dependent on forest ecosystems for their livelihoods. The model shows that while the projected increase in NPP may lead to increased timber and fuelwood supply in the medium term, benefiting dependent communities, this increase will not be sustainable: forest dieback and loss of biodiversity will limit forest resources in the longer term, adversely impacting the communities and economies depending on these resources.

What are the policy implications of these predictions?

Climate change is predicted to result in a large scale shifting of forest biomes throughout India. Whilst this may benefit some forest biomes, it may also cause irreversible damage to others, rendering several species extinct and affecting markets, water supply, and energy production. These shifts will impact livelihoods at a community level, as well as impact trade of forest products at the regional and national levels. As such, policymakers will need to address both the ecological impacts of climate change on the forestry sector, as well as the social and economic impacts on communities. This will require effective forest management practices and policies as well as understanding the inter-relations between communities, government, the private sector, and forestry products.

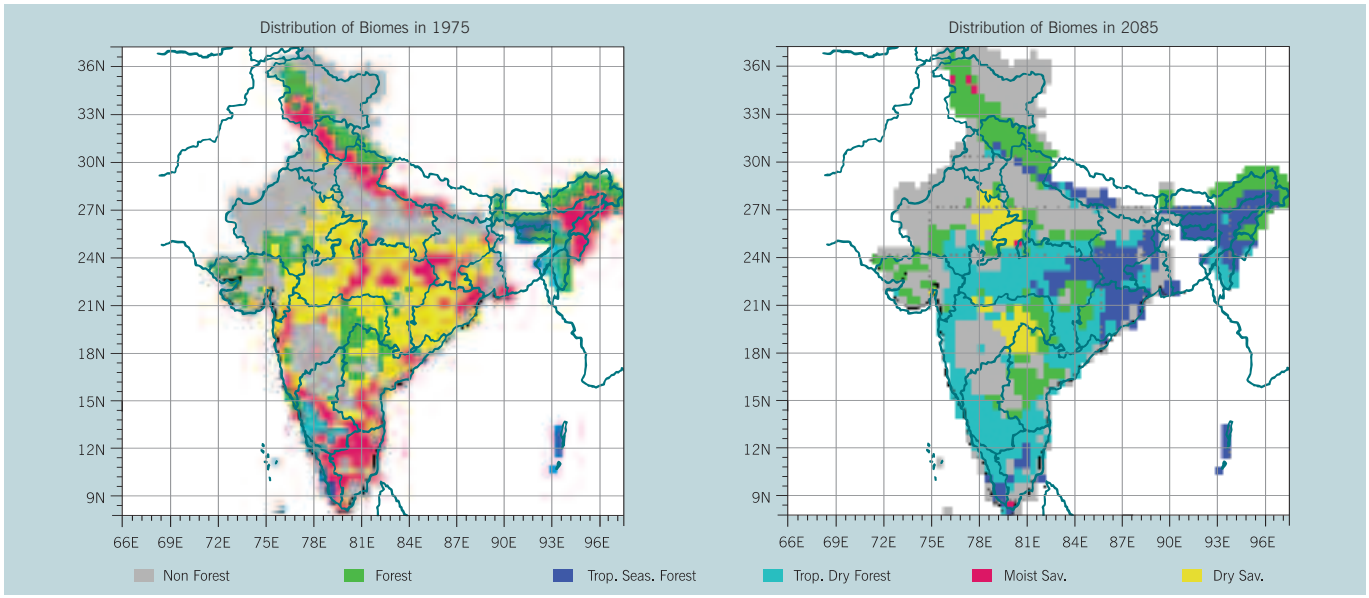
Needs for further research

This study demonstrates considerable shifts in vegetative cover throughout India in the short, medium, and long term, as a result of climate change. Further research would be useful to improve the reliability of climate projections at a regional level as well as use of dynamic vegetation models. Data limitations in the use of dynamic vegetation models could be overcome by initiating studies to develop databases on:

- forest vegetation characteristics and plant functional types;
- plant physiological parameters, soil and water data; and
- socio-economic dependence and pressures on forest ecosystems.

Figure 7.1

Impact on forest biomes (B2 scenario)



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