7 Agriculture and Allied Sectors: Constraints and Policy Options

1. Agriculture in Assam exhibits most of the characteristics of underdeveloped/backward agriculture, namely, a high dependence on agriculture for livelihood, widespread practice of traditional farming techniques and correspondingly low usage of modern farm inputs, low levels and low growth in productivity and incomes in the sector, widespread prevalence of subsistence cultivation, poor / inadequate agricultural infrastructure, and so on. About 89 per cent of the population in Assam lives in rural areas as per the 1991 Census. About 75 per cent of the state's population is directly or indirectly dependent on agriculture, while about 69 per cent of the workforce in the state is actually engaged in agricultural activities. On the other hand, the sector's contribution to the state's income has been falling sharply over time, from nearly 50 per cent in early 1980s to only about 35 per cent by the end of 1990s. Though this is natural when economic development occurs, in Assam this has come about despite the slow overall economic growth in the state. Even though the state is richly endowed in natural resources, such as abundant rainfall, alluvial soil, rich and diverse plant and animal genetic base, development of agriculture in Assam has been slow over the decades. Consequently, the state is not just lagging behind most others in the country but is unable to meet its own requirements in many agricultural commodities.

2. In this chapter, we examine the progress of agriculture in Assam, the constraints it faces and possible policy actions that can be taken to remove / reduce those constraints to agricultural growth in the state.

7.1 Data

3. Before proceeding to assess the status of agriculture in Assam, a few remarks on the database are warranted. The analysis in this chapter relies on secondary data on various variables of interest. The data have been collated from various official statistical documents published by the Government of India, the Government of Assam, the North-Eastern Council, the Fertiliser Association of India, and the Assam Agricultural

University, Jorhat. The analysis is confined to the post-1980 period up to the latest year for which data are available.

4. There are innumerable problems in the official data on many variables. One such problem with regard to the gross cropped acreage total and under different crops is reported in Table 7.1 as an illustration. The data on total cropped acreage under the state does not tally with the sum total of the acreage under individual crops. This obviously raises doubts about estimates of cropping intensity, cropping patterns, yield levels, et cetera.

5. Similarly, the data on irrigation also present a somewhat confusing and uncertain picture. On one hand, the data on net area irrigated in the state has not been updated ever since 1953-54. Whereas at other places in the above-mentioned data sources, various figures are reported as the irrigation potential developed and potential utilized. In such a situation, the true picture with regard to the status of irrigation cannot be properly gauged. Further, the status with regard to the availability / use of irrigation for different crops is more or less unknown, as the crop-wise irrigation data have not been updated since 1953-54.

6. Similar problems abound with regard to the data on other variables too. With the available data being in such a situation, one can obtain only a rough idea of the state of affairs with regard to agriculture in Assam. Caution is well advised while interpreting the data presented in the tables reported in this chapter. We use them only to obtain a rough comparative picture of the status of agriculture in Assam vis-à-vis the country as a whole and in some cases with Punjab, probably agriculturally the most advanced state in India. We believe that such comparisons, though lacking in precision, could still provide valuable insights into the problems confronting agriculture in Assam. With these caveats, we proceed with the analysis in the rest of this chapter.

7. In Table 7.1, the data on total cropped acreage and the cropping intensity in Assam are reported. Subject to the data problems mentioned above, one finds that gross cropped acreage in Assam has increased over the 1980s and 1990s. Cropping intensity too has registered significant increase over this period, albeit with some large fluctuations. It is interesting to note that cropping intensity in Assam has consistently been higher than the national average. The growth in gross cropped acreage and in cropping intensity, however, has not translated into rapid growth in output. The all crop index of agricultural production in Assam (See Table 7.2) has grown by less than one per cent per annum (average over 1992-93 to 1998-99), in comparison with an average growth of about 2.7 per cent per annum at the all-India level over the same period.

8. Turning to the cropping pattern in Assam, Table 7.3 reports the crop-wise shares in the total gross cropped area in Assam. It is seen that the cropping pattern in Assam has been more or less stable with only marginal changes in the importance of a few crops. Rice is the most important crop in Assam with a fairly stable share in the total cultivated area.

Rapeseed and mustard, and tea are the next most important crops, again with fairly stable shares. Wheat, pulses, jute and mesta, and sugarcane have witnessed a marginal decline in their shares while potato, banana, arecanut and chillies have gained importance over time.

Table 7.1: Cropped acreage and cropping intensity

Year	Net	Gross cropped area			Cropping Intensity (%)	
	sown	Official	Sum over	Difference#	Assam	All-India
	area	figures$	crops*	(%)		
1980-81	2655	3446	3294	4.4	129.8	123.3
1981-82	2696	3439	3291	4.3	127.6	124.5
1982-83	2696	3556	3410	4.1	131.9	123.2
1983-84	2696	3577	3430	4.1	132.7	125.7
1984-85	2696	3718	3571	4.0	137.9	125.2
1980-81 to	**2688**	**3547**	**3399**	**4.2**	**132.0**	**124.4**
1984-85						
1985-86	2706	3794	3640	4.1	140.2	126.7
1986-87	2706	3644	3495	4.1	134.7	126.4
1987-88	2706	3700	3538	4.4	136.7	127.3
1988-89	2706	3654	3487	4.6	135.0	128.5
1989-90	2706	3752	3581	4.6	138.7	128.1
1985-86 to	**2706**	**3709**	**3548**	**4.3**	**137.1**	**127.4**
1989-90						
1990-91	2706	3797	3629	4.4	140.3	129.9
1991-92	2706	3860	3688	4.5	142.6	130.1
1992-93	2706	3837	3659	4.6	141.8	130.1
1993-94	2706	3817	3644	4.5	141.1	131.0
1994-95	2777	3825	3591	6.1	137.7	131.5
1990-91 to	**2720**	**3827**	**3642**	**4.8**	**140.7**	**130.5**
1994-95						
1995-96	2780	3938	3647	7.4	141.7	131.2
1996-97	3279	4621	3654	20.9	140.8	130.6
1997-98			3666			

Notes:
a) Net sown area and gross cropped area (GCA) are in 000 hectares.
b) All the documents cited below report the same figure for net sown area for all the years between 1985-86 to 1993-94.
c) $ This refers to the GCA data as reported in the documents cited below.
d) * This refers to the sum total of the individual crop-wise gross acreages reported in the documents cited below.
e) # This refers to the difference between the official figure and the sum total over crops (expresed as %).
f) Cropping intensity is defined as gross cropped area over net sown area in percentage. GCA sum over crops are used in this calculation for Assam.

Source:
a) Data are from *Area and Production of Principal Crops,* Govt. of India, and *Fertiliser Statistics.*
b) Calculations are by author and Goyari (2000).

Table 7.2: Index of agricultural production

Year	Assam			All-India		
	Food	Non-food	All crops	Food	Non-food	All crops
1992-93	144	142	143	144	164	152
1993-94	148	149	148	150	170	157
1994-95	146	154	150	156	181	165
1995-96	150	157	153	146	185	161
1996-97	148	157	153	161	201	176
1997-98	149	161	155	156	181	165
1998-99	143	158	151	165	198	177
Percentage change over previous year						
1993-94	2.8	4.9	3.5	4.2	3.7	3.3
1994-95	-1.4	3.4	1.4	4.0	6.5	5.1
1995-96	2.7	1.9	2.0	-6.4	2.2	-2.4
1996-97	-1.3	0.0	0.0	10.3	8.6	9.3
1997-98	0.7	2.5	1.3	-3.1	-10.0	-6.3
1998-99	-4.0	-1.9	-2.6	5.8	9.4	7.3
Average growth rate	-0.1	1.8	0.9	2.4	3.4	2.7

Source: a) Data are from Economic Survey - Assam: 2000-2001, Govt. of Assam.
b) Calculations are by author.

7.2 Agricultural Situation in Assam

9. Which are the crops in which Assam is a significant producer in the country? Assam's share in the country's acreage and output of various crops are presented in Tables 7.4 and 7.5, respectively. Assam accounts for a fairly significant share of the country's acreage and output of many crops. Notable are rice, rapeseed and mustard, jute and mesta, tea, potato, sweet potato, banana, papaya, arecanut and turmeric. Tea, of course, is the pride of Assam. Assam is not just the largest producer of tea in the country (accounting for over half the country's output), but it accounts for about 14 per cent of the world's tea output. Another feature that emerges from these two tables is that there is a remarkable stability in Assam's share in both the acreage and output of several crops, particularly foodgrains crops. Only a few crops show a small but steady trend in their acreage / output shares in the country. In the case of oilseeds, sugarcane and turmeric Assam's share (both acreage and output) in the country has declined while in the case of potato, sweet potato and papaya Assam's share has increased. Tea and banana are the only two crops in which Assam's share in the country's output has witnessed a marginal decline though its share in the country's acreage has been more or less stable.

10. Is there scope for expanding the cultivation of those crops in which Assam has market power in the country? Table 7.6 presents a two-way categorization of the various crops according to their acreage share in the cropping pattern in Assam and if Assam is an important producer of the crop in the country. The table is self-explanatory. Assam has emerged as an important producer in the country in many crops such as sweet potato, banana, papaya, chilies, turmeric cabbage, cauliflower, brinjal, lemon, orange and pineapple even

Table 7.3: Cropping pattern in Assam - % in total gross cropped area

Year	Rice	Wheat	Total cereals	Total pulses	Food-grains	R & M	Total oilseeds	J & M	Tea	Sugar-cane	Potato	Sweet potato	Banana	Papaya	Areca-nuts	Chillies	Turmeric
1980-81	69.06	3.10	73.10	3.44	76.54	6.47	7.08	3.77	6.09	1.46	1.16	0.31	0.75	0.10	1.55	0.33	0.24
1981-82	68.64	3.11	72.57	3.56	76.13	6.81	7.42	3.73	6.17	1.50	1.24	0.30	0.78	0.09	1.43	0.31	0.24
1982-83	67.50	3.09	71.42	3.71	75.13	7.85	8.48	3.78	6.20	1.45	1.27	0.28	0.75	0.12	1.44	0.30	0.24
1983-84	67.43	2.89	71.13	3.81	74.94	8.34	9.01	3.31	6.21	1.43	1.29	0.25	0.79	0.12	1.46	0.27	0.25
1984-85	65.10	4.19	70.18	3.87	74.04	8.96	9.75	3.39	6.02	1.48	1.37	0.29	0.88	0.13	1.43	0.32	0.24
1980-81 to	**67.50**	**3.29**	**71.65**	**3.68**	**75.33**	**7.71**	**8.38**	**3.60**	**6.14**	**1.47**	**1.27**	**0.29**	**0.79**	**0.11**	**1.46**	**0.31**	**0.24**
1984-85																	
1985-86	67.69	2.55	71.05	3.86	74.91	7.99	8.72	3.59	5.94	1.31	1.48	0.23	0.81	0.11	1.39	0.30	0.25
1986-87	65.44	3.43	69.69	4.13	73.82	8.86	9.57	3.90	6.43	1.33	1.61	0.26	0.88	0.14	1.65	0.32	0.25
1987-88	66.03	2.78	69.61	3.73	73.35	9.54	10.28	3.05	6.41	1.22	1.53	0.24	0.92	0.16	1.66	0.32	0.26
1988-89	65.99	3.05	69.82	3.49	73.31	9.27	9.97	3.03	6.58	1.20	1.66	0.24	0.99	0.14	1.71	0.36	0.24
1989-90	68.00	2.60	71.43	3.16	74.59	8.48	9.14	2.98	6.43	1.08	1.59	0.23	0.96	0.11	1.76	0.35	0.23
1985-86 to	**66.64**	**2.88**	**70.33**	**3.67**	**74.00**	**8.82**	**9.53**	**3.31**	**6.36**	**1.23**	**1.57**	**0.24**	**0.91**	**0.13**	**1.63**	**0.33**	**0.25**
1989-90																	
1990-91	68.62	2.31	71.79	3.12	74.91	8.13	8.81	2.85	6.43	0.99	1.63	0.26	0.98	0.13	1.82	0.36	0.22
1991-92	68.54	2.07	71.39	3.17	74.56	8.22	8.90	3.17	6.34	1.02	1.67	0.25	1.07	0.13	1.83	0.34	0.22
1992-93	68.94	2.02	71.73	2.98	74.71	7.93	8.60	2.84	6.41	1.09	1.74	0.24	1.10	0.12	1.92	0.35	0.22
1993-94	69.31	2.17	72.21	3.00	75.21	7.67	8.37	2.96	6.46	0.98	1.76	0.25	1.14	0.13	1.96	0.36	0.24
1994-95	68.23	2.24	71.25	3.03	74.28	7.84	8.59	2.71	6.32	0.99	2.01	0.25	1.19	0.14	1.99	0.36	0.27
1990-91 to	**68.73**	**2.16**	**71.68**	**3.06**	**74.74**	**7.96**	**8.65**	**2.90**	**6.39**	**1.02**	**1.76**	**0.25**	**1.10**	**0.13**	**1.90**	**0.35**	**0.24**
1994-95																	
1995-96	68.64	2.35	71.83	2.93	74.76	7.65	8.39	2.25	6.20	0.98	2.03	0.25	1.11	0.20	1.98	0.39	0.26
1996-97	68.20	2.41	71.41	3.27	74.68	7.55	8.31	2.68	6.22	0.89	2.01	0.25	1.13	0.22	2.03	0.40	0.27
1997-98	67.91	2.39	71.03	3.22	74.25	7.62	8.64	2.69	6.23	0.85	2.05	0.26	1.18	0.16	2.02	0.39	0.28

Notes: a) Gross cropped area sum over crops reported in Table 1 are used for these calculations.
b) R & M refers to rapeseed and mustard.
c) J & M refers to jute and mesta.
d) Other crops account for the balance percentage.

Source: a) Data are from *Area and Production of Principal Crops,* Govt. of India, and *Fertiliser Statistics* .
b) Calculations are by author and Goyari (2000).

Table 7.4: Assam's share (%) in All-India acreage

year	Rice	Wheat	Total cereals	Total pulses	Total foodgrains	R & M	Total oilseeds	J & M	Tea	Sugar-cane	Potato	Sweet potato	Banana	Papaya	Areca-nuts	Chillies	Turmeric
1980-81	5.7	0.5	2.3	0.5	2.0	5.2	1.3	9.6	52.6	1.80	5.2	4.8	8.5	13.0	27.5	1.3	7.7
1981-82	5.5	0.5	2.3	0.5	1.9	5.1	1.3	10.7	52.9	1.55	5.3	4.4	8.9	10.9	25.8	1.3	8.7
1982-83	6.0	0.4	2.4	0.6	2.0	7.0	1.6	12.6	53.6	1.47	5.9	4.4	8.9	14.7	26.7	1.3	9.4
1983-84	5.6	0.4	2.3	0.6	2.0	7.4	1.7	10.8	53.8	1.58	5.9	4.0	9.6	14.2	27.0	1.2	9.1
1984-85	5.6	0.6	2.4	0.6	2.1	8.0	1.8	10.7	53.9	1.79	5.7	5.5	10.4	14.3	27.5	1.4	8.2
1980-81 to	**5.7**	**0.5**	**2.3**	**0.5**	**2.0**	**6.5**	**1.5**	**10.9**	**53.4**	**1.64**	**5.6**	**4.6**	**9.2**	**13.4**	**26.9**	**1.3**	**8.6**
1984-85																	
1985-86	6.0	0.4	2.5	0.6	2.1	7.3	1.7	9.5	54.0	1.68	6.4	4.7	9.7	15.4	27.3	1.2	8.3
1986-87	5.6	0.5	2.3	0.6	2.0	8.3	1.8	10.0	54.7	1.51	6.8	5.1	10.2	16.5	29.5	1.4	8.1
1987-88	6.0	0.4	2.5	0.6	2.2	7.3	1.8	11.2	54.8	1.32	6.1	5.3	10.6	14.6	29.4	1.5	8.3
1988-89	5.5	0.4	2.3	0.5	2.0	6.7	1.6	11.3	55.3	1.25	6.2	5.4	10.5	10.6	29.3	1.6	6.8
1989-90	5.8	0.4	2.5	0.5	2.1	6.1	1.4	11.3	55.5	1.13	6.1	5.4	10.4	13.1	30.0	1.4	6.7
1985-86 to	**5.8**	**0.4**	**2.4**	**0.6**	**2.1**	**7.2**	**1.7**	**10.7**	**54.9**	**1.38**	**6.3**	**5.2**	**10.3**	**14.1**	**29.1**	**1.4**	**7.6**
1989-90																	
1990-91	5.8	0.3	2.5	0.5	2.1	5.1	1.3	10.1	56.0	0.97	6.3	6.2	9.7	12.4	30.4	1.6	6.7
1991-92	5.9	0.3	2.7	0.5	2.3	4.6	1.3	9.8	55.6	0.98	6.0	5.9	10.4	10.8	30.6	1.5	6.8
1992-93	6.0	0.3	2.6	0.5	2.2	4.7	1.2	10.6	55.8	1.12	6.0	6.3	10.0	11.1	31.0	1.3	6.3
1993-94	5.9	0.3	2.6	0.5	2.2	4.4	1.1	9.3	56.3	1.05	6.1	6.3	9.6	12.8	30.3	1.4	6.0
1994-95	5.7	0.3	2.5	0.5	2.2	4.6	1.2	10.4	53.3	0.92	6.8	6.5	10.2	12.8	29.3	1.6	6.5
1990-91 to	**5.9**	**0.3**	**2.6**	**0.5**	**2.2**	**4.7**	**1.2**	**10.0**	**55.4**	**1.01**	**6.2**	**6.2**	**10.0**	**12.0**	**30.3**	**1.5**	**6.5**
1994-95																	
1995-96	5.8	0.3	2.7	0.5	2.3	4.3	1.2	10.2	52.7	0.9	6.7	6.5	9.4	17.4	28.4	1.6	6.7
1996-97	5.7	0.3	2.6	0.5	2.2	4.2	1.2	9.0	52.6	0.9	5.9	6.9	9.4	16.3	28.4	1.5	7.4

Notes: a) R & M refers to rapeseed and mustard.
b) J & M refers to jute and mesta.

Source: a) Data are from *Area and Production of Principal Crops,* Govt. of India, and *Fertiliser Statistics* .
b) Calculations are by author.

Table 7.5: Assam's share (%) in All-India output

year	Rice	Wheat	Total cereals	Total pulses	Total foodgrains	R & M	Total oilseeds	J & M	Tea	Sugar-cane	Potato	Sweet potato	Banana	Papaya	Areca-nuts	Chillies	Turmeric
1980-81	4.7	0.3	2.2	0.4	2.1	4.4	1.2	11.8	52.8	1.12	2.3	2.2	7.3	13.0	25.6	1.2	2.3
1981-82	4.2	0.3	1.9	0.5	1.8	4.3	0.9	12.0	54.4	1.16	2.9	1.9	7.4	19.4	24.8	1.2	2.6
1982-83	5.5	0.3	2.3	0.4	2.1	5.7	1.4	14.0	53.4	1.10	2.7	2.0	8.4	17.9	27.2	1.1	2.9
1983-84	4.2	0.3	1.9	0.4	1.8	5.5	1.2	11.7	57.3	1.24	2.6	1.8	7.6	20.0	25.2	1.0	2.5
1984-85	4.2	0.4	2.0	0.5	1.8	4.0	1.1	11.3	58.2	1.58	2.6	2.1	7.7	30.0	29.4	1.1	2.0
1980-81 to	**4.5**	**0.3**	**2.1**	**0.4**	**1.9**	**4.8**	**1.1**	**12.2**	**55.2**	**1.24**	**2.6**	**2.0**	**7.7**	**20.0**	**26.4**	**1.1**	**2.4**
1984-85																	
1985-86	4.5	0.2	2.2	0.5	2.0	5.1	1.4	9.7	55.1	1.16	2.9	1.9	7.0	28.5	27.8	0.7	1.5
1986-87	3.9	0.3	1.9	0.5	1.8	5.7	1.4	11.5	51.1	1.14	2.7	1.9	6.8	31.5	26.7	1.0	1.7
1987-88	4.8	0.2	2.2	0.6	2.1	4.8	1.4	13.7	54.7	0.96	2.3	2.2	7.0	28.2	27.0	1.2	1.8
1988-89	3.5	0.2	1.7	0.4	1.5	3.5	0.9	9.1	54.3	0.92	2.3	2.1	7.4	15.0	31.4	1.1	1.4
1989-90	3.8	0.2	1.8	0.4	1.7	3.3	0.9	10.0	56.4	0.74	2.3	2.2	6.9	20.0	28.0	0.9	1.1
1985-86 to	**4.1**	**0.2**	**2.0**	**0.5**	**1.8**	**4.5**	**1.2**	**10.8**	**54.3**	**0.98**	**2.5**	**2.1**	**7.0**	**24.6**	**28.2**	**1.0**	**1.5**
1989-90																	
1990-91	4.4	0.2	2.1	0.3	2.0	3.0	0.9	9.8	55.1	0.63	2.8	2.5	6.4	15.4	21.2	1.0	1.5
1991-92	4.3	0.2	2.1	0.4	2.0	3.0	1.0	8.8	54.6	0.57	2.9	2.3	6.6	18.5	22.0	1.2	1.3
1992-93	4.5	0.1	2.0	0.4	1.9	2.9	0.7	12.4	55.0	0.68	2.5	2.4	6.3	19.8	21.6	1.0	1.3
1993-94	4.2	0.2	2.0	0.4	1.9	2.5	0.7	8.3	52.7	0.60	2.9	2.4	5.8	21.9	20.1	1.1	0.8
1994-95	4.0	0.2	1.9	0.4	1.8	2.6	0.8	10.5	53.9	0.55	3.3	2.7	6.0	22.8	18.8	1.1	1.0
1990-91 to	**4.3**	**0.2**	**2.0**	**0.4**	**1.9**	**2.8**	**0.8**	**9.9**	**54.3**	**0.61**	**2.9**	**2.5**	**6.2**	**19.7**	**20.7**	**1.1**	**1.2**
1994-95																	
1995-96	4.4	0.2	2.1	0.5	2.0	2.4	0.7	9.9	51.6	0.53	2.7	2.7	5.3	22.3	17.7	1.2	1.4
1996-97	4.1	0.2	1.9	0.5	1.8	2.1	0.7	7.5	52.4	0.46	2.4	2.9	5.6	20.5	20.8	0.9	1.3

Notes: a) R & M refers to rapeseed and mustard.
b) J & M refers to jute and mesta.

Source: a) Data are from *Area and Production of Principal Crops,* Govt. of India, and *Fertiliser Statistics* .
b) Calculations are by author.

though less than one per cent of the cropped area in Assam is being used for cultivating each of them. There is thus, tremendous scope for pushing the acreage under these crops, and in general under vegetables, fruits and spice crops. All these crops are high value crops widely considered to have enormous potential for commercialization.

Table 7.6: Crop categorization

	Assam important in All-India	Assam unimportant in All-India
Acreage share > 1% in total cropped area in Assam	Rice Rapeseed & mustard Jute & mesta Tea Potato Arecanut	Wheat Pulses
Acreage share < 1% in total cropped area in Assam	Sweet potato Banana Papaya Chillies Turmeric Cabbage* Cauliflower* Brinjal* Lemon* Orange* Pineapple*	Sugarcane

Notes: a) Assam is considered an important producer of a crop in the country if its share in acreage (and output) has consistently been over 1% over the period 1980-81 to 1996-97; unimportant otherwise.

b) * For these crops the classification is based on data from 1991-92 onwards as the relevant time series data are not available for the earlier years.

Source: Based on data presented in Tables 3, 4 and 5.

11. Turning to productivity levels in Assam, it can be seen from Table 7.7 that yield levels of all the major crops in Assam are very low and well below their corresponding national average. More distressing is the fact that the gap in yield levels between Assam and the national average has widened for all the crops reported in Table 7.7. This situation has emerged in spite of positive and significant growth in yields of all crops in Assam except sugarcane and arecanut. That is, while productivity levels are improving in Assam, they are improving much faster in the rest of the country. The gap in productivity levels is not just in terms of aggregate yields, but is also true under both irrigated and unirrigated situations. This can be seen from the comparison with Punjab in Table 7.8 for the few crops for which such data are available. This shows clearly how much Assam is lagging behind the best practice achieved elsewhere in the country, even under irrigated conditions.

Table 7.7: Crop-wise yields and growth rates

Crop	Yield levels (kilo grams per hectare)						Exponential growth rates (%)		
	1980-81 to 1984-85		1985-86 to 1989-90		1990-91 to 1994-95		1980-81 to 1994-95		
	Assam	All-India	Assam	All-India	Assam	All-India	Acreage	Yield	Production
Rice	1071	1350	1114	1584	1313	1807	0.8	1.8	2.6
Wheat	1146	1770	1059	2066	1267	2388	-2.8	0.8*	-2.1
Foodgrains	1037	1080	1073	1231	1271	1453	0.6	1.9	2.4
R & M	458	624	475	772	521	874	1.4	0.9*	2.3
Jute	1478	1467	1560	1696	1721	1876	-2.1	1.2	-0.9*
Tea	1501	1451	1614	1630	1728	1764	1.1	1.4	2.5
Sugarcane	43201	57257	43602	61387	40084	66736	-2.8	-0.4*	-3.2
Potato	6566	14166	5922	15037	7354	15900	4.0	1.2	5.2
Arecanuts	980	1083	1163	1167	780	1141	3.2	-2.6	0.6*

Notes: a) R & M refers to rapeseed and mustard.
b) The growth rates are all for Assam. All growth rates are significant at 5% level, except those with an asterix.

Source: a) Data are from *Area and Production of Principal Crops,* Govt. of India, and *Fertiliser Statistics.*
b) Calculations are by Goyari (2000).

Table 7.8: Crop yields under irrigated and unirrigated conditions (kg/ha)

Year	Autmn rice		Winter rice		Summer rice		Wheat		Rapeseed & Mustard	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
Assam										
1993-94	1849	1058	1847	1428	2103	1343	1520	1246	815	478
1994-95	1705	1051	2445	1662	2179	1227	798	1293	723	531
1995-96	1434	1012	1920	1463	2075	1207	…	1110	…	505
1996-97	…	…	…	…	…	…	…	…	…	…
1997-98	2008	1172	1419	1413	2247	1315	…	1299	…	553
Punjab										
1993-94	3522	1593	…	…	…	…	4072	2256	1205	768
1994-95	3419	1295	…	…	…	…	4143	2427	1132	819
1995-96	3147	1467	…	…	…	…	3936	2084	1144	792
1996-97	…	1854	…	…	…	…	…	…	…	…
1997-98	3414	…	…	…	…	…	…	…	…	…

Source: *Area and Production of Principal Crops in India, 1997-98* , Govt. of India.

12. The main reason for this yield gap is the relatively slow spread of modern technology in Assam and the progress made in the use of modern farm inputs. Table 7.9 presents some data on the use of high yielding variety (HYV) seeds in paddy cultivation and fertilisers in Assam, Punjab and in the country as a whole. The relative backwardness of agriculture in Assam stands out clearly. Just about half of paddy cultivation in Assam is using HYV seeds, with very little change observed over the last two decades. Though fertiliser use in Assam has grown over time, it is still very low at about 14 kilograms per hectare in Assam in 1996-97 compared to the national average of 74 kilograms per hectare.

Table 7.9: HYV seeds adoption rates and fertiliser usage

Year	Paddy area under HYV (%)			Fertiliser consumption (kg/ha)		
	Assam	Punjab	All-India	Assam	Punjab	All-India
1980-81	25.4	93.0	45.4	2.8	111.4	31.9
1981-82	39.0	95.0	48.4	3.3	118.4	34.3
1982-83	41.1	94.9	49.2	3.8	128.9	37.1
1983-84	42.8	95.5	52.7	5.0	142.1	42.9
1984-85	44.4	96.3	55.3	3.9	149.4	46.6
1985-86	41.2	95.1	57.1	4.6	153.4	47.5
1986-87	45.0	94.5	58.4	4.8	154.6	49.0
1987-88	41.2	88.8	57.3	6.7	151.7	51.4
1988-89	46.1	94.3	60.9	7.3	151.0	60.6
1989-90	51.5	94.8	62.0	6.6	154.9	63.5
1990-91	40.3	94.2	64.2	10.4	159.7	67.5
1991-92	45.5	93.9	65.5	9.6	165.6	69.8
1992-93	47.6	92.3	65.8	7.2	158.8	65.5
1993-94	46.3	92.4	67.5	5.0	157.4	66.3
1994-95	49.0	92.9	72.0	10.3	167.0	72.1
1995-96	49.9	94.4	73.2	13.5	155.8	74.4
1996-97	57.1	94.5	77.2			

Notes: Ratio of fertiliser consumption (N+P+K) to the total gross cropped area are reported.

Source: *Fertiliser Statistics* various issues.

13. Why has agriculture in Assam lagged behind the rest of the country? What are the constraints to agricultural development in Assam? Why has the spread of modern technology been slow in Assam? What is the potential for commercialization of agriculture in Assam? What should be the government's policy and priorities? These questions are explored in the following sections. The chapter ends with a summary of action plan for agricultural development in Assam.

7.3 Constraints to Agricultural Development in Assam

14. The constraints to agricultural development in Assam can be broadly categorized into the following types:

- Agronomic / environmental constraints.
- Constraints to adoption of modern farming techniques.

- Social / institutional constraints.

15. The situation in Assam with respect to each of these constraints is discussed below.

7.3.1 Agronomic / Environmental Constraints

16. The main agronomic / environmental constraints to agriculture in Assam are (a) soil conditions, (b) short sunshine hours, (c) excessive humidity, and (d) frequent floods.

17. Assam has a wide variety of soils. Soil in the Central and Lower Brahmaputra valley varies from alluvial to sandy loam. The Upper Brahmaputra valley and Barak valley consist of clayey loam, alluvial and red alluvial soils, while in the hill districts it is laterite. The soil condition in most parts of the state is acidic. The distribution of acidic soils in different parts of Assam is estimated to range between 75 per cent to 100 per cent (Assam Agricultural University, 1990). Such highly acidic conditions combined with poor nutrient status, particularly in the Upper Brahmaputra valley, limits the crop varieties that can be cultivated.

18. Assam frequently witnesses overcast sky resulting in short sunshine (bright) hours, which reduces the photosynthetic efficiency of the high yielding varieties. Assam also receives abundant rainfall during the kharif season as a result of which humidity levels are very high. The hot and humid conditions during kharif season favours spread of pests and disease, resulting in crop losses. The excessive humidity conditions also implies that the grain harvested during the kharif season often contains a higher than acceptable level of moisture, because of which sometimes farmers are forced to sell their output at a very low price.

19. Over and above all these, the sate is also subject to frequent floods and extensive water logging. Frequent floods, mainly during the kharif-cropping season, exposes farmers in Assam to severe risk of crop and property loss. Besides, floods also introduce uncertainty in the length of the kharif-cropping season.

20. Under these agronomic and environmental conditions, farmers have adopted a risk averse strategy of not using purchased inputs such as HYV seeds, fertilisers, pesticides, etc. As a result, the kharif crop in Assam has been more for subsistence purposes and less so for commercial purposes.

21. Most of these problems are well known and so are the possible solutions. The Assam Agricultural University (AAU), Jorhat, has formulated scientific response to these problems. The thrust of these plans is the development of alternative cropping system and production technologies that can effectively bypass these natural constraints. Separate cropping systems have been proposed for different soil and flood situations found in different parts of Assam. These cropping systems are centered on rice with tea, oilseeds, fruits and vegetable forming the periphery. Appropriate short duration varieties with high photosynthetic efficiency and pest / disease resistance capability have been developed for rice to suit the proposed cropping pattern. Further, appropriate combinations of crop cultivation and animal farming (fishery, livestock, poultry, silk worm breeding, and the like) have also been developed suitable for different agronomic

conditions in the state. Details of these plans / strategies can be found in the various AAU reports cited in the reference and are hence not repeated here. The Planning Commission and various other official Committees too have recommended the adoption of these scientific solutions (see, for example, the Jain Committee Report on Economic Development of Assam, and also the Shukla Commission Report on Transforming the North-East).

22. The critical question here is - have the farmers in Assam adopted these scientific cropping patterns and modern farming techniques? The answer, unfortunately, is largely no. As seen earlier, spread of HYV seeds and fertiliser usage has been very low in Assam. This clearly indicates that the slow speed of adoption of modern farming techniques is really the major problem in Assam. Why has the spread of modern technology been slow in Assam?

7.3.2 Constraints to adoption of modern farming techniques

23. The literature on adoption of modern technology in agriculture has stressed the role of price and non-price factors in determining farmers' adoption decisions. Price factors refers to the relative profitability of cultivating a particular crop / variety. Thus both the output and input prices matter here. Government's policies with regard to the pricing of various crops and farm inputs, stocks and trade (both domestic and external), play a crucial role in determining the relative profitability of various crops. Arguably, the government's policy of providing subsidized farm inputs (such as fertiliser, irrigation and power) and the efficacy of the government's procurement system in states such as Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, et cetera, were critical factors that accelerated the spread of modern farming technologies in those states; whereas the relative failure of the procurement system in Assam has been a missing link responsible for the slow progress in technology adoption in Assam. Thus, while there may be scope to improve the functioning of the procurement system in Assam, recent experiences (namely, high procurement prices leading to build-up of huge stocks, far above available storage capacity and any sensible buffer stock requirements) suggest that the support price – procurement policies themselves may be fiscally unsustainable and may need drastic reforms.

24. Similarly, many studies have drawn attention to the negative impacts of providing subsidized farm inputs, namely the inefficient use of these inputs in many of the agriculturally advanced states often resulting in environmental problems such as land degradation, water logging, etc. Thus, there is a need to reform these input subsidy policies too both for improving input use efficiency and reducing the fiscal burden that they impose. Besides, India's commitments to the World Trade Organization (WTO) are likely to impose further disciplines on the policy of subsidizing farm inputs and maintaining a support price through a procurement system. In sum, one may expect government intervention with regard to input and output prices to reduce over the years and farmers would increasingly have to rely on market signals in their decision-making. The role for the government, if any, may be in ensuring that markets function

efficiently and that market signals are transmitted efficiently to farmers to enable them to make right decisions.

25. Amongst the non-price factors, irrigation development, credit availability, and access to markets, amongst others, have often been cited as critical determinants of technology adoption. Table 7.10 reports some data on irrigation potential created and utilized in Assam. Out of an ultimate irrigation potential of 2870 thousand hectares only about 481 thousand hectares of irrigation potential have been created by 1996-97. The irrigation potential created is only about 17 per cent of the net sown area in Assam.

26. The underdeveloped status of irrigation potential is not due to a want of plans / intention on part of the Government, but a case of targets not being achieved. This comes out clearly from the data reported in Table 7.11. Year after year ambitious targets for irrigation development are routinely set with scant regard for the realization of those targets. The reasons for this could be many including improper project planning, insufficient provisioning of funds, lapses in implementation / supervision / accountability, etc.[1]

27. More worrisome is the fact that utilization of the irrigation potential created has declined over the years (See Table 7.10) and is less than 25 per cent in 1996-97.[2] Such low utilization rates mean that most of the crops are cultivated under unirrigated conditions. For example, only about 22 per cent of rice cultivation is under irrigation, a figure that has hardly changed over the last two decades (See Table 7.10). While many reasons are hypothesized in the literature (for example, see Khound and Borthakur, 1999) for the low utilization rates, such as problems of stray cattle, labour shortage, cultural inhibitions, lack of proper distribution channels to carry water from the distribution channels to the farmers' fields, and lack of suitable cropping pattern, the latter two are probably the most plausible ones.

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1 Indeed, the official comments by the Assam State Government on an earlier draft of this chapter is an indirect admission to this effect. To quote, "Since Independence, Government has been putting more emphasis on development of agriculture because this sector contributes lion's share to the total economy. But inspite of that, the progress in agriculture has not been achieved to the extent desired. The main factor in this regard is perhaps poor delivery system and poor performance of economic and administrative governance."

2 Here it is worth recalling the problems with the data on irrigation. Given the uncertainty surrounding the data, it is quite possible that the high utilization rate observed in the earlier years is a statistical artefact.

Table 7.10: Irrigation potential and utilisation

Year	Irrigation potential in Assam			Rice area under irrigation (%)		
	Created	Utilized	Utilisation	Assam	Punjab	All-India
	(ha)	(ha)	rate (%)			
1980-81		118563		23.4	98.2	40.7
1981-82		145279		23.6	98.1	42.0
1982-83		157925		23.1	98.7	42.0
1983-84	280274	165199	58.9	23.0	98.7	42.3
1984-85	311107	172112	55.3	22.9	98.6	43.0
1985-86		203011		21.6	98.8	43.0
1986-87		225757		23.3	97.6	44.1
1987-88		222451		22.8	99.1	43.7
1988-89		235331		23.1	98.7	44.9
1989-90		223711		21.8	99.0	45.6
1990-91		239193		21.4	98.7	44.9
1991-92		227263		21.0	99.0	46.7
1992-93	455650	214922	47.2	21.1	99.4	48.1
1993-94	466498	129950	27.9	21.1	99.2	48.8
1994-95	477011	147249	30.9	21.7	99.8	50.0
1995-96	480078	113088	23.6	21.3	99.8	50.1
1996-97	480590	114100	23.7			

Notes: a) Data on irrigation potential created are as on March of each year, and do not refer to the potential created during the year.
b) Data on irrigation potential utilised are for each year.
c) Irrigation utilisation rate for any year is the ratio of irrigation potential utilized in that year to irrigation potential created as on March of that year (expressed as %).
d) Data on irrigated area under rice for Assam has not been updated since 1953-54, and hence the percentage irrigated acreage for rice reported above should be interpreted with caution.

Source: a) Data on irrigation potential for Assam (created and utilized) are from *Statistical Handbook of Assam* , Govt. of Assam.
b) Data on rice irrigation are from *Fertiliser Statistics* , various issues.

Table 7.11: Progress in irrigation development through Government schemes

	Ultimate potential (000 ha)	1996-97 Target (ha)	1996-97 Achievement (ha)	1997-98 Target (ha)	1997-98 Achievement (ha)
Minor irrigation	1900	5300	512	5300	334
Major/medium irrigation	970	7000	0	200	0
Total	2870	12300	512	5500	334

Source: a) Data on ultimate potential are from *Indian Agriculture in Brief* , Govt. of India., 27th Ed., 2000.
b) Data on target and achievement are from *Statistical Handbook of Assam* , Govt. of Assam, various issues.

28. Credit availability is another major problem in Assam. The low overall credit-deposit ratio amongst banks in Assam has been commented upon by many authors and has been discussed elsewhere in this report. In such a situation agriculture is no exception to this as can be seen from the data presented in Table 7.12. It is seen that credit

disbursement per hectare (at 1980-81 prices) in Assam is far below the national average. Moreover, it has fallen over time in Assam, which is contrary to the trend observed at the national level. As a result, by 1996-97 per hectare credit disbursed in Assam was only about 30 per cent of the national average, a fall from about 60 per cent of the national average in 1988-89. Under such tight credit situation, farmers in Assam would be unable to adopt modern farming techniques that are intense in purchased inputs.

Table 7.12: Credit advanced to agriculture (at 1980-81 prices)

Year	Assam			Punjab			All-India		
	PACS	SCBs	Total	PACS	SCBs	Total	PACS	SCBs	Total
	(Rs. in Crores)		(Rs./ha)	(Rs. in Crores)		(Rs./ha)	(Rs. in Crores)		(Rs./ha)
1988-89	3.6	116.1	343.2	230.0	502.1	989.7	2641.9	8157.0	592.4
1989-90	3.9	130.1	374.2	286.7	497.2	1060.4	2714.7	8195.2	598.2
1990-91	4.9	111.4	320.5	208.8	539.2	997.0	1764.7	8250.6	538.7
1991-92	3.6	112.7	315.2	249.2	500.4	997.1	2069.7	7834.2	543.4
1992-93	1.1	96.4	266.4	435.7	461.1	1187.5	3348.7	7877.4	604.8
1993-94	0.8	90.0	249.3	429.9	460.4	1168.0	3301.1	7463.7	576.9
1994-95	3.0	94.8	272.4	424.3	475.3	1169.4	2784.1	7406.6	541.6
1995-96	0.3	87.5	240.8	317.2	458.3	1000.5	2875.5	7905.4	758.1
1996-97	0.1	86.8	237.9	354.4	471.5	1053.1	3085.3	8171.2	788.2

Notes: a) PACS refers to Primary Agricultural Credit Societies
b) SCBs refers to Scheduled Commercial Banks
c) Credit figures are adjusted for inflation using GDP deflators at 1980-81 prices

Sources: a) *Indian Agriculture in Brief* (various issues), *CMIE, 1998* , and *National Accounts Statistics of India* (various issues).
b) Calculations are by Goyari (2000).

29. Lack of markets and storage facilities is another major problem afflicting agriculture in Assam. From Table 7.13 it can be seen that Assam has in all only 34 regulated markets of all types, whereas Punjab has 667 such regulated markets and even Haryana has 273. Further, even in the few regulated markets that exist in Assam, various infrastructures necessary for such markets to function efficiently are mostly lacking as can be seen from the data presented in Tables 7.14 and 7.15. Besides marketing facilities, Assam is also severely lacking in storage facilities for agricultural products. This fact comes out clearly from the data in Table 7.16.

Table 7.13: Number of regulated markets

	As on 31-3-1981			As on 31-3-1994		
	Principal markets	Sub-market yards	Total	Principal markets	Sub-market yards	Total
Assam	7	9	16	15	19	34
Punjab	119	228	347	143	524	667
Haryana	88	90	178	99	174	273

Source: *Bulletin of Food Statistics, 1981-82 and 1994-95*.

Table 7.14: Infrastructural facilities created in principal and sub-market yards in Assam

Facilities (No.)	Principal market	Sub-market
Administrative building	11	-
Staff quarters	15	1
Godown	9	2
Auction platform / hall	12	8
Auction hall-cum-godown	-	4
Guest house	2	-
Internal roads / tubewells / toilets	provided in 9 market places	-
Buying and selling complex	4	-
Chowkidar's quarter	-	1
Total number of markets	15	19

Notes: The table reports the faicilities created up to March 1997.

Source: Reproduced from Khound and Borthakur, 1999.

Table 7.15: Additional infrastructural facilities provided in the principal and sub-market yards in Assam

Facilities	No.
Retailers shed	9
Fish-cum-vegetable shed	1
Retailers shop	3
Ring well	1
Market complex	1
Auction platform	9
Tubewell	1
Jute grading units with bailing press and grading shed	4

Notes: The table reports the faicilities created up to March 1997.

Source: Reproduced from Khound and Borthakur, 1999.

Table 7.16: Central and State warehousing corporations

	As on 31-03-1998	As on 31-03-1999	As on 30-09-1999
Central warehousing corpn.			
Number	6	6	6
Storage capacity (000 tonnes)	45	45	47
State warehousing corpn.			
Number	40	40	40
Storage capacity (000 tonnes)	240	249	250

Source: *Basic Statistics of North Eastern Region, 2000* , North-Eastern Council, Shillong, quoting *Central Warehousing Corporation, New Delhi* .

30. The lack of marketing and storage facilities puts the farmers in Assam at a great disadvantage in comparison with their counterparts elsewhere in the country. With few markets to sell their output, farmers have little incentive to improve productivity and production by adopting modern farming techniques and increasing input use efficiency. This can be one more reason for the abysmally low irrigation utilization rate in Assam seen earlier.

31. Indeed this aspect came out clearly from the interactions that this team had with farmers in a village that we visited in November 2000, close to Nagaon town. This

village is one of the beneficiary villages where the shallow tubewells programme has been implemented. The positive results from the irrigation scheme were to be seen all over this village, where farmers said they were now able to cultivate three crops in a year. When enquired about the problems that they now face, most of the farmers cited the lack of markets and the consequent low price for the vegetables and fruits that they were now able to cultivate. Clearly, lack of commercialization opportunities is hindering agricultural growth in this village. If this is the situation in a village not very far from a town (where one may expect the markets for farm produce to be fairly large) the fate of more remote villages needs no further description.

32. Besides the above agricultural infrastructure, the lack of general infrastructure such as roads, transportation network, communication, et cetera, has been commented elsewhere in this report. These too exert an adverse pressure on agriculture by imposing high transaction costs on farmers, while purchasing inputs and selling their output. The high transaction cost reduces their profitability and it is no surprise that technology adoption has been slow in such adverse conditions.

7.3.3. Social / Institutional Constraints

33. Agriculture in Assam is also subject to various social and institutional constraints. The most obvious such constraint is the land holding pattern, which is dominated by smallholdings / small operational size of farms (See Table 7.17). Nearly three-fourths of all operational holdings are either 'marginal' (that is, less than 2 hectares) or 'small' (that is, between 2 and 4 hectares). As a result, the average size of holdings in Assam is only about 1.27 hectares.

Table 17: Number, area and average size of operational holding in Assam, 1990-91 (all social groups)

Size / Class	Number of	Operated area		Average size
(hectares)	holding	hectares	% in total	of holding
Marginal				
< 0.02	7497	115	0.004	0.02
0.02 - 0.5	906999	208300	6.5	0.23
0.5 - 1.0	606337	398707	12.4	0.66
1.0 - 2.0	559863	784081	24.5	1.40
Small				
2.0 - 3.0	237135	566720	17.7	2.39
3.0 - 4.0	105420	351277	11.0	3.33
Semi-medium				
4.0 - 5.0	49567	210999	6.6	4.26
5.0 - 7.5	38267	224140	7.0	5.86
7.5 - 10.0	6864	56472	1.8	8.23
Medium				
10.0 - 20.0	3051	39503	1.2	12.95
Large				
> 20.0	2379	364438	11.4	153.19
All sizes	2523379	3204751	100.0	1.27

Source: *Statistical Handbook of Assam, 1999*, Govt. of Assam.

34. Small / marginal farmers typically face severe capital constraint. Capital scarcity limits their capacity to adopt modern technologies that are intensive in purchased inputs and also often require a lot of on-farm investments on land, water and pest management, etc. Small farm size can also limit the scope for undertaking commercial farming. Under such a situation, it is a common practice for small farmers to operate on leased land. The nature of tenancy contracts then is a critical determinant for farmers / landowners to invest on land improvement and on modern farm inputs.

35. The problems arising out of the land holding pattern, tenancy contracts, etc., are, of course, faced by the country as a whole and are not really peculiar to Assam. Land / tenancy reforms really is the solution in the long run. Land reforms are filled with political problems and gains are unlikely in the short-run. Political determination on part of the government is the key and that is nowhere in sight both at the Centre and in most of the states, including Assam.

36. One alternative here is for the small / marginal farmers to organize themselves into groups such as cooperatives, village committees, etc. Under such a farmers' organization, they would collectively be better placed to access capital from the organised financial sector than in their individual capacity. Indeed the benefits of such farmers' organization can extend to other markets such as for outputs, inputs, and even improve access to agricultural research extension services. In Assam there is a programme to encourage farmers to organize themselves into groups called Pathar Parichalana Samity or Field Management Committee (FMC). The functioning of such FMCs is discussed in more detail later in this chapter.

37. While land holding pattern is a national level problem, there is one particular social / institutional problem which is peculiar to Assam (and to other North-East states), namely, the widespread prevalence of Jhum or shifting cultivation in the two hill districts of the state. This is a rather primitive farming technology that causes enormous environmental damage. The problem, however, is a socio-economic problem and is really a livelihood strategy for the people living in hilly terrain. This too is a long-run problem, whose solution lies in improving the education standards of people in these regions, and more fundamentally in providing alternative sources of livelihood to them.

38. Given the various constraints to agriculture discussed above, what should be the strategy for agricultural development in Assam?

7.4 Strategy for Agricultural Development in Assam

39. A strategy for agricultural development in Assam should be built around two elements, namely, (a) promoting the rabi season as the engine for agricultural growth in Assam, and (b) aggressively pushing for commercialization of agriculture in Assam.

40. As seen earlier, agronomic factors in Assam does limit the crop varieties that can be cultivated. The kharif season, which is the main cropping season in Assam, is subject to various natural risks such as floods and high humidity, and farmers have practiced a risk averse strategy of not using purchased inputs such as HYV seeds, fertilisers,

pesticides, etc. As a result, the kharif crop in Assam has been more for subsistence purposes and less so for commercial purposes. The rabi season, on the other hand, is generally free from the problems of flood and high humidity. In such a situation, rabi season can emerge as the engine for agricultural growth in Assam. Government policies over the next decade must aim to increase the acreage in the rabi season and promote modern farming techniques.[3] To achieve this, development of various agricultural infrastructures, particularly irrigation, marketing and storage, is the key and government certainly has a very important role to play in this regard.

41. The liberalization process / economic reforms taking place in the country is putting a lot of stress on private initiative and the importance of market forces as keys to achieving high economic growth. This implies that future growth of different sectors and of different regions will be determined in accordance with their comparative advantage. Sectoral and regional growth will depend entirely on their capacity to trade, both domestically and externally. This would require that the production structure should be oriented towards catering to demand, with emphasis on quality, quantity and timeliness. Commercialization is the key to future agricultural development of Assam. Government policies must be designed with a view to improve the commercial potential of the sector.

42. There are two aspects to commercialization of agriculture in the context of Assam. First, transforming from production for self-consumption to production for the market. Second, shifting towards crops with a high commercial value. The first aspect requires improving efficiency and productivity levels so that farmers from Assam can compete effectively in the market. This in turn requires rapid progress in the adoption of modern farming techniques, to facilitate both public and private investments in various agricultural infrastructures.

43. The second aspect involves identifying crops in which Assam has a comparative advantage, and encouraging their cultivation. As seen earlier rice is the most dominant crop in Assam. Can Assam hope to become a major producer of rice in the country given the present state of glut in rice production in the country? The answer is yes, in the medium- to long-run, though in the short-run the present glut situation in the country as a whole does pose a problem. This glut situation is unlikely to persist in the future once farmers all over the country adjust their cropping decisions in response to the present situation. Perhaps what is critically more in favour of Assam is the very transport disadvantages that Assam and other North-East states face. The transport disadvantage is such that it would definitely be cheaper to transport rice from Assam to the rest of the North-East than from far away Punjab or Andhra Pradesh. Assam only has to get its act together and become an efficient and low-cost producer of rice and it can emerge as the granary for the entire North-East and perhaps also supply to

[3] In the comments to an earlier draft, concern over the environmental impact of using chemical fertilisers and pesticides were expressed. While these concerns are valid and cannot be ignored, it is probably too premature for Assam to worry about this issue given the current very low levels of use of these chemical inputs, compared even with the national average. Herein, perhaps is an opportunity for Assam to go for more environment friendly chemical inputs and application techniques, so that environmental concerns are addressed to at an early stage in agricultural development.

neighbouring countries such as Bangladesh, Bhutan and Nepal. One can hence safely assume that there is tremendous potential for rice in Assam.

44. But rice is not the only crop on which Assam should concentrate. As seen earlier (See Table 7.6), there is still enormous potential for increasing the acreage under fruits, vegetables, tea and spices. These are the crops in which Assam already has a fairly significant market power in the country. These are the crops on which Assam should concentrate. This is a first step towards exploiting the untapped potentials for commercialization of agriculture in Assam. Vegetables, fruits and spices are high value crops with enormous scope for commercialization. Many processed food products such as chips, semi-processed / frozen vegetables, juices, jams, spice preparations, etc. can be produced using these crops as raw materials. These processed food products in general command a high price and they have enormous market both domestically and externally. Besides, processed food products have storage and transportation advantages over raw products, a factor of particular concern to Assam suffering from transportation / connectivity problems. These food-processing industries do not necessarily have to be large industrial units, but can even be small-scale units (even household operations) with enormous scope for local employment. The government should, therefore, aggressively promote such agro-processing industries in Assam.

45. Action plan to achieve these two elements of the strategy would require massive effort in developing irrigation, marketing and storage facilities besides general infrastructure such as roads, railways, waterways, telecommunication, power, etc., all of which Assam currently lacks to a very great extent.

46. As seen earlier, enormous untapped potential for both surface and ground water irrigation still exists in Assam. Only about 17 per cent of the ultimate irrigation potential has been developed in Assam so far. In the short-run, groundwater irrigation has to be promoted. Groundwater based irrigation provides high quality irrigation and can lead to productivity growth. In the context of Assam, assured irrigation from ground water sources would help promote rabi crop. Besides, these facilities can be created in a fairly short period of time. It is widely claimed that the shallow tubewell program has worked well in Assam. Though these claims need to be verified, if found to be true, it clearly is a justification for accelerating the development of ground water based irrigation.[4] Simultaneously, surface water irrigation too should be developed, though these may come into use only over the medium- and long-run. This is essential to achieve geographical spread of the rabi crop across different parts of Assam. While developing these surface water irrigation systems care should be taken to integrate them with flood control / management systems.

47. Commercialization of agriculture requires establishing markets and trading centres with adequate storage facilities close to production centres. There cannot be commerce unless there are markets. Without commerce value addition will not take place and low-incomes, poverty and unemployment would be the end result. Indeed the low

productivity levels of irrigated agriculture in Assam seen earlier can be attributed to the absence of commercial opportunities that markets and trading centres would throw open.

48. Regulated markets and trading centres with adequate storage facilities, provide a space where farmers, traders, and in a limited way even retail buyers can interact in the price discovery process. This is essential for farmers to respond to market signals. Markets and trading centres have to be close to the production centres. Else farmers being mostly unorganized would lose out to the relatively more organised traders, especially on account of transport costs. Faraway markets offer very little incentive for commercial production and in such a situation farmers would restrict their cultivation to meet their self-consumption needs. It is high time that the government and development planners recognize that markets, trading centres and storage facilities are complementary 'commercial' infrastructure to irrigation facilities, which is a 'technical' infrastructure, and should be developed along with irrigation facilities.

49. The government should invest in developing regulated markets and trading centres with adequate storage facilities across the entire state. Developing such market centres in a short period should be fairly easy. The target should be to at least double the number of such markets in Assam over the next three years and to attain a level comparable to Punjab or Haryana within a decade. This would provide a far better incentive to farmers to adopt modern technologies essential for commercialization than using the same resources for providing subsidized fertilizer, irrigation and other farm inputs.

50. The role of private sector must be recognized here. Private sector may be expected to play a major role in the development of ground water based irrigation systems as such systems typically allow full control to the private agent investing in them. On the other hand, major / medium irrigation projects have many of the characteristics of public goods, and hence would not attract private investments. It is then primarily the responsibility of the government to develop such major / medium irrigation systems. Similarly, the private sector is unlikely to take initiative in developing general-purpose agricultural markets and marketing yards, though some narrow private channels of trade might emerge over time. Here too, the initiative has to come primarily from the government.

51. As argued elsewhere in this report, the government has important role to play in creating a facilitating environment for private initiative to flourish, by providing various social services, infrastructure and good governance. With appropriate policies, agriculture in Assam can grow much faster than it has in the past and realize its full potential.

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[4] The institutional structure conducive to the success of the Shallow Tubewells programme is assessed by Sharma in this report.

7.5 Summary of Action Plan

52. The action plan for agricultural growth should involve the following:
    - Promote rabi season as engine for agricultural growth.
    - Aggressively push for commercialization of agriculture.
    - Production for market as opposed to production for self-consumption (as is the case now).
    - Promote rice, tea, vegetables, fruits, and spices.
    - Develop linkages with downstream local food processing industries.
    - Invest in agricultural infrastructure.

53. For development of irrigation, the following actions are needed:
    - Ground water irrigation – shallow tubewells with appropriate institutional structures.
    - Surface water irrigation – for promoting the geographic spread of rabi season and for flood control.
    - Marketing and storage facilities.
    - Start in all those regions where the shallow tubewells programme has been initiated.
    - Double the number in three years.
    - Attain the level in Haryana within a decade.
    - The ultimate objective should be to have a regulated market / trading centre with storage facilities close to every village (say within 20 to 25 km – so that a farmer can make a same-day round-trip to the market to sell his produce).

7.6 Shallow Tubewell Programme: Impacts and Institutional Reforms

54. Agriculture is the primary occupation for almost 70 per cent of the total main workers of Assam, and their income depends primarily on production of foodgrains, especially rice. Due to the suitability of climate, soil and abundant rainfall, rice occupies about 70 per cent of the gross cropped area and more than 90 per cent of the total area under foodgrains. Nevertheless, Assam has been chronically suffering from food deficit since the early 1960s due to considerably high growth of population in the state combined with almost unchanged land productivity. Similarly, contribution of the agricultural sector to the aggregate State Domestic Product has also been sharply declining without any appreciable reduction in the number of people dependent on the sector. The disappointing performance of the agricultural sector can be attributed to small holdings, low cropping intensity, low productivity, low level of technology, inadequate irrigational facilities besides recurrent floods (and at times drought) which affect large chunk of area under crops in the state resulting in a staggering loss almost every year. With this backdrop, this chapter analyzes the impacts of the measures recently initiated by the government of Assam to accelerate agricultural development in the state.

7.6.1 Strategy Adopted for Development of Agriculture

55. Considering the importance of agriculture in the state's economy, the topmost priority of the government of Assam has been on development of this sector. Achieving self-

sufficiency in production of foodgrains has been the primary objective of the government and the basic strategy is to enhance productivity by increasing cropping intensity per unit area and yields through use of high yielding variety seeds, fertilizers and improved agricultural practices. These efforts have been directed to increase the area under double cropping by bringing in more area under rabi, pulse and oilseeds.

56. Thus, this strategy essentially demands more emphasis on rabi crops and considering the uncertainty in the occurrence and the disparity in the distribution of rainfall in the season, assured irrigation facility is undoubtedly the most important prerequisite for a breakthrough in the agricultural sector of Assam. A rational approach for development of irrigation in the state, first of all, demands more reliance on utilization of the abundant ground water, and it requires a shift of emphasis from major and medium irrigation projects, which are mainly based on surface water, to installation of shallow tubewells (STW). Secondly, considering the overwhelming domination of the small and marginal farmers besides fragmentation of holding and the existing land tenure system in the state, optimum use of the ground water resource requires a new institutional arrangement. Taking into account mainly these two aspects, the government of Assam in its recent policy to promote agricultural development in the state has emphasized on (a) creation of irrigation potential through installation of shallow tubewells, and (b) establishment of Field Management Committees (FMC) in every village.

7.6.1.1 Shallow Tubewell Programme

57. Implementation of irrigation plans and programmes in Assam started during the First Five Year Plan itself with a couple of medium surface irrigation projects, and the government of Assam continued to emphasize surface irrigation schemes during the successive five-year plan also. Nevertheless, ground water irrigation started getting priority from the Fifth Five Year Plan. By the end of the Eighth Five Year Plan, the government of Assam implemented a number of irrigation projects including installation of 61,428 shallow tubewells covering different parts of the state. The impacts of all such efforts, however, were far below the expected level. Till 1996-97, the state had about 527 thousand hectares of net irrigated area which constituted only about 21 per cent of the net sown area against 38.61 per cent of the national average. Similarly, only about 14 per cent of the gross cropped area of the state could be irrigated against the national average of 38.66 per cent (CMIE, November 2000).

58. In 1996-97, the government of Assam enthusiastically initiated the scheme of installation of shallow tubewells under Samriddha Krishak Yojana (SKY) with finance from NABARD and Assam Rural Infrastructure and Agricultural Service Project (ARIASP) financed by the World Bank to accelerate the pace of agricultural development in the state. The government of Assam has aimed and installed 1,47,250 STWs (1,00,000 under SKY and 47,250 under ARIASP) by March 2001, and the primary objective of the scheme has been to increase the area under assured irrigation for increasing productivity and cropping intensity so as to bridge the gap between

production and requirement. Considering the technical and geo-hydrological parameters, 18 out of the total 23 districts of Assam have been selected for this scheme.

59. The total cost of each STW including the installation charge is approximately Rs 23,000/- of which the share of the government is two-third while the balance has to be borne by the beneficiaries. It may also be mentioned that 90 per cent of the total STWs under ARIASP are to be given to FMCs and only the remaining 10 per cent may be given to interested individuals. In case of NABARD, all the STWs are to be given to the FMCs.

7.6.1.2 FMCs as Agents of Agricultural Development

60. It is, therefore, explicit that the STW scheme has been a collective effort of the state government, financial institutions and FMCs constituted by the end users. A Pathar Parichalana Samity or Field Management Committee is an organization of a group of not less than 20 and not more than 80 farmers actively engaged in land-based activities carried out on a contiguous plot of cultivable land (pathar) measuring 500 bighas (nearly 67 hectares), except in those cases where the contiguity of the area is limited by geographical barrier like rivers, hills, terrain etc. But, in no case the area of the contiguous cultivable land can be less than 300 bighas (40 hectares). The primary objective of this institutional arrangement is to make optimum utilization of the potentialities of the cultivable land leading to enhancement of production and productivity of various crops.

61. As per the norms laid down by the Government of Assam, the FMCs should install the STWs by themselves under constant supervision of the officials of the Directorate of Agriculture. The FMCs are also given the responsibility to purchase the required materials such as pipes, strainers, etc. at a rate and quality prescribed by the Directorate of Agriculture except pumpsets which are purchased centrally by the state government. Similarly, the FMCs are also responsible for any damage, loss and theft of the STWs and can seek legal steps, if necessary, with an intimation to the Department of Agriculture.

7.6.2 Impacts of the STW Programme

62. Installation of the STWs in different parts of Assam involving the FMCs has certain visible impacts on the agricultural sector of the state. Beyond any doubt, the programme has been successful to create an additional potential to irrigate about 294 thousand hectares or approximately 13 per cent of the net sown area in the state. Table 7.18 shows distribution of the STWs in different districts of Assam covered under the programme and the additional irrigation potential created by the STWs in each district. However, the programme has not succeeded in achieving the stated objective of achieving self-sufficiency in production of foodgrains.

Table 7.18: Dynamic Ground Water Resource Potential of Assam and the Numbers of Shallow Tube Wells Installed in Different Districts

Sl. No.	District	Gross dynamic ground water resource (mcm)	Drinking water 15% mcm	Utilizable ground resource (mcm)	Feasible nos. Of Shallow Tube Wells based on 100% utilizable resource and 0.0216 mcm annual draft	Net area sown (hectares)	Total number of STWs installed till June, 2001	Irrigation Potential created		Balance STWs feasible	Potential to be created	
								(hect)	As % of net sown area		Area (hect)	As % of net sown area
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Dhubri	1,205.06	180.76	1,024.3	47,421	146788	20798	41596	28.34	26623	53246	36.27
2	Bongaigaon	622.21	93.33	528.88	24,485	93203	10789	21578	23.15	13696	27392	29.39
3	Kokrajhar	949.76	142.46	807.3	37,375	85638	3850	7700	8.99	33525	67050	78.29
4	Goalpara	565.41	84.81	480.6	19,935	79260	7442	14884	18.78	12493	24986	31.52
5	Barpeta	1,133.88	170.08	963.8	44,620	170915	12406	24812	14.52	32214	64428	37.70
6	Nalbari	866.33	129.95	736.38	34,091	146499	12508	25016	17.08	21583	43166	29.47
7	Kamrup	1,035.44	155.32	880.12	39,357	182258	15206	30412	16.69	24151	48302	26.50
8	Darrang	1,121.73	168.26	953.47	44,142	203596	11500	23000	11.30	32642	65284	32.07
9	Sonitpur	1,530.73	229.61	1,301.02	60,237	162597	5763	11526	7.09	54474	108948	67.00
10	Lakhimpur	707.8	106.17	601.63	27,853	87366	1901	3802	4.35	25952	51904	59.41
11	Dhemaji	1,023.65	153.55	870.1	40,282	55821	1360	2720	4.87	38922	77844	139.45
12	Morigaon	386.38	57.96	328.42	15,204	99738	6908	13816	13.85	8296	16592	16.64
13	Nagaon	1,309.23	196.38	1,112.85	51,520	232837	17476	34952	15.01	34044	68088	29.24
14	Golaghat	1,111.15	166.67	944.48	43,725	117134	5091	10182	8.69	38634	77268	65.97
15	Sibsagar	1,140.88	171.13	969.75	44,895	126106	3700	7400	5.87	41195	82390	65.33
16	Jorhat	938.88	140.83	798.05	36,946	113925	3172	6344	5.57	33774	67548	59.29
17	Dibrugarh	1,100.86	165.13	935.73	43,320	125508	4800	9600	7.65	38520	77040	61.38
18	Tinsukia	1,222.29	183.34	1,038.95	48,099	95381	2580	5160	5.41	45519	91038	95.45
Total		17,971.67	2,695.74	15,275.83	703,507	2324570	147250	294500	12.67	546257	1092514	47.00

Source: Columns 3,4 and 5 : Central Ground Water Board, NE Region, Guwahati

Column 7 : Statistical Hand Book, Assam, 2000, Directorate of Economics & Statistics, Govt. of Assam

Column 8 : Department of Agriculture, Govt. of Assam

Columns 9, 10, 11, 12, & 13 : Calculated by the author

63. Expansion of irrigation facility has significantly influenced the cropping pattern, particularly of rice, as it is evident from Table 7.19. With the expanded irrigation facilities, the farmers, particularly of the flood affected areas, are gradually becoming more interested in summer rice for an assured harvest before the monsoon rainfalls. Consequently, the area under summer rice in the state has increased by almost 68 per cent from 1997-98 to 1999-2000 while its production has increased by more than 107 per cent as its average yield per hectare has gone up to 22.19 qtls. in 1999-2000 from 17.97 qtls. in 1997-98. Autumn rice, however, has registered a decline in both area under the crop and its average yield per hectare.

Table 7.19: Area, Production and Productivity of Major Crops in Assam

Crops	1997-98			1998-99			1999-2000		
Rice	A	P	AY	A	P	AY	A	P	AY
a. Autumn	607.40	597.48	10.00	594.97	520.60	8.89	557.22	514.16	9.38
b. Winter	1743.32	2470.95	14.39	1635.23	2288.14	14.21	1793.99	2692.71	15.24
c. Summer	174.97	314.44	17.97	223.91	446.11	19.92	294.65	653.78	22.19
Total rice	2525.69	3382.87	13.59	2454.12	3254.83	13.45	2645.86	3860.65	14.79
Wheat	84.69	110.05	12.99	89.59	90.51	10.10	76.31	97.58	12.79
Maize	19.22	14.72	7.66	19.81	13.96	7.05	19.71	14.06	7.13
Pulse	117.91	64.46	5.47	138.10	74.82	5.42	127.48	70.59	5.54
Oilseed	341.79	173.77	5.49	342.97	174.74	5.09	348.46	174.79	5.02

Source: Department of Agriculture, Government of Assam (2001)

A – Area in 000' hect

P- Production in 000' tonnes

AY – Average Yield in Qtls/hect.

64. Yet, winter rice has been still maintaining its predominant position due to its higher demand notwithstanding its lower average yield compared to summer rice. Winter rice enjoys a preferential advantage in Assam, but its production has been constrained mainly by erratic monsoon rainfall quite often resulting in floods besides use of traditional practices of production with a good probability of flood, use of expensive inputs is naturally avoided by farmers. The decline in the area under winter rice and its average yield in 1998-99 can be attributed to heavy floods in the year, but the area under this crop has again increased in the following year along with a noticeable improvement in its average yield. The total rice production increased by 14 per cent over two years.

65. The increase in area under summer rice coupled with growing concern for higher productivity boosted by assured irrigation, has led to a noticeable increase in consumption of fertilizers in Assam. As Table 7.20 reveals, consumption of fertilizers in the state has increased from 12.48 kg. /hectare in 1995-96 to 27.66 kg/hectare in 1999-2000. Of course, it is still far below the average for the country as a whole.

Table 7.20: Fertilizer Consumption Per Hectare (kg/hectare)

Year	Assam	India
1995-96	12.48	74.38
1996-97	14.02	75.49
1997-98	17.90	85.44
1998-99	18.74	88.49
1999-2000	27.66	95.33

Source: CMIE, November 2000

66. It is, however, evident from Table 7.19 that the STW programme launched by the Government of Assam had very little impacts on both production and productivity of the major crops grown in the state other than summer rice. For a quick assessment of the impacts of the STW programme, case studies of three FMCs belonging to the Chaygaon Agricultural Extension Officer Circle of Kamrup district have been conducted by the author in the second week of June 2001. The important observations that are common to all the three case studies are summarized below:

a. Regarding the area covered by the FMCs and their total number of members, the discrepancies between the official figures and the figures reported by the farmers are noticeable. As per the office records, total 170 families are members of the three FMCs, and their total area of operation is 2170 bighas (290 hectares). But the farmers, who are members of the three FMCs, reported that the total number of members of the three FMCs together is only 129 families. The members of the Executive Committee of two out of three FMCs are ignorant about the actual operational area of their respective FMCs. Nevertheless, the Secretary of the FMC has reported that the actual operational area of his FMC is 125 bigha (16.73 hectares) while the same has been found to be 520 bighas (69.61 hectares) in the office records. In such a situation, the question of contiguity of operational area of each FMC definitely does not arise.

b. As per laid down norms, every FMC should be divided into a number of sub-committees depending on the size of holdings of its members. Each sub-committee should have at least a contiguous area of two hectares that can be irrigated by one STW. To ensure optimum utilization of the irrigation potential of each STW, each such sub-committee is eligible for getting one STW instead of one single household that may not have the required size of land. Each sub-committee should collect the amount required, that is, one-third of the total cost of the STW, from its members on the basis of size of their holding to effect equitable distribution of water and deposit the same to the concerned authority. Keeping in view the small size of holdings, this provision has its own merit. It has, however, been observed that this rational approach of distribution of STWs has been grossly violated in all the FMCs. Officially, the sub-committees are formed and the STWs are given to the sub-committees of

the FMCs. Nonetheless, at the empirical level, the individual farmer who has the capacity to pay the required amount has got the STW in the name of a sub-committee which exist only on paper. Therefore, all the STWs distributed in the three FMCs are individually owned by relatively better off farmers, but hardly a few of them have an operational area of two hectares. Consequently, as it has been found, only about 30 per cent of the total operational area of the three FMCs has been brought under assured irrigation.

c. The irrigation facilities are utilized by all farmers who have STWs, for production of summer rice only. As the area covered by the FMCs is flood prone, the users of the STWs are now interested more in production of summer rice. It is worth noting that with assured irrigation, a farmer with one acre of land under summer rice can now produce some amount of marketable surplus.

d. The users of STWs are found to have basic knowledge about use of chemical fertilizers, pesticides, HYV etc. Nevertheless, most of the farmers have reported they do not get the required support and guidance from the department of agriculture. The Agriculture Extension Officers or the Village Agriculture Extension Workers hardly visit their fields nor remain in their office for providing guidance at the time of need.

e. Some members of the FMCs who do not have their own STWs get their land irrigated by depending on their fellow members who have been provided with STWs under the programme. Approximately 23 per cent of the total members of the three FMCs depend on their fellow members for use of STWs. These household have to pay a fixed amount, that is, 3.6 qtls. of rice for getting one acre of their land irrigated.

f. It has also been observed that all the STWs in the three FMCs were installed by contractors engaged by the Department of Agriculture although it was the responsibility of the FMCs. It is also interesting to note that the contractors even identified some of the beneficiaries of the programme. Therefore, the assigned role of the FMCs to plan and implement the programme has been marginalized by vested interests.

g. The share-croppers or the tenants till now have no access to the irrigation facilities created under this programme mainly due to the prevailing practices, in which, half of the produce goes to the actual owner of the land who does not share the cost of the required inputs. The cost of inputs excluding labour is about Rs 5200/ (estimated by the author), and a share-cropper obviously cannot bear it alone.

67. The above observations give a fair idea of the nature of implementation of the STW programme in Assam. As per the estimates made by the government of Assam, the total requirement of foodgrains, that is, rice, wheat and pulses was 4893 thousand tonnes in 1999-2000, and it was expected that this target could be achieved through the

STW Programme. Nevertheless the total production of these crops was 4028 thousand tonnes in the year, and hence, the gap between production and requirement of food crops persisted till 1999-2000. Perhaps, the marginal gap could have been filled through the STW programme if it would have been backed by appropriate institutional arrangement.

7.6.3 Institutional Reforms for a Better Future

68. Assam can produce enough agricultural surplus through appropriate technological intervention designed for increasing cropping intensity from its present level of about 146 per cent to at least 200 per cent, and evolving a cropping pattern consistent with its agro-climatic factors. A large part of the state gets severely affected by floods every year, nevertheless, as the technical experts have shown, at least 200 per cent of cropping intensity can be achieved even in the flood prone areas (Compendium on Installation of one lakh STWs Under NABARD Assistance Programme during 1999-2000, Department of agriculture, Govt. of Assam). This, however, requires assured irrigation. It is evident from Table 7.18 that Assam is enormously rich in ground water resource on the basis of which, another 47 per cent of the net sown area of the state can be brought under assured irrigation. The experience of the present STW programme, however, suggests that the technical intervention should have been supported by the required institutional reforms for achieving a qualitative breakthrough. The major institutional reforms required for Assam are summarized below.

a. Conceptually, the FMC is an instrument that can assure participation of the people at the grass roots in the process of planning and management of agricultural products besides representing a collective ethos for achieving a definite goal. At the empirical level, as it has been noted through the case studies cited earlier, the FMCs have become merely an official requirement for benefit of the relatively better-off farmers. Therefore, it is imperative to restructure the FMCs to assure effective participation of people at the grass roots and to make it accountable to the people at large instead of any government department. The most effective mechanism will be to bring the FMCs under the purview of the Panchayati Raj which is likely to be revitalized soon in the state. Such a step will not be contrary to the provisions of the Assam Panchayat Act, 1994 that was enacted by and large in conformity with the 73rd Amendment of the Constitution.

b. Arranging the required technical training for the FMCs was a primary responsibility of the Department of Agriculture. The performance of the department, in this respect has, however, been extremely poor. Therefore, the department must be geared up to arrange adequate training for the farmers. Besides that, the administrative machinery of the department should also take appropriate steps to ensure support services to the farmers at the time of need.

c. As a part of an effective mechanism of marketing the products, it is imperative to bring the FMCs under a scientifically designed market information system.

d. Tenancy reform is another important step required for agricultural development in Assam. Despite the legal measures taken in the state since Independence against exploitative tenancy, as reported by NSSO in its 48th Round, the proportion of tenanted land in total operated area in Assam had increased from 6.4 per cent in 1981-82 to 8.9 per cent in 1991-92. The rate of growth is high, and probably, it continues to grow at the same rate, if not more. With the present practices of tenancy where the costs are not shared proportionately, as indicated earlier, at least 10 per cent of the operational area of the state will continue have low productivity. Therefore, the existing tenancy reform programmes should be implemented in the state more vigorously. So far, the issue has eluded any action.

7.7 Pisciculture in Assam: Status and Prospects

7.7.1 Background

69. Fish is an important constituent of diet of about 95 per cent of Assam's population. It is a high protein and easily digestible food, and therefore, important for nutrition. No study has been made to estimate the demand for fish in the state and external supply of fish to the state. Department of Fisheries has a scheme to collect information in this regard. Data on these aspects are essential for planning purposes. The survey work under this scheme is totally stagnant due to paucity of fund. However, 11 kilogram is considered as per capita annual requirement of fish. Assam's fish production can meet only about fifty per cent of the nutritional requirement of 280 thousand tonnes, whereas internal production stands at around 160 thousand tonnes (Department of Fisheries, 1997-98). The deficiency is met by importing fish by private traders from other states, mostly from Andhra Pradesh. According to the Department of Fisheries, the state imports around 20,000 tonnes of fish annually.

70. The estimated value of this annual import is about Rs 80 crore (A recent estimate shows that about Rs 200 crore is spent annually to import fish to the state from outside. However it has not mentioned the quantum of fish imported). What is imported is mostly common fish and if Assam can produce more in a competitive price import would cease. It is sad that a state with 1.5 lakh hectares of inland water bodies and 5500-km long river stretches should import fresh water fish from other states. Assam has not been able to utilize its full potential of fish production, despite the initiation in 1995-96 of an eight year programme for improvement of pisciculture in the state under the World Bank aided Assam Rural Infrastructure and Agriculture Services Programme (ARIASP). Though deficient in fish production, aquaculture plays an important role in the state's economy providing livelihood to thousands of people directly or indirectly. The gross value of fish production in the state in 2000-01 is estimated to be around Rs 640.00 crore (Department of Fisheries, 2001).

7.7.2 Water Resources in the State

71. The state is endowed with rich capture (defined as fishing in open waters like rivers with natural fish stock) and culture fisheries of varied types. The Brahmaputra and the Barak along with their tributaries and numerous floodplain lakes (beel) and ponds constitute traditional sources of fishing in the state. Category wise fishery resources are as follows -

    a. River Fisheries – 5,500 km of river length
    b. Beel/ Ox-bow lakes – 100,000 ha
    c. Forest Fisheries- 5017 ha
    d. Derelict water bodies/swamps, 10,000 ha
    e. Reservoir Fisheries- 1713 ha
    f. Ponds/Tanks- 25,423 ha

    Source: Department of Fisheries, Government of Assam, 1997-98

72. The district-wise distribution of water resources (fisheries) is shown in Table 7.21. The table does not cover riverine sources.

Table 7.21: District-wise Water Resources (Fisheries) in Assam 1997-98

Sl.No.	District	Ponds/ Tanks (hectare)	Beel/ Swamp, Low lying area (hectare)	Total (hectare)
1	Dhubri	726.36	7287.42	8007.78
2	Kokrajhar	451.93	913.50	1365.43
3	Bongaigaon	330.35	1758.09	2088.44
4	Goalpara	754.49	10487.29	11241.78
5	Barpeta	1659.71	6764.80	8424.51
6	Nalbari	2245.19	2863.83	5109.02
7	Kamrup	1500.00	1607.16	3107.16
8	Darrang	2008.00	6092.37	8700.37
9	Sonitpur	1226.69	7390.45	8617.14
10	Lakimpur	621.03	5255.97	5875.00
11	Dhemaji	270.00	7015.98	7285.98
12	Marigaon	587.14	2955.96	3543.10
13	Nagaon	3910.00	16532.40	20442.40
14	Golaghat	795.33	2819.21	3114.54
15	Jorhat	289.30	6778.98	7068.28
16	Sibasagar	956.27	5068.31	6024.58
17	Dibrugarh	125.73	4755.85	4881.58
18	Tinsukia	182.82	3907.27	4090.09
19	Karbi Anglong	503.07	97.18	600.25
20	N.C. Hills	51.45	1725.87	1777.32
21	Karimganj	2267.26	4310.44	6577.70
22	Hailakandi	1261.69	2103.05	3364.74
23	Cachar	3200.00	4812.58	8012.58
	Total	25423.81	113295.96	138719.77

Source: Department of Fisheries, Government of Assam

73. The river Brahmaputra harbours some of the finest fish species of the world such as the Indian major carps (*labeo rohita, labeo calbasu, catla catla* and *cirrhinus mrigala*). Other economically important species are catfish (*wallago attu, silondia silondia, pangasius pangasius, aorichthys seenghala, aorichthys aor, bagarious bagarious*, and *ompok bimaculatus*). "Although there is no official fish catch statistics of the rivers in Assam, observation made by the Central Inland Fisheries Research Institute has indicated a declining trend due to habitat loss" (Assam Prakalpa 2000).

7.7.3 The Trend in Fish Production

74. There is no reliable data on the fish production in Assam. The State Fisheries Department does not have any machinery to collect fish catch statistics from rivers, *beels* and ponds. Apart from this there seems to be some bias in estimates of production. In the year 1991-92 fish production suddenly jumped to 134 thousand tonnes from 76 thousand tonnes in the previous year registering a growth of 76 per cent. "Considering the area under aquaculture and the level of technology such a drastic increase in one year cannot be expected. Moreover, such unprecedented increase in catch would have been accompanied by a glut in the market. No such drop in price was noticed. Moreover, such large increase in production was not noticed in subsequent years" (Assam Prakalpa, 2000). Apart from this so far the state has able to meet the modest target with growth rates that were modest even during the implementation of the ARIASP (Table 7.22). The annual growth rate is just 0.6 per cent during the period 1995-96 to 1999- 2000. The poor increase in production is stated primarily due to lack of extension support to farmers and poor coverage of water area for development of government sponsored schemes. The state has production potential of 400 thousand tonnes fish annually, whereas achievement is about 160 thousand tonnes (Department of Fisheries, 2000-01).

75. As reported by the Department of Fisheries, Assam has attained self-sufficiency in carp seed production in the stage of *fry*. This is primarily due to commissioning of 61 eco-hatcheries in the state. It may be noted that most of the eco-hatcheries of the state are in private sector. Infrastructures available for seed production in the districts of the state are shown in Table 7.23. The trend in production of fish and fingerlings in the districts of the state can be inferred from Tables 7.24 and 7.25.

76. The scenario of production of seed of live-fishes is not at all encouraging at present (See Table 7.22). To meet the growing demand of live fishes, mainly of *magur* (clarias batrachus), four breeding centre were established in the state during 1997-98 under World Bank assisted ARIASP for research purpose. There is also a move to introduce prawn culture with seed to be brought from West Bengal. The World Bank is funding the farmers' ponds and community tanks programme and the beel and open water fisheries programme under the ARIASP.

77. The beels, which are organically productive ecosystems with a conducive environment for fish growth, are the prime inland fisheries of the state. However, most of the beels are in derelict stage. The state has achieved fish production at a level of about 158.62

thousand tonnes during 2000-01. This included fish of all varieties from all types of water sources.

Table 7.22: The Trend in Production of Fish and Fish Seed

Year	Fish Seed (in million numbers)		Fish (in thousand ton)	
	Target	Achievement	Target	Achievement
1990-91	140.00	1188.60	75.00	76.02
1991-92	135.00	1215.14	85.00	134.07
1992-93	1500.00	1626.32	140.00	140.60
1993-94	2000.00	2170.81	142.00	151.60
1994-95	2000.00	2386.79	145.00	153.00
1995-96	2400.00	2547.54	148.00	155.00
1996-97	2500.00	2634.38	153.00	154.60
1997-98	2600.00	2245.57	157.00	155.10
1998-99	2600.00	1703.06	157.00	155.70
1999-00	2600.00	2114.14	157.00	159.77
2000-01	2600.00	1485.65	160.00	158.62
2001-02	3000.00	N.A.	175.00	N.A.

Source: Department of Fisheries, Government of Assam

Table 7.23: Infrastructure for Fish Seed Production in the Districts of Assam

Sl.No.	District	Eco hatchery	Hapa breeding centre	Mini embankment with portable hatchery
1	Dhubri	-	4	1
2	Kokrajhar	-	-	-
3	Bongaigaon	1	-	-
4	Goalpara	-	6	-
5	Barpeta	6	16	1
6	Nalbari	3	11	-
7	Kamrup	1	2	1
8	Darrang	-	-	1
9	Sonitpur	2	13	1
10	Lakimpur	3	10	1
11	Dhemaji	-	11	-
12	Marigaon	2	-	-
13	Nagaon	33	-	-
14	Golaghat	1	3	-
15	Jorhat	-	3	-
16	Sibasagar	3	-	1
17	Dibrugarh	1	1	1
18	Tinsukia	1	5	-
19	Karbi Anglong	1	2	-
20	N.C. Hills	-	-	-
21	Karimganj	2	32	-
22	Hailakandi	1	14	-
23	Cachar	-	15	-
	Total	61	251	1

Source: Department of Fisheries, Government of Assam

Table 7.24: District-wise trend in Fish Production in Assam (in tonnes)

Sl.No	District	1993-94	1994-95	1995-96	1996-97	1997-98
1	Dhubri	11012	11402	11605	9978	10088
2	Kokrajhar	5997	5592	4576	4049	4150
3	Bongaigaon	5434	4412	3900	5050	5243
4	Goalpara	5547	5801	5776	5812	5873
5	Barpeta	9173	9286	9528	9760	9956
6	Nalbari	12902	9762	8501	8650	8766
7	Kamrup	9501	9642	7983	9960	9985
8	Darrang	6365	6585	8037	6727	6089
9	Sonitpur	5187	5451	6225	5809	5802
10	Lakimpur	6533	4855	6114	6098	5732
11	Dhemaji	2807	4193	3486	3673	3857
12	Marigaon	6760	6804	6874	6846	6892
13	Nagaon	12576	12630	12837	12935	13065
14	Golaghat	2469	3289	4726	4172	4178
15	Jorhat	6401	6627	6653	6427	6488
16	Sibasagar	5253	5222	5318	5455	5570
17	Dibrugarh	6939	7292	8177	7832	7870
18	Tinsukia	8146	8302	5379	7321	7775
19	Karbi Anglong	3028	3392	3110	2808	2245
20	N.C. Hills	521	714	1120	720	755
21	Karimganj	7447	7380	10076	9457	9470
22	Hailakandi	2296	5180	5455	5303	5485
23	Cachar	9347	9207	9601	9765	9790
	Total	151641	153020	155057	154607	155124

Source: Department of Fisheries, Government of Assam

7.7.4 The Trend in Productivity

78. The productivity of carp-fish in culture ponds has reached 1680 kg/ha yearly. Annual productivity has reached 300 kilograms per hectare in the beel areas covering 4572 hectare, which was developed under the World Food Programme during 1987-88 to 1996-97. Natural productivity of some beel fisheries has gone down due to discontinuation of auto-stocking facilities because of silting of link channels with the river, resulting primarily from construction of flood control embankments. These environmental factors have been taken into consideration in the development of ARIASP. Riverine fish production is in the range of 50 kg per hectare. Indiscriminate catching of brood fish and juveniles using prohibited nets has reduced the river productivity. Attempts are being made to achieve Maximum Sustainable Yield (MSY) in such natural bodies.

Table 7.25: District-wise trend in Fry and Fingerling Production in Assam (million number)

Sl.No	District	1993-94	1994-95	1995-96	1996-97	1997-98
1	Dhubri	6.71	15.85	30.43	17.36	4.68
2	Kokrajhar	.08	3.99	3.43	2.51	NA
3	Bongaigaon	7.20	10.66	11.72	11.66	15.51
4	Goalpara	.31	1.50	2.80	2.20	2.90
5	Barpeta	161.30	176.14	317.12	404.31	198.67
6	Nalbari	111.51	111.84	151.00	269.52	153.09
7	Kamrup	1.47	3.70	5.15	1.22	.29
8	Darrang	17.46	27.44	7.80	14.13	6.93
9	Sonitpur	12.02	13.90	18.97	8.70	20.23
10	Lakimpur	19.61	31.69	50.17	65.86	70.47
11	Dhemaji	1.24	5.98	3.78	1.95	.97
12	Marigaon	12.78	14.55	30.67	5.62	6.08
13	Nagaon	1037.19	1810.67	1258.00	1300.97	1452.85
14	Golaghat	3.16	7.83	11.93	8.31	8.20
15	Jorhat	1.69	.46	4.22	1.21	16.20
16	Sibasagar	7.49	7.88	15.20	16.72	18.35
17	Dibrugarh	2.67	5.65	11.22	15.32	17.71
18	Tinsukia	4.23	4.88	8.61	9.55	8.54
19	Karbi Anglong	.53	.84	1.20	1.85	1.77
20	N.C. Hills	.09	NA	.90	.05	.09
21	Karimganj	713.44	85.65	536.15	410.76	163.25
22	Hailakandi	26.31	28.40	34.14	36.24	67.67
23	Cachar	22.32	17.29	33.68	28.25	11.12
	Total	2170.81	2386.79	2548.29	2634.27	2245.57

Source: Department of Fisheries, Government of Assam

79. "There are two approaches in increasing fish production from beels. One is the creation of battery of (one-hectare unit each) enclosures along the margin of a beel These aquaculture estates can be leased out to entrepreneurs for growing fish in captivity. Here productivity can be achieved at par with the culture fisheries. The other approach is to stock the main beel with fingerlings of economically viable species" (Assam Prakalpa 2000). The Department of Fishery reported that productivity in the beel fisheries could be achieved up to 800 kilogram per hectare by practising intensive culture-based fisheries.

80. Pig-cum-fish culture can be a highly profitable venture. Waste from pigpens is rich in nitrogen and act as excellent pond fertilizers and fish feed. By combining piggery and aquaculture, the input cost of aquaculture can be brought down substantially. It is estimated that seven tonnes of fish and 4500 kilogram of pig meat can be produced from a one-hectare farm. Similarly, poultry and duck farming can be linked with aquaculture. It is estimated that from one-hectare poultry-cum-fish culture farm, five tonnes of fish, 1250 kilogram of chicken meat and 70,000 eggs can be produced. A one-hectare duck- cum-fish farm can provide four tonnes of fish, 750 kilogram of duck meat and 6000 eggs. Such integrated system of aquaculture can raise the productivity of fish in the state (Assam Prakalpa 2000).

7.7.5 Constraints of Increase in Productivity

81. The reasons for low fish productivity in the culture fisheries of the state are attributed to: non-availability of uniform standard quality seed in the right season, scarcity of balanced fish feed and inadequacy of technology transfer. It is complained that though there is provision under the World Bank aided ARIASP, adequate quantity of fish feed does not reach to fish farmers. Recently, Government of Assam has ordered a probe into a scam of Rs 100 lakh related to procurement and distribution of fish feed. The problem is further aggravated by the low temperature regime and acidic soil, where breeding and rearing are difficult. It requires 600 kilograms of lime per hectare fisheries for treatment of the acidic soil. One kilogram of lime costs Rs 6 and it leads to high cost of production. Fisheries in Assam have to incur this additional cost in pisciculture. The Department of Fisheries reported that the variable cost to produce one kilogram of fish in culture fisheries is Rs 20.

82. The general constraints for low fish productivity due to under utilization of aquatic resources in low lying areas, insufficient rearing tank area in seed production farms for raising fingerling from the fry stage in comparison to volume of fry produced in the state, mortality of fish in both culture and capture fisheries due to Epizootic Ulcerative Syndrome (EUS), causing heavy financial loss to fish farmers. The disease is more prevalent in culture fisheries particularly during the winter months. Moreover several waves of flood during the monsoon season lead to financial loss to the farmers.

83. It requires substantial investment to develop culture fisheries. According to the Department of Fisheries it costs Rs 60,000 to develop one hectare of beel fisheries. If one wants to double the production in the existing beel fisheries an additional amount of Rs 15,000 has to be invested per hectare. Intensive pisciculture means there are requirements of more fish feeds and more efficient management.

7.7.6 Assam Rural Infrastructure and Agriculture Services Program (ARIASP) in the State

84. The Department of Fisheries, Assam has secured a World Bank Assistance project with a fund provision of Rs 28.37 crore for a period of eight years from 1995-96. The components of this project are –

    a. Fish seed production – establishment of an eco-hatchery at Assam Agriculture University to produce genetically improved quality fish seed

    b. Mobile Fish Health Clinic to provide fish health cares to farmers.

    c. Targets for the ARIASP for financial assistance are set as follows: for fish production in farmers/community tanks to achieve production up to 3000 kilogram per hectare per annum in 800 farmers' ponds covering 200 hectare, 150 community tanks covering 300 hectare, 125 pig cum fish farms covering 31.25 hectare and 500 fish cum horticulture project covering 125 hectare. It is also targeted to develop 50 beels covering 5000 hectare and 10 open water areas covering 500 hectare to increase the productivity from the present level of 100 kilogram to 500 kilogram per hectare.

d. ARIASP also proposes to strengthen the existing facilities for research at Assam Agriculture University, Jorhat and College of Fisheries, Raha. A College of Fisheries was established at Raha in Nagaon district in 1987-88 with financial assistance from ICAR and Government of Assam. This College has an intake capacity of 20 students and affiliated to Assam Agriculture University. A research project is being organised jointly with the Assam Agriculture University for the development of two of the locally important species – *Punctius sarana* (seni puthi) and *Notopterus* (chital). Species like *Clarias batrachus* (magur), *Heteropnestes fossilis* (singhi) and *Puntius sophore* (puthi), once found in large number all over the country, are now freely available only in Assam. Six research projects approved for funding under the ARIASP are in various stages of operation at AAU, Jorhat and College of Fisheries, Raha.

Table 7.26: Target and achievement under ARIASP project since its inception

Sl. No.	Item	Unit	1995-96		1996-97		1997-98	
			Target	Achiev-ement	Target	Achieve-ment	Target	Achieve ment
1	Eco-hatchery	Number	1	-	1	-	1	-
2	Farmers pond dev.	Hectare	25	-	25	55.63	57	57.65
3	Community tank dev.	Hectare	20	-	40	90.53	40	92.02
4	Dev. Of beel fishery	Hectare	625	-	625	-	625	783
5	Mini fish feed plant	Number	1	-	1	-	1	1
6	Magur breeding centre	Number	2	-	3	-	5	4
7	Training centre (new	Number	3	-	3	1	5	5
8	Strengthening of existing training centres	Number	2	-	2	2	-	-
9	Training of staff	Number	40	-	40	34	40	38
10	Demonstration projects	Number	50	-	50	44	50	84
11	Wet laboratory	Number	2	-	2	-	2	1
12	Training of fish farmers	Number	200	-	200	200	200	200
13	Research projects	Number	2	-	2	-	2	5
14	Demonstration projects	Number	25	25	25	25	25	25

Source: Department of Fisheries, Government of Assam

85. The trend in first three years show that after some initial hiccups ARIASP has got the momentum and has able to hit its targets set (See Table 7.26).

7.7.7 Development Programme of Department of Fisheries, Government of Assam

86. The development programmes of the state department as per Ninth Plan allocation were as follows –

a. Aquaculture Development under Fish Farmer's Development Agency (FFDA) – the pattern of funding for this centrally sponsored scheme was 50:50 between the Government of India and Government of Assam till 1999-2000. Now in this scheme, the state's share has been reduced to 25 per cent. There is enough scope to develop existing ponds covering 25,400 hectares and create ponds in low-lying areas covering a potential of about 20,000 hectares. However, the expected level of progress could not be made, as the state government could not release the matching share. This has resulted non-availability of the Central share for these schemes. Till the fourth year of the 9th Plan only 200 hectares of fisheries could be developed against the target of 5750 hectares.

b. Development of derelict water bodies – The state has 10,000 hectares of derelict water bodies with potential for pisciculture. Only 127.5 hectares against the target of 357.25 hectares could be developed till the fourth year of Ninth Plan.

c. Rejuvenation of River Fisheries (Social Fisheries) – Steps have been taken to revitalize the fisheries to achieve maximum sustainable yield by artificial stocking of fingerling and by following strict observation of Fishery Acts and Rules.

d. Prawn farming has been proposed to introduce in the state, as there is high demand for it. Naturally entrepreneurs are showing interest in prawn farming. This scheme has been proposed under the Central scheme.

e. National Welfare Fund for Fisherman – This Centrally sponsored scheme is to construct low-cost houses, tube well and community hall for poor fisherman in selected villages. The expenditure for this scheme was to be shared between the Central and state governments on 50:50 basis. However under this scheme till now only 20 houses could be constructed against the target of 354 houses in the 9th Plan.

f. Development of Beel Fisheries – The state has one lakh hectare of beel and open water fisheries. This constitutes 12 per cent of the country's wetland. During the 8th Plan the Department of Fisheries had developed 4523 hectares under the World Food Programme. During the 9th Plan target was to develop 6000 hectare of wetland under the ARIASP. However it is anticipated that only 4676 hectares would be developed during the Plan. At present beel fisheries of Assam is giving an annual production of 24,205 tonnes only. Assam Fisheries Development Corporation, a sister organization of Department of Fisheries is responsible for development of beel fisheries in the state. The Corporation has been assigned to develop 192 beels. After the

development of the beels, the Corporation leases out the beel areas to fisherman and local cooperative societies. The highest bidder gets the lease, however, there is 7 to 12 per cent relaxation for the people from scheduled communities. Generally beels are leased out for one to three years. At present excessive number of employees in the Corporation has been eating up its resources. This impedes the Corporation's development initiatives.

87. Fish Seed Farming- the state has achieved self-sufficiency in seed production mainly through involvement of private sector. However the quality of the seed is not up to standard due to the fact that these seeds are in bred and also under sized.

88. Extension and Training – The Central Sector Scheme of fisheries extension and training could not be introduced so far due to poor financial health of the state. The state has not able to provide 20 per cent of its share under this scheme.

89. A major decision has been taken by the Government in 1994 to hand over all low lying areas in the state in the range of 3 hectares and above which are unsuitable for agriculture from Revenue Department to Department of Fisheries. These lands are proposed to be leased out to FFDA trained interested entrepreneurs subsequently for development of aquaculture.

Table 7.27: Target for Ninth Five-Year Plan of Department of Fishery

	Schemes	Unit	Target for 9th Plan
1	Seed Production	Million	3000
2	Fish Production	000' tones	175
3	FFDA	No. of beneficiary	5750
4	Reclamation of derelict water bodies	Hectare	785.80
5	Training of farmers	Number	4200
6	National welfare fund for fisherman	Number of houses	384
7	ARIASP		
a	Eco hatchery	Number	1
b	Ambulance van	Number	6
c	Farmers pond development	Hectare	144.37
d	Community tank	Hectare	209.47
e	Development of beel fisheries	Hectare	5000
f	Mini fish feed plant	Number	1
g	Magur breeding unit	Number	4
h	Establishment of Fishery training centre	Number	6
i	Training of extension staff	Number	120
j	Fish cum horticulture centre	Number	500
K	Wet laboratory	Number	2
l	Training of farmers	Number	1000
m	Research programme	Number	5
n	Pig cum fish centre	Number	125

Source: Department of Fisheries, Government of Assam

Table 7.28: Target and Achievement of Department of Fishery for the year 1997-98

	Schemes	Unit	Target	Achievement
1	Seed Production	Million	2598	2245.57
2	Fish Production	000' tonnes	157	155
3	FFDA	No. of beneficiary	1150	575
4	Reclamation of derelict water bodies	Hectare	162.28	112.28
5	Training of farmers	Number	1850	1325
6	National welfare fund for fisherman	Number of houses	56	28

Source: Department of Fisheries, Government of Assam

90. The Department of Fisheries of the State has set a modest target for the 9th Plan. The Department has collaborated with ARIASP and has given more emphasis on FFDA and training of farmers. Emphasis of ARIASP is seen more on infrastructure development such as establishment of eco-hatcheries, breeding plant, wet laboratory, farmers and community pond development and also on training of farmers (Table 7.27).

91. A glance at the target and achievement of the Department of Fisheries for the year 1997-98 will show that the department has not been able to reach its target in a single scheme (See Table 7.28).

7.7.8 Problems and Development Strategies

92. The state is in a better position to attain self-sufficiency in fish production. The perennial problem of floods, under utilization of aquatic resources and low lying areas, use of unscientific methods in fishing and indiscriminate poaching of brood fish are some of the main reasons for the low fish production in the state.

93. Technology, development of water resources, local entrepreneurial efforts and adequate provision of fund are required for the development of aquaculture in the state. According to the Department of Fisheries, the state can reach its production level up to 400 thousand tonnes annually. The fisheries officials tell that this is the ultimate potentially of the state if all financial and technological provisions are made available and there is effort from the local entrepreneurs. Thus, the Department of Fisheries aims for maximum additional 40,000 tonnes over the next few years to the existing production level of 160 thousand tonnes. According the fisheries officials utilization of the fullest potential would lead to glut in the market. The estimated demand at the current market price is about 180 thousand tonnes. With a population growth of 10 per cent over the next five years, the fish demand would grow by 18 thousand tonnes. In fact, it will grow more because of increase in per capita income. To this one should add 20 thousand tones to replace present imports. Thus, 40 thousand tones of fish could easily be absorbed in Assam. This implies a fisheries production growth rate of 5 per cent per annum. A per a survey report prepared by Barrackpore Central Fishery Research Institute, Assam has the potential to produce surplus fish if its potential is tapped properly. This, however, requires development of storage and transport infrastructure to export fish to other states. Given Assam's transport disadvantage, and

the high cost of fisheries due to the problem of acidic soils, exports at this stage do not seem promising.

94. Some short-term strategies include modern aquaculture practices in private sector to optimize production level, introduction of integrated farming, revitalization of extension machinery, training of farmers and financial support to farmers for development of their pond. The long-term measures include development of water bodies, rational exploitation of the fisheries in low-lying areas and regeneration of unsuitable agricultural land to piscicultural activities. Rearing of fingerlings is an essential prerequisite for obtaining optimum fish production. Stocking of fingerlings of the right size is the most important prerequisite for the success of beel fisheries. Though the state department has claimed to have reached self-sufficiency in production of fingerling, the problem of limited supply of quality fingerlings still persists (Department of Fisheries, 1997-98).

95. It is important to ensure that fisheries are exploited rationally. Generally the Assam Fisheries Development Corporation leases out the beel fisheries for a duration of one to three years. This leads to overexploitation of fisheries. It may be noted that there is no provision to control overfishing. If provision is made to lease out the beel fisheries for longer duration (seven years as suggested by fisheries officials) then there is incentive for the lessees to develop the beel fisheries. It requires about Rs 15,000 to develop one hectare of beel fisheries and the investors cannot get the return of this investment in one year.

96. There is need to strengthen the cooperative movement in Assam to usher in a revolution in fish farming. The Assam Apex Cooperative Fish Marketing and Processing Federation Limited (Fishfed) was established in 1978 to work towards enhancing fish production in the state by encouraging activities of fisheries in cooperatives and also through its own production. However, Fishfed itself is now struggling for its survival. Lack of support from the government, non- professional management and a handful of ineffectual projects have dragged fishfed to a deplorable status. Since its inception, it has accumulated financial loss of Rs 120 lakh. Annual running cost of this federation is Rs 20 lakh per annum of which Rs 15 lakh goes towards payment of its staff salaries. However, it could sell fish worth only Rs 13 lakh annually. The opportunity to effectively utilize the Rs 250 lakh loan from National Cooperative Development Cooperation (NCDC) in 1994-95 to set up cold storage facilities in the state could not be availed by Fishfed for want of a suitable plot of land.

97. Asia's biggest dry fish market is located at Jagirod, Assam. It is a Rs 40000 lakh annual business and on average 400 truck load of dry fish is sold in this market every year. However, it is on the verge of closure with the sales dropping alarmingly following imposition of eight per cent sales tax by the state government in 1999. That year it resulted 75 per cent drop in sales. The government needs to look into the implications of its policy.

98. A sum of Rs 9425 lakh was allotted during the Ninth Plan for development of fisheries in Assam. Moreover, provision of Rs 2837 lakh has been made under the ARIASP for

a period of eight years. There were nine schemes under implementation under the Department of Fisheries, however, all of them had a very high salary component leaving a negligible amount for development purpose.

99. Assam's fish production need not be restricted to meeting only demand in the North-East. If Andhra Pradesh can export fish to Assam, so can Assam export to Andhra Pradesh. The possibility of ushering in a blue revolution in Assam was outlined by an eminent fisheries scientist and Chief General Manager of NABARD. (See Box 7).

7.8 Forestry in Assam

7.8.1 Background

100. The state of Assam is well known for its extensive forest area with varieties of flora and fauna. The total area under forest is 23688 square km (1999 estimate of the State forest Department). This constitutes 30.20 per cent of total geographical area of the state. The total area under reserved forest was reported to be 17420 square km in 1999 (20.21 per cent of the total geographical area of the state). The State Forest Department manages the forest in the plain districts of the state. In the two hill districts (Karbi Anglong and North Cachar Hills) the management of forest is a responsibility of their respective districts councils.

101. The forest products of Assam comprise mainly industrial wood, fuel wood, bamboo, stone, thatch, cane, sand, etc. Among these industrial wood and fuel wood are the two main forest products. Outturn of industrial wood was 49.55 thousand cubic meters and of fuel wood was 33.84-thousand stack cubic meter during 1995-96 (Economic Survey, Assam 2000-2001).

102. The forest provides economic support to about 15 lakh people particularly in rural areas of Assam. The state government earns a good amount of revenue from various forest products. There is a sharp decline of revenue earned from timber during the year 1997-98 (Table 7.29). It is because of the ban imposed by the Supreme Court on felling and movement of timber from 1996 onwards. However, it has again shown an increasing trend from year 1999- 2000 onwards. The expenditure of the forest department has shown an increasing trend till the year 1999-2000 for both plan and non-plan expenditure. But for the year 2000-2001 the expenditure of the forest department in both heads has decreased (See Table 7.30).

Box 7:
BLUE REVOLUTION FOR INCREASING FISH PRODUCTION IN ASSAM – STRATEGIES

The capture fishery from Brahmaputra river, Barak river and Beel fisheries contribute about 80.6% but is fast declining due to over exploitation and indiscriminate fishing. Efforts will have to be made to increase the capture fishery production through measures like conservation, protection of breeding grounds, ranching with quality seed and selective fishing. The best course to increase capture production is to ban fishing in monsoon when most of the commercially important fishes breed as well as go for ranching the natural areas by releasing surplus seed of seed farms. It should be the endeavor of the state to increase per unit area production to at least 500 kg fish per kilometer length of rivers and 1000kg/ha from beel fisheries. This could substantially contribute to increase in the fish production of the state. The World Bank funded ARIASP is aimed at developing the beels of Assam.

The reservoir fishery in Assam did not get adequate attention despite having a potential of over 1700 ha water area spread across two reservoirs. Both the reservoirs are quite productive and unpolluted. Based on the experiences of other states it can safely be assumed that these reservoirs could easily produce about 100kg per ha. giving a total production of over 170 tonnes per annum. Integrated development of reservoirs would not only increase fish production of the state but could also generate ancillary activities providing job opportunities to rural youths.

Ponds and tanks cover an area of 25423 ha in the state out of which only 62% is being used for aquaculture contributing a mere 19.4% of the total fish production. Because of traditional cultural practices the average production per hectare is merely 1680 kg/ha/yr as against 3000 to 5000 kg/ha/yr in several other states. It should, therefore, be possible to increase the productivity of these confined water bodies to a level of 2800 kg/ha/yr.

Composite fish culture for Indian major carps (catla, rohu, mrigal, and kalbasu) and exotic fishes (silver carp, grass carp and common carp) could be taken up through eco friendly semi - intensive method. It is easily possible to produce two and half to three tonnes per hectare on a sustainable basis under climatic conditions prevailing in Assam.

The state can plan to bring in about 30000 ha. water area under composite culture in next three years by renovation of existing ponds and by construction of new ponds. These areas can be stocked at the rate of 5000 fingerlings/ha in different proportions depending upon the seed availability. Assuming 70% survival rate, minimum management and a modest average weight of 800gm, this could yield about 84,000 tonnes of fish in 9-12 month culture period.

For this each District Fishery Officer and Chief Executive Officer of FFDA may be provided yearly physical targets. Development would include excavation of ponds upto 1.5m depth and raising of bundhs and compaction to a level so as to prevent inundation and flooding. Implementation of the programme coupled with extension has to be taken up at sub-division/ block levels by the Fishery Extension Officers and Demonstrators and, to be monitored by the Director of Fisheries as well as by the Deputy Commissioners. The unit costs for renovation of existing ponds and excavation of new ponds are estimated in year 2000 to be Rs 1.157 lakh and 1.683 lakh per hectare respectively and total project cost to be about Rs 8674.95 lakh and Rs 37876.45 lakh. Appropriate development of fish seed hatcheries, nurseries, and reaming areas has to be done to attain this target.

In three years the state would be producing additional about 420 millions of spawn, 140 millions of fry, 35 millions fingerlings and about 84,000 tonnes of table fish per annum. The state could then be in position to bridge the gap of supply and demand by about 75%, earn revenue of Rs 430.24 crore, restrict outflow of funds, generate employment and improve rural economy. The project has the potential to generate gainful employment for about 3.12 lakh skilled and unskilled people directly and another 15.12 lakh people indirectly over a three-year period, which will go a long way in improving the socio economic situation of nearly 10% of the population of the state in the rural areas. It is estimated that with an investment of Rs.492.25 crore at the ground level an income of Rs 430.24 crore per annum ca be generated with these efforts. Though the state has missed out on the "blue revolution" that has taken place in some of the other states it is time to catch up with development, better late than never.

Date: August 29, 2002

Dr. S. C. Pathak
Chief General Manager
(Nov 1998- Dec. 2000)
NABARD, Guwahati, Assam

103. Apart from the ban faulty government policy has also contributed to the decline in the revenue earning from the forest products. The government had passed an order on December 20, 1993, according to which contractors engaged by various government departments are required to pay only 25 per cent of royalty in advance for forest products. The balance 75 per cent royalty are to be adjusted by the departments concerned at the time of running or final bill payments. The Bureau of Investigation (Economic Offence) conducted a random check in the year 2000 at three forest divisions to assess the quantum of the outstanding amount as royalty. It was found that Rs 60 lakh was outstanding royalty in the three surveyed divisions. If similar royalty dues are outstanding in 36 forest divisions of the state, the total would be, Rs 7.2 crore over an annual revenue of the forest department of around 11.4 crore (The Telegraph, January 25, 2000).

Table 7.29: Revenue Earned by the Forest Department in Assam. (Rs crore)

Year	Timber	Others	Total
1991-92	10.86	6.67	17.53
1992-93	11.44	7.68	19.12
1993-94	14.53	8.07	22.60
1994-95	10.70	6.23	16.93
1995-96	11.03	6.73	17.76
1996-97	9.16	6.12	15.28
1997-98	0.50	7.22	7.72
1998-99	0.50	9.01.	9.51
1999-2000	1.98	9.30	11.28
2000-01	2.86	8.51	11.37

Source: Principal Chief Conservator of Forest, Assam

Table 7.30: Expenditure of the Forest Department (Rs crore)

Year	Non-Plan	Plan	Total
1991-92	25.94	26.78	52.72
1992-93	29.27	21.02	50.29
1993-94	27.86	29.95	57.81
1994-95	28.51	25.18	53.69
1995-96	32.22	22.46	54.68
1996-97	36.24	27.93	64.17
1997-98	43.38	22.00	65.38
1998-99	51.74	24.26	76.00
1999-2000	74.77	31.75	106.52
2000-01	54.71	26.51	81.22

Source: Principal Chief Conservator of Forest, Assam

7.8.2 The State of Forest in the State

104. The forest department has very stringent rules and regulations for harvesting forest produce. The Assam Forest Regulation of 1891, which has undergone changes during

1892-1998, includes many clauses for general protection of forest and forest produce. Further the Assam Forest Protection Force Act, 1986 was enacted for better protection and security of the forest produce. Still it is very sad to note that 15 per cent of the total reserved forest of 17.42 lakh hectare has already been cleared and grabbed by encroachers. In the reserved forest there is large scale over-felling of trees that have reduced the density of the forests.

105. Table 7.31 shows that Assam has lost 820 square km of forest in just six year. If we look at the area under reserved forest (See Table 7.32) we can see that most of the forest divisions experienced a declining trend in their coverage in the late nineties. The table shows that the forest coverage has been has drastically reduced in Dhubri, Doomdooma, Goalpara, Hamren, Kamrup East, Kamrup West, Karbi Anglong East, Kokrajhar Wildlife, Lakhimpur, Mangaldai Wildlife, Nagaon Wildlife, Sonitpur East and in Tinsukia Wildlife Divisions. It also shows that in most of the forest divisions there is a check on the decline of forest area after 1995-96. This may be due to the ban imposed by Supreme Court on felling of trees from 1996 onwards. The area under reserved forest has increased in the District Council, Karbi Anglong West, Karimganj, N C Hills and Nagaon Division.

106. In respect of percentage of forest area Assam was ranked 11th in the country in 1997. But in 1999 the position of the state has gone down to 12th. Shifting cultivation in the hill areas, unrestricted encroachment and illegal felling of trees have contributed to the loss of forest areas in the state.

7.8.3 The Demand for Timber and Firewood

107. Most of the villagers in Assam use firewood as fuel. The scarcity of firewood is a major problem in the villages. The annual consumption of firewood is estimated at 5.2 million tonnes in the state. It is estimated that about half of the total requirements of firewood is drawn from the forest. However, annual availability of firewood in the forest of Assam is about 1.4 million tonnes. Thus, overexploitation has led to decrease in the crown density in the forest of Assam. Apart from this about 1.8 lakh cubic meters are used annually for the construction of houses.

Table 7.31: Forest Area in Assam

	Forest area in square km				
	1993	1995	1997	1999	Loss during the six years in sq. km
Assam	24,508	24,061	23,824	23,688	-820

Source: Principal Chief Conservator of Forest, Assam

Table 7.32: Area under Reserved Forest

		Area in hectare					
		1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
1	Aie Valley	48806.60	49041.60	48953.18	48953.18	48953.18	48953.18
2	Darrang	18020.00	18020.00	18022.21	18022.21	18022.21	18022.21
3	District Council	70333.00	70333.00	70333.00	70333.00	108086.00	108086.00
4	State Zoo	544.00	544.00	130.00	130.00	130.00	130.00
5	Dhubri	32687.00	32687.00	27915.33	27915.33	27951.33	27951.33
6	Dibrugarh	20914.00	20914.00	20912.75	20912.75	20912.75	20912.75
7	Digboi	55521.00	55521.00	55522.90	55522.90	55522.75	55522.75
8	Doom Dooma	29809.00	29809.00	29261.73	29261.73	29261.73	29261.73
9	East Assam Wild Life	49090.00	49090.00	49090.00	49090.00	49090.00	49090.0
10	Tiger Project	51662.00	51662.00	51661.71	51661.71	51661.71	51661.71
11	Forest Utilization Division	NA	NA	NA	NA	NA	NA
12	Goalpara	25779.00	25779.00	24255.33	24255.33	24255.33	24255.33
13	Golaghat	103627.00	103627.00	103627.0	103627.0	103627.00	103627.00
14	Haltugaon	61173.00	61173.00	61173.00	61173.00	61173.65	61173.65
15	Hamren	10538.00	10538.00	10268.00	10268.00	10268.00	10268.00
16	Jorhat	28203.00	28203.00	28194.76	28194.76	28194.76	28194.76
17	Kachugaon	82201.00	82201.00	82240.46	82240.46	82240.45	82240.45
18	Kamrup East	47387.00	47387.00	43930.49	43930.49	43930.49	43930.49
19	Kamrup West	68404.18	68404.18	67076.33	67076.33	67076.33	67076.33
20	Karbi Anglong East	81669.00	111855.00	72720.00	72720.00	72720.00	72720.00
21	Karbi Anglong West	102646.00	102646.00	112734.0	112734.0	112734.00	112734.00
22	Karimganj	76734.00	76734.00	84045.57	84045.57	84045.57	84045.57
23	Kokrajhar Wildlife	NA	21446.00	4566.89	4566.89	4556.69	4556.89
24	Lakhimpur	84277.00	84277.00	73567.42	73567.42	73567.42	73567.42
25	Mangaldai Wildlife	10181.00	10181.00	9831.78	9831.78	9831.78	9831.78
26	N C Hills	61766.00	61766.00	63776.44	63776.44	63776.44	63776.44
27	Nagaon	31821.00	31821.00	33317.50	33317.50	33317.50	33317.50
28	Nagaon South	49227.00	49227.00	50280.50	50280.50	50280.50	50280.50
29	Nagaon Wildlife	10897.00	10897.00	9793.44	9793.44	9857.9	9857.9
30	North Kamrup	44330.00	44330.00	47177.51	47177.51	47177.51	47177.51
31	Sibsagar	25387.00	25387.00	24075.15	24075.15	24075.15	24075.15
32	Silchar	NA	NA	NA	NA	83890.50	83890.79
33	Sonitpur East	60222.00	73929.00	52691.39	52691.39	52691.39	52691.39
34	Sonitpur West	66036.00	66036.00	66065.54	66065.54	66065.59	66065.59
35	Tinsukia Wildlife	65000.00	34000.00	31887.89	31887.89	31887.87	31887.89
36	West Assam Wildlife	20268.00	20268.00	27800.25	27800.25	27800.25	27800.25
37	Hailakandi					63561.07	63561.07
	Total					1742194.96	1742194.96

Source: Principal Chief Conservator of Forest, Assam

108. It is estimated that the wood based industries of the state use (excluding the paper mills) 14.5 lakh cubic meters of wood annually whereas only 6.7 lakh cubic meter can be obtained from the forest optimally (The Sentinel, 8 May 2001*)*. All these have led to depletion of the forest resource of the state. The Forest Policy Resolution of 1988 says provision of sufficient fodder, fuel and pasture, especially in areas adjoining forest, is necessary in order to prevent depletion of forests beyond the sustainable limit. Since fuelwood continues to be the predominant source of energy in rural areas, the programme of afforestation should be intensified with special emphasis on augmenting fuelwood production to meet the requirement of the rural people.

7.8.4 The Supreme Court Ban on Timber Harvest and Transport

109. A public interest litigation was filled in 1995 against the rampant felling of trees in the forest and the Supreme Court came forward with an intervention in December 1996. It

was believed that the order was a right step towards the preservation of ecology of the region. The ban on felling of trees, however, has a negative impact. Hundreds of saw mills and plywood units of the state were closed down since December 1996 (See Table 7.33), throwing the workers out of employment. However, for brief periods of six months each in 1997 and in 2000, the ban was lifted. The Supreme Court issued an interim order asking the mill owners to make regular payment to the permanent employee until the Court's further order. But the mill owners had stopped paying the wages to the permanent employees with effect from December 1998.

110. Afforestation drive in Assam has been hard hit following the Supreme Court order. Apart from the ban on felling of trees, restriction has been imposed on the movement of timber from the North-East to other parts of the country. The ban has affected the nursery owners of the state. It is reported that there has been a sharp decline in the sale of *Simul* and *Kadam* sapling fearing that the planters would not able to reap harvest from their plantation. The argument is that what is the use of plantation when there is a ban on felling trees. People go for such varieties as they fetch Rs 8000 to Rs 10,000 after 10 years of plantation (The Telegraph, March 5,2001). On the other hand in towns like Tinsukia, the saw mills and plywood factories are still running and their godowns are full with sawn timbers. The Supreme Court had issued another order allowing the mill owners to convert the logs to sawn timber lying in the mill premises before the ban was imposed. It is sad to note that most of these logs lying in the open for a long time became unfit for conversion to sawn timbers. So the ban led to wastage of thousands of cubic meters of logs. Further it is alleged that old logs are being replaced and supplemented by fresh ones from forests by the mill owners (The Sentinel, March 24, 2001).

111. In a further move aimed at restricting the movement of illegal timber from the North-East, the Supreme Court ordered all the state governments and the railways to curb illegal movement of timber. The irregularities in movement of forest produce came to the notice of the apex court in the year 2000 when 202 wagons loaded with illegal timbers originating from the North-East was detected by the Ministry of Forest and Environment (The Assam Tribune, May 13, 2001).

112. The apex court held the state governments responsible for movement of timber out of their states. It was ordered that all the states in the region would inform the Special Investigation Team beforehand detailing the total availability of legal timber in their states. This will help to keep an eye on movement of the timber. The railways have also been asked to restrict the availability of wagons for transportation of timber. The Supreme Court also directed the State Forest Departments to use watermarks Transit Pass to avoid forgery in vital documents (The Assam Tribune, May 13, 2001). It is alleged that illegal timbers were being smuggled out of the region using forged Transit Pass. Further the Court has made it clear that the North-Eastern states would not be permitted to fell trees in their forests unless they have sufficient financial back up for regeneration of such areas. Despite all the measures the forest areas of Assam continues to decline. Even after the ban during the period 1997-99 the state has lost 136

square km of its forest area. The lose however, show a declining trend as compared to the loss of 447 square km during 1993-95 and 237 km during 1995-97.

7.8.5 The Effect of the Ban on Industry of the State

113. The Supreme Court ban on timber has affected on the timber-based industries of the state. The number of timber-based factories has gone down drastically from 624 in 1996 to 426 in 1998 (See Table 7.33). Likewise there is decline in paper-based factories in the state. The National Forest Policy, 1988 states that no forest based enterprise, except at the village and cottage level, should be permitted in future unless it has been first cleared after a careful scrutiny with regard to assured availability of raw material.

114. Table 7.34 shows that there is sharp decline in the index of industrial production in case of sawn wood, plywood and matches. The index in the case of sawn wood was 153 in 1993 (at 1970 base) had reached to zero in five years. The same is the case for match industries. The index of plywood production was 454 in 1994 (at 1970 base) that had come down to 164 in 1998.

Table 7.33: Number of Registered Wood based Factories in the State:

	1993	1994	1995	1996	1997	1998
Manufactures of Wood and wood products, furniture and fixtures	606	634	634	624	548	426
Manufactures of Paper and Paper Products, Printing, Publishing and Allied Industries	30	34	34	34	32	30

Source: Directorate of Economics and Statistics, Assam

Table 7.34: Index of Industrial Production in Assam, base 1971=100

	1993	1994	1995	1996	1997	1998
Sawing and planning of Wood	153	115	140	128	3	zero
Manufactures of Plywood	390	454	394	314	178	164
Manufactures of Matches	87	76	80	70	7	zero

Source: Directorate of Economics and Statistics, Assam

115. However, there is optimism in the wood based industrial sector of the state. This is largely due to the compliance by the state government with the mandatory features of the Supreme Court order of January 1998. The order states setting up of industrial estates, framing specific rules for buying and selling timber by the plywood units within industrial estates set up by the state government (The Economic Times, January 20, 2000). However, the promotion of forest-based industry in Assam is not a viable proposition at present. The area covered by the forest is already below the norms set by the National Forest Policy of 1988. The forest cover of the state is dwindling even after the Supreme Court ban. This has affected the environment and ecology of the state.

The National Forest Policy of 1988 also laid down that forest based industry should meet its raw material needs by establishing a direct relationship with tree planters rather than depending on forest, which would henceforth be maintained primarily for ecological functions and for meeting the subsistence needs of the people. However, the amended Forest Conservation Act of 1927, which has been guiding the course of protection and development of forestry in India, has a number of its provisions contradicting the provision of the Forest Policy of 1988. The introduction of regulations to govern the felling of trees in private holdings come in the way of tree plantations by planters which was to provide requirements of the industry as per the Forest Policy of 1988 (Chopra, 1995).

116. There are some major forms of Non-Timber Forest Products (NTFP) in the state like bamboo, cane, thatch, grass, bark, etc. Most of the bamboo forests of the state have been leased out to the paper mills of the state. Moreover many household and non-household industries of the state is based on bamboo and cane products. The National Industrial Classification data of Census of India for Assam shows that persons engaged in manufactures of bamboo and cane furniture and fixtures and other related non-timber based products show 148.5 per cent growth during the period 1971-91. Whereas persons engaged in timber based industries show 72.6 per cent growth during the same period in the state. This shows the possibilities of sustainable job opportunities in NTFP sector.

Table 7.35: Growth of Workers Engaged in wood based industries

Industries	NIC code	1971	1991	Growth rate
Wood and Wood Products	27			72.6
Wooden and cane boxes, baskets, made entirely or mainly of cane, rattan, reed, bamboo, willow, fibres, leaves, grass etc.	272- 1970 273- 1987	3,411	3,867	13.37
Manufactures of bamboo & cane furniture and fixtures	277	2,420	9,030	273.14
Manufactures of products of wood, bamboo, cane, reed and grass	279	1,313	4,857	267.91
	Total workers in NTFP	7,144	17,754	148.5
Wooden goods, treated timber	273 - 1970 272 - 1987	11,709	7,437	-30.5
Manufactures of wooden furniture and fixtures	276	10,927	22,599	106.8

Source: Census of India, Economic Tables, Assam 1971, 1991
Note: National Industrial Classification 1970 modified to an extent in 1987

7.8.6 Social Forestry Programme in the State

117. The pressure of population for settlement and grazing, the removal of forest cover for timber and firewood, and the shifting cultivation put together have led to massive depletion of the forest cover. This has led to implementation of various forestry development programmes such as afforestation and social forestry, wildlife management, improvement of infrastructural facilities, etc. by the forest department of

the state. The social forestry programme aims at increasing area under afforestation in the residential areas and otherwise occupied areas of the state. The achievement of the programme during the year 1998-99 was not very encouraging. During that year 4646 hectares could be covered against the target of 4958 hectares. However, in the previous year the modest target to cover 2357 hectare had been achieved (See Table 7.36). The number of seedling planted under the programme was 25 lakh during 1998-99, 59.32 lakh during 1997-98 and 147.66 lakh during 1996-97 (See Table 7.37). The records of seedling distribution by the forest department show that more that 4 crore of seedlings have been distributed during the year 2000. It is estimated that about 30 per cent of the seedlings were actually planted and maintained.

Table 7.36: Target and Achievement of Social Forestry (in hectares)

		1996-97		1997-98		1998-99	
Sl.	Districts	Target	Achievement	Target	Achievement	Target	Achievement
1	Dhubri	683.00	682.00	386.00	386.00	487.75	273.00
2	Kokrajhar	400.00	400.00	157.00	159.00	347.00	347.00
3	Bongaigaon	774.75	772.75	256.00	259.00	512.75	361.00
4	Goalpara	523.00	523.00	152.00	152.00	918.00	918.00
5	Barpeta	336.00	336.00	148.00	150.00	319.00	319.00
6	Nalbari	382.00	382.00	165.00	166.00	141.00	141.00
7	Kamrup	858.00	858.00	208.00	208.00	249.5	248.5
8	Darrang	9.00	9.00	11.00	11.00	96.5	94.5
9	Sonitpur	75.00	75.00	Nil	Nil	181.00	182.00
10	Lakhimpur	59.00	57.00	14.00	14.00	225.00	221.00
11	Dhemaji	173.00	173.00	53.00	55.00	71.00	72.00
12	Morigaon	15.00	14.00	Nil	Nil	11.00	12.00
13	Nagaon	21.00	21.00	15.00	15.00	148.00	146.00
14	Golaghat	148.00	147.00	212.00	213.00	328.00	300.00
15	Jorhat	219.5	237.5	Nil	Nil	10.00	10.00
16	Sibsagar	408.00	408.00	257.00	259.00	254.00	253.5
17	Dibrugarh	40.00	40.00	4.00	4.00	76.00	76.00
18	Tinsukia	106.00	106.00	Nil	Nil	142.00	142.00
19	Karbi Anglong	3154.00	Nil	Nil	Nil	Nil	Nil
20	N.C.Hills	1894.00	Nil	Nil	Nil	Nil	Nil
21	Karimganj	275.00	275.00	154.00	156.00	222.5	222.5
22	Hailakandi	70.00	70.00	6.00	6.00	1.00	100.00
23	Cachar	322.00	322.00	159.00	160.00	217.00	207.00
		10945.25	5908.25	2357	2373	4958	4646

Source: Principal Chief Conservator of Forest, (Social Forestry)

Table 7.37: Seedlings Planted under the Social Forestry Programmes in the Districts of Assam (in hectares)

		1996-97		1997-98		1998-99	
Sl.	Districts	Target (In Hect.)	Achievement	Target (In Hect.)	Achievement	Target (In lakh.)	Achievement
1	Dhubri	N.A	17.07	N.A	9.65	2.00	2.00
2	Kokrajhar	N.A	10.08	N.A	3.97	1.80	1.80
3	Bongaigaon	N.A	19.31	N.A	6.47	0.80	0.80
4	Goalpara	N.A	13.07	N.A	3.80	0.60	0.60
5	Barpeta	N.A	8.40	N.A	3.75	2.50	2.50
6	Nalbari	N.A	9.55	N.A	4.15	2.00	2.00
7	Kamrup	N.A	21.45	N.A	5.20	2.00	2.00
8	Darrang	N.A	0.22	N.A	0.28	1.20	1.20
9	Sonitpur	N.A	1.87	N.A	-	1.00	1.00
10	Lakhimpur	N.A	1.42	N.A	0.35	0.45	0.45
11	Dhemaji	N.A	4.32	N.A	1.38	0.60	0.60
12	Morigaon	N.A	0.35	N.A	-	0.45	0.45
13	Nagaon	N.A	0.52	N.A	0.37	1.00	1.00
14	Golaghat	N.A	3.67	N.A	5.33	0.60	0.60
15	Jorhat	N.A	5.92	N.A	-	0.70	0.70
16	Sibsagar	N.A	10.20	N.A	6.47	0.50	0.50
17	Dibrugarh	N.A	1.00	N.A	0.10	0.45	0.45
18	Tinsukia	N.A	2.65	N.A	-	0.60	0.60
19	Karbi Anglong	N.A	-	N.A	-	2.00	2.00
20	N.C.Hills	N.A	-	N.A	-	2.00	2.00
21	Karimganj	N.A	6.87	N.A	3.90	`0.50	0.50
22	Hailakandi	N.A	1.75	N.A	0.15	0.45	0.45
23	Cachar	N.A	8.05	N.A	4.00	0.80	0.80
			147.74		59.32	24.5	25

Source: Principal Chief Conservator of Forest, (Social Forestry)

118. The forest department has different programme for regeneration of the forest areas of the state (See Table 7.38). However, the achievement of such programme was far below the target set in 1998-99. It is attributed to lack of adequate fund to carry out such programme. The costs of afforestation per hectare for different plantation are shown in Table 7.39. The forest department also says that most of the areas where regeneration can be taken up are encroached by people. Prior to the Supreme Court ban there was enthusiasm among the people to go for teak and other plantations with expectation of high return in later years. The ban may be the one of the causes for slump in the regeneration programme. It is also estimated that the survival percentage of plantation is around 75 per cent.

119. It is sometimes said that social forestry programme in the state has not achieved the desired result. However, if we look at the data on district-wise performance of the social forestry programme in the state, it reflects that the overall failure in the state is due to non-performance by the hill districts of the state, where forest is managed by their respective district councils not by the state forest department. Moreover, even after successful implementation of the programme in the initial years some districts in

the valley region could not improve their performance. It seems that the motivational and operational aspects vary among the implementing agencies at the local level.

Table 7.38: Achievement under various Forestry Programmme (area in hectare)

Programme	1995-96	1996-97	1997-98	1998-99
1. Regeneration	1071	1555	6622	1329
2. Regeneration of Degraded Forest	954	760	1679	507
3. Quick Growing Species	1333	2115	2740	2148
4. Plywood	903	1230	2857	700
5. Teak Wood	738	1138	3728	240
6. Match Wood	422	800	2535	1601
7. Minor Forest Yield	5421	7538	-	-

Source: Principal Chief Conservator of Forest, (Social Forestry)

Table 7.39: Cost of Different Plantation Scheme

Sl. No.	Plantation scheme	Total cost per hectare
1	Matchwood plantation	Rs 5200.00
2	Plywood plantation	Rs 8700.00
3	Quick growing species	Rs 6100.00
4	Teakwood plantation	Rs 6000.00
5	Regeneration of degraded forest	Rs 6500.00
6.	Regeneration a) under planting	Rs 3900.00
	Regeneration b) Sal	Rs 17800.00
	Regeneration c) Hardwood	Rs 8200.00
	Regeneration d) Hollong	Rs 3900.00

Source: Principal Chief Conservator of Forest, (Social Forestry)

120. There are four components of social forestry programme in the state- (a) Social Forestry General, (b) Tribal Sub Plan, (c) Schedule Caste Component Plan and (d) Area-oriented Fuelwood and Fodder Project. The implementation of these programmes is more visible in the districts of lower Assam, namely Dhubri, Kokrajhar, Bongaingaon, Goalpara, Barpeta, Nalbari and Kamrup (See Table 7.40). It again reflects the motivational and operational variations at the local level in the implementation of state conducted programme in the state.

Table 7.40: Components of Social Forestry in Assam

Districts	Social Forestry General		Tribal Sub Plan		Scheduled Caste Component Plan		Area Oriented Fuelwood and Fodder Projects	
	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99	1997-98	1998-99
Dhubri	175.00	110.00	Nil	2.00	11.00	61.00	200.00	100.00
Kokrajhar	57.00	84.00	Nil	50.00	2.00	16.00	100.00	200.00
Bongaigaon	59.00	151.00	Nil	52.00	Nil	58.00	200.00	100.00
Goalpara	Nil	202.00	Nil	551.00	2.00	5.00	150.00	160.00
Barpeta	Nil	97.00	Nil	56.00	Nil	31.00	150.00	135.00
Nalbari	1.00	51.00	Nil	34.00	15.00	6.00	150.00	50.00
Kamrup	Nil	37.50	Nil	2.00	8.00	9.00	200.00	200.00
Darrang	9.00	66.00	Nil	6.00	2.00	22.50	Nil	Nil
Sonitpur	Nil	83.00	Nil	51.00	Nil	48.00	Nil	Nil
Lakhimpur	Nil	64.00	Nil	129.00	14.00	28.00	Nil	Nil
Dhemaji	Nil	20.00	Nil	Nil	55.00	52.00	Nil	Nil
Morigaon	Nil	7.00	Nil	Nil	Nil	5.00	Nil	Nil
Nagaon	5.00	126.00	Nil	Nil	10.00	20.00	Nil	Nil
Golaghat	Nil	110.00	Nil	61.00	13.00	6.00	200.00	123.00
Jorhat	Nil	2.00	Nil	Nil	Nil	8.00	Nil	Nil
Sibsagar	Nil	60.00	2.00	43.50	7.00	Nil	250.00	150.00
Dibrugarh	Nil	50.00	1.00	11.00	3.00	15.00	Nil	Nil
Tinsukia	Nil	107.00	Nil	Nil	Nil	35.00	Nil	Nil
Karbi Anglong	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N.C.Hills	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Karimganj	1.00	107.00	Nil	31.00	5.00	34.5	150.00	50.00
Hailakandi	Nil	35.00	Nil	Nil	6.00	15.00	Nil	50.00
Cachar	Nil	76.00	Nil	10.00	10.00	31.00	150.00	100.00
		1642.5		1089.5		506		1418.00

Source: Principal Chief Conservator of Forest (Social Forestry)

7.8.7 Joint Forest Management in the State

121. The Indian forestry sector has witnessed a major policy shift during the last decade towards a more decentralized and people oriented-forestry. Following the June 1990 resolution of the Government of India, the Joint Forestry Management (JFM) programme was formally introduced in the country. The philosophy of JFM in essence aims at involving people in resource generation through motivation, and eliciting their participation in forest management and sharing of benefits through adequate institutional arrangements (TERI report on JFM, 2001).

122. Recently the forest department changed its approach towards the regeneration of forest programme. The Government of Assam has worked out a resolution for JFM programme. For JFM programme the selected site including all areas outside reserved forest and peripheral areas of reserved forest shall be worked out in accordance with a working scheme prepared in consultation with the beneficiaries and duly approved by the concerned forest officer. The area of JFM committee may usually be limited to five hectare for natural regeneration and two hectare for intensive planting. The unit for

natural regeneration and artificial regeneration will depend upon the number of beneficiaries. However, the unit should be viable for effective protection and management.

123. The divisional forest officer shall select the beneficiaries for the purpose of constituting of the forest protection and regeneration committees in consultation with the local panchayats. The beneficiaries are to be identified from economically backward people of homogenous groups living in the vicinity of the forest concerned.

124. There is a provision in the resolution for a supportive role of the gram panchayats in the JFM committees. Non Government Organizations (NGOs) and Voluntary Organizations (VOs) of the locality should be utilized for motivating and organising village communities for protection, regeneration and afforestation purposes. The NGOs and VOs may be associated as interface between the forest officers and village communities. The resolution decided to follow the provisions made under the Assam Forest Regulation Act of 1891, the Wildlife (Protection) rules of 1980 and the Forest (Conservation) Act of 1980 in the successful implementation of JFM programme.

125. It is the responsibility of the concerned divisional forest officer to monitor, supervise and resume the functions of JFM committees. The resolution says the beneficiaries will have to protect the forest for at least five years to be eligible for sharing usufructs under natural regeneration scheme of JFM. Time bar for sharing usufructs in the case of artificial regeneration areas will be worked out according to the silviculture requirements. The beneficiaries will be permitted to collect minor forest produce, fallen leaves and wood and fodder free of cost without causing damage to forests/plantations. The beneficiaries are entitled to utilize the forest products for their bona fide needs. They can also use the forest products, but it should be ensured that the benefits of people's participation should go to the village communities and not for commercial purpose.

126. After meeting the legitimate needs of the beneficiaries and for community purpose, the surplus out of the harvest from silviculture thinning and the main felling shall be sold by the Forest Department and the JFM committee will be entitled to 50 per cent of the net receipts.

127. The philosophy of the JFM programme sounds good. Here the people will operate and the government will cooperate in the protection of the forest and ecology as well as people will get the benefits from the forest. However, the progress of JFM is somewhat slow in the state (See Table 7.41). The JFM programme was introduced in the State of Assam in November 1998. Till now only the committees have been formed for JFM programme. Altogether 245 committees have been registered for JFM in Assam till May 2001 and among them 82 committees are all women committees. These committees plan to cover 6970 hectares of land. Out of which 5070 hectare area under reserved forest and rest of the area under Government community land. These committees plan to cover 6970 hectares of land. There are several reasons for the slow progress of JFM in the state. JFM plans to involve people living in the forest villages and villages in the vicinity of the forest. They are largely depended on forest for their

livelihood. The beneficiaries of the JFM committees have to protect the forest for 5 years to be eligible for sharing the usufructs. There is need to make provision for other support activities for the people to be involved in JFM. There is need for creation of assets and other activities such as animal husbandry, horticulture, bamboo cultivation, roads etc. for the people to be involved in the JFM. The Forest Department of the state so far has been unable to do these for paucity of fund. Unless an alternative arrangement for livelihood is made, at least during the period of regeneration of forest, these people have no option but to exploit the forest resources often beyond their sustainable limits. Thus JFM should be coupled with other development programmes.

Table 7.41: Status of Joint Forest Management in Assam- May 2001

		Number of JFM Committees	Area covered in Hectare	All Women JFMC
1	Reserved Forest	196	5070	40
2	Government Community Land	49	1900	42
		245	6970	82

Source: Chief Conservator of Forest (Social Forestry) Assam

128. Moreover, no rule has been made for operationalization of JFM. At present, the JFM Committees are being registered in various division under social forestry wing as per the provision under rule 7 (i) to (xi) contained in the Assam Joint (Peoples Participation) Forestry Management Rules 1998. However, the Forest Protection Division of Ministry of Environment and Forest has suggested that all JFM Committees are to be registered under the Societies Registration Act of 1860. However, the Act of 1860, in Assam has no provision for registration of forest protection committees. The meeting of the divisional forest officers and chief conservators of Assam for the operationalization of JFM decided that the registration of JFM committees may be taken up in the initial stages under the Assam Joint (Peoples Participation) Forestry Management Rules of 1998 as there are adequate provisions under this rule (Report of the Chief Conservator of Forest, Social Forestry, 2001).

129. The JFM resolution for the state says that the cost of regeneration and maintenance of degraded forests and allied developmental works as per the approved scheme shall be borne by the government. Provision has been made to distribute the required fund to the JFM committees through the divisional forest officers. It is alleged that in most of the cases a few affluent people without active involvement of economically backward local people, form the JFM committees on paper and they siphon off fund from the Forest Department with the help of some forest officials. They take no initiatives for regeneration programme. All these have jolted the take off of JMF programme in the state.

130. However, some cases of success can be cited in the state. Dhubri, a lower Assam district has shown success in the social forestry programme (See Box A). Such

examples of synergy in development initiative by the people as well as the government are not many.

Box A: JFM and Rural Development

In a tiny village, Bashbari, near Golakganj, the JFM progamme is taking its stride (The Assam Tribune January 19, 2001). Here for years trees were illegally being felled. As a result there was soil erosion and sharp drop in the level of water table. A forest protection committee was formed in 1984, much before the formal launch of the JFM programme in the country to work towards the maintenance, protection, plantation and development activities in the region. Now illicit felling and cattle grazing has come to an end in the reserve forest of this region. The Forest Department is employing the forest protection committee to carry out the plantation in the forest, nursery raising and other support activities like laying out roads, boundary demarcation of reserve forest area etc.

7.8.8 Commercial Logging and Wood Industry

131. Unfortunately, the Supreme Court ban continues even after five years. The State Forest Department was given a time limit of two years (that is, till January 2000) to produce working plans for sustainable use of forests. It was found that just 11 divisions had prepared plans till June 2001. Rests of the divisions have not prepared plans for want of funds. (Why are funds needed to prepare plans only the forest department can explain)?

132. Even when the working plan for sustainable forestry is developed, how would one ensure that these are honestly implemented? Parikh (1999) has suggested a way to use markets for sustainable forestry, which is represented, in Box B.

7.8.9 Strategies for Sustainability of Forests in Assam

133. Involvement of local people in protection and management of the forest seems to be the only way out for sustainability of forest area in Assam at least as far as meeting needs for fuelwood, fodder and other non-timber forest products are concerned. There is a shift in the approach in the Forest Policy of 1988 with more focus on involvement of people is in the right direction. However, the people oriented JFM has not able to make its impact in Assam. The following steps must be taken into account for successful implementation of the JFM programme in the state.

    a. The service from the poor villagers in the management and protection of forest cannot be expected unless economic security is provided to them. In most cases they are fully or partially dependent on the forest for their livelihood. There is need to make provisions for other support activities for the people to be fully involved in JFM. Creation of assets and other activities such as horticulture, animal husbandry, bamboo cultivation, etc. is an essential prerequisite.

Box B: Using Markets for Sustainable Forestry

Another example where financial market can play an allocative role is in sustainable exploitation of forests. Today, a forest contractor has no incentive to nurture the forest assigned to him. He would like to fell it. The forest department is forced to micro-manage his actions, but the forest department officials are only human. Over the last 50 years, the area under the forest department has risen, but the area under forests has gone down.

The problem arises from the fact that the ownership of the forests is not with the contractor. If forests were privatized, however, there is no guarantee that they would be maintained as forests. Even if the land contained trees, the private owner may prefer a commercial plantation with inferior bio-diversity.

One can think of giving our forests on long-lease to private firms with a stipulation that a forest of the same quality (as defined by some objective metrics about bio-mass, bio-diversity etc.) will be returned in 15 years. The failure to do so would evoke substantial penalties. However, how would we ensure that the terminal conditions generate altered behaviour today? One way out is to require that these leases are only given to joint-stock companies with shares which are meaningfully traded on the stock market.

The stock market would know that a large penalty awaits the company if the forest is not maintained in adherence of certain minimal standards. Security analysts today visit the plants of companies that they cover; it is not unreasonable to think that they would visit the forests that are comparable productive assets. The stock market would do this monitoring in a more efficient and corruption - free fashion as compared with any bureaucratic organisation.

Similarly, it is feasible for voluntary environmental groups to visit a given forest once in 15 years and verify the correct calculation of penalties. In contrast, it is infeasible for them to ensure the honest day-to-day micro-management by the forest department that is required to produce good behaviour on the part of forest contractors. Of course, markets are not a perfect and infallible monitoring instrument. Yet, they offer a much better chance of success than our current system of control by fallible human bureaucrats.

b. There is the need to think of evolving a cost-effective alternative to fuelwood to the villagers; otherwise they will continue to exploit the forest. The use of kerosene and LPG is minimal in most of the villages due to their low economic status. There is scope and necessity to exploit rural energy components (improvised chulla etc.) with the JFM programme.
c. In most cases the villagers find it difficult to comprehend the mechanisms of the functioning of JFM. A massive motivational and training programme for the people to be involved in JFM can help to serve the objective. The service of VOs can be utilized for this purpose.

134. The other steps need to follow are:

a. All stringent forest laws must be put into action in actual practice. Some corrupt officials who themselves break the rules provide forged transit passes to smuggle out the illegal timbers.

b. Unrestricted encroachment must be stopped in the forest areas of Assam. The rapid population growth in the state has put pressure on the land of Assam. So, the people have encroached the forest areas. The Revenue Department of the state is stated to be the main culprit as the department is providing *patta* (settlement rights) to the settlers in the forest areas. The National Forest Policy, 1988 states that diversion of forest land for any non-forest purpose should be subject to the most careful examinations by specialists from the standpoint of social and environmental costs and benefits.

c. Every forest division in the state is supposed to have a working plan. The working plan acts as a guide for rational exploitation of the forest. However, most of forest divisions have not prepared their working plan. As reported by the forest department only 11 divisions have at present current and approved working plans. These must be prepared urgently to vacate the Supreme Court ban. Even with such plans there may be difficulties in reviving forest-based industry in Assam. The working plans act as a guide for rational exploitation of the forest. The National Forest Policy of 1988 lay down that the forest-based industries should meet its raw material need from private plantations. It states "as far as possible, a forest-based industry should raise the raw material needed for meeting its own requirements, preferably by establishment of a direct relationship between the factory and the individuals who can grow the raw material by supporting the individuals with inputs including credit, constant technical advice and finally harvesting and transport services" (Ministry of Environment and Forest, 1988). However, the Forest Conservation Act of 1927, governs the felling of trees in private holdings. Only through amendment of this contradiction and encouraging large-scale plantation of quick growing species (QGS) the forest-based industries of the State can be revived.

d. Innovative use of market mechanism may be made to promote sustainable forestry, through long-term lease and penalty for misuse monitored by the stock market.

e. Jhuming (shifting cultivation) in the hill areas must be stopped through stringent regulations. The Assam Forest Regulation, 1891 (the act has undergone changes many times during 1892 to 1988) does not have any clear cut provision for banning jhum cultivation. It states that jhuming can be done with the written permission from the Forest Settlement Officer, or any clearings lawfully made for jhum cultivation by persons in the habit of practising such cultivation in the hills. If any claim relating to the practice of jhuming is made the Forest Settlement Officer records a statement setting forth the particulars of the claim and of any local rule under which the practice is allowed or regulated and submit to the state government, together with his opinion whether such practice should be permitted or prohibited. So, in the

Assam Forest Regulation, 1891, there is no provision for complete ban on jhuming in the state.

f. Area covered by the forest may not give the actual status unless the density of the forest is not taken into account. There is need to use the information of remote sensing for regular monitoring of the forest areas in the state along with their crown densities.

g. There is the need to evolve alternatives to timber for meeting household and industrial consumption requirements. The Forest Policy, 1988 states that the long-term solution for meeting the existing gap lies in increasing the productivity of the forests, but to relieve the existing pressure on forests for the demand of railway sleepers, construction industry (particularly in the public sector), furniture and panelling, mine-pit props, paper and paperboard, etc. substitution of wood needs to be taken recourse to. Similarly, on the front of domestic energy, fuelwood needs to be substituted as far as practicable with alternate sources like bio-gas, LPG and solar energy. Nowadays there is an increasing trend to use fabricated steel in lieu of wood, mostly in urban areas of the state. Utilization of forest resources for industrial development and revenue generation is not a viable proposition considering the present ecological condition of the state. The present focus should more be on regeneration and protection of the forest for next few years.

h. There is need to strengthen the Forest Protection Task Force. The outdated 303 rifles are not enough to counter the sophisticated weapons used by the poacher.

i. Above all massive plantation is the way out for sustainability of the forest areas of the state.

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