



INDIA



Population (millions): 1,064.4 (ranked 2 nd)	Area: 3,287,570 km ²
PPP GDP (millions): \$3,096,239	PPP GDP per capita: \$2,909
Internet Users (per 1,000 people): 29.7	HDI: 0.595
Major Cities: Mumbai, Kolkata, Delhi	
Agriculture: 23.6% • Industry: 28.4% • Services: 48%	
National Space Agency: Indian Space Research Organization (ISRO)	
Remote Sensing Agency: National Remote Sensing Agency www.nrsa.gov.in	
EO Satellites under operation: Kalpana-1, IRS-1C, IRS-1D, IRS-P3, IRS-P4, IRS-P6, Technology Experiment Satellite (TES), Insat 2A and Insat 3E	
EO Satellites under development: Cartosat-1, 2, RISAT (Radar Imaging Satellite), Insat-3D, Megha-Tropiques	
Major EO partners: France, US, ESA, Russia, Japan, Canada, Malaysia, Thailand	
Other EO organizations: Antrix Corporation	
Main EO applications Complete range of environmental and resource applications	
Main EO hurdles Real-time integrated service delivery	
Main EO opportunities Partnering for value-added services, operational disaster management, South-South cooperation	

India has had a longstanding policy of indigenous development in the remote sensing area, as evidenced by the number of remote sensing satellites it has launched and currently still has in orbit. The remote sensing efforts of India are coordinated by the following entities:

- National Remote Sensing Agency, an organization that comes under the Department of Space within the Indian Government. Its mandate is the conduct of activities involved in satellite and aerial data reception, data processing and dissemination, applications for the provision of value added services and education and training.
- National Natural Resources Management System, an inter-agency system for integrated natural resource management. It oversees the use of remote sensing for the application of natural resource management and has done so since its formation in 1983. It is coordinated at the national level through the Department of Space. The activities of the National Natural Resources Management System include the determination of user and application needs for remote sensing, conceptualization and implementation of both the space and ground segments and data processing and analysis. Its main activity is the Indian Earth Observation Program.

India currently has 10 satellites in operation to carry out the country's mandates. They include:

- Kalpana-1: launched in late 2002 as India's first dedicated geostationary weather satellite.
- Indian Remote Sensing (IRS) series: at present there are five satellites from the IRS series in orbit. These are the IRS-1C, IRS-1D, IRS-P3, IRS-P4 and IRS-P6 (also known as ResourceSat-1). IRS-1C and 1D are identical and were launched two years apart in 1995 and 1997. They image at 5.8m resolution, 23.5m, 70.5m and 188m. The IRS-P3 launched in 1996 carries a wide field sensor and an electro-optic scanner. The IRS-P4 launched in 1999 carries an Ocean Color Monitor with a resolution of 360m. Its primary function is to measure physical and biological oceanography parameters. IRS-P6 was launched in 2003 and is intended to continue the remote sensing services provided by IRS-1C and 1D as well as to improve on their data quality.
- Technology Experiment Satellite: launched in 2001, this satellite is being used to validate technologies that may be used in future Indian remote sensing satellites. It carries a 1m resolution panchromatic imager.

- Insat: launched in 1999 and 2003, the Insat series satellites (2A and 3E) provide meteorological data services.

In addition to its current operational fleet, India has a number of remote sensing satellites it plans to launch in the near future. The satellites and their estimated launch dates are:

- Cartosat-1 (2005).
- Cartosat-2 (2006).
- RISAT Radar Imaging Satellite (2007).
- Insat-3D (2007).
- Megha-Tropiques (2007).

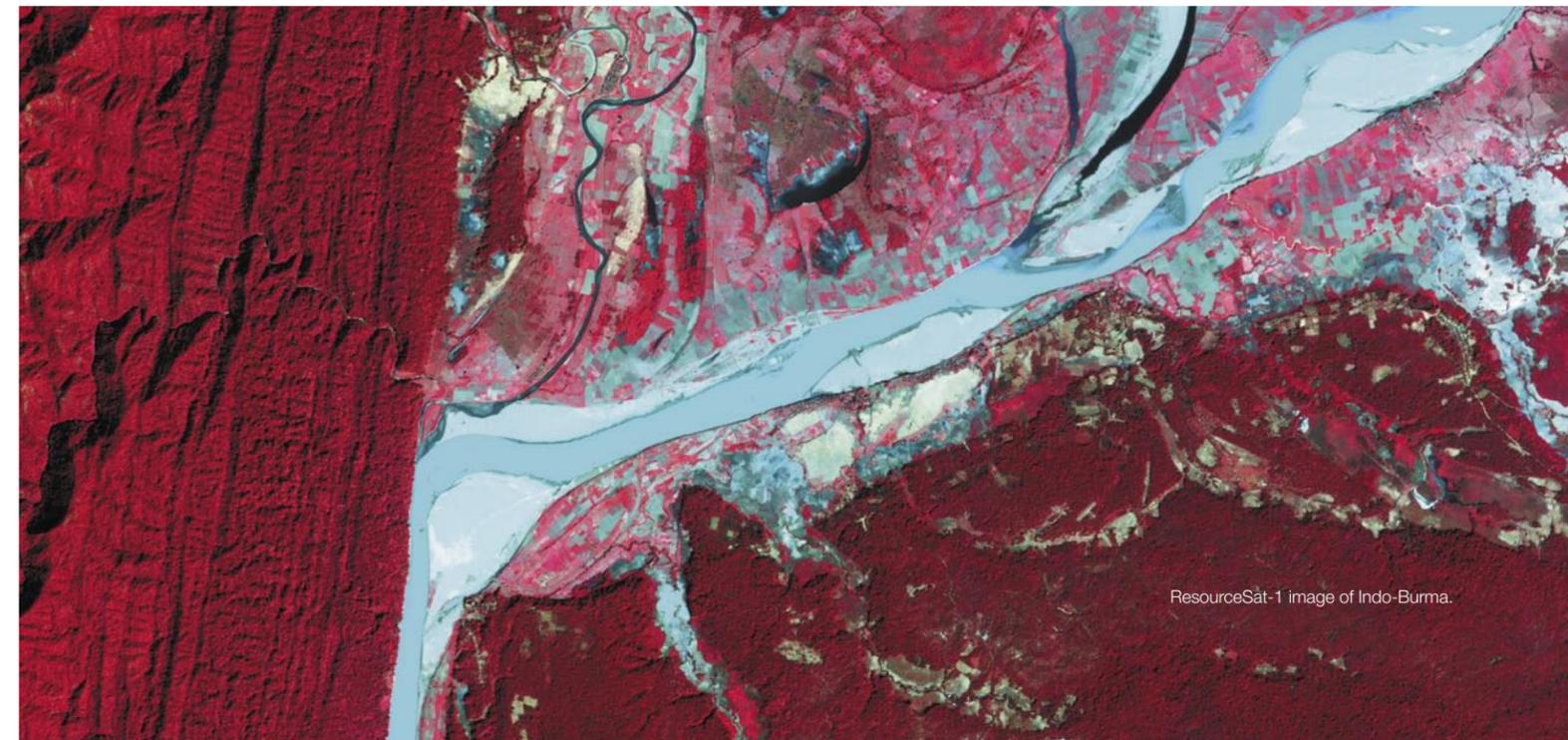
India's current program for the application of remote sensing includes:

- Agriculture: crop acreage and yield estimates for wheat, rice, peanuts, sorghum and cotton over most of the agriculturally productive land. Drought warnings and assessment are also performed, as are soil conservation studies.
- Land use and land cover: application from road cartography and urban sprawl assessment to habitat assessment for endangered species.
- Flood warning, control and damage assessment on a near real-time basis in the Gangetic and Brahmaputra

basins. In 2003, 17 major floods in five provincial states were monitored. Snow melt runoff prediction and landslide hazard zone mapping have also been done.

- Forestry: The extent and density of India's forests are mapped country-wide on a two-year cycle. Biodiversity maps have been produced for the Western and Northeastern Himalaya and the Western Ghats.
- Groundwater: hydrogeomorphology has been mapped country-wide at 1:250,000 and 1:50,000 scales. Use of the maps to assist the location of possible borewell sites has greatly increased the success rate in drilling.
- Mineral targeting and assessment of environmental impacts of mining activity.
- Coastal zone management and fisheries development. The coastal zone is mapped; processes affecting the shoreline and the mangrove forest are monitored. Ocean phenomena affecting fish behavior are analyzed and used to predict productive fishing areas.

In addition to the large number of satellites it possesses in the space segment, India also has a number of receiving stations. For the IRS satellite series, the National Remote Sensing Agency's ground station located near Hyderabad receives all data. This facility also receives data from NOAA and ERS satellites.



ResourceSat-1 image of Indo-Burma.