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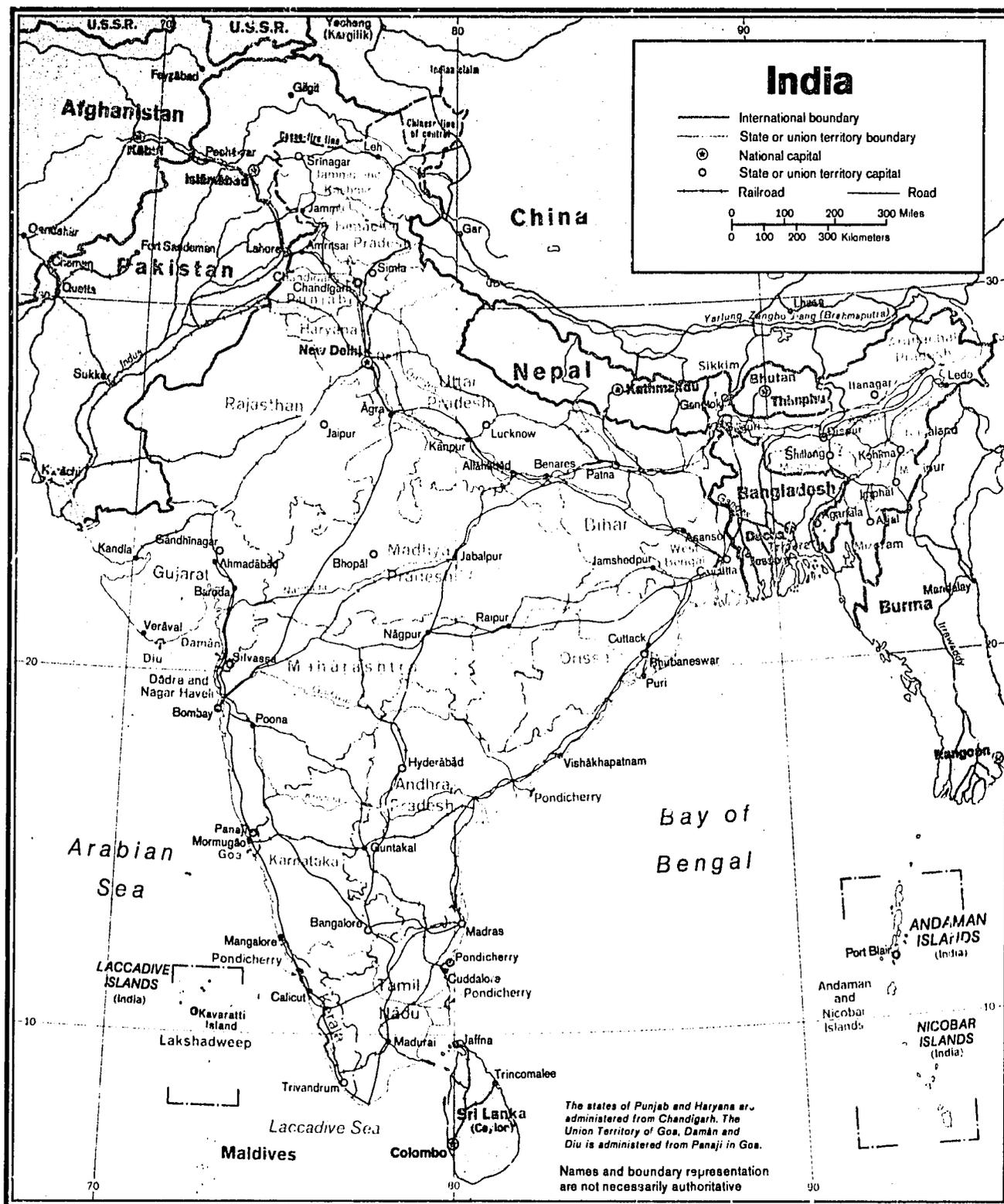
ISN 31988

# India

## A Country Profile



Office of Foreign Disaster Assistance  
Agency for International Development  
Washington, D.C. 20523



**INDIA: A COUNTRY PROFILE**

prepared for

**The Office of U.S. Foreign Disaster Assistance  
Agency for International Development  
Department of State  
Washington, D.C. 20523**

by

**Evaluation Technologies, Inc.  
Arlington, Virginia  
under contract AID/SOD/PDC-C-2112**

The profile of India is part of a series designed to provide baseline country data in support of the planning and relief operations of the Office of U.S. Foreign Disaster Assistance (OFDA). Content, scope, and sources have evolved over the course of the last several years; the relatively narrow focus is intentional. To avoid redundancy, some topics one might expect to find in a "country profile" are not covered here.

We hope that the information provided will also be useful to others in the disaster assistance and development communities. Every effort is made to obtain current, reliable data; unfortunately it is not possible to issue updates as fast as changes would warrant. A cautionary note, therefore, to the reader: statistics are indicators at best, and if names and numbers matter, the bibliography will point to a current source.

We invite your comments and corrections. Address these and other queries to OFDA, A.I.D., as given above.

June 1983

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1. General Information1.1 Geographic Codes

AID Standard	386
State Region	NEA
FIPS	IN

1.2 Time Zones

EST + 10.5 hours; GMT + 5.5 hours

1.3 Host Country Mission in U.S.

Embassy of India  
2107 Massachusetts Avenue, N.W.  
Washington, D.C. 20008  
Tel: 202/265-5050

Consulates General: In California,  
District of Columbia, Illinois,  
Louisiana, Massachusetts, New York,  
Ohio, and Washington

For current information on the Indian Embassy  
staff in the United States, refer to U.S.  
Department of State, Diplomatic List.

1.4 U.S. Mission to India

Embassy of the United States  
Shanti Path, Chanakyapuri 21  
New Delhi, India  
Tel: 690351  
Telex: USCS IN 031-4589  
USICA Tel: 46841

Bombay Consulate  
Lincoln House, 78 Bhulabhai Desai Rd.  
Bombay, India  
Tel: 363611/8  
Telex: 011-6525 ACON IN

Calcutta Consulate  
 5/A Ho Chi Minh Sarani  
 Calcutta, India 70071  
 Tel: 443611/6  
 Telex: 021-2483

Madras Consulate  
 Mount Rd.-6  
 Tel: 83041

For current information on the U.S. diplomatic staff in India, refer to U.S. Department of State, Key Officers of Foreign Service Posts.

### 1.5 Currency

One rupee = 100 paise  
 9.860 rupees = U.S.\$ 1.00 (March 31, 1983)

### 1.6 Travel and Visa Information

#### Passport and Visa Requirements:

Visa not required if the following conditions are met: (1) traveler arrives by air or boat and is traveling as a tourist; (2) traveler has not been in India within the preceding six months; stay does not exceed 30 days. All persons entering India overland must be in possession of visa issued by India Consular Office. Check Embassy/Consulate for specific requirements.

#### Health Requirements:

Cholera immunization is required only of travelers proceeding to countries which require a certificate. Yellow fever immunization required of travelers arriving from a country any part of which is infected.

### 1.7 Calendar and Holidays

Republic Day.....Jan. 26  
 Independence Day.....Aug. 15  
 Gandhi Jayanti.....Oct. 2  
 Christmas Day.....Dec. 25

1.7 Calendar and Holidays (cont'd.)

Good Friday.....Mar.-Apr.\*  
 Holi.....Mar.-Apr.\*  
 Ram Navami.....Apr.-May\*  
 Buddha Purnima.....May-June\*  
 Janmashtami.....July-Aug.\*  
 Dassehra.....Sept.-Oct.\*  
 Diwali.....Oct.-Nov.\*  
 Guru Nanak's Birth.....Oct.-Nov.\*  
 Muharram.....\*  
 Il-ul-Fitr.....\*  
 Id-uz-Zuha.....\*

\* Variable dates: in 1982, Muharram fell on  
 Oct. 28, Il-u-Fitr on  
 July 23, and Id-uz-Zuha  
 on Sept. 28.

1.8 Treaties and Agreements

Agricultural Commodities  
 Atomic Energy  
 Aviation  
 Defense  
 Economic and Technical Cooperation  
 Investment Guaranties  
 Meteorology  
 Relief Supplies and Packages  
 Remote Sensing  
 Satellites  
 Scientific Cooperation  
 Surplus Property  
 Telecommunications  
 Trade and Commerce

1.9 International OrganizationMemberships

ADB, AIOEC, Colombo Plan, Commonwealth,  
 FAO, G-77, GATT, IAEA, IBRD, ICAC, ICAO, ICO,  
 IDA, IFAD, IFC, IHO, ILO, International Lead  
 and Zinc Study Group, IMCO, IMF, IPU, ITC,  
 ITU, IWC (International Wheat Council), NAM,  
 UN, UNESCO, UPU, WHO, WIPO, WMO, WSG, WTO

### 1.10 Government

**Political Status:** Federal republic.

**Government Structure:** The President is constitutional head of the union; real power is vested in a Council of Ministers headed by a Prime Minister. A bicameral Parliament consists of the Rajya Sabha (Council of States) and the Lok Sabha (House of the People). An independent judiciary is headed by a Supreme Court.

**Regional Organization:** The Union of India comprises nine centrally administered union territories and 22 states with parliamentary governments headed by presidentially appointed governors. Each Governor selects a Chief Minister whose position is analagous to the Prime Minister's. States are subdivided into districts, each with a district collector. The country's 395 districts are further broken down into tehsils (or talukas) and subdivisions. Large cities are administered by corporations, smaller cities by municipal committees or boards, and rural villages by village councils in the Panchayat Raj system.

### 1.11 Ethnic and Sociocultural Groups

Racial elements are blurred: Caucasoid people 97%; Mongoloids 2%. Linguistic groups are more easily identified. There are two major ethno-linguistic families: Indo-Aryan speakers in the northern three-fifths of the country, 72% of the population; and Dravidian speakers in the southern two-fifths, 25% of the population. Tribal peoples, concentrated in the hill areas and in the northeast, may speak an Austro-Asiatic or Sino-Tibetan language or one belonging to a majority language group. Parsis, Jews, and Anglo-Indians (including Goanese) are small but well-defined minorities.

### 1.11 Ethnic and Sociocultural Groups (cont.d)

A caste system, determining status and occupation, has traditionally divided Indian society. Though caste remains an important factor, its role is changing in a modernizing society.

### 1.12 Languages

Hindi (spoken by about 30% of the population) and English are the national languages. Efforts to phase out English as the national language and substitute Hindi have met with strong resistance in the south. Fourteen regional languages are recognized: (Indo-Aryan) Hindi, Oriya, Gujarati, Marathi, Bengali, Assamese, Punjabi, Urdu, Kashmiri, Sindhi; (Dravidian) Tamil, Kannada, Teluga, Malayalam.

### 1.13 Religions

About 84% of the population are Hindus; another 11.2% embrace Islam. Minority groups include Christians (2.6%), Sikhs, Jains, Buddhists, Zoroastrians (Parsis), Jews, and various tribal religions. Minority religions, including Islam, tend to concentrate in certain geographic locations.

### 1.14 Geography

#### Area:

Mainland - 3,287,782 sq. km. Greatest north-south distance 3,214 km.; east-west 2,933 km. Andaman and Nicobar Islands (Bay of Bengal) - 8,293 sq. km.; Laccadive, Minicoy, Amindivi Islands (Lackshadweep) (Arabian Sea) - 32 sq. km.

- Geographic Type:** India has a highly varied relief, the mainland consisting of three well-defined regions: the Himalayan Mountains, the Indo-Gangetic Plain (a broad alluvial lowland), and the Southern Peninsula (a vast plateau of which the Deccan is the largest). An east-west central chain of low mountains, including the Vindhya and Satpura ranges, rises south of the plain. The Aravalli mountains separate the plain from the deserts of Rajasthan. The peninsula interior is flanked by coastal ranges, the Eastern and Western Ghats.
- Rivers:** Three major river systems rise in the Himalayas: the Indus flows into the Arabian Sea in Pakistan; the Ganges (principal tributary is the Jumna) flows the length of the Gangetic plain and drains into the Bay of Bengal; the Brahmaputra follows a tortuous course through Assam and Bangladesh where it joins the Ganges before emptying into the Bay of Bengal. In addition, there are six major rainfed peninsula rivers: the Mahanadi, Godavari, Krishna, Cauvery, Namada and Tapti.
- Climate:** The climate is tropical monsoon but wide regional variations exist. Four seasons: cool dry winter (Dec.-Feb.); dry hot summer (Mar.-May); rainy season or southwest monsoon (June-Sept.); post or retreating monsoon (Oct.-Dec.). Temperature extremes are most marked in the north where in Delhi, for example, the average is 10-15° C in the cool season and 32-35° C in the hot season. In the Ganges Delta, Calcutta's average temperature ranges from 19° C in January to 30° C in May. The range is even narrower in the far south, with Tamil Nadu experiencing an average temperature of 24° C in January and 32° C in May-June. Rainfall is erratic and unevenly distributed; extremes of average annual rainfall range from 11,419 mm in Cherrapunji (Meghalaya) to 100-500 mm in Rajasthan and parts of Kashmir. 80-90% of India's rainfall occurs during the monsoon season.

1.15 PopulationNational Demographic  
Characteristics  
(1981 census):

India is the second most populous country in the world. The 1981 census gave a total of 683,810,015 (including the disputed area of Jammu and Kashmir). Family planning is promoted by the government and integrated with basic health services.

Average annual growth rate (1971-81) - 2.23%

Density per sq. km. - 221

Percent urban - 23

Sex ratio - 1,000 males per 935 females

Family size 4.3 persons

Age structure (percent) (1983 World Bank estimate) -

0-14	40.2
15-64	56.8
65+	3.0

Regional Distribution  
(1981 census):

<u>States/Union Territories</u>	<u>Population and Rank</u>	<u>Density/</u>	
		<u>Sq. Km</u>	<u>% of Total</u>
INDIA	683,810,051	221*	100.00
Andhra Pradesh	53,403,619(5)	194	7.81
Assam (a)	19,902,826(13)	254	2.91
Bihar	69,823,154(2)	402	10.21
Gujarat	33,960,905(10)	173	4.97
Haryana	12,850,902(15)	291	1.88
Himachal Pradesh	4,237,569(18)	76	0.62
Jammu & Kashmir (a)	5,981,600(17)	NA	0.87
Karnataka	37,043,451(8)	193	5.42
Kerala	25,403,217(12)	654	3.71
Madhya Pradesh	52,131,717(6)	118	7.62
Maharashtra	62,693,898(3)	204	9.17
Manipur	1,433,691(20)	64	0.21
Meghalaya	1,327,874(21)	59	0.19
Nagaland	773,281(23)	47	0.11
Orissa	26,272,054(11)	169	3.84
Punjab	16,669,755(14)	331	2.44
Rajasthan	34,102,912(9)	100	4.99
Sikkim	315,682(28)	44	0.05
Tamil Nadu	48,297,456(7)	371	7.06
Tripura	2,060,189(19)	196	0.30
Uttar Pradesh	110,858,019(1)	377	16.21
West Bengal	54,485,560(4)	614	7.97

Regional Distribution (1981 census) (cont'd)	States/Union Territories	Population and Rank	Density/	
			Sq. Km	% of Total
	UNION TERRITORIES			
	Andaman & Nicobar Islands	188,254(29)	23	0.03
	Arunachal Pradesh	628,050(24)	7	0.09
	Chandigarh	450,061(27)	3948	0.07
	Dadra & Nagar Haveli	103,677(30)	211	0.02
	Delhi	6,196,414(16)	4178	0.09
	Goa, Daman & Diu	1,082,117(22)	284	0.16
	Lakshadweep	40,237(31)	1257	0.01
	Mizoram	487,774(26)	23	0.07
	Pondicherry	604,136(25)	1228	0.09

NA - not available.

(a) - Projected figures for 1981.

\* While working out the density of India, Jammu & Kashmir has been excluded as density figures are not available for that State.

Source: Hindustan Year-Book and Who's Who 1982.

Urban areas (1981 census):		
	Calcutta	9,165,650
	Greater Bombay	8,202,759
	Delhi	5,227,730
	Madras	4,276,635
	Bangalore	2,913,537
	Hyderabad	2,565,536
	Ahmedabad	2,515,195
	Kanpur	1,685,308
	Pune	1,685,266
	Nagpur	1,297,977
	Lucknow	1,006,843
	Jaipur	1,004,669

Source: Europa. The Far East and Australia 1982-83.

1.16 Health

Vital Statistics:	Births/1,000 population	35.6
	Deaths/1,000 population	13.6
	Infant mortality/1,000 live births	123.4
	Life expectancy at birth	51.8 years
	Access to safe water (percent of population) urban	83
	rural	20

Source: World Bank estimates, October 1982.

Health Care System:	The central government determines broad health policy and provides financial and technical assistance to the states which implement programs. National programs and facilities exist for the treatment and prevention of major diseases. The rural health network is built around a district hospital, a sub-divisional hospital, upgraded primary health centers, primary health centers (one per development block), and sub-centers.
Facilities and Personnel:	6,670 hospitals and numerous clinics for the treatment of specific diseases; 460,886 hospital beds; 5,532 public health centers, 51,184 sub-centers, 3,550 subsidiary health centers (India Ministry of Health and Family Welfare, Annual Report 1981-82); 255,138 registered doctors (practicing modern medicine and concentrated in urban areas), 146,201 trained nurses, 141,995 midwives, 71,434 auxiliary nurses/midwives, 9,286 health visitors, 155,621 pharmacists, 8,487 dentists. Traditional systems of medicine - Ayurvedic (Hindu), Siddha (in the south), Unani (Muslim), and Homeopathy - are widely practiced in addition to Western medicine.
Major Health Problems:	Malnutrition and gastrointestinal infections are widespread and contribute to the high infant mortality rate. Vitamin deficiencies and deficiency-related ailments (e.g., goiter in the sub-Himalayan belt) are prevalent. Endemic diseases include malaria (incidence down to 2.2 million cases in 1981-82 after a resurgence to 6.4 million cases in 1976), leprosy (endemic in Tamil Nadu and Andhra but also occurring in several other states),

filariasis (in humid areas), cholera (particularly in the south and east coast areas - 8,684 reported cases in 1980 and 306 deaths), and tuberculosis. Kalaazar is mainly prevalent in Bihar and West Bengal.

### 1.17 Economy

#### Overview:

Mixed economy; high degree of government control and ownership. Economic growth over the past 30 years averaged 3.6% annually. GDP increased by 7.5% in 1980/81 and 5.5% in 1981/82, representing a recovery over the sharp decline in growth in 1979/80 brought about by the doubling of international oil prices, shortages in commodities and services, and a severe drought. Reflecting the influence of weather conditions on India's economy, GDP growth dipped again during the 1982/83 drought year to about 2%. Agriculture accounts for about 40% of GDP, employs more than two-thirds of the labor force. Industry, 24% of GDP, 12% of labor force, is diversified but below capacity. Major products: textiles, jute, sugar, paper and paperboard, iron and steel, fertilizers, machines and engineering tools, and handicrafts. Coal and iron are relatively abundant; oil reserves modest. Chronic shortage of cement despite adequate supply of raw materials. GNP: \$165.38 billion (1981/82); \$250 per capita (1981) (World Bank estimates). An estimated 51% of the rural and 38% of the urban population are below the poverty line.

#### Balance of Payments:

A sharp deterioration in the terms of trade in the early 1970s spurred a period of rapid export growth. While the impact of the economic slowdown in 1979/80 continued to be felt in the balance of payments in 1981/82, the situation improved somewhat in 1982/83. India's trade deficit of \$6.7 billion in 1981/82 fell to \$6 billion in 1982/83 (World Bank estimates). The current account deficit was still high at \$3.3 billion in 1982/83 due in part to foodgrain imports.

- Exports:** Estimated at \$8.8 billion in 1982-83 (exclusive of petroleum products); tea, coffee, vegetable oils, raw cotton, unmanufactured tobacco, iron ore, jute goods, cotton textiles, clothing, leather goods, gems, handicrafts, engineering goods.
- Export Markets:** Saudi Arabia and other OPEC countries, Japan, U.S.S.R., West Germany, U.K., U.S.
- Imports:** Estimated at \$14.8 billion in 1982-83; petroleum, foodgrains, fertilizers, iron and steel, non-ferrous metals, edible oils, fibers, diamonds, pulp and paper, chemicals, machinery, transport equipment.
- Suppliers:** U.S., Iran, Iraq, Japan, U.S.S.R., U.K.
- Agriculture:** Growth in agricultural production since the early 1960s in the "green revolution" (increased use of high yield seeds, fertilizer, and irrigation) has led to virtual self-sufficiency in foodgrains. Most potential agricultural land is under cultivation. Foodgrains occupy 70% of cropped area. Cereals (rice, wheat) constitute 90% of foodgrains; pulses (mainly chickpeas) the rest. Production of 132-134 million tons of foodgrains in 1981/82, though about the same as the record 1978/79 crop, is low compared with potential. The 1982/83 foodgrains harvest is expected to fall to about 128 million tons because of a poor monsoon. Cash crops include oilseeds, cotton, sugar cane, jute, and tea.

### 1.18 Communications

- Radio Network:** All India Radio (AIR) and Doordarshan India (Television India) are autonomous corporations under the Ministry of Information and Broadcasting. In order to reach a wider audience, the Government has installed radio and television sets at selected community centers and schools. There are five broadcasting zones. The News Services Division of AIR has 40 regional news units, broadcasts 116 bulletins daily in 23 languages and 33 dialects. An estimated 20,724,013 radio licenses were issued in 1979.

**Television:**

Television centers are located at Delhi, Bombay, Calcutta, Madras, Srinigar, Jullundur, and Lucknow. In addition, there are four relay centers and seven Satellite Instructional Experiment (SITE) on-going transmitters. An estimated 1,151,311 television sets were in operation in 1979, reaching about 83,200,000 people (15.2% of population) over an area of 200,000 sq. km.

**Telecommunications:**

The telecommunications sector is state-owned. The Post and Telegraph Department (P and T) and the Overseas Communications Service are under the Ministry of Communications. While the network is large by world standards -- more than 2.5 million phones -- service is described as fair to poor. Density (number of phones per 100 population) was only 0.36 country-wide in 1978, somewhat greater in the major cities -- about 2 for Hyderabad, Calcutta, and Lucknow and nearly 4 for Delhi and Bombay. Many rural areas and towns are without service.

**1.19 Power**

Top priority consideration is being given to developing the electric power sector but power shortages remain a problem. State Electricity Boards operate about 88% of total installed capacity which in March 1981 was approximately 33,000 MW: 62% conventional thermal, 36% hydro, and 2% nuclear. Another 3,212 MW was scheduled for commissioning in 1981/82. About 48% of Indian villages were electrified as of October 1981.

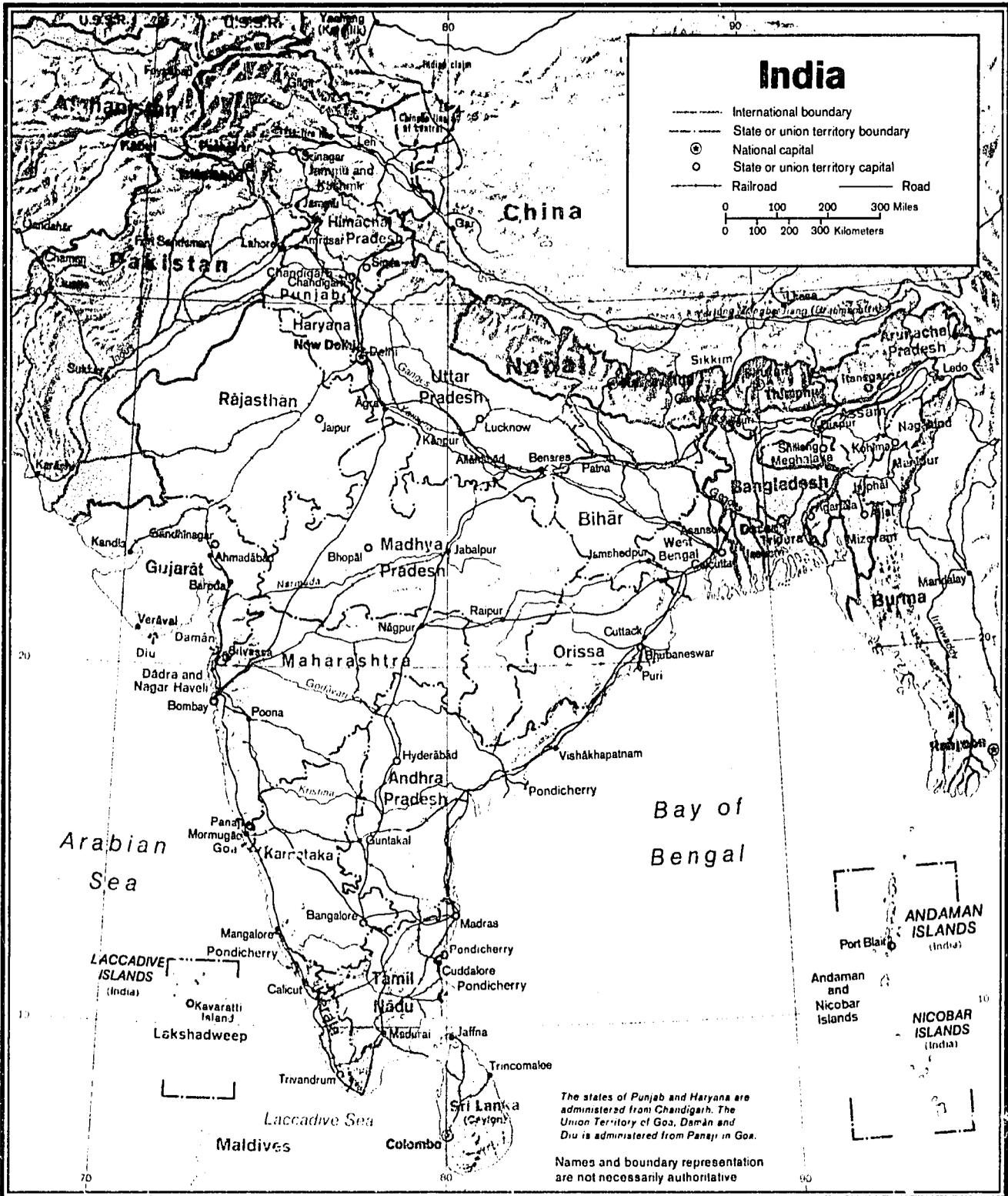
**1.20 Transportation****Railways:**

Rail and road are the dominant transport modes. Highways serve as a feeder system to railways which provide mainly trunk services. The Indian railway system is the largest in Asia, carrying two-thirds of the country's total freight traffic and nearly one-half of passenger traffic. India Railways (IR), owned and managed by the GOI and directed by

the India Railway Board, operates over 60,000 route-km (75,860 km of running track) in nine zonal railways.

- Roads:** Ports, shipping, and roads are under the Ministry of Shipping and Transport. The central government is responsible for national highways. State, district, and rural roads are maintained by various agencies in the states and union territories. The total network consisted of 1,604,110 km of roads in 1979, of which 623,402 km were surfaced and 29,340 km were classed as national.
- Inland Waterways:** India has 14,300 km of inland waterways. About 5,200 km of major rivers and 485 km of canals are navigable by mechanized craft. The Ganges and Brahmaputra and their tributaries are heavily traveled. The Godavari, Krishna, and other peninsula rivers and their canals are also important.
- Ports:** Ten major ports can accommodate and berth ships of at least 4,000 tons: (west coast) Bombay, Kandla, Mormugao, New Mangalore, and Cochin; (east coast) Tuticorin, Madras, Visakhapatam, Paradip, Calcutta, and Haldia. Bombay, a natural harbor, is the most important port in terms of volume of cargo handled, followed by Calcutta (including Haldia), and Madras. Designated major ports are administered by the central government; some 190 intermediate and smaller ports by state governments.
- Shipping:** There are 63 domestic shipping companies: 19 in coastal trade, 35 in overseas trade, and nine in both. The central government's Shipping Corporation of India (SCI) (148 vessels) and Mogul Line Ltd. (17 vessels) carry both coastal and overseas trade and together account for nearly 55% of the country's total tonnage. Both companies have headquarters in Bombay; SCI has several branch offices.

- Airports:** India's four international airports are located in Bombay (Santa Cruz), Calcutta (Dum Dum), Delhi (Palam), and Madras (Meenambakkam). 85 other aerodromes are distributed throughout the country.
- Airlines:** International - Aeroflot (U.S.S.R.), Air France, Alitalia, Ariana Afghan, Bangladesh Biman, British Airways, BAC (Burma), CAAC (People's Republic of China), CSA (Czechoslovakia), Egypt Air, Ethiopian Airlines, Garuda (Indonesia), Gulf Aviation, Iran Air, Iraqi Airways, JAL (Japan), Kenya Air, KLM (Netherlands), Kuwait Airways, LOT (Poland), Lufthansa (Federal Republic of Germany), Maldiv International Airlines, Pan Am (U.S.A.), PIA (Pakistan), Qantas (Australia), Royal Nepal, Sabena (Belgium), Saudia, SAS (Sweden), SIA (Singapore), Swissair, Thai International, and Yemen Airways (Yemen Arab Republic).
- Domestic - Air India has services to 40 countries; Indian Airlines operates regional and domestic flights; Vayudoot Private, Ltd. provides local services in northeastern India.
- Please note: A more detailed discussion of transportation in India is found in section 3.8, Host Transportation Resources.



## 2. Disaster Vulnerability

### 2.1 Physical Environment

Mainland India comprises three well-defined relief regions: the Himalayan mountain system in the north; the great plains of the Ganges and Indus rivers; and the plateaus of the peninsula.

Peaks rise to more than 8,000 m in the Great Himalayas, the northernmost of the three almost parallel ranges that make up the Himalayan system. The middle range, the Lesser Himalayas, averages 5,000 m in height. The Outer Himalayas, foothills averaging 600 m in elevation, form a northern wall to the broad alluvial Indo-Gangetic Plain built up by the basins of the snow-fed Indus, Ganges, and Brahmaputra rivers. The plain stretches from the arid and semi-arid regions of Rajasthan in the west to the Ganges delta in the east, with a variation in elevation of only about 200 meters.

South of the plain, and separated from it by a central chain of hills and low mountains, is the peninsula interior. This ancient and geologically stable area consists of a series of mostly eastward sloping plateaus, of which the Deccan is the largest. The Shillong Plateau in northeastern India, though geographically isolated from the southern peninsula, is part of the same crystalline formation. The Deccan is intersected by numerous rivers, chief of which are the Godavari, Krishna, Mahanadi, and Cauvery, which empty into the Bay of Bengal, and the Narmada and Tapi which flow into the Arabian Sea.

The main ranges of the central mountains, varying from 460 m to 1,220 m in height, are the north-south Aravalli and the east-west Vindhya and Satpura. Two other mountain ranges, the Eastern Ghats (average elevation 610 m) and the Western Ghats (rising to over 2,440 m), flank the peninsula interior and separate it from the coastal plains. The two ranges converge at the tip of the peninsula in a densely wooded and hilly area of heavy rainfall and many rivers.

With such a wide range of climatic and topographic conditions, India is subject to natural disasters of a variety of types. The country's physical features have an important effect on weather patterns. The Western Ghats, for example, obstruct the southwest monsoon so that rainfall is heavy on the coastal region west of the Ghats, while peninsula India to the east receives low rainfall and is an area of chronic drought. The Himalayan mountain system, though largely outside of India, is the source of India's three great river systems and acts as a barrier to cold winds from the north and to the monsoon air-flow from the south. Because of continuing uplift movements in these mountains, the region is susceptible to earthquakes.

Deforestation in parts of the Himalayas has been linked increasingly with the problem of flooding. All of India's river basins, including the Himalayan rivers, the rain-fed Deccan or peninsula rivers, and the ephemeral coastal and inland drainage rivers are subject to flooding; however, flooding is most common in the lower Ganges River Basin and the Brahmaputra. The flatness of the terrain in much of the Indo-Gangetic Plain, coupled with silt accumulation in rivers due to erosion, prevents rapid drainage during periods of heavy rainfall.

The country is heavily dependent on unstable monsoon rains for moisture, particularly the southwest monsoon which covers much of India between June and September. Inundation of the flood plains is expected annually, but extreme conditions are not uncommon. Prolonged and heavy rainfall may cause disastrous flooding, while poorly distributed monsoon rains of below normal volume may result in crop failure and food scarcity. Drought is chronic in some areas but has occurred in nearly all parts of the country with failure of the monsoons. Tropical cyclones and accompanying storm surges are an annual menace during the onset and retreat periods of the southwest monsoon. The east coast is most frequently affected.

## 2.2 Hazard Analysis

Drought - Drought has been a major natural disaster throughout India's history. Peninsula India east of the Western Ghats and parts of Rajasthan and Gujarat are normally low rainfall areas. Drought-prone regions make up about 16% of the country. Wider areas may be affected by failure of the monsoon, with resulting food shortages, loss of rural purchasing power, and scarcity of water for drinking, irrigation, and power production. Drought has followed a 3-5 year cycle in India with severe droughts in this century occurring in 1901 (Bengal), 1918, 1943 (Bengal famine), 1964 (Rajasthan, central India), 1967 (north India), 1972 (central India), 1979, and 1982.

Floods - Major rivers and their tributaries are subject to annual flooding during the latter part of the monsoon period. Himalayan rivers, in particular, overflow their channels during the monsoon season when discharge is high. Floods are estimated to affect an average of 6.7 million hectares of land annually (about 20% of the country), including about 2.6 million hectares under crops. Even normally low-rainfall areas may experience devastating flash floods. In recent years, disastrous monsoon floods occurred in 1964, 1970 (eight states), and 1975 (Arunachal Pradesh, Assam, Bihar, Kerala, Uttar Pradesh, Kashmir, Punjab, Rajasthan, West Bengal, and Orissa states), and have affected some part of the country nearly every year since. Flooding is also associated with tropical cyclones.

Tropical Cyclones - The more intense and destructive cyclonic storms usually occur during the transition periods: pre- (April-May) and post- (September-December) monsoon periods, the latter being the most active period. Storms originate with greatest frequency in the Bay of Bengal, fewer in the Arabian Sea; West Bengal, Orissa, Andhra Pradesh, and Tamil Nadu on the east coast are the states most likely to be affected. Kerala and Karnataka in the southwest, and the islands of Andaman and Nicobar and Lakshadweep are also particularly vulnerable. The annual average number of tropical cyclones originating in the Bay is 4.8 (three severe), while the annual average over the Arabian Sea is 1.4 or 14 every 10 years (about half becoming severe). Occasionally, Bay storms cross the peninsula and rejuvenate in the Arabian Sea. Tropical cyclones have caused enormous destruction and loss of life in India as well as in other countries surrounding the Bay of Bengal. Bay storms are noted particularly for their devastating storm tides which inundate low-lying coastal areas. Storm surges as high as 12 meters were reported in some of the historic cyclones. In recent times, a tropical cyclone with a 6 meter storm tide killed 40,000 people in West Bengal in October 1942; another, also with a 6 meter storm surge, took nearly 10,000 lives in Orissa in October 1971. Devastating cyclones struck Andhra Pradesh in 1969, 1977, and 1979 and Tamil Nadu, Kerala, and Lakshadweep in 1977.

Erosion, desertification - Four types of erosion - gully, sheet, wind, and marine - affect different regions. The need of India's rapidly growing population to obtain firewood and expand agricultural land has resulted in deforestation of large areas. An estimated 4.0 million hectares of forest have been lost during the last two decades. The removal of protective forest cover reduces the water holding capacity of the soil with consequent loss of soil fertility and sediment build-up in reservoirs and rivers. The clogging of rivers and reservoirs contributes, in turn, to flooding in the wet season and to water shortages during dry periods. Gully and sheet erosion are both associated with heavy rainfall, the former being most evident in the plains and river valleys of the Jamuna River and its tributaries, and the latter most severe in deforested hillsides in peninsula uplands and the Himalayas.

Deforestation and overgrazing also aggravate wind erosion which is especially severe in the desert areas of Rajasthan and the Gujarat Plain and in areas of the Indo-Gangetic Plain west of the Kosi River. The deterioration of the environment of desert zones and marginal lands brought about by human settlement contributes to desertification. There is some evidence that the desert is extending to semi-arid regions east of the Aravallis Mountains.

Marine erosion caused by the monsoons is a problem along the western coast of Kerala and the eastern coast of Tamil Nadu.

Degradation of Water Supplies - Surface water pollution creates environmental hazards in urban areas in India where sewage and industrial wastes are discharged into rivers. Water quality is also affected by sea

water encroachment and silt accumulation. Ground water pollution is a less serious problem at present.

Seismicity - Displacements along the Himalayan boundary faults are the major cause of earthquakes in India, although a strained zone of crumpled and fractured rock below the Indo-Gangetic alluvium is another possible source. The main seismic belts are the Himalayan regions from Kashmir to Arunachal, Nagaland, Manipur, Mizoram, the Bay Islands, and the Kutch region. About 20 earthquakes have affected India during the past century. Particularly devastating were the Assam earthquake of 1897, the Kangra earthquake of 1905 which took 20,000 lives, the Bihar-Nepal earthquake of 1934 which killed 10,000, and the Assam earthquake of 1950. Earthquakes have occurred in recent years in Koyna (1967), Bhadrachalam (1969), Broach (1970), Kinnaur (1975), Uttar Pradesh (1980), and Jammu and Kashmir (1980).

Volcanicity - India has no active volcanoes. Barren Island in the Bay of Bengal (east of the Andamans) is a dormant volcano which last erupted in the early 1800s. The island of Nacodam (150 km northeast of Barren Island) is considered an extinct volcano.

Other - Other possible disasters include tornadoes, hailstorms, locusts, fire, cold waves, epidemics, civil strife, nuclear and other accidents.

Tornadoes usually occur with severe thundershowers and more commonly in northeast India. In the recent past, tornadoes were reported in Cooch Behar (West Bengal) in April 1963, Ludhiana (Punjab) in March 1975, Delhi in March 1978, and Orissa in April 1978.

Though epidemics have taken a dreadful toll of lives in the past (over four and a half million people died from bubonic plague, cholera, and smallpox in the early years of this century), improved public health measures and the eradication of smallpox have reduced the threat. Still, cholera is endemic in some areas and outbreaks occur with regularity; encephalitis and measles epidemics have also been reported in the recent past.

Damage from hailstorms and coldwaves is usually confined to crops, although people with inadequate protection in northern regions may also suffer and deaths are frequently reported. Forest and village fires are not uncommon during the dry summer months. Locusts invade India from West Asian deserts every few years.

Differences in religion, language, and caste are divisive forces in Indian society and have provoked unrest and violence in the past. Civil strife remains a potential and recurring form of disaster.

India is a world nuclear power, and the possibility of nuclear, as well as other kinds of accidents, also exists.

Selected Disasters 1970 to Present\*

<u>Disaster</u>	<u>Location</u>	<u>Date</u>	<u>Number Killed</u>	<u>Number Affected</u>	<u>Damage (\$ 000)</u>
Floods	NE, Ganges R System	07/20/70	627	10,000,000	101,200
Displaced Persons	NE, W Bengal	03/25/71	5,560	10,000,000	n.a.
Cyclone	Orissa State	10/29/71	9,658	4,900,000	30,000
Floods	Uttar Pradesh	09/09/71	300	35,000	n.a.
Coldwave	Uttar Pradesh, Bihar	01/05/73	115	n.a.	n.a.
Drought	Central India	00/00/72	n.a.	200,000,000	100,000
Windstorm	Srinagar, Kashmir	10/21/72	50	75	n.a.
Coldwave	Bihar, Delhi	12/23/73	146	n.a.	n.a.
Earthquake	Himachal Pradesh	01/19/75	n.a.	n.a.	n.a.
Cyclone	West Bengal State	08/15/74	20	4,000	n.a.
Floods	NW, Bihar	07/00/75	350	27,000,000	227,397
Mine Expl	Dhanbad (Bihar)	12/28/75	372	n.a.	n.a.
Storm	Eastern India	08/00/75	450	n.a.	200,000
Storm	Bulandshar (U.P.)	09/00/75	30	n.a.	n.a.
Storm	Gujarat	10/22/75	21	n.a.	n.a.
Flood	Ganges System	08/06/77	500	1,000,000	n.a.
3 Cyclones	Tamil, Kerala, Andhra	11/12/77	14,204	9,037,400	498,535
Floods	Northern Regions	09/00/78	3,800	32,000,000	165,000
Cholera	West Bengal	10/00/78	113	n.a.	n.a.
Encephalitis	Uttar Pradesh	10/00/78	2,000	n.a.	n.a.
Drought		00/00/79	n.a.	10,000,000	200,000
Cyclone	Andhra Pradesh	05/18/79	594	1,605,772	12,800
Heatwave	Bihar, Eastern	05/00/79	300	n.a.	n.a.
Dam Collapse	Morvi (Gujarat)	08/11/79	1,335	150,000	10,000
Monsoon	Northern, NE	08/00/80	1,600	30,000,000	320,000
Earthquake	Jammu & Kashmir	08/24/80	13	40	n.a.
Cholera	Madhya Pradesh	07/00/80	390	n.a.	n.a.
Encephalitis	Northern	09/00/80	400	n.a.	n.a.
Coldwave	Northern	01/00/81	300	n.a.	n.a.
Flood	4 States	07/00/81	600	1,500,000	n.a.
Cyclone	Orissa, W. Bengal	12/10/81	200	20,000	n.a.
Monsoons	NE, 5 States	06/00/82	932	33,500,000	n.a.

\* Partial listing to show variety of types as well as severity of major disasters.

Source: OFDA Disaster History on file in Washington, D.C. Covers 1900 - present.

### 2.3 Vulnerability of Infrastructure

The damaging effect of natural disasters on property and infrastructure in India is well documented in disaster histories. Damage is most often associated with floods and tropical cyclones. Earthquakes, fires, and other accidents cause substantial but less frequent destruction. The disruption of communication and transportation links with disaster-affected areas is often a major problem in carrying out relief activities.

Kacha (impermanent) housing of the poor is particularly vulnerable to storm and flood damage. Entire villages may be submerged or isolated. More likely than pucca (permanent) housing to be constructed in disaster-prone areas, kacha housing is typically built of mud and thatch and is subject to fairly rapid deterioration under normal conditions. This type of housing has the advantage, however, of being inexpensive to replace and perhaps less likely to cause injury to occupants if it collapses. Pucca houses of mortared brick or stone may also suffer damage in severe storms and earthquakes.

Transportation service is frequently disrupted during floods and cyclones. Only about 169,000 of India's 576,000 villages have all-weather road connections. The use of unsurfaced roads is limited in many areas by seasonal flooding. Even many surfaced roads become impassable during the rainy season. Earthquake- or flood-induced landslides, fallen trees and power lines, washed-out bridges and embankments, or inundated stretches of track and highway may sever vital rail and road connections. Three of the country's four international airports are located in cyclone-prone areas. Those on the east coast, Dum Dum (Calcutta) and Meenambakkam (Madras), are more likely to be affected because of the greater frequency of tropical cyclones on that coast. Ports are subject to wind and storm surge damage in tropical cyclones. Ports may be affected when a disturbance is several miles away. India's major ports are all-weather ports; several intermediate and minor ports are closed or have limited capacity during the monsoons.

While it is difficult to judge how vulnerable a particular installation will be in a natural disaster, it appears that some of India's numerous dams and power plants, including some of the existing and proposed nuclear plants, may be subject to damage from floods, earthquakes, and accidents.\* Irrigation systems and drinking water supplies are vulnerable to damage (or contamination) from cyclones, floods, and drought.

\* The OFDA Disaster History list shows that a dam break or collapse has occurred at two different sites during the past 20 years. An earthquake near Koyna (Maharashtra) in 1967 temporarily knocked out several generators of the Koyna Hydroelectric Project but fortunately did not cause the collapse of a dam downstream on the Koyna River. (See India: A Reference Annual 1981 for a list of power plants and their locations.)

## 2.4 Vulnerability of Agriculture

The Indian government places a high priority on expanding irrigated land so that the important agricultural sector (40% of GNP, 70% of the labor force, and the base of 45% of exports) will be less vulnerable to the vagaries of weather. Irrigation has long been practiced in India as protection against famine. However, despite rapid advancements in that method of farming in recent decades (57 million hectares irrigated in 1982: 60% from surface sources; 40% from groundwater), Indian agriculture remains highly dependent on moisture from the southwest monsoon, with 40% of production rainfed. The amount and distribution of rainfall during July and August largely determine the fate of kharif crops which are sown at the onset of the monsoons (June/July) and harvested in October-January. Principal kharif crops are rice, millet, maize, jute, sesame, and cotton. Rabi crops (wheat, barley, pulses, linseed, rape and mustard) are generally more dependent on irrigation and are planted after the monsoons (October/November) and harvested in March-May, (See Appendix for harvest dates for major crops.) Exceptions to the two-harvest pattern: crops in the southern peninsula where rains come from October to December (north-east monsoon); sugarcane plantings; and plantings in irrigated areas of the northwest where triple cropping is common.

The character of the monsoons can spell the difference, then, between a normal harvest and disaster. Torrential monsoon rains of longer than normal duration may result in serious flooding and heavy crop and cattle losses. Conversely, failure of the monsoon, when rainfall is less than normal or erratically distributed, may result in crop failure and consequent hardship for the people of the stricken area.

Tropical cyclones also pose a yearly threat to agricultural production in cyclone-prone states. Enormous crop and livestock losses have resulted from the flooding associated with such storms. Sea water intrusion in storm tides may destroy crops over a wide area and render the soil unfit for cultivation for several months. Irrigation systems in the affected areas are also frequently damaged.

### Agriculture by State

Agriculture is the dominant sector in the majority of Indian states. The following description gives an indication of how disaster-related agricultural losses would affect the economy and food supply in individual states.

Andhra Pradesh - Agriculture accounts for 55% of the state's net domestic product, 70-74% of employment. Major rice producer; contributes 10% of India's cereals, 20% of oilseeds, 40% of tobacco, 6.5% of sugar.

Assam - 72% of population dependent on agriculture which contributes 50% of the state's income. Rice and maize are major food crops; tea, jute, cotton, rape and mustard, sugarcane, potatoes, and tobacco are main cash crops.

Bihar - 83% of population depends on agriculture which accounts for 70% of the state's domestic product. Rice, sugarcane, and tobacco are principal crops; oilseeds, maize, wheat, barley, jute, pulses are also grown.

Gujarat - 36% of domestic product derived from agriculture which employs 65% of labor force. Cotton, tobacco, and groundnuts are principal crops; net importer of foodgrains.

Haryana - Agriculture accounts for 54% of state's income, 65% of employment. The state grows a surplus of foodgrains as well as some sugarcane, oilseeds, and cotton.

Himachal Pradesh - 75% of population depends on agriculture. Foodgrains, sugarcane, potatoes, nuts, fruits are principal crops; forests occupy 35% of the total area.

Jammu and Kashmir - 51% of state's income derived from agriculture which employs 71.5% of labor force. Chief crops include rice, wheat, maize, barley, tobacco, oilseeds, saffron, and cotton.

Karnataka - Agriculture accounts for 40-50% of the state's income, 70% of employment. Rice is most important cereal crop; coffee, ragi, cotton, sugarcane, oilseeds, cashews, pepper are other important crops.

Kerala - 53% of population depends on agriculture which provides 60% of the state's income. Major producer of export crops, accounting for 94% of India's total production of pepper, 94% of rubber, 80% of cashewnuts, 66% of coconuts, 62% of cardamom, 53% of ginger; rice is major food crop but half of consumption is imported.

Madhya Pradesh - Over 80% of population dependent on agriculture which contributes 55% of the state's domestic product. Chief food crops are sorghum, wheat, rice, and grains; cash crops include sugarcane, groundnuts, linseed, rape and mustard, tobacco, and cotton.

Maharashtra - Agriculture contributes 30-35% of the net domestic product, employs 65% of the labor force. Oilseeds, sugarcane, and cotton are chief crops; net importer of foodgrains.

Manipur - Agriculture is the chief occupation. Rice is the main crop; wheat, maize, pulses, potatoes, sugarcane are also grown.

Meghalaya - Forest products are the chief resource. Potatoes, cassialeaf, fruits, sugarcane, oilseeds, cotton, and tobacco are main crops.

Nagaland - Agriculture is the chief occupation with forest products the main source of income. Rice is the only important foodgrain.

Orissa - Agriculture contributes 50% of the state's income, engages 80% of labor force. Paddy occupies 70% of cropped area; pulses, oilseeds, jute, sugarcane, and coconut are other crops.

Punjab - Over 70% of population depends on agriculture which provides 60% of the state's income. The Punjab grows a surplus of rice, wheat, and other foodgrains; oilseeds, sugarcane, and cotton are important cash crops.

Rajasthan - Agriculture contributes 56% of state's income. Sorghum, millet, wheat, maize, barley and grain are main crops.

Sikkim - Citrus and cardamom are the major crops.

Tamil Nadu - Agriculture accounts for 34% of the state's income, 60% of employment. Paddy occupies 36% of cropped area, cereals 27%; pulses, oilseeds, cotton, sugarcane, coconut, tobacco, coffee, tea, rubber are other important crops.

Tripura - Forests occupy 60% of total area. Main crops are rice, jute, potatoes, oilseeds, sugarcane, cotton, and tea.

Uttar Pradesh - 65% of total area is cultivated with cereals and pulses occupying 85% of cultivated land. Other important crops are sesame, sugarcane, and linseed.

West Bengal - Agriculture accounts for 40% of the state's income, 60% of employment. Rice occupies 88% of cropped area and jute 10%; other crops include tea, linseed, sugarcane, cotton, tobacco, grain, barley, and maize.

3. Disaster Preparedness and Assistance3.1 Host Country Disaster Plan

There is no national disaster plan. Under the Indian federal system, disaster management is the responsibility of state governments. Central government responsibilities include research, surveys, guidelines, and provision of financial assistance to the states. In the event of a disaster, a multidisciplinary central government team, at the invitation of the affected state, conducts a disaster assessment. This assessment is coordinated by the central Ministry of Agriculture, Department of Irrigation, and evaluated by the High Level Committee on Relief which also makes recommendations for assistance. Army, police, and public services assistance is also available.

The role of the central government in disaster assistance is under review in the wake of recent recommendations that its responsibilities be expanded. In mid-1979 the Ministry of Agriculture circulated model action plans for disaster (monsoon, flooding, drought) preparedness to the states. The plans provide a checklist of action points at state, district, and subdivisional levels; suggest central authority for disaster management at the state level, assisted by a coordinating committee from various departments; recommend that all flood-prone areas be identified and steps taken to assure that they can be reached by telephone or wireless in case of flood; and that relief articles and essential medicines be stored and inventories verified. In addition, the GOI's Sixth Five Year Plan (1980-85) provides for establishment of a National (disaster preparedness) Institute under the Planning Commission and a Crop Insurance Corporation.

Disaster preparedness and response in the states is usually delegated to the Relief and Rehabilitation Ministry or the Department of Revenue. The states of Andhra Pradesh, Orissa, and Tamil Nadu have developed contingency plans. Other states are in various stages of developing them.

The state of Tamil Nadu has been particularly active in disaster planning. Preparedness components of the state's Anti-Disaster Plan include: definition of high risk areas and highly vulnerable development schemes, planning measures, action plans, and training programs. An Emergency Relief Organization under the supervision of the state's Chief Minister acts as the coordinating agency during a disaster.

GOI Contacts

Ministry of Agriculture and Irrigation  
Krishi Bhavan, New Delhi

Mr. K.C.S. Acharya  
Additional Secretary and Relief Commissioner  
Phone: 384468

Mr. B. K. Paimni  
Director, Scarcity Relief  
Phone: 382244

Ministry of Health - Directorate of Health Services  
Nirman Bhavan, New Delhi

Dr. D. B. Bisht  
Director General Services  
Phone: 386221

Dr. B. K. Varma  
Director - Civil Defence (Medical)  
Phone: 388409

Department of Meteorology  
Mausam Bhavan  
Room 605  
Lodhi Road  
New Delhi 110003

Dr. P. K. Das  
Director General  
Phone: 611842

Ministry of Social Welfare  
Shashtri Bhavan  
New Delhi

Mr. M. S. Dayal  
Deputy Secretary  
Phone: 386227

### 3.2 Warning Systems

Drought - Efforts are made to anticipate scarcity due to drought. District administrators are expected to watch for the several established indicators which warn of scarcity - e.g., large-scale migration of people and cattle at other than normal times, marked unemployment, and an increase in mortality. Meteorological forecasts are used in drought prediction but are imprecise in estimating rainfall over a long period. An interdepartmental Crop Weather Watch Group provides periodic reporting on kharif crop progress to the various state governments.

Floods - The Central Water Commission (CWC) in the Ministry of Irrigation operates a flood forecasting program which covers most interstate flood-prone river basins. Several flood forecasting centers are located throughout the country; headquarters of the Central Flood Forecasting Organization are in Patna. On the basis of data supplied by

the CWC on river flows during the monsoons and by the India Meteorological Department (IMD) on rainfall in catchment areas, experts in the centers determine the maximum height likely to be reached in a particular river. If water levels are expected to be dangerously high, warnings are sent out to authorities at the state, division and district levels. It is the function of district officials to communicate flood warnings to people in vulnerable areas. A "folk" warning network often reinforces the official system.

There is little information on how effectively the flood forecasting and warning systems operate; however, a recent study pointed out weaknesses in communications channels as well as in the meteorological forecasting capability in the Damodar Valley of West Bengal.\*

Tropical Cyclones - The IMD detects and tracks cyclonic storms by means of weather satellite monitoring equipment and coastal radar in several locations. Storms can be tracked within the radar's range of about 400 kms, enabling forecasters to issue warnings to affected coastal areas approximately 24 hours in advance. Ships at sea also provide information about storms, and aerial surveillance was being considered in 1979 to give monitoring facilities a larger warning time.

Coastal weather bulletins are broadcast routinely and their frequency increased during times of disturbed weather. Warnings are sent to threatened ports by landline telegram or wireless transmitter; ports, in turn, use a signal system to inform ships and fishermen. Key government officials in states and districts likely to be affected are given advance warning when a depression forms in the Bay of Bengal. Because of the unreliability of landline communications in a storm, arrangements have reportedly been made to provide transistor radio sets to designated officials at the district and local levels who are responsible for the rapid dissemination of storm warnings among the public.

Earthquakes - The IMD also has a network of observatories to monitor earthquakes. The Central Seismological Observatory is located at Shillong. Although no precise techniques exist for predicting earthquakes, areas most frequently affected have been identified.

Other - Coldwave forecasts are issued to give farmers time to water crops to reduce damage. Attempts are made to advise farmers on how to cope with locust invasion; however, the Department of Agriculture takes primary action in providing plant protection.

\*United Nations Research Institute for Social Development (UNRISD). Flood Forecasting and Warning: The Social Value and Use of Information in West Bengal. Robert Schware.

### 3.3' Mitigation Efforts

Drought - The central government's Drought-Prone Areas Program (D.P.A.P.) provides continuing assistance to the states, primarily in developing irrigation. A Drought Coordinating Committee, functioning on the national, state, and district levels, recognizes the need for long-term solutions to the drought problem and encourages contingency planning, new cropping patterns, and research to evolve drought-resistant crop varieties.

Advance Plan Assistance in the form of central government grants to the states is related to long-term development. Drought and flood victims are employed in the construction of irrigation works, dams, etc., in "food for work" programs.

A geostationary satellite, which was scheduled for launching in early 1982, is expected to transmit remote sensing data useful in drought management.

Floods - Water management is generally an area of state rather than central control. The construction of engineering works to combat floods has been carried out on a fairly extensive scale and includes dams, embankments, and drainage channels. The government recognizes the need for improved watershed management (soil conservation, afforestation), requiring close cooperation with neighboring countries, as part of the long-term effort. The Sixth Five Year Plan addresses the problem of flood control as well as other disaster preparedness issues. The CWC urges flood plain zoning which, however, has not yet been adopted.

Tropical Cyclones - Several cyclone-prone states are attempting through the use of educational materials to impress upon the public the importance of recognizing and heeding cyclone warnings. Additionally, Andhra Pradesh and Tamil Nadu have launched programs to build cyclone-resistant shelters. Relief agencies helped construct reinforced traditional and/or "pucca" housing in some of the vulnerable areas of Andhra Pradesh after the 1977 cyclone. Tamil Nadu is building 150 circular, two-story concrete cyclone shelters along its 600 km coastline. Each has a capacity of at least 500 people and is stocked with relief supplies. The shelters will be used as community centers during the non-cyclone season.

Earthquakes - Mitigation efforts include the distribution of pamphlets in vulnerable areas which inform the public of the nature of earthquakes, precautions to be taken, and the location of relief centers. A seismic zoning map has been drawn up to provide building guidelines. Earthquake-resistant design was reportedly used in the reconstruction of dwellings in the Koyna area.

Other - Preventive measures, including immunization campaigns, disinfection, water purification, etc., are carried out in the wake of natural disasters to avert epidemics.

3.4 Diet Summary and Host Food Resources

**Staple grains** - millets, sorghum, maize (dry areas) for poor; wheat (whole wheat flour baked into flat unleavened bread) in north; rice (polished) in south and east if affordable.

**Fats** - vegetable oils, shortening; clarified butter (ghi).

**Vegetables** - lentils, chick peas, onions, potatoes, okra, beans, eggplant, tomatoes, greens, chilis.

**Fruits** - bananas, papayas, mangos, oranges, apples, pineapples.

**Meat and fish** - mutton, chicken, fish in coastal areas.

**Milk products** - yogurt, cheese from buffalo, cow and goat milk.

**Beverages** - milk, buttermilk, tea with milk and sugar, coffee (south).

**Other** - eggs, unrefined sugar.

**Prohibitions** - Hindus do not eat beef nor Muslims pork. Many high-caste Hindus are vegetarian, particularly in the west and south. Bengali vegetarians eat fish; consumption of eggs by vegetarians is now more common with the commercial availability of nonfertile eggs.

**Food preparation/acceptance behavior** is traditionally regulated by caste and is extremely complex; however, taboos tend to break down in towns and cities. Local diets are quite limited, and villagers are frequently reluctant to consume unfamiliar foods.

The aggregate per capita food supply is about 10% less than the minimum needed for everyone to have an adequate diet (based on WHO/FAO recommendations). However, food is not equally available to all income groups. Families below the GOI poverty line consume from 32-72% less than the WHO/FAO standard.

The government aims at maintaining a minimum of five million tons of buffer stocks (maximum capacity about 12 million tons). The 2.25 million tons of wheat imported in 1981/82 were to rebuild depleted stocks after the 1979/80 drought. Wheat imports totaling 4 million tons were again necessary in 1982/83 to assure price stability. Domestic production meets only about two-thirds of the demand for edible oils.

When one region is affected by a disaster which results in local shortages, foodstuffs and other essential commodities can often be made available from other parts of the country. The government maintains

about 250,000 Fair Price Shops, covering urban and some rural areas, to ensure the equitable distribution of scarce commodities.

A fortified cereal-legume mixture called balahar has been developed in India and is widely used in school feeding programs.

### 3.5 Host Medical Resources

Most drugs used in India are manufactured locally by government agencies or private companies. Refrigeration facilities are available in airports and hospitals; domestic refrigerators are used in health centers.

A Medical Stores Organization maintains medical stores depots in Bombay, Madras, Calcutta, Karnal, Hyderabad, and Gauhati. The depots keep a reserve of civil defense stocks, including supplies for mobile hospital units used during national emergencies.

For information on health facilities and services see section 1.16, Health.

### 3.6 Housing Types and Host Building Supplies

Rural housing varies with climate and local availability of building materials. In hill regions, houses are usually of wood; elsewhere of stone, mud, or straw. In the south, bamboo and other plant materials are used. A distinction is made between pucca (permanent) housing made of mortared brick or stone, and katcha (impermanent) housing based on mud and thatch. (See also 2.4, Vulnerability of Infrastructure.) Severe shortages exist in both rural and urban housing.

Small timber for housing, like other forest products, is in increasingly short supply. Building stone and raw materials for cement are available in adequate supply; however, cement production has not met demand in recent years. It appears from disaster case reports that external assistance would be required to meet shelter needs in a major disaster such as the 1977 cyclones.

### 3.7 Host Power Supply

The GOI strongly emphasizes rural electrification to ensure continued agricultural development. About 279,000 (48%) of India's 576,000 villages had been electrified as of October 1981. The percentages of villages receiving electricity in each state ranged from about 15% to 100%. The Sixth Five Year Plan provides for the connection of an additional 100,000 villages to the grid.

Power supplies have not kept pace with demand since the early 1970s. Shortages are due to underutilization of capacity and delays in construction of power plants. The power deficit was greatest in the eastern part of the country in 1980/81. In addition, local outages are common in some disaster situations. (See also section 1.19, Power and section 2.4, Vulnerability of Infrastructure.)

### 3.8 Host Transportation Resources

**Railways:** The railway sector is the backbone of India's internal freight and passenger transportation system. It is the principal mode for moving traffic over long hauls from production and trade centers. Indian Railways (IR) operates over 60,000 route-km. IR's track network is not uniform: 62% of total track is broad gauge; 34% is meter gauge; 4% is narrow gauge. As of March 1981, locomotives in use included 2,403 diesel electric and diesel hydraulic, 1,051 electric, and 7,393 steam driven. Rolling stock includes 70 diesel rail cars, 2,361 electric multiple units (EMU), and 34,475 coaches, all in passenger service, and 402,000 freight wagons.

#### Distances by Rail (km)

Delhi-Agra	204	Delhi-Cuttack	1,850
Delhi-Ahmadabad	1,081	Delhi-Hyderabad	1,680
Delhi-Amritsar	463	Delhi-Jaipur	307
Delhi-Varanasi	808	Delhi-Lucknow	496
Delhi-Bhopal	703	Delhi-Madras	2,271
Delhi-Bombay	1,413	Delhi-Nagpur	1,017
Delhi-Calcutta	1,483	Delhi-Simla	447

**Roads:** The national highway system (29,340 km in 1979) connects state capitals, major ports, and some foreign highways. State, district, and rural roads make up the remainder of the country's total road network. The best roads are in the south, especially Kerala, where railways are poorly developed. The poorest are in the hills of Assam, Madhya Pradesh, Orissa, in the northwest, and the Indo-Gangetic Plain. A lack of bridges over numerous rivers and canals limits road use in the plain.

#### Distances by Road, National Highway (km)

Delhi-Calcutta, via Mathura, Agra, Allahabad, Varanasi, Sarhi (No. 2).....	1,387
Agra-Bombay, via Cwalior, Indore, Dhulia, Thana (No. 3).....	1,122

Thana-Madras, via Poona, Belgaum, Bangalore (No. 4).....	1,207
Bharagora-Madras, via Cuttack, Bhubaneswar, Visakhapatnam, Vijayawada (No. 5).....	1,457
Dhulia-Calcutta, via Nagpur, Raipur, Baharagora (No. 6).....	1,578
Varanasi-Cape Comorin, via Mangawan, Jabalpur, Nagpur, Hyderabad, Bangalore, Salem, Madurai (No. 7).....	2,324
Delhi-Bombay, via Jaipur, Ahmedabad, Baroda (No. 8).....	1,365

Source: Hindustan Year-Book and Who's Who 1982.

Improved strategic roads include the Hindustan-Tibet road (Ambala via Simla toward Tibetan border); the road to Bomdila (western Arunachal Pradesh); the Delhi-Bikaner road (to Pakistani frontier); and the road north from the Assam Access Road into eastern Bhutan.

Vehicles: A total of 3,696,000 vehicles in operation in 1979 included 842,000 cars and jeeps and 440,000 trucks. The India Red Cross maintains an emergency transport fleet. Military transport equipment is made available in disaster situations.

Ports: The port of Bombay has three main docks and can accommodate vessels up to 90,000 grt, loa (length overall) 206 m, and ~~minimum~~ draught of 9.5 m. Calcutta has two main docks. Because of its location on the Hoogley River, 90 miles from the Bay of Bengal, shipping depends on the tides. The largest vessel able to enter the port of Calcutta is usually under 167.75 m in length (between perpendiculars), 19.8 m to 21.35 m in beam and loading to maximum of 7.93 m draught. Haldia is being built as a subsidiary port for deep-draught vessels. Jawahar Docks in Madras harbor can accommodate six vessels at a time. Storage, cargo handling equipment, water, fuel, and ship repairs are available at most major ports. There are 63 domestic shipping companies.

Consult Lloyd's of London, Ports of the World, for more detailed information on Indian ports.

Airports: Besides the four international airports in Bombay, Calcutta, Delhi, and Madras, 22 other airports are classified as major.

The following airports were maintained by the Civil Aviation Department as of December 1980: Agartala, Ahmedabad, Amritsar, Aurangabad, Barapani, Bhubaneswar, Bhub, Gauhati, Hyderabad, Imphal (Tulihal), Jaipur, Khajuraho, Lucknow, Mangalore, Nagpur, Panagarh,

Patna, Ranchi, Trivandrum, Tiruchirappalli, Udaipur and Varanasi.

Intermediate Aerodromes: Belgaum, Bhopal, Bhavnagar, Chakulia, Dibrugarh, Mohambari, Gaya, Indore, Jabalpur, Kandla, Keshod, North Lakhimpur, Port Blair, Raipur, Rajkot, Silchar, Tirupati, Vadodara, Vijayawada and Visakhapatnam.

Minor Aerodromes: Akola, Balurghat, Bilaspur, Behala, Cooch-Bihar, Cuddapah, Delhi (Safdarjung), Hassan, Hadapsar (Gliderdrome, Pune), Jharsuguda, Juhu (Bombay), Kanpur, Khandea, Khowal, Kailashahar, Kamalpur, Kota, Kulu (Bhuntar), Jhansi, Jogbani, Kolhapur, Donakonda, Lalitpur, Malda, Muzaffarpur, Mysore, Nadirgul (Gliderdrome), Panna, Palanpur (Dessa), Porbandar, Pantnagar, Passighat, Rajamundry, Raxaul, Rupsi, Satna, Shella, Sholapur, Tanjore, Vellore, Warangal and Ramnad.

For more detailed information, see the latest issue of International Notams, International Flight Information Manual, and/or ICAO's Air Navigation Plan for the appropriate region.

AHMADABAD/Ahmadabad AS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
23° 04' N	05/23	A	B707-420	100,JX
72° 38' E	Instr		B707-320C B747	

Remarks: alternate aerodromes - BOMBAY, DELHI, KARACHI, TEHERAN  
Aids: VOR, SA, VA, RWY, TE, B, DES, CLM, THR, FXD, TWY, L4, 5; no telex.

AMRITSAR/Amritsar RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
31° 42' N	16/34	B	B727-100	
74° 48' E	Instr			

Remarks: alternate aerodromes - DELHI, LAHORE  
Aids: VOR, SA, VA, RWY, TE, B, DES, CLM, THR, FXD, TWY

## BOMBAY/Bombay RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
19° 05' N	09/27	A	DC8-40	100,JX
72° 52' E	PA2		DC8-30	
	14/32	A	B747	
	Instr			

Remarks: alternate aerodromes - AHMADABAD, COLOMBO, DELHI, KARACHI, MADRAS, NAGPUR

Aids: ILS (ID, 2), VOR, NDB/L, PA (1,2), SA, VA (L), RWY, CLL, TDZ, TE, B, DES, CLM, THR, TDZ, SST, FXD, TWY, L4, 7, 9; closed to non-scheduled flights from 1430-0230Z

## CALCUTTA/Calcutta RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
22° 39' N	OIR/19L	A	B707-420	100,JX
88° 27' E	PA2		B707-338C	
			B747	

Remarks: alternate aerodromes - BANGKOK, DHAKA/Kurmitola, DHAKA/Tejgaon, DELHI, LUCKNOW, PATNA, RANGOON

Aids: ILS (1), NDB/L, PA (1), VA (L), RWY, CLL, TDZ, TE, B, DES, CLM, THR, TDZ, SST, FXD, TWY, L4, 7, 9; closed to non-scheduled flights at night; no telex.

## DELHI/Delhi RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
28° 34' N	10/28	A	B707-420	100,JX
77° 07' E	PA2		B707-330	
			DC10-30	
			B747	

Remarks: alternate aerodromes - AHMADABAD, BOMBAY, CALCUTTA, KARACHI, LAHORE, LUCKNOW, ISLAMABAD, VARANASI

Aids: ILS (1), VOR (D), NDB/L, PA, SA, VA (L), RWY, CLL, TDZ, TE, B, DES, CLM, THR, TDZ, SST, FXD, TWY, L6, 7, 9; closed to non-scheduled flights from 1430-0230Z; no telex

## LUCKNOW/Lucknow AS

Runway Characteristics

<u>Location</u>	<u>Designation/</u>		<u>Aircraft</u>	<u>Fuel/</u>
<u>Coordinates</u>	<u>Type</u>	<u>Class</u>	<u>Capacity</u>	<u>Octane</u>
26° 46' N	09/27	A	B707-420	
80° 53' E	Instr		B707-320C	

Remarks: alternate aerodromes - CALCUTTA, DELHI, KATHMANDU, PATNA,  
VARANASI

Aids: VOR, SA, VA, RWY, TE, B, DES, CLM, THR, FXD, TWY

## MADRAS/Madras RS

Runway Characteristics

<u>Location</u>	<u>Designation/</u>		<u>Aircraft</u>	<u>Fuel/</u>
<u>Coordinates</u>	<u>Type</u>	<u>Class</u>	<u>Capacity</u>	<u>Octane</u>
13° 00' N	07/25	A	B707-320	100, JX
80° 11' E	PA1		-AS- DC10-30 B747	

Remarks: alternate aerodromes - BOMBAY, CALCUTTA, COLOMBO,  
TIRUCHCHIRAPPALLI

Aids: ILS, NDB/L, PA, VA (L), RWY, TE, B, DES, CLM, THR, TDZ, SST,  
FXD, TWY, L6, 5, 9; no telex

## NAGPUR/Nagpur AS

Runway Characteristics

<u>Location</u>	<u>Designation/</u>		<u>Aircraft</u>	<u>Fuel/</u>
<u>Coordinates</u>	<u>Type</u>	<u>Class</u>	<u>Capacity</u>	<u>Octane</u>
21° 05' N	09/27	A	DC10-30	
79° 03' E	Instr		B747	

Remarks: alternate aerodromes - BOMBAY

Aids: VOR, SA, VA, RWY, TE, DES, CLM, THR, TDZ, SST, FXD, TWY

## PATNA/Patna RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
25° 36' N 85° 06' E	07/25 Instr	B	FK27	100,JX

Remarks: alternate aerodromes - BIRATNAGAR, LUCKNOW  
Aids: VOR, SA, RWY, TE, B, DES, CLM, THR, FXD, TWY

## TIRUCHCHIRAPPALLI/Tiruchchirappalli RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
10° 46' N 78° 43' E	09/27 Instr	B	AV74	100,JX

Remarks: alternate aerodromes - COLOMBO, JAFFNA, MADRAS  
Aids: VOR, SA, RWY, TE, B, DES, CLM, THR, FXD, TWY, L4, 7; no telex

## TRIVANDRUM/Trivandrum RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
08° 29' N 76° 5' E	14/32 N-Instr	B	AV74	

Remarks: alternate aerodromes - TIRUCHCHIRAPPALLI  
Aids: VOR, DES, CLM, THR, TWY

## VARANASI/Varanasi RS

Runway Characteristics

<u>Location</u> <u>Coordinates</u>	<u>Designation/</u> <u>Type</u>	<u>Class</u>	<u>Aircraft</u> <u>Capacity</u>	<u>Fuel/</u> <u>Octane</u>
25° 27' N 82° 52' E	19/27 N-Instr	B	B737-200	JX

Remarks: alternate aerodromes - DELHI, LUCKNOW  
Aids: VOR, DES, CLM, THR, TXD, TWY, L4; no telex

KeyAbbreviations

INSTR	Instrument Approach Runway
N-INSTR	Non-Instrument Runway
PA1	Precision Approach Runway Category I
PA2	Precision Approach Runway Category II
PA3	Precision Approach Runway Category III
RS	International Scheduled Air Transport, Regular Use
RNS	International Non-Scheduled Air Transport, Regular Use
RG	International General Aviation, Regular Use
AS	International Scheduled Air Transport, Alternate Use

Radio Aids

ILS	Instrument Landing System
DME	Distance Measuring Equipment
VOR	Very High Frequency Omni-Directional Radio Range
NDB/L	Non-Directional Beacon or Locator

Lighting Aids

PA	Precision Approach Lighting System
SA	Simple Approach Lighting System
VA	Visual Approach Slope Indicator System
AV	Abbreviated Visual Approach Slope Indicator System
RWY	Runway Edge, Threshold, and Runway End Lighting
CLL	Runway Center Line Lighting
TDZ	Runway Touchdown Zone Lighting
TE	Taxiway Edge Lighting
TC	Taxiway Center Line Lighting
STB	Stop Bars
B	Aerodrome or Identification Beacon

Marking Aids

DES	Runway Designation Marking
CLM	Runway Center Line Marking
THR	Runway Threshold Marking
TDZ	Runway Touchdown Marking
SST	Runway Sidestripe Marking
FXD	Fixed Distance Marking
TWY	Taxiway Center Line Marking
HLD	Taxiway Holding Position Marking

Runway Surface and Length

H	Hard Surface (numbers = ft. in hundreds)
S	Non-Hard Surface (numbers = ft. in hundreds)

Additional Lighting

L1	Portable Runway Lights (electrical)
L2	Boundary Lights
L3	Runway Flood Lights
L4	Low Intensity Runway Lights
L5	Low Intensity Approach Lights
L6	High Intensity Runway Lights
L7	High Intensity Approach Lights
L8	Sequenced Flashing Lights
L9	Visual Approach Slope Indicator (VASI)

Domestic airlines provide services as follows: Air India serves 40 countries with a fleet of ten Boeing 747, three Boeing 707-337 B, two 707-337 C, and two 707-437; Indian Airlines operates regional and domestic flights with a fleet of eighteen Boeing 737, fourteen HS-748, eight F-27, and eight Airbus; Vayudoot Private, Ltd., jointly owned by Indian Airlines and Air India, operates a fleet of Fokker Friendship aircraft to link the smaller towns of northeastern India.

(See also section 1.20, Transportation and section 2.4, Vulnerability of Infrastructure)

3.9 Host Communications Resources

The overland telephone and telegraph network is relatively large, but many rural areas are without service. Moreover, network overloading frequently results in long delays in placing calls. All India Radio (AIR) broadcasts throughout the country in all regional languages. The railway microwave network and police wireless transmission are also available in emergencies. (See also section 1.18, Communications and section 3.2, Warning Systems. A frequency chart of India radio stations is included as Appendix "B" of the U.S. Mission Disaster Preparedness Plan on file at OFDA.)

3.10 Indian Voluntary Agencies

India Red Cross - The IRC has established Disaster Relief Operational headquarters in New Delhi, Bombay, Calcutta, and Madras and regional operational centers in Gauhati, Assam, and Ahmedabad. Other centers are planned for Vijayawada, Andhra Pradesh and a location near the point where the borders of Himachal Pradesh, Kashmir, and Punjab intersect. Each

center contains a central warehouse (about 50 MT capacity), a transport fleet, and communications and operations equipment. The IRC also plans to build 30 medical/welfare centers, 30 mobile dispensaries, four state and 20 district-level warehouses (10 MT capacity) in Assam, Bihar, Haryana, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal. In addition, the IRC is constructing 230 cyclone centers, each to be stocked with supplies for about 350 persons.

India Red Cross (IRC)  
Mr. Ajit Bhowmik  
General Secretary  
1, Red Cross Road  
New Delhi - 11001  
Phone: 386441

Mr. R. Yvenes  
Liaison Officer  
League of Red Cross Societies  
c/o Indian Red Cross  
Phone: 366441

Appropriate Reconstruction Training & Information Centre  
(ARTIC)  
Mr. H. R. Prakash  
Kalikivai Village & Post  
Kandukur Taluk  
Prakasam Dist. Andhra Pradesh  
Phone PCO:23

CARITAS/India  
CBCI Centre, Ashoka Place, New Delhi-110001  
Bishop L. D'Souza  
Executive Director

Church Auxiliary for Social Action  
Rachna Building, 2 Rajendra Place  
New Delhi-110008  
Maj. J.K. Michael  
Executive Director  
Phone 565305

Evangelical Fellowship of India  
Commission on Relief (EFICOR)  
Lt. Col. M. R. Mathews  
No 11 McPherson Road  
Cooke Town  
Bangalore 56005, Karnataka

**OXFAM**

Country Director  
314 Mansarovar Building  
90 Nehru Place  
New Delhi-110019  
Phone: 682137

Ramakrishna Mission  
Swami Ganbirananda, Director  
P. O. Belur Math  
Dist. Howrah  
West Bengal

Village Reconstruction Organization (VRO)  
Prof. M. A. Windey  
6/9 Brodiepet  
P. O. Guntur, Dist. Guntur 522002  
Andhra Pradesh

**3.11 U.S. Mission Disaster Plan (as of March 18, 1983)**

There is no detailed U.S. plan. In general, A.I.D. Handbook 8, "Foreign Disaster Assistance", which outlines policy, authority requirements, and guidelines for emergency assistance in the event of a disaster in the area, is to be followed. In a disaster situation in which USG involvement is likely, the Mission Disaster Relief Officer (MDRO) should establish contacts with the following to determine appropriateness and manner of U.S. assistance: Consul General in whose district the disaster is likely to or has occurred (The Mission Plan outlines initial actions for Consulate Generals.); GOI Ministries of Agriculture and Health, Departments of Irrigation, Meteorology, Central Water Commission, etc.; voluntary and international agencies; embassies/economic development agencies of major aid donors; and the Chief of Mission (CM) to assist in the exercise of his/her Disaster Assistance Authority (DAA). In accordance with Handbook guidelines for a Disaster Assessment Survey Team (DAST), and with GOI and local government concurrence, the Mission may elect to carry out a disaster assessment to assist in the development of an appropriate USG response.

India does not normally request the direct involvement of foreign governments or donor agencies in the distribution or monitoring of relief assistance. The GOI may indicate informally, however, that U.S. and other external aid would be welcomed through a designated coordinating agency, such as the UNDP, IRC, or an ad hoc body. The Chief of Mission may exercise his DAA within that context.

USG Contacts

[See section 1.4, U.S. Mission to India]

Mission Disaster Relief  
Officer  
Phone: 690351/595

Alternate:  
Phone: 690351/565

Mrs. Priscilla M. Boughton  
Director, USAID/India  
Home Address: See Emergency  
Locator Directory  
Harry H. Houck  
Office of Food for Development  
Home Address: See Emergency  
Locator Directory

A Mission Disaster Relief Working Group (MDRWG) has been designated, as listed below, to assist the Mission Disaster Relief Officer in the discharge of his/her responsibilities. Members of the MDRWG serve as the core group of a command center when circumstances require that one be established.

Mission Disaster Relief Officer (MDRO)	USAID Director 690351 X 595	Ms. Priscilla M. Boughton End of Tour Date 8/26/83
Chairman, MDRWG	Chief, FFD X 565	Harry H. Houck Chief End of Tour Date: 11/15/85
Deputy Chairman	Deputy Chief, FFD X 572	David R. Nelson Deputy Chief End of Tour Date: 7/31/83
Member	Press Attache X 210	Mr. William D. Miller, Jr. End of Tour Date: 8/85
Member	ODC, Office of Defense Coopn.	Lt. Col. Marvin Luster End of Tour Date: 6/84
Member	Counsellor for Administration X 535	Mr. Byron P. Walker End of Tour Date: 6/83

3.12 U.S. Resources

The U.S. Agency for International Development has ongoing programs in India. Those proposed for FY 1983 to FY 1987 are in three priority areas: irrigation development; health/family planning/nutrition; and forestry and conservation. The Mission expects to concentrate two of the programs - irrigation and forestry/conservation - in the four states of

Gujarat, Madhya Pradesh, Maharashtra, and Rajasthan. Other programs are more widely distributed geographically.

USAID is recommending a 403,899 MT PL 480 Title II program in India for FY 1983. Three U.S. voluntary and cooperative agencies - CARE, Catholic Relief Services (CRS), and the Cooperative League of the U.S.A. (CLUSA) - will conduct the program in 19 states and at over 220,000 project sites. Beneficiaries are expected to number 14,875 million.

### 3.13 International and U.S. Voluntary Agencies and Their Resources

Several governments and multinational organizations assist development programs in India. In addition, many international voluntary agencies have local counterparts/representatives. (See also section 3.10 Indian Voluntary Agencies.)

#### U.N. System

The Resident Representative of the United Nations Development Program (UNDP) in India is responsible for coordinating the disaster response activities of its component, the World Food Program (WFP/India), and for maintaining liaison with UNDRO/Geneva. While the UNDP does not have a designated disaster officer, two program officers are responsible for maintaining coordination between the UNDP, the GOI, and other U.N. system offices such as UNICEF and the World Health Organization (WHO) which may be requested by the GOI to participate in disaster relief efforts. The GOI may ask the UNDP to coordinate the efforts of foreign donor organizations in disaster relief and reconstruction.

#### U.N. Contacts

UNDP - Mr. Michael Priestly, Resident Representative  
55, Lodhi Estate  
New Delhi - 110003  
Phone: 690410

WFP - Mr. Trevor Page, Deputy Resident Representative  
55, Lodhi Estate  
New Delhi - 110003  
Phone: 690410

UNICEF - Mr. Alex Tosh, Program Officer  
73-74 Lodhi Estate  
New Delhi - 110003  
Phone: 690410

WHO - Dr. V.V. Koko, Regional Director  
Indraprastha Estate  
New Delhi - 11002  
Phone: 270181

Note: A contact list of major bilateral aid donors in disaster situations can be found in the U.S. Mission Disaster Preparedness Plan.

#### U.S. Voluntary Agencies

Numerous U.S. based voluntary agencies are involved in development and social programs in India, and several have a disaster relief capability. CARE and CRS serve as cooperating sponsors under the PL 480 Title II program. Upon receiving a request from local government officials or diocesan social service groups, the voluntary agency, with USAID's authorization, releases PL 480 foodstuffs from regular programs for emergency distribution. U.S.-registered PVOs may also administer OFDA grants providing emergency and short-term rehabilitation assistance.

A detailed list of U.S. based voluntary agencies operating in India has been prepared by the American Council of Voluntary Agencies for Foreign Service, Inc. and is available at the OFDA library in Washington, D.C. The agencies listed below are among those which have been particularly active in relief and reconstruction efforts in past disasters.

#### Cooperative for American Relief Everywhere (CARE)

B-28, Greater Kailash I  
New Delhi 110 048  
Mailing Address: P. O. Box 4220, New Delhi 110 048  
Telephone: 648341, 648342  
Cable: CARIND, New Delhi  
Telex: ND 2701  
Mr. Douglas G. Atwood, Country Director

Program: Food-for-work agricultural and rural development projects. Training of health workers and educators in basic health; future emphasis will be placed on integrated nutrition programs. Construction of warehouses, day-care and community centers; this program will be phased out in July 1983. Reconstruction of schools damaged by floods. Integrated community development and supplementary feeding through community centers.

CARE has a CARE-wide disaster procedures manual used in all of its countries of operation.

Catholic Relief Services (CRS)

2 Community Center, East of Kailish  
New Delhi 110 024

Mailing Address: P.O. Box 3534, New Delhi 110 024

Telephone: 682745, 682746

Cable: CATHWEL, New Delhi

Telex: 312812 USCCIN

Mr. Terrence Kirch, Program Director

Program: Program using food-for-work with agriculture, rural development focus. Emergency relief programs. Maternal/child health, school feeding and nutrition education. Provision of medical equipment.

Church World Service (CWS)

Church's Auxiliary for Social Action (CASA)

2 Rajendra Place

Rachna Building, Rusa Road

New Delhi 110 008

Telephone: 575498, 575499, 571105

Cable: CASARD, New Delhi

Major J. K. Michael, Director, CASA

CWS does not have a representative in India at present.

Program: The following projects are all carried out through CASA: Food-for-work programs in water resources, soil conservation, building construction, disaster clean-up and housing. Use of PL 480 commodities ended in mid-1981; grains, etc., for these programs are bought locally. Nutrition programs for those at risk, women and children. New "Parliament to the people" program to create awareness among people on India laws. Acts as a clearing house for projects, screens local ones, refers to outside funding, assists the GOI and beneficiaries with currency regulations, acts as go-between between donor and beneficiary.

Mennonite Central Committee

22 Girish Chandra Bose Road

Calcutta 700 014

Telephone: 242417

Mr. Al Doerksen, Representative

Program: Has had a long-standing partnership with Lutheran World Services (see Church World Service) in India. With rural Mennonite churches and Mennonite Christian Fellowship of India is involved in agricultural development and health and preventive medicine. Disaster relief; educational training and vocational training; agricultural programs; speech and hearing institute. In partnership with indigenous group carries on economic development, job training, agricultural and housing reconstruction projects.

The Salvation Army

There are six autonomous Army regions in India:

Calcutta - Telephone: 24-3910

Madras - Telephone: 33148

New Delhi - Telephone: 662394

Tami' Nadu - Telephone: Tirunelveli 2682

Kerala State - Telephone: Trivandrum 6026

Bombay - Telephone: 394705

Program: Disaster services; education, including the operation of many schools; agricultural colonies; hospitals, clinics, etc.; homes/institutions for different kinds of poor and handicapped.

Seventh Day Adventist World Service, Inc.

Salisbury Park

Poona 411 001

Mailing address: P. O. Box 15, Poona 411 001

Telephone: 449390, 449398

Telex no.: 145358

Cable address: "Adventist," Poona, India

Mr. L. D. Cooper, Director

Programs: Ships equipment and material aid via Church World Service to CASA.

World Relief Corporation

Address and contact in India:

Society of Economic and Vocational Assistance (SEVA)

2/3 Hindusthan Park, first floor

Calcutta 700 029

Telephone: 462495

Mr. Arun Sircar, Secretary

Program: SEVA is World Relief Corporation's counterpart in India. Sends funds and equipment for famine and disasters to Evangelical Fellowship of India as well as to SEVA. Carries out vocational training programs.

World Vision Relief Organization, Inc.

Eighth floor, Khaleel Shirazi Estate

345 Pantheon Road

Egmore, Madras 600 008

Mailing address: World Vision of India, Post Bag no. 507,  
Egmore, Madras 600 008

Telephone: 82536

Cable address: WORVIS, Madras

Telex no.: 41-7436 Cook In (this is located outside the office;  
World Vision should be spelled out when using it)

Mr. Saeed Rallia-Ram, Executive Director

Program: Agricultural training, extension; child care and family planning; preventive health & nutrition; training of village leaders in above.

Source: American Council of Voluntary Agencies for Foreign Service. Technical Assistance Information Clearing House (TAICH). March 1983.

#### 3.14 Relief and Rehabilitation Assistance

India's self-help capability (states plus central GOI) in disaster response and rehabilitation is considerable. However, substantial external assistance has been welcomed in major disasters in the past. As widespread drought-induced famine becomes less of a threat, future donor assistance on a large scale will likely be required most often in sudden onset calamities such as tropical cyclones and floods.

Food assistance has been a fairly constant requirement in all types of major disasters. Temporary shelters, blankets, clothing, household utensils, medicines (especially vaccines), and chemicals for disinfection and water purification have been the emergency items most often supplied in cyclone and flood disasters.

To assist cyclone rehabilitation efforts, external donors have provided materials for shelter repair, livestock and poultry, fertilizer, small agricultural implements, tubewells, fishing boats and nets. Self-help (cash/food for work) reconstruction and development activities have received external support in all types of disasters. This will likely continue, in drought as well as in rapid onset disasters. In drought situations, rehabilitation assistance has focused on the development of water resources.

#### 3.15 Relationship with Development and Planning

An in-depth analysis of the interrelated aspects of development would doubtless show that many programs have an indirect effect on disaster mitigation/prevention. This discussion is limited to a few broad areas where the relationship is most evident.

As stated above (see section 3.3, Mitigation Efforts), Indian authorities are aware of the need for long-term efforts to alleviate conditions which contribute to drought/scarcity and flooding. The land and water management problems are massive on a national scale and cannot be quickly or entirely solved, but some of the development projects being carried out with bilateral and multilateral assistance have direct application.

One area in which the relationship between development and disaster mitigation can be seen is in the improvement in agricultural performance made possible by the expansion of irrigation. It is estimated that the increased production resulting in investment from irrigation has accounted for at least three-quarters of agricultural growth since 1960. While agricultural potential is far from realized and the possibility of scarcity from drought and flooding remains, the threat of widespread drought-induced famine has been reduced by these advances. The success of irrigation, however, is dependent on the availability of other resources: electricity for pumping; cement for the construction of dams, storage tanks, feeder pipes, and other components of the system; and fertilizers and other agricultural inputs. An unfortunate secondary effect of surface irrigation has been an increase in soil waterlogging and salinity in some areas. Silt accumulation in reservoirs and soil waterlogging contribute to the problem of flooding.

Increasing attention is being given to long-term development in the area of flood control. The outlay proposed for flood control in the Sixth Five-Year Plan was three times that of the Fifth Plan. A National Flood Commission established in 1976 has conducted an in-depth study of present programs with a view toward recommending an integrated, scientific approach and fixing priorities. Projects being carried out by external donors in the fields of energy, forestry, and conservation are assisting GOI efforts in reforestation and erosion control.

New technical programs in the India Meteorological Department described in the Sixth Plan, including those which apply remote sensing techniques to agricultural meteorology, promise to improve capabilities for forecasting severe weather phenomena.

Finally, development programs in the area of health, nutrition, and family planning have an impact on disaster prevention. Advances in public health and sanitation reduce the threat of epidemics while generally improving the health status of the population. Measures to check population growth have a direct bearing, since population pressure on scarce resources exacerbates environmental problems contributing to disasters.

Harvest Dates for Major Crops

	<u>Harvest Period</u>
<b>Wheat:</b>	
Bihar.....	Mar - Apr
Maharashtra.....	Feb - Mar
Madhya Pradesh.....	Feb - Mar
Punjab.....	Apr - May
Uttar Pradesh.....	Mar - Apr
Rajasthan.....	Apr - May
India Consolidated.....	Mar - May
Uttar Pradesh.....	Oct - Nov
Rajasthan.....	Nov - Dec
Tamil Nadu.....	Oct - Nov (K)
	Jan - Feb (R)
India Consolidated.....	Oct - Dec (K)
	Jan - Mar (R)
<b>Rice:</b>	
<b>Andhra Pradesh</b>	
Winter.....	Nov - Mar
Summer.....	Mar - May
Autumn.....	June - Sept
<b>Assam</b>	
Winter.....	Nov - Jan
Summer.....	Mar - Apr
Autumn.....	June - Aug
<b>Bihar</b>	
Winter.....	Nov - Dec
Summer.....	Feb - Mar
Autumn.....	Aug - Oct
<b>Maharashtra</b>	
Winter.....	Oct - Nov
<b>Madhya Pradesh</b>	
Winter.....	Oct - Nov
<b>Tamil Nadu</b>	
Winter.....	Sept - Jan
Summer.....	Apr - June
<b>Orissa</b>	
Winter.....	Dec - Jan
Summer.....	May - June
Autumn.....	Sept - Oct
<b>West Bengal</b>	
Winter.....	Nov - Jan
Summer.....	Mar - May
Autumn.....	July - Oct

Uttar Pradesh	
Winter.....	Sept - Dec
Barley:	
Bihar.....	Mar - Apr
Punjab.....	Mar - Apr
Uttar Pradesh.....	Mar
Rajasthan.....	Mar - Apr
India Consolidated.....	Feb - Apr
Maize:	
Bihar.....	Sept - Oct
Maharashtra.....	Sept - Oct
Punjab.....	Sept - Nov
Uttar Pradesh.....	Aug - Sept
Rajasthan.....	Sept - Nov
India Consolidated.....	Aug - Nov
Millets:	
Ragi (Eleusina Coracana):	
Andhra.....	Sept - Jan (K) Mar - May (R)
Maharashtra.....	Oct - Nov
Tamil Nadu.....	Oct - Feb (D)
Karnataka.....	Oct - Dec
Bihar.....	Sept
Bajra (Pennisetum Typhoideum):	
Andhra Pradesh.....	Sept - Dec
Maharashtra.....	Oct - Nov
Punjab.....	Oct - Nov
Uttar Pradesh.....	Oct - Nov
Rajasthan.....	Sept - Oct
Tamil Nadu.....	Oct - Feb (D)
India Consolidated.....	Aug - Nov
Jowar (Sorghum Vulgare):	
Maharashtra.....	Nov - Dec (K)
Andhra Pradesh.....	Jan - Apr (K)
Madhya Pradesh.....	Nov - Dec (K) Feb - Mar (R)
India Consolidated:	
Winter.....	Oct - Jan )
Summer.....	Mar - June )
Autumn.....	Aug - Dec )
Sugar Cane:	
Uttar Pradesh.....	Nov - Apr
Bihar.....	Dec - Apr

Punjab.....	Dec - Mar
Maharashtra.....	Nov - Apr
Tamil Nadu.....	Nov - Apr
Andhra.....	Jan - Apr
India Consolidated.....	Nov - Apr
Potatoes.....	Jan - Apr (W) May - Sept (S)
Sweet Potatoes.....	Dec - May
Cassava 1/.....	-
Vegetables 1/.....	-
Dry Beans 2/.....	-
Gram (Chick Peas).....	Feb - Apr
Masur (Lentils) 3/.....	-
Peas 4/.....	-
Other Pulses 5/.....	-
Citrus Fruits 1/.....	-
Peanuts:	
Andhra.....	Sept - Jan (D) May - July (I)
Maharashtra.....	Sept - July
Tamil Nadu.....	Aug - Jan (D)
Madhya Pradesh.....	Sept - Nov
Karnataka.....	Oct - Dec
Uttar Pradesh.....	Nov - Dec
India Consolidated.....	Sept - Jan
Linseed:	
India Consolidated.....	Jan - Apr
Rape and Mustard (Brassicinapus and Brassicanigra):	
India Consolidated.....	Jan - Apr
Sesame Seed:	
India Consolidated.....	Aug - Dec (K) May - July (R)
Castor Seed:	
India Consolidated.....	Jan - Feb (K) Mar - Apr (R)
Coffee:	
India Consolidated:	
Arabica.....	Oct - Mar
Robusta.....	Jan - Apr

## Tea:

North.....	Apr - Dec
South.....	Jan - Dec

## Tobacco:

Andhra.....	Feb
Maharashtra.....	Jan - Mar
Bihar.....	Feb - Apr
Uttar Pradesh.....	Sept - Apr
West Bengal.....	Feb - Apr
Madras.....	Jan - Mar
Mysore.....	Dec - Jan
India Consolidated.....	Feb - May

## Cotton:

India Consolidated.....	Sept - Apr
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## Jute:

Assam.....	July - Aug
Bihar.....	Aug - Mid Sept
Orissa.....	Sept - Mid Oct
West Bengal.....	July - Sept
India Consolidated.....	July - Sept

- 1/ Supposed to be harvested the whole year round.
  - 2/ Phaseolus radiatus and phaseolus mung mainly harvested in the Kharif season (September - January).
  - 3/ Virtually the whole production is harvested in the Rabi season (February - May).
  - 4/ The whole production is harvested in the Rabi season.
  - 5/ Lakh or khosari harvested only in the Rabi season; and tur or arhar (pigeon peas) supposed to be harvested then also.
- (K) Kharif: October - January Harvest  
 (R) Rabi: March - May Harvest  
 (I) Irrigated  
 (D) Dry  
 (W) Winter  
 (S) Summer

- Asia Yearbook 1982. Far Eastern Economic Review. Hong Kong: Far Eastern Economic Review, Ltd., 1982.
- Europa. The Far East and Australasia 1982-83: A Survey and Directory of Asia and the Pacific. London: Europa Publications Limited, 1982.
- Government of India. Central Water Commission. Central Flood Forecasting Organization. Two Decades of Flood Forecasting in India. Basawan Sinha. Patna, December 1978. (mimeo)
- \_\_\_\_\_. Ministry of Agriculture and Irrigation. Country Paper on Disaster Preparedness in India. New Delhi: GOI, January 1979.
- \_\_\_\_\_. Ministry of Health and Family Welfare. Annual Report 1981-82. New Delhi: GOI.
- \_\_\_\_\_. Ministry of Information and Broadcasting. Research and Reference Division. India: A Reference Annual 1981. New Delhi: GOI.
- Hindustan Yearbook and Who's Who 1982. S. Sarkar, ed. Calcutta: M.C. Sarkar and Sons Private, Ltd.
- International Civil Aviation Organization. Air Navigation Plan Middle East and South East Asia Regions. Montreal: ICAO, August 1982.
- League of International Red Cross Societies (LICROSS). Basic Facts on India, 1978. (mimeo)
- Library of Congress. Science and Technology Division. Draft Environmental Report on India. Prepared for the Agency for International Development. Department of State. Washington, D.C.: LC, March 1980.
- Mariners Weather Log. Vol. 20, No. 4. July 1976.
- Nyrop, Richard, et al. Area Handbook for India. 2nd edition. Washington, D.C.: GPO, 1975.
- Pichamuthu, C. S. Physical Geography of India. New Delhi: National Book Trust, India, 1967.
- Ports of the World 1982. London: Lloyd's of London Press Ltd, 1982.

- Practical Concepts Incorporated. Disaster Preparedness in South Asia: Report of an Assessment Mission. Prepared for the Office of U.S. Foreign Disaster Assistance. Agency for International Development. Washington, D.C.: PCI, April 1981.
- United Nations. Food and Agriculture Organization. World Crop Harvests and Calendar. Rome: FAO, 1959.
- \_\_\_\_\_. United Nations Research Institute for Social Development. Flood Forecasting and Warning: The Social Value and Use of Information in West Bengal. Robert Schwere. Geneva: UNRISD, 1981.
- U.S. Agency for International Development. Annual Budget Submission FY 83: India. United States International Development Cooperation Agency. June 1981.
- \_\_\_\_\_. Country Development Strategy Statement, FY 1983: India. New Delhi: USAID, January 1981.
- \_\_\_\_\_. Country Development Strategy Statement, FY 1984: India. New Delhi: USAID, January 1982.
- \_\_\_\_\_. Office of U.S. Foreign Disaster Assistance. Disaster Case Reports: India Drought/Famine, Latter Part of 1965, 1966, 1967; India Earthquake, December 11, 1967; India Floods, July, August 1968 and October 1968; India Cyclone, October 19, 1971; India Drought, 1972/73; India Floods, July-September 1975; India Cyclones, November 12, 19, 22-23, 1977; India Cyclones, May 12, 1979.
- \_\_\_\_\_. Office of U.S. Foreign Disaster Assistance. India: A Country Profile. Washington, D.C.: OFDA, May 1980.
- \_\_\_\_\_. Office of U.S. Foreign Disaster Assistance. OFDA Disaster History List. Washington, D.C.: OFDA, March 1983. (Unpublished)
- \_\_\_\_\_. Office of U.S. Foreign Disaster Assistance. South Asia Disaster Preparedness Seminar: Proceedings, Issues and Recommendations. New Delhi, India. January 23-February 1, 1979. Washington, D.C.: AID.
- \_\_\_\_\_. U.S. Mission to India. Disaster Preparedness Plan. New Delhi: USAID, March 1983.
- U.S. Central Intelligence Agency. The World Factbook. Washington, D.C.: GPO, 1982.

- U.S. Department of Health and Human Services. Public Health Services. Centers for Disease Control. Health Information for International Travel. Washington, D.C.: GPO, 1981.
- U.S. Department of State. Background Notes: India. Washington, D.C.: GPO, 1982.
- \_\_\_\_\_. Diplomatic List. Washington, D.C.: GPO, February 1983.
- \_\_\_\_\_. Key Officers in Foreign Service Posts. Washington, D.C.: GPO, January 1983.
- \_\_\_\_\_. Travel and Visa Information. Washington, D.C.: GPO, 1981.
- \_\_\_\_\_. Treaties in Force. Washington, D.C.: GPO, January 1, 1982.
- \_\_\_\_\_. Visa Requirements for Foreign Governments, Washington, D.C.: GPO, 1981.
- U.S. Department of Transportation. Federal Aviation Administration. International Flight Information Manual. Vol. 20. Washington, D.C.: GPO, April 1982.
- U.S. Department of the Treasury. Fiscal Service, Bureau of Government Financial Operations. Treasury Reporting Rates of Exchange as of March 31, 1983.
- World Bank. Andhra Pradesh Agricultural Extension Project. Report No. P-3232-IN. Washington, D.C.: IBRD, March 9, 1982.
- \_\_\_\_\_. Economic Situation and Prospects of India. Report No. 3872-IN. Washington, D.C.: IBRD, April 7, 1982.
- \_\_\_\_\_. Economic Situation of India and Resource Mobilization issues. Report No. 4395-IN. Washington, D.C.: IBRD, April 11, 1983.
- \_\_\_\_\_. Eighth Communications Project. Report No. P-2964-IN. Washington, D.C.: IBRD, February 25, 1981.
- \_\_\_\_\_. Fourth Annual Refinance and Development Corporation Credit Project. Report No. P-3196-IN. Washington, D.C.: IBRD, February 1, 1982.
- \_\_\_\_\_. Jammu and Kashmir and Haryana Social Forestry Project. Report No. P-3365-IN. Washington, D.C.: IBRD, July 15, 1982.
- \_\_\_\_\_. Kallada Irrigation and Treecrop Development Project. Report No. P-3347-IN. Washington, D.C.: IBRD, June 7, 1982.

- \_\_\_\_\_ .Kanataka Tank Irrigation Project. Report No. P-2968-In.  
Washington, D.C.: IBRD, February 26, 1981.
- \_\_\_\_\_ .Kandi Watershed and Area Development Project. Report No.  
P-2384-In. Washington, D.C.: IBRD, June 30, 1980.
- \_\_\_\_\_ . Kerala Agricultural Extension Project. Report No. P-2797-IN.  
Washington, D.C.: IBRD, May 1, 1980.
- \_\_\_\_\_ . Maharashtra Agricultural Extension Project. Report No.  
P-3002-IN. Washington, D.C.: IBRD, March 30, 1981.
- \_\_\_\_\_ . Rajasthan Water Supply and Sewerage Project. Report No.  
P-2831-IN. Washington, D.C.: IBRD, June 2, 1980.
- \_\_\_\_\_ . Second Chambal (Madhya Pradesh) Irrigation Project. Report  
No. P-3372-IN. Washington, D.C.: IBRD, July 22, 1982.
- \_\_\_\_\_ . Second Gujarat Irrigation Project. Report No. P-2765-IN.  
Washington, D.C.: IBRD, April 9, 1980.
- \_\_\_\_\_ . Second Railway Modernization and Maintenance Project. Report  
No. P-3396-IN. Washington, D.C., October 25, 1982.
- \_\_\_\_\_ . Subernareka Irrigation Project. Report No. P-3375-IN.  
Washington, D.C.: IBRD, July 28, 1982.
- \_\_\_\_\_ . Tamil Nadu Agricultural Extension Project. Report No.  
P-3011-IN. Washington, D.C.: IBRD, April 6, 1981.
- \_\_\_\_\_ . Third Rural Electrification Project. Report No. P-3316-IN.  
Washington, D.C.: IBRD, May 12, 1982.
- \_\_\_\_\_ . West Bengal Social Forestry Project. Report No. P-3119-IN.  
Washington, D.C.: IBRD, September 15, 1981.

Researched and Written By: Faye Henderson  
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