

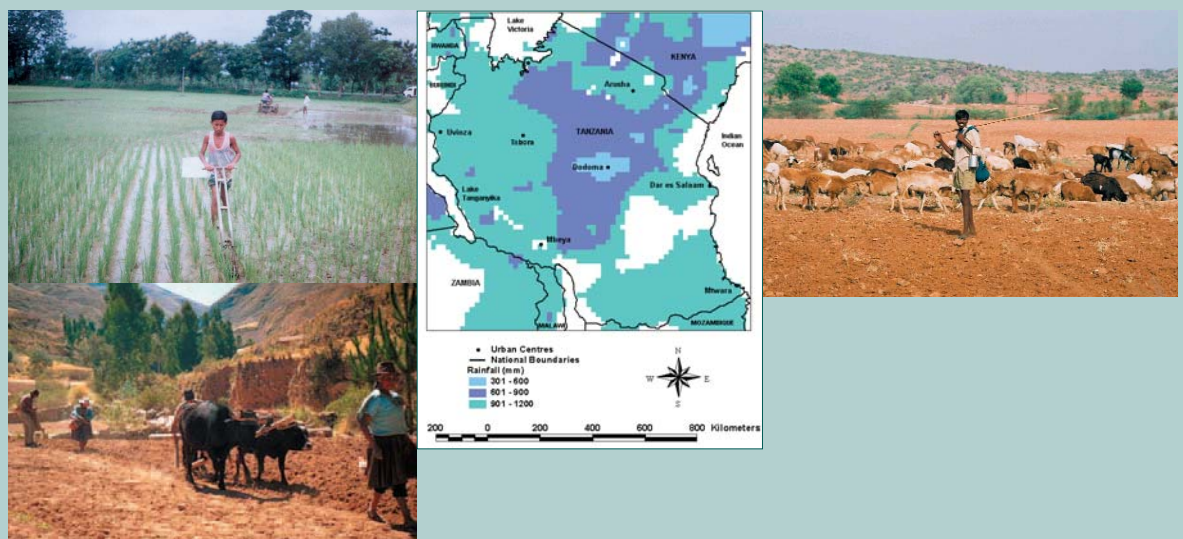


DFID Natural Resources Systems Programme



The Characterisation of Six Natural Resources Production Systems

J. Taylor, M. Tang, C. Beddows, F.M. Quin, M.A. Stocking



August 2003

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5 PRODUCTION SYSTEMS CHARACTERISATION MAPS

5.1 OVERVIEW

The following section presents the production system maps and supporting information, arranged in the alphabetical order of the target countries. For each target country there is a general description of the main features and parameters that were applied to define the area of a production system. Also, in addition to the production system map(s) for each target country, maps are included to illustrate how the production system area was derived.

Table 5.1 provides details of the production systems maps for each target country. The map reference number is included in the appropriate cell of the matrix.

**Table 5.1: Production Systems Characterisation Maps
(map numbers are shown in the relevant cell)**

	Production Systems					
	-			Interfaces		
	High Potential	Hillsides	Semi-Arid	Forest Agriculture	Land Water	Peri-Urban
Countries						
Bangladesh	1				2	
Bolivia		4				
Brazil				5		
Caribbean					7	
Ghana				9		11
India	12		14, 15			17
Kenya	18					
Nepal		22		22		
Tanzania			24, 25			
Uganda		26			29, 30	
Zimbabwe			31, 32			

5.2 BANGLADESH

PRODUCTION SYSTEM – HIGH POTENTIAL AND LAND WATER INTERFACE

Based on land area below 100 metres elevation and excluding the Hill Tracts District of Chittagong Region. The target area was divided between the floodplain region and the coastal zone. The coastal zone was taken as the Ganges Tidal Floodplain, which includes the Kulna Sunderbans, and the saline areas of the Young Meghna River Floodplain.

Land Area	Area mapped using ArcView, calculated in km ² .												
Population	The UN Economic and Social Commission for Asia and the Pacific quotes a figure of 20% for the proportion of the Bangladeshi population inhabiting the Hill Tracts District of Chittagong Region. Accordingly the population for the target area is 80% of the UN 1998 estimate for Bangladesh.												
Road Density	Estimated density of roads in target area using GeoCenter World Country Maps: India (North East). Scale used: 5 = dense, 1 = sparse.												
Demand Side Assessment	Seventeen cities with populations greater than 100,000 persons (UN data) per 1000 km ² of target area.												
Assessment of Export Potential	From any point within the production system, it is estimated that it is a maximum of 100 km to the nearest of any of major cities.												
Land Productivity Potential	From the Bangladesh Statistical Yearbook (1998 data) it is calculated that the target area contributes to the following percentages to national production for selected key products: <table border="0" style="margin-left: 40px;"> <tr> <td>Rice</td> <td>95%</td> </tr> <tr> <td>Wheat</td> <td>99%</td> </tr> <tr> <td>Groundnuts</td> <td>94%</td> </tr> <tr> <td>Livestock</td> <td>99%</td> </tr> <tr> <td>Inland Fisheries</td> <td>93%</td> </tr> <tr> <td>Bananas</td> <td>96%</td> </tr> </table> <p>A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area was applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data from the <i>Statistical Yearbook of Bangladesh</i> and maps from the FAO/GIEWS website. This assessment does not include tourism.</p>	Rice	95%	Wheat	99%	Groundnuts	94%	Livestock	99%	Inland Fisheries	93%	Bananas	96%
Rice	95%												
Wheat	99%												
Groundnuts	94%												
Livestock	99%												
Inland Fisheries	93%												
Bananas	96%												
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.												
NR Knowledge Base	Data for degree level of national researchers not available. Number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.												

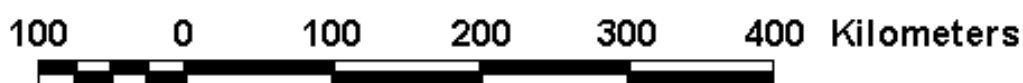
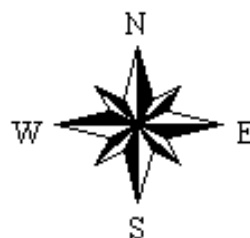
Map 1: Bangladesh – High Potential Production System

Production System Area below 100 metres

National Land Area	138,507 km ²		
Floodplain System Area	103,827 km ²	Floodplain Population	77,831,315



- Urban Centres
- National Boundaries
- Floodplain
- Forest Reserve Areas (Sanderbans)



Note: This Map was based on an elevation map of Bangladesh and FAO, 1988

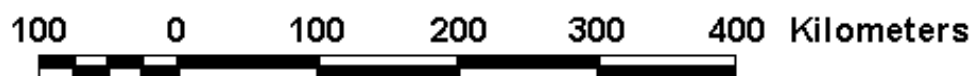
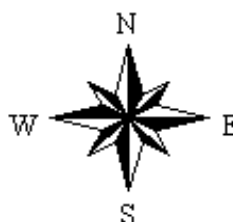
Map 2: Bangladesh – Land Water Interface

Production System Area below 100 metres

National Land Area	138,507 km ²		
Floodplain Area	103,827 km ²	Coastal Area	20,322 km ² (incl. Sunderbans)
Floodplain Population	77,831,315	Coastal Population	20,223,885



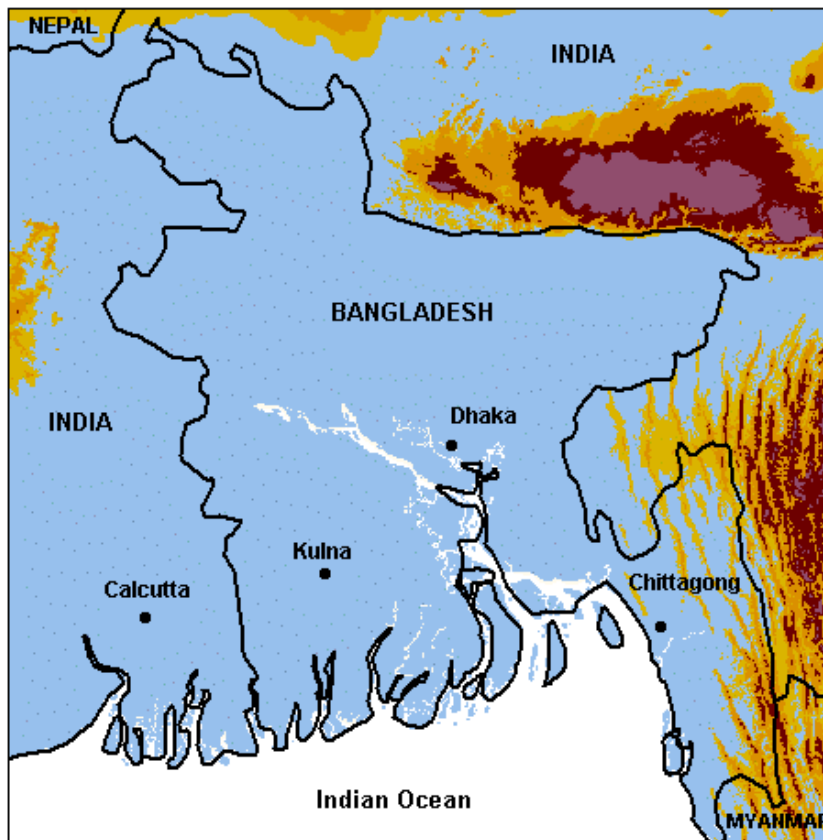
- Urban Centres
- National Boundaries
- Floodplain
- Coastal Zone
- Forest Reserve Areas (Sunderbans)



Note: This Map was based on an elevation map of Bangladesh and FAO, 1988

Map 3: Bangladesh – Elevation Map

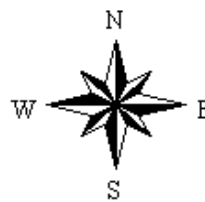
National Land Area 138,507 km²



- Urban Centres
- National Boundaries

Elevation (Metres)

	1 - 99
	100 - 199
	200 - 499
	500 - 999
	1000 - 4999



5.3 BOLIVIA

Production system – Hillsides

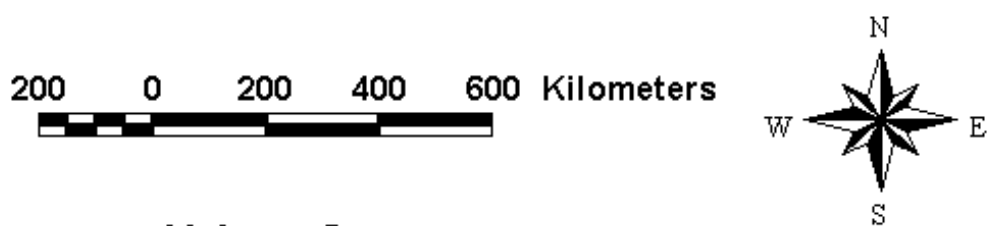
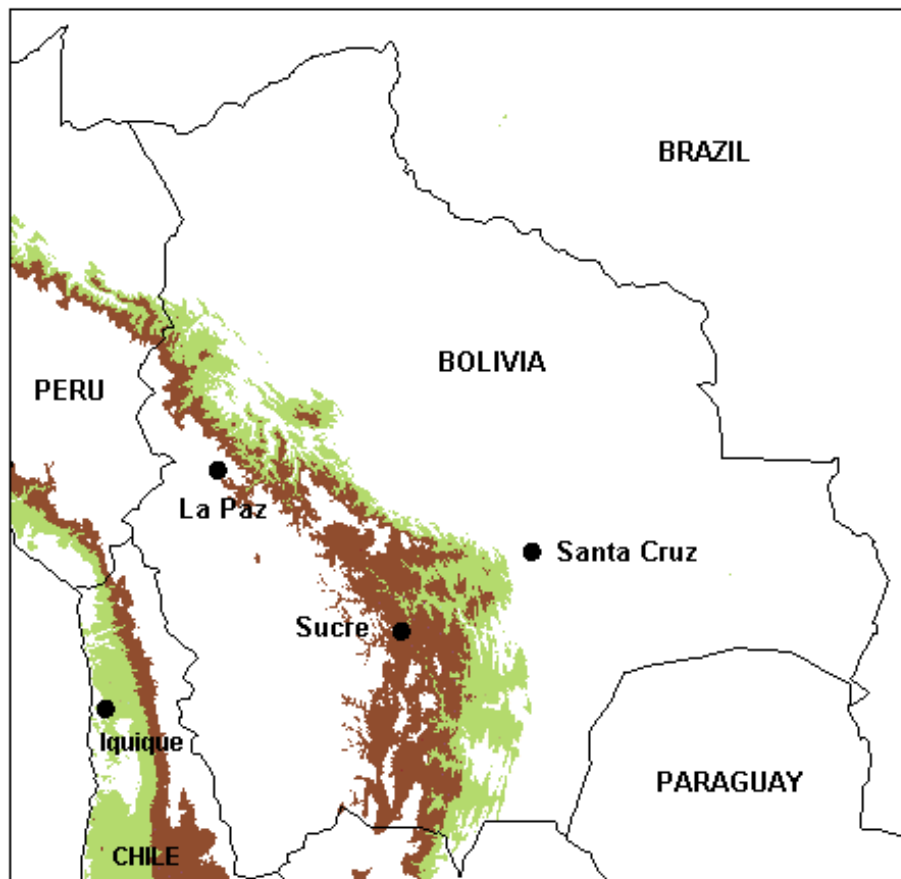
Based on lands between elevations of 1000-3500 metres. This zone equates to the Valleys AEZ, which, according to CID data accounts for 19% of the Bolivian land area and 53% of its population. The target area has been divided into two sub-systems (elevations of 1000-2000 m and 2000-3500 m respectively – the subtropical and temperate valleys). It forms a band across the south-west of the country from the Peru border around Lake Titicaca in La Paz province, to the east and north of Potosi provinces. It covers the central and southern Cochabamba province, the western fringes of Santa Cruz province, the western 80% of Chuquisaca province, and the western half of Tarija.

Land Area	Area mapped using ArcView, calculated in km ₂ .
Population	CID data quotes that 53% of the population live in the valleys AEZ. This percentage has been applied to the UN 1998 estimate of 7.95million. The proportion of rural and urban inhabitants as percentages of the total population has also been applied to the UN data.
Road Density	Estimated density of roads in target area using GeoCenter World Country Maps: South America (North). Scale used: 5 = dense, 1 = sparse.
Demand Side Assessment	Number of towns with populations of greater than 100,000 persons per 1000 km ₂ of target area.
Assessment of Export Potential	Estimated 150 km maximum distance from any point in the target area to a major town. As this is a mountain region, distances will be distorted by the topography and this assessment takes no account of the state of the transport network.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. This assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> and WHO website.
NR Knowledge Base	Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

Map 4: Bolivia – Hillsides Production System

Elevation 1000 metres to 3500 metres

National Land Area	1,090,353 km ²	
Production System Area	183,585 km ²	
Subtropical Valley Area	77,891 km ²	Temperate Valley Area 105,694 km ²



- Urban Centres
- National Boundaries

Elevation (Metres)

- Subtropical Valleys (1000m - 2000 m)
- Temperate Valleys (2000 m - 3500 m)

5.4 BRAZIL

Production system - Forest Agriculture Interface

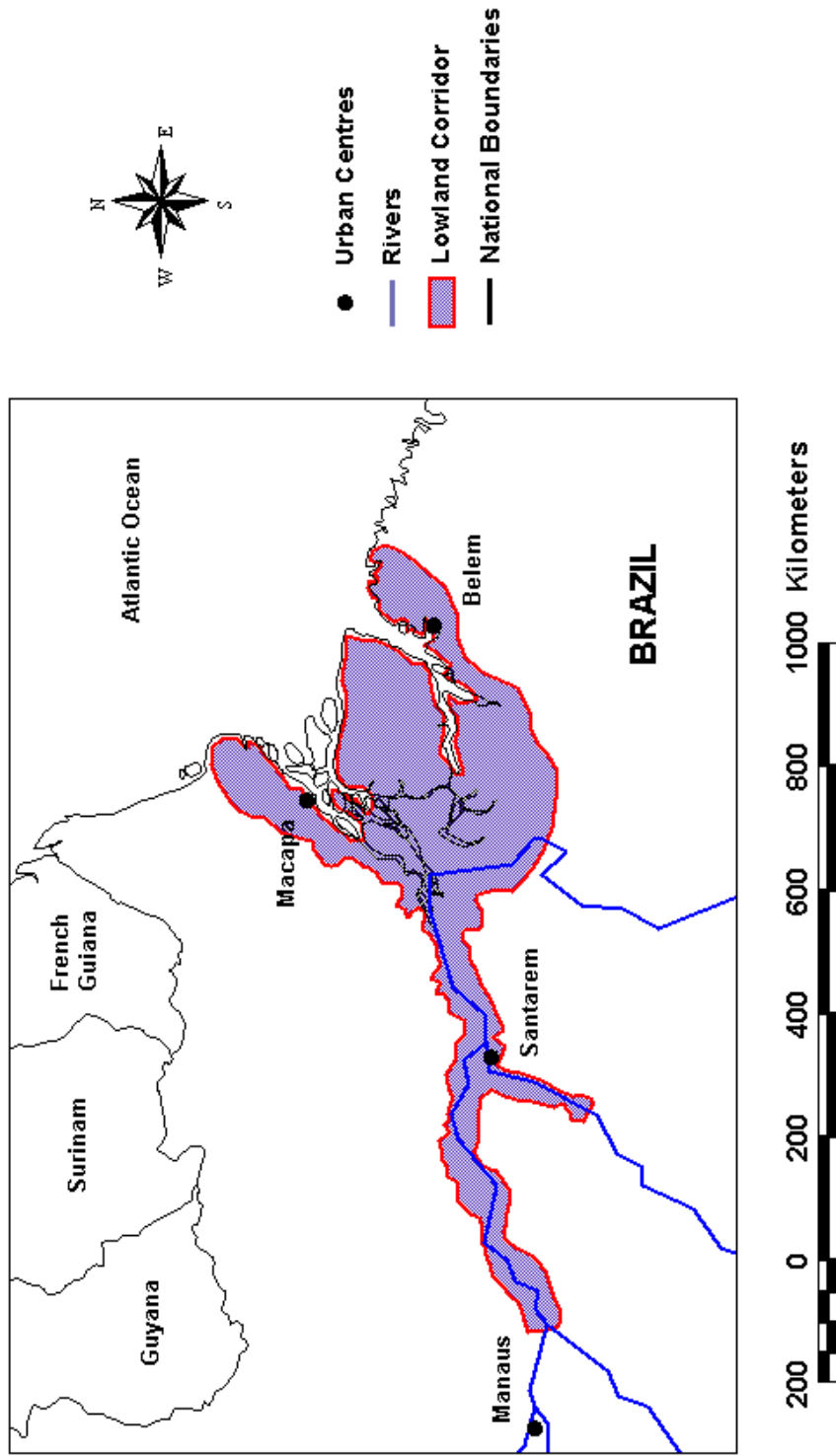
The lowland corridor along the Amazon river from Manaus to the delta including the areas around Belém and Macapá either side of the delta and the banks of the Rio Tapajós as far as Itaituba in Pará state. Occupies south of Amapá, 70% of Pará and 5% of Amazonas states. Zone of lowland forest clearance, all at elevations below 100 metres.

Land Area	Area mapped using ArcView, calculated in km ² .
Population	Calculated using a value of 3 people per km ² for the total target area (based on an average population density taken from the Times World Atlas) plus the UN (1993) data for those cities falling within the zone: Belem, Manaus, Santarem, Itaituba, Altamira and Macapa.
Road Density	Estimated density of roads in target area using GeoCenter World Country Maps: South America (North). Scale used: 5 = dense, 1 = sparse.
Demand Side Assessment	Based on the six towns in the target area with populations greater than 100,000 persons.
Assessment of Export Potential	Estimated maximum of 300 km from any point in target area to a major town. This is a linear measurement only and does not account for transport infrastructure.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. This assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> and WHO website.
NR Knowledge Base	Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

Map 5: Brazil – Forest Agriculture Interface based on the Lowland River Corridor

National Land Area 8,507,128 km²

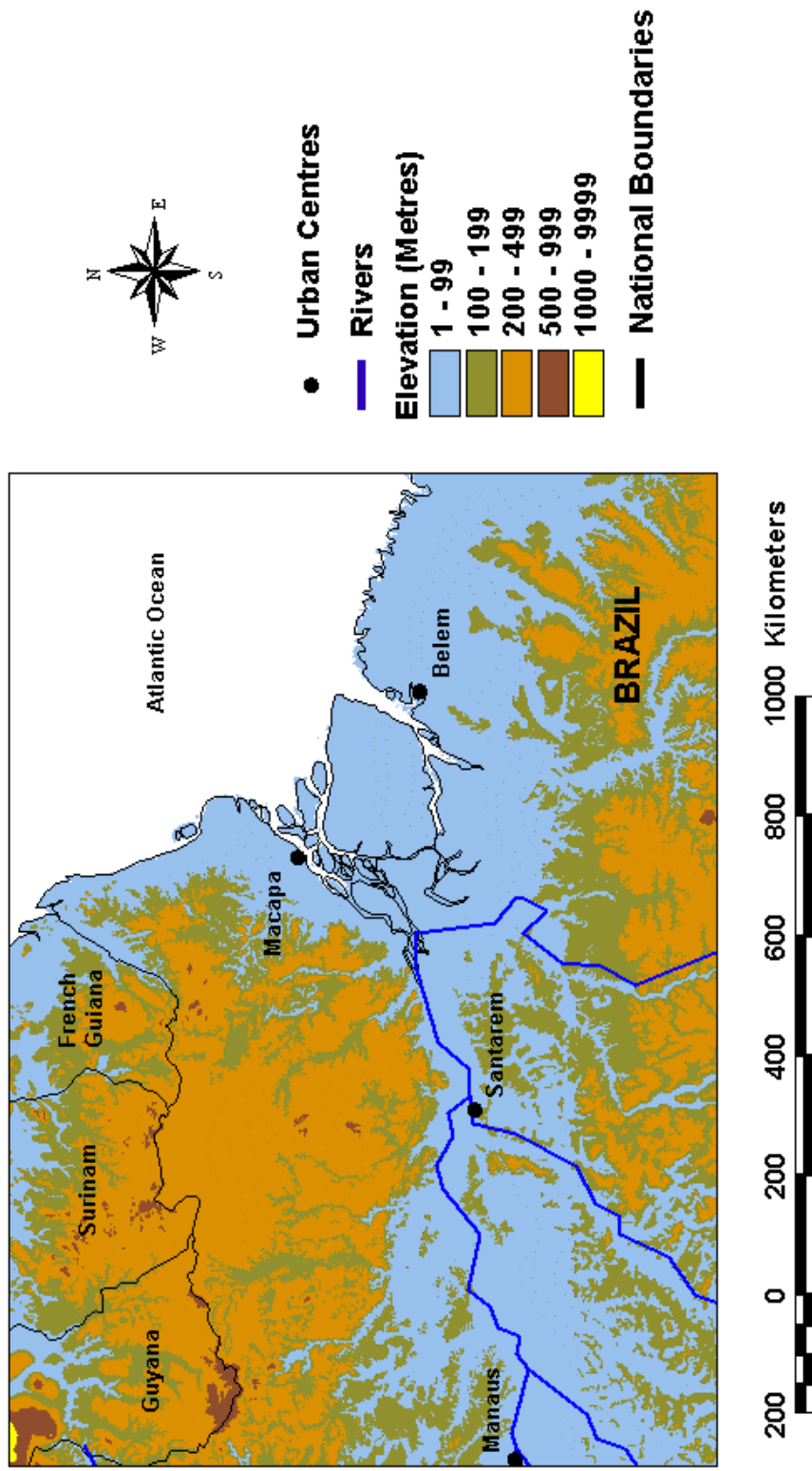
Production System Area 237,927 km²



Note: This map was based on an elevation map of Brazil

Map 6: Brazil –Elevation Map (eastern Amazonia)

National Land Area 8,507,128 km²



5.5 CARIBBEAN

Production system – Land Water Interface

Based on a modified DFID definition of the Caribbean, consisting of the small sovereign island states, Jamaica, UK dependencies and the mainland coastal zone of Guyana. Alternative definitions include all CARICOM countries, which also encompass The Bahamas, Haiti and Surinam. French, Dutch and US dependencies and overseas territories are not included. The definition used here is: Anguilla, Antigua & Barbuda, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana (coastal zone), Jamaica, Montserrat, St Kitts & Nevis, St Lucia, St Vincent & the Grenadines, Trinidad & Tobago and the Turks & Caicos Islands.

Land Area	Areas obtained from CIA <i>World Factbook</i> . 80% of the area of Guyana was excluded. The relevant data are in Table 5.2.
Population	Calculated using total population data for the countries in the target area (refer to Table 5.3). For Guyana 50% of the total was used. The heavy concentration of population in coastal areas justifies this weighting, however the overall numbers involved are small in comparison to other parts of the world so using other proportions could be considered without affecting the final outcome.
Road Density	Calculated using 1996 estimates from the CIA World Factbook (total kms of paved and unpaved road) for the target countries. The figure includes the total length of roads in Guyana. A value of 5 on the scale 5 = dense, 1 = sparse was applied.
Demand Side Assessment	The only towns with populations greater than 100,000 persons are Kingston, Georgetown and Port of Spain. The result is distorted by the greater land area represented by the mainland.
Assessment of Export Potential	Maximum distance from the target area to a major town relative to the size of the territory under consideration. This varies greatly: from 100 km in Guyana and 50 km in Jamaica to only a few km in the smaller islands. If the size of the towns on the small islands is considered unsuitable for this analysis then the distances will be far greater as larger export destinations represented by cities such as Kingston, Port of Spain or mainland cities outside the target area will enter the equation. This would require an analysis of freight transport infrastructure.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. As the target area occupies the entire national area of the countries under consideration (except Guyana) it has been assumed that the production system contributes all 'national' production. This assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website. National GDP per capita data and adult literacy data weighted to reflect the relative sizes of populations in the various territories. Jamaica and Trinidad & Tobago tend to dominate. For the weight for height data only figures for Dominica, Granada, Jamaica and Trinidad & Tobago were available. An average for the latter two was taken.

NR Knowledge Base Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research were obtained from ISNAR website for a few countries but the limited data could not produce any meaningful figures.

Table 5.2 Target Country Land Area, Caribbean

State	Area (km ²)	Target Area (km ²)
Anguilla	91	91
Antigua & Barbuda	440	440
Barbados	430	430
British Virgin Islands	150	150
Cayman Islands	260	260
Dominica	750	750
Grenada	340	340
Guyana ¹⁰	214,970	42,994
Jamaica	10,990	10,990
Montserrat	100	100
St Kitts & Nevis	269	269
St Lucia	620	620
St Vincent & the Grenadines	340	340
Trinidad & Tobago	5,130	5,130
Turks & Caicos Islands	430	430

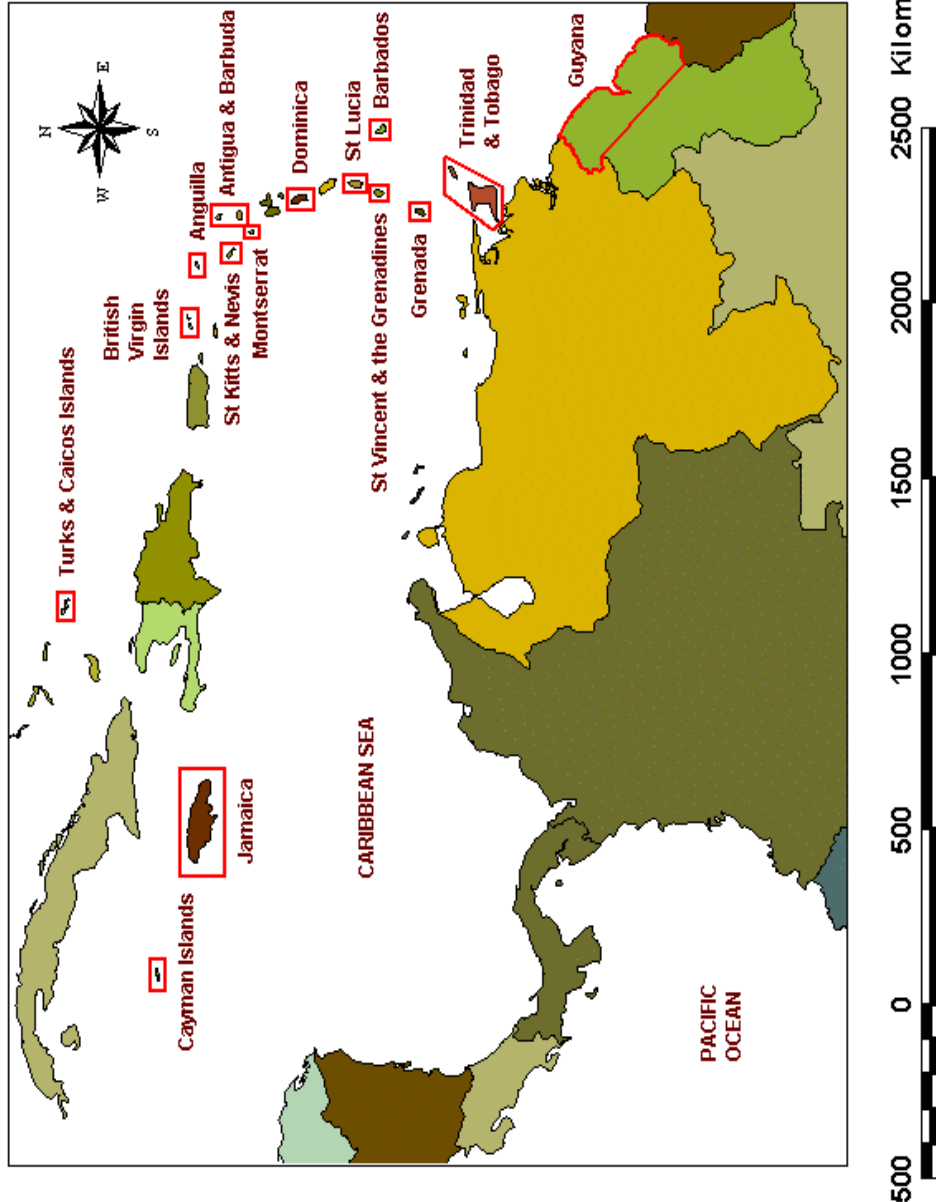
Table 5.3 Target Country Population, Caribbean

State	Population (1996)	Target Area Population
Anguilla	10,000	10,000
Antigua & Barbuda	66,000	66,000
Barbados	257,000	257,000
British Virgin Islands	13,000	13,000
Cayman Islands	35,000	35,000
Dominica	83,000	83,000
Grenada	95,000	95,000
Guyana ¹⁰	712,000	356,000
Jamaica	2,595,000	2,595,000
Montserrat	13,000	13,000
St Kitts & Nevis	41,000	41,000
St Lucia	158,000	158,000
St Vincent & the Grenadines	118,000	118,000
Trinidad & Tobago	1,272,000	1,272,000
Turks & Caicos Islands	14,000	14,000

¹⁰ / Contrary to expectation, in subsequent commissioning of research, Belize replaced Guyana as the target mainland state with a target land area of 22,965 km² and target population of 209,00 persons. Thus the inclusion of Guyana rather than Belize in this Study's definition of the Caribbean slightly overestimates the values for total target area and total population respectively.

Map 7: Caribbean – Land Water Interface

National Land Area 235,310 km² Production System Area 63,334 km²



5.6 GHANA

Production system – Forest Agriculture Interface

Scenario 1 – disturbed deciduous forest belt and forest-savanna transition (part)

Based on LGP of 9-10 months. Forms a band across country extending from the eastern border and Lake Volta across Ashanti region. Takes in all of Ashanti region, western Brong Ahafo, northern third of Eastern and the central portion of Volta region.

Scenario 2 – forest-savanna transition (part) with derived savanna

Based on LGP of 8 months. Forms a band across the country from northern Lake Volta. The southern half of Northern province, the eastern portion of Brong Ahafo and the northern third of Volta province.

Land Area Area mapped using ArcView, calculated in km².

Population Calculated by applying the same proportion of the land area occupying the target zone to the population. As the provincial population data obtained was dated 1984, totals were increased by 55% to reflect the growth in the total population to the 1998 UN estimate:

	Province	1984 Census	% Applied	Target Pop.	Plus 55%
Scenario 1	Ashanti	2,090,000	100	2,090,000	3,239,500
	Brong-Ahafo	1,207,000	100	1,207,000	1,870,850
	Eastern	1,681,000	30	504,300	781,665
	Volta	1,212,000	50	606,000	939,300
Scenario 2	Brong-Ahafo	1,207,000	25	301,750	467,712
	Northern	1,165,000	30	582,500	902,875
	Volta	1,212,000	50	363,600	563,525

Road Density Estimated density of roads in target area using International Travel Maps: Ghana. Scale used: 5 = dense, 1 = sparse.

Demand Side Assessment Major towns identified from Times Atlas and UN data. As the two scenarios occupy different areas the towns under consideration are also different and so may range in size and significance.

Assessment of Export Potential It is estimated that there would be no more than 100 km to travel to a main town in the southerly target area and 150 km in the northerly zone. The major towns on the coast lie outside both target areas and are 200-300 km distant.

Land Productivity Potential A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. This assessment does not include tourism.

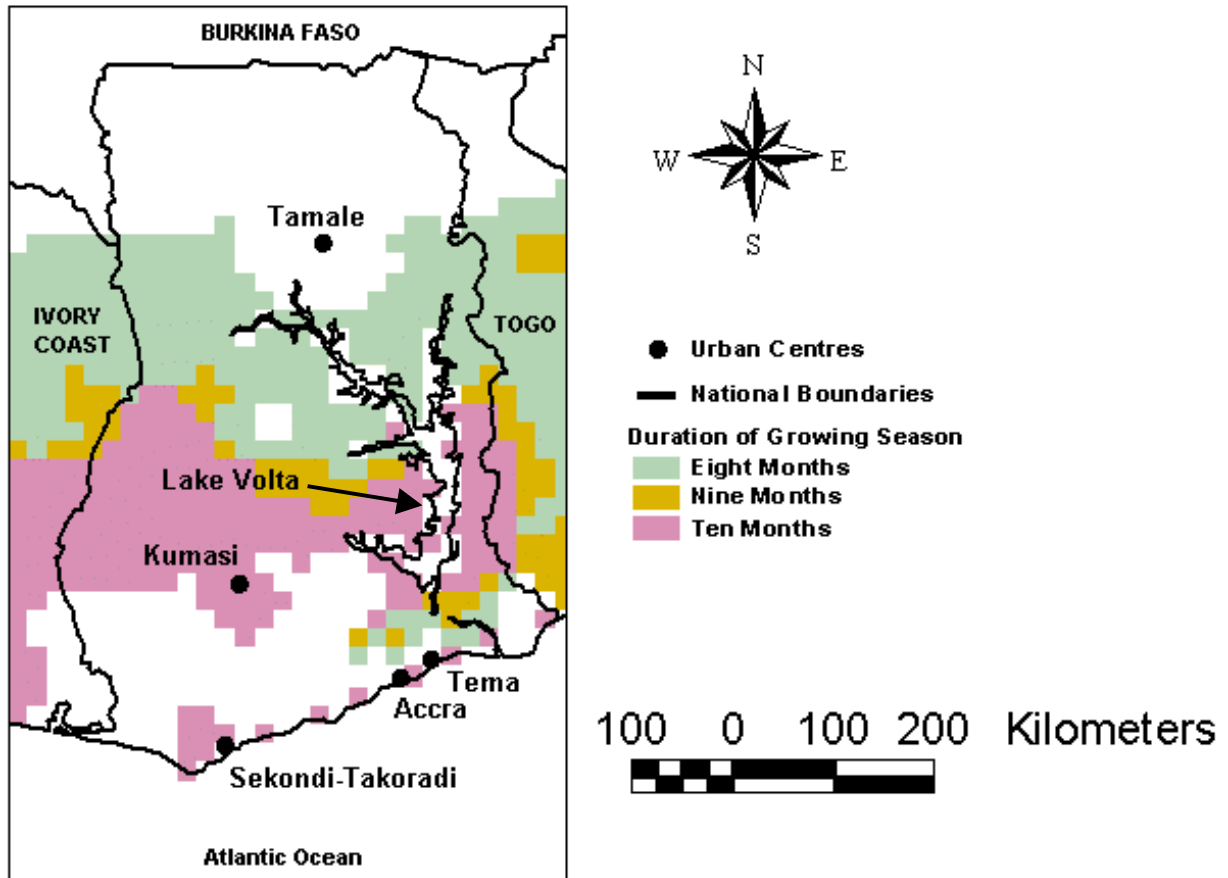
Poverty Status National data obtained from UNDP *Human Development Report* and WHO website.

NR Knowledge Base Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

Map 8: Ghana – Forest Agriculture Interface

As defined by length of growing period, 8-10 months

National Land Area	239,981 km ²
Combined Production System Area	122,238 km ²



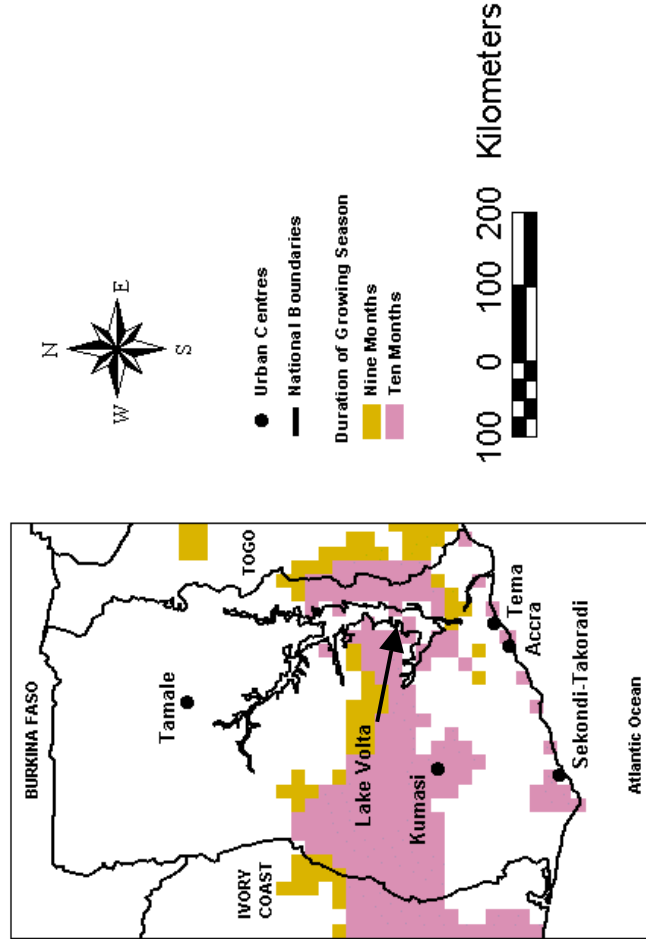
Map 9: Ghana – Forest Agriculture Interface (two scenarios)

Scenario 1

Length of Growing Period 9-10 Months

National Land Area 239,981 km²

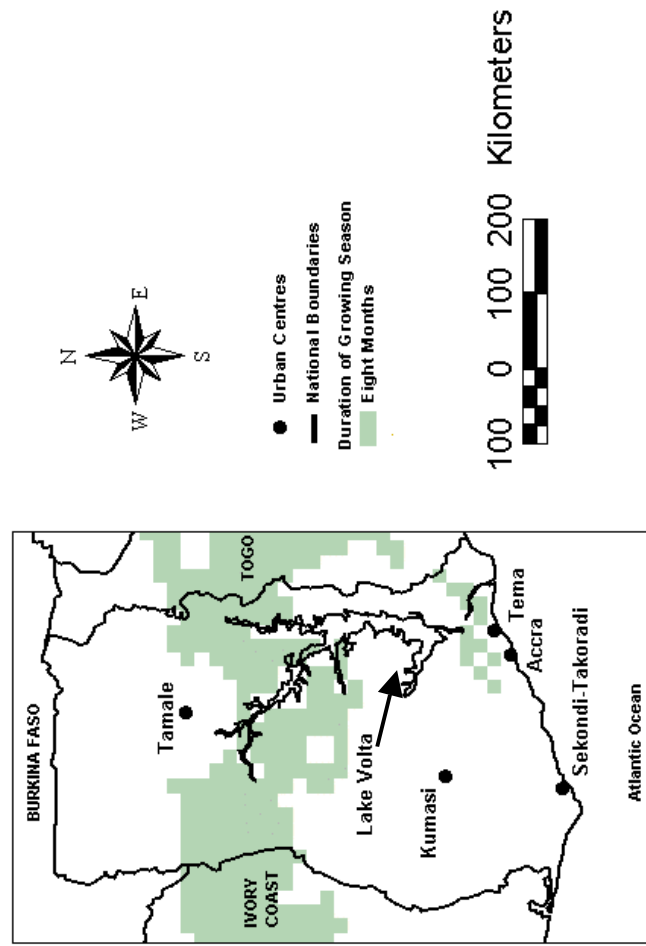
Production System Area 67,123 km²



Scenario 2

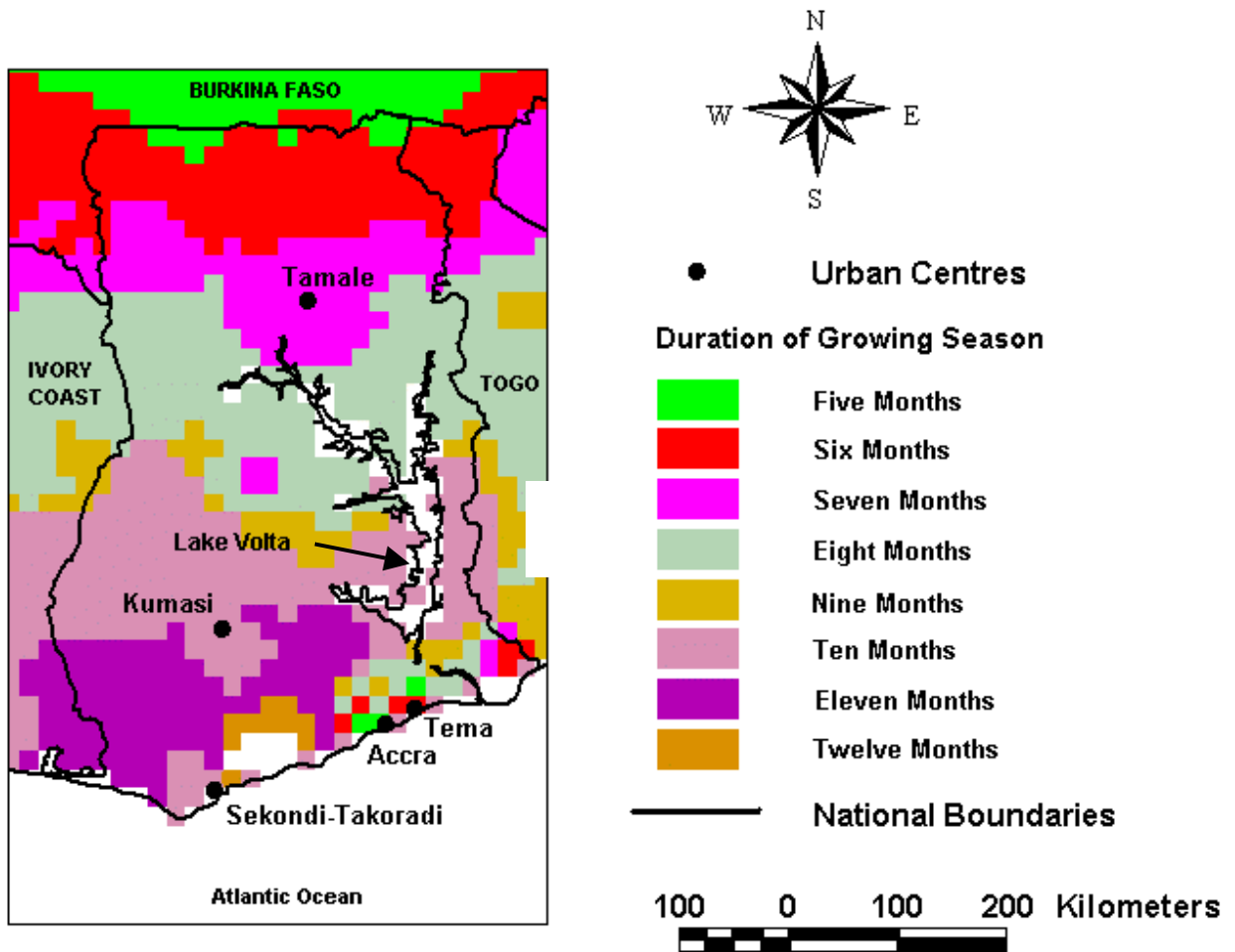
Length of Growing Period 8 Months

Production System Area 55,115 km²



Map 10: Ghana – Length of Growing Period

National Land Area 239,981 km²



5.7 GHANA

Production system – Peri-Urban Interface

Cities with population of more than 100,000 persons:

- Accra
- Kumasi (this is the NRSP target city region)
- Sekondi-Takoradi
- Tamale
- Tema

Land Area Not available.

Population Refer to the city population table below.

City	City Area (1984 Census + 55%)	Metropolitan Area (1998 estimate)	Peri-Urban Population
Accra	1,344,561	2,218,000	873,439
Kumasi	583,186	700,000	116,814
Sekondi-Takoradi	144,770	300,000	155,230
Tamale	210,725	300,000	89,275
Tema	203,868	250,000	46,132

City populations from the 1984 Census scaled up by 55% to reflect the general increase in the country's population (may be greater if the rate of urbanisation is higher than population growth rate). Metropolitan area populations were from FWKC encyclopaedia (1998 estimates). It should be noted that Tema lies within Greater Accra administrative district and it is unclear from the source documents if the data for Greater Accra refer to this district or are a general term for the metropolitan area. There may therefore be some double counting.

Road Density On the scale employed here (5 = dense, 1 = sparse) a value of 5 has been applied.

Demand Side Assessment N/a

Assessment of Export Potential N/a

Land Productivity Potential N/a

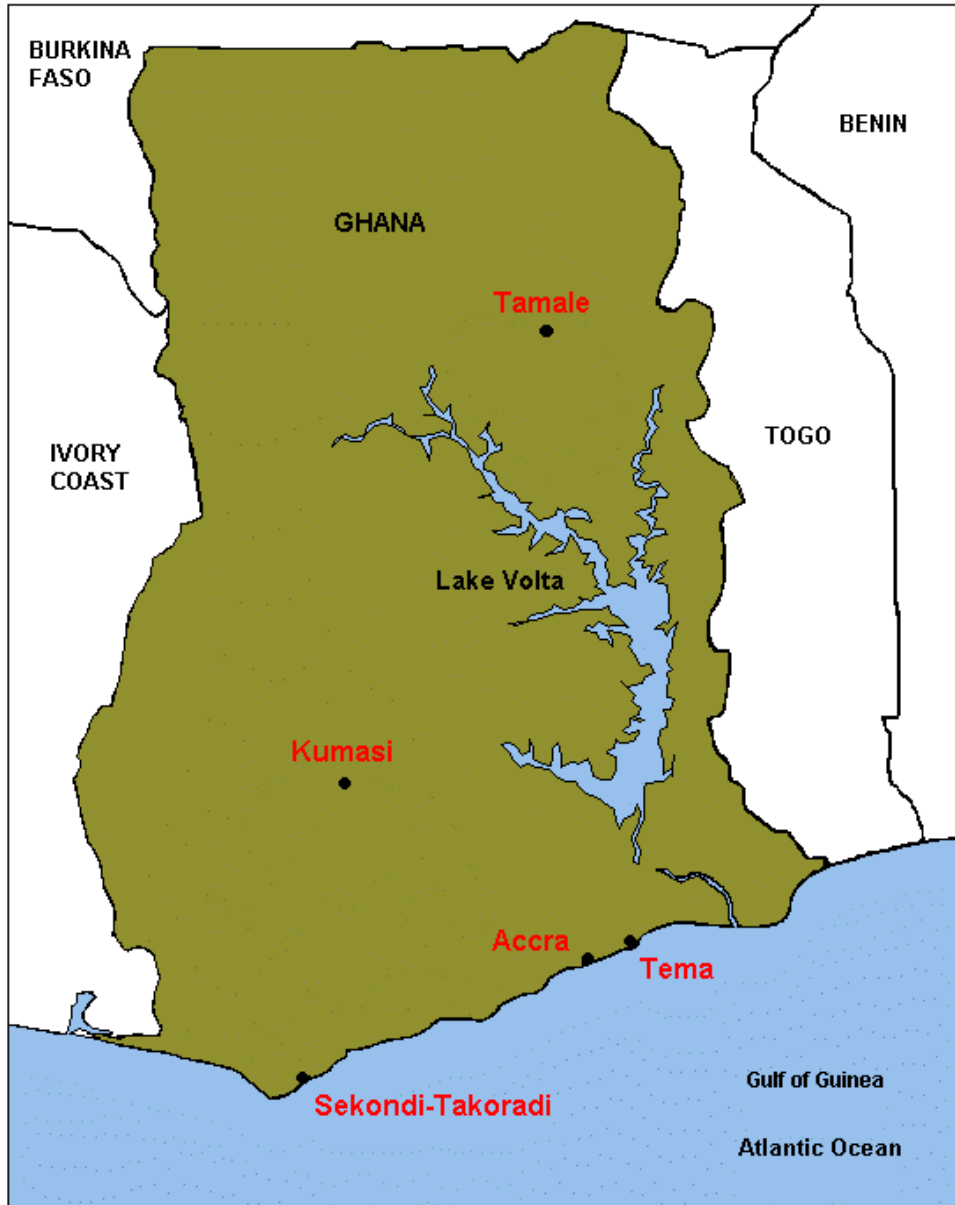
Poverty Status National data obtained from UNDP *Human Development Report*, and WHO website.

NR Knowledge Base Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

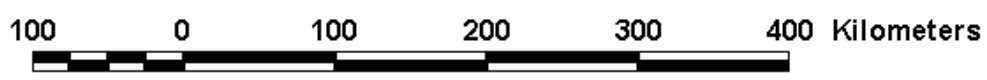
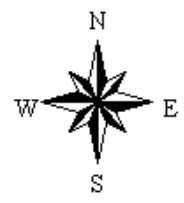
Map 11: Ghana – Peri-Urban Interface

Peri-Urban Cities with Population of > 100,000 persons

National Land Area 239,981 km²



- Peri-Urban Centres
- National Boundaries
- Water



5.8 INDIA

Production system – High Potential

Scenario 1

Lower Indo-Gangetic Plain (eastern Uttar Pradesh, and northern Bihar at altitudes of below 150 metres with rainfall in the range 1250-1750 mm, and LGP up to 180 days per year). Characterised as subtropical and low altitude with alluvial soils. Mixed irrigated and rainfed, with mixed cropping.

Scenario 2

Scenario 1 area plus the upper Plain area of western Uttar Pradesh into Haryana and Punjab at altitudes between 150 and 500 metres. Predominantly irrigated wheat-based systems with rainfall towards the drier end of the range 1250-1750 mm.

Land Area Area mapped using ArcView which calculated area in km₂.

Population Population of target area calculated by applying percentage of state land area occupied:

Scenario 1	Scenario 2
Bihar ¹¹ (75%) Uttar Pradesh (60%).	Bihar ¹¹ (75%) Uttar Pradesh (80%) Haryana (90%) Delhi (100%) Punjab (90%).
Area includes cities of Allahabad, Benares, Gorakhpur, Kanpur, Lucknow, and Patna.	Area includes cities of Agra, Amritsar, Bareilly, Delhi and New Delhi plus those mentioned in Scenario 1.

Total increased by 14% to reflect increase in total population since 1991 census (refer to Table 5.4).

Road Density Estimated density of roads in target area using GeoCenter World Country Maps: India (North East) & India (South). Scale used: 5 = dense, 1 = sparse.

Demand Side Assessment Number of cities with populations greater than 500,000 persons (from the 1991 Census) per 1000 km₂ of target area.

Assessment of Export Potential It is estimated that it is a maximum of 200 km to any of the major cities within the target zone. There are many smaller towns in the target area.

Land Productivity Potential By applying the same percentages to provincial data as were used to estimate population, the percentages of total production of key agricultural products which are contributed by the target areas, are as follows:

	Rice	Maize	Wheat	Pulses	Sugar	Potato	Milk
Scenario 1	14	19	26	8	27	31	14
Scenario 2	27	26	62	20	41	44	33

¹¹ / This considers the State of Bihar before the creation of the State of Jharkland that took in part of (old) Bihar

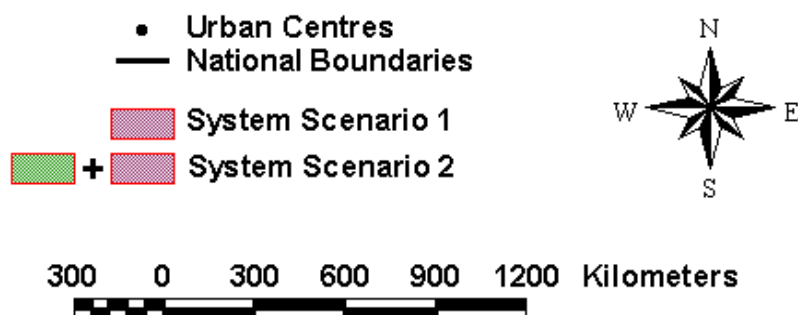
Land Productivity Potential contd.	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40- 60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data from the <i>Statistical Abstract of India</i> and maps from the FAO/GIEWS website. This assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.
NR Knowledge Base	Data for degree level of national researchers not available. Number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

Table 5.4 Census Data 1991, India

State/City	Population	% Rural
Bihar	86,374,465	87
Uttar Pradesh	139,112,287	80
Haryana	16,463,648	75
Punjab	20,281,969	70
Delhi	9,240,644	10
Agra	948,063	
Allahabad	844,546	
Amritsar	708,835	
Bareilly	617,350	
Benares	925,000*	
Gorakpur	505,566	
Kanpur	2,029,889	
Lucknow	1,669,204	
New Delhi	301,297	
Patna	1,099,647	
(*estimate ESRI 1998)		

Map 12: India – High Potential Production System

National Land Area	3,089,282 km ²	
System Scenario 1	309,929 km ²	
System Scenario 2	483,739 km ²	(173,810 km ² + 309,929 km ²)

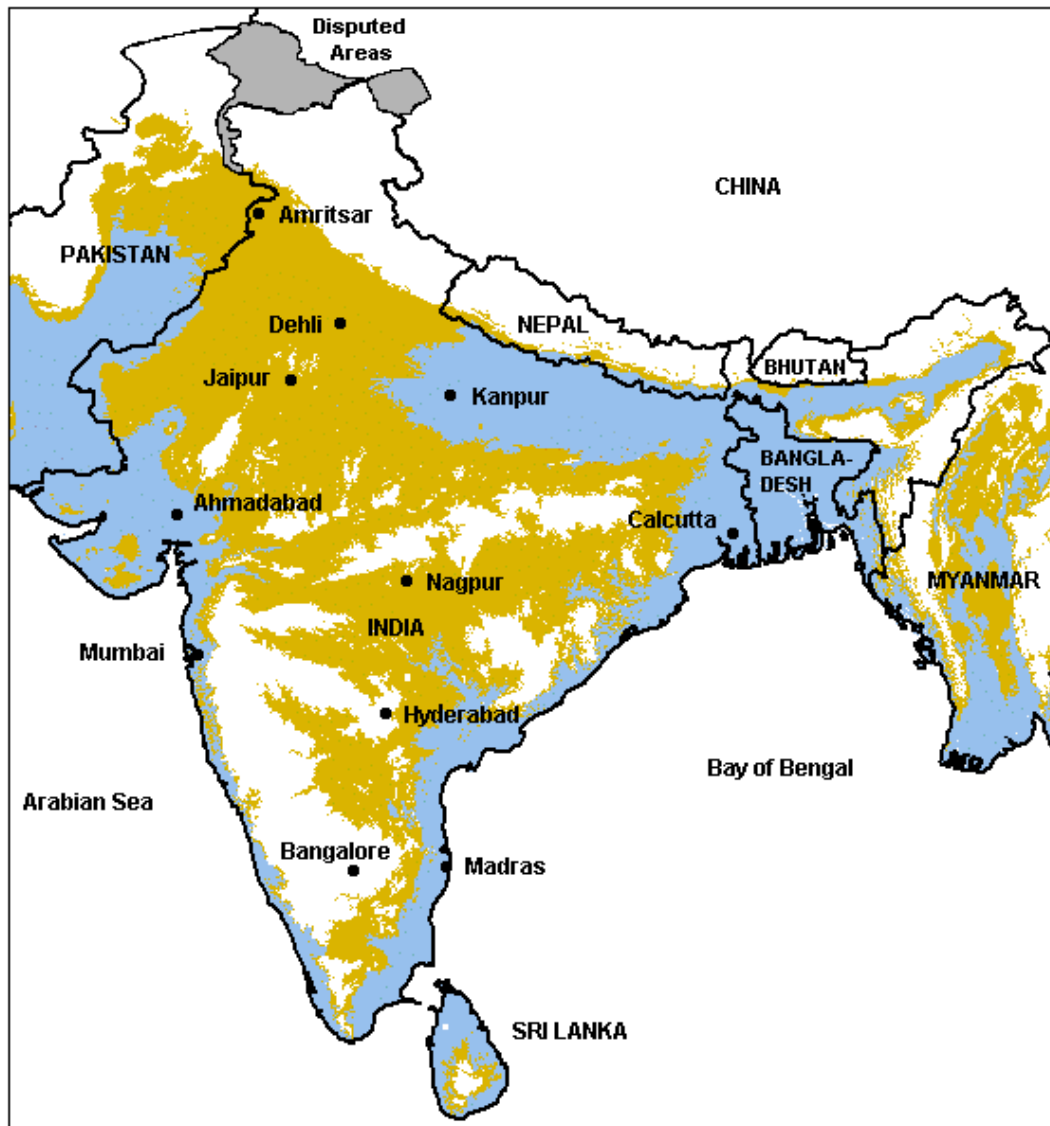


Note: This Map was based on an elevation map of India and ICRISAT production systems

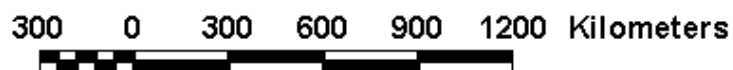
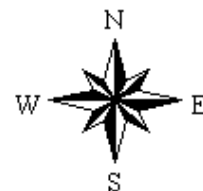
Map 13: India – Elevation

Range 1 metre to 500 metres

National Land Area 3,089,282 km²



- Urban Centres
 - National Boundaries
- Elevation (Metres)**
- 1 - 150
 - 151 - 500



5.9 INDIA

Production system – Semi-Arid

Scenario 1

Semi-arid agro-ecological zone consisting of two sub-systems: dry semi-arid (500-750 mm annual rainfall and 90-120 days LGP) and moist semi-arid (750-1000 mm and 90 –150 days). The target zone extends from Tamil Nadu through inland Karnataka, eastern Andhra Pradesh, inland Maharashtra, western Madhya Pradesh, western Gujarat, western Rajasthan to eastern Uttar Pradesh and northern Haryana and Punjab.

Scenario 2

Scenario 1 plus the dry sub-humid sub-system (1000-1200 mm rainfall and 150-180 days LGP). The target area is as Scenario 1 with the addition of eastern Maharashtra, western Madhya Pradesh, western Uttar Pradesh, central Bihar and south eastern Gujarat.

The areas selected correspond partially with AEZ mapping found in various literature sources. For this reason wider and narrower definitions have been mapped

Land Area Area mapped using ArcView, calculated in km₂.

Population Calculated using the approximate land area covered by the target area and allocating population from the 1991 census using the same percentage. The national rural population percentage (74%) was applied. The table below gives the relevant data. 1991 data has been increased by 14% to reflect the increase in the national population.

Scenario 1	Scenario 2
The following cities are located within the target area: Agra, Ahmadabad, Allahabad, Amritsar, Bangalore, Bareilly, Delhi, Gandhinagar, Gwalior, Jaipur, Jamnagar, Kanpur, Kota, Ludhiana, Madurai, Mysore, New Delhi, Solapur, Tiruchchirappali, Udaipur and Vadodara (see Table 5.5).	In addition to the cities listed above this wider target area also includes Allahabad, Benares, Bhopal, Mumbai, Chandigarh, Gorakhpur, Hyderabad, Lucknow, Madras, Nagpur, Patna, Pune, Surat and Varanasi (see Table 5.6).

Road Density Estimated density of roads in target area using GeoCenter World Country Maps: India (North East) & India (South). Scale used: 5 = dense, 1 = sparse.

Demand Side Assessment Number of cities with populations greater than 500,000 (from 1991 Census) per 1000 km₂ of target area.

Assessment of Export Potential It is estimated that it is a maximum of 200 km to any of the major cities within the target zone. There are many smaller towns in the target area.

Land Productivity Potential By applying the same percentages to provincial data as were used to estimate population, the percentages of total production of key agricultural products which are contributed by the target areas are as follows:

	Rice	Maize	Wheat	Pulses	Banana	Sugarcane	Coffee	Potato	Milk
Scenario 1	30	32	35	27	46	47	54	22	38
Scenario 2	48	55	59	45	66	73	60	43	58

- Land Productivity Potential contd.** A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data from the *Statistical Abstract of India* and maps from the FAO/GIEWS website. This assessment does not include tourism.
- Poverty Status** National data obtained from UNDP *Human Development Report*, and WHO website.
- NR Knowledge Base** Data for degree level of national researchers not available. Number of agricultural research scientists and percentage of GDP allocated to agricultural research were obtained from ISNAR website.

Table 5.5 Scenario 1 – Population, India

State / U.T.	Total Population ('000)	% Applied	Population ('000)	% Rural
Andhra Pradesh	66508	60	39904.8	73
Delhi	9421	100	9421.0	10
Gujarat	41310	60	24786.0	66
Haryana	16464	40	6585.6	75
Karnataka	44977	70	31483.9	69
Madhya Pradesh	66181	25	16545.3	77
Maharashtra	78937	50	39468.5	61
Punjab	20282	40	8112.8	70
Rajasthan	44006	40	17602.4	77
Tamil Nadu	55859	60	33515.4	60
Uttar Pradesh	139112	40	55644.8	80

Table 5.6 Scenario 2 – Population, India

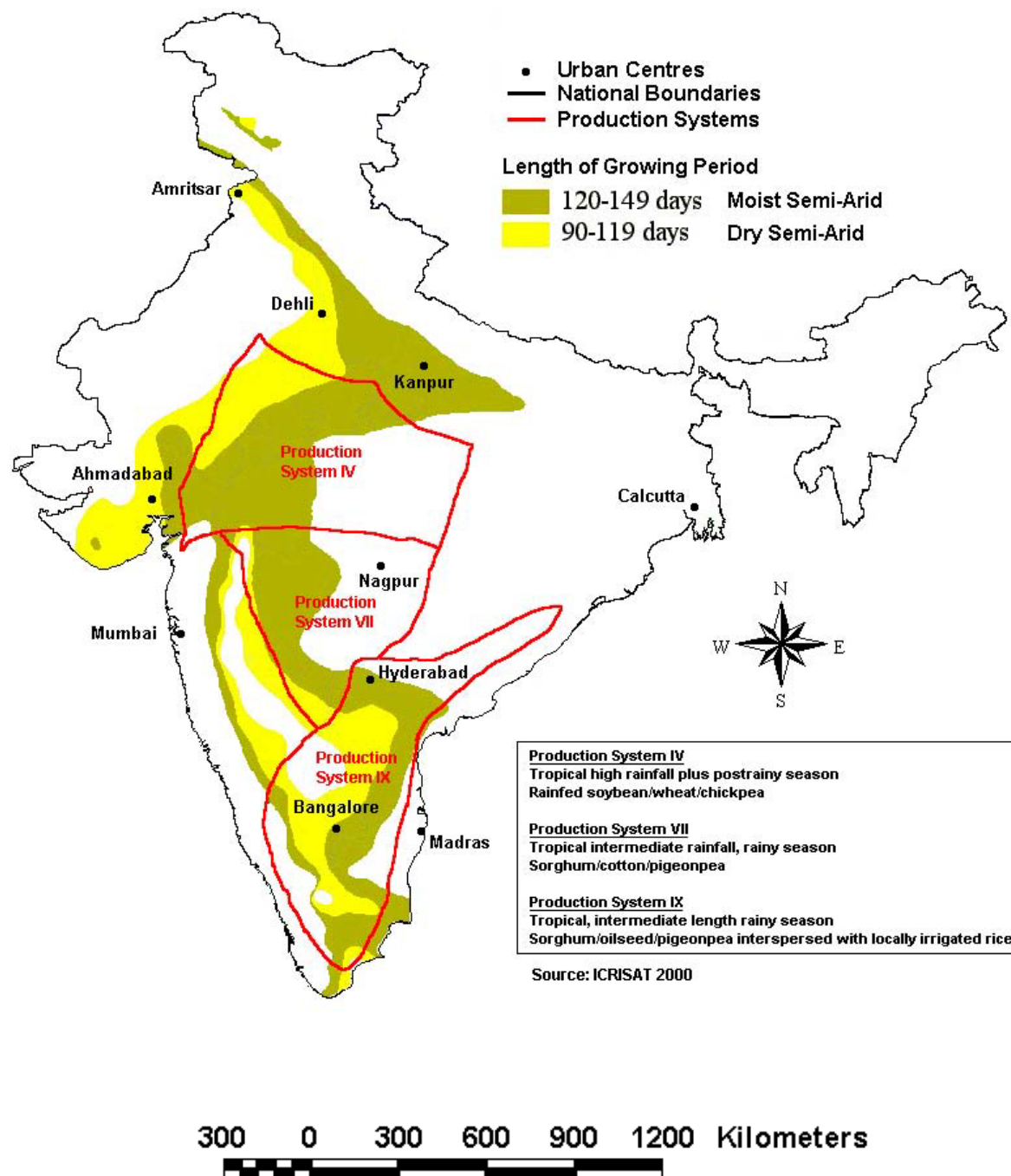
State / U.T.	Total Population ('000)	% Applied	Population ('000)	% Rural
Andhra Pradesh	66508	80	50273.1	73
Bihar	86374	50	43187.0	87
Chandigarh	642	100	642.0	10
Delhi	9421	100	9421.0	10
Gujarat	41310	70	28917.0	66
Haryana	16464	50	6585.6	75
Karnataka	44977	75	33732.8	69
Madhya Pradesh	66181	70	46326.7	77
Maharashtra	78937	75	59202.8	61
Punjab	20282	50	10141.0	70
Rajasthan	44006	40	17602.4	77
Tamil Nadu	55859	90	50273.1	60
Uttar Pradesh	139112	75	104334.0	80

Map 14: India – Semi-Arid, Scenario 1

Production Systems with 3 to 5 Months Length of Growing Period

National Land Area 3,089,282 km²

Semi-Arid Area 1,027,260 km²

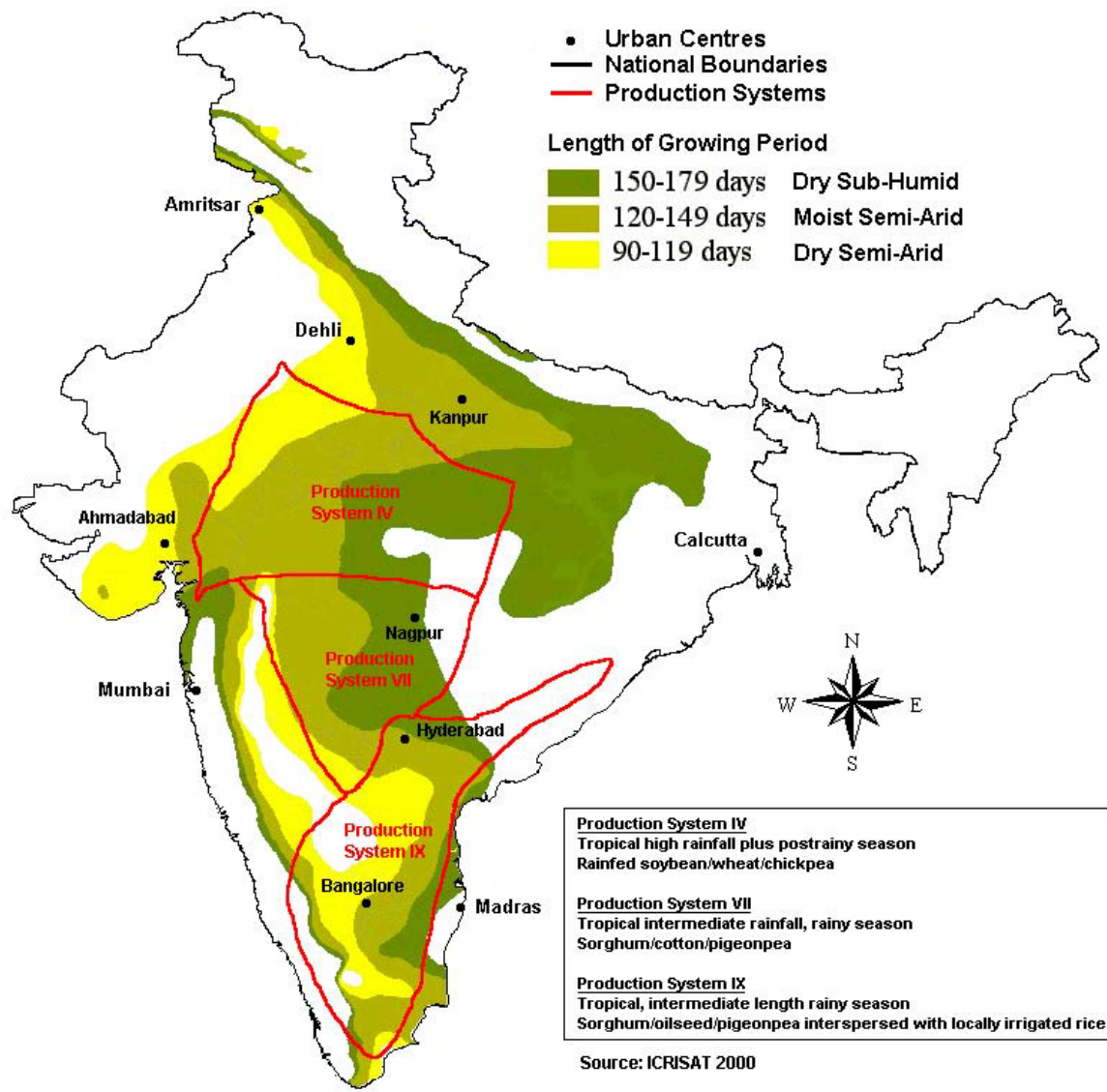


Map 15: India – Semi-Arid, Scenario 2

Production Systems with 3 to 6 Months Length of Growing Period

National Land Area 3,089,282 km²

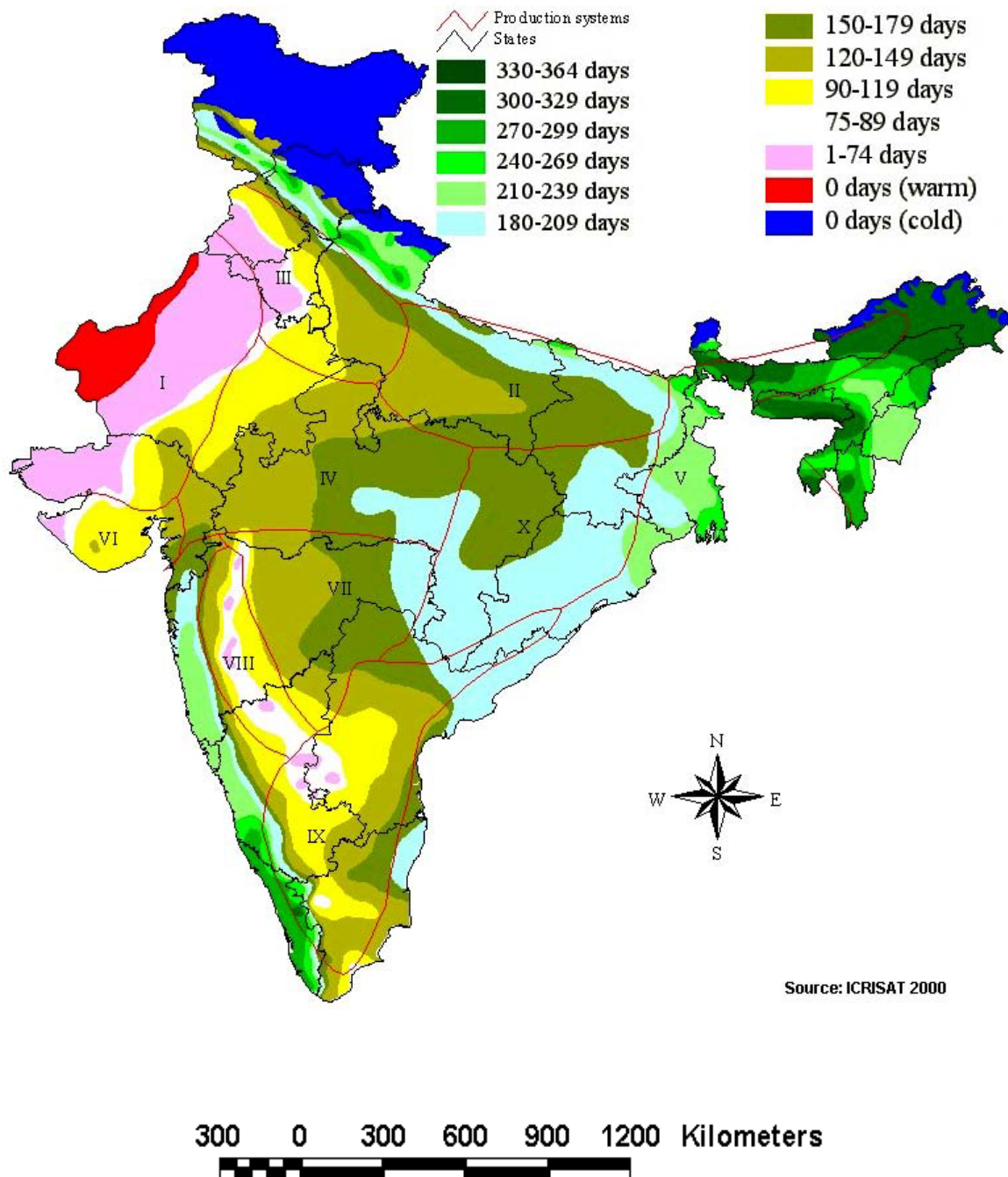
Dry Sub-Humid & Semi-Arid Areas 1,620,487 km²



Map 16: India – Agricultural Production Systems

Length of Growing Period and ICRISAT Production Systems

National Land Area 3,089,282 km²



5.10 INDIA

Production system – Peri-Urban Interface

Random selection of cities: two ‘mega’, two large, two medium and two small. Cities selected: Agra, Bangalore, Mumbai, Kolkata, Kharagpur, Hubli-Dharwad, Hyderabad, and Shillong. The twin cities of Hubli and Dharwad form the NRSP target city region¹².

Land Area City areas were only available for Bangalore (366 km²), Calcutta (852 km²) and Hyderabad (217 km²) and it is unclear whether these refer to the city or the metropolitan area.

Population 1991 census populations of the selected cities and their metropolitan areas increased by 14% to reflect the general increase in population.

City	City Population	Metropolitan Population	Peri-Urban Population
Agra	1,016,641	1,080,792	64,151
Bangalore	3,032,500	4,708,528	1,676,028
Hubli-Dharwad	739,060	(estimate) 855,000	115,940
Hyderabad	3,379,687	4,952,658	1,572,971
Kharagpur	202,908	301,920	99,012
Kolkata	5,015,794	12,564,987	7,549,193
Mumbai	11,315,516	14,359,717	3,044,201
Shillong	150,160	254,637	104,477

The data depends on the definition of the city boundaries (compare Mumbai and Kolkata) and may not be a guide to the density of the population.

Road Density Assumed that urban environment will have high road density.

Demand Side Assessment N/a

Assessment of Export Potential N/a

Land Productivity Potential N/a

Poverty Status National data obtained from UNDP *Human Development Report*, and WHO website.

NR Knowledge Base Data for degree level of national researchers not available. Number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

¹² / One additional target city region, Kolkata, was added to the NRSP-PUI portfolio in October 2000.

Map 17: India – Peri-Urban Interface

Selected Cities for Peri-Urban Characterisation

National Land Area 3,089,282 km²



- Peri-Urban Centres
- National Boundaries
- Water



5.11 KENYA

Production System - High Potential

Based on an interaction of rainfall, LGP and soils data. Annual rainfall >900 mm, LGP >7 mths and soil classes: Ferrasol, Luvisol, Cambisol, Nitosol, Vertisol, Planosol and Andosol. Occupies a broad western area bordering Uganda and Tanzania running south from Mount Elgon; a central area around Mount Kenya in Eastern and Central provinces; and two smaller areas covering the lower north eastern slopes of Mount Kilimanjaro and the coastal hinterland region extending from Malindi to the Tanzanian border in Coast province.

Land Area Area mapped using ArcView, calculated in km₂.

Population Population was calculated using 1998 provincial population data and approximating the proportions of those provinces falling within the target area. As the area is the region of greatest population density a judgement was made as to the percentage of the provincial population to include. The total calculated was then increased by 35% to reflect the difference between the 1989 EIU data and the UN 1998 estimate for total population.

Province	1998 Population	% Applied	Target Population	Plus 35%
Central	3,117,000	100	3,117,000	4,207,950
Coast	1,829,000	55	1,005,950	1,358,033
Eastern	3,769,000	70	2,638,300	3,561,705
Nyanza	3,507,000	100	3,507,000	4,734,450
Rift Valley	4,982,000	60	2,989,200	4,035,420
Western	2,544,000	100	2,544,000	3,434,400

Road Density Estimated density of roads in target area using GeoCenter World Country Maps: Kenya. Scale used: 5 = dense, 1 = sparse.

Demand Side Assessment Data for town populations is patchy, however from UN data and the Times Atlas twelve towns of greater than 50,000 have been identified in the target area which is the zone of greatest population density. Therefore a relatively high value (of towns per 1000 km₂) was obtained.

Assessment of Export Potential It is estimated that there would be a maximum of 100 km to travel to one of these towns from within the target area.

Land Productivity Potential A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. This assessment does not include tourism.

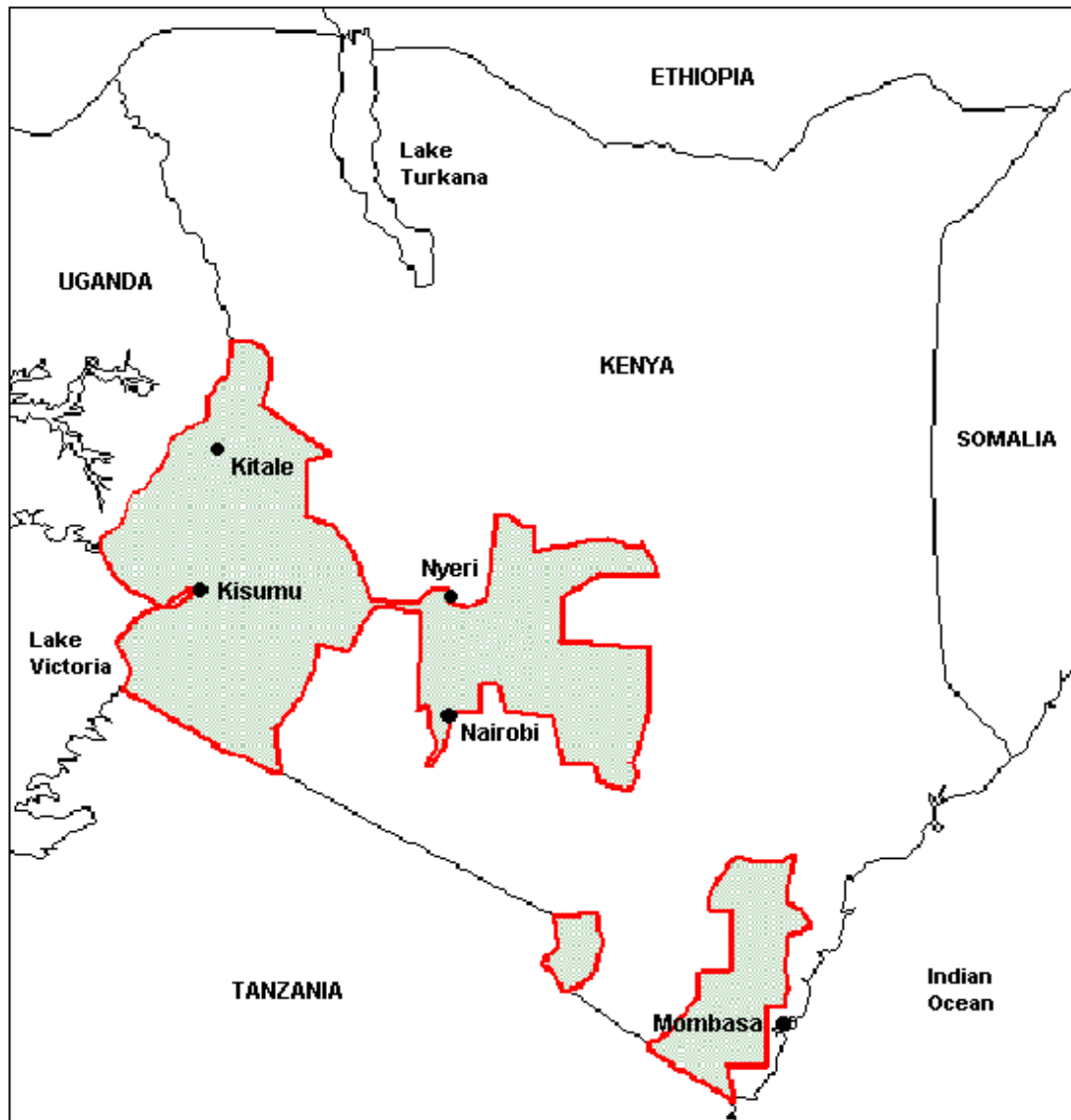
Poverty Status National data obtained from UNDP *Human Development Report*, and WHO website.

NR Knowledge Base Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

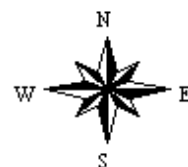
Map 18: Kenya – High Potential Production System

National Land Area 580,367 km²

Production System Area 107,551 km²



- Urban Centres
- National Boundaries
- ▨ High Potential Production Area

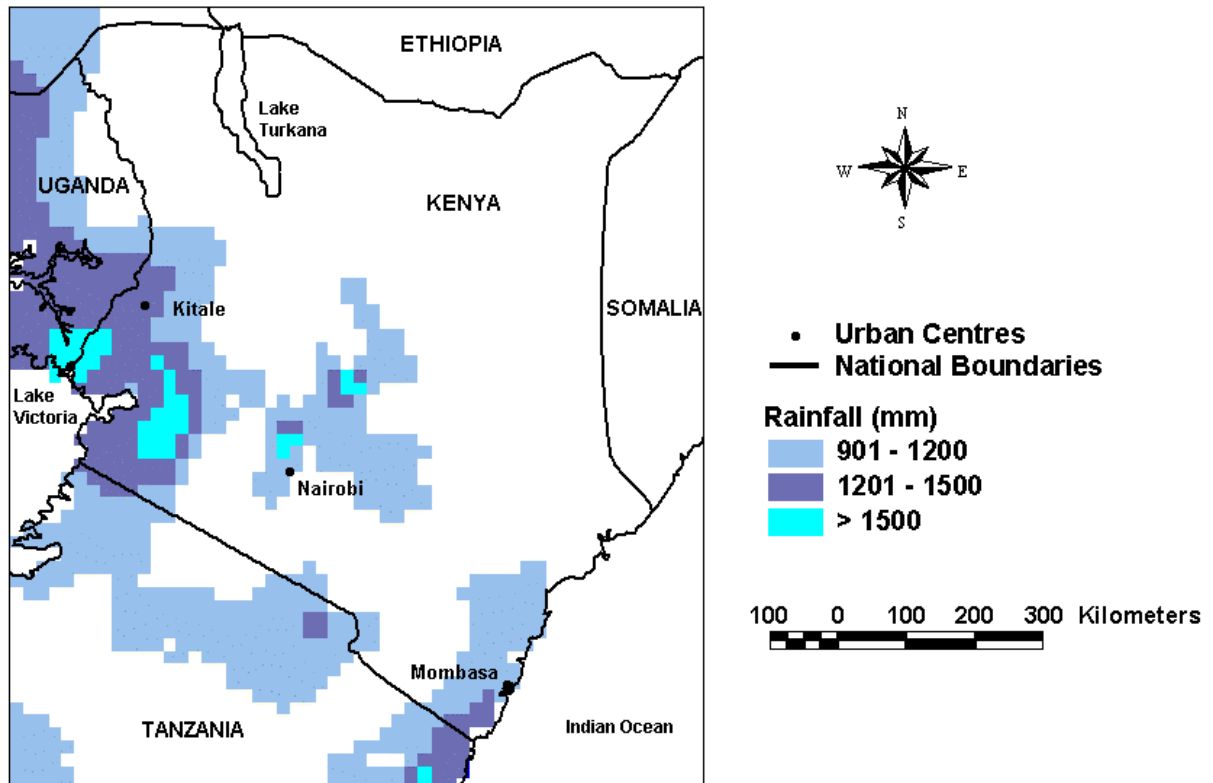


Map 19: Kenya – Annual Rainfall

Range 900 mm to >1500 mm

National Land Area 580,367 km²

Production System Area 131,321 km²

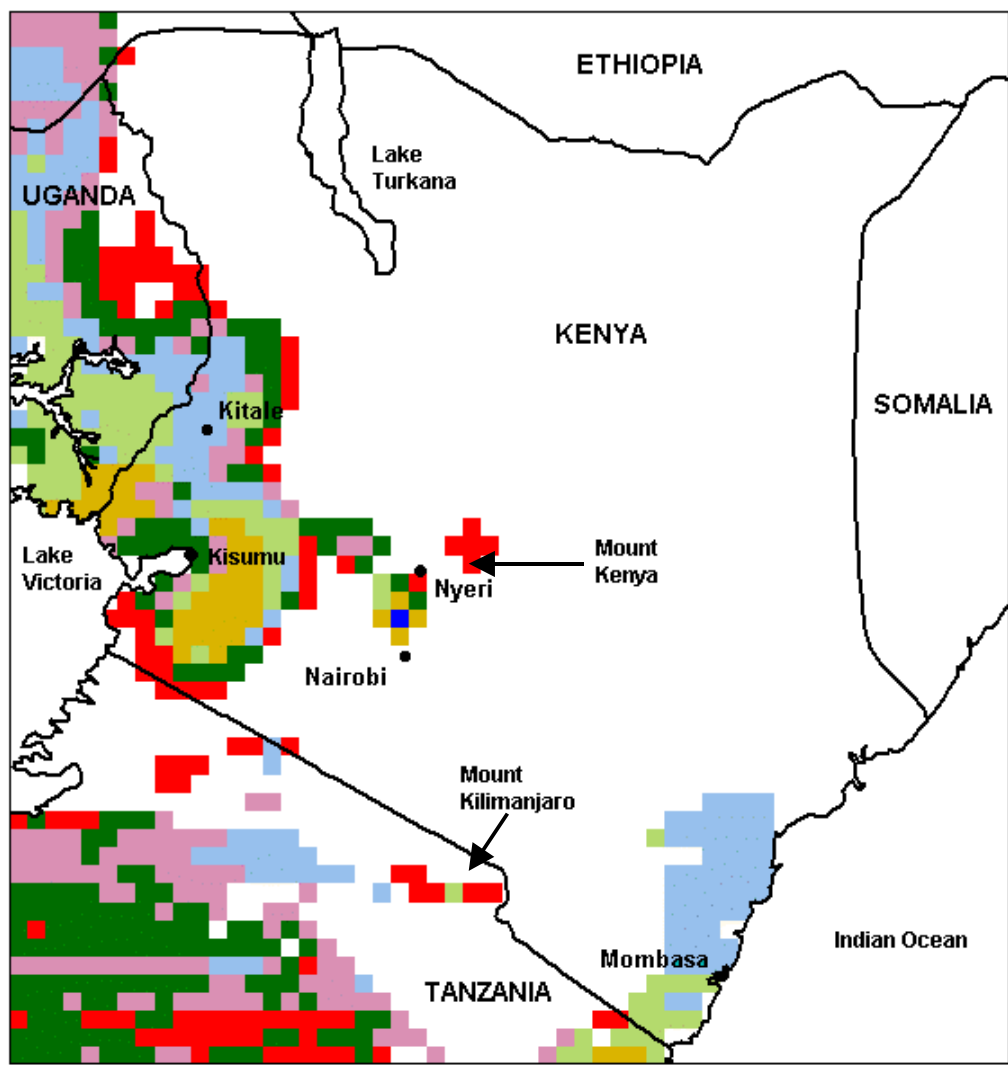


Map 20: Kenya – Length of Growing Season

Range 6 to 12 Months

National Land Area 580,367 km²

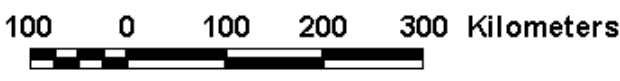
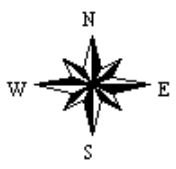
Production System Area 75,201 km²



- Urban Centres
- National Boundaries

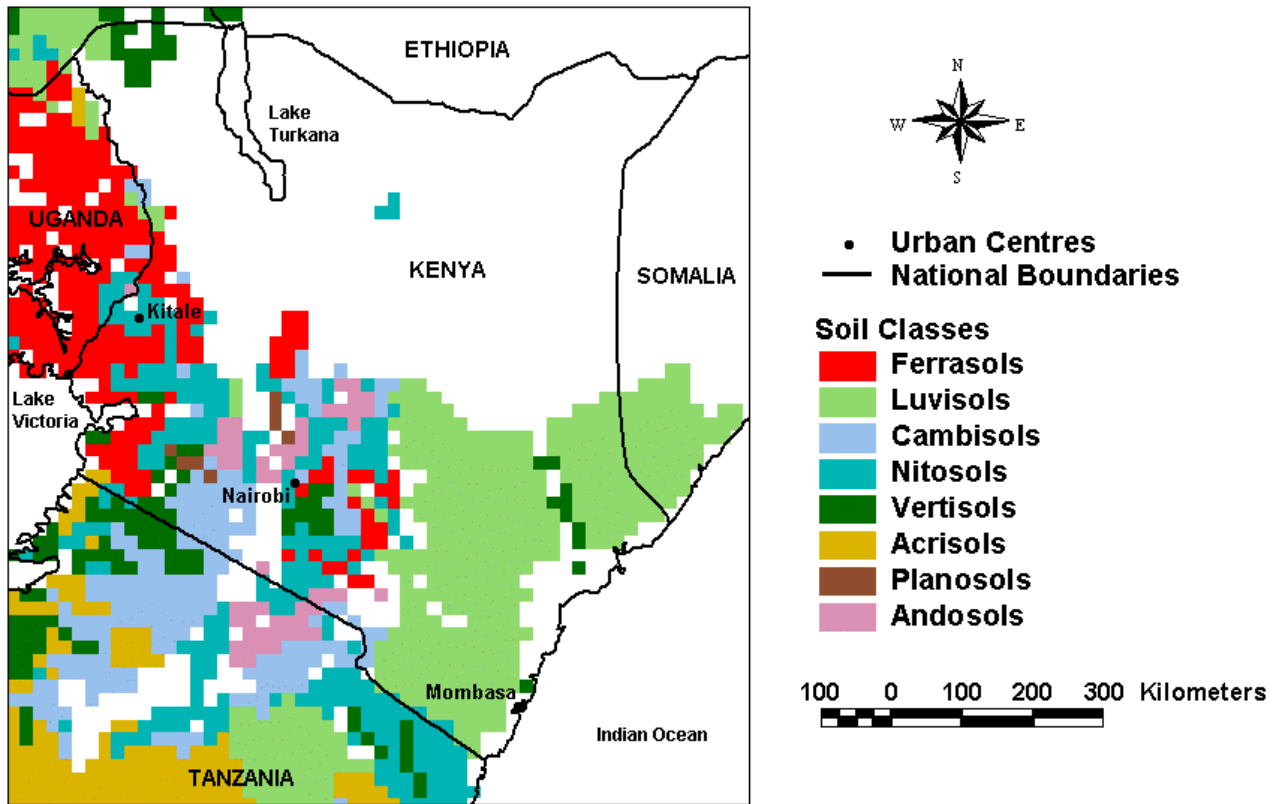
Duration of Growing Season

- Six Months
- Seven Months
- Eight Months
- Nine Months
- Ten Months
- Eleven Months
- Twelve Months



Map 21: Kenya – Soil Classes

National Land Area 580,367 km²



5.12 NEPAL

Production Systems – Forest Agriculture Interface and Hillsides

Based on the area represented by land in the range 300-2499 metres altitude. It includes the central band of the country and the higher elevation valleys of the Himalaya foothills. Takes in the lands characterised as low, mid and high hills but not the lower (60-300 m) 'Terai' and does not go beyond the altitude limits of staple crops such as rice and potato.

Land Area Area mapped using ArcView, calculated in km₂.

Population Calculated using 1981 population data detailed by administrative district. The small districts were approximately equated with the target area and totalled. The total is comprised as follows:

FAR WESTERN		MID WESTERN		WESTERN		CENTRAL		EASTERN	
Dadeldhura	868853	Dang Deokhuri	266393	Arghkhach	157304	Sindhuli	183705	Ilam	178356
Doti	153135	Pyuthan	157669	Gulumi	238113	Ramechhap	161445	Dhankuta	129781
Baitadi	179316	Rolpa	168116	Palapa	214442	Dholakha	150576	Terhathum	95542
Achham	185212	Jajarkot	99312	Baglung	215228	Makawanpur	243411	Bhojpur	192689
Bajura	74649	Salyan	152063	Kaski	221272	Kathmandu	422237	Udayapur	159805
		Surkhet	166196	Tanahu	223438	Dhading	243401	Khotang	215571
		Dailekh	166527	Syangja	271824	Khavrepalanchok	307150	Okhaldhun	137640
				Gorkha	231292	Parsa	284338		
				Lamjung	152720	Lalitpur	184341		
						Bhaktapur	159767		
						Nuwakot	202976		

The resulting figure was then increased by 45.6% to reflect the growth in the total Nepalese population between the 1981 data and the UN mid 1998 estimate. The national urban percentage of 10.9% was applied to this figure as the Kathmandu district falls within the target zone.

Road Density Estimated density of roads in target area using International Travel Maps: Nepal. Scale used: 5 = dense, 1 = sparse.

Demand Side Assessment Number of major towns in target area per 1000 km₂ of target area. No data for size of towns, and an assumption that the chosen towns were 'major' relative to the area in that they appeared in bold script in the Times World Atlas.

Assessment of Export Potential Estimated that it is a maximum of 100 km to a major town from any point in the target area. This is a linear measurement only and does not account for the terrain.

Land Productivity Potential By employing the same method as was used to estimate population it was estimated that the target area contributes the following percentages of total production of key agricultural products:

Rice	28%
Wheat	40%
Maize	69%
Millet	76%
Potato	50%
Sugarcane	10%

Land Productivity Potential contd.

A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data from the *Statistical Yearbook for Nepal 1991* and maps from the FAO/GIEWS website. This assessment does not include tourism.

Poverty Status

National data obtained from UNDP *Human Development Report*, and WHO website.

NR Knowledge Base

Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research not available.

Map 22: Nepal – Low, Mid and High Hills

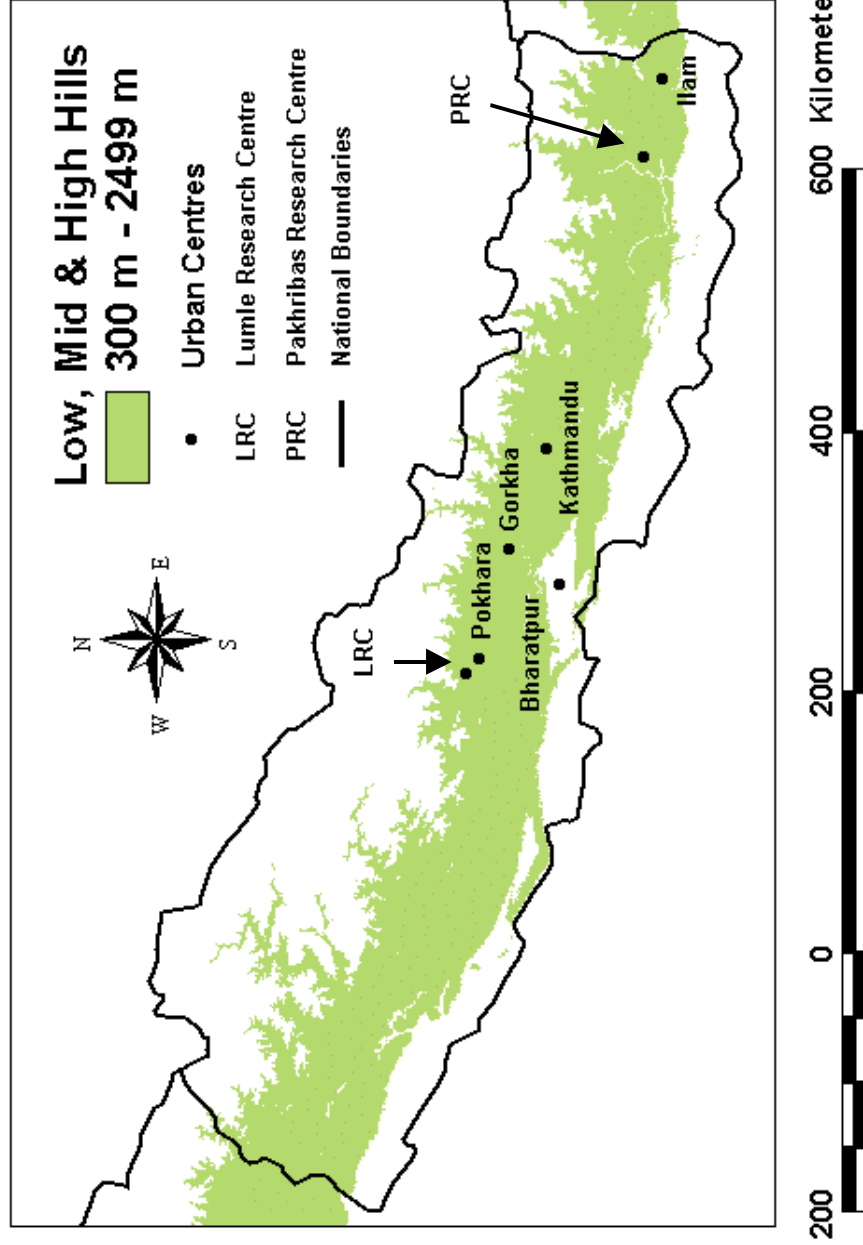
Range 300 metres to 2499 metres elevation

National Land Area

147,293 km²

Production System Area

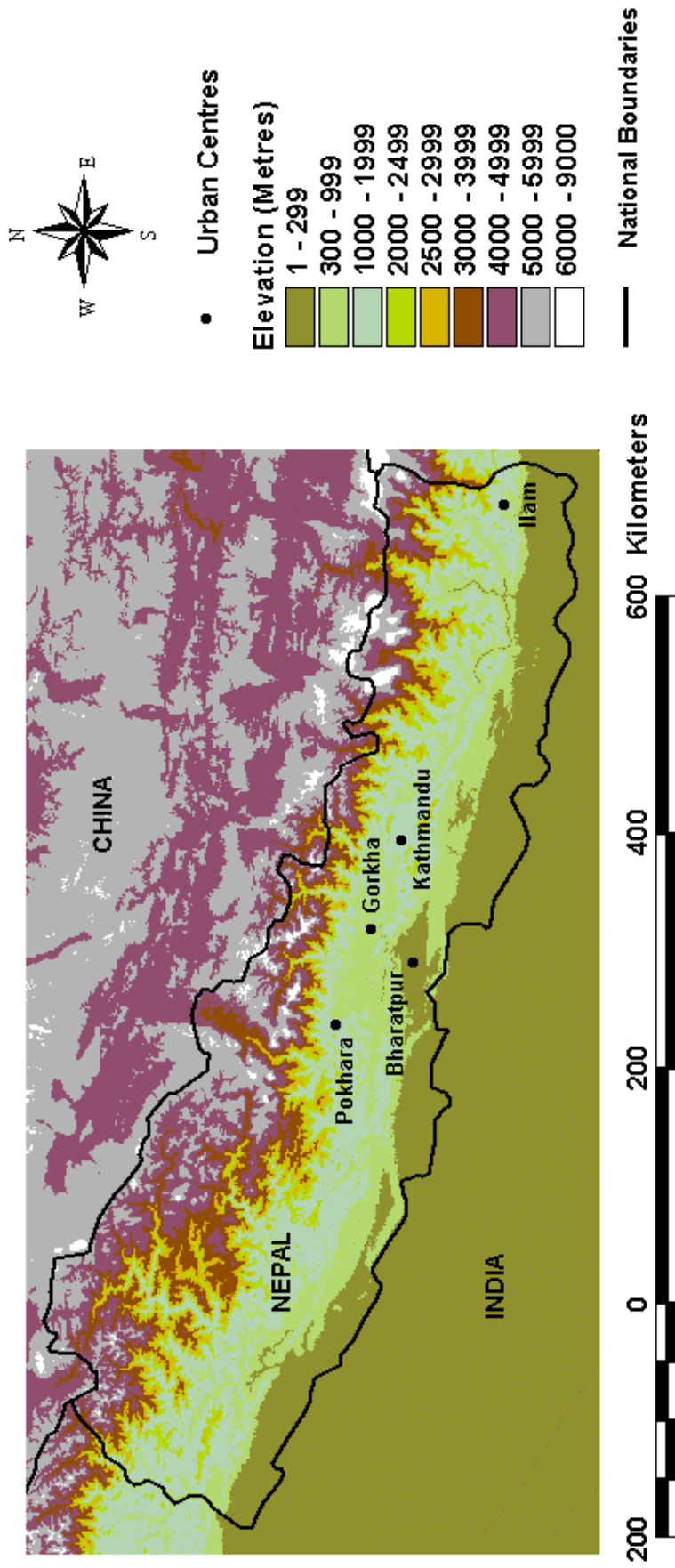
81,430 km²



Note: This Map was based on an elevation map of Nepal

Map 23: Nepal – Elevation Map

National Land Area 147,293 km²



5.13 TANZANIA

Production System – Semi-Arid

DFID (refer Section 3.2) has defined the semi-arid lands of Tanzania as those with annual rainfall of 300-1200 mm. This takes in most of the country except the southern hill and highland areas and parts of the coast (refer Map 24). In contrast, the FAO definition of semi-arid (74-199 days LGP – see Map 25, but commencing at 90 days) delineates the north-east to south-west dry land tract and the southern dry lands, possibly under-emphasising the central dry lands. The area of 300-900mm annual rainfall better captures the central dry lands but does not include parts of the southern areas that experience erratic rainfall.

Scenario 1

Based on 300-900 mm rainfall per annum. It occupies 25-30% of country: in Arusha province around Lake Natron and the central areas of Shinyanga, Singida, Dodoma and Mbeya provinces. Compromise between 300-600 mm which only took in a small area (about 5% of the total land area) of the central plateau, and the 300-1200 mm range which covers around 90% of the country (Bourn & Blench 1999).

Scenario 2

Based on LGP 3-6 months. It occupies the northern belt along the Kenya and Uganda border (Kagera, Mara, Arusha and Kilimanjaro provinces), the central zone (Dodoma, Iringa and Mbeya provinces) and southern areas bordering Mozambique (Ruvuma and Mtwara provinces), occupying 40-50% of the country. Inclusion of parts of Southern Highlands questionable but taking LGP 3-5 months is too restricted.

Land Area	Area mapped using ArcView, calculated in km ² .
Population	Calculated from 1995 provincial population data by estimating the percentage of the province falling within the target area and applying the same proportion to the population. The resulting total was then increased by 13% to reflect the increase in the total population since 1995 (refer to Table 5.7 and Table 5.8).
Road Density	Estimated density of roads in target area using International Travel Maps: Tanzania. Scale used: 5 = dense, 1 = sparse.
Demand Side Assessment	Main towns in target area were identified from Times Atlas. Very low values obtained for this analysis were due to size of target area and relatively few sizeable towns.
Assessment of Export Potential	Estimated 200 km maximum distance to a main town.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. The assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.
NR Knowledge Base	Data for degree level of national researchers and number of agricultural research scientists obtained from ISNAR website. Percentage of GDP allocated to agricultural research not available.

Table 5.7 Scenario 1 – Provincial Population, Tanzania

Province	1995 Population	% Applied	Target Population	Plus 13%
Arusha	1,643,000	50	820,000	926,600
Dodoma	1,502,000	100	1,502,000	1,697,260
Iringa	1,467,000	100	1,467,000	1,657,710
Kilimanjaro	1,345,000	50	672,500	759,925
Mbeya	1,792,000	15	268,800	303,744
Morogoro	1,526,000	10	152,600	172,438
Mwanza	2,280,000	30	684,000	772,920
Rukwa	843,000	5	42,150	47,630
Shinyanga	2,152,000	40	860,800	972,704
Singida	961,000	100	961,000	1,085,930
Tabora	1,257,000	15	188,550	213,061
Tanga	1,590,000	5	79,500	89,835

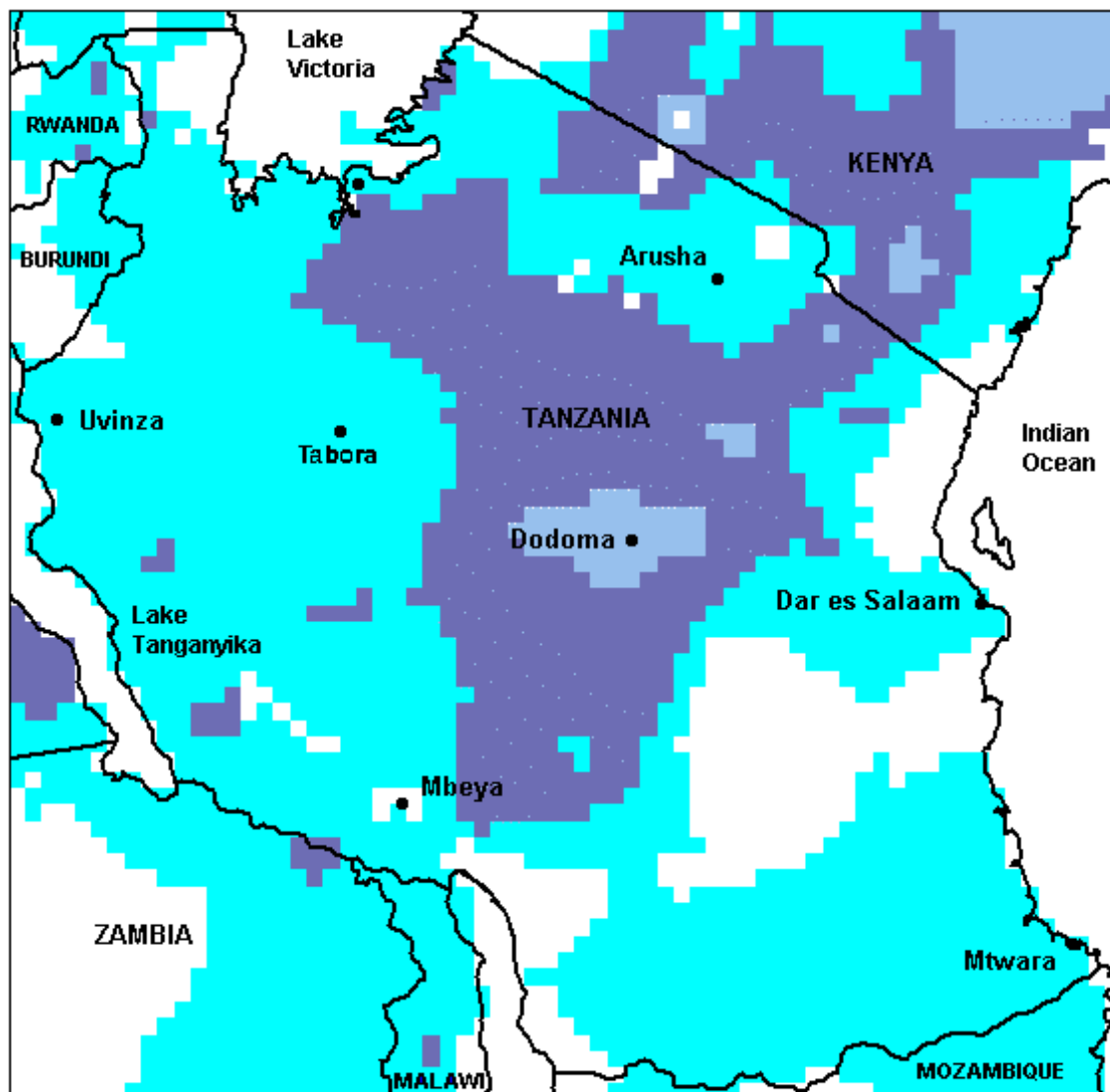
Table 5.8 Scenario 2 – Provincial Population, Tanzania

Province	1995 Population	% Applied	Target Population	Plus 13%
Arusha	1,640,000	50	820,000	926,600
Dar / Salaam	1,651,000	100	1,651,000	1,865,630
Dodoma	1,502,000	50	751,000	848,630
Iringa	1,467,000	100	1,467,000	1,657,710
Kagera	1,653,000	100	1,653,000	1,867,890
Kilimanjaro	1,345,000	100	1,345,000	1,519,850
Lindi	785,000	30	235,500	266,115
Mara	1,178,000	100	1,178,000	1,331,140
Mbeya	1,792,000	50	896,000	1,012,480
Morogoro	1,526,000	40	610,400	689,752
Mtwara	1,079,000	80	863,200	975,416
Mwanza	2,280,000	15	342,000	386,460
Pwani	774,000	40	309,600	349,248
Ruvuma	951,000	80	760,800	859,704
Shinyanga	2,152,000	20	430,400	486,352
Singida	961,000	70	672,700	760,151
Tabora	1,257,000	5	62,850	71,021
Tanga	1,590,000	60	954,000	1,078,020

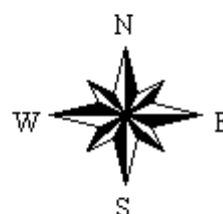
Map 24: Tanzania – Semi-Arid, Scenario 1

Annual Rainfall limits 300mm to 900 mm defines Scenario 1

National Land Area	944,977 km ²		
300 mm – 900 mm Area	248,282 km ²	300 mm – 1200 mm Area	829,832 km ²



- Urban Centres
- National Boundaries
- Rainfall (mm)
- 301 - 600
- 601 - 900
- 901 - 1200

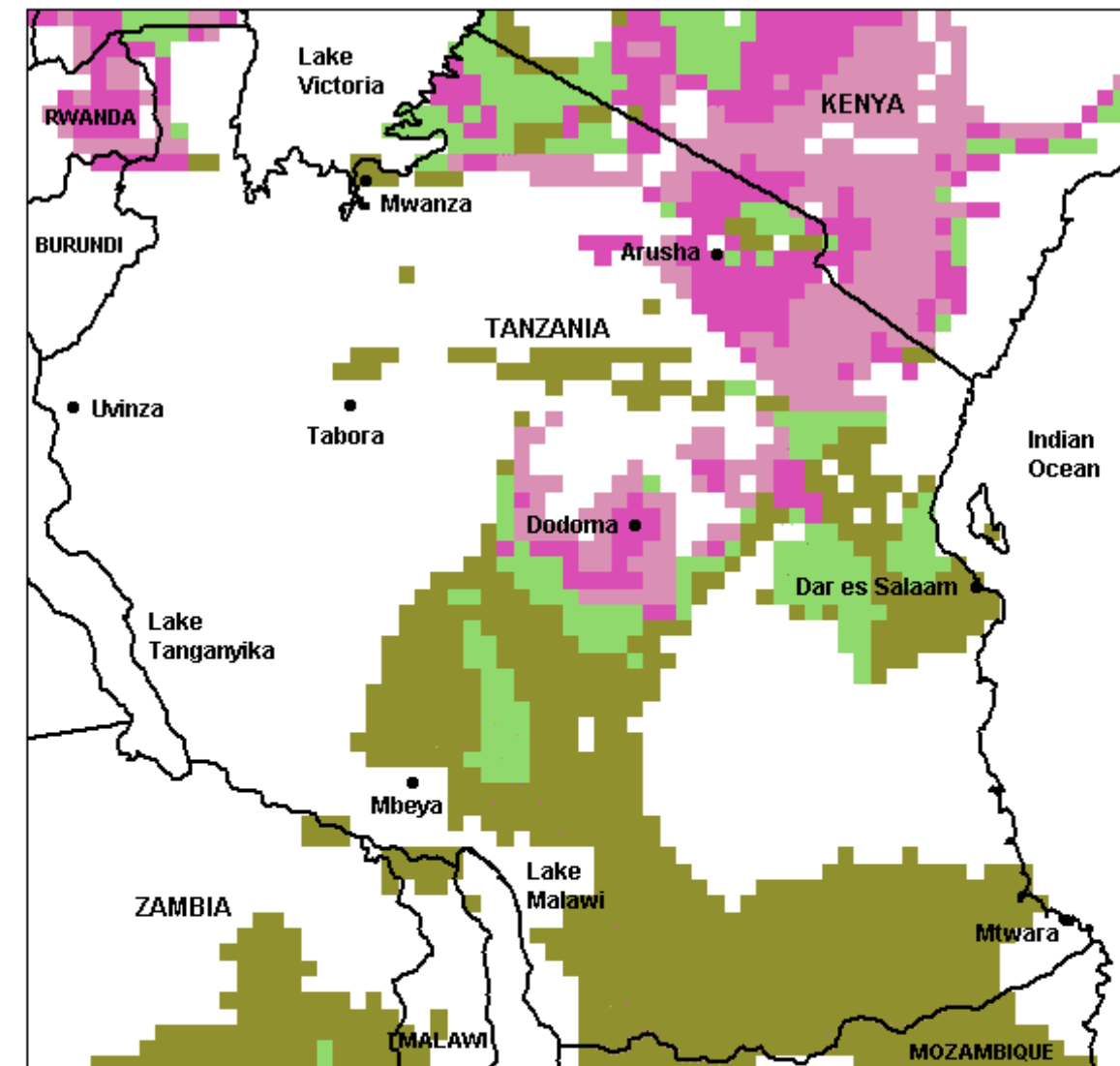


Map 25: Tanzania – Semi-Arid, Scenario 2

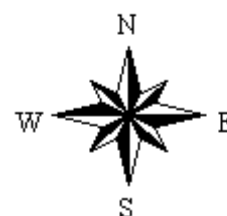
Length of Growing Period 3 to 6 Months

National Land Area 944,977 km²

Production System Area 392,076 km²



- Urban Centres
- National Boundaries
- Duration of Growing Season
- Three Months
- Four Months
- Five Months
- Six Months



5.14 UGANDA

Production System – Hillsides

Based on land of 1500-2000 m elevation. Scattered zone around eastern and western borders of country. Rainfall around 900-1500 mm and LGPs mainly in the 9-10 month range, except in South Western Uganda around Kabale, where the LGP is in the 3-4 month range.

Land Area	Area mapped using ArcView, calculated in km ₂ .
Population	<p>Population data by district for 1990 was available from Eurostat and a judgement was made as to what proportion of each district the target area occupied. The districts were identified and a proportion of the population data according to land occurring in the target area was allocated (see Table 5.9).</p> <p>The resulting total was increased by 25% to reflect the difference in the Eurostat 1990 and UN 1998 data. A calculation of population density using the target land area of 13912 km₂ and population of 2,063,438 results in 148 persons per km₂.</p>
Road Density	Estimated density of roads in target area using International Travel Maps: Uganda. Scale used; 5 = dense, 1 = sparse.
Demand Side Assessment	Data for main towns in target area not available, however it was assumed that those shown in the Times Atlas are significant relative to the target area and in the main they are the regional administrative centres.
Assessment of Export Potential	Four towns have been selected for this analysis and it is estimated that it is a maximum of 40km to the nearest main town. This does not account for the condition of the transport infrastructure. As this area is very fragmented and distributed around the frontiers of Uganda the distance to the major commercial centres in the central region of the country and those in neighbouring countries could also be considered.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. The assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.
NR Knowledge Base	Data for degree level of national researchers obtained from ISNAR website. Number of agricultural research scientists and percentage of GDP allocated to agricultural research not available.

Table 5.9 District Population, Uganda

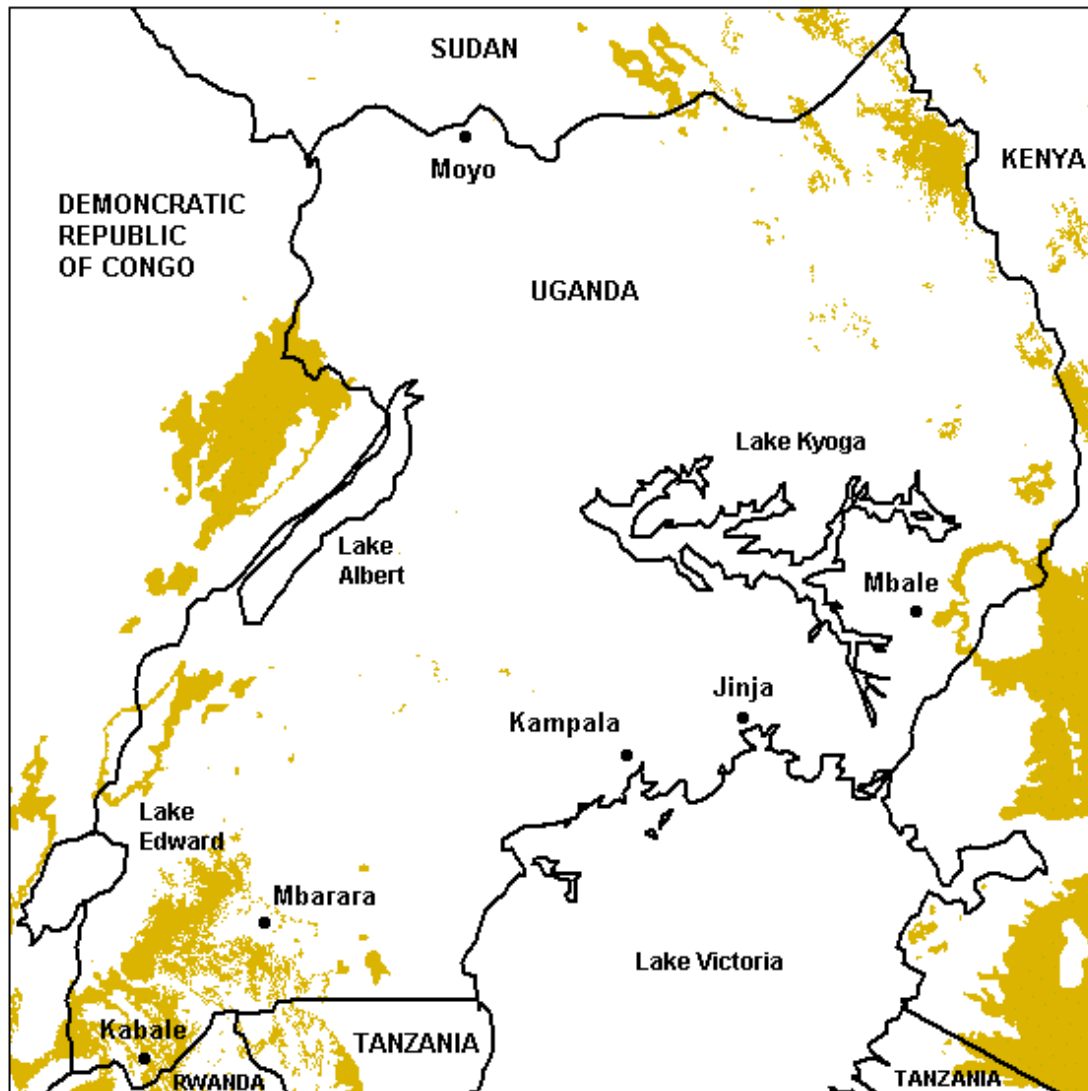
District	1990 Population	% Applied	Target Population	Plus 25%
Bundribugyo	161,000	40	64,400	80,500
Bushenyi	678,000	50	339,000	423,750
Kabale	536,000	100	536,000	670,000
Kapchorwa	90,000	30	27,000	33,750
Kasese	425,000	10	42,500	53,125
Kotido	235,000	15	35,250	44,063
Mbarara	1,000,000	15	150,000	187,500
Mbale	743,000	30	222,900	278,625
Moroto	226,000	15	33,900	42,375
Nebbi	293,000	30	87,900	109,875
Rukungiri	373,000	30	111,900	139,875

Map 26: Uganda – Hillsides

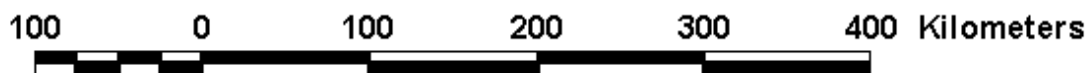
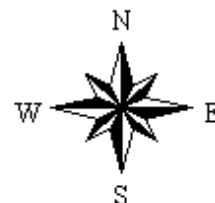
Elevation 1500 metres to 2000 metres

National Land Area 243,050 km²

Production System Area 13,912 km²

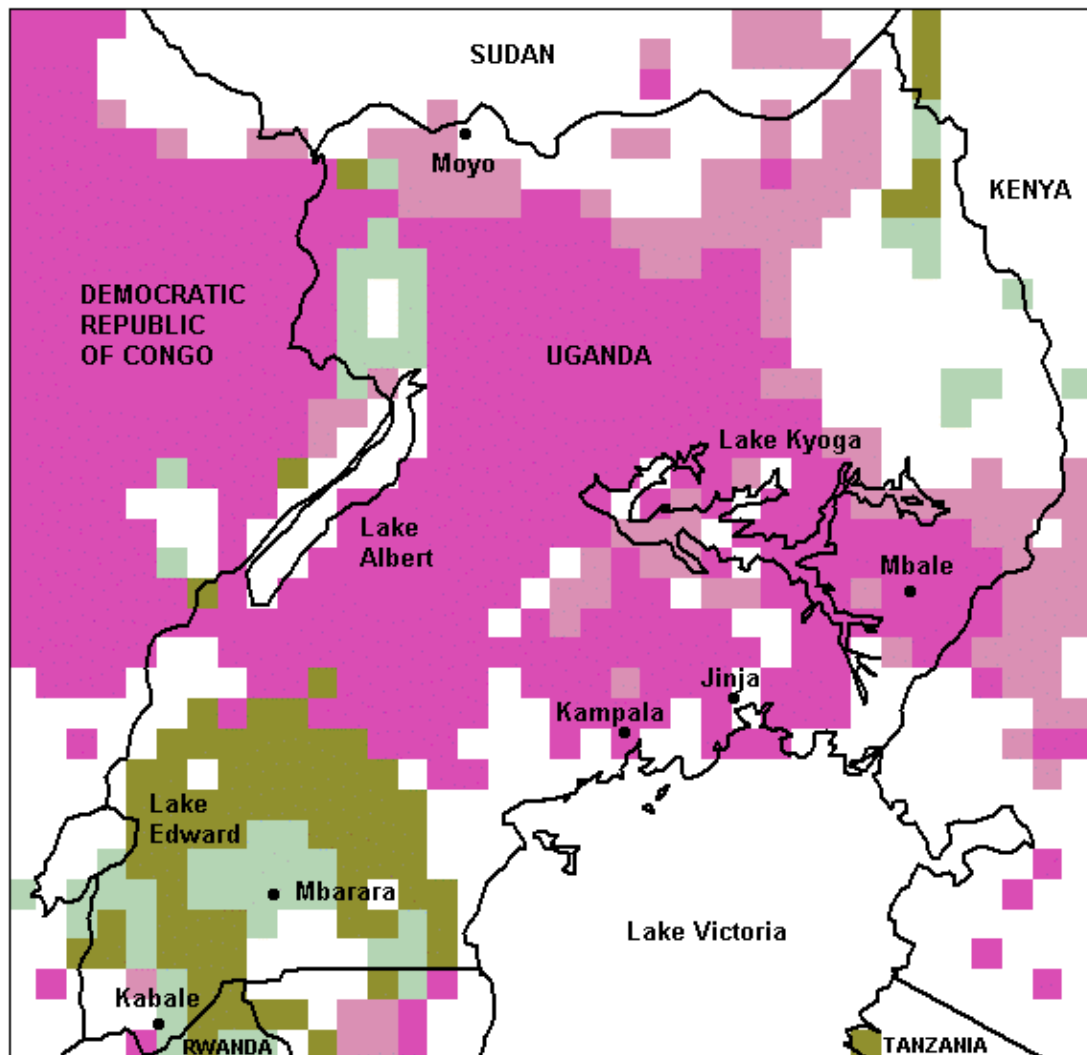


- Urban Centres
- National Boundaries
- Elevation (Metres)
- 1500 - 2000

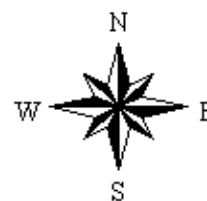


Map 27: Uganda – Length of Growing Season

National Land Area 243,050 km²



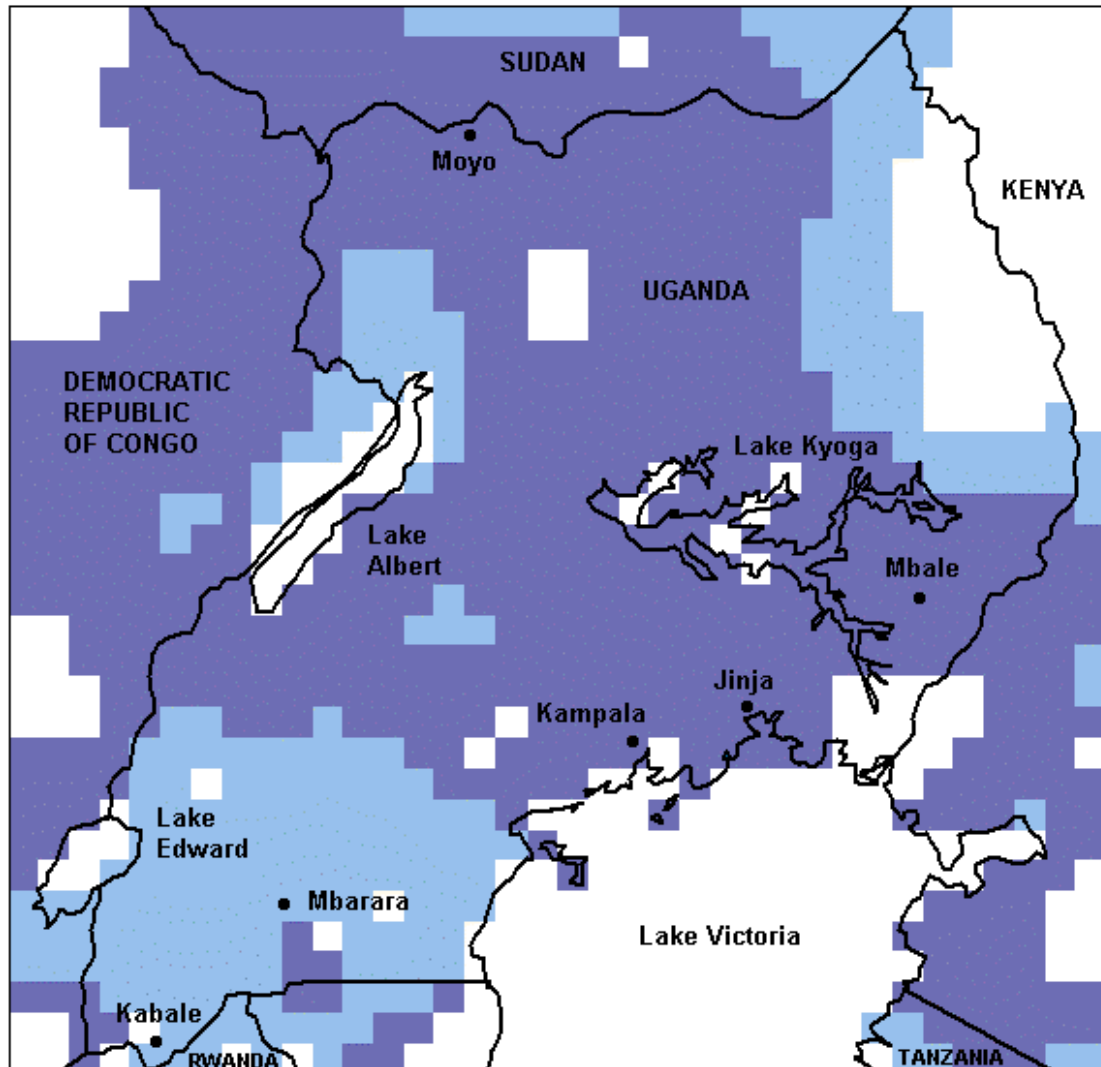
- Urban Centres
- National Boundaries
- Duration of Growing Season**
- Three Months
- Four Months
- Nine Months
- Ten Months



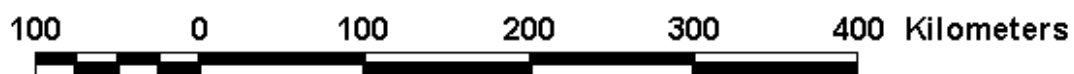
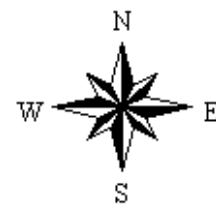
Map 28: Uganda – Annual Rainfall

Range 900 mm to 1500 mm

National Land Area 243,050 km²



- Urban Centres
- National Boundaries
- Rainfall (mm)
- 901 - 1200
- 1201 - 1500



5.15 UGANDA

Production System – Land Water Interface

Based on 50 km distance from Lake Kyoga. LGP in this area is mainly 9-10 months and annual rainfall is mainly more than 1200 mm except for the easterly side where it falls to 900-1200 mm. A wider definition was considered (Scenario 2) but rejected on the basis that Uganda was not yet in the LWI portfolio and a narrow definition (based on expressed national demand) was appropriate.

Land Area	Area mapped using ArcView which calculated area in km ₂ .
Population	<p>Target area closely approximates the administrative districts of: Rakai, Masaka, Mpigi, Luwero, Apac, Lira, Soroti, Kumi, Tororo, Iganga, Kamuli, Jinja, Mukono and Kampala. 1990 population totals were obtained for these districts and increased by 25% to reflect the increase in the total Uganda population between 1990 and the 1998 UN estimate (see Table 5.10).</p> <p>Population density was based on the calculated total of 10,578,750 in 54,407 km₂, resulting in 194 persons per km₂.</p>
Road Density	Estimated density of roads in target area using International Travel Maps: Uganda. Scale used: 5 = dense, 1 = sparse.
Demand Side Assessment	Data for main towns in target area were not available, however it was assumed that those shown in the Times Atlas are significant relative to the target area and in the main they are the regional administrative centres.
Assessment of Export Potential	Thirteen towns have been selected for this analysis and it is estimated that it is a maximum of 60 km to the nearest main town. This does not account for the condition of the transport infrastructure.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. The assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.
NR Knowledge Base	Data for degree level of national researchers obtained from ISNAR website. Number of agricultural research scientists and percentage of GDP allocated to agricultural research not available.

Table 5.10 Administrative District Population, Uganda

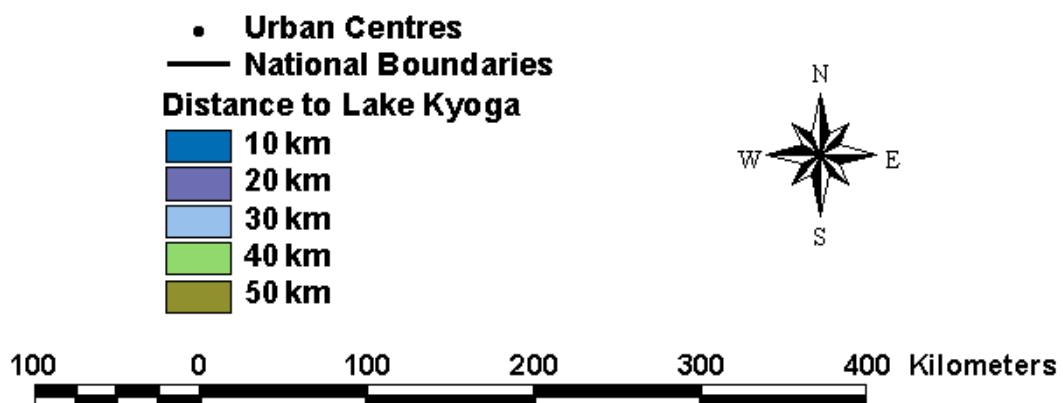
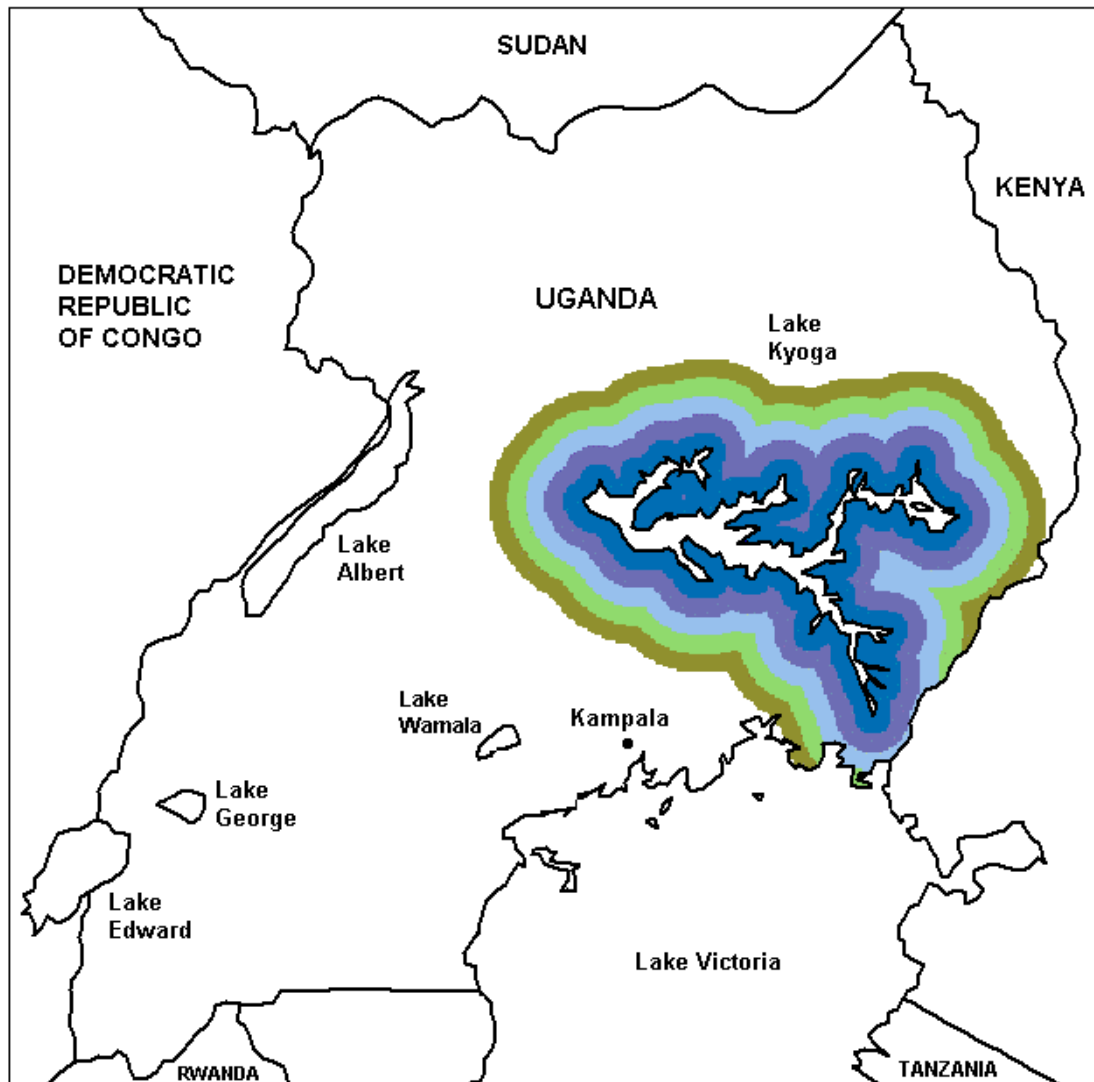
District	1990 Population	Plus 25%
Apac	432,000	540,000
Iganga	878,000	1,097,500
Jinja	271,000	338,750
Kamuli	449,000	561,250
Kampala	651,000	813,750
Kumi	306,000	382,500
Lira	498,000	622,500
Luwero	545,000	681,250
Masaka	849,000	1,061,250
Mpigi	840,000	1,050,000
Mukono	771,000	963,750
Rakai	396,000	495,000
Soroti	612,000	765,000
Tororo	965,000	1,206,250

Map 29: Uganda – Land Water Interface, Scenario 1

50 Kilometre Distance to Lake Kyoga

National Land Area 243,050 km²

Production System Area 49,535 km²

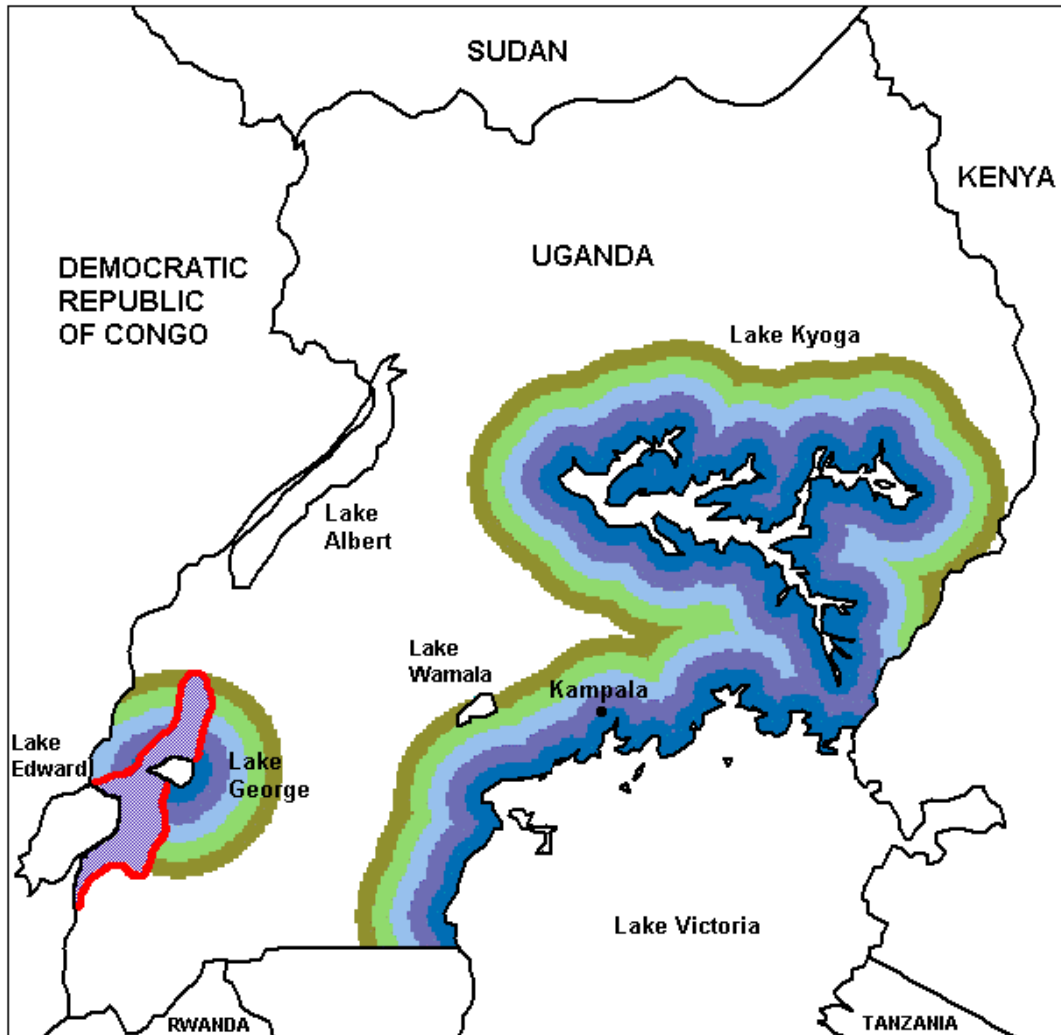


Map 30: Uganda – Land Water Interface, Scenario 2

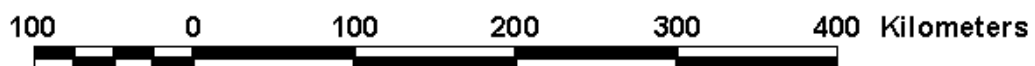
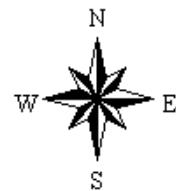
50 Kilometre Distance to Lakes

National Land Area 243,050 km²

Production System Area 75,477 km²



- Urban Centres
 - National Boundaries
 - National Park
- Distance to Lakes**
- 10 km
 - 20 km
 - 30 km
 - 40 km
 - 50 km



5.16 ZIMBABWE

Production System – Semi-Arid

Based on 3-5 month LGP. The annual rainfall range of 300-1200 mm (to compare with the DFID definition of SA as 400-1200 mm) occupies the whole country. Similarly, taking a narrower rainfall definition (300-600 mm) failed to include the arid western zone around Bulawayo and Victoria Falls. Widening the range to 300-900mm covered the entire country except the Eastern Highlands, which also equates to the 3-6 month LGP. The target zone of 3-5 months LGP covers roughly half of the country: south and west and shores of Lake Kariba, covering Matabeleland North and South, most of Masvingo, Midland provinces and small parts of Mashonaland and Manicaland.

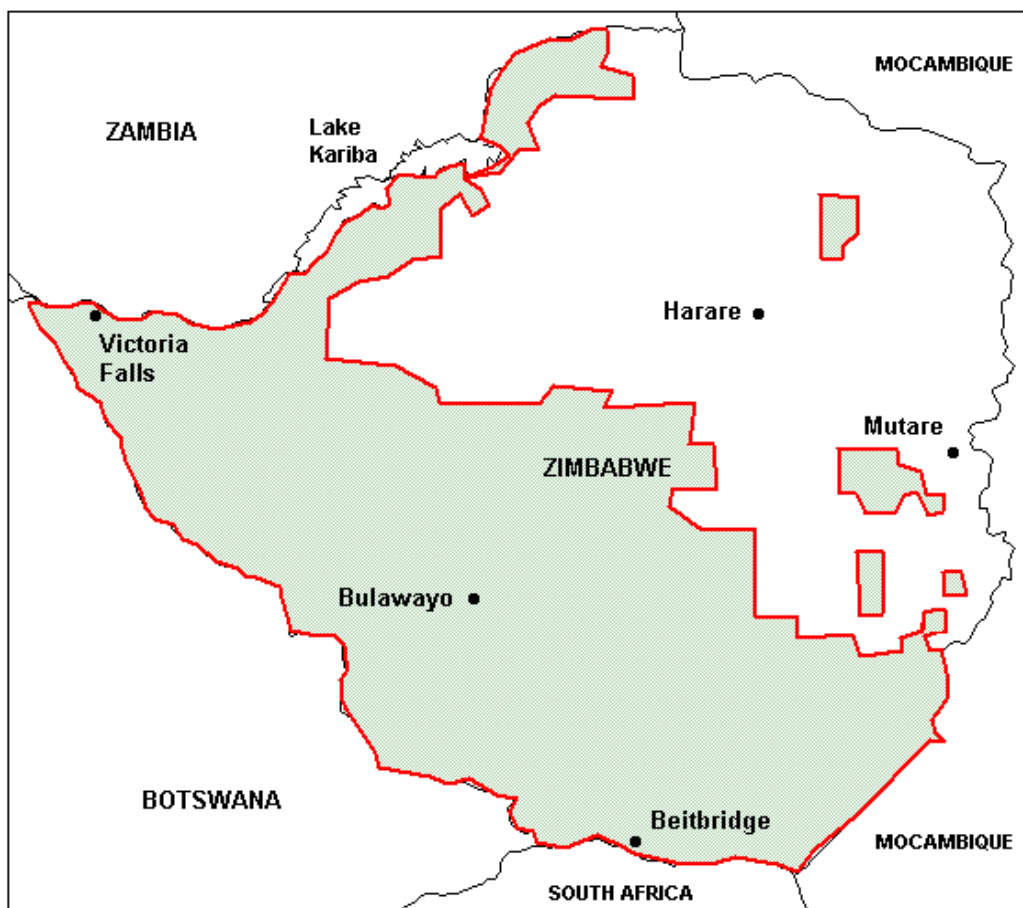
Land Area	Area mapped using ArcView, calculated in km ² .
Population	Calculated taking an average population density for the target area of 25 persons per km ² in the absence of detailed provincial data. This assessment is based on 1997 FAO population density data showing the eastern provinces of Matabeleland to have a density of 11 to 20 persons per km ² , Mashonaland West and Midlands with 20 to 29 per km ² and Masvingo with 33 to 45 per km ² . As 75% of the target area falls within Matabeleland a conservative estimate was made.
Road Density	Estimated density of roads in target area using International Travel Maps: Zimbabwe. Scale used; 5 = dense, 1 = sparse.
Demand Side Assessment	Data on major towns in target area not available: based on those shown in bold type in Times Atlas.
Assessment of Export Potential	Estimated 150 km maximum distance to one of these towns.
Land Productivity Potential	A value on a five point scale according to the percentage of agricultural production for key products contributed by the target area has been applied, where: 5 = 80-100%, 4 = 60-80%, 3 = 40-60%, 2 = 20-40% and 1 = 0-20%. This judgement was made using crop zone data and maps from the FAO/GIEWS website. The assessment does not include tourism.
Poverty Status	National data obtained from UNDP <i>Human Development Report</i> , and WHO website.
NR Knowledge Base	Data for degree level of national researchers, number of agricultural research scientists and percentage of GDP allocated to agricultural research obtained from ISNAR website.

Map 31: Zimbabwe – Semi-Arid, Scenario 1

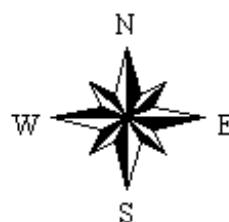
Length of Growing Period 3 to 5 Months

National Land Area 390,803 km²

Production System Area 229,790 km²



- Urban Centres
- National Boundaries
- 3 - 5 Month Growing Period



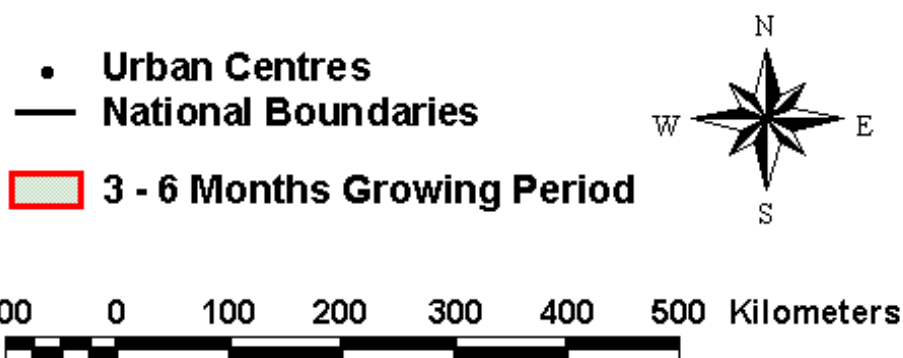
Note: This Map was based on the length of growing period by ICRISAT

Map 32: Zimbabwe – Semi-Arid, Scenario 2

Length of Growing Period 3 to 6 Months

National Land Area 390,803 km²

Production System Area 384,429 km²



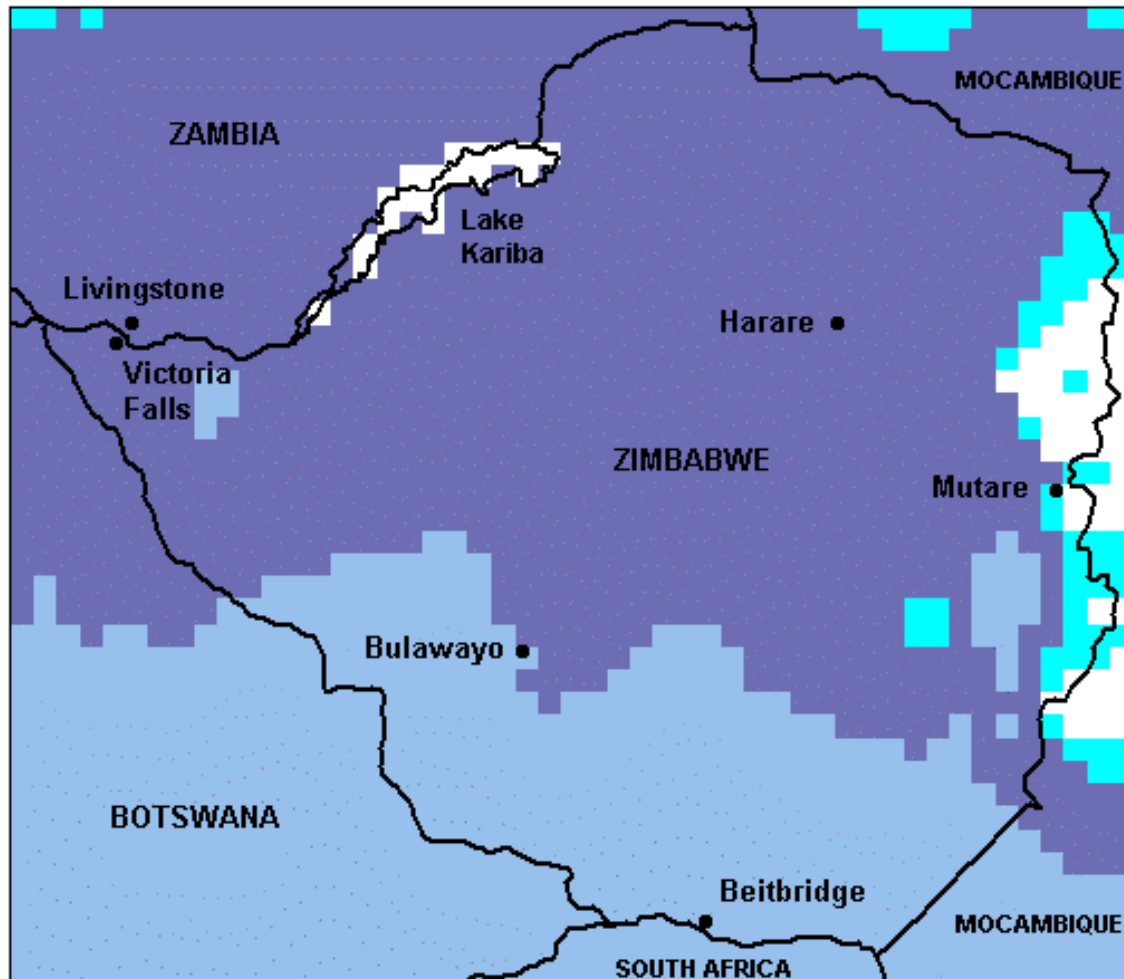
Note: This Map was based on the length of growing period by ICRISAT

Map 33: Zimbabwe – Annual Rainfall

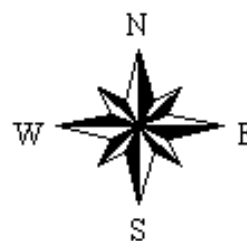
Range 300 mm to 1200 mm

National Land Area 390,803 km²

Production System Area 387,929 km²



- Urban Centres
- National Boundaries
- Rainfall (mm)**
- 301 - 600
- 601 - 900
- 901 - 1200



Map 34: Southern Africa – Length of Growing Period

