

**DEPARTMENT OF AGRICULTURE,
THE STATE GOVERNMENT OF HIMACHAL PRADESH**

**THE STUDY
ON
DIVERSIFIED AGRICULTURE
FOR
ENHANCED FARM INCOME
IN
THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

**VOLUME-II
ANNEXES PART-1**

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**THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME
IN THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

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Jammu & Kashmir



CHINA

Punjab

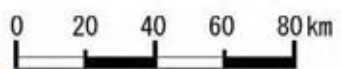
Uttarakhand

Haryana

SHIMLA

LEGEND

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	National Boundary
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Location Map

ANNEX-A
National and State
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**THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME
IN THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

**ANNEX-A
NATIONAL AND STATE SOCIO-ECONOMIC BACKGROUND**

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ANNEX-A NATIONAL AND STATE SOCIO-ECONOMIC BACKGROUND

A-1 National Policy

A-1.1 Vision 2020

According to the Report of the Committee on Vision 2020, the total population will exceed 1.3 billion in 2020, and the demand for principle foods at that time is projected to be 119 million tons for rice, 92 million tons for wheat, 15.6 million tons for coarse cereals, 19.5 million tons for pulses and 166 million tons for milk. Assuming the moderate growth rate of production at the same rates as during the 1990s, India will be able to meet these projected demands for rice, wheat and milk, although there would be shortage supplies of 2.6 million tons for coarse cereals and 3.5 million tons of pulses. If the high growth rate of production like the 1980s is realized, India will also be able to meet the future demand for feed grains which will grow significantly as milk consumption is likely to increase at a high rate. In this regard, India needs to sustain an agricultural growth rate of 4.0% to 4.5% in order to reduce food insecurity and poverty.

With keeping this growth rate, agricultural development could more rapidly diversify into horticulture, fishery, dairying, animal husbandry and other areas. It would also spur the growth of agro-processing industries in rural areas. Such an achievement is well within reach, provided there is the requisite commitment to: a) raising crop productivity by dissemination of advanced technologies; b) increasing investment in irrigation, research and training; c) water harvesting; and d) improved access to credit.

A-1.2 Eleventh Five Year Plan

In India, the agriculture sector still provides livelihood to nearly 60% of people and remains vital for food security. To ensure a better life for women and men engaged in agriculture, it was necessary to double the growth rate of 1.7% achieved in the Tenth Five Year Plan (2002/03-2006/07) and put agriculture on a growth path of 4.1% based on the proposed growth rates for sub-sectors of agriculture as shown in Table A-1.1.

Table A-1.1 Projected Growth Rates of Sub-sectors of Agriculture (2002/03-2006/07)

Sub-sector	Output Share (%)	Proposed Growth Rate (% per annum)	Sub-sector	Output Share (%)	Proposed Growth Rate (% per annum)
Crops	46	2.7	Livestock	25	6.0
Food grains	26	2.3	Fisheries	4	6.0
Oilseeds	6	4.0	Forestry/Logging	4	0.0
Other crops	14	3.0			
Horticulture	21	5.0	Total/Overall	100%	4.1%

Source: Towards Faster and More Inclusive Growth, an Approach to the Eleventh Five Year Plan, Planning Commission, Government of India

To do this and at the same time maintain prices and profitability, a corresponding increase in demand for agricultural output as shown in Table A-1.2 matched with the supply side response based on productivity improvements is required for the Eleventh Five Year Plan period.

Table A-1.2 Projected Growth Rate and Demand for Various Food Commodities (2002/03-2006/07)

Food Item	Projected Growth Rate (% per annum)	Projected Demand (million tons)	Food Item	Projected Growth Rate (% per annum)	Projected Demand (million tons)
Food grains	2.21	251.7	Fish	4.58	5.9
Milk and milk products	3.18	100.4	Oilseeds	2.94	49.2
Meat	4.65	5.4	Vegetables	2.51	92.9
Eggs	4.62	35,770.0	Fresh fruits	3.46	29.4
			Sugar and brown sugar	1.88	22.5

Source: Report on the Steering Committee on Agriculture and Allied Sectors for Formulation of the Eleventh Five Year Plan, Planning Commission, Government of India

In order to raise agricultural output, the strategy of Eleventh Five Year Plan (2007/08-2011/12) will be based on such elements as: a) to double the rate of growth of irrigated area; b) to improve water management, rain water harvesting and watershed development; c) to reclaim degraded land and focus on soil quality; d) to bridge the knowledge gap through effective extension; e) to diversify into high value outputs such as vegetables, fruits, flowers, herbs and spices, medical plants, bamboo, bio-diesel etc., but with adequate measures to ensure food security; f) to promote animal husbandry and fisheries; g) to provide easy access to credit at affordable rates; h) to improve the incentive structure and functioning of markets; and i) to refocus on land reforms issues.

With regard to technical issues which need to be looked into during the Eleventh Five Year Plan period, no meaningful programmes have been launched on vegetables in recent times and vegetables are excluded from targets of the National Horticulture Mission, although vegetables contribute a major share in ensuring food and nutritional security of population. In this regard, the following aspects of vegetables are to be taken on priority:

- a) Saturation of area with F1 hybrids;
- b) Promotion of leafy vegetables for nutrition particularly in villages and tribe areas;
- c) Protected cultivation (cultivation in greenhouse, net house, etc) for high quality vegetables for export;
- d) Promotion of kitchen gardening;
- e) Focus on crops having short supply; and
- f) Promotion of technologies for year-round production of crops like onion.

Projected outlay for horticulture development during the Eleventh Five Year Plan period is Rs. 415 billion in total comprising Rs. 265.5 billion for on-going schemes under the Ministry of Agriculture, Rs. 51.5 billion for continuous schemes under the Ministry of Commerce and Rs. 98.0 billion for new schemes proposed for the Eleventh Five Year Plan. Among horticulture development programmes, an allocation of Rs. 30 billion is proposed to the Technology Mission for Integrated Development of Horticulture in North East Region and Himalayan States including Himachal Pradesh.

A-2 Development Policy and Programs of Himachal Pradesh State

A-2.1 Eleventh Five Year Plan of Himachal Pradesh State (2007/08-2011/12)

(1) Objectives and Growth Projections for Eleventh Five Year Plan

The major objectives of Eleventh Five Year Plan would be the provision of essential public services especially for disadvantaged sections of society, coupled with increasing farm incomes, developing vital infrastructure, nurturing human capital, protecting the environment and improving governance. The focus would remain on reduction of poverty, enhancing of equity among various sections of the society and a balanced regional development.

The annual growth rate during the Eleventh Five Year Plan period is targeted at 8.5% with the same level of the national target. The sector-wise target of growth rate of and contribution to Gross State Domestic Product (GSDP) are as summarized in Table A-2.1.

Table A-2.1 Sector-wise Targets of Economic Growth Rate and Contribution to GSDP

Sector	Tenth Five Year Plan(2002-07)		Eleventh Five Year Plan(2007-12)	
	Growth Rate (%)	Share in GSDP (%)	Growth Rate (%)	Share in GSDP (%)
Primary	8.50	22.45	7.50	21.16
Secondary	7.42	35.98	9.30	36.85
Tertiary	7.53	41.57	9.00	41.09

Source: Approach Paper Eleventh Five Year Plan (2007~2012), Planning Department, Himachal Pradesh, Remarks; GSDP: Gross State Domestic Products

(2) Development Strategies of Core Sectors for Eleventh Five Year Plan

In the Eleventh Five Year Plan, the development strategies set up for core economic sectors are summarized as follows:

- a. Farm sector: To fulfill the twin objectives to increase the incomes from farming and allied activities as well as the employment opportunities within this sector, the focus is to be on improvement of irrigation facilities, supply of high quality seeds, fertilizers & other inputs, facilitation of adequate credit and effective market linkage, and research and extension works, all of which are expected to lead to sustainable value addition. Among others, the priority is put over speedy completion of ongoing irrigation projects, bringing of additional 98,000 ha under irrigation and bridging of the existing gap between irrigation potential already created and its actual utilization;
- b. Rural connectivity sector: In Himachal Pradesh, road connectivity is crucial for the people as over 90% of them live in rural areas. Aiming to serve all weathered roads to all villages with more than 250 habitants by 2012, the components of special program “Pradhan Mantri Gram Sadak Yojana (PMGSY)” is to be enhanced;
- c. Hydropower sector: To ensure such twin benefits as to make the country’s gain in ameliorating shortages in its crucial infrastructure sector through enhanced production of “green energy” and to augment the State’s financial resources by reducing its financial dependence on central resources, the hydro-potential of 5,676 MW ready for development is to be actualized by 2012; and
- d. Forestry and environment sector: To minimize problems of floods and soil erosion, the goal is to ensure that 35.5% of the total State’s geographical area is brought under forest and tree cover in consideration of the vast existence of area above tree line (limit of tree

vegetation) and/or incapable of sustaining forests. Towards this goal, the focus is to be on stepping up of investment in a considerable manner for nurturing and preserving the forest cover and wild life sanctuaries.

The sector-wise physical targets of the Eleventh Five Year Plan is set up as shown in Table A-2.2, following the above development strategies.

Table A-2.2 Sector-wise Physical Targets for Eleventh Five Year Plan

	Unit	Tenth Five Year Plan Actual Achievement	Eleventh Five Year Plan		
			Target	Change compared with Tenth Five Year Plan	
				Quantity	Rate (%)
Food grain production	'000 MT	1,669	1,700	+31	+1.9
Vegetable production	'000 MT	1,000	1,300	+300	+30.0
Fruit production	'000 MT	696	906	+210	+30.2
Milk production	'000 MT	870	920	+50	+5.7
Fish production	ton	8,100	40,000	+31,900	+393.8
Additional irrigation area created	ha	8,287	31,000	+22,713	+274.1
Afforestation	ha	6,934	4,000	-2,934	-42.3
IRD family assisted: SGSY (Disbursement of credit)	million Rs.	996	750	-246	-24.7
Road length added	km	2,714	7,580	+4,866	+179.3
Electricity installed capacity added	MW	472	5,744	+5,272	+1,116.9
Opening of Ayurvedic dispensaries	number	22	60	+38	+172.7
Rural water supply to left-out habitations	number	10,196	3,000	-7,196	-70.6
Construction of housing units	number	8,216	54,036	+45,820	+557.7
Hand pumps installed	number	1,779	1,500	-279	-15.7

Source: Draft Eleventh Five Year Plan (2007-2012) and Annual Plan (2007/08), Planning Department, Himachal Pradesh

(3) Proposed Outlay for Eleventh Five Year Plan

Following the basic concept and the sector-wise physical targets, the proposed outlay for the Eleventh Five Year Plan works out to Rs.140 billion. Compared with the originally approved outlay for the previous Tenth Five Year Plan, the total amount increases by Rs.37 billion or 35.9%. The increased amount and rate against the accumulated Annual Plan Outlay for the Tenth Five Year Plan period are Rs.56,144.3 million and 67.0%, respectively, and the priority is put on transport & communication, water supply/sewerage/housing/urban development, irrigation & flood control, and agriculture & allied services sectors in order on the allocated amount basis. Keeping the past enormous debt liabilities of the State in view, the limits of fiscal prudence for the State would be to not borrow more than 10% of its aggregate Plan size. This implies the need for total Central Assistance of Rs. 126 billion (90% of Rs. 140 billion) for an aggregate Eleventh Plan size of Rs. 140 billion in the State.

The sector-wise outlay proposed for the Eleventh Five Year Plan is as shown in Table A-2.3.

Table A-2.3 Sector-wise Outlay Proposed for Eleventh Five Year Plan

Sector	Proposed Outlay for Eleventh Five Year Plan (x 10 million)	Comparison with Outlay for Tenth Five Year Plan			
		Originally Approved Amount (x 10 million)	Rate of Change (%)	Actually Accumulated Amount* (x 10 million)	Rate of Change (%)
Agriculture & Allied Services	1,493.77	1,201.69	+24.3	868.70	+72.0
Rural Development	361.35	415.49	-13.0	258.37	39.9
Special Area Program	20.80	20.80	0.0	35.60	-41.6
Irrigation & Flood Control	1,240.29	453.17	173.7	538.64	130.3
Energy	1,140.22	1,257.68	-9.3	872.37	30.7
Industry & Minerals	180.54	104.73	72.4	71.94	151.0
Transport & Communication	2,176.85	1,638.05	32.9	1,313.41	65.7
Science, Technology & Environment	2.97	6.42	-53.7	3.79	-21.6
General Economic Services	811.46	223.74	262.7	399.55	103.1
Education	1,706.94	2,732.66	-37.5	1,168.50	46.1
Health	1,468.48	787.72	86.4	907.60	61.8
Water Supply, Sewerage, Housing & Urban Development	2,159.47	995.90	116.8	1,382.69	56.2
Social Services	823.05	377.20	118.2	396.90	107.4
General Services	413.81	84.75	388.3	192.72	114.7
Total	14,000.00	10,300.00	35.9	8,286.38	690

Source: Draft Eleventh Five Year Plan (2007-2012) and Annual Plan (2007/08), Planning Department, Himachal Pradesh
Remarks: *: Accumulated amount of annually planned outlay amount for 5 years (2002/03 – 2006/07)

A-2.2 Sector-wise Focal Points of Eleventh Five Year Plan of Himachal Pradesh

(1) Focal Points of Agriculture Sector

Eleven (11) priority areas given below in the agriculture sector are demarcated based on the Eleventh Five Year Plan of Himachal Pradesh, particularly focusing on diversification of area from traditional crops to commercial crops where irrigation potential has been created.

- 1) Diversification of area from traditional crops to commercial crops where irrigation potential has been created. The farmers shall be motivated to produce organic vegetables without the use of pesticide and chemical fertilizer;
- 2) Development of rainfed areas through watershed approach on a large scale for efficient use of natural resources. Increased funding shall be arranged under Rural Infrastructure Development Fund;
- 3) Rainwater harvesting is another measure, which will not only provide life saving irrigation to the crops but shall also recharge the groundwater and check erosion. The Department of Agriculture shall seek financial assistance from Government of India for small irrigation tanks/shallow wells and pumping set;
- 4) Increase in maize productivity through high yielding hybrids;
- 5) Organic farming shall be the trust area;
- 6) Post harvesting and efficient marketing system;
- 7) Farm mechanization with special reference to hill agriculture shall be given major trust in the years to come. This is necessary to reduce cost of cultivation in view high cost of labour. The Department has already constituted a Technical Working Group to identify new farm implements and machinery, which can be introduced in the State;

- 8) A strong research extension interface directed towards problems oriented research programmes. Research projects to be identified and funded in problem areas;
- 9) Extension reforms through public-private partnership;
- 10) Agro processing and value addition; and
- 11) Increase in productivity and quality.

In general, all the on-going programs and projects in the Tenth Five Year Plan will be continuously implemented during the Eleventh Five Year Plan period. In addition, two new schemes will be taken up focusing on integrated cropping system approach under different agro-climatic zones, and support to farm mechanization and seed storage facility.

Table A-2.4 shows the prospected physical targets the Eleventh Five Year Plan in terms of cropped area and crop production of food grains as well as commercial crops.

Table A-2.4 Prospected Physical Targets of Food Grains and Vegetables for Eleventh Five Year Plan

Category	Cropping Season	Crop	Cropped Area			Crop Production		
			Prospected Target (‘000 ha)	Change based on Tenth Five Year Plan		Prospected Target (‘000 tons)	Change based on Tenth Five Year Plan	
				(‘000 ha)	(%)		(‘000 tons)	(%)
Food Grains	Kharif	Paddy	75.00	-1.00	-1.3	140.00	-22.00	-13.6
		Maize	295.00	-7.00	-2.3	795.00	-100.00	-11.2
		Ragi	2.50	-0.50	-16.7	4.50	0.00	0.0
		Millet	8.00	-2.00	-20.0	7.50	-3.00	-28.6
		Pulses	28.00	-7.00	-20.0	12.00	-16.00	-57.1
		Total	408.50	-17.50	-4.1	959.00	-141.00	-12.8
	Rabi	Wheat	358.00	-3.00	-0.8	690.00	-21.00	-2.9
		Barley	22.00	-1.00	-4.3	41.00	-5.00	-10.9
		Gram	3.00	-1.00	-25.0	4.50	-2.50	-35.7
		Pulses	6.00	-2.00	-25.0	5.50	-5.50	-50.0
	Total	389.00	-7.00	-1.8	741.00	-34.00	-4.4	
	Grand Total	797.50	-24.50	-3.0	1,700.00	-175.00	-9.3	
Commercial Crops (Kharif & Rabi)	Potato	14.00	0.00	0.0	180.00	+5.00	+2.9	
	<u>Vegetables</u>	<u>65.00</u>	<u>+15.00</u>	<u>+30.0</u>	<u>1,300.00</u>	<u>+300.00</u>	<u>+30.0</u>	
	Ginger	5.00	0.00	0.0	70.00	0.00	0.0	

Source: Draft Eleventh Five Year Plan 2007-2012 and Annual Plan (2007/08), Planning Department, Himachal Pradesh

It is understood from the above table that 15,000 ha for food grain cultivation will be converted for vegetable cultivation in accordance with the diversification policy in the Eleventh Five Year Plan.

From the proposed outlay for the Eleventh Five Year Plan, a total of Rs.735.1 million is allocated to crop husbandry programs and schemes, while another Rs.943.3 million is shared out for soil and water conservation programs and schemes.

(2) Focal Points of Horticulture Sector

The horticulture sector in Himachal Pradesh has a highly comparative advantage under the mountainous environment to play an important role in providing nutritional foods to the people in the country, although it is featured by ecological fragility and inaccessibility. Taking into account such advantage and weak point, the following strategy is mapped out for the Eleventh Five Year Plan:

- a. Development of modern facilities for the propagation of plant materials to the farmers through introduction of improved genome and plasma technology from abroad and identification of the plant materials of outstanding merits from within and outside of the

State and its mortification;

- b. Improvement of water management through scientific method of on-farm water harvesting, conservation and application for making best use of scarce water resources by means of micro irrigation techniques for the improvement of horticulture productivity;
- c. Integrated nutrition management with emphasis on need based application of fertilizer for maintenance of soil productivity;
- d. Implementation of program for pest and weather forecasting;
- e. Diversification of horticulture with grater emphasis on planting of nut crops, olive, cherry, pear, small fruits and others as well as cultivation of medical and aromatic plants in farmers' fields;
- f. Utilization of IT as an important tool for horticulture extension, dissemination of technical know-how and market information;
- g. Utilization of protected cultivation (cultivation in greenhouse, net house, etc) of flower and high value horticulture crops like strawberries; and
- h. Development of horticulture crops especially for fruit processing like wine varieties of grapes, cider varieties of apples, apple varieties of juice making and so on.

Table A-2.5 shows the prospected physical targets of fruit planted area and production for the Eleventh Five Year Plan.

Table A-2.5 Prospected Physical Targets of Fruits for Eleventh Five Year Plan

Crop	Planted Area			Fruit Production		
	Prospected Target	Change based on Tenth Five Year Plan		Prospected Target	Change based on Tenth Five Year Plan	
	('000 ha)	('000 ha)	(%)	('000 tons)	('000 tons)	(%)
Apple	99.00	-1.72	-1.7	578.40	+110.60	+19.1
Other temperate fruits	27.80	-8.36	-23.1	80.60	+54.23	+205.7
Nuts and dry fruits	18.46	-5.96	-32.3	4.70	+0.21	+4.7
Citrus fruits	42.77	-19.57	-45.8	37.20	+51.73	+268.9
Other tropical fruits	46.92	+8.58	+18.3	94.50	+65.33	+224.0
Total	245.03	-27.03	-11.0	906.00	+248.33	+37.8

Source: Draft Eleventh Five Year Plan 2007-2012 and Annual Plan (2007/08), Planning Department, Himachal Pradesh

In order to attain the above, the prospected targets of other items work out as follows:

- a. Area based physical targets are prospected at 20,000 ha for the additional area brought under fruit production and 10,000 ha for the area brought under re-plantation, both having the same target for the Tenth Five Year Plan. The prospected target areas brought under fruit trees apart from apple are 55,000 ha under mango and lichi including 1,000 ha under in-situ plantation of mango, 6,000 ha under walnut/picannut, 80 ha under hops and 15 ha under olive, all of which are set up at higher levels compared with the previous ones under the Tenth Five Year Plan;
- b. The prospected target of fruit plant distribution is set up at 10.0 million;
- c. The physical target of fruit processed products is prospected to be 1,000 tons for the Processing Unit under Department of Horticulture and 250 tons for community centres;

- d. The physical targets of specific crop development activities other than fruits work out 500 ha for floriculture, 6,000 tons for mushrooms production, and 5,000 bee colonies to be distributed and 1,500 tons for honey production; and
- e. Area based physical targets for cultivation of forest resource based plants are mapped out at 200 ha each for medical and aromatic plants.

With regard to medicinal and aromatic plants, the Medical Plants Policy 2006 was issued by the Department of Forestry aiming to highlight the concerns related to medical plants growing in forests and set comprehensive programs in motion for a long term development. At present, three different agencies in the State are involved in this new field, which are Department of Forestry, Department of Horticulture and Ayurveda Directorate Himachal Pradesh under National Medical Plant Board, while there is no effective coordination among these agencies concerned focusing on establishment of a policy linkage to formulate and implement programs and plans in terms of medial and aromatic plants in Himachal Pradesh.

Although the Department of Horticulture has mapped out the following strategies for promoting cultivation of medical and aromatic plants on farmers' fields, a detailed scheme aiming at implementation of medical and aromatic crop planting is yet under formulation;

- a. To establish demonstration farms for the collection and multiplication of medical and aromatic plants for supply to the farmers;
- b. To demonstrate the technology in the cultivation of medical and aromatic plants on farmers' fields;
- c. To provide incentives to the farmers for increasing the production of medical and aromatic plants in the State for providing raw materials to the pharmaceutical and cosmetic industries; and
- d. To supplement the farm income of the farmers for their upliftment.

From the proposed outlay for the Eleventh Five Year Plan, a total of Rs.431.6 million is allocated to programs and schemes in the horticulture sector.

(3) Focal Points of Animal Husbandry Sector

The most important objectives of the animal husbandry sector in Himachal Pradesh are: a) breeding policy focusing on cross breeding of cattle with Jersey to maintain exotic inheritance at 50%, up gradation of Murrah buffalo to maintain Murrah inheritance up to 75%, and cross breeding of sheep with Rambouillet and Russian Merino to maintain exotic inheritance at 75%; b) artificial insemination in cow and buffaloes; c) castration; d) vaccination against contagious diseases; e) drenching/dipping of sheep; f) fodder plants, roots and seed distribution; g) backyard poultry farming; h) organization of infertility camps; i) distribution of rams; and j) increase in livestock productivity.

To attain the physical targets of the Eleventh Five Year Plan as shown in Table A-2.6, a total of Rs.1,143.2 million is allotted to animal husbandry programs and further Rs.51.8 million is distributed to dairy production. Milk and egg production is stressed in the eleventh plan.

Table A-2.6 Prospected Physical Targets of Livestock and Fish Production for Eleventh Five Year Plan

Item	Animal Husbandry				Item	Fishery			
	Unit	Prospected Target	Increase from			Unit	Prospected Target	Increase from	
			Tenth 5-Year Plan	%				Tenth 5-Year Plan	%
Milk	1,000 tons	920	+80	+9.5	Fish	1,000 tons	40	+25	+167
Eggs	Million	109	+10	+9.1	Carp seed	Million.	100	+50	+100
Wool	1,000 kg	1,675	+25	+1.5	Trout ova	1,000	1,000	-1,000	-50

Source: Draft Eleventh Five Year Plan 2007-2012 and Annual Plan (2007/08), Planning Department, Himachal Pradesh

(4) Focal Points of Fishery Sector

The objectives for the Eleventh Five Year Plan set up by the Department of Fishery are: a) to generate employment opportunity in the fishery sector and ameliorate the condition of fishermen; b) to enhance fish seed production of carp and other hill fishes in government and private fish farms; c) to initiate suitable incentives including subsidy-oriented schemes for private entrepreneurs in order to set up fish farms/hatcheries/feed mill with the ultimate aim of raising fish production to 1,000 tons; d) to strengthen aquaculture promotion programs; e) to implement large scale seed stocking programs in rivers/streams; f) to protect and conserve reservoir and lacustrine fisheries resources; g) to promote game fishery with particular emphasis on commercial farming of trout; and h) to encourage habitat restoration and management of riverine fisheries.

To attain the physical targets of the Eleventh Five Year Plan as shown in Table 2.6, a total of Rs.159.5 million is allocated. Carp production is stressed in the eleventh plan.

(5) Focal Points of Irrigation Sector

The main objectives of the irrigation sector under the Eleventh Five Year Plan are:

- To speed up completion of ongoing irrigation projects;
- To bring additional 98,000 ha under irrigation;
- To bridge the existing gap between irrigation potential already created and its actual utilization; and
- To tap all sources of water and to construct water harvesting structures.

The physical targets set up by the Department of Irrigation and Public Health (DOIPH) and the Department of Agriculture (DOA) for the Eleventh Five Year Plan are summarized in Table A-2.7.

Table A-2.7 Prospected Physical Targets of Irrigation Schemes under Eleventh Five Year Plan

Scheme	Executing Agency	Prospected Target (ha)	Increase from Tenth Five Year Plan	
			(ha)	(%)
Major and Medium Irrigation	DOIPH	16,000	+8,000	+100
Minor Irrigation	DOIPH	15,000	+5,000	+50
Command Area Development (Field Channel)	DOIPH	7,500	+4,500	+150
Command Area Development (Warabandi)	DOIPH	7,500	+4,500	+150
Soil and Water Conservation	DOA	18,000	-4,500	-20

Source: Draft Eleventh Five Year Plan 2007-2012 and Annual Plan (2007/08), Planning Department, Himachal Pradesh Remarks: (Warabandi); system improvement for rotational irrigation

To realize such big physical targets of the Eleventh Five Year Plan, a total of Rs.11,105.4 million is allotted to DOIPH, comprising Rs.2,770.7 million for major and medium irrigation schemes, Rs.8,100.5 million for minor irrigation schemes and Rs.234.2 million for command area development

schemes. Rs 943.3 million is allotted to soil and water conservation schemes of DOA.

From the above target development area and allocated budget including recurrent administration cost, it is understood that average unit cost per development area by DOIPH is approximately 173,200 Rs/ha for major and medium schemes, 540,000 Rs/ha for minor schemes, and 15,600 Rs/ha for command area development. Generally, minor irrigation scheme is more costly than larger scale irrigation scheme probably due to steep topography in the State. On the other hand, the unit cost for water conservation schemes by DOA is 52,400 Rs/ha approximately.

(6) Agricultural Infrastructure

The Department of Public Works puts its emphasis on acceleration of improvement of road connectivity in remote parts of the State coupled with the upgrading of existing National and State Highway networks to support exploitation of development potential in agriculture, horticulture, tourism, industry and hydro-power generation. The physical targets prospected are: a) motorable road of 13,077 km; b) village access road of about 5,500 km; and c) upgrading and periodical renewal of the existing road of 3,330 km. The outlay allocated to road sector for the Eleventh Five Year Plan period amounts to Rs.19,519.7 million.

A-3 Hilly States in India

The geo-morphology and climatic conditions of India are extremely diverse, it varies from the snow capped mountains of the Himalayas to hot and cold deserts, including in its breadth vast coastal areas and wide plains. Although administratively Indian States can be divided into five zones of the East, North, South, West and the Northeast, geographically one can also divide Indian States and Union Territories into the 11 Himalayan States or Hilly States, 13 Coastal States Himachal Pradesh and the other being essentially plain areas¹.

The 11 Hilly States of the Himalayas are all designated as the 'special category States'. These include the States of Himachal Pradesh, Jammu & Kashmir, the newly formed State of Uttarakhand and the States of the North East- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Special category states are those having characteristics like strategic border locations, hilly terrain, inadequate infrastructure, large tribal population and limited resource bases compared to development needs and therefore are comparable with each other in terms of their socio-economic trends and development needs. These states, having comparative disadvantage of mobilising additional resources that limited the States ability to develop a robust economic base, have been recipient of Special Central Assistance that supports the growth and development of the State. Consequent to their constrained potential for economic development the Hill States are among some of the poorest States of India.

When compared to the Hill States, especially the Northeast States, Himachal Pradesh is considered 'unique' and as an example to the other Hill States. This is primarily because despite starting out with the same disadvantages as the other Hill States, it has shown remarkable achievement in terms of sustained growth and human development. As the recent World Bank States- 'HP is unique state in many respects-most importantly because of the enormous success it has achieved over the past three decades, despite severe structural disadvantages of relative remoteness, environmental, fragility, and

¹ The division is extremely broad and not necessarily scientific.

difficult hilly terrain, characteristic of Himalayan states in India².

Having achieved full Statehood in as late as 1971, Himachal Pradesh, after the initial slow growth of the 1970s and 1980s, has social indices and economic growth far exceed the other Hill States.

Table A-3.1 Indicators of Development of the 11 Hill States of the Himalayas

States	Population ³ (million)	Literacy ⁴ (%)	Human Development Index ⁵ (full: 1.0)	Poverty ⁶ (Population BPL) (%)	Per Capita Income ⁷ (Rupees)
Arunachal Pradesh	1.09	54.74	0.51 ⁸	33.47	22,542
Assam	26.64	64.28	0.40	36.09	16,825
Himachal Pradesh ⁹	6.08	75.91	0.46 ¹⁰	10.0 (BPL- 23.8%)	31,140
Jammu & Kashmir	10.07	54.46	0.40 ¹¹	3.48	18,630
Manipur	2.39	68.87	0.53	28.54	18,368
Meghalaya	2.31	63.31	0.36	33.87	21,915
Mizoram	0.89	88.49	0.59 ¹²	19.47	22,417
Nagaland	1.99	67.11	0.62 ¹³	32.67	20,998
Sikkim	0.54	69.68	0.53 ¹⁴	36.55	23,791
Tripura	3.19	73.66	0.59	34.44	22,836
Uttarakhand	8.48	71.6 ¹⁵	Not calculated yet	39.6 ¹⁶	22,093

Since 1990s the State has achieved remarkable development progress and its success can be attributed largely to the following factors;

- a) Unlike the Northeast and Jammu & Kashmir which are marred by insurgency, violence, terrorism and political unrest, Himachal Pradesh has been mostly a peaceful State.
- b) It has had the advantage of having a relatively Stable, people friendly and committed government which has always supported the power at the Centre and has commendably implemented the various economic and infrastructural schemes with supportive policy and peoples participation
- c) It has through the 1980s and 1990s has successfully invested and thus developed a relatively well developed infrastructure facilities in the State. Although rural connectivity still needs to be developed adequately, most of the part of the State is connected and electrification of the State is almost 100%
- d) Its political commitment to the economic enhancement of the State is evident from the fact that over the past decade it has successfully restructured economy to reduce the share of the primary sector

² Accelerating Development and Sustaining Success in a Hill State, World Bank 2007, p i

³ Source: Census 2001, Government of India

⁴ National Human Development Report 2001

⁵ The latest HDI for Manipur and Meghalaya has not been calculated. This data is derived from the HDI 1991 in the National Human Development Report

⁶ Number and Percentage of Population below Poverty Line 1999-2000: Planning Commission of India, Government of India

⁷ Source For Sl. No.1-32—Directorate of Economics & Statistics of Respective State Governments, and for All-India-Central Statistical Organisation; This is calculated for the year 2004-2005

⁸ Arunachal Human Development Report, 2005. Govt. of Arunachal Pradesh

⁹ Sources: ICIMOD & CSKHPAU, 2006, 'Developing Himachal Pradesh Agricultural Systems: Information Files (HASIF) and Tools for Decision Support Systems for Niche Based Hill Farming.; Planning Commission 2005, Himachal Pradesh Development Report' Government of India, UNDP, 2002, Himachal Pradesh Human Development Report, UNDP, New Delhi.

¹⁰ Himachal Pradesh Human Development Report 2002, Govt of Himachal Pradesh

¹¹ National Human Development Report 2001; HDI for J&K is for 1991

¹² Tripura Human Development Report 2007

¹³ Nagaland Human Development Report, 2004, Government of Nagaland

¹⁴ Sikkim Human Development Report, 2001, Govt. of Sikkim. The HDI is for the year 1998

¹⁵ Directorate of Economic and Statistics, Uttarakhand, <http://gov.ua.nic/uaglance/>

¹⁶ Planning Document, Govt of Uttarakhand.: <http://www.gov.ua.nic.in>

(mostly traditional agriculture) from almost 50% to the GSDP to a mere 20% and increased its contribution of the tertiary sector to over 40%.

- e) It is the second most transparent government of the Country and has high level of social cohesion among its people.
- f) It has effectively delivered on most investment initiatives in the State including the on-going investments in the power sector and therefore it offers a good investment climate for any initiative.

Enhancing farm income through diversified agriculture in the State is highly desirable in terms of its wide ranging impact on the other Hill States, the specific advantages the State has on developing its potential and for ensuring the minimum food security needs of the majority of its rural population. The following are some of the factors which necessitate the proposed program

- a) Himachal Pradesh has a particularly advantageous bio-geographical variation (altitude approx. EL:300-7,000m) making it advantageous for creating a niche for off-season vegetables.
- b) Unlike the other Hill States of India, it has a politically stable climate and a responsible government which has effectively been able to enhance the socio-economic development of the State.
- c) Diversification of agriculture is an important for sustaining the economic success of the state and for contributing towards the fiscal self sufficiency of the State as well as generating employment for its large number of its rural people.
- d) While similar, the lack of infrastructure and unstable political climate make it unviable to undertake the much needed project in other Hill States. However the successful implementation of the project in Himachal Pradesh can serve as an good example and offer lessons to these other States.
- e) Will enhance the food security and reduce the vulnerability of the marginal farmers of the State.
- f) The State of Himachal not only has the needed infrastructure for undertaking the Project (in terms of availability of universities, good peoples participation, better road connectivity and other social indicators) but also the political will-as reflected in the Departmental Vision of Agriculture.

The potential of undertaking the diversified agriculture plan in Uttarakhand the neighbouring state of Himachal Pradesh is less advantageous for the following reasons;

- a) Being formed in 2000, it is a younger state and is still in the process of consolidating its administrative systems and infrastructure development.
- b) The State currently faces a shortage of manpower
- c) Its diversification to vegetable is still at a very nascent stage (except potato) and thus may require much more investment of time and resources to be able to take full advantage of the proposed programme.

Following the national crop diversification policy stipulated in Eleventh Five Year Plan (2007/08-2011/12) and the above situation of Hill States in India, Himachal Pradesh State will be the most suitable state at present to implement the national diversification policy as a pilot hill state among 11 Hill States in India.

Table A-3.2 Indices for the Suitability of the Project in Himachal Pradesh as Compared other Hill States

States	Year of Formation	Altitudinal Variation (meters)	Vegetable Production ¹⁷ (metric tonne)	Road Density ¹⁸ (1,000 km ²)	Political Environment/ Security	Agricultural Institute/university ¹⁹
Arunachal Pradesh	1948	200-4,500	78.8	168	Politically Sensitive and spill over tension of the insurgency trouble in Nagaland. Indigenous insurgent groups are resurfacing.	NRC for Yak
Assam	1947	50-400	2020.4	872	Insurgency, Separatist Movement is strong.	1 University,
<u>Himachal Pradesh</u> ²⁰	<u>1971</u>	<u>300-7,000</u>	<u>1013.5</u>	<u>542</u>	<u>Steady and Peaceful</u>	<u>2 Universities, CPRI, NRC for Mushroom</u>
Jammu & Kashmir	1948	300-8,500	843.0	97	Politically Unsteady and Unsafe	1 University , Central Institute of Temperate Horticulture,
Manipur	1972	800-3,000	86.0	490	Insurgency present	1 University,
Meghalaya	1972	150-2,000	270.5	378	Internal tribal conflicts. Criminal and extortionist activities high	I CAR Research Complex for North-East Hill Region
Mizoram	1987	50-1,500	24.0	229	Relatively more peaceful but activities of Separatist group resurfacing	None
Nagaland	1963	200-2,000	88.1	1107	Insurgency present	NRC for Mithun
Sikkim	1975	300-7,000	76.5	258	Spill over trouble from neighbouring states but relatively peaceful. Insurgency present	NRC for Orchids
Tripura	1949	15-1,000	373.4	1405	Separatist / insurgency movement has come down but still simmering	None
Uttarakhand	2000	150-4,000	951.8	520 ²¹	Mostly peaceful except for vulnerable security situation	1 University, NRC for Cold Water Fisheries, Research Institute for Mountain Farming

¹⁷ Source: Vegetable Production in India (2004-2005): Indian Horticulture Data Base, National Horticulture Board.

¹⁸ Source: Himachal Development Report 2005, Planning Commission, Government of India p 431.

¹⁹ These are recognised institutes, research centres and universities under the Indian Council for Agricultural Research. NRC: National Research Centre

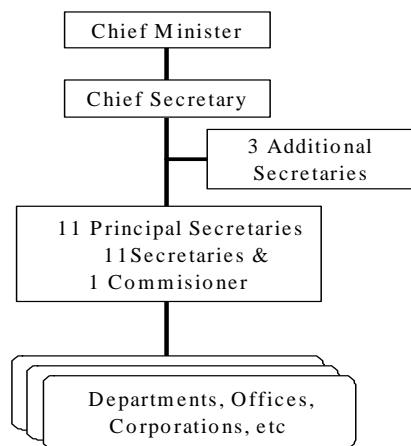
²⁰ Sources: ICIMOD & CSKHPAU, 2006, 'Developing Himachal Pradesh Agricultural Systems: Information Files (HASIF) and Tools for Decision Support Systems for Niche Based Hill Farming.:', Planning Commission 2005, Himachal Pradesh Development Report' Government of India, UNDP, 2002, Himachal Pradesh Human Development Report, UNDP, New Delhi.

²¹ Department of Public Works, Govt of Uttarakhand

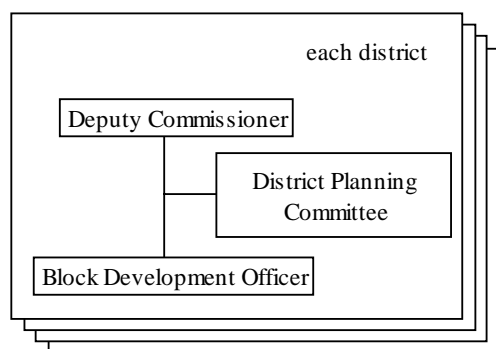
A-4 Administrative and Social Conditions

A-4.1 Administrative Structure

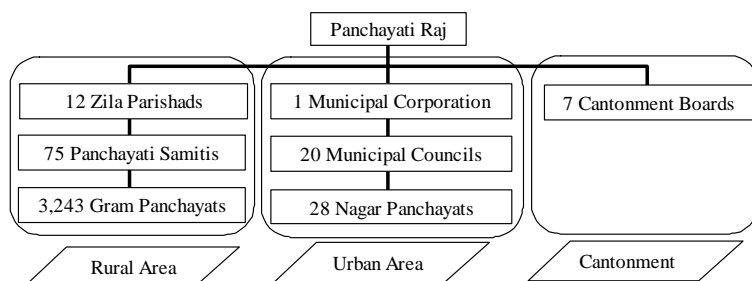
The Himachal Pradesh State Government led by the Chief Minister is formed by the Council of Ministers in which 10 ministers are presently appointed. The 10 ministers of the Council are Chief Minister, Public Works, Education, Forest, Irrigation & Public Health, Transport, Horticulture, Food· Civil Supplies & Consumers Affairs, Health & Family Welfare and Social Justice & Empowerment. Each minister holds several additional charges apart from its designation.



Under the Council of Ministers, senior Administrative Officers are posted in the State Government Secretariat as the top officers who are responsible for covering specific parts of the State Government's administration. They are composed of one Chief Secretary, one 3 Additional Chief Secretaries, 11 principal secretaries, 11 secretaries and one financial commissioner. To carry out the state-wise administration in Himachal Pradesh, the State Government organizes 36 Departments, 4 Courts, 17 State-owned Corporations, 8 Boards, 14 education institutions and others.



At present, the State administratively consists of 12 districts, 52 sub-districts, and 109 tehsils and sub-tehsils, while the State is divided into 75 development blocks for development planning purpose. The State Government appoints 12 Deputy Commissioners who are responsible for managing District Planning Committees and monitoring performance of decentralized administrative activities on the grass-roots basis in the respective Districts. Under the Deputy Commissioner, a Block Development Officer is assigned to each of 75 development blocks and delegated to conduct development planning works of economic activities within the concerned block.



Along with the national decentralization policy, three tier Panchayati Raj structures are presently functioning. (*Panchayat: autonomous community group with governmental subsidy*).

The present functioning ones are 12 Zila Parishads, 75 Panchayat Samitis and 3,243 Gram Panchayats on the rural side, 1 Municipal Corporation, 20 Municipal Councils and 28 Nagar Panchayats on the urban side, and 7 Cantonment Boards.

Table A-4.1 shows physiographical areas of 12 Districts in Himachal Pradesh as well as district-wise distribution of 75 development blocks and 3,243 Gram Panchayats.

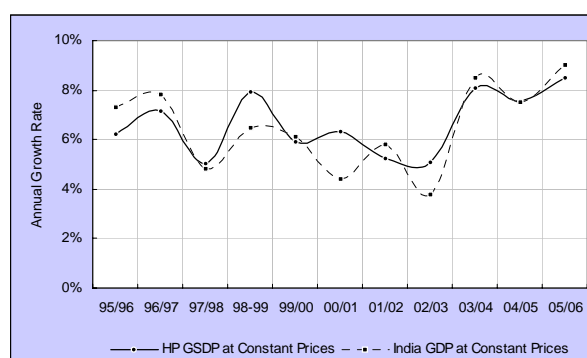
Table A-4.1 Physiographical Area, Development Blocks and Gram Panchayats by District

District	Area (sq. km)	No. of Develop. Block	No. of Gram Panchayat	District	Area (sq. km)	No. of Develop. Block	No. of Gram Panchayat
Bilaspur	1,167	3	151	Lahaul-Spiti	13,835	2	41
Chamba	6,528	7	283	Mandi	3,950	10	473
Hamirpur	1,118	6	229	Shimla	5,131	9	363
Kangra	5,739	14	760	Sirmaur	2,825	6	228
Kinnaur	6,401	3	65	Solan	1,936	5	211
Kullu	5,503	5	204	Una	1,540	5	235

Source: Statistics and data, Planning Department, Himachal Pradesh

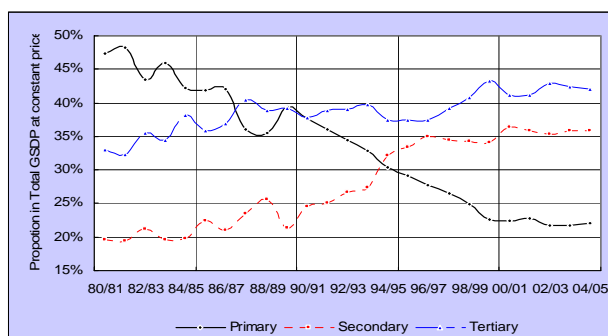
A-4.2 Economic Situation of the State

During the period from 1995/96 to 2006/07, the real Gross State Domestic Products (GSDP) of the State, expressed at constant price of 1993/94, showed the favourable growth at the average rate of 6.8% per annum, ranging from the lowest of 5.0% per annum in 1997/98 to the highest of 8.5% in 2005/06. This economic growth rate is almost same as that of the all India's rate, as shown in the right figure. Under such economic situation, the per capita income of the State has reached to Rs.33,800 (US\$760) in 2005/06, slightly higher than the national average of Rs.32,000 (US\$720).



Source: Statistical Outline, Economic & Statistical Dept, Himachal Pradesh

Fig. A-4.1 Economic Growth Rate of State & All India

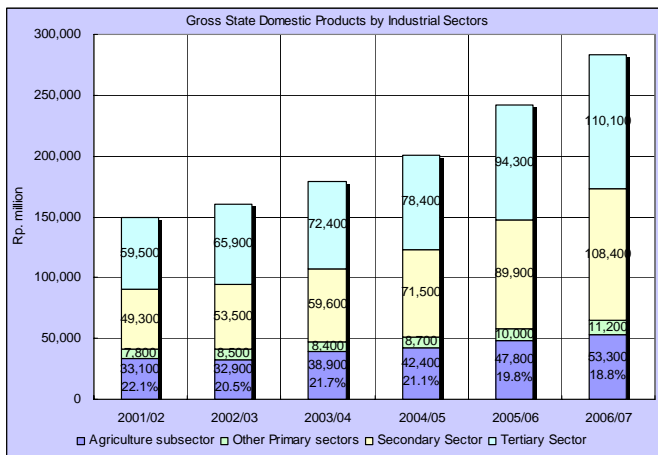


Source: Economic Survey, Economic & Statistical Dept, Himachal Pradesh.

Fig. A-4.2 Proportion of Real GSDP by Sector

Out of these sectors, 77% of the State GSDP is derived from the secondary and tertiary sectors in 2006/7, and the primary sector contributes about 23%. The primary sector has been decreasing its share in the total GSDP from 45% in early 1980s, 30% in mid 1990s, and to 22% in 2004/05, as shown in the left figure.

The economic sectors are generally categorized into three sectors of the primary, secondary and tertiary. The primary sector includes the sub-sectors of agriculture, forestry, fishery and mining & quarrying. The secondary sector contains the manufacturing, construction, and electricity/gas/water supply. The tertiary sector involves transport, communication, trade, finance, real estate, and services.

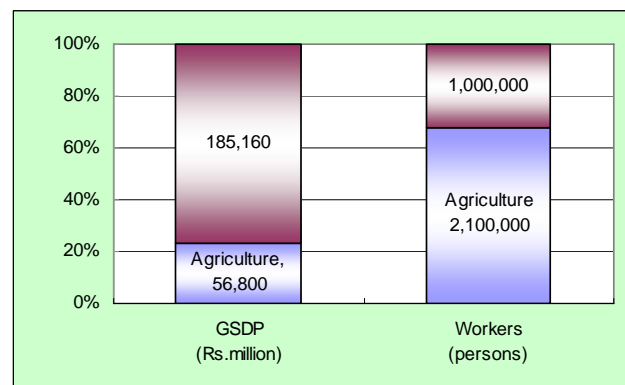


Source: Economic Survey and Economic Abstract, Economic & Statistical Dept, Himachal Pradesh.

Fig. A-4.3 Nominal GSDP by Sector from 2001/02 to 2006/07

households. These households are directly or indirectly engaged in the agriculture, and about 2 million of farm employment or 68% of total workers in the state are working in the State.

Based on the nominal GSDP and total number of the workers, the GSDP per worker is estimated at Rs.73,300 on average, with large gap among the industrial sectors, Rs.25,800 per worker (of which 95% are the cultivators) in the agriculture sector and Rs.168,000 in other sectors. In order to fill this gap, agricultural and development is required, particularly, for farm income generation by producing and selling the higher value added.



Source: Statistical Outline 2006-07, and Economic Survey and Economic Abstract, Economic & Statistical Dept, Himachal Pradesh.

Fig. A-4.4 GSDP per Worker and Workers by Sector

A-4.3 Fiscal Management of State Government

Himachal Pradesh has been a 'special category state' ever since the State was conferred statehood in 1971 and its financial viability has been dependent on transfers from the Central Government. The State Government has put forth more efforts to increase its financial sources through direct and indirect taxes, non-tax revenue, share of central taxes and grants-in-aid from the Central Government to meet the expenditure on administration and development activities as well as to reduce interest payments.

The tax and non-tax revenues, as a result, have been increased and recorded the highest amount in 2005/06 and the chronic revenue deficit has been reduced to the minimum level as shown in Table A-4.2.

Table A-4.2 Financial Status of Himachal Pradesh State

Revenue & Capital Item	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
1. Revenue Receipts (= a + b + c)	3,046	3,716	3,659	3,981	4,636	6,333
a. Tax Revenue	1,059	1,241	1,235	1,434	1,789	1,913
b. Non-tax Revenue	177	198	175	292	611	626
c. Grants-in-aid by Central Government	1,810	2,277	2,249	2,255	2,235	3,794
2. Revenue Expenditure (including a.)	4,376	4,576	5,141	5,588	5,793	6,427
a. Interest payments	798	1,042	1,172	1,472	1,649	1,669
3. Net Revenue Surplus/Deficit (= 1-2)	-1,330	-860	-1,482	-1,607	-1,158	-94
4. Capital Receipts (= a + b + c)	3,927	4,366	5,817	7,036	5,600	2,543
a. Recovery of loans	27	29	29	28	26	29
b. Other receipts	765	-66	846	371	999	413
c. Borrowings & liabilities	3,135	4,403	4,942	6,637	4,575	2,101
5. Capital Expenditure	2,532	3,659	4,315	5,534	4,235	2,302
6. Net Capital Surplus/Deficit (= 4-5)	1,395	707	1,502	1,502	1,365	241
7. Total Net Revenue&Capital (= 3+6)	65	-153	20	105	207	147
8. Total Expenditure (= 2 + 5)	6,909	8,235	9,456	11,122	10,028	8,729
a. Plan expenditure	1,875	1,866	2,276	1,639	1,591	1,946
b. Non-plan expenditure	5,033	6,369	7,180	9,483	8,437	6,783

Source: Economic Survey Himachal Pradesh 2004-05, 2005-06 & 2006-07

The capital receipts include market borrowings with higher interest rates and negotiated loans which are normally to be utilised to meet expenditure for creation of assets and development purpose, but a part of the capital expenditure was used for the revenue expenditure in the past.

However, the State has started to improve this past chronic situation to more sound financial one since 2005/06 as given in Table A-4.2.

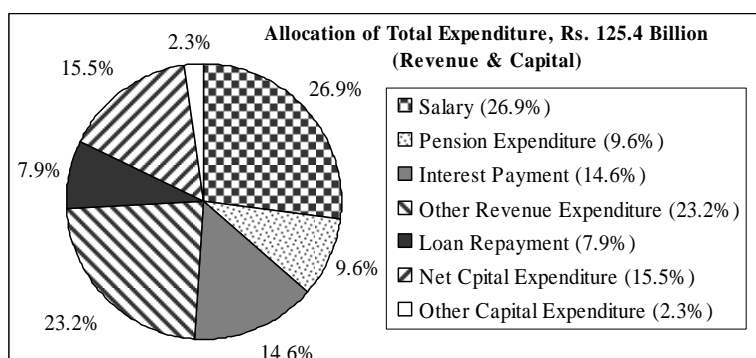


Fig. A-4.5 Allocation of Expenditure in 2008/09 Outlay

Allocation of the Budget 2008/09 is given in Fig. A-4.5 based on the Finance Minister's speech on March 7, 2008. Total expenditure is Rs. 125.42 billion and net capital expenditure is Rs. 19.31 billion. Interest payment and loan repayment amount to Rs 28.26 million or 22.5 % of the total expenditure.

A-4.4 Population and Employment

The 2001 Population Census reveals that the population of Himachal Pradesh was 6,078 thousand in total, comprising 3,088 thousand males and 2,990 thousand females. Of these, 5,482 thousand persons or 90.2% lived in 17,945 inhabited villages, while only 596 thousand persons or 9.8% were residents in urban areas. The working age population from 15 to 59 years old was 3,519 thousand with the share of 57.9%, while younger population of 7 to 14 years old was 1,118 thousand persons or 18.4% followed by child population of 769 thousand persons or 12.7% and aged population of 607 thousand persons or 10.0%. The compounded growth of population per annum in the State between 1991 and 2001 was 1.75%.

In Himachal Pradesh, there were 1,502 thousand scheduled castes and 245 thousand scheduled tribes sharing 24.7% and 4.0% of the total population of 2001, respectively. The total number of households in 2001 was 1,240,633, and the average family size in Himachal Pradesh was 4.9 persons.

According to the 2001 Population Census, the working population was 2,992 thousand in the State, out of which the total number of main workers was 1,964 thousand corresponding to 32.1% of the total

population, while marginal workers were 1,028 thousand or 16.9%. 2,049 thousand or 68.5% of the total working population were engaged in agriculture as cultivators and agriculture labourers, and the remaining 943 thousand worked in other economic sectors including 227 thousand of government employees. As the agriculture sector is absorbing majority of work force, the working population in urban areas of the State was only 220 thousand as of 2001. Salient features of district-wise demography based on the 2001 Population Census are summarized as shown in Table A-4.3.

The 2001 Population Census revealed that 68% of the total workers were engaged in agriculture. Even though almost 95% of agricultural workers possessed their own farm lands, 44% of them were forced to get non-agricultural job opportunities due mainly to climatic condition and small land holding size as shown in Table A-4.4.

Table A-4.3 Demographic Features of District

District	Total Population	Growth Rate (%)	No. of Scheduled		Total No. of Households	Agricultural Workers	Share* (%)
			Castes	Tribes			
Bilaspur	340,885	1.53	86,581	9,181	67,195	117,167	70.3
Chamba	460,887	1.71	92,339	117,569	87,699	169,245	73.4
Hamirpur	412,700	1.16	98,539	155	87,596	146,826	71.5
Kangra	1,339,080	1.4	279,540	1,597	272,697	374,891	63.6
Kinnaur	78,334	1.78	7,625	56,268	20,781	32,078	67.1
Kullu	381,571	2.56	107,897	11,351	78,362	170,236	78.6
Lahaul-Spiti	33,224	0.62	2,605	24,238	9,155	11,499	54.5
Mandi	901,344	1.61	261,233	10,564	186,571	335,990	74.0
Shimla	722,502	1.69	188,787	4,112	160,646	247,304	66.8
Simlaur	458,593	2.07	135,774	5,960	82,543	167,365	74.1
Solan	500,557	3.06	140,642	3,542	98,519	149,939	56.9
Una	448,273	1.84	100,588	51	88,869	126,501	62.7
Total of State	6,077,900	1.75	1,502,170	244,587	1,240,633	2,049,041	68.5

Note: *, Share of agricultural workers against total workers
Source: Fact Book on Mnpower, Planning Department, Himachal Pradesh State Government

Table A-4.4 Agricultural Workers of District

District	Total Workers	Agricultural Workers	Cultivators		Agric. Labourers		No. of Farm Households
			Min	Marginal	Min	Marginal	
Bilaspur	166,708	117,167	66,487	47,757	1,014	1,909	45,998
Chamba	230,452	169,245	72,827	94,763	667	988	63,859
Hamirpur	205,405	146,826	68,675	74,860	719	2,572	61,642
Kangra	588,994	374,891	144,834	190,523	11,266	28,268	169,111
Kinnaur	47,811	32,078	24,317	6,660	852	249	12,477
Kullu	216,513	170,236	120,959	43,687	3,008	2,582	60,074
Lahaul-Spiti	21,088	11,499	9,981	1,179	186	153	4,279
Mandi	454,292	335,990	163,760	165,712	1,442	5,076	133,462
Shimla	370,223	247,304	181,359	56,131	6,977	2,837	97,602
Simlaur	225,872	167,365	119,585	42,013	2,775	2,992	57,949
Solan	263,445	149,939	65,255	78,375	3,385	2,924	55,888
Una	201,658	126,501	51,085	64,086	3,865	7,465	53,202
Total of State	2,992,461	2,049,041	1,089,124	865,746	36,156	58,015	815,543

Source: Fact Book on Mnpower, Planning Department, Himachal Pradesh State Government

A-4.5 Land Resources and Land Utilization

From the land use viewpoint, Himachal Pradesh has three regional characteristics as follows:

- Southern part of the State is featured by intensively cultivated and moderately forested land covers with marginal presence of pasture and other grazing lands;
- Central part of the State is predominated by moderately cultivated and highly forested land covers with a considerable proportion of pasture and other grazing lands; and
- Northern part of the State is represented by poorly cultivated and sparsely forested land covers with a high proportion of pastures and other grazing land.

The spatial distribution of land cover types in Himachal Pradesh is summarized in Table A-4.5 and Fig. A-4.6

Table A-4.5 Distribution of Land Cover

Classification	Area (km ²)	(%)	Classification	Area (km ²)	(%)
Agriculture Cultivated Lands	7,306	13.1	Snow/Clouds	3,903	7.0
Alpine Forest - Alpine Meadows, Dry	2,476	4.4	Temperate Conifer Forest - Blue Pin	2,646	4.8
Glaciers	1,939	3.5	Temperate Conifer Forest - Deodar,	1,226	2.2
Grass and Shrub Lands	9,332	16.8	Temperate Mixed Forest - Mixed Blue	2,251	4.0
Lower Sub-alpine Forest -Fir Forest	1,435	2.6	Upper Sub-alpine Forest - Birch Blu	937	1.7
Lower subtropical forest	1,711	3.1	Upper subtropical forest	1,477	2.7
Lower tropical forest	50	0.1	Upper tropical forest	3,934	7.1
Rocks/Non-Vegetation	14,581	26.2	Water Body	469	0.8

Source: Agro-Ecological Zonation of Himachal Pradesh- Agricultural System Information Development at micro-level, Geo-Centre, CSK HPAU, Palampur (2006)

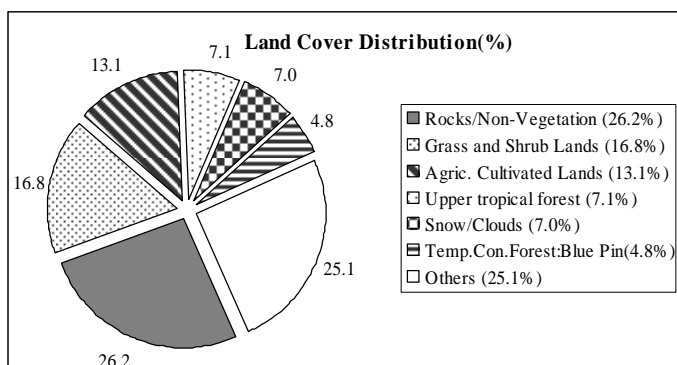


Fig. A-4.6 Distribution of Land Cover Classes in Himachal Pradesh

Land cover in the State is characterized by wide rock/non-vegetation, grass & shrub and forest which count 54.9 % of the State.

Agriculture cultivated land cover is only 13.1 % and limited to expansion drastically due to the State topography as well as from a view point of environmental conservation.

The forest area legally defined covering 37,033 km² in Himachal Pradesh is classified into the following groups from the five different viewpoints:

- Six groups based on legal status such as reserved forests of 1,896 km² or 5.1%, demarcated protected forests of 11,830 km² or 31.9%, un-demarcated protected forests of 21,213 km² or 57.3%, un-classed forests of 977 km² or 2.7%, other managed by Forest Department of 369 km² and not managed by Forest Department of 748 km² or 2.0%;
- Three groups based on ownership such as State owned forests of 35,916 km² or 97.0%, Cantonment & Municipal forests of 42 km² or 0.1% and private individual forests of 1,075 km² or 2.9%;
- Three groups based on crop composition such as coniferous of 9,002 km² or 24.3%, broad leaves/scrub of 7,306 km² or 19.9% and waste, blank/pasture of 20,663 km² or 55.8%;
- Two groups based on management status such as forest area covered by working plans of 24,909 km² or 67.3% and forest area not covered by working plans including alpine pastures and parts of un-demarcated protected forests of 12,124 km² or 32.7%; and
- Four groups based on density distribution of forests such as dense forests with crown density above 40% covering 8,976 km² or 24.2%, open forests with crown density between 10% and 40% extending over 5,377 km² or 14.6%, forest blanks with crown density less than 10% being 6,304 km² or 17.0% and uncultivable barren land including alpine pasture, snow covered area, etc. amounting to 16,376 km² or 44.2%.

A-4.6 Education and Literacy

By the decadal achievement of educational institutions through the State Government's continuous efforts, the literacy rate in Himachal Pradesh increased from 32.0% in 1971 to 42.5% in 1981, 63.9% in 1991 and 77.1% in 2001. As of March 2005, there were 10,651 primary schools, 2,199 middle schools, 949 high schools, 696 senior high schools and 41 colleges. In addition, 50 industrial training institutes and seven polytechnics provide young generation in the State with technical education opportunities. The enrolment rate in March 2005 was 100% at the primary school level and 93.4 % at the middle school level.

As a result of the above efforts, the overall literacy rate in Himachal Pradesh achieved to higher level of 76.5% than the country average of 65.4% in 2001, and it was improved by 34.0% for the period of 20 years between 1981 and 2001. Female's literacy rate went up from 31.5% in 1981 to 67.4% in 2001, while male's rate went up from 53.2% to 85.3%.

A-4.7 Health

In Himachal Pradesh, there exist 116 hospitals, 505 primary health centres, community health centres, rural hospitals and subsidiary health centres, 22 allopathic dispensaries, 1,122 Ayurvedic dispensaries, and 2,068 health sub-centres as of March 2005. Vital statistics show therefore such better situation compared with all India that the birth rate of Himachal Pradesh was 20.60 per 1,000 persons against 24.40 as well as the death rate of 7.1 per 1,000 persons against 8.0, the infant mortality of 49 per 1,000 babies against 60, and the life expectancy at birth of 65.9 against 62.5.

A-4.8 Cultural Characteristics

Earliest history of Himachal Pradesh can be traced back to 3000 BC has evolved from a 'primitive feudalistic society to a vibrant, democratic and developing economy'²². Through its long history political Himachal has been the home or the melting pot of several races and culture that has lend itself to its present rich diversity of people and culture comprising of different ethnic stock, tribes, castes and religions. Thus evident on the cultural landscape of the State are traces of the Tibetan, Mongolian, Mughal, British, Punjabi cultures which co-exist with distinct local and ethnic culture-religious practices of its many tribes and schedule castes.

The total population of Himachal Pradesh is 6.0008 million of which 90.2% lives in the rural area and 9.8% lives in urban areas. The Schedule Tribe (5.1%) and Schedule Caste (24.6%) make up almost 30% of its population. Predominant among the Schedule Caste population are the castes of Kolis, Chamars, Rehars, Chanals, Lohars, Baris, Dagis and Truri. Among the non-Schedule Castes or 'general castes', the castes of Brahmins, Soods and Thakurs are predominant.

Majority of the Schedule Tribes are founds in the Scheduled Areas of Lahaul &Spiti, Kinnaur and Pangi and Bharamour (District Chamba). Schedule Areas are special category areas declared under the Constitution of India where almost 100% of the population is Tribal. There are also two Modified Area Development Approach (MADA) Blocks of Chamba and Bhatiyat. MADA Blocks are pockets of tribal concentration having 10,000 populations in contiguous areas of which 50% or more are tribal. A small population of tribal are also found in other parts of the State and are categorised as 'dispersed tribals'. These tribal areas of the State are among the most remote and infrastructure –wise least developed. The Tribals living in Chamba and the dispersed tribes are also among the poorest. The Tribal culture of Himachal is both distinct and rich. The predominant tribes of the State are Kinners, Lahaulas, Pangwals, Gaddis and Gujjars²³. While many of the Tribals have taken to settled agriculture and horticulture, many still survive as pastoral nomads, eking out their livelihood from cattle, sheep and goat rearing.

The Schedule Caste, the Schedule Tribes of Chamba and dispersed tribes are among the poorest in the State and in recent times have been beneficiaries of special development schemes, including agriculture where they are given special subsidies and discounts. The Development needs of the Schedule Caste and Tribes are addressed through specific Tribal and Schedule Caste Sub-Plans of the State. The Schedule Areas of the State are administered through the Tribal Area Development Agencies that function under the Tribal Development Department.

Himachal Pradesh is locally known as the 'land of gods' or *dev bhumi*. Religion forms an integral part

²² Padamnabh Gautam 2001- 'Socio-Administrative System of Himachal Pradesh' in Laxman. S. Thakur (ed)-*Where Mortals and Mountain Gods Meet: Society and Culture in Himachal Pradesh* .Indian Institute of Advanced Studies, Simla.

²³ M.S. Ahluwalia 1998 *Social, Cultural & Economic History of Himachal Pradesh*. Indus Publishing Company, New Delhi.

of people everyday socio-economic functioning of its people- in undertaking any work or activity the sanction of the local deities is important; perhaps equally important as any governmental sanction. In Himachal there are six important religious communities, the Hindus, the Muslims, the Christian, the Buddhist, the Sikhs and the Jains. Hinduism is the predominant religion; 95.43%, of the people are Hindus. Muslims comprising 1.97% of the population are concentrated mainly around Chamba, Kangra and Sirmaur. 1.25% of the population is Buddhists and is concentrated in the districts of Lahaul and Spiti, Kinnaur and Kullu. Sikhs, living mostly in Kangra, Shimla and Mandi districts comprise 1.19% of the population. The Christians (0.13%) and Jains (0.02%) have no specific concentration²⁴.

Evolved around its deep-rooted religious traditions, Himachal Pradesh is specially known for rich culture of religious fair and festivals as well as for its varied temples, their architecture and art. In Himachal Pradesh, its social institutions, particularly the fairs and festivals have a considerable impact on its development. They not only form an important part of their religious and cultural life, but also provide healthy recreation and marketing/trading places for the people²⁵.

The people of Himachal are known for their industriousness and hard work. As some have observed agriculture here is not merely an occupation but an established tradition and accepted way of life. Although now the tertiary sectors have become the biggest contributor to the State Domestic Product, till the 1990s agriculture sector was the biggest contributor to the State's economy. Even today it comprises almost 19% of the States Domestic Product and 68.5% of the main workers are engaged in agricultural pursuits, which remains the main source of their income. However given the difficult terrain and topography of the State, agriculture in the State has evolved only due to the industrious labour of the Himachal farmers. Majority of agriculturists have to eke out their livelihood by tilling the poor, hard, stony denuding and thin-surfaced soils and small size holding. Yet among the work done by farmers in the mountainous regions, throughout the country, whether it be Nagaland, Mizoram, Sikkim or Uttarakahnd farmers of Himachal Pradesh are known to have done the maximum plantation which has been responsible for checking soil erosion and significantly improving the economic condition of the people²⁶. The industriousness of the farmers is also evident in the rapid manner in which they have come forward to adopt the horticultural initiatives of the State. From being entirely dependent on traditional agriculture, today due to almost 10% of the total cultivated area is under vegetables and 26% under fruit cultivation²⁷.

The people of Himachal Pradesh are also known for their simplicity, peace-loving nature and their honesty. They are known to be 'god-fearing, chivalrous and extremely social²⁸'. As Mian Goverdhan Singh remarks-'The people of Himachal Pradesh are among the most delightfully colourful in the world, they are humorous and light-hearted even in adversity, and are fond of good living and almost entirely without guile...they are honest...they generally have a great regard for truthfulness'²⁹. Even in the recent Study conducted by Transparency International, in the composite ranking of States on corruption involving common citizen and in the context of eleven public services, Himachal Pradesh

²⁴ Statistical Outline of Himachal Pradesh 2006-2007.

²⁵ M.S. Ahluwalia (ibid).

²⁶ Parliament of India Debate. 2008. <http://parliamentofindia.nic.in/ls/lsdeb/ls10/ses1/1328089105.htm>

²⁷ Data of Department of Agriculture, Himachal Pradesh (2005-2006 Season).

²⁸ Padma Nabh Gautam 2008 'Socio-Administrative System of Himachal Pradesh' in Laxman S. Thakur (ed) *Where Mortals and Mounatin Gods Meet: Society and Culture in Himachal Pradesh*. Indian Institute of Advanced Studies, Simla

²⁹ Mian Goverdhan Singh 1988, *Himachal Pradesh: History Culture and Economy*, As cited in Padma Nabh Gautam (ibid)

was ranked the second least corrupt state in India³⁰. Himachal Pradesh is also adjudged recently as being the fourth most peaceful State in the country³¹.

Perhaps the greatest asset of Himachal Pradesh is the social capital and social cohesion of its people. Historically, as Singh (2008) observes –‘a combination of village-level co-operation (for economic reasons) and community-consciousness (as a socio-political phenomenon) was probably the organising principle of rural life in the mountains’³². In fact an implicit social compact and cohesion of the people in HP has been recognised as key a factor in the significant economic growth of the State in the last two decades³³. Hence people participation through organised group activities has been successful achieved in most areas of development in Himachal Pradesh. This is evident in the large number of farmers cooperatives (2086 in number), Farmers Interest Groups (1200³⁴), Women SHGs (over a lakh), Women’s Groups (23,000) and the Water User Association/Krishi Vikas Kendras (500) present in the State. There are also a significant number of farmers organisations like the Lahaul Patoto Growers Group that are yet to be enumerated. To promote people’s participation, at the governmental level, decentralisation of development planning and governance has become a precondition to the mobilisation of the vast human resource potential. The government has been promoting participatory institutions like Panchayati Raj Institutions (PRIs), co-operatives and SHGs and seeking active people’s participation in promotion of agriculture, food and nutritional security, providing safe drinking water, primary health care, universal primary education, housing, roads, forest management and empowerment of women³⁵.

Finally, and third –best state in terms of overall socio-economic advancement has always had a highly motivated, people friendly and result-oriented government³⁶.

³⁰ India corruption study 2005 to Improve governance: Transparency India International and Centre for Media Studies, New Delhi, 2006.

³¹ Survey on States of States carried out by the India Today Group, 2007

³² Chetan Singh 2008 ‘Dhoom in Himachal Pradesh: Community Consciousness, Peasant Resistance or Political Intrigue’ in Laxman S. Thakur (ed).

³³ World Bank 2007: Himachal Pradesh: Accelerating Development and Sustaining Success in a Hill State.

³⁴ Directorate of Agriculture, Government of Himachal Pradesh

³⁵ Himachal Pradesh Development Report 2005, Planning Commission, Government of India.

³⁶ Himachal Pradesh Human Development Report 2002

A-4.9 Gender in Agriculture

Women participate practically in every aspect of food grain, vegetable and fruit cultivation. According to the 2001 Population Census, women engaged in agriculture were 1.16 million in number or 88.8% of the total female workers in Himachal Pradesh as shown in Table A-4.6.

Table A-4.6 District-wise Women's Participation in Agriculture

District	No. of Workers		No. of Female Agricultural Workers		% of Agri. Workers		
	Total	Female	Cultivators	Labourers	Total	Female	Male
Bilaspur	166,708	77,283	70,176	555	71,307	92.3	51.3
Chamba	230,452	103,734	92,751	1,206	93,422	90.1	59.8
Hamirpur	205,405	105,338	96,635	669	98,153	93.2	48.6
Kangra	588,994	253,547	200,783	7,807	216,516	85.4	47.2
Kinnaur	47,811	19,770	16,959	295	17,293	87.5	52.7
Kullu	216,513	97,118	85,910	1,120	88,548	91.2	68.4
Lahaul-Spiti	21,088	8,484	6,409	87	6,577	77.5	39.1
Mandi	454,292	218,538	197,576	2,123	200,862	91.9	57.3
Shimla	370,223	151,090	126,832	1,321	130,748	86.5	53.2
Sirmaur	225,872	89,843	79,836	637	82,082	91.4	62.7
Solan	263,445	98,168	80,568	1,153	83,142	84.7	40.4
Una	201,658	82,890	66,123	1,512	70,421	85.0	47.2
Total of State	2,992,461	1,305,803	1,120,558	18,485	1,159,071	88.8	52.8

Source: Population Census 2001

It is obviously said that the level of women's participation in agriculture is very high as much as 88.8% compared with the situation of male agricultural working populations of 0.89 million with the share of 52.8% in the total male workers.

As indicated below in terms of women's participation rate in agriculture and related activities, the participation in land preparation reflects a lower rate because generally women are not permitted to plough the field as there is a taboo against women touching the plough in most areas. Contrarily, vegetable cultivation involves more labour and requires more participation from women resulting in that up to 70% of the total time spent in the fields by women would be on vegetable cultivation.

- Participation rates in food grain cultivation are 40~45% of land preparation, 80~90% of sowing, 35~40% of rice seedling transplanting, 35~40% of irrigation, 70~80% of compost and manure application, 40~42% of fertilizer application, 80~85% of weeding, 20~30% of plant protection, 75~80% of harvesting, and 50~55% of post-harvest practices;
- Participation rates in vegetable cultivation are 40~45% of land preparation, 60~65% of nursery raising, 50~52% of transplanting, 60~65% of inter-cultivation, 75~80% of picking, grading and packing, and 10~20% of marketing practices; and
- Participation rates in horticulture crop cultivation are 40~50% of digging pits, 45~50% of planting, 15~20% of training/picking, 40~45% of spraying, 20~25% of fruit picking, 60~75% of transport to road head, 10~15% of marketing, and 70~80% of orchard maintenance practices.

Almost 80~90 % of the animal husbandry work is done by women at the household level, as activities in this field are also low skill and high on labour, involving tending to cattle in the shed, grazing, fodder collection, dung collection, cleaning of sheds, preparing cattle feed, milking and preparing other dairy products.

Focal points clarified through group discussions with female farmers conducted by the Study Team in Bilaspur, Hamirpur, Kullu, Kangra, Mandi and Una Districts are as follows:

- a. Regarding land ownership and assets, there is provision for women to claim property rights. But they are discouraged from doing so, and their daughters inherit only if they are unmarried or there are no male siblings. Women felt that not owning land was not necessarily a hindrance as long as it was held within the household and that men were better placed to handle land related issues. However, widowed women and other women-headed household expressed a desire for owning land in their own names. Few women own any productive assets and resources. Some women have bought cattle, farm equipment and even land through micro-finance facilities, but they hardly exercise any control on these assets;
- b. So far as possible they try to avoid the use of chemical fertiliser in the traditional cereal crops that they grow for consumption. They argued that the use of chemicals considerably brings down the nutritive value of the crops; and
- c. Their interests in the development of specific tools include harvester & cutter, paddy thresher; wheat thresher, cob sheller, transplanter, potato planter, chaff cutter, seed drill, weeder, etc. Although some of these implements have been developed by research institutions, the women were unaware of their existence.

One of the approaches towards economic empowerment of women through direct access to money has been enabling them to undertake income-generating and entrepreneurship activities. Most of the income-generating activities which the state has undertaken have been through the SHG approach. These micro-credit and savings groups are aimed at women who get left out of the normal credit delivery systems. The National Bank for Agriculture and Rural Development (NABARD) was among the first to facilitate the SHG programme in the State. NABARD sponsored micro-credit programmes helps the formation of SHGs in order to enable these groups to access credit with ease. It is implemented through the collaboration of banks with NGOs and concerned government departments. NABARD has been work extensively through the Department of Social Justice and Empowerment. As on March 31st, 2006 number of NABARD sponsored SHGs in Himachal Pradesh which had been linked to banks was a total of 22, 920³⁷.

The Government through its Department of Rural Development, Agriculture, Social Justice and Empowerment and other departments has initiated program to give women trainings and facilities to develop income generating activities through the use of local resources and through developing new ideas. The State is keen on promoting income-generating initiatives which are agro-based and focussed on post-harvest management and processing of fruits and vegetable.

A-4.10 Rural Poverty

The Planning Commission as the Nodal agency in the Government of India for estimation of poverty has been estimating the number and percentage of poor at national and state levels. Since, March 1997 it has been using the Expert Group Method (Expert Group on Estimation of Proportion and Number of Poor) to estimate poverty. According to this method the estimates of poverty are made from the large sample survey data on household consumer expenditure conducted by the National Sample Survey Organization (NSSO) of the Ministry of Statistics and Programme Implementation. Using this methodology the Planning Commission, Government of India, in the past, has released poverty estimates for the year 1973-74, 1977-78, 1983, 1987-88 and 1993-94. Subsequently, the poverty estimates for 1999-2000 were released by the Government of India February 2001 based on the NSSO

³⁷ NABARD Annual Report 2006.

55th Round. While releasing the estimates of poverty for 1999-2000, it had been noted that these estimates were not strictly comparable with the estimates for the previous years as questions asked by the NSSO was different from the previous years.

Current poverty lines in rural and urban areas in each state are based on the total sum of food consumption for necessary calorie intake for life (2400 calories for rural areas and 2100 calories for urban areas) and on non-food consumption which is then estimated in terms of the monthly per capita expenditure. (MPCE). The national poverty line is estimated based on the distribution of MPCE groups and the state level poverty headcount ratio (the total number of people under poverty line) at state level³⁸. The national poverty line for the years 1999/2000 was 327.56 Rupees for rural and 454.11 Rupees for urban areas. Adjusting for inflation, the 2004-2005 poverty lines are Rs.356.30 and 538.609 for rural and urban areas respectively.

(1) Re-assessed Poverty in Himachal Pradesh

Current national level projection of poverty in Himachal Pradesh has been much lower than what actually exists at the State level. As per the Planning Commission estimates, the poverty level in Himachal Pradesh has consistently declined from 26.39% in 1973-1974 to a mere 7.63% in 1999-2000. The poverty estimates of 1999-2000 have been controversial and this decline particularly from 1993 to 2000 has been ascribed to a change in Methodology. The 1999-2000 poverty ratios are not being presently used by the State Department of Rural Development as the criterion for allocation of funds for HP.

The current estimates of Household living below poverty line (BPL) are arrived through a census conducted by the State level Department of Rural Development (under guidelines for the Planning Commission) for the 11th Plan. It must be noted that the current estimates also function under a limit set by the Planning Commission. The Planning Commission has directed the State that the total number of families below poverty is not to exceed the total they have estimated under the 'adjusted shares' - that is, in order to harmonize the 1999-2000 poverty ratio with the previous years and arrive at a more realistic estimate, the Planning Commission allowed for a state-specific number of households to be added to the earlier calculated percentage of poverty ratios for the State and in addition another 10% of transient poor³⁹.

The household survey for identification of BPL in the State is based on 13 criteria. Given that in the rural areas, objective data on household income is difficult to assess, income did not form a criteria except as an eliminating criteria for consideration under BPL. As per the State level household survey suggests that an average of 23.87% percent of household is below poverty line which is lower than the national average of 26.1%. It should be noted that under the direction from the Ministry of Rural Development (Monitoring Division), the State has reduced almost 4,100 families from its poverty estimates for the 10th Plan according to which 27.62% of people lived below the poverty line.

³⁸ JBIC 2006 Poverty Profile India

³⁹ Department of Rural Development, Govt. of Himachal Pradesh

Table A-4.7 Poverty Ratios in HP: National and State

Year	National Level Rural Poverty Estimates	State Level Rural Poverty Estimates
1973-1974	27.42	Not available
1993-1994	30.34	Not available
1999-2000	7.94	27.62
2002-2007	10.7	23.87

Source: Government of India 2002 & Department of Rural Development, Government of HP

Apart from the households identified as BPL families an additional 5, 00,000 families have been identified to be considered under the Public Distribution Systems (PDS) that addresses the minimum food security needs of the families⁴⁰. Considering that the PDS functions mainly to provide families Below Poverty Line, an additional 5, 00,000 families can be considered to be under BPL.

(2) Significant Regional Disparities

Although the State as a whole has made notable economic advancement, there are significant regional imbalances that exist within the State. The development potentials of the high mountain regions are limited by the availability of infrastructure facilities, income opportunities, land availability and productivity of lands etc. Hence, as seen in the Table below, one finds that concentration of poverty across the districts varies-the highest concentration being in the District of Chamba and Lahaul Spiti. As noted by the World Bank report⁴¹, access to social and economic benefits tend to be worse for poorer households, women, household with less educated members, household without regular employment, household with high dependency ratios (i.e.the ratio of the non-earning members to earning members) and remote areas.

Table A-4.8 Survey on Poor Families (2002-07)

District	Total Family at Survey time	No of Family Below Poverty Line	% of Family Below Poverty Line
Bilaspur	75,051	17,337	23.10
Chamba	85,676	46,393	54.15
Hamirpur	95,795	19,514	20.37
Kangra	2,89,185	63,250	21.87
Kinnaur	13,255	2,824	21.31
Kullu	69,388	11,267	16.24
Lahaul-Spiti	5,517	2,400	43.50
Mandi	2,06,096	41,339	20.06
Shimla	1,08,999	31,682	29.07
Sirmaur	70,439	13,695	19.44
Solan	73,733	17,478	23.70
Una	89, 792	15,191	16.92
Himachal Pradesh	11,82,926	2,82,370	23.87

Source: Rural Development Department. Himachal Pradesh

(3) High Vulnerability to Poverty

Vulnerability, i.e. the possibility of a family to slip into poverty when exposed to risks is considered a more dynamic conceptualization of poverty. Vulnerability assessment recognizes the fact that the

⁴⁰ Department of Rural Development, Himachal Pradesh; Himachal Pradesh Development Report, Planning Commission, Government of India.

⁴¹ World Bank Report 2007 (ibid)

welfare of households is not simply dependent upon their income or consumption in any given period but also on their exposure to risk. Exposure to risk and vulnerability is not only a constituent dimension of poverty but is also an important cause of future poverty. The possibility of a family unable to cope with income shocks due to weak financial institutions and social insurance mechanisms is often a key problem faced by the poor⁴².

According to recent World Bank report on Himachal Pradesh economic growth and future strategies⁴³, HP faces issues in terms of its vulnerability. While absolute poverty is not a major issue in the State, vulnerability estimates for the State suggest that the possibility of households falling into poverty in the near future is higher than the proportion of the households currently poor-especially in the rural areas. It is estimated that about a fifth of the population could slip into poverty within the next three years if the States good economic performance cannot be maintained. The vulnerability rate of Himachal Pradesh is 22%.

A recent study of the FAO⁴⁴ that followed a 'livelihoods based approach' to understand the dynamic of food insecurity and vulnerability in Himachal Pradesh suggested that whilst the State compares favorably to other States in terms of food availability, anthropometric measures in HP underscore the persistence of poor nutritional status among children. According to the Report close to half the number of children under five in the State are underweight, only slightly lower than the national figure. In addition 59% of the children under five and 41% of adult women are anemic. Besides the study that also looked specifically at the food security issues of Subsistence Farm Households (farming subsistence cereal for self-consumption) and Marginal Commercial Household among others concluded that the unless the former category diversify considerably their livelihood strategies, they are susceptible to food insecurity and vulnerability as without irrigation, the agricultural produce can meet the average household food requirement only for three to seven months. For the Marginal Commercial Households (MCH), which is marginal who are have started small-scale vegetable cultivation it was observed that farmers who have started cultivating cash crops including vegetable, fruits and floriculture have higher levels of household food security and reduced vulnerability because of enhanced income and asset accumulation. However, because of lack of adequate support, infrastructure and small landholding, MCH have relatively high costs of production and have low risk bearing capacity.

(4) Poverty Estimates: An Inadequate Assessment

As noted in Poverty Profile India by JBIC rightly, the current means and estimated poverty line in India is highly contested, arguing for the revision of the establishment of a calorie consumption pattern which changes yearly, for consideration of the increasing cost of health and education services, and further on the adjustment of state-wise price indexes, and on employment of the total average food basket nationwide⁴⁵.

A much debated current study⁴⁶ in India has argued that the Indian State needs to revisit its concept of

⁴² Ajay Tandon and Rana Hasan –'Conceptualising and Measuring Poverty as Vulnerability: Does it Make a Difference?'. ERD Policy Brief, ADB 2005.

⁴³ Himachal Pradesh: Accelerating Development and Sustaining Success in a Hill State. World Bank 2007

⁴⁴ Understanding the Dynamics of Food Insecurity and Vulnerability in Himachal Pradesh: ESA Working Paper No.07-22. FAO, 2007

⁴⁵ Poverty Profile: India, JBIC 2006

⁴⁶ Redefining Poverty: A New Poverty Line for a New India, Mohan Guruswamy and Ronald Joseph Abraham, Centre for Policy Alternatives, New Delhi, 2006

poverty. According to the report the current poverty lines of Rs.368 for rural areas and Rs.559 for urban areas, apart from factoring around 650 grams of food grain everyday, makes very little provision for the other essentials of life. Saying a true definition of poverty should include all the basic needs of human life with a modest modicum of quality of life, it said a person should be deemed poor in India if he or she has a monthly per capita expenditure less than Rs.840 or does not have access to drinking water, proper shelter, sanitation, quality secondary education or an all weather road with public transport. The Rs. 840 is made up of minimum costs for nutrition (Rs.573), health (Rs.30), clothing (Rs.17), energy consumption (Rs.55) and miscellaneous expenditure (Rs.164) .

When estimated by a poverty line of Rs.840, the poverty ratio of the State would be significantly higher than the current estimate. It would be even higher if calculated on the basis of international poverty line of \$ 1.25 per day.

A-5 Externally Aided Projects

A-5.1 Overview

Himachal Pradesh State has no experience to receive such instructions by the Ministry of Finance, Government of India, that the debt sustainability of the States is a pre-requisite condition for access to external assistance. If any State is categorized as “debt stressed” by the Ministry of Finance, no access to externally aided projects can be posed for the concerned state.

In Himachal Pradesh, a total of nine projects externally aided are under execution.

These are: a) Himachal Pradesh Forest Sector Reforms Project assisted by the Department of International Development (DFID), U.K.; b) Mid-Himalaya Integrated Watershed Development Project (IWDP) financed by the World Bank; c) Hydrology Project-II aided by the World Bank; d) Water, Sanitation & Hygiene Project (WASH) financially assisted by the German Federal Ministry for Economic Cooperation and Development (BMZ) and technically supported by the German Public Corporation for Technical Cooperation (GTZ); e) Technical Education Quality Improvement Project financed by the International Development Association (IDA); f) Swan River Flood Management, Integrated Land Development and Watershed Management Project financed by the Japan Bank for International Cooperation (JBIC); g) Macro Planning at Panchayat Level assisted by GTZ; h) Rural Roads Project financed by World Bank group; and i) Strengthening Agricultural Marketing System (SAMS) aided by USAID.

A-5.2 Salient Features of Agriculture-related Projects

Salient features of Mid-Himalaya IWDP, WASH Project, and Swan River Flood Management, Integrated Land Development and Watershed Management Project, all of which include agriculture-related components, are summarized below.

(1) Mid-Himalaya Integrated Watershed Development Project

The outline of Mid-Himalaya IWDP is as follows:

- a. **Objectives:** The primary objective is to reserve the process of degradation of the natural resources base and to improve the productive potential of natural resources and income of the rural households in the Project area. The secondary objective is to support policy and institutional development projects and policies across the State in accordance with best practices;

- b. Project area: Bilaspur, Chamba, Hamirpur, Kangra, Mandi, Shimla, Sirmaur and Solan Districts;
- c. Executing agency: Himachal Pradesh Natural Resources Management Society newly created within the Department of Forestry at state level, and Gram Panchayats at local level under the support of Watershed Development Office, Watershed Development Coordination Office and Watershed Committee at district level;
- d. Implementation period: 2006 ~ 2012;
- e. Beneficiaries: 600 Panchayats;
- f. Project components: Institutional strengthening, watershed development & management, enhancement of mountain livelihoods, and project coordination;
- g. Project cost: Rs. 3,650 million.

(2) Water, Sanitation & Hygiene (WASH) Project

The followings are the outline of WASH Project:

- a. Objectives: The goal is to enable and empower water users, PRIs & other stakeholders to plan, implement & manage safe drinking water & minor irrigation systems in a sustainable manner;
- b. Project area: Pilot sites in Shimla, Mandi and Kangra Districts;
- c. Executing agency: Central Coordination & Development Unit created within the Department of Irrigation and Public Health (IPH) at state level, and Village Water & Sanitation Committee formed at pilot sites of Panchayats;
- d. Implementation period: 2005 ~ 2007 for first phase;
- e. Beneficiaries: Approximately 5,000 persons at 10 pilot sites;
- f. Project components: Awareness & training of key stakeholders, capacity building & training of key staff of the Department of IPH, provision of technical assistance to the Department of IPH, documentation & sharing of best practices, pilot schemes to identify & demonstrate best practices, and policy support to the Department of IPH; and
- g. Project cost: Rs.130 million (85% from BMZ and 15% from the State Government) and grant aid for technical assistance by GTZ.

(3) Swan River Flood Management, Integrated Land Development and Watershed Management Project

The Swan River Flood Management, Integrated Land Development and Watershed Management Project is outlined as follows:

- a. Objective: The project goal is stabilize 73 target tributaries as the Project priority target area of the Swan River Watershed, to mitigate flood damages from the target tributaries, and to reduce soil erosion in catchments of the Swan River;
- b. Project area: Una District;
- c. Executing agency: Project Management Unit under CCF of the Department of Forestry;
- d. Implementation period: 2006 ~ 2014;

- e. Project components: Afforestation, civil works, hillside works, livelihood improvement, and technology transfer; and
- f. Project cost: Rs.1,450 million (90% from JBIC and 10% from the State Government).

(4) Rural Roads Project

The outline of Rural Road Project is as follows:

- a. Objectives: The PMGSY (Pradhan Mantri Gram Sadak Yojana, Prime Minister's Village Road Programme) of the central government aims to connect 180,000 villages nationwide by constructing 370,000 km of all weather roads and upgrading another 370,000 km of the existing rural road network. To assist the Government of India in rural road construction, the World Bank's Rural Roads Project is supporting the PMGSY in Himachal Pradesh, Rajasthan, Jharkhand and Uttar Pradesh.
- b. Project area: Entire state
- c. Executing agency: Public Works Department of Himachal Pradesh
- d. Implementation period: 2004 ~ 2008, (Rural Roads Project II is under preparation)
- e. Work Quantities: 9,919 km (1,308 km in H.P)
- f. Project components: Construction of rural roads
- g. Project cost: 592 million USD (IBRD portion 164 million\$, IDA portion 164 million US\$, and GOI portion 264 million USD)

(5) Strengthening Agricultural Marketing System (SAMS)

The outline of the SAMS is as follows:

- a. Objectives: The objective is to strengthen agriculture marketing System to provide basic know-how about the production and marketing of agricultural produce to the various stakeholders. Major subjects covered by the project are show as follows:
 - (1) Improvement of marketing support systems such as information, grades and standards to foster the development of markets;
 - (2) Increases Indian institutions' ability to introduce and share new procedures for quality and food safety standardization, crop and price forecasting, and market extension;
 - (3) Upgrade India's existing marketing news information and marketing extension systems;
- b. Project area and Beneficiary: two Districts as pilot area
 - Shimla District: apple farmers in pilot area in Theog, Narkandha, Rohtu, and Jubbal
 - Solan District: tomato farmers in pilot area in Kandaghat, Dharampur, Kunihar, and Nalagarh
- c. Executing agency:
 - Central level: Ministry of Agriculture (MOA)
 - State Level: Himachal Pradesh State Agricultural Marketing Board
- d. Implementation period: 2006 ~ 2009
- e. Beneficiaries: 700 farmers;
- f. Project components: training for government staff and farmers' groups

g. Project cost: Rs. 1.2 million.AA

A-5.3 Newly Committed Projects

The World Bank has recently approved to provide the State Government of Himachal Pradesh with 303.43 million USD loan for State Road Project in June 2007 and 200 million USD loan for First Himachal Pradesh Development Policy Loan and Credit Project in September 2007.

The former project aims to reduce transport costs and to improve traffic flows on priority segments of the core road network of the State. The latter project supports the medium term program of the Government of Himachal Pradesh focusing on the implementation of critical structural, fiscal and administrative reforms needed to achieve sustainable and rapid economic growth coupled with sustaining of the environmental heritage of the State. Its priority areas for the operation will be fiscal adjustment and promotion of environmentally sustainable development with particular reference to the development of hydropower.

ANNEX-B
Agriculture

**THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME
IN THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

**ANNEX-B
AGRICULTURE**

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ANNEX-B AGRICULTURE

B-1 Agricultural Production

B-1.1 Agro-ecological Zone

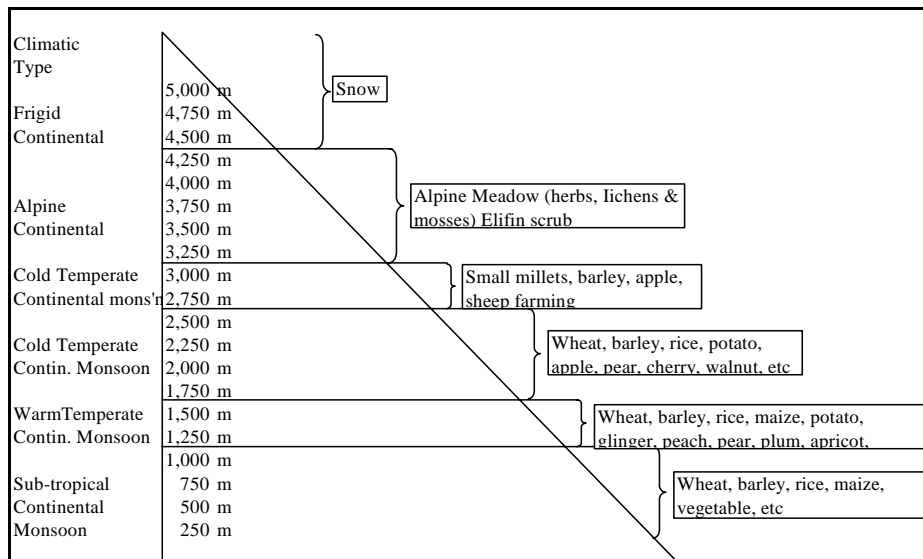
In a Study conducted in 2006 by the Centre for Geo-Informatics Research and Training (Geo-Centre) of CSK Himachal Pradesh Agricultural University (CSKHPAU), the old agro-ecological zoning based on the altitude was modified on the basis of elevation and rainfall. The new agro-ecological zoning criteria is shown in Table B-1.1 and a distribution map of the new agro-ecological zones is illustrated in Fig. B-1.1 and B.1.2. The specific features of agro-ecological zones are summarized in Table B-1.2.

Table B-1.1 New Agro-ecological Zoning Criteria

Zone	Zoning Criteria		
	Sub-zone	Altitude range (m)	Rainfall (mm)
1.	Zone 1.1	240-1,000	Less than or equal to 1500
	Zone 1.2	240-1,000	Greater than 1500
2.	Zone 2.1	1,001-1,500	Less than or equal to 1500
	Zone 2.2	1,001-1,500	Greater than 1500
3.	Zone 3.1	1,501-2,500	Less than or equal to 1500
	Zone 3.2	1,501-3,250	Greater than 1500
4.	Zone 4.1	2,501-3,250	Less than or equal to 700 (dry)*
	Zone 4.2	3,251-4,250	Dry / snow
	Zone 4.3	>4,250	Dry / snow

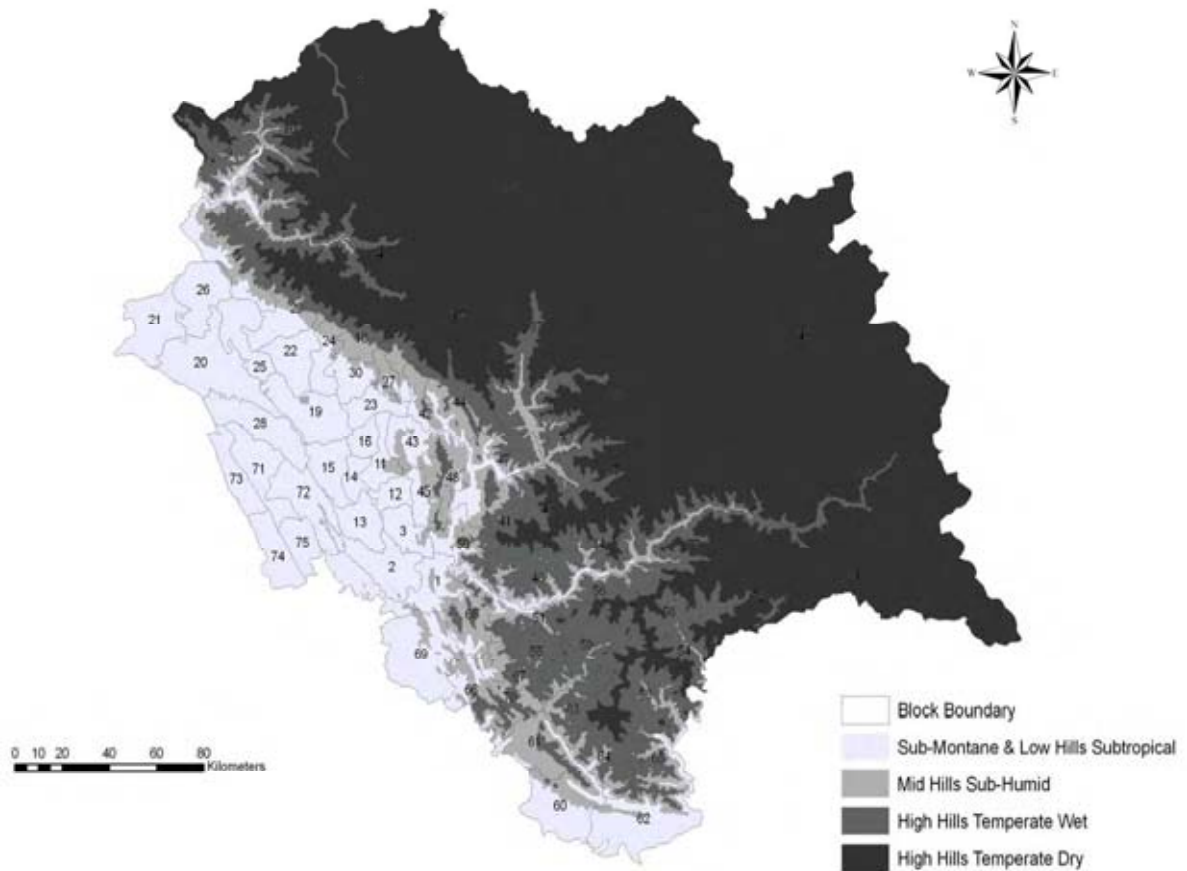
Source: Agro-Ecological Zonation of Himachal Pradesh – Agricultural System Information Development at micro-level by Geo-Centre, CSK HPA University, Palampur (2006)

*Remarks: *; it is in principal but varies area by area.*



Source: Agro-Ecological Zonation of Himachal Pradesh – Agricultural System Information Development at micro-level by Geo-Centre, CSK HPA University, Palampur (2006)

Fig. B-1.1 Schematic Altitudinal Agro-climatic Zones



Source: *Agro-Ecological Zonation of Himachal Pradesh – Agricultural System Information Development at micro-level by Geo-Centre, CSK HPA University, Palampur (2006)*

Fig. B-1.2 Agro-ecological Zone Distribution Map of Himachal Pradesh

Table B-1.2 Specific Features of Agro-ecological Zones

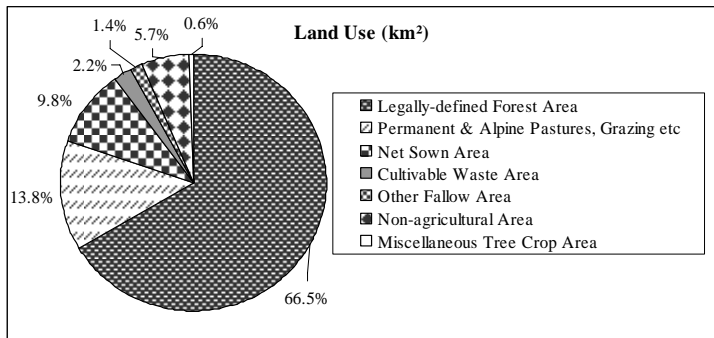
Zone	Area	Climate	Soils & Land Cover	Crops
Agro-ecological Zone 1 Sub-montane & low hills sub-tropical 240 < Altitude ≤1,000m	10,260 km ² (18.43% of the State)	The climate is sub-tropical wherein the mean annual temperature lies between 15 and 23°C. Average rainfall is 1,100 mm of which 80% is received during monsoon season.	Soils are shallow, light textured and low in fertility. pH ranges between 6.5 to 7.5. Zone is characterized by (i) northern dry mixed deciduous forests, (ii) dry deciduous scrub, and (iii) Shivalik chir pine forests.	Rainfed farming is mostly practiced in this zone. Important crops grown are wheat, maize, paddy, pulses and oil seeds. Barley, and potato are grown to some extent. Sub tropical fruits such as citrus, mango and litchi are the important fruit crops in this zone.
Agro-ecological Zone 2 Mid hills sub humid 1,000<Altitude≤1,500m	4,664 km ² (8.37% of the State)	The climate is sub-humid wherein mean annual temperature lies between 14 to 22°C. The rainfall around Dharamshala and Palampur is as high as 3,000 mm, while in the remaining areas, it is about 1,500 mm.	Soil is loam-clay loam. Deficient in N&P with poor water and nutrient holding capacity. Acidic soils, respond to liming. Soil & water conservation and fertility management are important problems. Zone has generally two types of vegetation, (i) lower west Himalayan temperate forests, (ii) Himalayan Chir pine forests.	Rainfed farming is mostly practiced in this zone. Important crops grown are wheat, paddy, barley, pulses and oil seeds. Some parts are suitable for off-season vegetables. Citrus fruits are also grown in some areas of this zone.
Agro-ecological Zone 3 High hills temperate wet 1,500<Altitude≤3,250m	9,217 km ² (16.54% of the State)	The climate is temperate wet and the average rainfall is about 1,000 mm which is received during monsoon season.	Soils have shallow depth, and silt loam to loam. Acidic and respond to liming. Soil erosion, low fertility and inadequate water management are major problems. Zone has upper west Himalayan temperate forests.	The major crops are wheat, barley, maize, millets, pulses and oil seeds. Apple, other temperate fruits and nuts are important horticulture crops. This zone is suitable for off-season vegetables and seed production of temperate vegetables.
Agro-ecological Zone 4 High hills temperate dry 2,500m <Altitude	31,509 km ² (56.61% of the State)	The climate is temperate dry. Average rainfall is generally less than 700 mm but is more in some area. High altitude areas (above 3,250 m) have perennial glacial reserves.	Soils are sandy loam texture, and neutral to alkaline, and low in fertility. Good response to nitrogen and phosphorus. Considerable loss of top soil due to erosion and glaciers. Soil erosion and water management are important problems. Zone is characterized by dry alpine range.	There is only one season for crop cultivation, i.e. April to October. Major crops grown in this zone are wheat, potato, barley, buckwheat, peas, minor millets and temperate vegetables. Apples, grapes, almonds, walnut and apricot are the main fruits grown in this zone. Some areas of this zone are highly suitable for quality potato seed. High value crops like hops, cumin and saffron are also grown in this zone.

Source: Agro-Ecological Zonation of Himachal Pradesh- Agricultural System Information Development at micro-level, Geo-Centre, CSK HPAU, Palampur (2006)

B-1.2 Agricultural Land Use

The total geographical area of Himachal Pradesh is 55,673 km² of which the forest area legally defined occupies 37,033 km² or 66.5%, followed by net area sown of 5,446 km² or 9.8%, lands put to non-agricultural use of 3,192 km² or 5.7%, cultivable wastes of 1,222 km² or 2.2%, current and other fallow lands of 755 km² or 1.4%, and land under miscellaneous tree crops not included in cultivation of 329 km² or 0.6%, while the remaining 7,696 km² or 13.8% consists of permanent pastures, other

grazing lands, alpine pastures, barren, and uncultivable wastes. Distribution of the land use is shown in Fig.B-1.3. The district-wise land use in Himachal Pradesh in 2002/03 is summarized in Table B-1.3.



Source: Department of Land Records, Himachal P. State Government

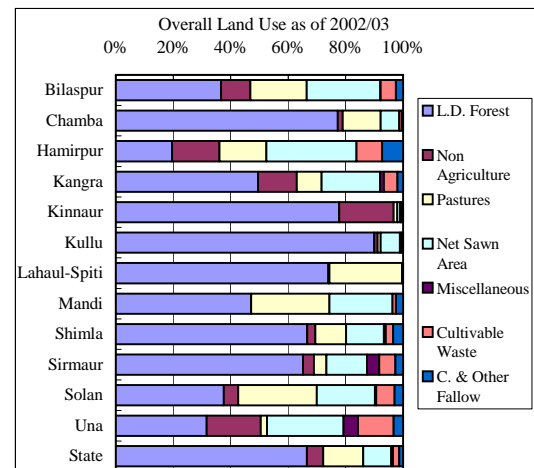
Fig. B-1.3 Distribution of Land Use in Himachal Pradesh

‘Net sown area’ means net farm land area where the cultivation is done once or more times in a year. ‘Total cropped area’ is the sum of cropped/ harvested area in a year in the net sown area. ‘Cultivable waste land’ is the land cultivated once, but not cultivated for five years or more. ‘Fallow land’ is the cultivated land, but temporarily not cultivated for a period of less than a year.

Table B-1.3 Overall Land Use as of 2002/03

District	Total Geographical Area	Legally Defined Forests	Non Agricultural Uses	Pastures & Other Grazing Lands	Net Area Sown	Miscellaneous Tree Crops & Groves	Cultivable Waste Lands	Unit: ha	
								Current	& Other Fallow Lands
Bilaspur	116,700	42,800	11,874	22,894	29,909	146	6,171	2,906	
Chamba	651,500	503,000	11,722	86,187	41,777	15	6,272	2,527	
Hamirpur	111,800	21,900	18,415	18,223	35,105	51	9,973	8,133	
Kangra	573,900	284,200	77,575	49,360	116,661	7,726	27,410	10,968	
Kinnaur	655,300	509,300	124,544	8,367	7,268	105	3,554	2,162	
Kullu	550,300	495,200	6,079	6,105	36,707	355	2,828	3,026	
Lahaul-Spiti	1,369,300	1,013,300	4,865	347,009	3,326	124	588	88	
Mandi	395,100	186,000	0	108,055	86,371	266	4,419	9,989	
Shimla	513,100	341,800	14,660	54,928	67,301	3,476	13,503	17,432	
Sirmaur	282,600	184,300	10,648	12,298	39,820	12,122	15,777	7,635	
Solan	193,700	72,800	9,779	52,913	39,264	834	12,484	5,626	
Una	154,000	48,700	29,039	3,261	41,091	7,680	19,221	5,008	
Total	5,567,300	3,703,300	319,200	769,600	544,600	32,900	122,200	75,500	
%	100%	66.5%	5.7%	13.8%	9.8%	0.6%	2.2%	1.4%	

Source: Department of Land Records, Himachal Pradesh State Government



The current agricultural land use as of 2002/03 is given in Table B-1.4 in which the cropping intensity is obtained by dividing the total cropped area by the net area sown. The total cropped area includes cultivated areas of annual crops and planted areas of fruit trees and other perennial crops. The overall average crop intensity of the State is 194 %. More than 800,000 cultivators in this State own a farm land of 0.67 ha on the average and they usually grow crops at least twice a year.

Table B-1.4 Agricultural Land Use in 2002/03

District	Cultivable Area (ha)	Net Area Sown		Land Holding Size		Cropped Area			Cropping Intensity (%)
		Area (ha)	Share (%)	Household (no.)	Size (ha)	Total (ha)	Annual Crop (ha)	Perennial Crop (ha)	
Bilaspur	32,961	29,909	91	45,998	0.65	63,502	57,967	5,535	212%
Chamba	44,319	41,777	94	63,859	0.65	77,079	64,232	12,847	185%
Hamirpur	43,289	35,105	81	61,642	0.57	75,221	70,724	4,497	214%
Kangra	135,355	116,661	86	169,111	0.69	241,539	205,517	36,022	207%
Kinnaur	9,535	7,268	76	12,477	0.58	15,417	6,995	8,422	212%
Kullu	40,088	36,707	92	60,074	0.61	75,973	52,239	23,734	207%
Lahaul-Spiti	3,538	3,326	94	4,279	0.78	5,878	5,509	369	177%
Mandi	96,626	86,371	89	133,462	0.65	184,567	153,670	30,897	214%
Shimla	88,209	67,301	76	97,607	0.69	92,892	59,522	33,370	138%
Sirmaur	59,577	39,820	67	57,949	0.69	84,514	68,572	15,942	212%
Solan	45,724	39,264	86	55,888	0.70	66,787	59,312	7,475	170%
Una	53,779	41,091	76	53,202	0.77	71,556	65,009	6,547	174%
State	653,000	544,600	83	815,548	0.67	1,054,925	869,268	185,657	194%

Source: Department of Land Records, Himachal Pradesh State Government

B-1.3 Crop Production

(1) Agricultural Administration in Himachal Pradesh

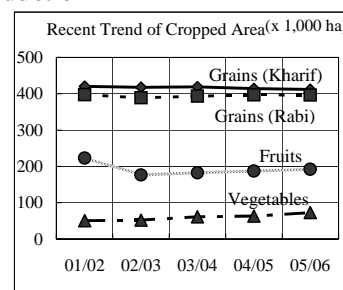
The agricultural administrative system of the State Government of Himachal Pradesh is different from that of the Central Government in which most of the agricultural development activities are under the Jurisdiction of Ministry of Agriculture with an exception of plantation crops which are handled by the Ministry of Commerce. In Himachal Pradesh, food grain crops and vegetables are under the jurisdiction of Directorate of Agriculture, while fruits, flowers, edible mushroom, hops, olives as well as cultivated medicinal and aromatic plants are under the jurisdiction of Directorate of Horticulture. The processing of fruits is also included with Directorate of Horticulture. Besides, wild plants including medicinal plants, aromatic plants and mushroom are under the jurisdiction of Directorate of Forestry. The breeding and development of new horticultural varieties are under the jurisdiction of agricultural research institutes of the Central Government. The marketing of horticultural products are managed by an independent board called as Himachal Pradesh Marketing Board, which manages the marketing issues through APMC.

(2) Recent Trend of Crop Production in Himachal Pradesh

The food crops grown in Himachal Pradesh are maize, rice, millets, ragi (finger millet), pulses, and oil seeds in kharif season (June to September), and wheat, barley, gram, pulses, and oil seeds in rabi season (November to April), while vegetable crops are mostly harvested from April to September. The recent trend of crop cultivation area and production in the State during the last five years from 2000/01 to 2005/06 is summarized in Table B-1.5, while the crop-wise breakdowns of vegetables are shown in Tables B-1.6.

Table B-1.5 Recent Trend of Cropped Area and Crop Production

Crop	2001/02		2002/03		2003/04		2004/05		2005/06	
	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)
Kharif season crops										
Grains	420,217	924,829	417,403	581,364	419,012	870,038	414,006	763,545	411,880	954,446
Oil seeds	5,262	3,261	5,367	3,145	5,387	3,250	4,836	3,004	7,688	6,314
Rabi season crops										
Grains	397,309	674,093	388,872	529,498	393,357	527,940	397,031	724,100	396,210	759,208
Oil seeds	11,772	9,118	10,320	5,139	10,346	3,618	10,552	4,713	10,705	16,122
Vegetables	50,628	764,664	52,307	782,023	61,354	919,170	63,064	994,928	72,983	1,089,415
Fruits	223,035	459,623	176,206	263,446	182,441	559,977	186,903	692,011	192,092	473,896



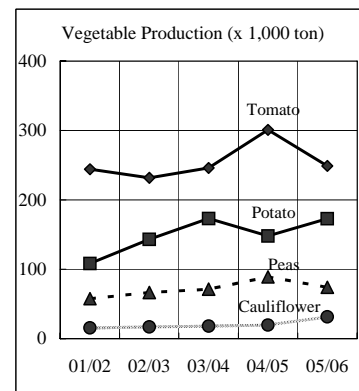
Source: Department of Land Records, and Department of Horticulture, Himachal Pradesh State Government (2001/02 - 2004/05), and

JICA Study Team through the block offices of Department of Agriculture (2005/06)

Remarks: 2002/03 drought year

Table B-1.6 Cropped Area and Production of Vegetables

Vegetable	2001/02		2002/03		2003/04		2004/05		2005/06	
	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)
Potato	13,869	108,207	14,632	143,054	15,036	173,162	14,808	147,919	14,984	172,871
Tomato	7,035	243,950	9,000	231,700	9,013	246,033	8,973	300,976	8,292	248,907
Onion	2,520	45,345	965	18,600	1,262	21,046	1,290	21,664	1,543	26,937
Cauliflower	1,370	24,980	1,450	30,435	1,648	29,328	1,808	34,445	3,224	51,332
Cabbage	2,200	57,660	2,195	66,311	2,790	71,134	2,889	88,927	3,029	73,818
Peas	9,830	94,170	9,505	90,480	14,789	154,943	15,441	162,144	19,450	202,734
Beans	2,240	22,040	1,910	20,798	2,444	27,202	2,608	26,684	3,672	34,628
Egg plant	380	6,840	350	6,784	544	9,170	624	11,121	516	10,072
Radish*	1,015	17,860	910	19,165	1,222	20,157	1,269	23,130	1,772	31,552
Okra	730	5,980	815	8,715	1,373	13,774	1,420	14,489	1,952	20,778
Cucurbits	2,600	64,500	2,245	58,280	1,993	49,830	2,021	46,925	962	16,620
Capsicum**	1,650	15,430	1,420	16,870	1,642	17,862	1,834	19,455	2,621	31,475
Garlic***	-	-	2,898	29,947	2,725	24,789	2,649	26,626	2,910	35,378
Ginger	2,609	29,012	2,455	17,051	2,044	14,658	2,043	14,567	3,244	46,446
Others	2,580	28,690	1,557	23,833	2,829	46,082	3,387	55,856	4,812	85,867
Total	50,628	764,664	52,307	782,023	61,354	919,170	63,064	994,928	72,983	1,089,415



Note: *Including turnip and carrot, **Including chilies, ***Included into onion in 2001/02

Source: Department of Land Records, Himachal Pradesh State Government (2001/02 - 2004/05), and JICA Study Team through the block offices of Department of Agriculture (2005/06)

Remarks: 2002/03 drought year

(3) Main Crop Production Areas in Himachal Pradesh

Main production areas of major food grain crops, vegetables and fruits in Himachal Pradesh according to the crop statistics of 2004/05 are represented by the top three districts as shown in Table B-1.7, while the district-wise records on the cultivation area and production are presented in Table B-1.8, and Table B-1.9 for selected food grain crops, and vegetables respectively.

In regard to introduction of new horticulture crops such as exotic vegetables, some of advanced farmers in Himachal Pradesh grow broccoli, red cabbage, lettuce, asparagus, celery, Swiss chard, parsley, Brussels sprouts, Chinese cabbage, etc. in limited areas. They have directly sold their produces to buyers (wholesalers, retailers, hotels, etc.) in Delhi or other big consuming area.

Table B-1.7 Main Production Areas of Major Crops

Crop	First Rank			Second Rank			Third Rank		
	District	Area (ha)	Produce (ton)	District	Area (ha)	Produce (ton)	District	Area (ha)	Produce (ton)
Food grains	Kangra	195,807	314,566	Mandi	142,026	287,251	Hamirpur	69,243	137,629
Maize	Mandi	46,517	131,179	Kangra	58,050	90,940	Chamba	28,804	72,559
Rice	Kangra	37,079	48,680	Mandi	20,092	25,275	Solan	4,742	10,401
Wheat	Kangra	94,424	170,283	Mandi	66,488	121,403	Hamirpur	34,689	71,439
Barley	Mandi	3,804	6,938	Shimla	4,704	5,753	Kullu	3,590	4,892
Vegetables	Shimla	12,923	185,737	Solan	7,237	173,939	Sirmaur	8,162	118,235
Potato	Shimla	5,429	46,560	Mandi	2,453	35,581	Kangra	1,640	20,886
Tomato	Solan	3,735	130,695	Sirmaur	1,525	48,800	Mandi	900	27,900
Cauliflower	Shimla	420	9,240	Kullu	450	9,000	Kangra	296	3,231
Cabbage	Shimla	1,500	52,500	Kullu	500	12,500	Kangra	307	8,596
Peas	L.-Spiti	3,770	44,282	Shimla	3,200	32,000	Sirmaur	1,850	18,500
Fruits	Shimla	34,966	322,895	Kullu	24,263	175,625	Kangra	31,470	85,587
Apple	Shimla	29,029	318,449	Kullu	20,524	141,844	Kinnaur	7,720	38,066
Mango	Kangra	19,952	46,215	Una	1,787	3,952	Bilaspur	3,652	3,595

Source: 2004/05 data of Department of Land Records and Department of Horticulture, Himachal Pradesh State Government

Table B-1.8 District-wise Cropped Area and Production of Food Grain Crops

District	Maize		Rice		Wheat		Barley		All Food Grain Crops	
	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)
Bilaspur	25,650	50,774	1,497	2,027	28,106	67,319	203	292	55,939	120,753
Chamba	28,804	72,559	2,760	4,193	20,202	31,049	3,455	4,618	59,944	113,920
Hamirpur	32,149	63,705	2,261	2,364	34,689	71,439	68	98	69,243	137,629
Kangra	58,050	90,940	37,079	48,680	94,424	170,283	2,412	3,200	195,807	314,566
Kinnaur	264	562	31	43	361	629	1,187	2,447	5,673	5,022
Kullu	16,516	39,319	1,546	2,571	25,383	45,924	3,590	4,892	51,375	94,249
Lahaul-Spiti	64	136	0	0	81	151	592	852	917	1,210
Mandi	46,517	131,179	20,092	25,275	66,488	121,403	3,804	6,938	142,026	287,251
Shimla	13,896	33,612	1,981	2,122	15,104	20,281	4,704	5,743	47,108	70,503
Sirmaur	23,610	48,402	5,509	7,881	25,824	48,027	1,730	2,699	60,843	109,029
Solan	22,852	40,291	4,742	10,401	24,694	47,483	1,682	1,924	56,888	101,265
Una	30,233	64,815	2,021	3,572	32,414	63,464	0	0	65,274	132,203
State	298,605	636,294	79,519	109,129	367,770	687,452	23,427	33,713	811,037	1,487,645

Source: 2004/05 data of Department of Land Records, Himachal Pradesh State Government

Table B-1.9 District-wise Cropped Area and Production of Vegetables

District	Potato		Tomato		Cauliflower		Peas		All Vegetables	
	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)
Bilaspur	19	189	740	25,900	90	2,380	80	1,680	2,141	50,261
Chamba	680	7,887	88	2,441	10	169	805	6,456	2,418	28,411
Hamirpur	4	40	115	2,430	80	1,760	90	900	1,251	22,497
Kangra	1,640	20,886	310	10,540	296	3,231	436	2,956	7,414	111,756
Kinnaur	183	2,005	10	200	7	140	1,750	18,000	2,628	29,729
Kullu	1,293	7,349	785	27,475	450	9,000	600	6,000	5,223	78,194
Lahaul-Spiti	759	10,385	5	65	25	359	3,770	44,282	4,701	56,625
Mandi	2,453	35,581	900	27,900	140	2,800	1,400	14,000	6,951	109,359
Shimla	5,429	46,560	690	22,080	420	9,240	3,200	32,000	12,923	185,737
Sirmaur	1,472	8,430	1,525	48,800	115	2,346	1,850	18,500	8,162	118,235
Solan	84	837	3,735	130,695	95	1,660	1,400	16,800	7,237	173,939
Una	792	7,894	70	2,450	80	1,360	60	570	2,015	30,309
State	14,808	147,919	8,973	300,976	1,808	34,445	15,441	162,144	63,064	994,928

Source: 2004/05 data of Department of Land Records, Himachal Pradesh State Government

(4) Comparison of Yields

1) Food grains

The average yields of food grains are shown below in Table B-1.10.

Table B-1.10 Average Yields of Food Grains

Food Crops	2000/01	2001/02	2002/03	2003/04	2004/05	Unit : t/ha	
						India (Ave) 2003/04 *	% Under irrigation
Kharif season							
Maize	2.29	2.55	1.61	2.44	2.13	1.98	22%
Paddy	1.53	1.71	1.03	1.48	1.37	2.05	54%
Ragi	1.01	1.17	1.26	1.09	1.28	1.50	-
Millets	0.66	0.65	0.69	0.60	0.64	0.77	8%
Kharif Pulses	0.50	0.33	0.23	0.35	0.34	0.62	12%
Rabi season							
Wheat	0.69	1.74	1.38	1.37	1.87	2.71	85%
Barley	0.84	1.39	1.30	1.16	1.44	1.99	-
Gram	1.11	0.77	0.75	0.90	0.99	0.79	30%
Rabi Pulses	1.14	0.28	0.52	0.38	0.36	0.66	-

Source : 2004/05 data of Department of Land Records, Himachal Pradesh State Government;

(*) - Agricultural Statistics at a Glance, 2004, Directorate of Economics & Statistics, Min. of Agriculture.

Since most of the area is grown under rainfed agriculture, the yield of the food crops is highly influenced by the climate, especially the rainfall. Because of the drought conditions during kharif season of 2002/03, the yield of maize, paddy are much lower than the other years. Maize performs well on well-drained soils and water logging should be avoided. Because of the good drainage conditions in H.P, the average yield of maize is slightly higher than that of the Indian average yield. However, for the other food crops such as paddy, and wheat, the average yield is lower than that of the Indian average. The low yield is mainly attributed to the following reasons:

- Cultivation is on the slopes.
- Land holdings are small and scattered.
- The soils are shallow.

- Irrigation is limited.
- Farm mechanization is scarce.

The consumption of fertilizers in the north zone of India is shown below.

Table B-1.11 Consumption of Fertilizers in 2003/04

State	Fertilizer Use (kg/ha)			
	N	P ₂ O ₅	K ₂ O	N + P ₂ O ₅ + K ₂ O
Haryana	125.6	38.9	2.6	167.1
Himachal Pradesh	32.6	9.2	7.6	49.4
Jammu & Kashmir	50.0	18.1	3.2	71.4
Punjab	139.6	40	4.5	184
Uttar Pradesh & Uttaranchal	91.2	29.4	6.1	126.7
North zone of India	102.9	32	5.3	140.1
All India	59.2	22.1	8.5	89.8

Source: Fertilizer Use by Crop in India, FAO 2005

As it can be seen, the consumption of fertilizers in Himachal is much lower than all the neighboring states, and also much below the Indian average. Because of the hilly terrain, the fertilizers applied are easily eroded by rain, and farmers have been habituated to apply minimum amount of fertilizers.

2) Vegetables

Vegetable yield in H.P. in comparison with the all-India average is shown in the following table. As it can be seen, the average of H.P. State is about 20-50% higher than that of all-India average. In case of Tomato, it is about 88% higher than all-India average. In H.P, vegetables are cultivated mostly in assured irrigated areas, and therefore the yield is higher than the all-India average. Besides, the agro-climatic conditions are also much favorable for cultivating vegetables in the off-season.

Table B-1.12 Vegetable Yield in Himachal Pradesh

Vegetables	H.P State Average Yield (t/ha)						India Ave. Yield (t/ha)
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2004-05
Peas	9.57	9.58	9.52	10.48	10.50	10.83	7.13
Tomato	34.65	34.68	25.74	27.30	33.54	32.70	17.36
Beans	9.82	9.84	10.89	11.13	10.23	10.46	-
Onion	18.35	17.99	19.27	16.68	16.79	15.02	12.65
Garlic	-	-	10.33	9.10	10.05	12.18	-
Cabbage	-	-	30.21	25.50	30.78	31.53	21.18
Cauliflower	-	-	20.99	17.80	19.05	23.47	18.93
Radish/Turnip/Carrot	17.55	17.60	21.06	16.50	18.23	20.80	-
Okra	8.17	8.19	10.69	10.03	10.20	11.38	9.84
Cucurbits	24.99	24.81	25.96	25.00	23.22	21.06	-
Capsicum/ Chillies	9.36	9.35	11.88	10.88	10.61	14.84	-
Egg plant	17.55	18.00	19.38	16.86	17.82	18.48	16.41
Other Vegetables	10.95	11.12	15.31	16.29	16.49	17.17	11.01
Total	18.13	18.37	17.66	16.52	18.01	18.65	15.01

Source : 2004/05 data of Department of Land Records, Himachal Pradesh State Government;

() - Agricultural Statistics at a Glance, 2004, Directorate of Economics & Statistics, Min. of Agriculture.*

(5) Crop Diversification Scheme

The Department of agriculture has been laying a thrust on crop diversification through the implementation of minor irrigation projects. Simultaneously, in order to popularize crop diversification, "Scheme for Promoting Diversified Farming System" has been carried out. The aim of this scheme was to motivate the farmers to shift from traditional crops to high value cash crops.

Crop diversification is popularized by adopting the project approach preferably in areas having

assured irrigation facilities. Farmers are imparted technical know-how by way of laying block demonstrations. Interactive workshops of farmers with different input agencies were organized so as to prepare location specific cropping plans. Integrated Pest Management (IPM) demonstrations were laid on farmers fields in order to demonstrate IPM technologies in diversified farming systems. The demonstrations were executed in 25 areas in 10 districts as shown in Table B-1.13.

Table B-1.13 Pilot Projects on Crop Diversification under Execution by DOA

District	Number	Area (ha)	Traditional Crops	Diversified Crops
Bilaspur	2	30.0	Maize-Paddy-Pulses	Maize-Paddy-Pulses-Vegetables
Chamba	2	22.0	Maize-Wheat	Tomato/Radish/Egg plant/Cabbage
Hamirpur	4	43.5	Maize-Wheat	Vegetables-Potato/Ginger
Kangra	4	194.0	Maize-Paddy-Pulses	Maize-Paddy-Pulses/Vegetables
Kullu	2	85.5	Maize-Paddy-Pulses	Maize-Paddy-Pulses-Vegetables
Mandi	4	81.9	Maize-Paddy-Wheat	Maize-Tomato/Cabbage/Capsicum/Peas
Shimla	2	20.9	Maize-Wheat-Vegetables	Cauliflower/Cabbage/Tomato/Radish
Sirmaur	2	20.0	Maize-Wheat	Tomato/Peas/Capsicum
Solan	1	20.5	Maize-Paddy-Barley-Vegetables	Tomato/Cauliflower/Beans/Peas
Una	2	63.0	Maize-Wheat-Pulses-Vegetables	Maize-Wheat-Vegetables

Source: Department of Agriculture, Himachal Pradesh State Government

In these projects, different diversified cropping patterns by including different vegetables were tried mainly based on the interest of the farmers. However, the planning was not made based on the marketing potential of the vegetable crops. Besides, no monitoring was carried out to study the impact after execution of such schemes.

B.1.4 Constraints and their Countermeasures in Agricultural Production

The constraints, development potentials and their countermeasures in agricultural production are summarized as shown below.

Table B-1.14 Constraints and their Countermeasures in Agricultural Production

Present Conditions / Constraints	Potential / Opportunities	Future Strategy & Measures
1. Majority of the farmers are small and marginal farmers with small landholding size.	i. A wide range of food grain and vegetable crops can be cultivated in kharif season (rainy season) because of variations of climate & altitude	1) Increasing vegetable production while ensuring food grain production.
2. Agriculture is based on traditional food grain production, and crop diversification is gaining attention only in the last decade.	ii. There are already Himachal brand vegetables such as peas.	2) Improved farming through introduction of high quality vegetable seeds, and protective agriculture, etc.
3. Land for new reclamation is limited. Large scale development is restricted because of mountainous area.	iii. There is a high possibility to convert from rainy season food grains (maize) to vegetables.	3) Improvement of post harvest activities such as sorting, grading & packing
4. The available irrigation facilities are insufficient to convert areas from food grains to vegetables	iv. There is a high possibility to increase unit yield and quality improvement.	4) Construction/improvement of small scale irrigation facilities and farm access roads
5. The farm access roads are insufficient for the transport of agricultural products, especially the vegetables	v. The farmers are receptive & highly interested towards crop diversification and adaptation of new technologies.	5) Strengthening of agricultural extension functions
6. The crop diversification demonstration schemes carried out are very few with no strategic planning.	vi. Market is available in the nearby States	6) Implementation more crop diversification demonstration trials
7. There is shortage of farmers support services including agricultural extension	vii. There are sufficient State and Central Research stations to carry out area oriented research.	7) Strengthening research & extension linkage, Extension system improvement
8. The available market information is insufficient.		8) Strengthening of market information system
9. There is insufficient farmers grouping / organization for extension & shipping their produces		9) Organizing farmers through agricultural extension

Source: JICA Study Team

B-2 Proposed Agriculture Development Plan

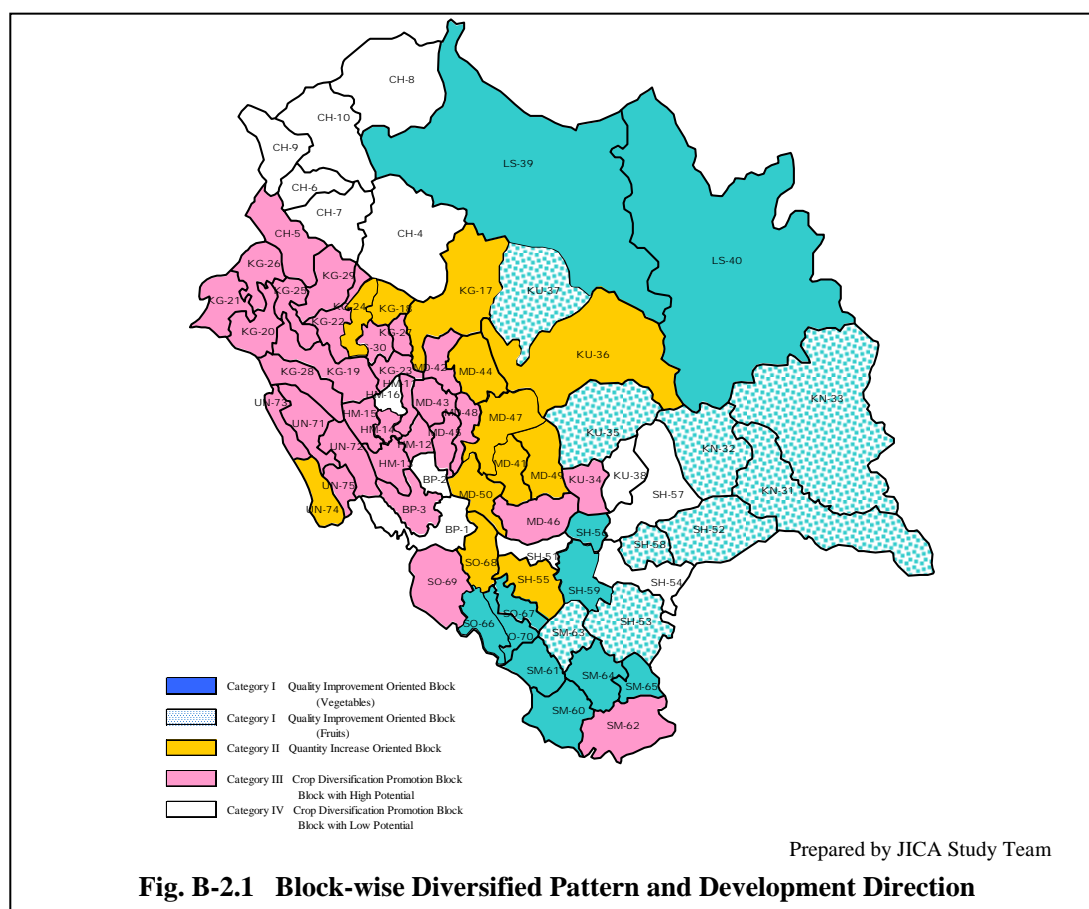
B-2.1 Category-Wise Diversification Strategy

As mentioned in Section 2.8, the diversified agriculture pattern has been divided into four categories focusing on vegetables in this study. Respective blocks in the State have been categorized in accordance with four diversified patterns. Crop diversification strategy has been studied for respective four categories and summarized in the following table:

Table B-2.1 Category-Wise Diversification Strategy

Category	Characteristics	Future Development Direction
Category-I	Advanced crop diversification area with less area expansion possibility	Further enhancement of farm income through productivity and quality improvement
Category-II	Crop diversification starting area with area expansion possibility	Enhancement of farm income through acceleration of crop diversification
Category-III	Predominantly grain crop cultivation and least crop diversification area with diversification area expansion potential	Enhancement of farm income through promotion of crop diversification
Category-IV	Area not covered by the above Category I to III	Enhancement of farm income through introduction of crop diversification followed by integrated farming consisting of horticulture, animal husbandry or fishery

Source: JICA Study Team



(1) Development Direction in Category I Area

21 blocks in the State has been classified into Category I. Category I area is characterized by advanced areas with less diversified area expansion possibility. Targets in this category are quality improvement and productivity increase in agriculture extension. Produces, mainly vegetables and temperate fruits, in Category I area has some market channels and their current market shares of produces are to be maintained at least or to be increased. Exotic vegetables are also growing in this area and their further market cultivation is needed.

Vegetable-oriented Area

Vegetable cultivation is advanced in the 12 blocks out of the 21 blocks. Focus point in the area are as follows:

- a. Targets of vegetable cultivation are i) saving of crop production cost, ii) introduction of new varieties, iii) productivity improvement, iv) quality improvement for marketing and v) selling higher prices;
- b. Harvesting period is to be off-season of other competitive producing areas outside the State where vegetable prices are relatively higher in the target markets such as Delhi. The off-season period is March to October. Accordingly planting time must be decided in recommended cropping pattern corresponding to the harvesting period and growing period. Rabi season vegetables will be planted after December and harvested after February;
- c. The quality is to be improved for getting reputation of consumers and higher prices through i) use of high quality seeds, ii) organic farming for consumer's safe and cost saving and iii) introduction of post-harvest technology, especially in sorting, grading and packing for target markets. Protective farming (green house) is to be promoted.
- d. Pilot demonstration is required, targeting to farmers i) to demonstrate farming practices of new varieties and/or exotic vegetables, and ii) to disseminate market channel possibility including direct channels to middle-class or higher consumers in urban area;
- e. Farmers' livelihood condition is expected to be improved and stabilized based on income generation from quality-improved vegetable-basis farming.

Fruits-oriented Area

Fruit planting is advanced in the 9 blocks out of the 21 blocks. Focus point in the area are as follows:

- a. Quality of apple as a core fruit in these 9 blocks is to be improved through replacement of old trees by introducing new varieties;
- b. Temperate fruit varieties are to be extended in order to create niche markets by taking advantages of wide range of agro-climate in the State;
- c. Soil conservation and soil fertility improvement are to be promoted in fruit tree planted areas on steep or hilly slopes, and one of its methods is to grow forage crops under and between fruit trees. Such practices also aim at creation of fodder production sources for cattle and sheep; and
- d. New commercial crops like flowers, medical/aromatic plants also have potential to be cultivated on farm land. Marketing efforts to open a direct channel to specific end users such as drug maker must be made for medical/aromatic plants.

(2) Development Direction for Category II Area

11 blocks in the State has been classified into Category II. Category II area is characterized by crop diversification starting area with area expansion possibility. Targets in Category II are production increase of diversified crops, mainly vegetables, by means of i) expansion of cropped area through the crop conversion, and ii) raising productivities of diversified crops. Increase in production and shipping

is the most important priority in promoting diversified agriculture in the blocks classified in this category. Focus point in the area are as follows:

- a. Vegetable producing area is to be newly created by the crop conversion from existing traditional crop area. Market shares of produced vegetables in existing vegetable growing areas are to be maintained or to be increased by new market cultivation;
- b. Reputation and market share of the main strategic vegetables such as potato, tomato, cauliflower and peas grown is expected to be gained in the target markets in Delhi. Harvesting period is to be off-season of other competitive producing areas outside the State, March to October.
- c. The productivity in existing vegetable growing area is to be improved through i) use of high quality seeds, ii) upgrading of farming practices, iii) provision of irrigation and iii) introduction of post-harvest technology, especially in sorting, grading and packing for target markets. Protective farming (green house) is to be promoted.
- d. Pilot demonstration is required, targeting to farmers i) to demonstrate farming practices of strategic vegetables and new varieties, ii) to introduce post-harvest technology such as sorting, grading and packing and iii) to disseminate market channel possibility. Protective farming (green house) is to be introduced. Nurturing of talented farmers is also target in this category;
- e. Initial priority is to be given to activities for expansion of cropped area followed by raising crop productivity. Farmers' livelihood conditions will be improved, following income generation from vegetable-basis farming.

(3) Development Direction for Category III Area

30 blocks in the State has been classified into Category III. Category III area is area where crop diversification, vegetable cultivation has not started yet or the cultivation area is least, but there is high potential in area expansion and productivity increase. Most of the area in this category belongs to agro-ecological zone 1 and partly zone 2 and zone 3. Targets in Category III are production increase of diversified crops, mainly vegetables, by means of expansion of cropped area through the crop conversion from traditional food grain. Increase in production and shipping is important priority in promoting diversified agriculture in the blocks classified in this category.

Majority of farmers in this category are growing food grain crops and not doing vegetables for shipping in most cases. Major food grain crops are maize and rice in Kharif season (rainy season) and wheat in Rabi season. Vegetables are growing in small scale in some home garden for domestic consumption. Farmer's income in this category is farm income only or farm income with additional non-farm income. Farm income comes from selling surplus grains after stocking for domestic consumption and non-farm income comes from labor wage from seasonal or temporary works generally. Part-time farmer, whose non-farm income is bigger than his farm income, is also cultivating food grain crops.

In order to promote vegetables in this Category III area, target farmers for crop diversification, especially vegetables, will be not the part-time farmers but the farmers whose income depend mostly upon farm income. Out of the target farmers, highly motivated and willing farmers will start crop conversion from traditional food crops to vegetables and become core vegetable farmers in the area. By impact of core vegetable farmers, the other target farmers nearby will be affected and are expected to start crop conversion. Farmer who is now cultivating vegetables in his home garden will be one of the promising target farmers.

Awareness camp will be organized to encourage motivation and willingness to start vegetable

cultivation as a first step, and workshop for vegetable farming practices will be organized for motivated and willing farmers as the second step. Farmers will do some rethinking themselves toward the diversification step by step. Conversion from traditional food crops to diversified crops by those farmers will be made not at a time but gradually.

According to block information on 2005/06 cultivation in agro-ecological zone 1 in Category III, advanced farmers harvested potato, tomato, beans, okra, cucumber, eggplant, pumpkin, chilly or ginger in Kharif season (rainy season) and potato, tomato, pea, cauliflower, onion, cabbage, radish or garlic in Rabi season. These vegetables have possibility to extend as starting crops in the diversification.

Focus point in the area are as follows:

- a. Vegetable producing area is to be newly created by the crop conversion from existing traditional food grain area with productivity increase of food grains for family food security. Existing market yards will be used as a market channel.
- b. Promotion of new crop diversification is to be centered on vegetable cultivation paying careful attention to identification and selection of adaptable crops from a viewpoint of agro-climatic limitations and market demands;
- c. Crop diversification is to be initially based on current strategic crops such as potato, tomato, cauliflower and peas in agro-ecological zone 2 and zone 3 and potato, tomato in Kharif season and potato, tomato, pea, cauliflower in Rabi season in the zone 1. Proper cropping seasons must be selected matching with crop growth condition and the off-season period in target markets;
- d. Research & development activities are to be focused on practical topics such as breeding of new variety of tomato, cauliflower and peas for the blocks belonging to agro-ecological conditions of Zone-1 and Zone-2;
- e. Area expansion is to be supported through i) awareness camp & workshop for promotion of vegetables ii) provision of irrigation, iii) introduction of quality seeds, and iii) introduction of sorting, grading and packing for target markets.
- f. Initially, priority is to be put on promotion of crop diversification on existing cropped area and then increase of crop productivity. Farmers' livelihood conditions will be improved based on income generation from vegetable-basis farming gradually.

(4) Development Direction for Category IV Area

13 blocks in the State has been classified into Category IV. Category IV area is presently predominant in food grain production. Potential in area expansion and production increase through crop conversion and productivity improvement is comparatively small. Therefore, promotion of diversified agriculture through alternative means such as the promotion of livestock and inland fishery are the keys.

These 13 blocks classified into Category IV should focus on raising crop productivity of food grain, since there is less potential for converting the existing food grain into diversified crops due to high population pressure or low productivity there. Focus point in the area are as follows:

- a. Food grain productivity is to be raised and improved as a first step. There is small potential area in Category IV where crop conversion can be made after raising productivity of food grain crops currently grown in Kharif season. In such area vegetable promotion will be made;
- b. In parallel, integrated farming is to be promoted which contains planting sub-tropical or temperate fruit trees, milk production by cattle and local buffalos or fish culture using pond supplied by irrigation water.

B-2.2 Vegetable Promotion

(1) Description of the Component

Crop diversification will be made mainly in the current cropped area of such food grain as maize, wheat, rice. Crop diversification is expected to such strategic vegetables as potato, tomato, cauliflower and peas where they are cultivable and profitable. In vegetable cultivation, essential points are i) cultivation area expansion, ii) productivity improvement, and iii) quality improvement.

In Himachal Pradesh, some of progressive farmers produce exotic vegetables and they directly sell their produces to buyers (wholesalers, retailers, hotels) in Delhi and other large consuming areas. Exotic vegetables are profitable, but the demand is still low. Although the consuming area is still limited to such big cities as Mumbai, Delhi, Kolkata, Chennai, its demand is expected to increase in the future.

The target, outputs, executing organization and proposed activities of this component are listed below:

Table B-2.2 Outline of Vegetable Promotion

Item	Outline of Component
Target	Crop diversification to vegetables, particularly strategic vegetables of potato, tomato, cauliflower and peas will be accelerated and productivities and quality will be improved. Exotic vegetables will be promoted in the suitable areas and will be sent to big cities.
Outputs	<ol style="list-style-type: none"> 1. Practical cropping pattern will be introduced. 2. Production area, and yield of strategic vegetables will increase. 3. Exotic vegetables will be cultivated in a wider area. 4. Quality of strategic vegetables will be improved. 5. Organic farming will become popular.
Activities	<p><u>Major Activities</u></p> <ol style="list-style-type: none"> 1. Introduction of cropping patterns suitable for markets <ol style="list-style-type: none"> 1.1 Review of cropping patterns 1.2 Demonstration and dissemination of recommended cropping patterns 2. Promotion of strategic vegetables such as potato, tomato, cauliflower and peas <ol style="list-style-type: none"> 2.1 Demonstration and dissemination of recommended cropping pattern with farming practices 2.2 Demonstration and dissemination of promising varieties 2a. Introduction and promotion of exotic vegetables <ol style="list-style-type: none"> 1.1 Demonstration and dissemination of recommended farming practices 1.2 Demonstration and dissemination of promising varieties 3. Improvement of productivity and quality of vegetables <ol style="list-style-type: none"> 3.1 Review of farming practices 3.2 Demonstration and dissemination of recommended cropping pattern 3.3 Demonstration and dissemination of promising varieties and quality seeds 4. Promotion of organic farming <p><u>Supporting activities</u></p> <ol style="list-style-type: none"> 5. Organizing or strengthening of farmers' groups (marketing group) 6. Supply of certified seeds for vegetables and planting materials 7. Extension of protective cultivation (Greenhouse) and provision of facilities in model farms 8. Introduction of farm mechanization through identification of suitable machinery and equipment for hilly area. 9. Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases. 10. Promotion of farming practices to reduce soil erosion 11. Introduction of contract farming 12. Monitoring and Evaluation of program component progress
Related components	Strengthening of Extension Service Functions, Infrastructure Development / Improvement, Post-Harvest Processing Promotion, Market-oriented Quality Improvement, Marketing System Improvement, Sales Promotion
Execution Organization	Execution: Department of Agriculture / District & Block Agriculture Offices Supporting: ATMA / Agriculture & Horticulture Universities

Source: JICA Study Team

(2) Future Direction of Improvement of the Component

Among the program components, the highest priority was given to vegetable promotion and infrastructure development/improvement in the workshop conducted for the 75 blocks. Based on the results of the workshop, future direction of the component is decided as follows:

- 1) The total area with potential to convert food grains to vegetables is 66,200 ha as shown in the Table 6.5.2. Among the categories, Category III has the highest potential with 37,300 ha while Category IV has the lowest with only 5,450 ha.

Table B-2.3 Block-wise Area of Crop Diversification Proposed by Blocks

Category of Blocks	No. of Blocks	Food Grain Area to Vegetables	Fallow Area to Vegetables	Increase Area of Strategic Vegetables	Increase Area of Multiple Vegetables	Increase Area of Exotic Vegetables	% of Diversification from Kharif Food Area
Category - I	21	10,420 ha	1,630 ha	5,350 ha	6,200 ha	490 ha	18.6%
Category - II	11	13,030 ha	1,150 ha	7,270 ha	6,240 ha	670 ha	19.2%
Category - III	30	37,320 ha	2,370 ha	14,160 ha	24,110 ha	1,420 ha	15.8%
Category - IV	13	5,450 ha	1,250 ha	3,240 ha	2,960 ha	500 ha	9.2%
State-Total		66,220 ha	6,400 ha	30,020 ha	39,510 ha	3,080 ha	15.8%

Source: JICA Study Team (Results of the Workshop)

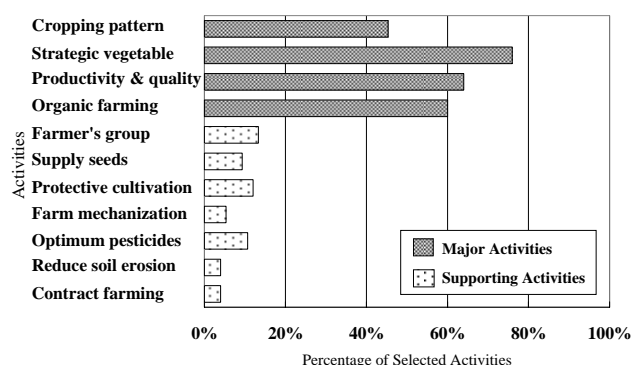
- 2) About 19% of the food grain area in Category I and II can be converted to vegetables, 16% in Category III and less than 10% in Category IV.

- 3) Since many of the blocks in Categories I and II are located in the Agro-Ecological Zones of 3 and 4 suitable for vegetables and fruits, a higher proportion of food grain area in these zones is to be converted to vegetables. Many blocks in Category III are extending over the lower AEZs of food grains production area, and the farmers in this area prefer to keep a certain portion of the land for food grain production. Hence, the percentage of area to be converted in Category III is less than in Category I and II.

- 4) While the focus on vegetable promotion is on the strategic vegetables (tomato, potato, cauliflower, and peas), a high proportion of area will be used for other multiple vegetables (cabbage, capsicum, beans, garlic, okra, etc.) considering suitability of the area and marketing demand.

- 5) Although exotic vegetables are not selected as the higher priority component, at least 10-100 ha in each block can be converted based on the suitability, marketing demand and willingness of the farmers. Farmers' group should be established so that exotic vegetables can be sold in a larger quantity to the larger markets such as Delhi.

- 6) Among the 12 activities in the program components of "Vegetable Promotion", the priority activities are selected by the blocks as shown in Fig. B.2.2. Among the main activities, the promotion of strategic vegetables was selected with the highest priority, followed by improvement of productivity and quality of vegetables, and organic farming.



Source: JICA Study Team

Fig. B-2.2 Priority Activities of Vegetable Promotion

- 7) Although the supporting activities were selected with lower priority, the activities including organizing or strengthening of farmers' groups (marketing group), supply of certified seeds for vegetables and planting materials, extension of protective cultivation (Greenhouse, Net-shade House, etc) and provision of facilities in model farms, and promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases were selected with a relatively higher priority.

(3) Proposed Master Plan

The current situation, proposed plan, subjects to be executed, and the target persons are summarized in Table B-2.4.

Table B-2.4 Proposed Master Plan of Vegetable Promotion

Activity	Current Situation	Proposed Plan	Subjects to be Executed	Schedule	Target Persons	Executing Institute
(1) Introduction of cropping patterns suitable for markets	<ul style="list-style-type: none"> Mostly food grain dominated cropping pattern is practiced. 	<ul style="list-style-type: none"> Conducting of demonstration trials Organizing of training camps – to be included in demonstration trials Exposure visits of farmers – to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Diversified cropping pattern suitable 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(2) Promotion of strategic vegetables such as potato, tomato, cauliflower and peas	<ul style="list-style-type: none"> Vegetable cultivation is based on natural & infrastructural conditions Very few demonstration activities 	<ul style="list-style-type: none"> Conducting of demonstration trials Organizing of training camps –to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of strategic vegetables suitable and farming practices for different areas 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA

Activity	Current Situation	Proposed Plan	Subjects to be Executed	Schedule	Target Persons	Executing Institute
(3) Introduction and promotion of exotic vegetables	<ul style="list-style-type: none"> Exotic vegetables are cultivated only in limited areas of H.P. State. No demonstration activities by DOA. 	<ul style="list-style-type: none"> Conducting of demonstration trials Organizing of training camps –to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of exotic vegetables suitable and farming practices for different areas Exposure visits of farmers 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(4) Improvement of productivity and quality of vegetables	<ul style="list-style-type: none"> Some productivity & quality trials are conducted at the agricultural university research farms. 	<ul style="list-style-type: none"> Conducting of demonstration trials Organizing of training camps –to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of vegetables suitable and proposed farming practices for the area 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(5) Promotion of organic farming	<ul style="list-style-type: none"> Some farmers are adapting organic farming for food grain cultivation. 	<ul style="list-style-type: none"> Demonstration of organic farming practices (including IPM, biological control) Organizing of training camps –to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days in farm schools – 4 times in a year to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of organic farming practices suitable for obtaining higher yields 	<ul style="list-style-type: none"> Trials – yearly Camps & exposure visits – 2 times a year. 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA

Activity	Current Situation	Proposed Plan	Subjects to be Executed	Schedule	Target Persons	Executing Institute
(6) Organizing or strengthening of farmers' groups	<ul style="list-style-type: none"> Some farmers groups are formed, but there are very few groups for vegetables. 	<ul style="list-style-type: none"> Workshops for group activities Capacity development of farmers on organizational management 	<ul style="list-style-type: none"> Promotion of farmers organization 	<ul style="list-style-type: none"> Depending on the project implementation 	<ul style="list-style-type: none"> Farmers 	<ul style="list-style-type: none"> DOA
(7) Extension of protective cultivation (Greenhouse) and provision of facilities in model farms	<ul style="list-style-type: none"> Some protective cultivation trials are conducted at the agricultural university research farms. 	<ul style="list-style-type: none"> Conducting of demonstration trials on package of practices (POP) under protective cultivation Organizing of training camps to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials Protective cultivation units to be supplied by on-going and newly proposed programs as demonstration activity 	<ul style="list-style-type: none"> Demonstration of vegetable cultivation under protective cultivation 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(8) Demonstration of suitable farm machinery and equipment for hilly area.	<ul style="list-style-type: none"> No such farm machinery trials are conducted by DOA 	<ul style="list-style-type: none"> Demonstration of farm machinery Organizing of training camps to be included in demonstration trials Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of farm machinery suitable for hilly areas 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA

Activity	Current Situation	Proposed Plan	Subjects to be Executed	Schedule	Target Persons	Executing Institute
(9) Promotion of optimum use of pesticides under IPM	<ul style="list-style-type: none"> Some trials are conducted by DOA and the agricultural universities 	<ul style="list-style-type: none"> Demonstration of Integrated Pest Management (IPM) Organizing of training camps to be included in demonstration trials Exposure visits of farmers – to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of optimum practices of IPM 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(10) Promotion of farming practices to reduce soil erosion	<ul style="list-style-type: none"> No such trials are conducted by DOA in vegetable cultivation 	<ul style="list-style-type: none"> Demonstration of farming practices (contour farming) Organizing of training camps to be included in demonstration trials Exposure visits of farmers - to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of suitable farming practices to reduce soil erosion 	<ul style="list-style-type: none"> Trials – yearly 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA
(11) Introduction of contract farming	<ul style="list-style-type: none"> Very few contract farming is presently done. 	<ul style="list-style-type: none"> Conducting of workshops 	<ul style="list-style-type: none"> Introduction of contract farming promotion of linkage between farmers and private traders. 	<ul style="list-style-type: none"> Once a year 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Private firms Farmers 	<ul style="list-style-type: none"> DOA
(12) Monitoring and Evaluation	<ul style="list-style-type: none"> Except ATMA, no monitoring is done. 	<ul style="list-style-type: none"> Employment of third part local consultant for monitoring and evaluation under Project Management Unit 	<ul style="list-style-type: none"> Confirmation of progress of vegetable cultivation 	<ul style="list-style-type: none"> Before and after implementation of activities 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices Farmers 	<ul style="list-style-type: none"> DOA

Source: JICA Study Team

(4) Proposed Action Plan

Activities for the Vegetable Promotion Plan, which are formulated for the M/P, are arranged, according to the features of four categories as follows: Requirement and estimate of cost are elaborated based on the activities by categories mentioned below table:

Table B-2.5 Activities for Vegetable Promotion by Categories

Category	Category-I	Category-II	Category-III	Category-IV
(1) Organizing or strengthening of farmers' groups	Yes	Yes	Yes	Yes
(2) Introduction of cropping patterns suitable for markets	Yes	Yes	Yes	Yes
(3) Improvement of productivity and quality of vegetables	Yes	Yes	Yes	Yes
(4) Promotion of optimum use of pesticides under IPM	Yes	Yes	Yes	
(5) Promotion of farming practices to reduce soil erosion	Yes	Yes	Yes	Yes
(6) Demonstration of farm machinery and equipment for hilly area.	Yes	Yes	Yes	
(7) Promotion of organic farming	Yes	Yes		
(8) Extension of protective cultivation (Greenhouse) and provision of facilities in model farms	Yes	Yes		
(9) Introduction and promotion of exotic vegetables	Yes			
(10) Introduction of contract farming	Yes			
(11) Promotion of strategic vegetables such as potato, tomato, cauliflower and peas		Yes	Yes	Yes
(12) Monitoring and Evaluation	Yes	Yes	Yes	Yes

Source: JICA Study Team

Details of each activity are shown as follows:

Table B-2.6 Proposed Action Plan of Vegetable Promotion

Activity	Subjects	Target	Executed by	Remarks
(1) Organizing or strengthening of farmers' groups	<ul style="list-style-type: none"> Promotion of farmers organization and its activities 	Farmers	DOA	(1) see Table B-2.14 regarding implementation cost
(2) Introduction of cropping patterns suitable for markets	<ul style="list-style-type: none"> Demonstration of diversified cropping pattern with combination of food grains and vegetables 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(3) Improvement of productivity and quality of vegetables	<ul style="list-style-type: none"> Demonstration of vegetables suitable and proposed farming practices for the area 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(4) Promotion of optimum use of pesticides under IPM	<ul style="list-style-type: none"> Demonstration of optimum practices of IPM 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(5) Promotion of farming practices to reduce soil erosion	<ul style="list-style-type: none"> Demonstration of suitable farming practices to reduce soil erosion 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(6) Demonstration of farm machinery and equipment for hilly area.	<ul style="list-style-type: none"> Demonstration of farm machinery suitable for hilly areas 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(7) Promotion of organic farming	<ul style="list-style-type: none"> Demonstration of organic farming practices suitable for obtaining higher yields 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(8) Extension of protective cultivation (Greenhouse) and provision of facilities in model farms	<ul style="list-style-type: none"> Demonstration of vegetable cultivation under protective cultivation 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(9) Introduction and promotion of exotic vegetables	<ul style="list-style-type: none"> Demonstration of exotic vegetables suitable and farming practices for different areas Exposure visits of farmers to advanced farmers 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(10) Introduction of contract farming	<ul style="list-style-type: none"> Introduction of contract farming promotion of linkage between farmers and private traders. 	Farmers Extension staff	DOA	(1) see Table B-2.14 regarding implementation cost
(11) Promotion of strategic vegetables such as potato, tomato, cauliflower and peas	<ul style="list-style-type: none"> Demonstration of strategic vegetables suitable and farming practices for different area 	Farmers Extension staff	DOA	(1) This activity is included in a demonstration trial. (2) see Table B-2.14 regarding implementation cost
(12) Monitoring and Evaluation	<ul style="list-style-type: none"> Confirmation of progress of vegetable cultivation 	Farmers Extension staff	DOA	(1) Monitoring and evaluation should be carried out by one group, which covers all the activities.

Source: JICA Study Team

B-2.3 Food Grain Crop Productivity Improvement

(1) Description of the Component

Crop diversification from food grains will be attained through increase of productivity of food grains, since many small and marginal farmers live on food grain production in the State. Under this situation, this component is planned and outlined below:

Table B-2.7 Outline of Food Grain Crop Productivity Improvement

Item	Outline of Component
Target	Crop diversification will be accelerated.
Outputs	1. Unit yield of food grain crops will increase. 2. Crop conversion area from food grains to vegetables will be increase.
Activities	<p><u>Major activities</u></p> <p>1. Promotion of diversified cropping patterns suitable for productivity increase of food grain crops</p> <p> 1.1 Review of cropping pattern and farming practices</p> <p> 1.2 Demonstration and dissemination of suitable cropping pattern and farming practices</p> <p>2. Promotion of optimum quantities of farm inputs such as seeds and fertilizers</p> <p><u>Supporting activities</u></p> <p>3. Promotion of organic farming</p> <p>4. Organizing or strengthening of farmers' groups (marketing group)</p> <p>5. Introduction of farm mechanization through identification of suitable machinery and equipment for hilly area.</p> <p>6. Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases.</p> <p>7. Promotion of farming practices to reduce soil erosion</p> <p>8. Monitoring and Evaluation</p>
Related components	Strengthening of extension service functions, infrastructure development and improvement
Execution Organization	Execution: Department of Agriculture / District & Block Agriculture Offices Supporting : Department of Agriculture / Agriculture & Horticulture Universities

Source: JICA Study Team

(2) Future Direction of Improvement of the Component

The future direction of improvement of the component shall be decided as follows:

- 1) In the workshop conducted for the 75 blocks, food grain improvement was ranked by the block officers as 6th priority overall. However, six blocks located in the lower AEZs selected this component as the highest priority.
- 2) While crop diversification focuses on vegetable promotion, food grain productivity improvement and food security is given ample importance to sustain food security
- 3) By increasing the food grains productivity by 30-50%, the food grains area can be converted for vegetable cultivation.

(3) Proposed Master Plan

The current situation, proposed plan, subjects to be executed, and the target persons are summarized in Table B-2.8.

Table B-2.8 Proposed Master Plan of Food Grain Crop Productivity Improvement

Activity	Current Situation	Proposed Plan	Subjects	Schedule	Target Persons	Executing Institute
(1) Promotion of diversified cropping patterns suitable for productivity increase of food grain crops	<ul style="list-style-type: none"> Mostly food grain dominated cropping pattern based on natural & infrastructural conditions is practiced. 	<ul style="list-style-type: none"> Conducting of demonstration trials Organizing of training camps to be included in demonstration trials Exposure visits of farmers to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Cropping pattern suitable for increasing food grains production and the farm income 	<ul style="list-style-type: none"> Yearly demonstrations 	<ul style="list-style-type: none"> Extension Staff Farmers 	DOA
(2) Promotion of optimum quantities of farm inputs such as seeds and fertilizers	<ul style="list-style-type: none"> Regarding food grains cultivation, mostly traditional farming practices are followed by farmers 	<ul style="list-style-type: none"> Conducting of varietal demonstration trials Conducting of demonstration trials on package of practices (POP) Organizing of training camps to be included in demonstration trials Exposure visits of farmers to be conducted as component of demonstration trials, if necessary Field days to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of food grains varieties Package of practices for different varieties 	<ul style="list-style-type: none"> Trials yearly 	<ul style="list-style-type: none"> Extension Staff Farmers 	DOA
(3) Organizing or strengthening of farmers' groups	<ul style="list-style-type: none"> Some farmers groups are formed. 	<ul style="list-style-type: none"> Conducting of workshops 	<ul style="list-style-type: none"> Promotion of farmers' organization 	<ul style="list-style-type: none"> Depending on the project implementation 	<ul style="list-style-type: none"> Farmers 	DOA
(4) Demonstration of suitable farm machinery and equipment for hilly area.	<ul style="list-style-type: none"> No such farm machinery trials are conducted by DOA 	<ul style="list-style-type: none"> Demonstration of farm machinery Organizing of training camps to be included in demonstration trials Exposure visits of farmers to be conducted as component of demonstration trials, if necessary Field day to be included in demonstration trials 	<ul style="list-style-type: none"> Demonstration of farm machinery suitable for hilly areas 	<ul style="list-style-type: none"> Trials yearly 	<ul style="list-style-type: none"> Extension Staff Farmers 	DOA

Activity	Current Situation	Proposed Plan	Subjects	Schedule	Target Persons	Executing Institute
(5) Promotion of optimum use of pesticides under IPM	<ul style="list-style-type: none"> Some trials are conducted by DOA and the agricultural universities 	<ul style="list-style-type: none"> Demonstration of Integrated Pest Management (IPM) Organizing of training camps to be included in demonstration trials Exposure visits of farmers to be conducted as component of demonstration trials, if necessary Field day to be included in demonstration trials 	<ul style="list-style-type: none"> Optimum practices of IPM and biological control of pests and diseases 	<ul style="list-style-type: none"> Trials yearly 	<ul style="list-style-type: none"> Extension Staff Farmers 	DOA
(6) Promotion of farming practices to reduce soil erosion	<ul style="list-style-type: none"> No such trials are conducted by DOA in vegetable cultivation 	<ul style="list-style-type: none"> Demonstration of farming practices (contour farming) Organizing of training camps to be included in demonstration trials Exposure visits of farmers to be conducted as component of demonstration trials, if necessary Field day to be included in demonstration trials 	<ul style="list-style-type: none"> Suitable farming practices to reduce soil erosion 	<ul style="list-style-type: none"> Trials yearly 	<ul style="list-style-type: none"> Extension Staff Farmers 	DOA
(7) Monitoring and Evaluation	<ul style="list-style-type: none"> Except ATMA, no monitoring is done. 	<ul style="list-style-type: none"> Employment of third part local consultant for monitoring and evaluation under Project Management Unit 	<ul style="list-style-type: none"> Progress of food productivity improvement 	<ul style="list-style-type: none"> Before and after implementation of activities 	<ul style="list-style-type: none"> Extension Staff of DOA and Line departments H.P. State farmers 	DOA

Source: JICA Study Team

(4) Proposed Action Plan

Regarding the program on food grain and crop productivity improvement, same requirement and estimate of cost for each category are elaborated as shown below:

Table B-2.9 Proposed Action Plan of Food Grain Crop Productivity Improvement

Activity	Subjects	Target	Executed by	Remarks
(1) Promotion of diversified cropping patterns suitable for productivity increase of food grain crops	<ul style="list-style-type: none"> • Cropping pattern suitable for increasing food grains production and the farm income 	<ul style="list-style-type: none"> • Extension Staff • Farmers 	DOA	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.15 regarding implementation cost</p>
(2) Promotion of optimum quantities of farm inputs such as seeds and fertilizers	<ul style="list-style-type: none"> • Demonstration of food grains varieties • Package of practices for different varieties 	<ul style="list-style-type: none"> • Extension Staff • Farmers 	DOA	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.15 regarding implementation cost</p>
(3) Organizing or strengthening of farmers' groups	<ul style="list-style-type: none"> • Demonstration of farm machinery suitable for hilly areas 	<ul style="list-style-type: none"> • Farmers 	DOA	<p>(1) If this program will be carried out before the implementation of vegetable promotion, this activity should be conducted.</p> <p>(2) see Table B-2.14 regarding implementation cost</p>
(4) Demonstration of suitable farm machinery and equipment for hilly area.	<ul style="list-style-type: none"> • Optimum practices of IPM and biological control of pests and diseases 	<ul style="list-style-type: none"> • Extension Staff • Farmers 	DOA	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.15 regarding implementation cost</p>
(5) Promotion of optimum use of pesticides under IPM	<ul style="list-style-type: none"> • Suitable farming practices to reduce soil erosion 	<ul style="list-style-type: none"> • Extension Staff • Farmers 	DOA	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.15 regarding implementation cost</p>
(6) Promotion of farming practices to reduce soil erosion	<ul style="list-style-type: none"> • Progress of food productivity improvement 	<ul style="list-style-type: none"> • Extension Staff • Farmers 	DOA	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.15 regarding implementation cost</p>
(7) Monitoring and Evaluation	<ul style="list-style-type: none"> • Cropping pattern suitable for increasing food grains production and the farm income 	<ul style="list-style-type: none"> • Extension Staff of DOA and Line departments • H.P. State farmers 	DOA	<p>(1) Monitoring and evaluation should be carried out by one group, which covers all the activities.</p>

Source: JICA Study Team

B-2.3 Integrated Farm Management (Horticulture, Animal Husbandry and Fishery)

(1) Description of the Component

The main objective of the M/P is crop diversification, particularly diversification to vegetable cultivation. However, there are potentials to enhance the farm income of small and marginal farmers in horticulture, animal husbandry and fisheries sub-sectors. Accordingly, it is worthwhile to pay attention to horticulture production, fodder production for animals, and fish production aiming at increasing the supplemental cash income sources of farmers who will be involved in diversified agriculture activities. Based on this concept, an integrated farm management component is planned and outlined below:

Table B-2.10 Outline of Integrated Farm Management

Item	Outline of Component
Target	Farm income sources under diversified agriculture will be enhanced by exploiting potential of horticulture production, fodder production for animal feeding and/or fish culture locally available.
Outputs	<ol style="list-style-type: none"> 1. Production of horticulture crops will increase and the quality will be improved. 2. Cattle milk production and sheep and goat meat production to local consumers will be increased by increased fodder production or reuse of vegetable residues in the crop diversification. 3. Warm water fish culture (Carp and cat fish) or cold water fish culture (trout) will be practiced on the farmers' group basis by using irrigation system.
Activity	<p><u>Major activities</u></p> <ol style="list-style-type: none"> 1. Improvement of productivity and quality of horticulture crops 2. Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification 3. Promotion of warm water fish culture (carp & cat fish) or cold water fish culture (trout) under integrated farming including the irrigation system. <p><u>Supporting activities</u></p> <ol style="list-style-type: none"> 4. Organizing or strengthening of farmers' groups (marketing group) 5. Introduction of contract farming 6. Monitoring and Evaluation
Related Components	Strengthening of Extension Service Functions, Vegetable Cultivation, Food Grain Crop Productivity Improvement, Infrastructure Development / Improvement
Executing Organization	<p>Execution : Department of Agriculture / District & Block Agriculture Offices</p> <p>Supporting : Departments of Horticulture, Animal Husbandry, and Fisheries</p>

Source: JICA Study Team

(2) Future Direction of Improvement of the Component

The future direction of improvement of the component shall be decided as follows:

- 1) In the workshop conducted for the 75 blocks, 3rd priority was given to integrated farm management. And, 5 blocks have selected this component as the highest priority. Similarly 5, 15, and 9 blocks have selected this component as the 2nd, 3rd, and 4th priority respectively.
- 2) While the crop diversification is focused on the vegetable promotion, integrated farm management should also be given enough importance so that the farm household income can be increased further.
- 3) Since ATMA model is used for extension, the line departments including Department of Horticulture, Department of Animal Husbandry, and Department of Fisheries shall work together towards the promotion of the integrated farm management.
- 4) Horticulture component is an integral component of vegetable promotion. Mainly, exposure visits to be conducted for vegetables promotion will be integrated with fruits and other horticulture activities. Any other training and field schools instead of exposure visits might be

also conducted, according to farmers' needs. While organizing workshops, the Department of Agriculture shall invite the horticultural experts for dissemination of technology to the farmers.

- 5) Promotion of fodder production should also be considered under integrated farming. In the common pasture lands, lantana/ageratum/congress grass are the major weeds, which restrict the pasture growth. Promotion of fodder production will also be considered under integrated farming. While organizing workshops, the Department of agriculture shall invite the animal husbandry experts for dissemination of technology to the farmers.
- 6) In integrated farming, the fish culture is proposed in an integral part of irrigation system. When irrigation ponds or check dams are constructed, fishery activities could be included, wherever the farmers have interest in this activity. During workshops for crop diversification, the DOA will invite various experts in integrated farming to orient and disseminate to the farmers new and advanced technology.

(3) Proposed Master Plan

The current situation, proposed plan, subjects to be executed, and the target persons are summarized in Table B-2.11.

Table B-2.11 Proposed Master Plan of Integrated Farm Management

Activity	Current Situation	Proposed Plan	Subjects	Schedule	Target Persons	Executing Institute
(1) Improvement of productivity and quality of horticulture crops	<ul style="list-style-type: none"> ▪ Although productivity and quality trials are conducted, more dissemination is needed to the farmers 	<ul style="list-style-type: none"> • Exposure visits of farmers • Followings to be conducted instead of exposure visits, according to farmers' needs: • Workshops for horticulture • Training camps • Field days 	<ul style="list-style-type: none"> • Improved varieties of horticulture crops • Improved cultivation practices of horticulture crops 	<ul style="list-style-type: none"> • Once for each farmers' group 	<ul style="list-style-type: none"> • Extension Staff for Agriculture and Horticulture • Farmers 	<ul style="list-style-type: none"> • DOA / Department of Horticulture
(2) Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification	<ul style="list-style-type: none"> • In sufficient fodder promotion • No promotion on reuse of vegetable residues 	<ul style="list-style-type: none"> • Exposure visits of farmers • Followings to be conducted instead of exposure visits, according to farmers' needs: • Workshops for horticulture • Training camps • Field days 	<ul style="list-style-type: none"> • Methods of removing weeds in fodder areas • Fodders suitable for the cropping pattern of the area 	<ul style="list-style-type: none"> • Once for each farmers' group 	<ul style="list-style-type: none"> • Extension Staff for Agriculture and Animal Husbandry • Farmers 	<ul style="list-style-type: none"> • DOA / Dept of Animal Husbandry
(3) Promotion of warm water fish culture (carp & cat fish) or cold water fish culture (trout) under integrated farming including the irrigation system	<ul style="list-style-type: none"> • Integrated fish farming is carried out in some areas 	<ul style="list-style-type: none"> • Exposure visits of farmers • Followings to be conducted instead of exposure visits, according to farmers' needs: • Workshops for horticulture • Training camps • Field days 	<ul style="list-style-type: none"> • Integrated fish farming techniques 	<ul style="list-style-type: none"> • Once for each farmers' group 	<ul style="list-style-type: none"> • Extension Staff for Agriculture and Fisheries • Farmers 	<ul style="list-style-type: none"> • DOA / Dept of Fisheries
(4) Monitoring and Evaluation	<ul style="list-style-type: none"> • Except ATMA, no monitoring is done. 	<ul style="list-style-type: none"> • Establishing of monitoring and evaluation system 	<ul style="list-style-type: none"> • Progress of integrated farm management 	<ul style="list-style-type: none"> • Before and after implementation of activities 	<ul style="list-style-type: none"> • Extension Staff for Agriculture and Fisheries • Farmers 	<ul style="list-style-type: none"> • DOA / Line Departments

Source: JICA Study Team

(4) Proposed Action Plan

The action plan related to each activity and its requirements are mentioned below.

Table B-2.12 Proposed Action Plan of Integrated Farm Management

Activity	Subjects	Target	Executed by	Remarks
(1) Improvement of productivity and quality of horticulture crops	<ul style="list-style-type: none"> Improved varieties of horticulture crops Improved cultivation practices of horticulture crops 	<ul style="list-style-type: none"> Extension Staff of Agriculture and Horticulture Farmers 	<ul style="list-style-type: none"> DOA / Department of Horticulture 	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.16 regarding implementation cost</p>
(2) Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification	<ul style="list-style-type: none"> Methods of removing weeds in fodder areas Fodders suitable for the cropping pattern of the area 	<ul style="list-style-type: none"> Extension Staff of Agriculture and Animal Husbandry Farmers 	<ul style="list-style-type: none"> DOA / Dept of Animal Husbandry 	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.16 regarding implementation cost</p>
(3) Promotion of warm water fish culture (carp & cat fish) or cold water fish culture (trout) under integrated farming including the irrigation system	<ul style="list-style-type: none"> Integrated fish farming techniques 	<ul style="list-style-type: none"> Extension Staff of Agriculture and Fisheries Farmers 	<ul style="list-style-type: none"> DOA / Dept of Fisheries 	<p>(1) This activity is included in a demonstration trial.</p> <p>(2) see Table B-2.16 regarding implementation cost</p>
(4) Monitoring and Evaluation	<ul style="list-style-type: none"> Progress of integrated farm management 	<ul style="list-style-type: none"> Extension Staff of District and Block Offices of DOA and Line departments Farmers 	<ul style="list-style-type: none"> DOA / Line Departments 	<p>(1) This activity is included in a demonstration trial.</p>

Source: JICA Study Team

B-2.4 Provisional Schedule for Program Implementation

Implementation schedule was prepared as shown in Fig. B-2.3 of Implementation Schedule, considering category-wise characteristics.

Fig. B-2.3 Implementation Schedule

Annual Fiscal Year	1 2008	2 2009	3 2010	4 2011	5 2012	6 2013	7 2014	8 2015	9 2016	10 2017	11 2018	12 2019	13 2020	14 2021	15 2022
Category-I: Diversification is advanced (21 Blocks) A) Vegetable Promotion (Diversified Area 11,400ha) B) Food Grains Productivity Improvement C) Post-Harvest Processing Promotion D) Infrastructure Development															
Category-II: Diversification has just started (11 Blocks) A) Vegetable Promotion (Diversified Area 8,500ha) B) Food Grains Productivity Improvement C) Post-Harvest Processing Promotion D) Infrastructure Development															
Category-III: Diversification has not yet started with high potential (30 Blocks) A) Vegetable Promotion (Diversified Area 25,900ha) B) Food Grains Productivity Improvement C) Post-Harvest Processing Promotion D) Infrastructure Development															
Category-IV: Diversification has not yet started with low potential (13 Blocks) A) Vegetable Promotion (Diversified Area 5,500ha) B) Food Grains Productivity Improvement C) Post-Harvest Processing Promotion D) Integrated Farm Management E) Infrastructure Development															
Market System Improvement A) Capacity Development of Staffs B) Improvement and Operation of Market Information System C) Setting and Dissemination of Standard D) Construction of Market Yard and Collection Center															

Source: JICA Study Team

Furthermore, it is expected that each training program mentioned above is continued for three years as follows:

- 1st year: Organizing farmers
- 2nd year: Implementation of training activities
- 3rd year: Implementation of training activities

B-2.5 Preliminary Cost Estimate

(1) Preliminary Cost Estimate for Vegetable Promotion

Activities and preliminary estimated costs for implementation of Proposed Action Plan mentioned in Table B.2.6 are shown in Attachment B-3 and summarized as follows:

Table B-2.13 Activities and Preliminary Estimated Cost for Vegetable Promotion

Activity	Preliminary Unit Cost (Rs.)	Remarks
(i) Organizing farmers	41,000	This activity should be carried out initially. One farmers' group could consist of around 30 farmers.
(ii) Demonstration	72,000	Demonstration activity should be carried out for three years. Activities in demonstration plot should be decided based on farmers' requirement.
(iii) Introduction of contract farming	168,000	Farmers can get more opportunity for receiving much information concerning market, consumers preference, etc.
(iv) General extension activity	322,000	Farmers will be able to get latest farming information as well as technique from extension staff.
(v) Farming experience program for next generation	72,000	It is expected that young generation get more information concerning agriculture and be interested in regional development.
(vi) Construction of collection centre	3,120,000 per unit	12 units shall be constructed as demonstration purpose. It is understandable that this centre is indispensable for vegetable promotion. The centre has multi-purpose function such as ordinary (or cold) storing space, meeting space, office, processing space, depending on farmers' requirement.
(vii) Construction of poly house	500,000 per unit	Farmers need more technical information for promotion of protective cultivation of vegetables. It is proposed that two poly houses be constructed in each block of Category I (21 blocks) and II (11 blocks). Namely 42 and 22 units shall be constructed in Category I and II, respectively. While training activities for poly house would be arranged in the program for demonstration plot.

Source: JICA Study Team

Particularly, (i) organizing farmers, (ii) demonstration, and (iii) Introduction of contract farming shall be carried out for three (3) years by each farmers' group as well as Categories, as shown in Attachment B-6, and those estimated costs are summarized as follows:

Table B-2.14 Cost Estimate of Demonstration and Major Training Activities by Farmers' Group
(Unit: Rs.)

		1st Year	2nd Year	3rd Year	Total
Category-I	Demonstration	72,000	72,000	72,000	216,000
	Awareness camp, etc.	41,000	-	168,000	209,000
Category-II	Demonstration	72,000	72,000	72,000	216,000
	Awareness camp, etc.	41,000	-	-	41,000
Category-III	Demonstration	72,000	72,000	72,000	216,000
	Awareness camp, etc.	41,000	-	-	41,000
Category-IV	Demonstration	72,000	72,000	72,000	216,000
	Awareness camp, etc.	41,000	-	-	41,000

Source: JICA Study Team

Remarks) refer Attachments B-3 and B-6 for details

(2) Preliminary Cost Estimate for Improvement of Food Grain Productivity

Activities and preliminary estimated costs for implementation of Proposed Action Plan mentioned in Table B.2.9 are shown in Attachment B-4 and summarized as follows:

Table B-2.15 Activity and Preliminary Estimated Cost for Food Grain Productivity

Activity	Preliminary Unit Cost (Rs.)	Remarks
(i) Demonstration	64,500	Demonstration activity should be carried out for three years. Activities in demonstration plot should be decided based on farmers' requirement.

Source: JICA Study Team

This demonstration activity shall be carried out for two (2) years by each farmers' group as well as Categories, as shown in Attachment B-7, and estimated cost is summarized as follows:

Table B-2.16 Cost Estimate for Implementation of Food Grain Productivity Improvement

(Unit: Rs.)

		1st Year	2nd Year	3rd Year	Total
Category-I, II, III, IV	Demonstration	64,500	64,500	-	129,000

Source: JICA Study Team

Remarks) refer Attachments B-4 and B-7 for details

(3) Preliminary Cost Estimate for Improvement of Integrated Farm Management

Activities and preliminary estimated costs for implementation of Proposed Action Plan mentioned in Table B.2.12 are shown in Attachment B-5 and summarized as follows:

Table B-2.17 Activity and Preliminary Estimated Cost for Integrated Farm Management

Activity	Preliminary Unit Cost (Rs.)	Remarks
(i) Field visit (Exposure visit)	25,000	3-days field visit is arranged depending on farmers' needs and requirement. Each farmers' group will be able to select one field visit out of three sectors such as horticulture, livestock, and fishery.

Source: JICA Study Team

This demonstration activity shall be carried out in 2nd year by each farmers' group as well as Categories, as shown in Attachment B-8, and estimated cost is summarized as follows:

Table B-2.18 Cost Estimate for Implementation of Integrated Farm Management

(Unit: Rs.)

		1st Year	2nd Year	3rd Year	Total
Category-I, II, III, IV	Field visit	-	25,000	-	25,000

Source: JICA Study Team

Remarks) refer Attachments B-5 and B-8 for details

(4) Cost Disbursement

Cost disbursement is estimated based on the cost estimate mentioned above, applying the following conditions:

- (i) Demonstration plot will be arranged per 100 farm households (HH).
- (ii) Training activities including organizing farmers and field visit are arranged per one farmers' groups.

- (iii) One farmers' groups include 30 HH.
- (iv) Annual requirement of demonstration and training activities by categories for vegetable promotion, Food grain productivity improvement, and integrated farm management are shown in Table B-2.20, according to the implementation schedule as shown in Table B-2.13.

Table B-2.19 Annual Requirement of Demonstration and Training Activities

	2009	2010	2011	2012	2013	2014	2015	2016	2017
	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
(1) Increment Cropped Area (ha)									30,200
(2) Increment Farm Land (ha)									63,200
(3) Increment HH by Category (HH)									
Category-1	1,000	1,500	2,100	2,700	2,700	2,700	2,700	2,700	2,800
Category-2	800	1,100	1,600	2,000	2,000	2,000	2,000	2,000	2,100
Category-3	0	2,400	4,800	6,700	6,700	6,700	6,700	6,700	7,100
Category-4	0	0	500	1,000	1,700	1,700	1,700	1,700	1,700
Total	1,800	5,000	9,000	12,400	13,100	13,100	13,100	13,100	13,700
(4) No. of Demonstration Plots (One Plot per 100HH)									
Category-1	10	15	21	27	27	27	27	27	28
Category-2	8	11	16	20	20	20	20	20	21
Category-3	0	24	48	67	67	67	67	67	71
Category-4	0	0	5	10	17	17	17	17	17
Total	18	50	90	124	131	131	131	131	137
(5) Requirement for training of farmers (30HH per one farmers' group)									
Category-1	33	50	70	90	90	90	90	90	93
Category-2	27	37	53	67	67	67	67	67	70
Category-3	0	80	160	223	223	223	223	223	237
Category-4	0	0	17	33	57	57	57	57	57
Total	60	167	300	413	437	437	437	437	457

Annual disbursement is shown in Attachment I-1, based on the cost estimate mentioned above.

Attachment B-3 Cost Breakdown for Vegetable Promotion

(1) Organizing Farmers

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
a. Meeting cost b. Materials	100 LS	30 farmers x 12 times	36,000 5,000	for farmers One meeting per month
Total			41,000 (41,000)	

(2) Demonstration (1 ha)

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
1. Direct Cost for Trial				
a. Farm Inputs & Materials				Tomato, cauliflower, potato, etc.
Seed	40	150 g	6,000	
Farmyard manure	300	10 ton	3,000	
Fertilizer	7	500 kg	3,500	
Chemicals	250	5 liter	1,250	
b. Machinery rental	2,000	1 day	2,000	
c. Miscellaneous	LS	of a. + b.	800	
Sub-Total			16,550	
2. Seminar & Guidance				
a. Stationary	50	100 farmers x 1 set	5,000	
c. Field school (10 times)	50	100 farmers x 10 times	50,000	
Sub-Total			55,000	
Total			71,550 (72,000)	

(3) Introduction of Contract Farming

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
One-day workshop				
a. Meeting cost	100	60 persons x 1 day	6,000	for farmers and investors
b. Transportation	100	60 persons x 1 day	6,000	
c. Materials	LS		4,800	
Total			16,800 (17,000) 168,000	for one time for 10 times for one farmers' group for one farmers' group

once a year / 12 districts

(4) General Extension Activity (Awareness camp)

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
a. Meeting cost	20	50 farmers x 2 times	2,000	2 times for one year
b. Materials	LS		300	
b. Renting meeting room	LS		2,000	
Total			4,300 (322,500)	for one block for 75 blocks annual

(5) Farming Experience Program for next generation (trial)

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
a. Educational materials	50	50 students x 2 kinds	5,000	2 times a year hiring bus for one-day trip
b. Field day	20	50 students x 2 times	2,000	
c. Transportation	2,500	1 x 2 times	5,000	
Total			12,000 (12,000) (72,000)	for one school for 6 school (E/S/H, 2 schools each) annual

(6) Construction of Collection Centre (see Attachment F-28 (6))

(7) Construction of Poly House

Items	Unit Cost (Rs.)	Qty	Amount (Rs.)	Remarks
a. Poly house b. Training activity	1000	500 m2 x 1 unit	500,000	- Poly house should be constructed in 21 blocks of Category I and 11 blocks of Category II. - Training activity should be arranged in demonstration activity.
Total			500,000 (500,000)	

Attachment B-4 Cost Breakdown for Improvement of Food Grain Productivity

(1) Demonstration (1ha)

Items	Unit Cost (Rs.)	Q'ty	Amount (Rs.)	Remarks
1. Direct Cost for Trial				
a. Farm Inputs & Materials				
Seed	34	100 kg	3,400	for maize, wheat, paddy
Farmyard manure	300	10 ton	3,000	
Fertilizer	7	300 kg	2,100	
Chemicals	250	2 liter	500	
b. Machinery rental	1,000	1 day	1,000	
c. Miscellaneous	LS	of a. + b.	500	
Sub-Total			10,500	
2. Seminar & Guidance				
a. Stationary	40	100 farmers x 1 set	4,000	
b. Field school (10 times)	50	100 farmers x 10 times	50,000	
Sub-Total			54,000	
Total			64,500	

Attachment B-5 Cost Breakdown for Integrated Farm Management

(1) Field Visit (Exposure visit)

Items	Unit Cost (Rs.)	Q'ty	Amount (Rs.)	Remarks
a. Transportation	200	10 farmers x 1 round-trip	2,000	3-days trip for horticulture, livestock, inland fishery
b. Lodging and meals	400	10 farmers x 3 days	12,000	
c. Car-rental (bus)	2500	1 bus x 3 days	7,500	
d. Materials	LS		3,000	
Total			24,500 (25,000)	

Attachment B-6 Annual Extension Activities and Cost by Category for Vegetable Promotion (1/2)

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
I	1. Organizing or strengthening of farmers' groups	(1)	1. Demonstration of crop diversification	(2)	1. Demonstration of crop diversification	(2)
	2. Demonstration of crop diversification	(2)	1.1 Introduction of cropping pattern suitable for markets		1.1 Introduction and promotion of exotic vegetables	
	2.1 Introduction of cropping pattern suitable for markets		1.2 Improvement of productivity and quality of vegetables		1.2 Promotion of organic farming	
	2.2 Improvement of productivity and quality of vegetables		1.3 Introduction and promotion of exotic vegetables		1.3 Extension of protective cultivation and provision of facilities in model farms	
	2.3 Promotion of IPM		1.4 Promotion of IPM		2. Introduction of contact farming	(3)
	2.4 Promotion of proposed farming practices, considering reduction of soil erosion		1.5 Promotion of proposed farming practices			
			1.6 Demonstration of farm mechanization for hilly area			
		1.7 Extension of protective cultivation and provision of facilities				

Remarks) Ref. (1) = Attachment B-3 (1), Ref. (2) = Attachment B-3 (2), Ref. (3) = Attachment B-3 (3)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Demonstration				
Ref.(2)	72,000	72,000	72,000	216,000
(see Attachment B-3 (2))				
Training activities				
Ref.(1)	41,000			41,000
Ref.(3)			168,000	168,000
(see Attachment B-3 (1) and (3))				
			Total	209,000

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
II	1. Organizing or strengthening of farmers' groups	(1)	1. Demonstration of crop diversification	(2)	1. Demonstration of crop diversification	(2)
	2. Demonstration of crop diversification	(2)	1.1 Introduction of cropping pattern suitable for markets		1.1 Promotion of strategic vegetables such as potato, tomato, cauliflower and peas	
	2.1 Introduction of cropping pattern suitable for markets		1.2 Promotion of strategic vegetables such as potato, tomato, cauliflower and peas		1.2 Promotion of organic farming	
	2.2 Improvement of productivity and quality of vegetables		1.3 Improvement of productivity and quality of vegetables		1.3 Improvement of productivity and quality of vegetables	
	2.3 Promotion of IPM		1.4 Promotion of IPM		1.4 Demonstration of farm mechanization for hilly area	
	2.4 Promotion of proposed farming practices, considering reduction of soil erosion		1.5 Promotion of proposed farming practices		1.5 Extension of protective cultivation and provision of facilities in model farms	
			1.6 Extension of protective cultivation and provision of facilities			

Remarks) Ref. (1) = Attachment B-3 (1), Ref. (2) = Attachment B-3 (2)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Demonstration				
Ref.(2)	72,000	72,000	72,000	216,000
(see Attachment B-3 (2))				
Training activities				
Ref.(1)	41,000	0	0	41,000
(see Attachment B-3 (1))				

Attachment B-6 Annual Extension Activities and Cost by Category for Vegetable Promotion (2/2)

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
III	1. Organizing or strengthening of farmers' groups	(1)	1. Demonstration of crop diversification	(2)	1. Demonstration of crop diversification	(2)
	2. Demonstration of crop diversification	(2)	1.1 Introduction of cropping pattern suitable for markets		1.1 Introduction of cropping pattern suitable for markets	
	2.1 Introduction of cropping pattern suitable for markets		1.2 Promotion of strategic vegetables such as potato, tomato, cauliflower and peas		1.2 Promotion of strategic vegetables such as potato, tomato, cauliflower and peas	
	2.2 Improvement of productivity and quality of vegetables		1.3 Improvement of productivity and quality of vegetables		1.3 Improvement of productivity and quality of vegetables	
	2.3 Promotion of IPM		1.4 Promotion of proposed farming practices		1.4 Promotion of proposed farming practices	
	2.4 Promotion of proposed farming practices					

Remarks) Ref. (1) = Attachment B-3 (1), Ref. (2) = Attachment B-3 (2)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Demonstration				
Ref-(2) (see Attachment B-3 (2))	72,000	72,000	72,000	216,000
Training activities				
Ref-(1) (see Attachment B-3 (1))	41,000	0	0	41,000

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
IV	1. Organizing or strengthening of farmers' groups	(1)	1. Demonstration of crop diversification	(2)	1. Demonstration of crop diversification	(2)
	2. Demonstration of crop diversification	(2)	1.1 Introduction of cropping pattern suitable for markets		1.1 Introduction of cropping pattern suitable for markets	
	2.1 Introduction of cropping pattern suitable for markets		1.2 Promotion of proposed farming practices		1.2 Promotion of proposed farming practices	
	2.2 Promotion of proposed farming practices					

Remarks) Ref. (1) = Attachment B-3 (1), Ref. (2) = Attachment B-3 (2)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Demonstration				
Ref-(2) (see Attachment B-3 (2))	72,000	72,000	72,000	216,000
Training activities				
Ref-(1) (see Attachment B-3 (1))	41,000	0	0	41,000

Attachment B-7 Annual Extension Activities and Cost by Category for Food Grain Productivity Improvement

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
I	1. Demonstration of crop diversification	(1)	1. Demonstration of crop diversification	(1)		
II						
III	1.1 Promotion of diversified cropping patterns suitable for productivity increase of food grains		1.1 Promotion of diversified cropping patterns suitable for productivity increase of food grains			
IV	1.2 Promotion of proposed farming practices		1.2 Promotion of proposed farming practices			
			1.3 Promotion of IPM			

Remarks) Ref. (1) = Attachment B-4 (1)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Demonstration				
Ref-(1)	64,500	64,500	0	129,000
(see Attachment B-4 (1))				

Attachment B-8 Annual Extension Activities and Cost by Category for Integrated Farm Management

Annual Extension Activities

Category	1st Year	Ref.	2nd Year	Ref.	3rd Year	Ref.
I			1. Improvement of productivity and quantity of horticulture crops	(1)		
II						
III			2. Promotion of fodder production and reuse of vegetable residues under integrated farming crop diversification	(1)		
IV			3. Promotion of warm water fish culture (Carp & cat fish) or cold water fish culture (trout) under integrated farming including the irrigation system	(1)		

Remarks) Ref. (1) = Attachment B-5 (1)

Annual Cost (Rs.)

	1st Year	2nd Year	3rd Year	Total for 3 years
Field Visits				
Ref-(1)	0	25,000	0	25,000
(see Attachment B-5 (1))				

ANNEX-CA
Horticulture
in Agriculture Allied Sectors

**THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME
IN THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

**ANNEX-CA
HORTICULTURE
IN AGRICULTURE-ALLIED SECTORS**

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ANNEX-CA

HORTICULTURE IN AGRICULTURE-ALLIED SECTORS

CA-1 Background of Horticulture Sector

CA-1.1 Horticulture Development

Horticulture sector in India covers fruits, vegetables including tubers, ornamental, medicinal and aromatic crops, spices, and plantation crops coupled with processing, value addition and marketing of these crops. Under the Union Ministry of Agriculture, the Department of Agriculture & Cooperation is responsible for the overview of horticulture development in the country and implements its programs through the State Departments of Horticulture by providing leadership and coordinating activities for the promotion of horticulture with supports from the National Horticulture Board (NHB), Coconut Development Board and National Bee Board.

During the Tenth Five Year Plan period, the emphasis for horticulture development was mainly focused through the developmental programs of the Department of Agriculture and Cooperation such as the National Horticulture Mission, Technology Mission for Integrated Development of Horticulture in North-Eastern and Himalayan States, Development of Commercial Horticulture and Capital Investment Subsidy Scheme of NHB, and Integrated Development of Coconut including the Technology Mission on Coconut. Further, new initiatives on micro-irrigation, National Bamboo Mission, the establishment of the Central Institute of Horticulture at Nagaland, and the promotion of bee keeping through the National Bee Board have been taken for the development of the horticulture sector in India. Among these centrally sponsored schemes, the followings are implemented in Himachal Pradesh.

- a. Technology Mission for Integrated Development of Horticulture in North-Eastern and Himalayan States was launched during the Ninth Five Year Plan period focusing on eight North-Eastern States and extended to the States of Jammu and Kashmir, Himachal Pradesh and Uttarakhand in 2003/04. For implementation of the scheme in these 11 States, the Tenth Five Year Plan outlay was approved at Rs. 8.45 billion. Under this scheme, funds to the State are made available on the basis of annual action plans/proposals, which are approved by the State-Level Steering Committee under the chairmanship of the Chief Secretary of the State Government concerned. In 2006/07, an amount of Rs. 1,570 million was released, of which Rs. 819 million was allocated to North-Eastern States and Rs. 756 million to the States of Jammu and Kashmir, Himachal Pradesh and Uttarakhand; and
- b. Micro Irrigation scheme was launched in January 2006 under the Tenth Five Year Plan aiming at implementation of drip and sprinkler irrigation in an area of 620,000 ha. This scheme envisages achieving greater water-use efficiency resulting in enhanced productivity and better quality of produce. Under the scheme, subsidiary assistance is provided to all categories of farmers at the rate of 50% for drip/sprinkler irrigation system implementation and 75% for training and demonstration in each district of the State for both horticulture crops and non-horticulture crops. During 2006/07, the annual action plans of 16 States have been approved for implementation as per the guidelines and a sum of Rs. 3.37 billion has been released to these States to cover an area of 331,000 ha.

CA-1.2 Horticulture Production

State-wise area and production of fruits and flowers for 1991/92, 2004/05 and 2005/06 are as shown in Tables CA-1.2.1 to 1.2.2. About fruits, Maharashtra State ranks first and contributes 27% in area and 22% in production. Andhra Pradesh ranks second contributing 13% in area and 16% in production. Tamil Nadu is the leading producer of loose traditional flowers closely followed by Karnataka both in terms of area and production. West Bengal leads with a production of cut flowers followed by Karnataka.

Various supporting activities in horticulture sector are briefed below:

- a. Research and development: At present, there exist 10 Central Institutes with 27 regional stations, 12 National Research Centers, nine Multi-disciplinary Institutes, 15 All India Coordinated Projects with 223 centers, one full fledged State Agricultural University on Horticulture & Forestry, and 25 State Agriculture Universities with Horticulture discipline. During the last two decades, over 50 varieties in different fruit crops have been released. Also a large number of vegetable varieties have been identified and released to meet various needs;
- b. Planting materials: Besides over 100 big public nurseries, private nurseries including 6,300 small and medium scale nurseries play an important role to meet the requirement of the growers. Recently micro-propagation is being commercially exploited, and some 1.5 million plants are being produced in banana, sugarcane, ornamental, spices and medicinal plants;
- c. High-tech horticulture: There are eight important methods under promotion to enhance productivity and improve product quality both in short duration and perennial horticulture crops. These are high density planting, use of plastics, precision farming, protected cultivation, mulching, integrated nutrient management, integrated pest management and mechanization;
- d. Organic farming: Because of increasing demand for safe food and an approach to sustainable development of farming based on rural livelihoods in marginal areas and for small farmers, organic farming has been mainstreaming in the country. Thus, organic farming was selected as one of the new areas for attention during the Tenth Five Year Plan period. Today, India produces a wide range of organic products including fruits, vegetables, spices, pulses, milk and cotton; and
- e. Post-harvest management: At each and every step of the value chain, post-harvest losses occur due mainly to mechanical injury. The losses at the farm level occur caused by improper harvesting methods, handling techniques and aggregation of the produce and then in transportation. The major losses at the wholesale level occur because of rough handling and inappropriate storage. To reduce such losses, attention has been paid to development of post-harvest infrastructure in the country. Maharashtra State leads in creating post-harvest infrastructure like cold storage, mechanical sorting, grading and waxing centers. Several grading and packing centers have also been installed in Himachal Pradesh as well as Jammu and Kashmir States;
- f. Marketing: As the present marketing system of horticulture produce in the country lacks system approach, there is a necessity to integrate farm production with markets, national

and international, to enable farmers to undertake market driven production plan and adoption of modern marketing practices. In this sense, examination of alternative marketing mechanism is required, including direct marketing, grading, forward and future marketing, levies, contract farming, amendment of the Agricultural Producers' Market Committee Act, warehouse receipt system, and licensing system.

Table CA-1.2.1 State-wise Area and Production of Fruits for 1991/92 and 2003/04 to 2005/06

State/Union Territory	Area ('000 ha)				Production ('000 tons)			
	1991/92	2003/04	2004/05	2005/06	1991/92	2003/04	2004/05	2005/06
Maharashtra	256	1,265	1,347	1,619	3,518	9,770	10,586	11,721
Andhra Pradesh	313	656	652	680	4,008	7,580	7,736	8,409
Tamilnadu	136	221	225	258	2,316	3,609	4,468	5,779
Kerala	236	171	332	340	1,101	1,002	2,643	5,051
Gujarat	85	201	252	270	1,829	2,957	4,014	4,678
Karnataka	209	243	255	263	3,192	3,833	4,079	4,242
Bihar	267	307	276	292	2,799	3,455	2,770	3,192
Uttar Pradesh	303	269	275	279	2,450	2,320	2,913	3,009
West Bengal	111	173	186	173	1,132	2,112	2,128	2,302
Orissa	136	227	233	238	978	1,353	1,404	1,403
Assam	72	94	93	104	886	1,181	1,151	1,367
Jammu & Kashmir	119	158	168	168	701	1,180	1,218	1,218
Madhya Pradesh	65	47	49	46	1,245	910	1,102	1,044
Punjab	73	44	47	52	664	628	680	746
Himachal Pradesh	157	202	176	183	340	588	688	692
Uttaranchal	151	79	156	163	429	645	652	676
Chhattisgarh	-	17	49	76	-	401	343	647
Tripura	45	31	32	33	319	487	503	525
Rajasthan	23	23	24	25	114	221	290	419
Jharkhand	-	32	33	33	-	296	403	387
Manipur	20	51	51	51	43	321	321	321
Haryana	14	32	24	27	110	257	257	236
Maghalaya	24	24	24	28	218	200	200	232
Goa	11	10	10	10	84	82	82	184
Arunachal Pradesh	20	48	51	52	47	101	101	105
Nagaland	5	13	13	13	9	49	49	49
Mizoram	9	21	21	21	35	43	43	43
Pondicherry	1	1	1	1	20	21	21	21
Andaman & Nicobar	3	4	4	3	13	22	23	19
Sikkim	8	10	8	9	19	8	12	13
Dadra & Nagar Haveli	1	1	1	1	7	7	7	7
Chandigarh	0	0	0	0	2	1	1	1
Lakshadweep	0	0	0	0	1	1	1	1
Delhi	0	0	0	0	1	1	0	1
Daman & DIU	0	0	0	0	3	0	0	0
Total	2,875	4,675	5,049	5,510	285,325	45,645	50,867	58,740

Source: Indian Horticulture Database 2006

Table CA-1.2.2 State-wise Area and Production of Flowers for 1991/92 and 2003/04 to 2005/06

State/Union Territory	Area (ha)			Production (Loose, ton)			Production (Cut, Million Nos.)		
	'91/92	'04/05	'05/06	'91/92	'04/05	'05/06	'91/92	'04/05	'05/06
Maharashtra	2,280	8,660	9,250	18,190	51,710	56,080	-	-	-
Andhra Pradesh	5,780	13,910	16,080	17,330	57,880	79.79	-	7.1	8.9
Tamilnadu	10	23,230	24,750	61,700	187,340	201,910	-	-	-
Kerala	-	-	-	-	-	-	-	-	-
Gujarat	-	6,960	7,120	-	41,810	42,180	-	196.9	439.2
Karnataka	15,240	20,400	21,060	88,000	150,230	156,260	-	503.8	523.9
Bihar	90	100	190	1,430	1,760	2,300	0.2	1.1	1.1
Uttar Pradesh	-	7,970	8,250	-	11,910	12,180	-	352.7	366.8
West Bengal	12,610	17,930	17,890	9,020	44,670	42,290	479	896.3	934.8
Orissa	100	310	590	460	17,250	19,280	0.4	1.2	12
Assam	280	-	990	40	-	-	-	-	-
Jammu & Kashmir	-	230	230	-	920	920	-	11	11
Madhya Pradesh	920	1,830	1,870	900	1,100	1,120	-	-	-
Punjab	330	620	800	550	3,080	4,100	-	-	-
Himachal Pradesh	30	410	400	110	2,240	3,010	42.9	47.6	43.4
Uttaranchal	-	530	560	-	560	640	-	-	-
Chhattisgarh	-	1,510	1,550	-	2,830	3,300	-	-	-
Tripura	-	-	-	-	-	-	-	-	-
Rajasthan	1,210	3,310	3,010	-	2,600	2,260	-	-	-
Jharkhand	-	-	-	-	-	-	-	-	-
Manipur	60	540	540	20	700	700	-	-	-
Haryana	1,200	4,810	5,420	22,400	58,330	55,580	32.7	50.8	62.3
Maghalaya	-	-	-	-	-	-	-	-	-
Goa	-	-	-	-	-	-	-	-	-
Arunachal Pradesh	-	-	-	-	-	-	-	-	-
Nagaland	-	-	-	-	-	-	-	-	-
Mizoram	-	60	60	-	0	0	-	0.1	0.1
Pondicherry	40	-	-	180	-	-	-	-	-
Andaman & Nicobar	-	-	10	-	-	0	-	-	253.7
Sikkim	-	80	100	-	-	33,100	-	-	-
Dadra & Nagar Haveli	-	-	-	-	-	-	-	-	-
Chandigarh	-	-	-	-	-	-	-	-	-
Lakshadweep	-	-	-	-	-	-	-	-	-
Delhi	800	4,480	5,540	4,060	25,010	5,670	-	-	103.8
Daman & DIU	10	0	-	50	10	-	-	-	-
Total	40,970	117,860	126,240	224,440	659,170	693,400	555.2	1,792.60	2,761.80

Source: Indian Horticulture Database 2006

CA-1.3 State Government Policies and Programs on Horticulture Sector

(1) State Government's Policies and Strategies

The basic policy of the State Government for the horticulture sector in Himachal Pradesh is to develop horticulture as a science, technology and business by facilitating the creation of infrastructure for research and development, extension, provision of production support services, post-harvest management including processing, and incentives to the farmers for all round development of the horticulture industry in the State:

The strategies for the development of horticulture in Himachal Pradesh are:

- Improvement of productivity of existing horticulture plantations;
- Quality improvement of horticulture produce;
- Diversification of the horticulture industry;
- Modernization of the nursery production program for the production of virus free certified planting material on suitable rootstocks;
- Introduction of improved fruit varieties and rootstocks from advanced countries and their

multiplication for supply to the farmers;

- f. New orientation to the planting density in the fruit orchards from the present low-density plantation to medium and high-density plantation, with the objective of obtaining higher productivity of quality fruits per unit area;
- g. Minimum use of pesticides with emphasis on Integrated Pest Management (IPM) and Biological Control of pests and diseases;
- h. Utilization of the information technology for the dissemination of technical know how and marketing information to the fruit growers;
- i. Improvement of water management practices in the orchards through adoption of scientific water harvesting, storage and application practices;
- j. Utilization of high-tech horticulture technologies like protected cultivation of horticulture produce, use of biotechnology, micro irrigation technologies, use of plastics etc. for the improvement of horticulture productivity;
- k. Creation of scientific post harvest management infrastructure;
- l. Value addition and diversification in processing industry; and
- m. Market promotion through branding, advertisement and exports.

(2) Central Government Sponsored Schemes

With financial assistance under the Technology Mission for Integrated Development of Horticulture in North-Eastern and Himalayan States and Mini Mission-II from the Central Government, the DOH has been implementing 13 programs aiming at sustainable development of the horticulture industry in Himachal Pradesh.

- a. Area expansion program focuses on temperate and sub-tropical fruit crops coupled with replacement of old and senile plants, flowers, medicinal and aromatic plants, spices, etc;
- b. Creation of water sources program aims to ensure sustainable irrigation water supply to horticultural crops;
- c. On-farm water management program purposes physical improvement of on-farm level water handling by applying plastic culture technologies to promote the judicious utilization of water and sunlight as well as to offer protection against natural vagaries;
- d. On-farm handling unit program takes aim at provision of grading, sorting and storage facilities of the produce at the farm level;
- e. Planting material production program targets to make genuine material available to the farmers;
- f. Program for transfer of technology through training, front line demonstrations, publicity and training of trainers focuses on continuous updating of the technical knowledge and skills of the DOH staff;
- g. Program for popularization of organic farming and use of bio-fertilizers aims to reduce the use of chemical fertilizers, pesticides and insecticides by encouraging farmers to practice organic farming;
- h. Program for promotion and popularization of horticulture equipment purposes making manual operated tools, power tillers and diesel engines available to the farmers;
- i. Integrated pest management promotion program takes aim at establishment of disease and pest forecast system to forewarn about the outbreak of diseases and pests;
- j. Plant health clinic establishment program targets to establish private institutes by encouraging

- agriculture/horticulture graduates to provide plant health diagnosis services at the farmers' doorstep;
- k. Tissue/leaf analysis laboratory establishment program focuses on the determination of essential nutrient availability to the plants and enabling recommendation of different dosage of fertilizers and trace elements for supplementing the deficiency of these nutrients;
- l. Bee keeping development program aims to provide quality bees to the bee keeping beginners; and
- m. Women farmers' entrepreneurial development program purposes to organise self-help groups and provide them with training opportunities concerning different horticulture activities.

(3) State Government's Subsidy

The DOH has been providing various incentives in the form of assistance to the farmers in order to help them take up horticulture. The followings are on-going subsidy menu:

- a. Subsidy on horticulture production inputs giving 25% of the cost to the small farmers, 33.3% to the marginal farmers and 50% to the scheduled caste, tribe and backward area farmers;
- b. Subsidy on pesticides giving 50% to the small farmers and 30% to the big farmers;
- c. Subsidy on mushroom trays, compost, pesticides and plant protection equipment required for mushroom cultivation giving 25% of the cost to the small farmers, 33.3% to the marginal farmers and 50% to the scheduled caste, tribe and backward area farmers. Additional subsidy giving 10% of the capital investment cost subject to a maximum of Rs. 2,500 per individual, 3% of the interest rate and 100% of compost transportation cost to all categories of farmers;
- d. Subsidy on corrugated fibreboard cartons for the packing of the fruits giving Rs. 8 per a 20-kg capacity telescopic carton subject to a ceiling of Rs. 9,600;
- e. Subsidy on the purchase of plastic crates giving 50%; and
- f. Subsidy on the transportation of wooden packing cases for fruits giving from Rs. 0.5 to Rs. 1.0 per box for importing such material from the outside of the State according to the distance. Subsidy on the transportation of wooden logs for making packing boxes giving Rs. 500 to Rs. 1,000 per truck according to the distance to the fruit farmers owing the land less than 0.8 ha.

CA-1.4 Eleventh Five Year Plan in Horticulture Sector

(1) Objectives

The main objectives for the development of horticulture in the State under the Eleventh Five Year Plan are:

- a. To implement the programs for the improvement of the productivity and quality of fruits and to double the existing average yield of fruits at the end of the plan period;
- b. To intensify horticulture development in the presently less developed areas and diversify horticulture in the already developed areas with emphasis on nut fruits and other new fruits having promise for commercial cultivation;
- c. To utilize the environmental friendly practices for horticulture production and marketing;
- d. To develop modern post harvest management facilities for reducing post harvest losses, increasing shelf life, standardizing grading and packing system, and regulating the flow of fruits to the market;
- e. To develop fruits exclusively for processing industry; and
- f. To increase the use of frontier technologies like remote sensing, information technology and bio-

technology in the field horticulture.

(2) Strategies

To achieve the above objectives, the following strategies in terms of production activities are to be taken up for the Eleventh Five Year Plan:

- a. Modern facilities are to be developed for propagating the plant material through (i) introduction of the improved germ plasm from abroad and identification of the plant material of outstanding merit from within and outside the State coupled with its multiplication, (ii) creation of facilities for the commercial production of the virus free plant material, (iii) utilization of the micro propagation of the plant material for increasing the supply of the improved plant material to the growers, (iv) shift towards the use of clonal rootstocks in place of existing practice of seedling rootstocks, (v) creation of the bud-wood banks of elite fruit varieties and rootstocks in the public sector for further supply to the private nurserymen for multiplication, and (vi) development of a scientific system for the supply of certified plant material of fruit crops to the farmers;
- b. Use of bio-technology is to be increased for promoting the fast multiplication of the plant material as and where the cost effective protocols are available;
- c. Integrated pest management technologies are to be utilized for decreasing the use of chemicals for pest control both for reducing the plant protection costs and checking environment pollution. Emphasis shall be given on biological control of the pests and diseases;
- d. Pest forecasting and weather forecasting programs are to be implemented;
- e. Integrated nutrition management is to be emphasized on need based application of the chemical fertilizers, and use of the biological fertilizers is to be increased for the maintenance of soil productivity;
- f. Water management is to be improved through scientific methods of on-farm water harvesting, conservation and application for making best use of the scarce water resource for the improvement of the horticultural crop productivity;
- g. Diversification of horticulture is to be emphasized focusing on cultivation of nut crops, olive, cherry, pear, small fruits as well as medicinal and aromatic plants on the farmer's fields;
- h. Protected cultivation of flowers and other high value horticulture crops like strawberries is to be utilized, for which area approach is to be adopted to formulate region specific schemes;
- g. Information technology as an important tool is to be utilized aiming at horticulture extension, dissemination of the technical know how, market information and E-Governance; and
- h. Horticulture crops are to be developed especially for fruit processing like wine varieties of grapes, cider varieties of apples, apple varieties for juice making.

With respect to post-harvest and processing activities, the following strategies are to be taken up for the Eleventh Five Year Plan:

- a. Infrastructure is to be developed by the private, cooperative and public sectors for practicing

scientific post-harvest management system and marketing extremely perishable horticulture commodities like flower crops and mushroom. Demonstration units are to be established in the public sector;

- b. Farmer's organization is to be developed for implementing the post-harvest management programs of horticulture produce;
- c. On-farm conservation/preservation of the unmarketable fruits is to be emphasized; and.
- d. Fruit preservation training and community fruit processing centre are to be established at the block level and in areas of concentrated fruit production.

Regarding research and development as well as other issues, the following strategies are to be taken up for the Eleventh Five Year Plan:

- a. Project approach is to be utilized for solving the various problems of horticulture industry through the research institutions;
- b. Remote sensing technology is to be utilized for undertaking inventory and assessment of the horticulture in the State and formulating development programs; and
- c. Horticulture census scheme is to be implemented for arriving at the realistic estimates of the area under fruit crops and fruit productivity.

(3) Physical Targets of Fruit Planting Area and Production

In Himachal Pradesh, most of the apple orchards have become quite old and the plants have outlived their economic life. Besides bringing more and more areas under fruit plantation during the Eleventh Five Year Plan period, therefore, due attention is to be given on the re-planting of old and uneconomical fruit crops. From this viewpoint, the physical targets of area expansion and re-planting programs are set up as below:

- a. Annual increase in net additional area is presumed at 2,500 ha for temperate fruit crops and 2,000 ha for sub-tropical fruit crops between 2006/07 and 2011/12; and
- b. Annual re-planting area is predicted to be 2,000 ha for the period from 2006/07 to 2011/12.

Fruit-wise targets are to be set up as shown below:

Table CA-1.4.1 Targets of Fruit Crops for Eleventh Five Year Plan

Unit: ha

Fruit Crop	Tenth Five Year Plan as of '06/07	2007/08~2011/12 Period		As of end 2011/12	
		Expansion	Re-planting	Total Area	Re-planted
Apple	87,810	7,500	6,000	95,310	6,000
Other temperate fruits	30,330	4,000	500	34,330	500
Nuts & dry fruits	11,380	1,000	200	12,380	200
Mango	38,370	4,500	600	42,870	600
Citrus fruits	21,130	2,000	2,500	23,130	2,500
Other sub-tropical fruits	8,430	3,500	200	11,930	200
Total	197,450	22,500	10,000	219,950	10,000

Source: Department of Horticulture, Himachal Pradesh State Government

The DOH has a long term target for area expansion and replanting area for the Twelfth Five Year Plan period during which the annual area expansion is predicted to be 2,200 ha for temperate fruit crops and 1,800 ha for sub-tropical fruit crops coupled with the annual replanting area is presumed to be increased by 2,500 ha.

The fruit production target for the Eleventh Five Year Plan period is set up based on such assumption

that the annual production increasing rate is 5% over the highest achievement of production during the Tenth Five Year Plan period. The target fruit crop production at the end of Eleventh Five Year Plan period is presented below:

Table CA-1.4.2 Fruit Crop Production Targets for Eleventh Five Year Plan

Unit: ton

Crop	Tenth Five Year Plan Period			Eleventh Plan	
	Highest Year	Highest Production	Production in 2005/06	Increased Production	Target Production
Apple	2005/06	540,400	540,400	148,600	689,000
Other temperate fruits	2002/03	63,100	48,300	32,300	80,600
Nuts & dry fruits	2004/05	3,700	3,900	800	4,700
Mango	2005/06	63,100	63,100	15,500	78,600
Citrus fruits	2005/06	29,100	29,100	8,100	37,200
Other sub-tropical fruits	2005/06	10,700	10,700	5,200	15,900
Total	-	-	695,520	219,950	906,000

Source: Department of Horticulture, Himachal Pradesh State Government

(4) Financial Outlays

Against an actual expenditure of Rs. 1,554 million incurred during the Tenth Five Year Plan period, an outlay of Rs. 2,025 million has been fixed for the Eleventh Five Year Plan. Table CA-1.4.3 shows the approved outlay and the actual expenditure of horticulture sector schemes under the Tenth Five Year Plan as well as development head-wise proposed outlay under the Eleventh Five Year Plan.

Table CA-1.4.3 Financial Outlays for 10th and 11th Five Year Plans of Horticulture Sector

Unit: Million Rs.

Development Head	Tenth Eleven Plan		11th Plan
	Approved	Expenditure	Proposed
I. Crop Husbandry	1,202.22	376.27	349.10
1. Direction & Administration	45.00	12.23	15.55
2. Maintenance of Government Orchards and Nurseries	208.20	57.88	88.00
3. Plant Nutrition	13.90	3.94	5.50
4. Plant Protection Schemes	95.20	30.00	5.00
5. Horticulture Training and Extension	252.20	61.45	6.50
6. Horticulture development Schemes	298.32	124.57	111.80
7. Development of Floriculture	29.10	8.46	15.50
8. Development of Apiculture	14.70	5.57	10.00
9. Development of Mushroom	45.00	14.98	21.00
10. Horticulture Economics and Statistics	19.90	0.10	0.50
11. Fruits Processing Units	34.20	21.18	23.50
12. Backward Area Sub-plan	75.00	25.81	18.75
13. Macro Management of Horticulture	66.80	10.11	25.00
14. Short-term Research Projects	4.70	0.00	0.50
II. Research and Education	340.50	521.25	1,025.00
III. Marketing and Quality Control	592.43	656.59	651.20
Total	2,135.14	1,554.10	2,025.30

Source: Department of Horticulture, Himachal Pradesh State Government

CA-2 Present Conditions of Horticulture in Himachal Pradesh

CA-2.1 General

Himachal Pradesh has set up four departments in the agricultural sector, i.e. Department of Agriculture, Horticulture, Animal Husbandry and Fisheries. Vegetables are administrated by Department of Agriculture. Horticulture in this annex focuses on fruit crops, floriculture, medicinal and aromatic

plants.

Himachal Pradesh is suitable for growing a large number of horticulture commodities including temperate to sub-tropical fruit crops, mushrooms, hops, tea, flowers as well as medicinal and aromatic plants. Apart from fruit crops, flower cultivation is successfully undertaken for off-season supply to the plains. The horticulture industry in Himachal Pradesh has therefore played a great role in the amelioration of the rural society of the State in the following manners:

- a. To generate cash income sources for the rural people;
- b. To create employment opportunities in the pre- and post-harvest sectors of the horticulture industry;
- c. To provide nutritive foods in the form of fruits, vegetables, nuts, mushrooms and honey;
- d. To satisfy attractive needs of the people; and
- e. To develop a sustainable system of permanent agriculture in the hilly areas.

CA-2.2 Fruit Crops

CA-2.2.1 Growing Area of Fruit

Considering the agro-ecological conditions and the suitability of a particular area for the growth of specific fruit crops in the concerned area, the State is broadly divided into four agro-climatic zones: (a) low hill and valley areas near the plains; (b) mid hills; (c) high hills and valleys in the interiors; and (d) cold and dry zone. Thus, fruit crops grown in Himachal Pradesh can be grouped into each zone based on the respective crop features as shown below:

Table CA-2.2.1 Horticulture Zone-wise Suitable Fruit Crops

Zone	Elevation (m)	Rainfall (mm)	Suitable Fruit Crop
Low hill and valley areas near the plains (Sub-tropical)	365~914	600~1,000	Mango, Litchi, Guava, Loquat, Citrus, Fig, Papaya, Ber, Grapes (early variety), Jack fruit, Banana, Peach (low chilling variety), Plum, Pear and Strawberry
Mid hills (Sub-temperate)	915~1523	900~1,000	Peach, Plum, Pear, Apricot, Persimmon, Pomegranate, Kiwi, Strawberry, Almond, Pecan nut and Walnut
High hills and valleys in the interiors (Temperate)	1524~2742	900~1,000	Apple, Pear (soft variety), Cherry, Strawberry, Almond, Walnut, Chestnut and Hazel-nut
Cold and dry zone (Dry Temperate)	1524~2656	240~400	Apple, Prune, plect (drying type), Grapes, Almond, Walnut, hazel-nut, Chilgoza, Pistachio-nut and Hops

Source: Department of Horticulture, State Government of Himachal Pradesh

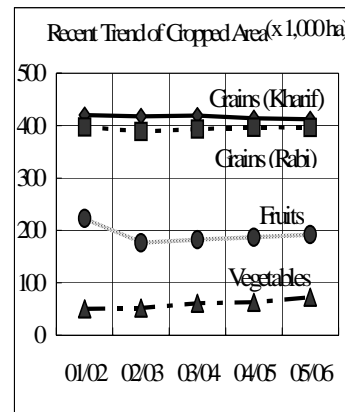
CA-2.2.2 Fruit Planted Area & Production

The total planted area of fruit crops in Himachal Pradesh has been increased and is 192,000 ha in 2005/06 and its production is 1,089,000 ton in 2005/06.

Apple contributed to 60% of the total planted area of fruit crops in 1970/71. Resulting from efforts of the State Government to encourage the farmers to enhance temperate fruit crops in the both zones of mid hills and high hills as well as to expand sub-tropical fruit planting areas in low hills and valley areas, the current share of apple has reduced to 46% in 2005/06, although the actual apple grown area became 3.3 times for 35 years from 26,740 ha in 1970/71 to 87,830 ha in 2005/06. The harvesting season of temperate and tropical fruits is between July and October. The recent trend of crop cultivation area and production in the State during the last five years from 2000/01 to 2005/06 is summarized in Table CA-2.2.2, while the crop-wise breakdowns of fruits are shown in Tables CA-2.2.3.

Table CA-2.2.2 Recent Trend of Cropped Area and Crop Production

Crop	2001/02		2002/03		2003/04		2004/05		2005/06	
	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)
Kharif season crops										
Grains	420,217	924,829	417,403	581,364	419,012	870,088	414,006	763,545	411,880	954,446
Oil seeds	5,262	3,261	5,367	3,145	5,387	3,250	4,836	3,004	7,688	6,314
Rabi season crops										
Grains	397,309	674,093	388,872	529,498	393,357	527,940	397,031	724,100	396,210	759,208
Oil seeds	11,772	9,118	10,320	5,139	10,346	3,618	10,552	4,713	10,705	16,122
Vegetables	50,628	764,664	52,307	782,023	61,354	919,170	63,064	994,928	72,983	1,089,415
Fruits	223,035	459,623	176,206	263,446	182,441	559,977	186,903	692,011	192,092	473,896



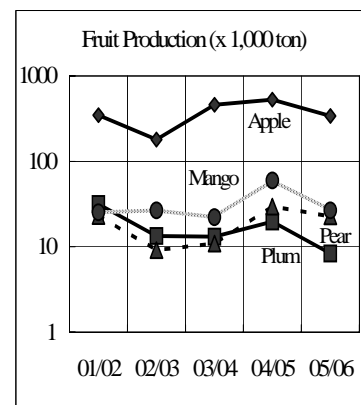
Source: Department of Land Records, and Department of Horticulture, Himachal Pradesh State Government (2001/02 - 2004/05), and

JICA Study Team through the block offices of Department of Agriculture (2005/06)

Remarks: 2002/03 drought year

Table CA-2.2.3 Breakdown of Cropped Area and Production of Fruits

Fruit	2001/02		2002/03		2003/04		2004/05		2005/06	
	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)	Area (ha)	Product (ton)
Apple	92,820	348,263	81,630	180,528	84,112	459,452	86,202	527,601	87,829	340,289
Plum	15,220	31,705	8,198	13,367	8,316	13,113	8,335	19,717	8,220	8,317
Peach	6,030	4,869	4,734	2,765	4,861	11,943	4,966	6,564	5,168	10,028
Apricot	3,688	1,947	2,783	1,657	2,897	3,582	2,947	2,415	3,339	3,640
Pear	7,714	22,986	7,403	9,125	7,519	10,938	7,564	29,590	7,194	22,738
Temperate	833	802	1,141	1,238	1,280	684	1,411	1,256	2,486	2,099
Almond	9,755	2,305	5,665	2,575	5,715	1,411	5,732	1,155	6,187	1,737
Walnut	6,155	1,636	4,526	1,481	4,651	2,410	4,729	3,099	3,841	1,343
Nuts & Dry	1,046	137	509	123	573	141	639	94	1,388	467
Mango	33,684	25,311	33,380	26,744	35,144	22,110	36,215	59,739	32,024	26,687
Sub-tropical	46,090	10,662	26,237	23,843	27,373	43,193	28,163	40,781	34,416	56,551
Total	223,035	459,623	176,206	263,446	182,441	568,977	186,903	692,011	192,092	473,896



Source: Department of Land Records, Himachal Pradesh State Government (2001/02 - 2004/05), and JICA Study Team through the block offices of Department of Agriculture (2005/06)

Remarks: (1) 2002/03 drought year

(2) Regarding cropped area and production in 2005/06, block data was adopted for the study work of JICA Study Team. Statistical data in 2005/06 from Department of Horticulture (total fruits: 191,668ha, temperate fruit: 235,303ha, sub-tropical fruit: 66,365ha) was utilized as reference.

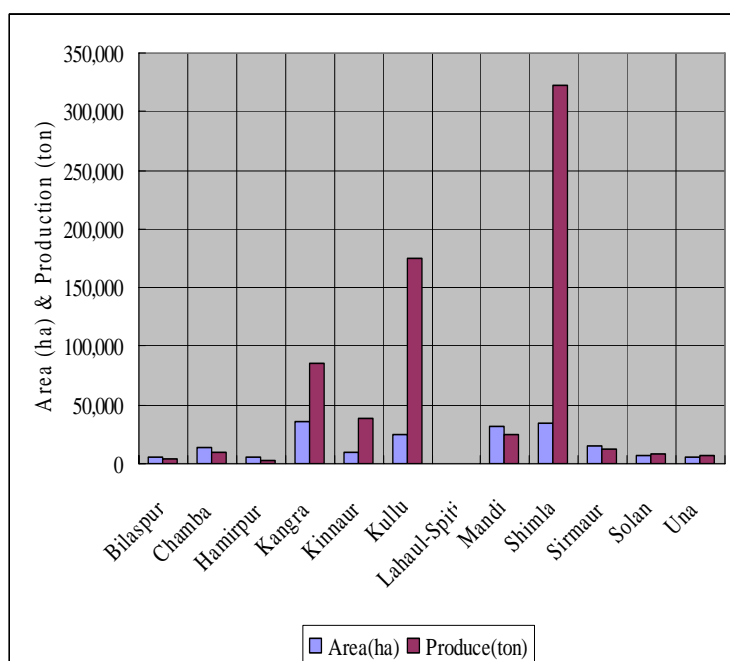


Fig. CA-2.2.1 District-wise Fruit Production and Area

District-wise planted areas and production in the State are given in Table CA-2.2.4. and Fig. CA-2.2.1.

Fruit production is concentrated in limited top 5 districts i.e. Shimla, Kullu, Kangra, Kinnaur and Mandi which share is 94 % of the State total production as shown left. District Shimla is the top district among five and the share occupies 46.7 % of the State Production.

Table CA-2.2.4 District-wise Cropped Area and Production of Fruits

District	Apple		Other Temperate Fruit		Mango		Nuts & Others		All Fruits	
	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)	Area (ha)	Produce (ton)
Bilaspur	4	0	751	253	3,652	3,595	1,572	624	5,979	4,472
Chamba	9,853	7,564	1,310	495	424	77	2,324	1,821	13,911	9,957
Hamirpur	0	0	402	323	2,465	941	2,014	1,136	4,881	2,400
Kangra	419	710	1,142	3,809	19,952	46,215	13,820	34,853	35,333	85,587
Kinnaur	7,720	38,066	361	557	0	0	1,235	395	9,316	39,018
Kullu	20,524	141,844	3,061	33,645	79	0	599	136	24,263	175,625
Lahaul-Spiti	533	209	30	25	0	0	7	4	570	238
Mandi	14,567	20,131	5,702	2,557	3,184	610	8,017	976	31,470	24,274
Shimla	29,029	318,449	3,312	3,763	197	44	2,428	639	34,966	322,895
Sirmaur	2,518	560	5,234	7,063	2,812	3,144	4,458	1,979	15,022	12,746
Solan	112	68	2,945	6,036	1,663	1,161	1,621	1,024	6,341	8,289
Una	0	0	977	1,016	1,787	3,952	2,087	1,542	4,851	6,510
State	86,202	527,601	25,227	59,542	36,215	59,739	39,259	45,129	186,903	692,011

Source: 2004/05 data of Department of Horticulture, Himachal Pradesh State Government

CA-2.2.3 Fruit Planting

(1) Planting Density

Planting density of fruit trees is different among fruit species depending upon the vigour and canopy of the trees. Prevailing density in Himachal Pradesh is given as follows:

- a. Apple: 278 tree/ha;
- b. Stone fruits like peach, plum, apricot and cherry: 330 tree/ha;
- c. Pomegranate: 494 tree/ha;
- d. Grapes: 1,111 tree/ha;
- e. Mango and litchi: 150 tree/ha; and
- f. Citrus including Kagzi lime, kinnow and orange: 300 tree/ha.

(2) Production Cost

Citing information on fruit production costs collected from the DOH, YSP University of Horticulture and Forestry and Agro-Economic Centre of Himachal Pradesh University together with the field survey done by JICA Study Team, annual unit production costs of typical fruit crops grown in the State are compiled as summarized below:

Table CA-2.2.5 Annual Production Cost of Typical Fruit Crops in Himachal Pradesh

Unit: Rs./ha

Fruit	Material Cost	Labour Cost	Harvesting Cost	Interest on Working Capital	Total Recurrent Cost	Annual Depreciation Cost	Total Annual Expense
Apple	9,580	10,470	5,570	1,280	26,900	13,480	40,380
Mango	8,220	5,430	3,540	860	18,050	8,590	26,640
Kagzi lime	5,390	2,980	5,960	970	15,300	12,990	28,290

Source: DOH, University of Horticulture and Forestry, Agro-Economic Centre of Himachal Pradesh University & JICA Team

CA-2.3 Floriculture

In Himachal Pradesh, floriculture is still in the initial stage in taking advantages on ecological and seasonal niches and is coming up in a big way. It enjoys a niche over flower cultivation in plains with favorable climatic conditions having a vast and magnificent opportunity to grow marigold, gladiolus, lily, carnations, and chrysanthemum. While, the zone of high hills and valleys in the interiors is

world's best place to produce hybrid seeds, bulbs, rhizomes, and ornamental plants:

As of 2007/08, there exist 510-ha areas under floriculture earning Rs.199 million to meet local demand in nearby markets like Chandigarh, Punjab, Haryana and Delhi. The largest area under floriculture is Sirmour district with 281 ha, followed by Kangra, Solan, Shimla, Chamba and Mandi districts. Floriculture produce includes cut flowers, flower seeds, pot plants, bulbs and propagules.

District-wise area under floriculture for 2006/07 is presented below:

Table CA-2.3.1 District-wise Area under Floriculture in Himachal Pradesh

Unit: ha

District	Marigold	Gladiolus	Chrysanthemum	Carnation	Other Cut Flower	Seasonal	Other Flowers	Seeds & Potted Plants	Total
Bilaspur	1.9	2.8	0.6	5.0	0.9	-	-	-	11.2
Chamba	7.9	3.6	-	0.6	0.7	1.0	-	0.2	14.0
Hamirpur	2.3	-	0.1	-	0.3	0.1	-	-	2.8
Kangra	12.8	6.3	3.0	-	10.4	24.2	20.9	-	77.6
Kinnaur	-	-	-	-	-	-	-	-	-
Kullu	8.0	6.3	0.5	1.5	1.3	0.7	0.2	0.3	18.8
Lahau-Spiti	-	0.2	-	-	-	-	-	-	0.2
Mandi	1.5	11.0	0.7	1.7	0.2	1.7	0.1	-	16.9
Shimla	3.1	8.1	4.7	2.2	0.2	0.1	3.4	2.9	24.7
Sirmaur	155.4	66.7	55.0	3.8	-	-	-	-	280.9
Solan	8.3	15.4	1.6	10.3	5.0	1.2	1.5	-	43.3
Una	13.2	0.2	-	-	2.0	2.0	1.0	1.0	19.4
State	214.4	120.6	66.2	25.1	21.0	31.0	27.1	4.4	509.8

Source: 2006/07 Department of Horticulture, Himachal Pradesh State Government

CA-2.4 Medicinal and Aromatic Plants

Medicinal plants are abundantly growing in nature in Himachal Pradesh. There are 2,500 species of medicinal and aromatic plants naturally grown in the State. Out of these, 1,200 species are identified with commercial values. Up to date, only 45 species have been recommended for cultivation for commercial exploitation purpose, distributing 14 species for the area with elevation up to 1200 m above mean sea level, eight species for the area with elevation between 1200 m and 1800 m, 10 species for the area with elevation between 1800 m and 2800 m, and 13 species for the area with elevation above 2800 m.

There are three Himachal Pradesh State Departments involved in promotion of medicinal plants. These are Department of Ayurveda, Department of Forest and DOH. The State Medicinal Plant Board in Himachal Pradesh is the analogy of National Medicinal Plant Board. Cultivation protocol for commercial exploitation of these medicinal and aromatic plants has been given to DOH. The existing cultivated area under medicinal and aromatic plants is 286 ha for 2006/07, comprising 170 ha for area under medicinal plants and 116 ha for area under aromatic plants. There is a tremendous scope of expansion under medicinal plants.

District-wise area under floriculture for 2006/07 is presented below:

Table CA-2.4.1 District-wise Cultivated Area under Medicinal and Aromatic Plants

District	Area (ha)	District	Area (ha)	District	Area (ha)	District	Area (ha)
Bilaspur	17.9	Kangra	148.0	Lahau-Spiti	5.0	Sirmaur	12.0
Chamba	27.5	Kinnaur	-	Mandi	16.0	Solan	15.0
Hamirpur	7.6	Kullu	10.0	Shimla	10.0	Una	17.0

Source: 2006/07 Department of Horticulture, Himachal Pradesh State Government

CA-2.5 Ancillary Horticulture Activities

CA-2.5.1 Horticulture Production Infrastructure

There exist six types of infrastructure to support horticulture production in Himachal Pradesh. These are progeny-cum-demonstration orchards/nurseries, private registered nurseries, plant tissue culture laboratories, olive stations, walnut development stations and plant protection centres.

(1) Progeny-cum-Demonstration Orchards/Nurseries

Progeny-cum-Demonstration Orchards/Nurseries have been established for different fruit crops in 98 locations in the State to serve as growth centers for the development of horticulture with their impact zone of normally 10 km radius. The objectives of these units are:

- a. Stocking of fruit trees of outstanding merit;
- b. Multiplication of pedigree and true to type planting material;
- c. Acting as model and demonstration orchards;
- d. Conducting of field adaptability trails for new fruit varieties and testing of other horticultural technologies; and
- e. Acting as extension and training units for local farmers.

The existing 98 Progeny-cum-Demonstration Orchards/Nurseries with the total area of 529.63 ha are distributed in 12 districts and propagate fruit plants as shown below:

Table CA-2.5.1 District-wise Progeny-cum-Demonstration Orchards/Nurseries

District	No. of Unit	Area (ha)	Kind of Propagated Fruit Crops
Bilaspur	6	16.55	Mango, litchi, citrus, guava, peach, pear, etc.
Chamba	14	55.43	Apple, stone fruits, mango, citrus, walnut, pear, guava, etc.
Hamirpur	5	10.75	Mango, citrus, pear
Kangra	8	35.76	Mango, litchi, citrus fruits, low chilling varieties of stone fruits, guava, pecan nut, aonla, grapes, etc.
Kinnaur	8	39.71	Apple, stone fruits, almond, apricot, grapes
Kullu	5	36.39	Apple, stone fruits, cherry, pomegranate, persimmon, kiwi, strawberry, clonal rootstocks of apple, cherry, pear, stone fruits, etc.
Lahau-Spiti	3	7.02	Apple, apricot, almond, hops
Mandi	11	48.98	Apple, stone fruits, mango, citrus fruits, kiwi, walnut, strawberry, etc.
Shimla	14	87.18	Apple, stone fruits, pear, cherry, pomegranate
Sirmaur	14	116.40	Apple, stone fruits, kiwi, mango, citrus fruits, etc
Solan	9	41.58	Stone fruits, kiwi, hazelnut, persimmon, pear, mango, citrus
Una	1	33.88	Mango, pear, citrus, papaya, pomegranate, etc.

Source: Department of Horticulture, Himachal Pradesh State Government

(2) Private Registered Nurseries

The propagation of fruit plant material in the State is regulated under the Himachal Pradesh Fruit Nurseries Registration Act 1973. So far 732 nurseries have been registered under this Act, out of which 662 nurseries are in the private sector and the balance 70 nurseries in the public sector. About 2 million fruit plants are annually propagated in these nurseries with the total area of 203.7 ha. District-wise distribution of these private nurseries is as shown below:

Table CA-2.5.2 District-wise Distribution of Private Registered Nurseries

District	No. of Unit	Area (ha)	Kind of Propagated Fruit Crops
Bilaspur	23	9.50	Mango, litchi, guava, aonla, pear, papaya, grapes
Chamba	67	22.30	Apple, stone fruits, mango, walnut, pear, guava, kiwi
Hamirpur	21	7.50	Mango, citrus, pear
Kangra	68	30.60	Mango, litchi, citrus, stone fruits, guava, pecan nut, aonla, grapes, loquat
Kinnaur	34	9.25	Apple, pear, almond, apricot, grapes, kiwi
Kullu	130	32.50	Apple, pear, stone fruits, pomegranate, persimmon, cherry, kiwi, olive
Lahau-Spiti	1	0.30	Apple, apricot, almond, hops
Mandi	110	28.00	Apple, stone fruits, mango, guava, litchi, walnut, olive, pomegranate, pecan nut, strawberry
Shimla	117	33.00	Apple, pear, cherry, apricot, peach, almond, pomegranate, kiwi, strawberry, walnut
Sirmaur	64	20.50	Apple, stone fruits, kiwi, mango, citrus
Solan	12	4.00	Stone fruits, apple, kiwi, guava, pear, mango, citrus
Una	15	6.25	Mango, pear, papaya, pomegranate, peach, banana, strawberry

Source: Department of Horticulture, Himachal Pradesh State Government

(3) Plant Tissue Culture Laboratories

For the rapid propagation of horticulture and floriculture planting materials, the DOH has promoted two plant tissue culture laboratories, one each in the public and private sectors. Their annual propagation capacity is approximately 200,000 plants for the private laboratory in Shimla and 50,000 plants for YSP University of Horticulture and Forestry in Solan.

(4) Olive Stations and Walnut Development Stations

For the purpose of promoting the development of olives in the State, three Olive Stations have been established with the objective of collection of varieties and development of suitable package of practices for its cultivation. A walnut Development station has been established for the collection of walnut varieties and to develop and adapt technology for the cultivation of this fruit. The supply capacity of each plant is as follows:

- Olive Station at Lanji in Chamba district produces 1,900 plants in its area of 8.09 ha;
- Olive Station at Panarsa in Mandi district produces 1,000 plants in its area of 4.80 ha;
- Olive Station at Jerva in Sirmaur district produces 400 plants in its area of 6.36 ha; and
- Walnut Development Station at Nohra in Sirmaur district produces 350 plants in its area of 4.40 ha.

(5) Plant Protection Centres

A total of 337 Plant Protection Centres have been established in the different fruit growing regions of the State with the objectives of serving as:

- Supply/sale centres for plant protection chemicals and equipments; and
- Extension units for the dissemination of technical information to the local farmers.

District-wise distribution of Plant Protection Centres is given below:

Table CA-2.5.3 District-wise Distribution of Plant Protection Centres in Himachal Pradesh

District	Unit	District	Unit	District	Unit	District	Unit
Bilaspur	16	Kangra	16	Lahau-Spiti	6	Sirmaur	13
Chamba	47	Kinnaur	20	Mandi	47	Solan	23
Hamirpur	16	Kullu	42	Shimla	78	Una	13

Source: Department of Horticulture, Himachal Pradesh State Government

CA-2.5.2 Horticulture Development Activities

(1) Introduction of Improved Material

Since the Seventh Five Year Plan period, the improved varieties of fruit crops have been introduced by the DOH from the advanced foreign countries and other States in India. So far 177 varieties of cultivars for 21 fruit crops and 26 varieties of rootstocks for six fruit crops in total have been introduced.

(2) Post-harvest Activities

Following the expansion of horticulture crop planting area and the fruit production increase, considerable post harvest management infrastructure has been created by the public, private and joint sectors in the State for taking care of the post harvest management and processing needs of the horticulture industry. The details are as below:

- a. Packing and grading houses with 5,000-ton capacity each located at five places which are Patlikuhal in Kullu district, and Gumma, Rohroo, Jarol and Oddi in Shimla district;
- b. Grading houses with 1,000-ton capacity each located at six places which are Recong Peo in Kinnaur district, Bhuntar in Kullu district, Chindi and Chail in Mandi district, and Tutu Pani and Rajgarh in Shimla district;
- c. Cold storages in production areas with 1,000-ton capacity each located at five places which are Patlikuhal in Kullu district, and Gumma, Rohroo, Jarol and Oddi in Shimla district, one unit in an exit point with 3,000-ton capacity located at Parwanoo in Solan district, and three units in terminal markets located at Delhi with 4,250-ton capacity as well as Mumbai and Chennai with 2,000-ton capacity each;
- d. Air cool storage constructed as a pilot unit at Patlikuhal in Kullu district and Khadralla in Shimla district;
- e. Corrugated fiber board manufacturing unit with producing capacity of 10 million cartons located at Prangati Nagar in Shimla district; and

(3) Floriculture Infrastructure

For the development of floriculture, seven floriculture stations and nurseries have been established with the following views:

- a. To procure and multiply elite floriculture plant materials for supply to the farmers; and
- b. To act as demonstration and training centers in floriculture.

The details are given below:

Table CA-2.5.4 List of Floriculture Infrastructure

Station	District	Area (ha)	Multiplied Floriculture Plant
Model Floriculture Centre, Mahog Bag	Solan	1.61	Gladiolus, carnation, lily, daffodil, orchids, chrysanthemum, alstroemeria, statice
Floriculture Nursery, Bhatoon	Kangra	0.48	Potted plants, seasonal flower seedlings, chrysanthemum
Floriculture Nursery, Dharamsala	Kangra	1.20	Potted plants, flower plants in poly bags, flower seedlings
Floriculture Nursery, Bajaura	Kullu	1.32	Carnation, marigold, gladiolus, potted flower plants, flower seedlings
Floriculture Nursery, Chharabra	Shimla	1.00	Potted plants, avenue plants, climbers etc.
Floriculture Nursery, Naubahar	Shimla	0.70	Carnation, lily, chrysanthemum, alstroemeria, potted plants, cactus seasonal flowers
Floriculture Nursery Parwanoo	Solan	0.16	Potted plants, seasonal flowers, rose

Source: Department of Horticulture, Himachal Pradesh State Government

(4) Bee Keeping

Bee keeping is a necessary activity attached to the horticulture industry, which, besides providing pollinating agents for improvement of fruit set and productivity, results in the production of economic apiculture products like honey and bee wax.

For the development of bee keeping in Himachal Pradesh, some 32 bee keeping stations have been established throughout the State aiming to provide technical know-how to the farmers in commercial bee keeping. In these stations, 1,256 bee colonies are maintained for multiplication purpose and supply to the farmers. In addition, two bee breeding multiplication centres have been promoted by the private sector, ag-marketing laboratories for honey have been established at Chaitru in Kangra district and Hatkoti in Shimla district. District-wise distribution of bee keeping stations is as shown below:

Table CA-2.5.5 District-wise Distribution of Bee Keeping Stations in Himachal Pradesh

District	Unit	District	Unit	District	Unit	District	Unit
Bilaspur	1	Kangra	3	Lahaul-Spiti	1	Sirmaur	1
Chamba	7	Kinnaur	4	Mandi	2	Solan	3
Hamirpur	1	Kullu	3	Shimla	5	Una	1

Source: Department of Horticulture, Himachal Pradesh State Government

(5) Mushroom Cultivation

For the development of mushrooms on scientific lines, the DOH has established mushroom compost manufacturing units, distributing two units to Kangra district, one each to Kullu and Sirmaur districts, and three to Solan district. The DOH has also established Kangra and Sirmaur districts and two in Solan district. In addition, the private sector has developed 38 mushroom compost production units locating one each in Hamirpur, Kangra, Kullu and Una districts, two in Bilaspur and Mandi districts, three in Sirmaur district, six in Shimla district and 21 in Solan district as well as one spawn unit in Sirmaur district and seven spawn units in Solan district.

CA-2.6 Horticulture Administration

(1) Department of Horticulture

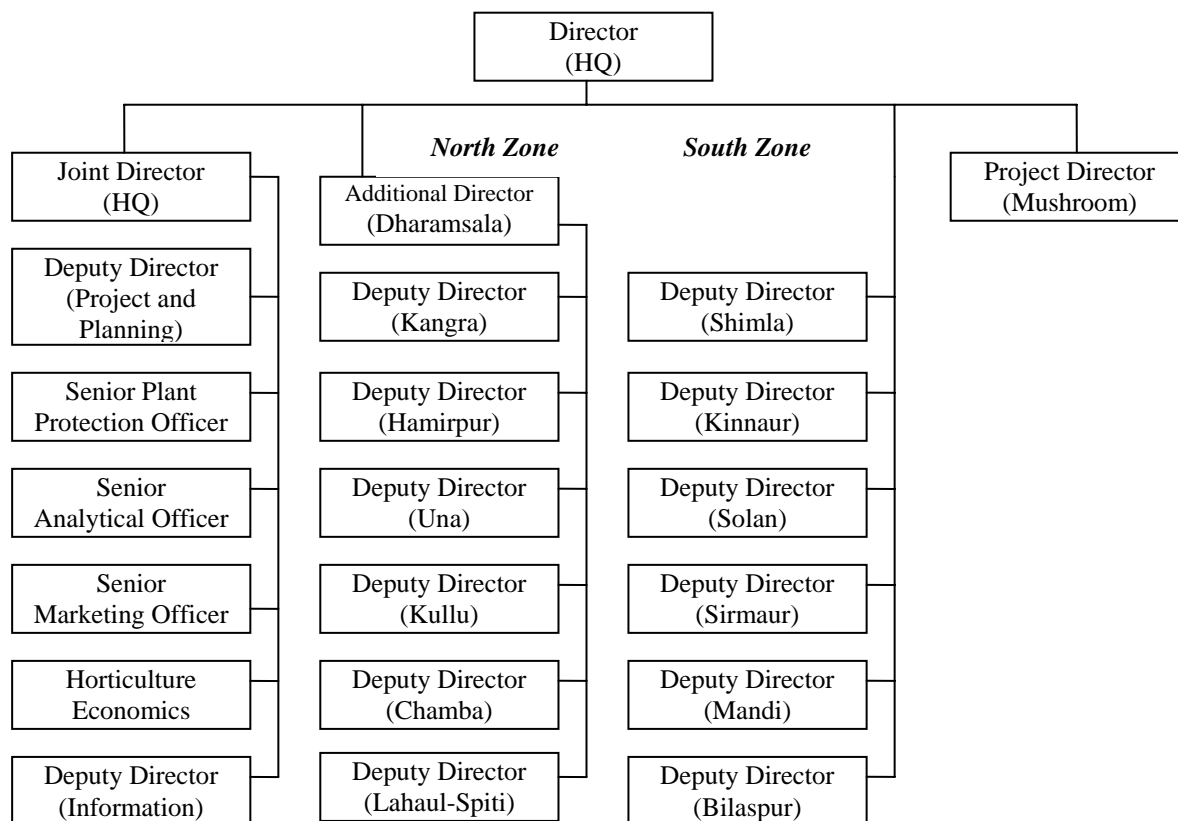
The DOH of the State Government is fully responsible for carrying out the following mandates:

- To diversify the traditional farming system based on subsistence agriculture to commercial market oriented farming system based on high income generating cash crops like fruits, flowers, mushrooms, medicinal plants, and so on;
- To harness the ecological niches for the promotion of environment friendly farming system suited to

the different agro-climatic conditions of the State;

- c. To create conditions, infrastructure, services and facilities for improving the levels of farm income and employment by increasing production, productivity and quality of produce thereby improving the quality of life of the rural population;
- d. To use science and technology to a greater extent for the optimum utilization of the State's horticulture potential and for that to develop, introduce, adapt and extend appropriate technology for adoption at the farm level; and
- e. To formulate and implement sound and scientific plans for the development of horticulture in Himachal Pradesh with equal participation from the farmers, farmers' organizations and the industry.

The DOH functions under the administrative control of the Principal Secretary (Horticulture) to the Government of Himachal Pradesh, and is headed by the Director of Horticulture with headquarters at Shimla. Its organization is illustrated in Fig. CA-2.6.1. In the headquarters, the Director of Horticulture is assisted by the Joint Director of Horticulture, Deputy Directors of Horticulture and Subject Matter Specialists at the Directorate level. There are seven specified divisions in the Directorate, consisting of General Horticulture, Plant Nutrition, Plant Protection, Marketing and Post harvest Management, Fruit Processing and Utilization, Horticulture Economics and Statistics, and Horticulture Information Services.



Source: Department of Horticulture, Himachal Pradesh State Government

Fig. CA-2.6.1 Organization Chart of Department of Horticulture of Himachal Pradesh

Deputy Directors of Horticulture are posted in the each district to implement and co-ordinate all the horticulture activities in their respective districts. They are assisted by District Horticulture Officer in extension and input supply as well as Subject Matter Specialists in the field of orchards and nurseries,

plant protection, floriculture and marketing, depending upon the scope of activities in the concerned district.

Horticulture Development Officers have been provided at each Development Block Horticulture Centre for implementation of the horticulture development schemes and providing extension services to the fruit growers. These Horticulture Development Officers are assisted by Horticulture Extension Officers of Horticulture Extension Circle who are the grass root functionaries of the DOH.

(2) Horticulture Research

The State Government has set up Dr. Y. S. Parmar University at Nauni in Solan district in December 1985 with the following mandate:

- a. Provision of education in horticulture, forestry and allied disciplines;
- b. Advancement of basic and applied research pertaining to horticulture, forestry and allied disciplines;
- c. Extension and dissemination of scientific information amongst rural masses;
- d. Development of linkages with State/Central/International institutions, NGO, orchards, farmers and industries for achieving economic and ecological security; and
- e. Other activities that university may determine from time to time.

Research works are carried out in the existing network as listed up in Table CA-2.6.1.

Table CA-2.6.1 Regional Network of Horticulture Research in Himachal Pradesh

Zone	Regional Level	Satellite Level
Low hill and valley areas near the plains (Sub-tropical)	- Regional Horticulture Research Station, at Jach in Kangra district - Regional Horticulture Research Station, at Bhota in Hamirpur district	- Horticulture and Forestry Research Station at Neri in Hamirpur district - Litchi and Mango Research Station at Nagrota Bagwan in Kangra district - Horticulture Research Station at Dhaulakuan in Sirmaur district
Mid hills (Sub-temperate)		- Horticulture Research Station at Katrain in Kangra district - Horticulture Research Station at Seobagh in Kangra district - Horticulture Research Station at Kandaghat in Solan district
High hills and valleys in the interiors (Temperate)	- Regional Horticulture Research Station, at Mashobra in Shimla district	- Forstry Research Sub-station at Rahla in Kullu district - Temperate Horticulture Research Station at Kotkhai in Shimla district
Cold and dry zone (Dry Temperate)	- Regional Horticulture Research Station, at Sharbo in Kinnaur district	- Vegetable Research Station at Kalpa in Kinnaur district - Horticulture Research Sub-station at Tabo in Lahaul-Spiti district

Source: Department of Horticulture, Himachal Pradesh State Government

(3) Horticulture Extension

For advisory services on fruit plant nutrition, three Plant Tissue Analysis Laboratories have been established in Kangra, Kullu and Shimla districts in which around 10,000 to 13,000 plant issue samples are analyzed annually for the diagnosis of the nutritional disorders and recommendations for dosages for fertilizer application. This has helped the orchards in making judicious use of chemical fertilizers.

The supply of the pesticides is arranged through 337 sales outlets established in the fruit growing areas

by the DOH. Every year around 225,000-ha area is covered under plant protection activities, and the pesticides are distributed to the farmers every year. A Biological Control Laboratory to decrease the chemical use in pests control has also been established in Shimla district.

The horticulture extension services have been strengthened up to the grass root level. In addition, the programs on the farmers training, demonstrations, fruit shows, exhibitions, seminars and workshops are organized for the dissemination of the technical know how to the farmers.

CA-2.7 Analysis of Current Fruit Crop Situation in Himachal Pradesh

CA-2.7.1 Impact of Horticulture Technology Mission

Since October 2003 when a centrally sponsored scheme “Horticulture Technology Mission” was launched, the financial assistance of Rs. 8 billion was made during the Tenth Five Year Plan period. This scheme is under continuation in the Eleventh Five Year Plan period and the financial assistance of Rs. 2.4 billion has been earmarked by the Central Government. The accumulated achievements of on-going programs can be judged to make large contributions to the development of horticulture sector in the State on the farmers’ need basis. Among others, remarkable impacts are to accelerate the diversification of fruit crops, both temperate and sub-tropical, coupled with area expansion in due consideration of crop suitability matching with a wider variation of agro-climatic conditions.

The achievements under the Horticulture Technology Mission scheme are itemized as follows:

- a. Farmers benefited are 77,333 persons, and 281 self help groups and 571 on-farm handling units are organized;
- b. Capacity building has been done through training 7,733 participants within the State, 3,161 trainees outside of the State and 2,561 women farmers;
- c. Additional areas brought under horticulture crops cover 14,333 ha with fruit crops, 2,245 ha with vegetables, 594 ha with flowers, 170 ha with medicinal plants, 116 ha with aromatic plants and 535 ha with spices;
- d. New irrigation areas of 10,338 ha are created by constructing 1,065 tanks with the total storage capacity of 310,000 cubic m, and another 426 ha are facilitated with 1,000 tube wells or bore wells. Areas brought under drip irrigation system are 396 ha, while areas under sprinkler irrigation system are 1,034 ha;
- e. Areas brought under green/poly house are 48.1 ha, while areas under low poly tunnel are 6.9 ha;
- f. Nurseries constructed consist of six each of public and private multi crop nurseries, 17 small public nurseries and 18 small private nurseries; and
- g. Equipments provided are of 15,980 anti hail nets, 36,116 vermi compost units, 2,847 power generators, 245 diesel engines, 357 power tillers and 5,403 mutually operated equipments.

CA-2.7.2 Further Requirements for Production Management

Although the implementation of “Horticulture Technology Mission” scheme has upgraded horticulture crop management in Himachal Pradesh, it is considered that there still exist a lot of requirements for improvement of present low productivity and income earning issues specified below:

- a. Diversification of fruit and other horticulture crops aims to arrest monoculture of crops coupled with diversification of varieties with characteristics of precocity and late bearing to prolong harvesting

season in the existing plantations. Shift from table to processing varieties to meet the requirement of processing industry needs for increasing production;

- b. High density plantation with the suitable root stocks is indispensable for ensuring good quality and quantity;
- c. Planting materials need to be genuine, true to type and disease free. For this need, Nursery Registration, Inspection and Certification Act should be stringent to ensure supply of quality planting material;
- d. Replanting of old and senile orchards temperate fruits especially for apple and sub-tropical fruits especially for citrus is a need to develop special technique with the suitable root stocks;
- e. Irrigation water sources need to be created for meeting water demand at crucial stages of flowering, fruit set and fruit development stages. In this regard, special attention should be paid to adoption of rain-fed technologies like soil and water conservation, rain water harvesting, contour farming, raising of vegetable barriers, mulching and judicious use of water through micro-irrigation;
- f. Awareness of farmers to useful effects of mixed farming module like intercropping of medicinal plants, leguminous crops, fodder crops and vegetable crops should be whipped up;
- g. Organic farming needs to be promoted for replenishing soils in order to increase microbial population, and covered cultivation methods need to be put into practice in a wider manner paying special attention to green houses, shade nets, anti-bird nets and anti-hail nets; and
- h. Waste land utilization should be promoted focusing on currently fallow land and cultivable waste land for the purpose of creating land resources to realize area expansion of fruit crops.

CA-3 Horticulture Development Potential

CA-3.1 Development Potentials

The DOH has set up its main target of horticulture development over the additional area expansion and replanting of old and senile fruit trees. To attain this target, it is required to shift land resources of 22,500 ha to fruit crop areas for the Eleventh Five Year Plan period and another 20,000 ha for the Twelfth Five Year Plan period. In Himachal Pradesh, however, the availability of land resources for new farm land reclamation is very limited. In this regard, there are some options to secure alternative land resources for realization of the fruit crop area expansion target. Possible land will be currently fallow land, cultivable waste land, pasture land & grassland, and non-vegetative land. Existing annual food grain cultivated land has also possibility, however, it would be second option, since family food security is important issues for farmers.

Among the above, it is considered that the fallow land has the top-ranked level of land suitability and productivity potentials for expanding fruit crop areas. The cultivable waste land is considered as an alternative land resource for the fruit crop area expansion as farmers once opened up for growing annual crops. The pasture land & grassland is to be utilized as mixed cropping areas with fodder crops under fruit trees, taking into account chronic deficiency of green and dry fodder supply to livestock throughout the State. Non-vegetative land is usually of rocks/moraines without any possibility of growing fruit trees and thus has rarely potential for fruit crop area expansion. Considering continuous security of farmers' income sources and dietary habits in Himachal Pradesh, vegetable crops are more

suitable than perennial orchards for converting the existing annual food grain crop cultivated land.

There exist fruit extension potential areas of around 60,000 ha of “Fallow Land” with the first priority and 96,400 ha of “Cultivable Waste Land” with the second priority in the State at present.

The existing orchards include old and senile trees of which economic life has completed. Further the number of fruitless trees has increased due to diseases and pest infestation. The former case is observed in apple orchards to a large extent and the latter concentrates into citrus orchards. To replenish the both cases, the effective countermeasures are to replant new seedlings, especially virus free for citrus crops.

With respect to flowers as well as medicinal and aromatic plants, different approaches are taken up as follows:

- a. Floriculture under protected culture in the State has more advantages than practices of flowers grown outdoors in selecting a wider range of flower varieties corresponding to market demand trends. As the site suitable for protected culture requires labor intensive daily cultivation management and water sources for micro irrigation systems, higher priority in selecting potential areas is to be given over the existing upland field located nearby resident places in villages; and
- b. Cultivation of medicinal and aromatic plants on farm land in Himachal Pradesh are still in the beginning stage and consequently have a lot of hurdles to be overcome in terms of accumulation of technical know how on pre- and post-harvest practices, establishment of mother plant nurseries and institutional supports, although promising medicinal and aromatic plants have been already identified for outdoor cultivation on farm land in different agro-climatic zones. In selecting potential areas, therefore, attention is to be paid to introduce these promising plants into annual cropping patterns in upland fields similar to exotic vegetables.

Aiming to formulate an exploitation plan of development potentials in line with the above considerations, criteria for identification of horticulture development potential areas are set up as summarized in Table CA-3.1.1.

Table CA-3.1.1 Criteria for Identification of Horticulture Development Potential Areas

Item	Criteria
Fruit crops (Area extension)	<ul style="list-style-type: none"> • Currently fallow land with top priority • Cultivable waste land with second priority in case for less available area of currently fallow land • No priority in planning exploitation of development potential over conversion of the existing cultivated farm land of food grain crops to permanent orchard except for the case of farmers' choice
Fruit crops (Replanting)	<ul style="list-style-type: none"> • Apple orchard planted more than 30 years ago • Citrus orchard with partial replanting of trees infested by infectious pests and/or diseases
Flowers	<ul style="list-style-type: none"> • Site with the minimum size of 1,000 m² and irrigation water source • Site with the possibility of forming a flower producing centre and grower' group
Medicinal & aromatic plants	<ul style="list-style-type: none"> • Upland field with the minimum cultivating area of 5 ha • Introduction of medicinal and/or aromatic plants into cropping pattern upon farmers' choice

Source: JICA Study Team

CA-3.2 Necessity and Requirements for Rational Plans of Potential Development

Existing constraints for exploiting area expansion potentials of fruit crops are classified into three categories, the necessity and requirements for overcoming constraints are to be examined for the respective categories. Based on the examination, rational plans to overcome constraints for development of fruit area expansion potentials have been drawn up focusing on the following points:

- a. The constraints related to the physical conditions are composed of two types. One can be overcome by taking hard measures on the individual farmer basis, while the other needs to gather farmers together based on their requirements. Therefore, specific features of these two types are taken into account;
- b. The constraints on the utilization of potential areas consist of fruit crop area expansion and replanting aspects. Therefore, special attention is paid to these points; and
- c. The constraints on supporting activities include post-harvest, marketing and administrative issues. Therefore, the background of each issue is considered.

The rational plans drawn up from the above viewpoints are summarized below:

Table CA-3.2.1 Necessity and Requirements for Overcoming Plan of Conditions

Constraints	Issues to be overcome	Necessity and Requirements
Physical Condition	Individual farmers' issues	<ul style="list-style-type: none"> • Necessity: Selection of suitable area for planting fruit crops out of potential areas identified • Requirement: Diagnosis of soil fertility and physical conditions • Improving accessibility to the existing road network because existing farm road net works are poor and the width is narrow for transport of heavy farm output such as fruits.
	Group activity issue	<ul style="list-style-type: none"> • Necessity: Formation of specific fruit crop producing area by utilising unutilized farm land • Requirement: Provision of technical and financial supports focusing on creation of farmers' awareness on group farming and cluster formation
Utilization of Potential Areas	Areas to be expanded	<ul style="list-style-type: none"> • Necessity: Diversification of fruit crops, increase in crop productivity, maintenance of fruit trees in disease free condition and risk reduction of climatic hazard • Requirement: Enhancement of species and varieties of fruit crops, strengthening of nursery capacity in supply quantity and quality control, practice of organic farming, adoption of rain-fed technologies for irrigation water supply to fruit crops at crucial stages, and promotion of protected measures like shade net and anti-hail net
	Areas to be replanted	<ul style="list-style-type: none"> • Necessity: Increase in productivity of the existing orchards focusing on apple and citrus fruits • Requirement: Setting up of criteria for identification of old and senile orchards followed by inventory survey and support to replanting
Supporting Activities	Post-harvest issue	<ul style="list-style-type: none"> • Necessity: Reduction of post-harvest losses and upgrading of quality • Requirement: Construction of common use facilities for sorting, grading and packing coupled with creation of grading/packing standard as well as arising of farmers' awareness on quality improvement

Constraints	Issues to be overcome	Necessity and Requirements
	Marketing issue	<ul style="list-style-type: none"> • Necessity: Value addition of produce • Requirement: Establishment and utilization of dual information system on supply and demand coupled with media involvement in fresh fruit marketing, and enhancement of processing industries
	Administrative issue	<ul style="list-style-type: none"> • Necessity: Increase in farm gate price of fruit crops and strengthening of extension services • Requirements: Promotion of reasonable profit sharing among stakeholders, and promotion of need based research and development works followed by transferring results to fruit farmers groups and NGO.

Source: JICA Study Team

CA-4 Recommended Fruits Development Plan

CA-4.1 Tentative Fruits Development Concept

In the face of demand increase for food and agricultural production caused by high growth of population and income, agricultural intensification is the main course of future growth of agriculture in India. Besides developing technologies for promoting intensification in the country, greater attention needs to be paid to the development of technologies that will facilitate agricultural diversification particularly towards intensive farming of fruits, vegetables, flowers and other high value crops which are expected to increase income growth.

Under the condition that the per capita availability of arable land is quite low in Himachal Pradesh, diversification towards the high value crops with labor intensive input is the remaining measure to provide adequate income and employment to the farmers who depend on small size of farms.

Crop diversification in horticulture sector should focus on:

- i) Production increase through effective utilization of existing fallow land and cultivable waste land, and
- ii) Improvement of quality and value addition through sorting, grading and packing for urban markets.

In addition, infrastructure development is required to support the above two focus points, especially access farm roads. Another important point needs to be focused is to recover crop productivity of old and senile fruit trees in the existing apple and citrus orchards by replacement of new trees.

The basic concept of horticulture development in Himachal Pradesh is therefore to be set up as follows:

- a. The expansion of fruit crop areas is to target on temporarily unutilized farm lands such as currently fallow land and cultivable waste land;
- b. Diversification of fruit crops is to enhance species of temperate fruit crops other than apple and sub-tropical fruit crops besides citrus fruits; and
- c. Re-planting is to focus on old and senile apple orchards as well as citrus orchards with virus disease affected trees.
- d. Construction of additional access farm roads or improvement of existing footpath and farm road for transport of diversified crops.

CA-4.2 Recommended Fruit Production Plan

CA-4.2.1 Fruit Crop Area Expansion

(1) Area Expansion Targets

As the fruit crop area expansion targets for the Eleventh and Twelfth Five Year Plan periods have been set up as described in Section CA-1.4, the target for the Thirteenth Five Year Plan period (2017/18~2021/22) is assumed based on the above concept. As shown in Table CA-4.2.1, the annual increase in fruit crop areas in this period is predicted to be 3,500 ha and the total area for 15 years will increase by 60,000 ha mainly in fallow or cultivable waste land.

Table CA-4.2.1 Assumed Area Expansion Targets of Fruits for Next 15-year Period

Unit: ha

Item	Eleventh Five Plan (2007/08~2011/12)		Twelfth Five Plan (2012/13~2016/17)		Thirteenth Five Plan (2017/18~2021/22)		Grand Total
	Annual	Whole	Annual	Whole	Annual	Whole	
	Temperate Fruit Crops	2,500	12,500	2,200	11,000	1,900	
Sub-tropical Fruit Crops	2,000	10,000	1,800	9,000	1,600	8,000	27,000
Total	4,500	22,500	4,000	20,000	3,500	17,500	60,000

Prepared by JICA Study Team

District-wise predictions of fruit cropping area expansion are made taking the following points into account:

- Increasing/decreasing trend of temperate, sub-tropical and dry fruit crop areas in 12 districts for three years between 2003/4 and 2006/07; and
- Available land resources usable for fruit area expansion and current fruit crop areas.

The predicted result of district-wise fruit crop areas at the end year of every Five Year Plan period are summarized below:

Table CA-4.2.2 District-wise Preliminarily-Predicted Area Expansion Plan of Fruits in the State

Unit: ha

District	Total Area in 2006/07	Increase in 11th Plan	Total Area in 2011/12	Increase in 12th Plan	Total Area in 2011/12	Increase in 13th Plan	Total Area in 2011/12	Total Area Expansion
Bilaspur	6,280	580	6,860	770	7,630	900	8,530	2,250
Chamba	15,310	2,730	18,040	2,240	20,280	1,790	22,070	6,760
Hamirpur	5,270	1,620	6,890	1,730	8,620	1,750	10,370	5,100
Kangra	37,140	3,130	40,270	3,540	43,810	3,550	47,360	10,220
Kinnaur	10,100	1,580	11,680	1,620	13,300	1,630	14,930	4,830
Kullu	25,700	980	26,680	700	27,380	400	27,780	2,080
Lahau-Spiti	730	280	1,010	190	1,200	130	1,330	600
Mandi	32,580	3,910	36,490	2,160	38,650	1,160	39,810	7,230
Shimla	36,890	3,460	40,350	3,350	43,700	3,110	46,810	9,920
Sirmaur	15,600	2,670	18,270	2,520	20,790	2,250	23,040	7,440
Solan	6,680	940	7,620	640	8,260	320	8,580	1,900
Una	5,170	620	5,790	540	6,330	510	6,840	1,670
State	197,450	22,500	219,950	20,000	239,950	17,500	257,450	60,000

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

(2) Temperate Fruit Crops

The above district-wise predicted fruit expansion areas are broken down in terms of temperate fruit crops as shown in Table CA-4.2.3.

Table CA-4.2.3 District-wise Preliminarily-Predicted Area Expansion Plan of Temperate Fruits

Unit: ha

District	Total Area in 2006/07	Increase in 11th Plan	Total Area in 2011/12	Increase in 12th Plan	Total Area in 2011/12	Increase in 13th Plan	Total Area in 2011/12	Total Area Expansion
Bilaspur	850	40	890	40	930	30	960	110
Chamba	12,400	2,320	14,720	1,910	16,630	1,580	18,210	5,810
Hamirpur	460	120	580	60	640	30	670	210
Kangra	1,690	150	1,840	90	1,930	60	1,990	300
Kinnaur	8,870	1,560	10,430	1,610	12,040	1,630	13,670	4,800
Kullu	24,950	830	25,780	600	26,380	330	26,710	1,760
Lahau-Spiti	720	280	1,000	190	1,190	130	1,320	600
Mandi	20,820	1,580	22,400	1,060	23,460	600	24,060	3,240
Shimla	34,100	3,070	37,170	3,080	40,250	2,960	43,210	9,110
Sirmaur	9,060	2,160	11,220	2,120	13,340	2,060	15,400	6,340
Solan	3,170	310	3,480	200	3,680	90	3,770	600
Una	1,050	80	1,130	40	1,170	0	1,170	120
State	118,140	12,500	130,640	11,000	141,640	9,500	151,140	33,000

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

(3) Sub-tropical Fruit Crops

The district-wise area expansion plan has been preliminarily calculated and is given below. In Mandi district, the existing sub-tropical fruit crop areas are proposed to be converted to temperate fruit crop areas because of lower crop suitability from the agro-climatic viewpoints.

Table CA-4.2.4 District-wise Preliminarily-Predicted Area Expansion Plan of Sub-tropical Fruits

Unit: ha

District	Total Area in 2006/07	Increase in 11th Plan	Total Area in 2011/12	Increase in 12th Plan	Total Area in 2011/12	Increase in 13th Plan	Total Area in 2011/12	Total Area Expansion
Bilaspur	5,340	530	5,870	720	6,590	860	7,450	2,110
Chamba	1,240	200	1,440	170	1,610	110	1,720	480
Hamirpur	4,520	1,460	5,980	1,640	7,620	1,710	9,330	4,810
Kangra	34,640	2,940	37,580	3,410	40,990	3,460	44,450	9,810
Kinnaur	0	0	0	0	0	0	0	0
Kullu	240	120	360	80	440	50	490	250
Lahau-Spiti	0	0	0	0	0	0	0	0
Mandi	8,890	-2,260	6,630	-2,000	4,630	-1,740	2,890	-6,000
Shimla	920	360	1,280	250	1,530	140	1,670	750
Sirmaur	4,950	450	5,400	360	5,760	170	5,930	980
Solan	3,200	610	3,810	430	4,240	230	4,470	1,270
Una	3,990	530	4,520	500	5,020	510	5,530	1,540
State	67,930	4,940	72,870	5,560	78,430	5,500	83,930	16,000

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

(4) Nuts and Dry Fruit Crops

The district-wise predicted fruit expansion areas given in Table CA-4.2.2 are broken down concerning nuts and dry fruit crops as shown below:

Table CA-4.2.5 District-wise Preliminarily-Predicted Area Expansion Plan of Nuts and Dry Fruit Crops
Unit: ha

District	Total Area in 2006/07	Increase in 11th Plan	Total Area in 2011/12	Increase in 12th Plan	Total Area in 2011/12	Increase in 13th Plan	Total Area in 2011/12	Total Area Expansion
Bilaspur	90	10	100	10	110	10	120	30
Chamba	1,670	210	1,880	160	2,040	100	2,140	470
Hamirpur	290	40	330	30	360	10	370	80
Kangra	810	40	850	40	890	30	920	110
Kinnaur	1,230	20	1,250	10	1,260	0	1,260	30
Kullu	510	30	540	20	560	20	580	70
Lahau-Spiti	10	0	10	0	0	0	10	0
Mandi	2,870	4,590	7,460	3,100	10,560	2,300	12,860	9,990
Shimla	1,870	30	1,900	20	1,920	10	1,930	60
Sirmaur	1,590	60	1,650	40	1,690	20	1,710	120
Solan	310	20	330	10	340	0	340	30
Una	130	10	140	0	140	0	140	10
State	11,380	5,060	16,440	3,440	19,880	2,500	22,380	11,000

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

CA-4.2.2 Fruit Crop Re-planting

Considering the fruit replanting area target of 10,000 ha for the Eleventh Five Year Plan period and the long term target of 12,500 ha for the Twelfth Five Year Plan period both of which is set up by the DOH, it is assumed that another 2,500 ha will be added for the Thirteenth Five Year Plan period. Paying a special attention to the replanting concept, fruit-wise targets for every Five Year Plan are to be set up as shown below:

Table CA-4.2.6 Preliminarily-Predicted Re-planting Plan of Fruits in Himachal Pradesh

Unit: ha

Fruit Crop	Existing Fruit Crop Areas as of '06/07	Predicted Re-planting Area			
		11th Plan	12th Plan	13th Plan	Total
Apple	87,810	6,000	8,500	11,000	25,500
Other temperate fruits	30,330	500	500	500	1,500
Nuts & dry fruits	11,380	200	200	200	600
Mango	38,370	600	600	600	1,800
Citrus fruits	21,130	2,500	2,500	2,500	7,500
Other sub-tropical fruits	8,430	200	200	200	600
Total	197,450	10,000	12,500	15,000	37,500

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

As shown in Table CA-4.2.7, district-wise targets of fruit crop re-planting areas for every Five Year Plan period are predicted in due consideration of the current fruit crop planting area conditions.

Table CA-4.2.7 District-wise Preliminarily-Predicted Re-planting Plan of Fruits in Himachal Pradesh

Unit: ha

District	Temperate Fruit Crops			Sub-tropical Fruit Crops			Nuts and Dry Fruit Crops		
	11th Plan	12th Plan	13th Plan	11th Plan	12th Plan	13th Plan	11th Plan	12th Plan	13th Plan
Bilaspur	0	0	0	150	150	100	0	0	0
Chamba	200	300	400	50	50	50	50	50	50
Hamirpur	0	0	0	150	200	250	0	0	0
Kangra	0	0	0	2,350	2,350	2,350	0	0	0
Kinnaur	600	900	1,200	0	0	0	0	0	0
Kullu	2,200	2,900	3,600	0	0	0	0	0	0
Lahau-Spiti	100	150	200	0	0	0	0	0	0
Mandi	200	300	400	0	0	0	50	50	50
Shimla	2,600	3,700	4,800	0	0	0	50	50	50
Sirmaur	500	650	800	250	200	200	50	50	50
Solan	100	100	100	150	150	100	0	0	0
Una	0	0	0	200	200	250	0	0	0
State	6,500	9,000	11,500	3,300	3,300	3,300	200	200	200

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

CA-4.2.3 Future Fruit Production

The assumption to set up the fruit production target for the Eleventh Five Year Plan period is based on the annual production increasing rate of 5% as the highest achievement of production during the Tenth Five Year Plan period. However, the average annual production increasing rate is assumed to reduce to about 2% for the Twelfth Five Year Plan period and approximately 3% for the Thirteenth Five Year Plan period considering the following points;

- Fruit crops newly planted in the both expansion and re-planted areas will take three to seven years until the first harvesting according to the botanical features of species;
- From the first harvesting, every fruit crop will take another three to five years to reach the highest potential yield level;
- The productivity of young fruit trees will increase year by year, while currently matured fruit trees will decrease with the years; and
- Damages caused by climatic risks especially for hail storms will remain to a certain extent.

The future fruit production at the respective end years of Twelfth and Thirteen Five Year Plan periods is estimated by referring to the above points. The results are summarized in a major crop-wise manner as shown below:

Table CA-4.2.8 Preliminarily-Predicted Fruit Production in the State

Unit: ton

Crops	Production in '05/06	Increase in 11th plan	Production in '11/12	Increase in 12th plan	Production in '16/17	Increase in 13th plan	Production in '21/22
Apple	540,400	148,600	689,000	54,000	743,000	81,000	824,000
Other temperate fruits	48,300	32,300	80,600	4,400	85,000	7,000	92,000
Nuts & dry fruits	3,900	800	4,700	300	5,000	600	5,600
Mango	63,100	15,500	78,600	6,400	85,000	9,400	94,400
Citrus fruits	29,100	8,100	37,200	2,800	40,000	4,400	44,400
Other sub-tropical fruits	10,700	5,200	15,900	1,100	17,000	1,600	17,600
Total	695,520	219,950	906,000	69,000	975,000	104,000	1,075,000

Source: Prepared by JICA Study Team based on data of Department of Horticulture, Himachal Pradesh State Government

CA-4.2.4 Fruit Crop Development Supporting Programs

Although various supporting services to farmers growing fruits have been provided under the Horticulture Technology Mission, the priority should be put over the following programs listed up in Table CA-4.2.9 in order to secure smooth implementation of fruit crop area expansion and replanting plans.

Table CA-4.2.9 Fruit Crop Development Supporting Programs

Program	Components
Support to inventory survey for area expansion	<ul style="list-style-type: none"> • Diagnosis of topographic condition and soil fertility • Checking of water resource availability
Support to replanting of old and senile fruit trees	<ul style="list-style-type: none"> • Diagnosis of fruit tree conditions • Arrangement of virus free seedlings
Support to formation of fruit growers' group and specific fruit crop growing clusters	<ul style="list-style-type: none"> • Arising of farmers' awareness on group farming • Integration of specific fruit crop growing clusters
Improvement of accessibility for diversified crops	<ul style="list-style-type: none"> • Construction of access farm roads connecting to existing public roads
Quality improvement of fruits	<ul style="list-style-type: none"> • Creation of grading/packing standard • Farmers awareness camp on quality improvement • Construction of common use facilities for sorting, grading and packing
Value addition to nonstandard fruits	<ul style="list-style-type: none"> • Agro-processing material supply for utilizing nonstandard fruits
Institutional strengthening	<ul style="list-style-type: none"> • Organization of fruit crop growers • Introduction of dual market information system • Promotion of reasonable profit sharing system among stakeholders • Promotion of need based research and development works coupled with transfer of results to fruit grower groups

Prepared by JICA Study Team

CA-4.3 Recommended Action for Fruit Crop Development

Among the development plans on the promotion of fruit crop development in Himachal Pradesh, principal requirements are fruit crop area expansion, re-planting of old and senile fruit trees, facilitation of farm roads, improvement of post-harvest activities, and value addition through processing of nonstandard fruits all of which are taken up in the Master Plan. Proposed activities for meeting these principal requirements are listed up in Table CA-4.3.1.

Table CA-4.3.1 Proposed Activities for Fruit Crop Development in Himachal Pradesh

Items	Actions
Fruit Area Expansion	<ul style="list-style-type: none"> • Inventory survey of potential expansion areas focusing on confirmation of soil fertility, topography and available water resources upon requests from farmers and Panchayat • Selection of fruit crops suitable for agro-climatic conditions • Organizing specific fruit crop growing group and integration of the groups
Fruit Re-planting	<ul style="list-style-type: none"> • Inventory survey of existing orchards focusing on diagnosis of old & senile and ill-affected fruit trees upon requests from farmers and Panchayat • Selection of varieties from the agro-climatic and market viewpoints • Multiplication and distribution of virus-free seedlings of fruit crops
Improvement of Access Farm Road	<ul style="list-style-type: none"> • Selection of a farm road alignment route followed by detailed design works upon requests from farmers • Construction/improvement of farm roads
Post-harvest Improvement	<ul style="list-style-type: none"> • Preparation of grading/packing standard • Construction of sorting, grading and packing facilities • Holding of farmers awareness camp on fruit quality improvement • Training of farmers in terms of operation and maintenance of grading and packing facilities
Value Addition	<ul style="list-style-type: none"> • Establishment of a tie-up with an agro-processing factory • Establishment of collection and distribution systems of nonstandard fruits
Institutional Strengthening	<ul style="list-style-type: none"> • Participatory formation of fruit growers group • Design and establishment of dual market information system • Creation of common understanding on reasonable profit sharing system among stakeholders • Preparation of a need based research and development scenario including a plan for transfer of technology to farmers

Prepared by JICA Study Team

ANNEX-CB
Animal Husbandry
in Agriculture Allied Sectors

**THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME
IN THE STATE OF HIMACHAL PRADESH**

FINAL REPORT

**ANNEX-CB
ANIMAL HUSBANDRY
IN AGRICULTURE-ALLIED SECTORS**

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ANNEX-CB

ANIMAL HUSBANDRY IN AGRICULTURE-ALLIED SECTORS

CB-1 Background of Animal Husbandry Sector

CB-1.1 National Background of Livestock Activities

In India, during 2003 to 2004, this sector contributed 27.3% of the agricultural GDP and 5.4% of the national GDP. According to the livestock census of 2003, India had 485 million livestock population and 489 million poultry population. Livestock sector plays a significant role in the Indian farmer's economy, particularly for the welfare of rural population of the country. Of 123 million households in total of the rural area, about 73% of farm households own some form of livestock. More importantly, small and marginal farmers account for three quarters of these households. The focus of the poor is on small animals, as the returns are quick, while losses if any are recovered soon and the poor can afford it.

This sector plays an important and vital role in providing nutritive food, rich in animal protein to the general public and in supplementing family incomes and generating gainful employment in the rural sector, particularly among the landless, small, marginal farmers and women. Income from livestock production accounts for significant proportion of total farm household's income in different states. Thus, an increase in demand for livestock products can be a major factor in raising the income and living standards of the rural household.

In India, the livestock production and agriculture are intrinsically linked, each one being dependent on the other and both crucial for the overall food security of the people. A significant output from small and backyard dairy farming is the production of dung, which is important organic manure. On an average, 800 million tones of manure are produced. Of this, some 300 million tones are burnt as fuel and the balanced used as manure.

India is rich in agro-ecological diversity, and concurrently one finds a range of unique livestock production systems which have evolved in each region in tune with the naturally available resources and needs of the people. This diversity begins with the choice of species which are reared, breeds that have evolved management and feeding practices, healthcare systems which are closely linked to the natural flora and fauna, and local marketing systems. Under mixed crop-livestock farming system which is found across rain fed agriculture zones. Farmers derive their livelihood somewhat equally from agriculture and livestock. It can be considered that development of small holders' mixed crop-livestock production is one of the most effective methods of poverty alleviation.

In the past, growth in livestock production was largely number-driven. This may not sustain in the long run and may stress the resources. The future growth should come from improvements in productivity. This will require overcoming of feed and fodder scarcity as well as improvements in delivery of animal health and breeding services. Technology will be a key driver of growth and concerted efforts will be needed to generate and disseminate yield-enhancing and yield-saving technologies.

During the Tenth Five Year Plan period, 22 schemes including four new ones of the animal husbandry sector was implemented. Major achievements are as follows:

- i) Milk production: Several measures initiated by the Union Ministry to increase the productivity of livestock have resulted in increased milk production to 100.9 million tons;
- ii) Egg production: The total quantity attained to around 51 billion eggs; and
- iii) Wool production: The production was estimated at amount 45.1 million kg.

For the Eleventh Five Year Plan, the Union Ministry sets up the following strategies:

- a. There is a need for institutional restructuring of the existing development machinery, both at the national and state levels;
- b. A sustainable and financially viable livestock farming, which will generate wealth and self-employment through entrepreneurship, is the need of the day;
- c. The successful examples of public-private partnership initiative should be replicated and expanded during the Eleventh Five Year Plan period;
- d. Initiatives on the pattern of producers' organizations need to be taken up in other livestock products, especially meat and poultry;
- e. There is a need to provide efficient and effective decentralized services at the doorstep of livestock farmers;
- f. A mechanism for transfer of technological development to the producers' should be instituted; and
- g. There is a need to build a line of credit to meet the requirement of livestock sector.

In line with the above strategies, the schemes of the Tenth Five Year Plan are continuously implemented with some modifications and addition of new components during the Eleventh Five Year Plan period. The total budget requirements for the animal husbandry sector under the Eleventh Five Year Plan have been estimated at Rs. 377.7 billion, including Rs. 80.0 billion for dairy development schemes and Rs. 12.75 billion for feed and fodder development schemes.

CB-1.2 State Government Policies and Programs for Animal Husbandry Sector

(1) Policy of Department of Animal Husbandry (DOAH)

The followings are 10 most important output objectives of the DOAH:

- a. Breeding policy is to increase exotic cattle inheritance rate from 40% to 50% by means of cross breeding, to increase population of upgraded buffaloes from 25% to 75%, and to increase population of crossbred sheep from 18% to 75%;
- b. Access to supporting services of artificial insemination in cows and buffaloes is to be improved through the intensification of service network;
- c. Castration services are to be provided through the above network;
- d. Vaccination against contagious diseases is to be provided in the form of free of charge;
- e. Services for drenching and dipping of sheep are to be provided by all veterinary institutions;
- f. Strengthening of fodder plants, roots and seed distribution services are to be accelerated;
- g. Backyard poultry farming is to be promoted in remote areas;
- h. Organization of infertility camps is to be upgraded;
- i. Distribution of rams is to be strengthened; and
- j. Increase in livestock productivity is to be realized through implementation of various

projects and schemes.

To attain these output objectives, the DOAH is running the following schemes to support farmers rearing livestock:

- a. National Project on Cattle and Buffalo Breeding is a centrally sponsored scheme with an objective to cover 100% of breed-able cows and buffaloes using artificial insemination technique. The project facilitates strengthening of semen banks for the purpose of storing, transporting and distributing to different sites coupled with strengthening of training facilities to impart effective capacity building of staff and farmers;
- b. Assistance to State for Control of Animal Diseases Project has the central assistance to cover 75% of project cost and the state budget allocation to share the remaining 25%, providing services of free vaccination to all livestock against contagious diseases;
- c. Backyard Poultry Development Scheme has 80%-financial assistance from the central and 20%-share by the state budget. Under this scheme improved varieties of chicks are supplied to farmers in a subsidiary manner. The department arranges free transport to the nearest point;
- d. Conservation of Threatened Breeds of Livestock is fully sponsored scheme by the central, aiming to conserve threatened breeds of sheep, goats, pigs, Yaks and pony;
- e. Grass Land Development including Grass Reserves scheme is another centrally full-sponsored scheme with the objective of increasing fodder production in common and individual lands at village level;
- f. Milk Livestock Insurance Scheme started in Mandi and Kangra districts with an objective to prevent production losses to farmers from high yielding cows and buffaloes in the event of deaths due to diseases. The insurance premium is 10% of the value of the cow/buffalo. The farmer pays 50% of the premium amount and the government as subsidy pays the other 50%;
- g. Dairy Development Scheme is to provide farmers with service menus through MILKFED;
- h. Integrated Wool Development Program is fully sponsored by the central focusing on breed improvement, health care, product development, training and market assistance including setting up of multipurpose extension centres in the north zone; and
- i. Integrated Wool Improvement Development Program is also fully sponsored by the central with the same objectives in the above and targeting the south zone.

(2) Budget

Budget allocation of the DOAH for 2006/07 is summarized below:

Table CB-1.2.1 Budget of DOAH for 2006/07

	Plan	Non-plan	Total
Direction & Administration	540	35,112	35,652
Veterinary Services & Animal Health	53,545	436,595	490,140
Cattle & Buffalo Development	3,531	27,046	30,577
Poultry Development	2,236	11,319	13,555
Sheep & Wool Development	2,450	13,999	16,449
Other Livestock Development	2,920	1,035	3,955
Fodder & Feed Development	1,101	1,600	2,701
Extension & Training	1,000	0	1,000
Administrative Investigation & Statistics	4,191	802	4,993
Dairy Development	8,301	22,095	30,396
Agriculture Research & Education (Animal Health)	66,384	0	66,384
Capital Outlay on Artificial Insemination	23,115	0	23,115
Public Works	0	1,000	1,000
Housing	0	600	600
Sub-total	169,314	551,203	720,517
Tribal Area Sub-plan	34,544	54,682	89,226
Agriculture Research & Education	1,600	0	1,600
Capital Outlay	8,540	0	8,540
Sub-total	44,684	54,682	99,366
Total	213,998	605,885	819,883

Source: Department of Animal Husbandry, Himachal Pradesh State Government

CB-2 Animal Husbandry in Himachal Pradesh

CB-2.1 Background of Livestock Activities in Himachal Pradesh

CB-2.1.1 Livestock Population

Livestock are an integral part of the livelihood opportunities of people of Himachal Pradesh. In the State, 92% of the households hold one or plural species of livestock and poultry. Crop production and livestock production go hand in hand as mixed crop-livestock production system in most parts of the State. Bovines, goats and sheep are the major income generating species of stocks reared by the farmers.

Cattle, goats, sheep and buffaloes are the principal livestock contributing to livelihoods opportunity for farmers of Himachal Pradesh. According to the 2003 livestock population census, the total livestock population in the State was 5.05 million, comprising 45% for cattle, 22% for goats, 18% for sheep and 15% for buffaloes. In addition to these major animals, there were 23,938 mules, 17,144 horses/ponies, 8,859 donkeys, 4,395 rabbits and 1,590 yaks.

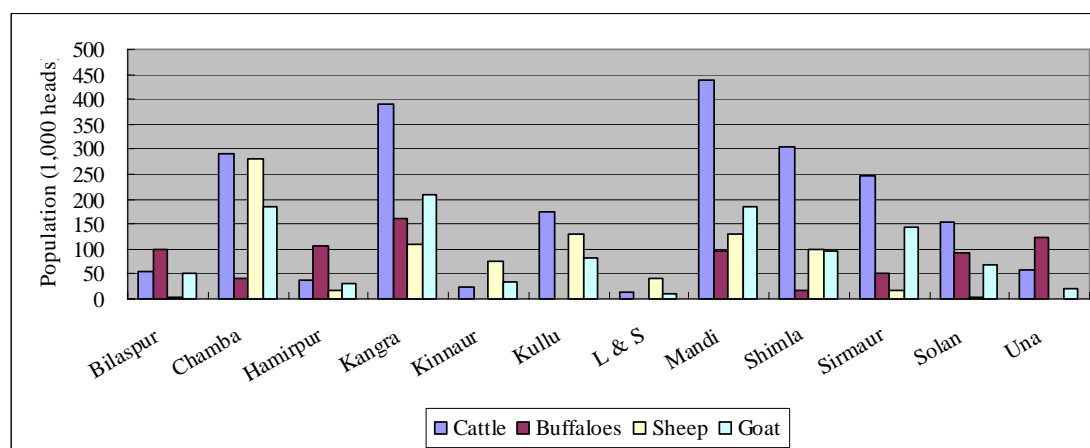
District-wise livestock population in the State as of 2003 is presented in Table CB-2.1.1 and Fig. CB-2.1.1.

Table CB-2.1.1 District-wise Livestock Population

District	Total Major Livestock*	Cattle		Buffaloes	Sheep		Goats	Poultry
		Total	Crossbred		Total	Crossbred		
Bilaspur	207,450	53,940	21,100	97,660	3,030	840	52,820	106,500
Chamba	798,150	290,830	27,990	41,330	281,370	26,570	184,620	48,160
Hamirpur	190,840	39,040	20,600	104,510	17,650	3,880	29,640	40,550
Kangra	872,480	392,240	153,020	161,670	108,330	23,330	210,240	263,070
Kinnaur	132,070	23,130	9,340	10	74,390	26,290	34,540	5,230
Kullu	387,660	174,950	63,660	300	129,560	15,530	82,850	15,690
Lahaul-Spiti	65,320	13,300	7,160	0	41,450	4,460	10,570	560
Mandi	850,160	440,490	136,190	95,680	129,830	7,790	184,160	59,360
Shimla	515,960	304,580	100,780	16,290	98,380	21,910	96,710	27,710
Sirmaur	462,110	248,050	38,640	52,840	17,770	1,820	143,450	20,410
Solan	317,170	154,570	47,120	90,800	4,310	1,320	67,490	79,820
Una	203,780	57,440	25,150	124,550	160	40	21,630	96,760
State	5,046,044	2,192,560	650,700	785,640	906,230	133,780	1,118,720	763,820

Note: *: Sum of cattle, buffaloes, sheep and goat

Source: Livestock Population Census 2003, Department of Animal Husbandry, Himachal Pradesh State Government



Source: Livestock Population Census 2003, Department of Animal Husbandry, Himachal Pradesh State Government

Fig. CB-2.1.1 District-wise Major Livestock Population in Himachal Pradesh

During the two livestock population census period between 1992 and 2003, the increasing rate was 59% for crossbred bulls and 163% for crossbred cows, while the rate was 20% for indigenous bulls and 15% for indigenous cows. This trend infers the farmers preference for crossbred cows over indigenous ones for obvious reasons of better milk producing abilities and shorter inter calving periods. Although the total population of sheep reduced by 16% during the same period, crossbred male sheep population increased by 53 % and female population by 103%. The goat population was stagnant for this period, while the poultry population rose by 6%.

CB-2.1.2 Livestock Production

The Integrated Sample Survey 2005/06 done by the Department of Animal Husbandry reveals that milk and wool production in Himachal Pradesh was stable at around 869,000 tons and 1,600 tons, respectively, in 2004/05 and 2005/06, while egg production reduced from around 81 million eggs in 2004/05 to 70 million eggs in 2005/06.

Goats, sheep and pigs are the meat-producing animals in the State and the cheviot is the most preferred meat. Next is poultry. Meat is produced through organized and unorganized slaughterhouses. Meat is also produced from household slaughters during festivals and rituals. In Himachal Pradesh, 2,394-ton meats were produced in 2005/06.

District-wise production of milk, egg and wool in 2004/05 and 2005/06 is summarized in Table CB-2.1.2.

Table CB-2.1.2 District-wise Milk, Egg and Wool Production

District	Milk ('000 tons)			Egg (Lakh)			Wool (ton)		
	2004/05	2005/06	Trend (%)	2004/05	2005/06	Trend (%)	2004/05	2005/06	Trend (%)
Bilaspur	53.18	41.11	-11.42	113.73	116.05	2.04	4.34	7.85	81.11
Chamba	64.78	70.12	8.39	102.35	67.41	-34.14	496.29	467.54	-5.79
Hamirpur	64.21	57.31	-10.75	14.82	11.56	-21.99	34.32	48.65	41.73
Kangra	155.33	178.71	15.05	148.41	172.99	16.56	212.76	215.10	1.10
Kinnaur	8.08	10.65	9.52	6.09	6.97	14.37	121.75	125.62	3.18
Kullu	46.81	51.27	9.52	22.46	20.29	-9.67	231.98	230.04	-0.83
Lahaul-Spiti	8.31	7.17	-13.70	1.64	1.48	-9.68	58.32	65.49	12.29
Mandi	146.69	127.93	-12.79	61.99	55.64	-10.24	245.30	237.55	-3.16
Shimla	95.91	94.57	-1.39	83.02	61.30	-26.16	156.27	162.96	4.28
Sirmaur	81.66	68.81	-14.51	26.52	24.51	-7.59	29.70	32.67	10.03
Solan	80.61	89.70	11.27	108.42	91.60	-15.51	6.07	7.16	18.10
Una	63.95	64.57	0.98	121.92	122.88	0.79	0.22	0.41	90.70
State	869.51	869.01	-0.06	811.35	752.67	-7.23	1597.32	1601.04	0.23

Source: Integrated Sample Survey 2005/06, Department of Animal Husbandry, Himachal Pradesh State Government

CB-2.1.3 Livestock Feeding and Management Practices

(1) Feeding Practices

The State is featured by the existence of small land holdings as the majority and tough competition between human food crops and animal-feeding resources. At the same time crops and livestock have symbiotic relationships such as animals producing biomass in the form of manure useful for maintenance of soil fertility vis-à-vis crops producing straws and bulks useful for livestock feeding as roughages. Such roughage yields from the cereal crops and crop residues from pulses are not enough for meeting livestock feeding requirements throughout the year so that farmers buy wheat straws from outside of Himachal Pradesh such as Punjab and Haryana.

In addition to crop residues, livestock in general and sheep and goats in particular largely depend on natural pastures from grasslands. Normally the grasses are harvested after October and conserved as hay for livestock feeding during winter. Subsequently the livestock are allowed to graze by June till the start of next monsoon. Then the grasslands are closed for grazing aiming to make vegetative growth of grasses sure during the monsoon season.

(2) Migratory Grazers

In Himachal Pradesh, there are two tribes, *Gaddi* and *Gujjar*, rearing sheep and goats as pastoral livestock production system. The former is prevalent in Kullu district, while the latter is seen in larger numbers in Chamba district. Every pastoral family is allotted a distinct pastureland along a certain approved migratory route and the migratory permit is issued by the State Department of Forest. Pastorals migrate with flocks to the pasturelands from late April and early May and return to their homes between mid October and Mid November.

CB-2.1.4 Market Channel

(1) Milk

According to the Integrated Sample Survey 2005/06 done by the DOAF, buffalo milk is converted to different milk products like *Khoya*, butter and ghee. Milk is sold directly to consumers, sweets makers and milk vendors in addition to home consumption and such conversion to milk products as shown below:

Table CB-2.1.3 Season-wise Utilization of Milk in Himachal Pradesh

Unit: %

Season	Cow Milk			Buffalo Milk		
	Direct Selling	Home Consumption	Conversion to Milk Products	Direct Selling	Home Consumption	Conversion to Milk Products
Summer	40.0	35.2	24.8	38.6	40.3	21.1
Rainy	44.5	25.6	29.9	43.8	39.9	16.3
Winter	35.6	40.1	24.3	29.7	34.7	35.6
Annual	40.0	33.7	26.3	36.4	38.3	34.3

Source: Integrated Sample Survey 2005/06, Directorate of Animal Husbandry, Himachal Pradesh State Government

Since 1967, the Department of Animal Husbandry had run its milk supply scheme functioning as a milk-marketing avenue to support milk producers distributed in remote places in the State. In 1980, the Department established the Himachal Pradesh Milk Federation (MILKFED), and has gradually transferred operation of the milk supply scheme to MILKFED after commencement of its operation in October 1983. The functions of MILKFED are as follows:

- a. To organize milk producers' cooperatives;
- b. To provide remunerative market to the milk producers for their surplus milk;
- c. To ensure availability of milk and milk products at reasonable prices to the urban consumers;
- d. To encourage use of balanced ration, green fodders and scientific management practices;
- e. To encourage women participation in dairy development; and
- f. To improve overall efficiency through manpower development.

As of April 2007, the MILKFED has organized 525 milk cooperative societies with 25,325 members. The MILKFED procures 28,000 lit/day on an average from these members and provides the following services to them:

- a. Employment opportunities for 1,000 rural people in its processing units;
- b. Facilities for supply of concentrated feed;
- c. Processing of milk to value added products like ghee, cottage cheese, curd, clean milk and flavoured milk and;
- d. Extension and training to milk producers as well as capacity building and skill upgrading of staff working in its processing units.

In view of the distances and topographic conditions, the MILKFED has established a network of the both chilling and processing centres as shown in Table CB-2.1.4, even though the current network covers thinly the State. The total capacity installed is 55,000 lit/day each for 21 chilling centres and four processing centres.

Table CB-2.1.4 List of Chilling and Processing Centres of MILKFED

District	Chilling Centre		Processing Centre	
	Location	Capacity (lit/day)	Location	Capacity (lit/day)
Bilaspur	Bilaspur	2,000	-	-
Chamba	-	-	Chamba & Rohru	500
Hamirpur	Jalari	2,000	-	-
Kangra	Bindraban	500	Kangra	20,000
	Darkana	2,000	-	-
	Milwan	2,000	-	-
	Rajakatalab	500	-	-
Kullu	Mohal	2,000	-	-
Mandi	Kahtula	2,000	Mandi	10,000
	Kotli	2,000	-	-
	Kunnu	2,000	-	-
	Sidhyani	2,000	-	-
Shimla	Kepu	9,000	Shimla	20,000
Sirmaur	Bagthan	5,000	-	-
	Maryog	2,000	-	-
	Nahan	5,000	-	-
	Nohradhar	1,000	-	-
	Raghar	2,000	-	-
	Renuka	2,000	-	-
	Sarhan	4,000	-	-
	Una	Bangana	2,000	-
	Jhalera	4,000	-	-

Source: MILKFED Himachal Pradesh

According to MILKFED, the annual procurement and sales volumes are as follows:

- a. 2003/04: Procurement; 9.3 million litter & Sales; 5.7 million litter ;
- b. 2004/05: Procurement; 10.2 million litter & Sales; 5.7 million litter ;
- c. 2005/06: Procurement; 9.2 million litter & Sales; 5.0 million litter; and
- d. 2006/07 (half year): Procurement; 8.9 million litter & Sales; 5.8 million litter

(2) Meat, Egg and Chicken

There is no organized meat marketing system in the state. Therefore, common practice in producing goat meat is handled by butchers who buy goats from farmers and slaughter them for meat. All of organized slaughterhouses are established in the notified areas of blocks. In these slaughterhouses, the butchers take their sheep and goats, and then the local veterinary doctors examine the animals before slaughtering them. The doctor has to inspect the carcasses and certify them being fit for human consumptions. Goats are also slaughtered during festivals and domestic functions/rituals. No information concerning import of meat from the outside of the State is available.

Chicken is normally processed and sold in urban chicken centres according to local demands. During the tourism season, live fowls and eggs are imported from Punjab to tourist towns like Shimla, Mandi, Kullu and Manali.

(3) Wool

In the public sector, Himachal Pradesh State Cooperative Wool Procurement and Marketing Federation Limited (WOOLFED) is the nodal agency to facilitate clipping and procurement of wool from the sheep farmers. This WOOLFED gets the financial assistance from National Wool Board. In the State, Chamba, Kangra, Kinnaur, Kullu, Mandi and Shimla districts are the top six wool-producing areas, and the annual wool production of these areas is around 1,400 tons. About 60% of the wool produced

is locally used by the producers for their own use and private fabrics. The remaining 40% as marketable surplus is procured by the WOOLFED mostly from migratory sheep breeders. Then the WOOLFED processes the procured wool and markets its wool products.

Wool is clipped three times a year. These clipping times are autumn clip season from September to October as the best wool quality season, winter clip season from January to February and summer clip season from May to June. Table CB-2.1.5 shows the annual wool procurement records of the WOOLFED.

Table CB-2.1.5 Annual Wool Procurement Records of WOOLFED

Fiscal Year	Sheep Wool					Angora Wool			
	Procured Vol. (kg)	Procurement Rate (Rs./kg)			Procured Val. (Rs.)	Procured Vol. (kg)	Procur. Rate (Rs./kg)		Procured Val. (Rs.)
		Autumn	Winter	Summer			Grade A	Grade B	
2003/04	37,140	46.0	23.0	30.0	1,078,545	462	425-510	350-420	191,633
2004/05	80,959	46.0	23.0	30.0	2,742,089	175	510-600	425-500	92,772
2005/06	90,190	50.0	25.5	35.0	3,117,521	220	600	500	129,945
2006/07*	103,159	50.0	25.5	35.0	3,920,480	162	-	-	96,015

Note: The record for 2006/07 covers the period from January 1 to March 20.

Source: Himachal Pradesh State Cooperative Wool Procurement and Marketing Federation Limited

CB-2.2 Livestock Administration

(1) Department of Animal Husbandry

The DOAH of the State Government is fully responsible for undertaking the following activities:

- a. Veterinary services and animal health care aiming at (i) treatment of ailing animals in its institution and at the door step of farmers, (ii) prophylactic vaccination of the animals against contagious disease, (iii) dipping and drenching of animals against parasites, (iv) investigation and diagnosis in the event of any outbreak of disease; and (v) disease surveillance work;
- b. Cattle and buffalo development to ensure the benefit of higher milk production potential of exotic breeds as well as disease resistance and hardiness traits to farmers through adoption of artificial insemination technology;
- c. Sheep and wool development to help in the practical approach in the hybridization of the local sheep through cross breeding;
- d. Angora rabbit breeding program aiming to provide unemployed youths with training opportunities on rabbit rearing and necessary infrastructure installation supports;
- e. Poultry development focusing on enhancement day to day income sources of the poor farmers and the scheduled casts by means of egg and broiler development;
- f. Horse breeding program to preserve specific breeds of the horse suitable for transportation in remote and hard areas of mountainous regions in the State;
- g. Feed and fodder development to secure availability of sufficient quantity of fodder crops by supplying certified seeds of cultivable fodder crops as well as improved fodder grass roots and plants to farmers ;
- h. Dairy development to provide farmers with minimum support price through MILKFED;
- i. Extension activities consisting of village level sexual health camps as well as information services through Radio School and Live Phone-in programs; and
- j. Other activities including animal husbandry component of Mid-Himalayan Development

Project and dairy enterprise promotion under District Rural Development Agency.

The Department of Animal Husbandry is led by the Director with headquarters at Shimla. Its organization is presented in Fig. CB-2.2.1. Under the Director, four Joint Directors are appointed to cover the Headquarters, North Zone, South Zone and Statistics. The Joint Director of the Headquarters is responsible for planning, monitoring and evaluating all activities of the Department with assistance of three Deputy Directors. The Joint Director in charge of North Zone manages all field activities with six Deputy Directors each covering one district out of Bilaspur, Kinnaur, Shimla, Sirmaur, Solan and Una, while the other Joint Director in charge of South Zone takes all field activities with six Deputy Directors each covering one district out of Chamba, Hamirpur, Kangra, Kaylong (Lahaul-Spiti), Kullu and Mandi.

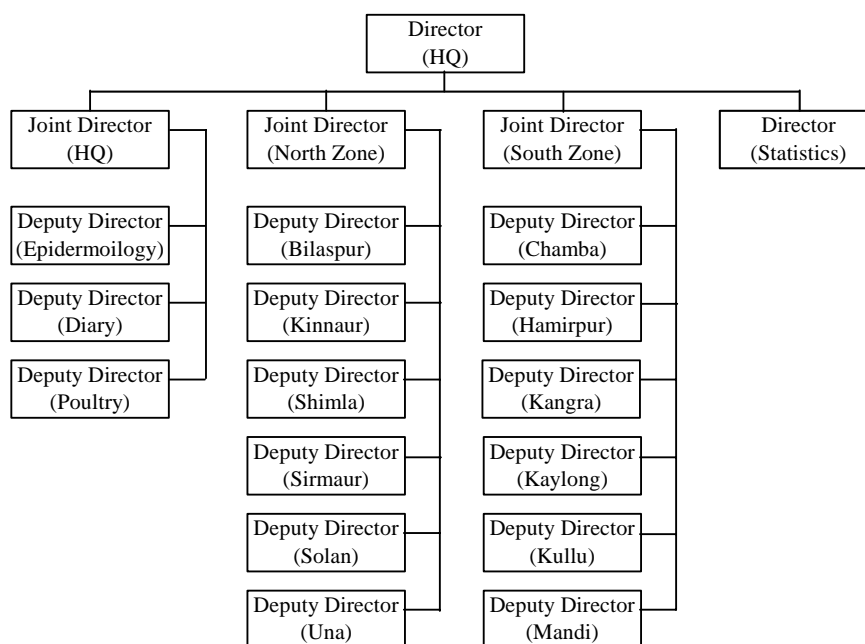


Fig. CB-2.2.1 Organization of Department of Animal Husbandry

(2) Institutional Supporting Services

In the State, the Department of Animal Husbandry has established various institutions to support animal farmers in terms of animal breeding, health, disease control, laboratory, extension and training. At present, there exist seven veterinary polyclinics, 313 veterinary hospitals, 33 central veterinary dispensaries, 1,721 veterinary dispensaries, 14 mobile veterinary dispensaries, four veterinary check posts, two semen banks, three semen processing laboratories, three clinical laboratories, three wool analysis laboratories, two disease investigation laboratories, six cattle breeding farms, five sheep breeding farms, nine sheep and wool extension centres, two rabbit breeding farms, one horse breeding farm, six poultry breeding farms, eight poultry extension centres, four feed and fodder farms, and two training centres throughout the State. Table CB-2.2.1 shows district-wise distribution of major institutions.

Table CB-2.2.1 District-wise Distribution of Major Supporting Institutions

District	Veterinary		Veterinary Dispensary			Breeding Farm			
	Polyclinic	Hospital	Central	Common	Mobile	Cattle	Sheep	Poultry	Feed/Fodder
Bilaspur	-	18	2	94	1	1	-	-	-
Chamba	1	32	1	158	1	-	1	1	-
Hamirpur	-	16	1	113	1	1	-	-	-
Kangra	1	52	7	329	2	1	-	1	-
Kinnaur	-	19	9	37	1	-	1	-	-
Kullu	1	15	1	85	1	-	-	-	-
Lahaul-Spiti	-	13	-	41	1	-	-	-	-
Mandi	1	36	2	261	1	2	1	1	2
Shimla	1	39	5	250	2	-	1	1	1
Sirmaur	1	26	3	121	1	1	-	1	1
Solan	1	21	1	130	1	-	-	-	-
Una	-	16	1	102	1	-	-	1	-

Source: Department of Animal Husbandry, Himachal Pradesh State Government

CB-2.3 Analysis of Current Livestock Situation in Himachal Pradesh

In view of the current livestock situation in the State, it seems that breeding and veterinary services have been improved to a considerable extent which is above the national average of veterinary facility rate against livestock population, but animal nutrition has pressing needs to be upgraded. Taking into account such requirements as well as the symbiotic relationships between crops and animals, therefore, an analysis is made focusing on livestock feeding situation and feed balances in Himachal Pradesh.

(1) Average Intake Quantity of Feed and Fodder by Cattle and Buffalo

According to the Integrated Sample Survey 2005/06 done by the DOAF, the average daily intake quantity of feed and fodder varies season by season as shown below:

Table CB-2.3.1 Average Daily Intake Quantity of Feed and Fodder by Cattle and Buffalo

Season	Type of fodder	Cattle (kg/day/head)				Buffalo (kg/day/head)		
		In milk	Dry/not yet calved	Adult males	Young stock	In milk	Dry/not yet calved	Young stock
Summer	Green fodder	6.70	5.70	7.00	2.10	7.30	6.90	2.00
	Dry fodder	12.00	10.00	13.70	3.00	13.20	8.50	2.40
	Concentrates	1.00	0.50	0.30	0.15	1.00	0.60	0.15
Rainy	Green fodder	17.00	16.00	20.00	5.00	19.00	18.00	5.00
	Dry fodder	4.00	3.50	5.00	3.00	5.00	3.00	2.00
	Concentrates	1.00	0.40	0.20	0.10	1.00	0.45	0.10
Winter	Green fodder	10.00	7.00	9.00	3.00	11.00	7.50	3.50
	Dry fodder	6.50	5.00	9.00	4.00	7.50	6.50	4.00
	Concentrates	1.10	0.55	0.70	0.15	1.00	0.45	0.19

Source: Integrated Sample Survey 2005/06, Directorate of Animal Husbandry, Himachal Pradesh State Government

(2) Demand and Supply Calculation of Fodder

By referring to several previous studies done by institutes concerned including Temperate Ecosystem Regional Station of the Indian Grassland and Fodder Research Institute (IGFRI) at Srinagar in Mandi, the following basis and assumptions are taken up for calculating demand and supply of fodders:

Bases

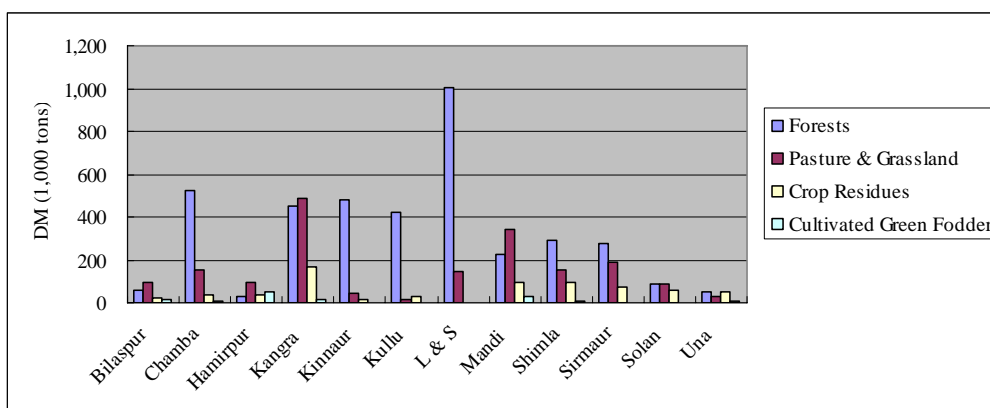
- Dry matter need was calculated based on Livestock Population Census 2003;
- Dry matter availability from forests and other land use patterns was calculated based on data of land use patterns 2005/06 and such formula to predict dry matter availability from 1-ha pasture, grazing land or fallows as dry matter (kg) = 4 x rainfall (mm) – 800. This formula was verified by means of grass cutting survey done by the IGFRI Regional Station;

- c. Dry matter availability from crop production was calculated from cropped area data as of 2005/06 collected from 75 block offices of the Department of Agriculture; and
- d. Rainfall data were obtained from State Meteorological Laboratory in Shimla for using as conversion factors to estimate dry matter yields from land use patterns.

Assumptions

- a. One adult cattle with 350-kg body weight requires daily dry matters equivalent to 2.5% of body weight;
- b. Of the dry matters, 33% comes from green fodder and 67% from dry fodder;
- c. One-third of biomass yields from pasture, grazing land or fallows is formed of green fodder, while two-third is of dry fodder;
- d. Green fodder comprises 25% for dry matter and 75% for moisture; and
- e. Dry fodder consists of dry matter of 90% and moisture of 10%.

The district-wise calculation results of dry matter supply quantity from four different resources such as forest & allied lands, permanent pastures & other grazing lands, crop residues and cultivated green fodders are illustrated below:

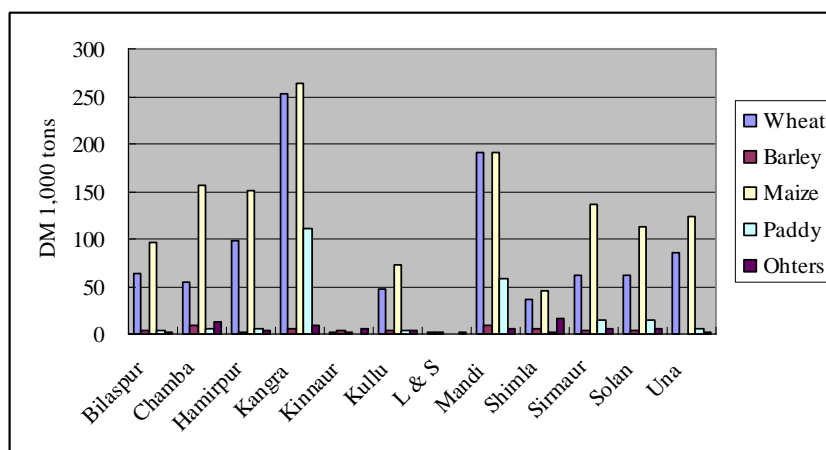


Source: Data collected from Department of Forestry and compiled by JICA Study Team

Fig. CB-2.3.1 District-wise Estimated Quantity of Dry Matters from Different Resources

As seen in the above, the dry matter resource and its supply capacity vary district by district. The availability of dry matter resource from forests is naturally the existence of actual forest or vegetative covers. Permanent pastures and other grazing lands followed by crop residues are also important dry matter supply source in throughout the State, while cultivated green fodder areas have less contribution to increase dry matter supply resources.

In terms of dry matter from crop residues, the district-wise breakdown by major crop as of 2005/06 is calculated as shown below:



Source: Data collected from Department of Agriculture and compiled by JICA Study Team

Fig. CB-2.3.2 District-wise Estimated Quantity of Dry Matters from Crop Residues

Among crops, food grain crop residues are major sources of dry matters at moment corresponding to the current situation of crop cultivation in the respective districts.

The demand for the both green and dry fodders is estimated on the basis of daily intake quantity presented in Table CB-2.3.1 as well as cattle and buffalo population summarized in Table CB-2.1.1, while the green and dry fodder supplies are calculated based on the abovementioned basis and assumptions. The district-wise demand and supply situation is depicted in Fig. CB-2.3.3 for green fodders and Fig. CB-2.3.4 for dry fodders.

It can be said from Figs. CB-2.3.3. and CB-2.3.4 that the current demand and supply positions of the both green and dry fodders in the whole districts of Himachal Pradesh are the main causes of lower level of animal nutrition and milk production as well.

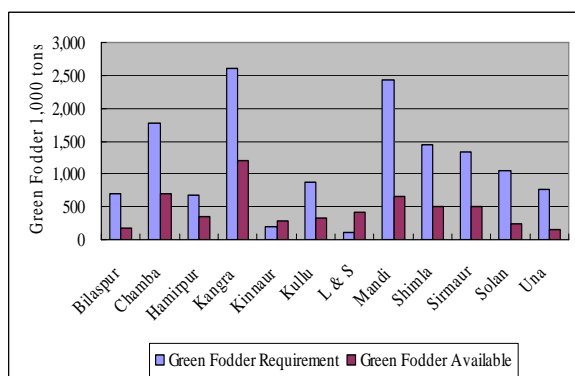


Fig. CB-2.3.3 District-wise Demand and Supply Position of Green Fodders

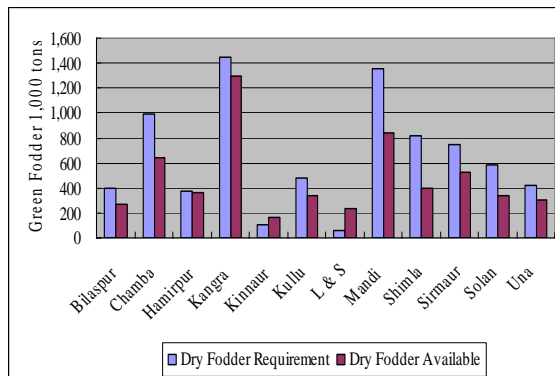


Fig. CB-2.3.4 District-wise Demand and Supply Position of Dry Fodders

Source: Data collected from Department of Agriculture and compiled by JICA Study Team

CB-3 Livestock Development Potential

CB-3.1 Development Potentials

CB-3.1.1 Criteria for Identification of Livestock Product Development Potentials

As discussed in Chapter CB-2, there are three major products of livestock in Himachal Pradesh. These are milk, meat and wool. In the State, however, livestock feeding material production is the prerequisite for supporting the increase in livestock production. In fact, specific features of agro-climate and geography particular to Himachal Pradesh have contributed to create mixed crop-livestock production systems. In this regard, it is important to lay stress on how to develop potentials of livestock feeding material production.

Aiming to formulate a potential development plan in line with the above consideration, criteria for identification of livestock product and feeding material development potentials are set up as summarized in Table CB-3.1.1.

Table CB-3.1.1 Criteria for Identification of Livestock Product and Feeding Material Development Potentials

Item	Criteria
Livestock products <ul style="list-style-type: none"> • Milk • Meat • Wool 	<ul style="list-style-type: none"> • Population share of sum of cows and buffaloes in the State High potential: <15% for district & <2.5% for block Medium potential: 7.5%~15% for district & 1.25%~2.5% for block Low potential: >7.5% for district & 1.25% for block • Population share of sum of goats and sheep in the State High potential: <15% for district & <2% for block Medium potential: 7.5%~15% for district & 1%~2% for block Low potential: >7.5% for district & 1% for block • Population share of sheep in the State and existing wool fabrics High potential: <15% for district & <2.5% for block Medium potential: 7.5%~15% for district & 1.25%~2.5% for block Low potential: >7.5% for district & 1.25% for block
Livestock feeding materials <ul style="list-style-type: none"> • Supply rate • Supply volume 	<ul style="list-style-type: none"> • Dry matter, dry fodder and green fodder supply positions against demand High position: 100% and above Medium position: State average (61% for dry matter, 73% for dry fodder and 39% for green fodder) to 100% Low position: Below State average • Dry matter production volume share in the State High level: <10% for district & <2.3% for block Medium level: 5%~10% for district & 1.15%~2.3% for block Low level: >5% for district & >1.15% for block

Source: JICA Study Team

CB-3.1.2 Identified Livestock Product Development Potentials

Livestock product development potentials are to be identified by each major product based on the above criteria presented on district basis given in Table CB-3.1.1. The identified potentials of livestock feeding material production as summarized on district basis in Table CB-3.1.2 are examined on demand and supply basis and represented from four different viewpoints of potential development ways such as forage diversification, entrepreneurship-oriented development, fruits field utilization as well as watershed management and conservation activities.

Table CB-3.1.2 District-wise Potentials of Livestock Product Development in Himachal Pradesh

Potential	BP	CH	HM	KG	KN	KU	LS	MD	SH	SM	SO	UN
Livestock Products												
• Dairy product	L	M	L	H	L	L	L	H	M	M	M	L
• Meat product	L	H	L	H	L	M	L	H	M	M	L	L
• Wool product	L	H	L	M	M	M	L	M	M	L	L	L
Livestock Feeding Materials												
• Dry matter supply rate	L	L	M	M	H	L	H	L	L	L	L	L
• Dry fodder supply rate	L	L	M	M	H	L	H	L	L	L	L	L
• Green fodder supply rate	M	M	M	M	H	M	H	L	L	L	L	L
• Dry matter supply volume	L	H	M	H	L	M	L	H	H	H	M	L

Note: BP; Biraspur, CH; Chamba, HM; Hamirpur, KG; Kangra, KN; Kinnaur, KU; Kullu, LS; Lahaul-Spiti, MD; Mandi, SH; Shimla, SM; Sirmaur, SO; Solan, and UN; Una

H; high, M; medium and L; low with definitions given in Table CB-3.1.1

Source: JICA Study Team

CB-3.2 Constraints to Exploitation of Livestock Product Development Potentials

In general, constraints for exploiting development potentials of livestock products are formed of two main issues. One is directly related to the nature of products, while the other is born from feeding situation of the concerned animal. From this viewpoint, various constraints which need to be overcome in exploiting development potentials of livestock products in Himachal Pradesh are listed up as shown in Table CB-3.2.1.

Table CB-3.2.1 Constraints for Exploitation of Development Potential of Livestock Products

Item	Constraints
Dairy Production	<ul style="list-style-type: none"> • Inadequate and low quality of feeding resources • Decreasing grasslands in extent and quality • Ignoring of MILKFED roles due to inadequate linkages and networking
Meat Production	<ul style="list-style-type: none"> • Inadequate focus on sanitary, phyto-sanitary and zoo-sanitary measures in meat production • Absence of specific schemes for promoting goat meat production
Wool Production	<ul style="list-style-type: none"> • Low lambing rates and low wool productivity • Production losses during migration • Inadequate access to improved breeding rams • Low wool grade due to presence of wooden and vegetative impurities
Feeding Material Sources	<ul style="list-style-type: none"> • Physical upper limitation of scale of grassland scheme • Huge gap between demand and supply of green and dry fodder • Non availability of quality concentrated feeds at affordable costs

Source: JICA Study Team

CB-3.3 Necessity and Requirements for Rational Plans of Potential Development

Taking into account development potentials of livestock products and feeding material resources as well as constraints for exploitation of such potentials, the necessity and requirements for drawing up rational plans of potential development are taken up as shown in Table CB-3.3.1.

Table CB-3.3.1 Necessity and Requirements for Rational Plans of Potential Development

Item	Development Potential	Necessity and Requirements
Livestock Product	Dairy Product	<ul style="list-style-type: none"> • Necessity: Expansion of success mechanism on wide scale paying attention to market trends, promotion of professional approaches to fertility management, supply of clean milk, and cost effective sources for replacement stocks • Requirement: Optimization of dairy production from crossbred cattle and graded buffaloes, introduction of total quality management system, and setting up of rearing and marketing system of crossbred and buffalo calf
	Meat Product	<ul style="list-style-type: none"> • Necessity: Promotion of better practices of goat rearing and meat production for small and tribe farmers • Requirement: Introduction of stall feeding of goats, creation of effective regulatory mechanisms of meat production, and promotion of quality control of meat
	Wool Product	<ul style="list-style-type: none"> • Necessity: Management of genetic diversity, increase in wool productivity, and design of entrepreneurship chains from production sites to markets • Requirements: Gearing up of sheep breeding farms of DOAH, livestock extension mechanism, and redesign of public-private partnership
Feeding System	Feeding Material Resources	<ul style="list-style-type: none"> • Necessity: Linkage between research and livestock farmers, Linkage between livestock product markets and livestock farmers, and Linkage between livestock productivity increase and crop farming system • Requirement: Diversification and optimization of forage production through legume and grasses mixed pasture development, fodder production in fruits field and watershed conservation sites, and entrepreneur oriented development method

Source: JICA Study Team

CB-3.4 Re-examination of Current Development Potentials on Block Basis

Aiming at clarification of livestock product development and feeding material production potentials in each of 75 blocks in 12 districts of the State, the current demand and supply positions of dry matter, green fodders and dry fodders have been re-examined. For this purpose, the data of Livestock Population Census 2003 have been re-arranged on block basis as shown in Table CB-3.4.1. The re-examination results are presented in Fig. CB-3.4.1. Considering the current positions, development potentials of milk, meat and wool products on block basis have been identified as presented in Table CB-3.4.2.

Table CB-3.4.1 Block-wise Population of Cattle, Buffalo, Sheep and Goat (1/2)

District	Block	Cattle			Buffalo	Sheep			Goat
		Crossbred	Indegenious	Total		Crossbred	Indegenious	Total	
Bilaspur	BP-1 Bilaspur Sadar	10,440	18,140	28,580	33,350	580	630	1,210	24,680
	BP-2 Geharwin	6,880	8,230	15,110	35,130	90	850	940	16,440
	BP-3 Ghumarwin	3,780	6,470	10,250	29,180	170	710	880	11,700
	Whole District	21,100	32,840	53,940	97,660	840	2,190	3,030	52,820
Chamba	CH-1 Bharmour	2,700	18,760	21,460	90	23,420	42,140	65,560	58,440
	CH-2 Bhatiyat	7,550	52,980	60,530	11,080	550	26,150	26,700	37,510
	CH-2 Chamba	5,870	37,140	43,010	6,010	1,090	27,370	28,460	16,620
	CH-4 Mehla	7,180	45,380	52,560	7,350	1,340	33,450	34,790	20,320
	CH-5 Pangi	2,360	7,870	10,230	-	120	25,880	26,000	11,830
	CH-6 Salooni	1,930	51,520	53,450	8,230	50	36,280	36,330	18,550
	CH-7 Tissa	400	49,190	49,590	8,570	0	63,530	63,530	21,350
	Whole District	27,990	262,840	290,830	41,330	26,570	254,800	281,370	184,620
Hamirpur	HM-1 Bamsan	2,570	2,110	4,680	12,420	580	2,680	3,260	3,300
	HM-2 Bhoranj	3,590	2,390	5,980	20,360	1,270	3,270	4,540	6,460
	HM-3 Bijhri	3,330	2,990	6,320	22,510	230	150	380	3,900
	HM-4 Hamirpur	2,770	2,280	5,050	13,450	630	2,900	3,530	3,570
	HM-5 Nadaun	4,110	5,770	9,880	26,840	40	1,350	1,390	4,590
	HM-6 Sujampur Tira	4,230	2,900	7,130	8,930	1,130	3,420	4,550	7,820
	Whole District	20,600	18,440	39,040	104,510	3,880	13,770	17,650	29,640
Kangra	KG-1 Baijnath	18,910	14,870	33,780	3,580	8,280	26,720	35,000	28,530
	KG-2 Bhawarna	12,520	8,440	20,960	2,890	4,080	4,960	9,040	8,740
	KG-3 Dehra	10,940	31,950	42,890	38,200	110	2,680	2,790	20,050
	KG-4 Fatepur	6,450	20,110	26,560	13,880	210	1,910	2,120	10,090
	KG-5 Indora	16,180	17,880	34,060	15,010	310	3,120	3,430	11,330
	KG-6 Kangra	7,100	10,380	17,480	10,160	650	4,210	4,860	18,420
	KG-7 Lamba Gaon	5,460	13,390	18,850	8,760	190	4,380	4,570	8,680
	KG-8 Nagrota Bagwan	9,190	19,510	28,700	11,010	810	6,790	7,600	21,740
	KG-9 Nagrota Surian	9,340	25,150	34,490	16,840	1,760	4,820	6,580	19,460
	KG-10 Nurpur	17,990	21,420	39,410	10,930	980	5,760	6,740	18,450
	KG-11 Panchrukhi	13,910	9,380	23,290	3,210	4,540	5,520	10,060	9,710
	KG-12 Pragpur	5,900	11,810	17,710	15,430	270	1,110	1,380	2,730
	KG-13 Rait	15,710	30,470	46,180	8,390	630	11,760	12,390	26,820
	KG-14 Sulah	3,420	4,460	7,880	3,380	510	1,260	1,770	5,490
	Whole District	153,020	239,220	392,240	161,670	23,330	85,000	108,330	210,240
Kinnaur	KN-1 Kalpa	4,190	3,630	7,820	10	13,780	6,640	20,420	9,340
	KN-2 Nichar	2,690	7,580	10,270	-	4,420	23,990	28,410	14,020
	KN-3 Pooh	2,460	2,580	5,040	-	8,090	17,470	25,560	11,180
	Whole District	9,340	13,790	23,130	10	26,290	48,100	74,390	34,540
Kullu	KU-1 Ani	1,200	1,710	2,910	-	-	1,110	1,110	550
	KU-2 Banjar	5,460	37,780	43,240	-	1,090	25,310	26,400	16,630
	KU-3 Kullu	30,660	35,930	66,590	150	9,320	50,370	59,690	39,960
	KU-4 Naggar	18,550	12,900	31,450	90	5,080	23,710	28,790	12,670
	KU-5 Nirmand	7,790	22,970	30,760	60	40	13,530	13,570	13,040
	Whole District	63,660	111,290	174,950	300	15,530	114,030	129,560	82,850

Source: Livestock Population 2003, Department of Animal Husbandry

Table CB-3.4.1 Block-wise Population of Cattle, Buffalo, Sheep and Goat (2/2)

District	Block	Cattle			Buffalo	Sheep			Goat
		Crossbred	Indegenious	Total		Crossbred	Indegenious	Total	
Lahaul-Spiti	LS-1 Lahaul	6,580	1,880	8,460	-	4,070	29,790	33,860	3,640
	LS-2 Spiti	580	4,260	4,840	-	390	7,200	7,590	6,930
	Whole District	7,160	6,140	13,300	0	4,460	36,990	41,450	10,570
Mandi	MD-1 Chachyot	13,040	22,240	35,280	2,600	1,320	11,380	12,700	10,380
	MD-2 Chauntra	7,160	17,490	24,650	3,710	280	2,450	2,730	10,440
	MD-3 Dharampur	5,820	18,580	24,400	17,680	360	6,180	6,540	19,690
	MD-4 Drang	15,820	41,230	57,050	7,600	1,850	13,170	15,020	26,540
	MD-5 Gopalpur	4,510	12,930	17,440	19,160	230	3,810	4,040	12,550
	MD-6 Karsog	15,040	60,020	75,060	2,370	620	14,980	15,600	27,580
	MD-7 Mandi Sadar	38,980	33,170	72,150	12,380	920	14,610	15,530	17,780
	MD-8 Rewalsar	17,420	21,570	38,990	4,960	1,500	8,840	10,340	12,810
	MD-9 Seraj	7,550	43,350	50,900	10,150	270	34,780	35,050	19,680
	MD-10 Sundernagar	10,850	33,720	44,570	15,070	440	11,840	12,280	26,710
	Whole District	136,190	304,300	440,490	95,680	7,790	122,040	129,830	184,160
Shimla	SH-1 Basantpur	4,210	21,950	26,160	2,790	60	1,460	1,520	6,940
	SH-2 Chhohara	6,870	16,200	23,070	150	18,430	23,580	42,010	20,220
	SH-3 Chopal	5,940	51,260	57,200	1,760	70	10,390	10,460	31,400
	SH-4 Jubbal	18,380	9,710	28,090	150	180	3,790	3,970	4,250
	SH-5 Mashobra	11,810	31,310	43,120	7,990	170	2,990	3,160	2,760
	SH-6 Narkanda	9,710	6,590	16,300	230	220	2,010	2,230	4,530
	SH-7 Rampur	15,820	24,110	39,930	730	1,820	26,370	28,190	19,600
	SH-8 Rohroo	16,110	6,420	22,530	70	290	3,520	3,810	980
	SH-9 Theog	11,880	36,300	48,180	2,420	670	2,360	3,030	6,030
	Whole District	100,730	203,850	304,580	16,290	21,910	76,470	98,380	96,710
Sirmaur	SM-1 Nahan	7,520	35,150	42,670	8,860	360	370	730	24,270
	SM-2 Pachhad	7,390	29,290	36,680	6,120	100	2,270	2,370	20,020
	SM-3 Paonta Sahib	11,420	44,850	56,270	25,060	290	1,410	1,700	22,330
	SM-4 Rajgar	6,540	27,710	34,250	4,530	10	2,450	2,460	12,130
	SM-5 Sangrah	4,380	43,080	47,460	3,650	1,050	3,890	4,940	35,510
	SM-6 Shillai	1,390	29,330	30,720	4,620	10	5,560	5,570	29,190
	Whole District	38,640	209,410	248,050	52,840	1,820	15,950	17,770	143,450
Solan	SO-1 Dharampur	8,540	19,240	27,780	11,150	540	350	890	15,360
	SO-2 Kandaghat	6,300	15,820	22,120	3,900	100	800	900	1,990
	SO-3 Kunihar	13,700	31,320	45,020	9,890	400	1,220	1,620	9,720
	SO-4 Nalagarh	7,960	23,590	31,550	60,330	150	40	190	33,860
	SO-5 Solan	10,620	17,480	28,100	5,530	130	580	710	6,560
	Whole District	47,120	107,450	154,570	90,800	1,320	2,990	4,310	67,490
Una	UN-1 Amb	5,450	7,800	13,250	18,720	10	30	40	2,540
	UN-2 Bangana	2,720	7,450	10,170	26,160	20	80	100	7,280
	UN-3 Gagret	6,510	8,610	15,120	23,090	10	0	10	2,890
	UN-4 Haroli	3,730	3,710	7,440	21,080	-	-	-	4,760
	UN-5 Una	6,740	4,720	11,460	35,500	0	10	10	4,160
	Whole District	25,150	32,290	57,440	124,550	40	120	160	21,630
Himachal Pradesh Total		650,700	1,541,860	2,192,560	785,640	133,780	772,450	906,230	1,118,720

Source: Livestock Population 2003, Department of Animal Husbandry

Table CB-3.4.2 Block-wise Current Position of Livestock Product Development Potential (1/2)

District	Block	Product Development Potential*			Feeding Material Resource Condition			
		Dairy	Meat	Wool	Supply against Demand (%)			Dry matter volume**
					Dry matter	Green fodder	Dry fodder	
Bilaspur	BP-1 Bilaspur Sadar	M	M	L	51	30	63	M
	BP-2 Geharwin	M	L	L	57	29	70	M
	BP-3 Ghumarwin	M	L	L	56	11	79	M
	Whole District	L	L	L	54	69	70	L
Chamba	CH-1 Bharmour	M	H	H	99	91	104	H
	CH-2 Bhatiyat	M	H	H	37	21	45	M
	CH-2 Chamba	M	H	H	41	17	52	M
	CH-4 Mehla	M	H	H	45	29	54	M
	CH-5 Pangi	L	M	H	184	166	192	M
	CH-6 Salooni	M	H	H	47	23	59	M
	CH-7 Tissa	M	H	H	50	36	57	M
	Whole District	M	H	H	56	39	65	H
Hamirpur	HM-1 Bamsan	L	L	L	78	89	103	L
	HM-2 Bhoranj	L	L	L	82	73	117	L
	HM-3 Bijhri	L	L	L	68	31	89	L
	HM-4 Hamirpur	L	L	L	77	85	111	L
	HM-5 Nadaun	L	L	L	67	27	89	M
	HM-6 Sujampur Tira	L	L	L	67	31	85	L
	Whole District	L	L	L	73	52	98	M
Kangra	KG-1 Baijnath	M	H	H	184	151	200	H
	KG-2 Bhawarna	L	L	L	71	78	83	L
	KG-3 Dehra	H	M	L	48	22	61	M
	KG-4 Fatepur	M	L	L	78	53	90	H
	KG-5 Indora	M	L	L	78	52	92	M
	KG-6 Kangra	L	M	L	75	44	94	M
	KG-7 Lamba Gaon	L	L	L	58	20	77	L
	KG-8 Nagrota Bagwan	M	M	L	69	62	84	M
	KG-9 Nagrota Surian	M	M	L	52	38	67	M
	KG-10 Nurpur	M	M	L	51	22	66	M
	KG-11 Panchrukhi	L	L	L	83	38	108	L
	KG-12 Pragpur	L	L	L	58	24	76	M
	KG-13 Rait	M	M	M	76	35	98	M
	KG-14 Sulah	L	L	L	56	21	73	L
	Whole District	H	H	M	73	46	89	H
Kinnaur	KN-1 Kalpa	L	M	M	145	138	149	L
	KN-2 Nichar	L	H	H	80	77	83	L
	KN-3 Pooh	L	M	H	244	237	247	M
	Whole District	L	L	M	146	141	149	L
Kullu	KU-1 Ani	L	L	L	429	164	560	L
	KU-2 Banjar	M	H	H	51	32	60	M
	KU-3 Kullu	M	H	H	62	45	71	H
	KU-4 Naggar	L	H	H	60	47	66	M
	KU-5 Nirmand	L	M	M	31	16	38	L
	Whole District	L	M	M	59	39	69	M

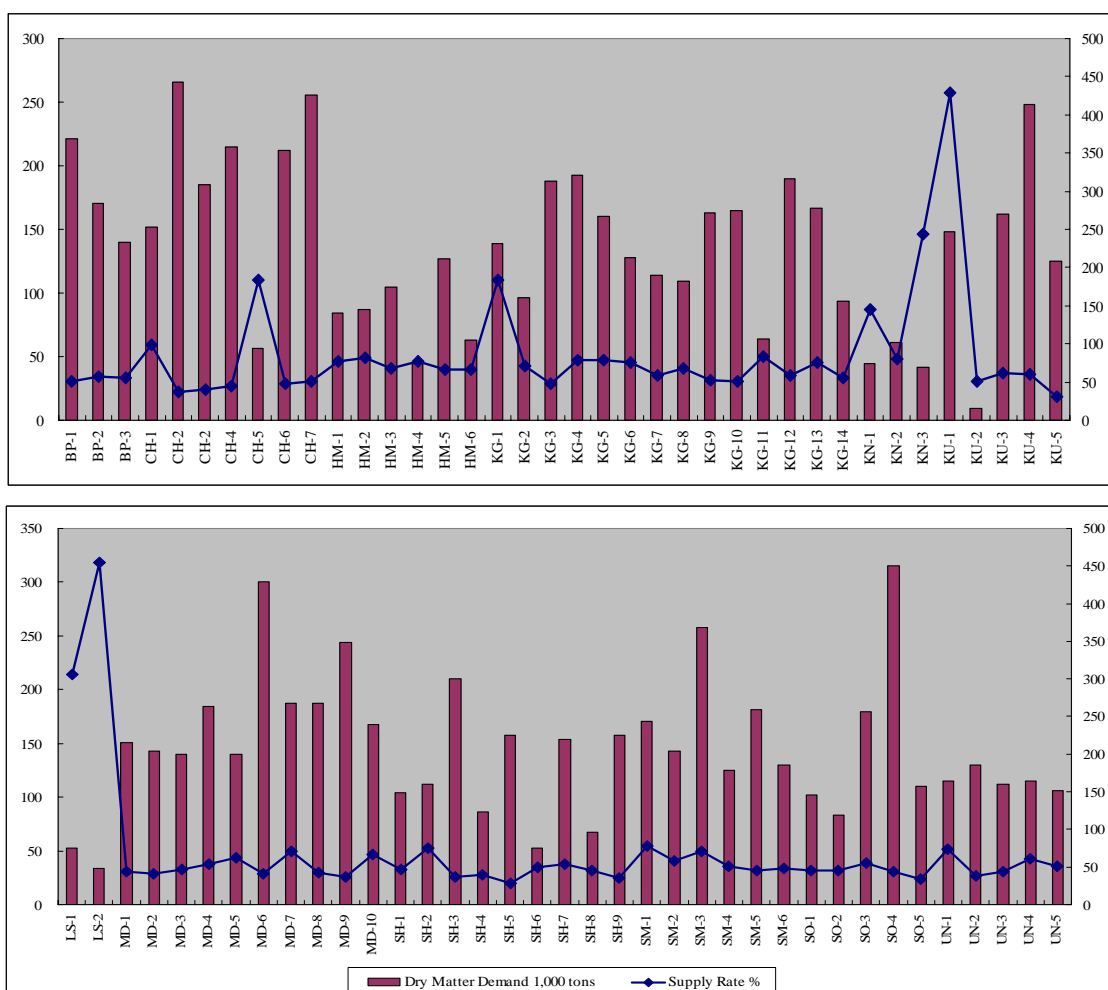
Prepared by JICA Study Team based on Livestock Population Census and data collected from 75 Block Offices of Department of Ag

Table CB-3.4.2 Block-wise Current Position of Livestock Product Development Potential (2/2)

District	Block	Product Development Potential*			Feeding Material Resource Condition			
		Dairy	Meat	Wool	Supply against Demand (%)			Dry matter volume**
					Dry matter	Green fodder	Dry fodder	
Lahaul-Spiti	LS-1 Lahaul	L	M	H	306	304	306	H
	LS-2 Spiti	L	L	L	455	449	458	H
	Whole District	L	L	L	363	360	365	L
Mandi	MD-1 Chachyot	M	M	M	43	26	52	L
	MD-2 Chauntra	L	L	L	41	11	56	L
	MD-3 Dharampur	M	M	L	47	21	60	L
	MD-4 Drang	M	H	M	54	32	65	M
	MD-5 Gopalpur	L	L	L	62	23	81	M
	MD-6 Karsog	H	H	M	41	27	48	M
	MD-7 Mandi Sadar	H	M	M	71	51	85	M
	MD-8 Rewalsar	M	M	L	43	20	58	M
	MD-9 Seraj	M	H	H	37	23	44	M
	MD-10 Sundernagar	M	M	M	66	35	84	M
	Whole District	H	H	M	50	27	62	M
Shimla	SH-1 Basantpur	L	L	L	46	32	53	L
	SH-2 Chhohara	L	H	H	75	67	79	M
	SH-3 Chopal	M	H	L	37	26	43	M
	SH-4 Jubbal	L	L	L	40	37	41	L
	SH-5 Mashobra	M	L	L	28	16	34	L
	SH-6 Narkanda	L	L	L	50	41	55	L
	SH-7 Rampur	M	H	H	54	44	59	M
	SH-8 Rohroo	L	L	L	45	42	50	L
	SH-9 Theog	M	L	L	35	30	39	L
		Whole District	M	M	M	44	35	49
Sirmaur	SM-1 Nahan	M	M	L	78	58	88	M
	SM-2 Pachhad	M	M	L	58	39	68	M
	SM-3 Paonta Sahib	H	M	L	70	36	87	H
	SM-4 Rajgar	M	L	L	52	37	59	M
	SM-5 Sangrah	M	H	L	46	27	55	M
	SM-6 Shillai	L	M	L	48	32	56	L
		Whole District	M	M	L	60	38	71
Solan	SO-1 Dharampur	M	L	L	46	24	58	L
	SO-2 Kandaghat	L	L	L	45	41	50	L
	SO-3 Kunihar	M	L	L	55	27	70	M
	SO-4 Nalagarh	H	M	L	44	14	60	M
	SO-5 Solan	L	L	L	34	23	40	L
		Whole District	M	L	L	46	22	58
Una	UN-1 Amb	L	L	L	74	22	98	M
	UN-2 Bangana	L	L	L	38	21	49	L
	UN-3 Gagret	M	L	L	44	11	61	L
	UN-4 Haroli	L	L	L	61	25	81	L
	UN-5 Una	M	L	L	51	19	70	L
		Whole District	L	L	L	53	20	71

Note: *, Refer to Table CB-3.1 1 concerning definition of potential level

**; L indicating dry matter supply ratio of below 50%, M for 50% to 79%, H for 80% to 110%, and S for above 110%



Prepared by JICA Study Team

Fig. CB-3.4.1 Block-wise Dry Matter Demand and Supply Rate in Himachal Pradesh

CB-4 Recommended Livestock Development Plan

CB-4.1 Tentative Livestock Development Concept

The most pressing need for the livestock sector in Himachal Pradesh is to increase feeding material resources aiming at solution of imbalance in demand and supply situation of green and dry fodders for grass eating animals. Therefore, the proposed plan on livestock development is to be prepared focusing on how to secure sustainable livestock feeding material supply sources for livestock farmers. Considering limited availability of land resources suitable for agricultural use in the State, the basic concepts to increase livestock feeding material supply capacity in line with the crop diversification policy of the State are set up as follows:

- a. To promote the mixed cropping system of fodder crops in between fruit trees in orchards where the Department of Horticulture is planning to implement fruit crop area expansion and replanting programs;
- b. To pay special attention to the future change in dry and green fodder production situation as result of the conversion program from food grain crops to vegetables to be promoted by the Department of Agriculture; and
- c. To introduce a fodder bank system under which compressed feed/fodder blocks are to be prepared in surplus fodder production areas and supplied to feeding material shortage areas.

CB-4.2 Recommended Livestock Feeding Material Resources Development Plan

CB-4.2.1 Future Livestock Population Projection

In coordination with the Department of Animal Husbandry, the future livestock population prediction has been made. For this purpose, district-wise annual increasing/decreasing rates of livestock population during the previous census period between 1997 and 2003 have been calculated. By applying the results of this calculation to the 2003 livestock population, the district-wise future livestock population for every end year of Eleventh, Twelfth and Thirteenth Five Year Plan periods is projected as shown in Table CB-4.2.1.

Table CB-4.2.1 District-wise Livestock Population Prediction

Unit: 1,000 heads

District	Cow			Buffaloes			Sheep			Goat		
	2012	2017	2022	2012	2017	2022	2012	2017	2022	2012	2017	2022
Bilaspur	52	58	68	98	99	100	2	1	1	43	39	35
Chamba	337	370	408	58	68	82	322	348	375	168	160	152
Hamirpur	39	46	58	109	112	115	10	7	6	22	19	16
Kangra	427	477	554	179	189	199	38	24	15	173	157	142
Kinnaur	28	33	38	0	0	0	66	62	59	41	44	49
Kullu	229	271	323	1	1	1	129	128	127	100	115	133
Lahaul-Spiti	9	10	11	-	-	-	38	36	35	13	14	16
Mandi	288	276	274	48	36	28	62	44	31	162	149	137
Shimla	194	184	183	18	19	21	67	56	46	90	86	82
Sirmaur	240	253	268	68	81	96	15	14	13	155	165	176
Solan	108	105	105	106	116	127	3	3	2	65	64	63
Una	36	37	39	154	174	196	0	0	0	22	23	23
State	1,987	2,120	2,329	839	895	965	752	723	710	1,054	1,035	1,024

Prepared by JICA Study Team in coordination with Department of Animal Husbandry, Himachal Pradesh

The predicted cow population above consists of crossbred and indigenous cows. The former will increase to 0.62 million heads in 2012, 0.81 million heads in 2017 and 1.06 million heads in 2022, while the latter will reduce to 1.37 million heads in 2012, 1.31 million heads in 2017 and 1.27 million heads in 2022. .

CB-4.2.2 Predicted Feeding Requirements

The future feeding requirements have been estimated for the respective districts by adopting the bases and assumptions described in Section CB-2.3 as well as the above population prediction. The results are presented in Table CB-4.2.2.

Table CB-4.2.2 District-wise Feeding Requirement Prediction

Unit: 1,000 tons

District	Dry Matter			Dry Fodder			Green Fodder		
	2012	2017	2022	2012	2017	2022	2012	2017	2022
Bilaspur	493	521	547	363	384	403	650	688	722
Chamba	1,585	1,672	1,844	1,168	1,232	1,359	2,092	2,207	2,434
Hamirpur	497	534	577	366	394	425	656	705	762
Kangra	1,899	2,115	2,333	1,399	1,559	1,719	2,507	2,792	3,079
Kinnaur	147	160	176	109	118	130	194	211	232
Kullu	846	940	1,100	624	693	811	1,117	1,241	1,452
Lahaul-Spiti	57	60	63	42	44	46	76	79	83
Mandi	1,098	1,092	1,029	809	804	759	1,449	1,441	1,359
Shimla	663	695	705	489	512	520	875	918	930
Sirmaur	1,061	1,122	1,219	782	827	898	1,401	1,481	1,609
Solan	691	740	772	509	546	569	912	977	1,019
Una	592	663	736	436	489	542	781	875	972
State	9,629	10,314	11,101	7,096	7,602	8,181	12,710	13,615	14,653

Prepared by JICA Study Team

CB-4.2.3 Plan of Increase in Feeding Material Supply Sources

(1) Creation of Fodder Supply Source

With high increasing numbers of crossbred cow at annual rate of 6.2%, the feeding material requirements will continuously go up as shown in the above. In order to meet such increasing demand, it is planned to promote the mixed green fodder cropping in newly expanded and re-planted orchards. According to the fruit crop area expansion plan by the Department of Horticulture, the both currently fallow and cultivable waste lands will be re-utilized for orchards. As these land resources are usually low in soil fertility, it is prerequisite to grow fodder crops in between fruit trees for the purpose of improving soil productivity and minimize mortality of newly planted seedlings of fruit crops.

Another new source of fodder is an old and senile orchard to which the Department of Horticulture has targeted its replanting program. In replacing the existing fruit trees with new young seedlings, it is promoted to grow fodder crops in replanting areas.

Taking into account high density fruit tree planting policy of the Department of Horticulture, it is assumed that possible areas of fodder cropping are 70% of newly expanded and re-planted orchards. Based on this assumption and by referring to the fruit crop area expansion and re-planting plans, the total areas possible for newly growing fodders up to 2022 at the end of the Thirteen Five Year Plan period are estimated as shown in Table CB-4.2.3.

From such newly created fodder cropped areas, it can be expected that about 3.2 million tons of green fodders will be additionally supplied as shown in Table CB-4.2.4. This green fodder production increase will enable livestock rearing farmers to improve nutritional condition and milk producing capability of cows and buffaloes, especially for crossbred cows.

Table CB-4.2.3 District-wise New Fodder Crop Growing Area Prediction up to 2022

Unit: ha

District	Currently Fallow Land		Cultivable Waste Land		Orchard			Fodder Crop Area
	Converted	Remained	Converted	Remained	Expansion	Replanting	Total	
Bilaspur	1,590	0	660	3,610	2,250	400	2,650	1,860
Chamba	6,120	0	640	1,090	6,760	1,200	7,960	5,570
Hamirpur	5,100	4,070	0	8,450	5,100	600	5,700	3,990
Kangra	3,480	0	6,740	5,510	10,220	7,050	17,270	12,090
Kinnaur	2,000	0	2,830	660	4,830	2,700	7,530	5,270
Kullu	1,010	0	1,070	0	2,080	8,700	10,780	7,550
Lahaul-Spiti	40	0	560	0	600	450	1,050	730
Mandi	3,340	0	3,890	6,060	7,230	1,050	8,280	5,800
Shimla	6,420	0	3,500	10,940	9,920	11,250	21,170	14,820
Sirmaur	4,590	0	2,850	6,250	7,440	2,750	10,190	7,130
Solan	1,900	8,650	0	12,410	1,900	700	2,600	1,820
Una	1,670	10,100	0	18,680	1,670	650	2,320	1,620
State	37,260	22,820	22,740	70,180	60,000	37,500	97,500	69,550

Prepared by JICA Study Team

Table CB-4.2.4 District-wise Green Fodder Production Prediction in Orchards for 2022

Unit: 1,000 tons

Green Fodder	BP	CH	HM	KG	KN	KU	LS	MD	SH	SM	SO	UN	HP
Fodder fields	12	13	201	148	3	0	0	57	11	0	16	28	489
Orchards	90	438	274	501	188	237	11	198	910	275	47	42	3,210
Total	102	451	475	649	191	237	11	255	921	275	63	70	3,699

Note: BP; Biraspur, CH; Chamba, HM; Hamirpur, KG; Kangra, KN; Kinnaur, KU; Kullu, LS; Lahaul-Spiti, MD; Mandi, SH; Shimla, SM; Sirmaur, SO; Solan, and UN; Una

Prepared by JICA Study Team

(2) Utilization of Crop Residues

Crop residues also play an important role to supply nutritional feeding materials to animals in Himachal Pradesh. Food grain crops are the main source of dry fodders, while vegetable residues are usually used as a source of green fodder. Under the crop diversification program, the Department of Agriculture is planning to switch some parts of the existing food grain crop cultivation fields to vegetable growing fields throughout the State. In order to recover the reduced production volume of food grain crops, it is planned to introduce improved farming practices aiming at increase in food grain crop yields.

In addition to the above-mentioned creation plan of new green fodder supply sources in orchards, another plan is formulated targeting on full utilization of crop residues in conformity with the vegetable-oriented crop diversification program.

Focal points in this plan are as follows:

- a. Wheat and barley as the main food grain crops of Rabi season are assumed to produce dry matter with a volume equivalent to 150% of grain yield;
- b. As for the main Kharif season food grain crops, the dry matter yield is assumed at 200% of grain yield for maize and 150% for paddy;
- c. Pulses harvested in the both Rabi and Kharif seasons are assumed to produce dry matter at the rate of 80% against crop yields;
- d. No vegetable residues mainly left on fields at harvesting time are counted as dry matters, although some volumes are used by farmers for the supplemental purpose; and
- e. Future food grain crop production volumes are to be originally projected in the Annex.

Citing the bases and assumptions in Section CB-2.3 coupled with the above points, the future dry matter production to be obtained from food grain crops in the both Rabi and Kharif seasons is predicted on the district basis as shown in Table CB-4.2.5.

Table CB-4.2.5 District-wise Prediction of Dry Matter Production from Crop Residues for 2022

Unit: 1,000 tons

	Maize	Paddy	Wheat	Barley	Pulses	Others	Total
Bilaspur	130	2	55	3	0	0	190
Chamba	166	5	46	8	3	10	238
Hamirpur	175	4	83	1	2	1	266
Kangra	309	90	216	4	3	6	628
Kinnaur	1	0	10	0	1	0	12
Kullu	87	3	40	3	2	1	136
Lahaul-Spiti	-	-	1	1	0	1	3
Mandi	224	47	162	8	2	3	446
Shimla	79	3	32	4	3	1	119
Sirmaur	180	12	52	3	4	3	254
Solan	118	11	53	3	2	4	191
Una	120	4	73	0	0	1	198
State	1,586	181	823	38	22	31	2,681

Prepared by JICA Study Team

CB-4.2.4 Future Demand and Supply Balance of Feeding Materials

In order to clarify the future demand and supply position on the district basis in Himachal Pradesh, the feeding material production in grass covered areas for 2022 is estimated, as the dry matters presently obtained from the both currently fallow and cultivable waste lands will decrease resulting from implementation of the planned conversion plan to new orchards. The results of estimate are presented in Table CB-4.2.6.

Table CB-4.2.6 District-wise Feeding Material Production Prediction in Grass Cover Areas for 2022

Unit: 1,000 tons

District	Forest Cover	Pasture/Grassland	Cultivable Waste	Currently Fallow	Orchard*	Total Dry Matter	Dry Fodder	Green Fodder
Bilaspur	56	97	9	0	8	170	125	224
Chamba	521	152	3	0	19	675	512	917
Hamirpur	26	93	22	3	6	150	111	199
Kangra	453	489	15	0	39	996	734	1,314
Kinnaur	479	45	2	0	10	536	395	707
Kullu	420	15	0	0	22	457	338	605
Lahaul-Spiti	1,004	147	0	0	0	1,151	849	1,520
Mandi	222	343	16	0	41	622	458	821
Shimla	293	150	29	0	34	506	372	667
Sirmaur	276	186	16	0	17	495	365	654
Solan	90	86	33	8	8	225	166	297
Una	52	28	49	9	6	144	105	188
State	3,892	1,831	194	20	210	6,147	4,530	8,113

Note: *; The orchards not included into the replanting program
Prepared by JICA Study Team

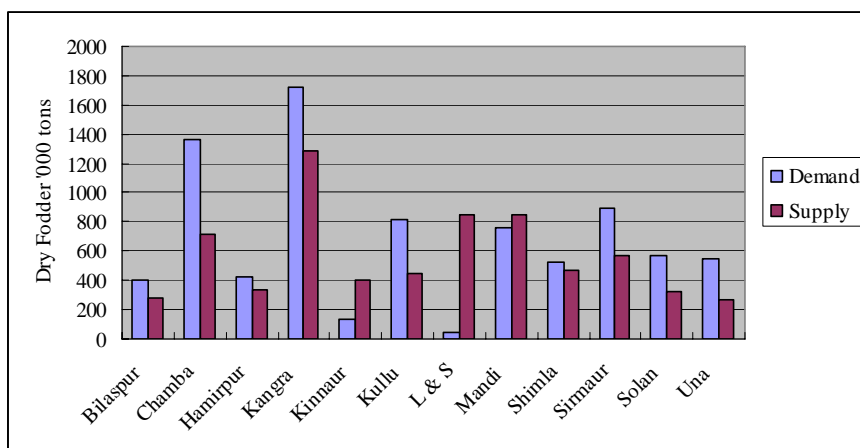
The overall demand and supply situation in 2022 is made on the district basis as shown in Table CB-4.2.7. The future balance of dry fodder and green fodder are depicted in Figs. CB-4.2.1 and CB-4.2.2 on the district basis. Compared with the current feeding material balance presented in Figs. CB-2.3.3 and CB-2.3.4, it can be expected to improve green fodder supply capacity to some extent throughout Himachal Pradesh.

Table CB-4.2.7 District-wise Feeding Material Demand and Supply Position in 2022

Unit: 1,000 tons

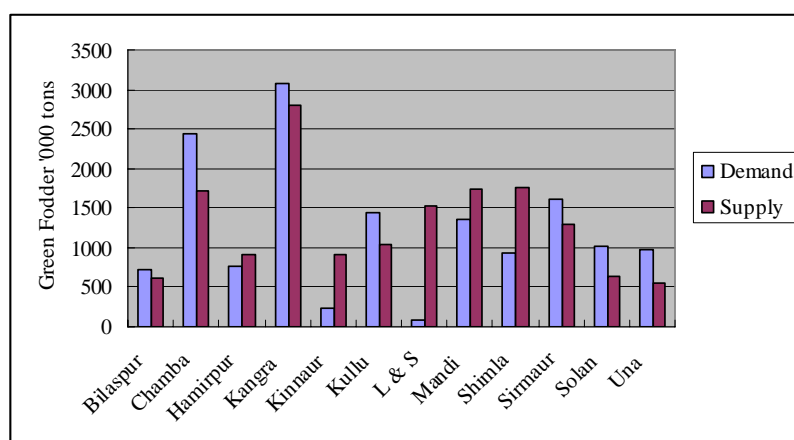
District	Dry Matter			Dry Fodder			Green Fodder		
	Demand	Supply	Surplus	Demand	Supply	Surplus	Demand	Supply	Surplus
Bilaspur	547	381	-166	403	281	-122	722	606	-116
Chamba	1,844	963	-881	1,359	710	-649	2,434	1,714	-720
Hamirpur	577	450	-127	425	331	-94	762	921	159
Kangra	2,333	1,738	-595	1,719	1,281	-438	3,079	2,809	-270
Kinnaur	176	552	376	130	407	277	232	921	689
Kullu	1,100	612	-488	811	451	-360	1,452	1,045	-407
Lahaul-Spiti	63	1,155	1,092	46	851	805	83	1,534	1,451
Mandi	1,029	1,146	117	759	845	86	1,359	1,743	384
Shimla	705	640	-65	520	472	-48	930	1,765	835
Sirmaur	1,219	775	-444	898	571	-327	1,609	1,298	-311
Solan	772	443	-329	569	326	-243	1,019	634	-385
Una	736	369	-367	542	272	-270	972	546	-426
State	11,101	9,224	-1,877	8,181	6,798	-1,383	14,653	15,536	883

Prepared by JICA Study Team



Prepared by JICA Study Team

Fig. CB-4.2.1 District-wise Dry Fodder Demand and Supply Position in 2022



Prepared by JICA Study Team

Fig. CB-4.2.2 District-wise Green Fodder Demand and Supply Position in 2022

CB-4.3 Recommended Action for Feeding Material Supply Sources

It is considered necessary to take the following actions aiming to strengthen the production capacity of green fodders which are indispensable for improvement of animal nutrition in Himachal Pradesh: .

- a. To keep close contact and well-organized coordination with the Department of Horticulture for promoting the mixed cropping system of fodder crops in orchards to which fruit crop expansion and replanting programs target; and
- b. To encourage non-animal farmers in surplus fodder production areas to establish a fodder bank system aiming at creation of a sustainable dry fodder supply source to animal farmers as well as additional farm income source for non-animal farmers.

ANNEX-CC
Fishery
in Agriculture Allied Sectors

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ANNEX-CC FISHERY IN AGRICULTURE-ALLIED SECTORS

CC-1 Background of Fishery Sector

CC-1.1 National Background of Fishery Activities

Indian fisheries sector comprises marine fisheries, inland fisheries and inland aquaculture. Inland fisheries resources including rivers and canals of 195,000 km, reservoirs of 3.15 million ha, floodplain wetlands of 0.35 million ha and estuaries of 0.26 million ha offer a major opportunity for fostering fish production enabling livelihoods of millions of people. The fisheries operations in these waters consist of capture fisheries, culture-based fisheries and other forms of fisheries enhancement. Aquaculture is practiced both in fresh and brackish waters with different culture systems and a number of fish/prawn species. Freshwater aquaculture is primarily confined to smaller water bodies like ponds and tanks in both private and public domains.

During the last 25 years, the annual fish production in the country increased from 0.75 million tons in 1950/51 to 6.4 million tons in 2005/06. According to the projection made by the Indian Council of Agricultural Research (ICAR), a total of 9.6 million tons in 2011/12 will be supplied against the projected demand of 9.74 million tons. Around 60% of this projected demand will be born from domestic markets for covering home consumption. Sector-wise current supply for 2005/06 comprises 46.5% from marine fisheries, 10.7% from inland fisheries and 42.8% from inland aquaculture. Considering limitations of capture fisheries activities and needs to address such demand increase, a paradigm shift to culture fisheries is expected to a large extent. Therefore, sector-wise projected demand will be 32.8% from marine fisheries, 11.7% from inland fisheries and 55.5% from inland aquaculture.

Fisheries and aquaculture have come to be recognized as important economic activities in the country. The programs of the Union Government as well as the State Governments were seen to be having perceptible impacts on the growth of the sector. The Department of Animal Husbandry, Dairying and Fisheries under the Ministry of Agriculture operated the schemes under two broad umbrellas, “Development of Inland Fisheries and Aquaculture” and “Development of Marine Fisheries, Infrastructure and Post-harvest Operations” during the Tenth Five Year Plan period.

The scheme under the umbrella of “Development of Inland Fisheries and Aquaculture” for the Tenth Five Year Plan was of six components including 1) development of freshwater aquaculture, 2) development of integrated coastal aquaculture, 3) development of coldwater fisheries and aquaculture in hilly regions, 4) development of water logged areas into aquaculture, 5) utilization of inland saline/alkaline soils for aquaculture, and 6) inland capture fisheries. To implement this scheme, the Union Ministry allocated Rs. 1,350 million in total in the outlay of Tenth Five Year Plan with the central share of 75%. However, the anticipated expenditure during the Plan period is 57%, although 130,000-ha area was brought under improved practices of fish culture realizing 81% of the target and 130,000 fishers were imparted training in aquaculture practices attaining 136% of the target. The lower fund utilization has been mainly due to inability of States to provide their share of allocation to contribute 25% of cost.

For the Eleventh Five Year Plan, the Union Ministry sets up the main objectives of fisheries and aquaculture development programs as follows:

- a. To enhance the fish production from Indian waters on an environmentally sustainable and socially equitable basis;
- b. To address the hitherto unexplored potentials of inland fisheries and non-food fisheries;
- c. To conserve aquatic resources and genetic diversity, preservation of health of ecosystems;
- d. To increase profitability of fisheries and aqua-farmers through an integrated approach from production to consumption;
- e. To promote fish as health food and meeting the changing requirements of both domestic and export markets;
- f. To strength infrastructure in harvest, post-harvest, value-addition and marketing; and
- g. To uplift fisheries and aqua-farmers communities with gainful employment opportunities and capacity strengthening.

To cater to the above objectives, the schemes of the Tenth Five Year Plan are continuously implemented with some modifications and addition of new components during the Eleventh Five Year Plan period. The total budget requirements for fisheries under the Eleventh Five Year Plan have been estimated at Rs. 4,013 crores, comprising 13.7% for Marine Fisheries and Mariculture schemes, 25.8% for Inland Fisheries and Aquaculture scheme, 31.0% for Infrastructure scheme, 12.4% for Welfare program, Governance, Transfer of Technology and Capacity building, 1.9% for strengthening of database and information networking, and 15.2% for Central institutes.

CC-1.2 State Government Policies and Programs for Fishery Sector

(1) State Government's Policies

In 2006, the State Government of Himachal Pradesh took a historic decision to safeguard the aquatic biodiversity in the downstream of dams and weirs of hydro power projects by means of release of at least 15% of water. As fish capture and culture activities of fishermen can be directly supported with funds from the Central Government and organizations involved in hydro power development schemes in Himachal Pradesh, the State Government's policy is to enhance welfare of fishermen by paying special attention to strengthening of accident insurance, fishing closed season assistance, risk fund as well as grant-in-aid/subsidy for pond fisheries promotion.

(2) Central Government Sponsored Schemes

A package of assistance is provided in the form of Fish Farmers Development Agency (FFDA) to the prospective fish farmers. The objectives of FFDA are as follows:

- a. To reclaim and bring all fish culture potentials under water bodies such as swamps, beets, silted up/neglected ponds, water logged/low lying areas, etc. for optimum fish production in the State;
- b. To work out the program in such a way that it serves as a nucleus of activity for further spread to other areas;
- c. To provide training and popularize a new avocation by way of fish culture to the people thereby build-up a trained cadre of fish farmers to undertake intensive fish farming thus providing increased employment to rural unemployed;
- d. To contribute to the strengthening of rural economy by making fish farming economically viable;

- e. To effectively involve financial assistance to provide loans for capital investment to fish farmers for excavating ponds or for improving existing water areas; and
- f. To provide initial technical and financial assistance to the fish farmers and also as required from time to time.

The FFDA consists of the following nine segments:

- a. Renovation/Reclamation of Ponds and Tanks to subsidize 20% for non-schedule caste and other farmers and 25% for schedule caste and tribe (SC/ST) of the maximum cost of Rs. 60,000;
- b. Construction of New Ponds to subsidize 20% for non-schedule caste and other farmers and 25% for SC/ST of the unit cost of Rs. 300,000/ha;
- c. Fish Culture in Running Water Raceways to subsidize 20% for non-schedule caste and other farmers and 25% for SC/ST of the construction cost of Rs. 20,000 per the fixed unit of 100 m²;
- d. Integrated Fish Farming to subsidize 20% for non-schedule caste and other farmers and 25% for SC/ST of the unit cost of Rs. 80,000/ha;
- e. Construction of Freshwater Prawn & Other Fish Hatchery to subsidize 10% of hatchery construction cost for entrepreneurs only with a maximum ceiling of Rs. 160,000 in the plain and Rs. 120,000 in the hilly areas based on the fish fry production capacity of 10 million;
- f. Aerators/Pumps for Seed Hatchery to subsidize 25% of purchasing cost of two units of 1-HP aerator and one unit of 5-HP pump in one set with a maximum ceiling of Rs. 12,500 for all categories who have attained an annual production level of 3,000 kg/ha. A maximum one set per 1 ha is subsidized;
- g. Establishment of Fish Feed Unit to subsidize 20% of fish feed unit setting up cost including building, machinery and equipment with a maximum ceiling of Rs. 100,000 for all groups of farmers;
- h. Training to Fish Farmers to provide the trainees with Rs. 100/day during the 10-day training period and a lump-sum Rs. 100 as travel/field visit expenses; and
- i. Subsidy on First Year Input to subsidize 20% for non-schedule caste and other farmers and 25% for SC/ST of the first year input purchase cost of Rs. 300,000/ha. The fish farmers who are participated in the renovation and construction schemes of ponds are benefited.

(3) State Government Sponsored Scheme

The DOF handles the following four schemes sponsored by the State Government:

- a. Reservoirs Fishermen Accident Insurance Scheme: As fishing in the big reservoirs is a hazardous job, there is every risk of life during heavy rains and storms. In this regard, all active fishermen working in the reservoirs have been insured for Rs. 25,000 in case of permanent disability and Rs. 50,000 in case of death of the fishermen. The insurance premium of Rs.14 is being shared by the both Governments of India and Himachal Pradesh, respectively in 50:50 ratio;
- b. Saving cum Relief Scheme (Close Season Assistance): Each fisherman who is a member of

the cooperative society deposits Rs. 50 every month for 10 consecutive fishing months from August to May. Under this scheme, proportionate amount is contributed by the Central and State Governments with the amount of Rs. 225 and Rs. 300, respectively. Thus, the total amount of Rs. 1,025 is distributed to the fishermen in the two main reservoirs during the close season;

- c. Fishermen Risk Fund Scheme: To mitigate the losses of fishing equipment due to natural disaster, each reservoir fisherman contributes annual certain amount while getting his fishing license. The State Government contributes an amount equal to the total contribution of the fishermen. The assistance under this scheme is given only on loss of gill nets, wooden boats and tents with the maximum 33% of the present value of the equipment; and
- d. Grant-in-Aid/Subsidy for the Construction of Fish Ponds: Under this scheme, those who take the fish culture are provided with subsidy up to the maximum Rs. 5,000 for constructing or renovating ponds covering 50% of the total project cost for SC/ST and 20% for other fish farmers below the poverty line.

(4) Budget

Budget allocation and expenditure of the DOF incurred for 2006/07 are given below:

Table CC-1.2.1 Budget Outlay and Actual Expenditure of DOF for 2006/07

Unit: Rs. 1,000

Item	Budget Outlay	Actual Expenditure
Administration and Operation	1,024	984
Reservoir Conservation	150	150
Carp Seed Production	5,164	4,967
Promotion of Sport Fisheries in Pong Reservoir	30	30
Trout Seed Production	4,034	3,984
Trout Table Fish Production	2,935	2,837
Operation and Maintenance of Carp Farms	269	222
Training and Publicity	206	188
Promotion of Freshwater Aquaculture	3,490	2,258
Fish Culture in Cold Water	4,514	4,514
Schedule Cast Special Component		
• Construction of community pond	2,800	2,660
• Training and publicity	200	91
• Fish cart scheme	750	750
Schedule Tribe Sub-plan	425	365
Strengthening of Data Base of Information Networking	624	621
Total	26,615	24,621

Source: Department of Fisheries, Himachal Pradesh State Government

In addition to the above budget of the DOF, special funds were released by the HPAMS for 24 projects and schemes with the total expenditure of Rs. 43.9 million for 2006/07. Among others, Rs. 9.88 million was released to the “Development of Fisheries in Nathpa Jhakri reservoir and tail end of Satluj river” project sponsored by the Satlaj Jal Vidyut Nigarn (SJVN) Authority for promoting trout farming, while 2.33 million was released to the “promotion of Fisheries in the Riparian Area of Suketi Khad and its Adjacent” sponsored by the Bhakra Bias Management Board (BBMB) for assisting carp farming.

CC-2 Inland Fishery in Himachal Pradesh

CC-2.1 Background of Fisheries Activity in Himachal Pradesh

Himachal Pradesh is endowed with rich diversity of water resources such as 3,000-km snow fed perennial rivers, 775-km seasonal streams, 60,000-ha reservoirs, and 2,000 ha in total of ponds, lateral lakes and irrigation channels, all of which hold a great potential for development of fisheries to be integrated with other agricultural activities. Among others, the main water bodies so far created are the Gobind Sagar Reservoir on the river Satluj, the Pong Reservoir on the river Beas and the Chamera Reservoir on the river Ravi.

At present, about 7,000 fishermen families are engaged in fishing operations by utilizing the above water resources in the State. During the last 55-year period, fisheries production in Himachal Pradesh has taken a quantum jump. Reservoirs in the State are producing the highest per hectare fish as compared to the other reservoirs in the country. Further, commercial trout farming is out to make inroads in the rural economy of hill people. However, such conditions as increasing human population, construction of roads, dumping of muck & silt on rivers banks, setting up of a large number of hydro-power projects, non-release of regular environmental flow to downstream of dams, rampant river mining and lack of seed production technology of hill stream fish species are becoming a complex cause of the recent decline fish catches, which are the main concern of fishermen families.

Aquaculture helps in many ways to the people especially the rural area. It helps to uplift the social-economic status of people, solve the problems of malnutrition and migration of rural youths to urban areas as well as provide the eco-friendly environment. Fishes have 96% digestibility of animal protein. The protein is 60 to 70% on wet basis, fat is 1 to 3% and full of minerals and vitamins. It controls the cholesterol levels in the blood due to presence of unsaturated eicosapentenoic fatty acid, thus it also provides a healthy food for the people. Aquaculture has been therefore considered as one of the most important integral part of the modern farming system under the scenario of diversification of conventional agriculture practices. Most of the states in India have already adopted the fish farming in a big way and leading towards blue revolution to pave a way for increasing the net income of the farmers. But due to lack of appropriate technology and awareness, the aquaculture in hills has not reached to the expected level.

CC-2.2 Fisheries Types

Fisheries in Himachal Pradesh can be broadly classified into 10 categories as shown in Table CC-2.2.1.

Table CC-2.2.1 Fisheries Types in Himachal Pradesh

Capture Fishery	Culture Fishery	
<ul style="list-style-type: none">• Reservoir fishery• Riverine fishery• Sport fishery• Indigenous fishery	<ul style="list-style-type: none">• Pond and tank fishery• Carp culture in running water• Trout culture in raceways• Integrated fish farming	<ul style="list-style-type: none">• Check dam fishery• Ornamental fishery• Freshwater pearl culture

Source: JICA Study Team

Table CC-2.2.2 depicts district-wise climatic condition coupled with distribution of capture and culture fisheries types in the State.

Table CC-2.2.2 District-wise Climate and Distribution of Fisheries Types in Himachal Pradesh

District	Climate	Capture Fishery	Culture Fishery
Bilaspur	Warm temperate & Sub-tropical	Reservoir, riverine & sport	Pond/tank, running water (carp), check dam & ornamental
Chamba	Alpine, Cold temperate & Warm temperate	Reservoir, riverine & sport	Pond/tank, running water (carp) & ornamental
Hamirpur	Cold temperate & Warm temperate	Riverine & sport	Pond/tank, running water (carp), check dam, ornamental & freshwater pearl
Kangra	Cold temperate & Warm temperate	Reservoir, riverine & sport	Pond/tank, running water (carp and trout) & ornamental
Kinnaur	Sub-artic, Alpine & Cold temperate	-	Running water (trout)
Kullu	Alpine, Cold temperate & Warm temperate	Riverine & sport	Running water (trout)
Lahaul-Spiti	Sub-artic, Alpine & Cold temperate	Indigenous	-
Mandi	Cold temperate & Warm temperate	Reservoir, riverine & sport	Running water (carp and trout) & ornamental
Shimla	Cold temperate & Warm temperate	Riverine & sport	Running water (trout) & ornamental
Sirmaur	Warm temperate & Sub-tropical	Riverine	Pond/tank, running water (carp) & ornamental
Solan	Warm temperate & Sub-tropical	Riverine	Pond/tank, running water (carp) & ornamental
Una	Warm temperate & Sub-tropical	Reservoir & riverine	Pond/tank, check dam & freshwater pearl

Source: JICA Study Team

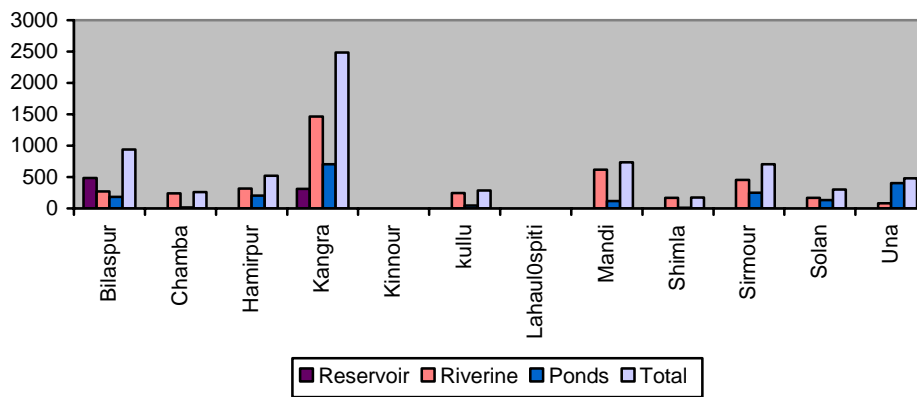
CC-2.3 Fish Production

The annual fish production in Himachal Pradesh fluctuated between around 6,500 tons and 7,300 tons for the period of 2002/03 to 2006/07. District-wise fish production in 2006/07 is as shown in Table CC-2.3.1 and Fig. CC-2.3.1. Historical trends of fish production in reservoirs, riverine and ponds/tanks in the State are illustrated in Fig. CC-2.3.2.

Table CC-2.3.1 District-wise Fish Production in Himachal Pradesh for 2006/07

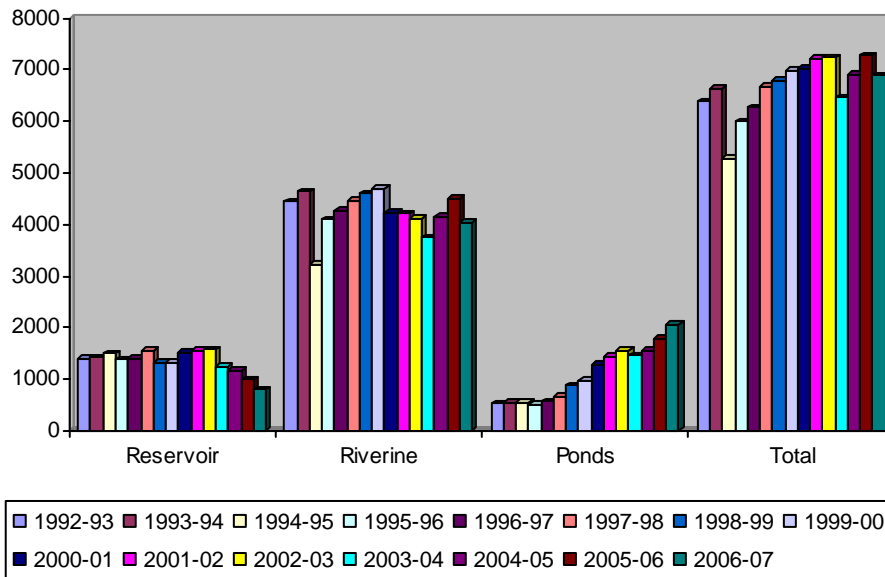
District	Unit: ton					
	Reservoirs	Riverine	Ponds/Tanks	Carp culture	Trout culture	Total
Bilaspur	484	271	181	0.42	-	937
Chamba	2	240	15	0.10	0.22	258
Hamirpur	-	318	203	-	-	521
Kangra	312	1,465	706	0.03	-	2,483
Kinnaur	-	-	-	-	0.42	0
Kullu	-	243	15	0.04	29.12	287
Lahaul-Spiti	-	-	-	-	-	-
Mandi	-	618	100	-	17.85	736
Shimla	-	168	8	-	-	176
Sirmaur	-	454	252	-	-	706
Solan	-	169	132	-	-	301
Una	-	81	401	-	-	482
State	798	4,027	2,013	0.59	47.61	6,887

Source: Department of Fisheries, Himachal Pradesh State Government



Source: Department of Fisheries, Himachal Pradesh State Government

Fig. CC-2.3.1 District-wise Fish Production in Himachal Pradesh for 2006/07



Source: Department of Fisheries, Himachal Pradesh State Government

Fig. CC-2.3.2 Historical Fish Production Trends in Himachal Pradesh

CC-2.4 Capture Fishery Activities

The upstream of Satluj and its tributaries are particularly rich in unique natural species of hill stream fishes including exotic trout and snow trout, while carp and catfish are predominant species introduced in man-made water bodies. Salient features of capture fisher activities in the State are highlighted below.

CC-2.4.1 Reservoir Fishery

Since 1960s, the main focus of development activities in Himachal Pradesh has been to harness various rivers for power generation and irrigation. As a result, a number of small to large scale water bodies has been created throughout the State. Of these, the Gobind Sagar and Pong Reservoirs are the two main very useful fishery resources in the State with mean water spread area of 25,000 ha. In view of sound management practices adopted by the Department of Fisheries, a total of 27,411 tons of fishes valued Rs. 6,106 lakhs was captured from these two reservoirs during the 20-year period from

1985/86 to 2005/06. The State Government has also realized the total income of Rs. 1,205 lakhs in the form of royalty, fee and fines. In 2006/07 alone, a total of 796 tons of fishes was harvested by 3,318 fishermen from the Gobind Sagar and Pong Reservoirs.

CC-2.4.2 Riverine Fishery

The State has about 3,000 km of riverine source available for fisheries. Out of this, about 600 km comprising the rivers Pabbar, Baspa, Tirthan, Sainj, Lambaduh Uhl, Rukti and Parvati support trout fisheries, while the rivers Beas, Satluj, Ravi, Chenab and Giri with a total stretch of 2,400 km support general fisheries. The riverine fisheries occupy a significant position in the hill districts. There are about 5,000 fishermen engaged in fishing activities and capturing annually around 4,000 tons in these rivers. All of them are operating on individual basis so that there are no formal or informal organizations. The fish caught by them is either sold in the local market or brought back for their home consumption.

CC-2.4.3 Sport Fishery

Exotic species such as brown trout and rainbow trout were transplanted in Indian rivers and streams for sport fisheries.¹ In Himachal Pradesh, brown trout was firstly introduced in the river Beas in Kullu valley. At present, rivers and streams in the State provide a large number of sport lovers/anglers and fishermen with exciting fishing opportunities. The major streams suitable for sport fishery in Himachal Pradesh include the rivers Beas, Sutlej, Ravi, Tirthan, Sainj, Uhl, Baspa, Pabar, Lambadug, Giri, Rana, Nugal, Gai, Baner and Bata. The major fish species available for sport fishery in these streams are trout, mahseer and snow trout (*Schizothorax spp.*). Fishing in these streams is regularized under the State Fisheries Act.

CC-2.5 Culture Fishery Activities

The culture fishery is widespread in Himachal Pradesh and practiced in various forms and in various water bodies including ponds/tanks and waterways. The existing water bodies used for culture fishery activities cover 675 ha in total throughout the State. District-wise area distribution of village ponds/tanks with less than 10-ha water surface is given in Fig. CC-2.5.1.

CC-2.5.1 Pond and Tank Fishery

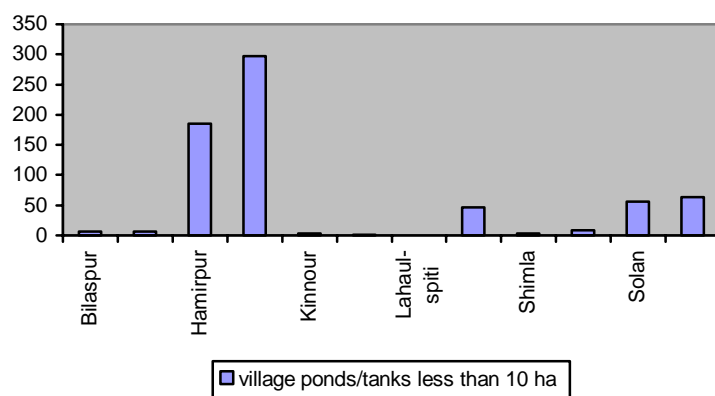
(1) Aquaculture in Dug-out Ponds

The technological interventions during the last three decades have led to increase the mean national production levels in ponds and tanks from about 600 kg/ha to over 2,000 kg/ha. Higher production levels of 6 to 8 ton/ha/year are being achieved by several farmers and entrepreneurs in the districts adjoining Punjab and districts which have lee hills, as they are doing well in carp farming. Presently, Fatehpur and Indora blocks of Kangra district, Paonta Sahib block of Sirmaur district, Nalagarh block of Solan district and all blocks of Una district are hubs of carp farming. The farmers are extremely doing well by utilizing all the available resources. The environment in these districts is suited to the culture of Indian major carps and common carps. Pisciculture is being carried out in dug-out ponds which are rich in natural feeds, fueled by the energy in sunlight, and abundant with nutrients and supplementary feeds like agricultural, poultry and dairy by-products. Common inputs such as manures, rice bran, farm wastes, kitchen wastes and oil cakes are used as supplementary feed materials.

¹ Fish and Fisheries of India- V. G. Jhingran

Farmers have dug out ponds in their own lands. Some of the ponds have also been constructed on the marshy, swampy, waterlogged or derelict land available in the region. The size of such ponds ranges from 1.0 to 10 ha with annual average fish production of 2.0 to 7.0 ton/ha.

There are also incidences of some farmers cultivating invasive and banned fish species like big head carp (*Hypophthalmichthys Nobilis*) locally known as B-grade.



Source: Department of Fisheries, Himachal Pradesh State Government

Fig. CC-2.5.1 District-wise Area Distribution of Village Ponds/Tanks in Himachal Pradesh

(2) Community Ponds

Community ponds have been used for irrigation and water supply purposes. Implementation of piped water supply schemes and availability of irrigation sources in villages have resulted in less dependence of the community on these ponds. Lack of maintenance resulted in the neglect of these water bodies. Some of these ponds are silted and heavily infested with weeds. The Department of Fisheries (DOF) of the Himachal Pradesh State Government initiates a scheme for the renovation of these water bodies. Renovation is allowed only for those community ponds located in villages where schedule caste and schedule tribe population is more than 50% and where Gram Panchayat office agrees to lease out the pond for five years to individual beneficiary of the schedule caste and schedule tribe community.

However, it has been found that the individual lessees are unable to carry out the fish culture in the allotted community ponds due to lack of financial resources and technical knowledge. Even if they pool resources, the short leasing period of five years does not help them to earn sufficient income. In some places, the ponds are found infested with lotus or water hyacinths, and a single individual finds it difficult to remove it. For cleaning and repairing of these ponds, therefore, assistance is provided by Central Government sponsored schemes such as Fish Farmers Development Agency (FFDA) and Agriculture Technology Management Agency (ATMA). Funds are also provided for construction of a new pond. These community ponds help in groundwater recharging and are good source of revenue for the Gram Panchayat offices.

CC-2.5.2 Carp Culture in Running Water

This culture system needs continuous supply of richly oxygenated water that helps in faster growth of the fish as well as 4 to 8 times stocking rate of fish seed compared with usual practices. Thus some of the farmers who have assured supply of water from the streams and small perennial sources are engaged in common carp culture in running water. Owners of water mill locally called as “Gharat” have also an advantage to enter into running water common carp culture as they can arrange running

water in operating their water mills to divert water from streams. Irrigation canals so-called “*Kuhl*” can be used for practising this common carp culture system. There exists a demonstration farm at Deoli in Bilaspur district to show farmers how to practice common carp culture in running water.

Despite of such available potentials, this culture practice has not taken off on a wider scale in the State because there is a limited awareness among farmers about the benefit of running water aquaculture.

CC-2.5.3 Trout Culture in Raceways

The trout was initially introduced in the cold water bodies of the country mainly to encourage sport fisheries. Apart from sport fisheries, culture of trout is now being increasingly identified as a commercial venture for table fish production. Major trout species available in Himachal Pradesh are brown trout (*Salmo trutta fario*) and rainbow trout (*Salmo gairdneri gairdneri*).

With technical assistance and financial grant of Rs. 3 million crore equivalent from the Government of Norway, the State Government set up a trout farm at Patlikuhl in Kullu district. The main components of Norwegian assistance were transfer of technology for trout seed production and trout production, capacity building of the staff, import of quick growing disease-resistant eggs, and development of economical and viable palletized feed production system using locally available ingredients. Since the termination of this assistance, the efforts of DOF have been paid to standardize trout seed production and feed manufacturing technologies.

Now this farm is fully operational with 10 cemented rectangular raceways of size 15 x 2 x 1.5 m. This farm has assured perennial icy-cold-oxygenated water supply of about 500 lit/sec suited for trout seed and table size trout production as well. The farm also has a pathological laboratory and a well established feed mill with installed capacity of 500 kg per day. The availability of seed has enabled individual farmers to adopt trout farming as an additional source of handsome income. Further, the regular stocking of the seed in streams and rivers has not only helped in conserving the trout but also in giving impetus to sport fisheries. This farm produced 157,000 fingerlings, 64-ton feed and 14.62-ton table size fish during the period of 2006/07.

The DOF procured 15,000 ova of ²Arctic Char (*Salvelinus alpinus*) from Canada. Now, the fingerlings are being reared at the Patlikuhl farm. These fingerlings will be transplanted into the high altitude lakes in Lahaul-Spiti district.

Encouraged with the success operation of Patlikuhl farm and successful demonstration of trout farming in running water, the DOF has transferred the technology to local entrepreneurs. The DOF through its extension effort has been able to support many entrepreneurs at various parts of the State, where suitable conditions for trout farming exist. As a part of the extension activities, the DOF has another five operational trout seed and table size trout production farms at Holi in Chamba district, Sangla in Kinnaur district, Hamini in Kullu district, Barot in Mandi district and Dhamwani in Shimla district.

As a result of such extension efforts, 45 farms in total are running trout farming in the State, distributing 6 farms in Chamba district, 3 in Kinnaur district, 11 in Kullu district, 21 in Mandi district

² Arctic Char is a freshwater and saltwater fish belonging to the *Salmonidae* family, native to Arctic, sub-Arctic and alpine lakes, freshwater of Alaska and Northern Canada, and coastal waters. The Freshwater Institute of the Department of Fisheries and Oceans under the Government of Canada at Winnipeg, Manitoba, and Huntsman Marine Science Laboratory of New Brunswick, pioneered the early efforts in determining the suitability of Arctic char as a cultured species.

and 4 in Shimla district.

CC-2.5.4 Integrated Fish Farming

(1) Integrated Agriculture-Aquaculture:

There are a significant number of small and big farmers who are practicing carp poly culture along with piggery, vegetable farming, poultry and dairy. The big, progressive and small farmers practicing integrated agriculture-aquaculture system in the State are utilizing a huge amount of organic wastes such as cow dung, poultry droppings and/or feed waste. Their annual production levels are being achieved to 1 to 3 ton/ha. Fish culture is being practiced in ponds of all shape and sizes. Some farmers are using the irrigation tanks constructed on their farm for fish culture purpose.

The diversification that has resulted from integrating crops, vegetables, livestock and fish is providing stability in production, efficiency in resource use and helping in conservation of the environment. A wide array of entrepreneur options helps farmers in countering uncertainty of markets and vagaries of the nature. Farmers are using wastes of one enterprise as inputs to another and thus optimizing the use of resources and hedging themselves against the various risks.

(2) Backyard/Homestead Aquaculture

There are large numbers of farmers who are operating small-scale aquaculture in their backyard or homestead. The usual practice is doing fish farming in very small ponds with area ranging from 0.01 ha to 0.05 ha. The ponds are cemented, earthen and sometime combined of both with either walls or sometimes the bottom to stop seepage losses. The feeding materials are usually of rice bran, kitchen waste, stalks of vegetables, poultry wastes and wheat/maize flour with periodic application of raw cow dung.

The species cultured are common carp, grass carp and silver carp. Farmers prefer common carp and grass carp because of their ability to sustain a wide range of temperature fluctuation. These farmers do not invest much on the artificial feed. They rely on feed available in their farms and home. This type of fish culture is helping the small farmers to earn some cash income from a very small water body situated on their farm and backyard. The annual production ranges from 400 to 900 kg/ha.

CC-2.5.5 Check Dam Fishery

In last two decades, hundreds of check dams came into existence in Himachal Pradesh. These check dams were constructed by different departments like Irrigation and Public Health, Forest, Agriculture, and Rural Development under different schemes and with different objectives. All these check dams are available on small streams locally called as “*khud*”. In some cases more than 10 check dams are located in series on the same stream. In general the size of pockets at these check dam sites varies from 0.1 to 2.0 ha with some exceptional cases having the size of more than 10 to 15 ha.

Though check dams are constructed in most of the districts in the State, around 300 check dams are concentrated into Hamirpur district. Aiming at utilization of this new avenue for fish production, 122 check dams are leased out from Water Users Associations and Gram Panchayat offices to individuals. These check dams have been stocked with fish seeds brought from various seed farms of the State as well as Punjab and Haryana, while only 30 % of the total seed demand could be met during 2005/06 as the demand for seeds in these water bodies was huge. It is reported by the DOF that about 175 tons of fishes were produced in 2005/06 and further most of the leasers of these check dams have no resources and skills in netting out the fish from these water bodies.

CC-2.5.6 Ornamental Fishery

The DOF is promoting breeding of aquarium fishes. It has successfully bred gold fish, platy, black molly and “Koi” carp at Deoli farm situated in Bilaspur district. A small aquarium has also been constructed in the farm. Another farm is being constructed in Kangra district in order to promote breeding of ornamental fishes. Aquarium facilities have also been constructed at Sultanpur fish farm in Chamba district. The DOF has imparted training to some of its staff on breeding of ornamental fishes. The DOF has been able to breed successfully guppy (*Lebistes reticulates*), molly fish (*Mollienisia lapipinna*, *M. vetifeara* and *M. sphenops*), gold fish, fan tail, platies (*Platylocilus maculates*) and “Koi” carp.

CC-2.6 Ancillary Fishery Activities

CC-2.6.1 Fish Seeds

(1) Fish Seed Requirement

In Himachal Pradesh, the total area under fish culture in village ponds is about 675 ha and the total surface area of water bodies under reservoir fisheries is about 25000 ha including Gobind Sagar and Pong Reservoirs. The total fish seed requirement for fish culture in ponds is 3.4 million fingerlings assuming that the stocking rate is 5,000 fingerling/ha, while that for reservoir fisheries is 25 million fingerlings assuming that the stocking rate is 1,000 fingerling/ha. Therefore, the total annual fish seed requirement in the State is about 28.4 million fingerlings. Assuming that a survival rate from fish fry to fingerling is around 50%, annual production of 56.8 million fish fries is to be needed in the State.

Although fish seed is the most important input for successful fish farming, it is apparent that the DOF is not going to meet the seed demand of fishers by seed production in its own seed farms. Accordingly there exists a huge gap between demand and supply of fish seeds in the State. This gap can be filled up only when individual small and medium farmers take seed production and nursing actions as micro-enterprise activities.

At present, fish farmers in Himachal Pradesh pay no adequate attention to quantity of fish seeds to be stocked, size of the seed and quality of the seed. Major factors concerning no awareness of the farmers to this most vital input are unavailability of quality seed as well as lack of information. If such situation is improved resulting in increase in farmers’ awareness to fish seeds, it is obvious that a new opportunity for small farmers can be created in terms of participation into fish seed production and nursing business activities. The activity can be said to have attractive markets, to require no high level skills, less resources and short time span of maximum 60 days and to be highly remunerative.

(2) Fish Seed Production

Today in Himachal Pradesh, trout seed production is done at six farms at Holi in Chamba district, Sangla in Kinnaur district, Hamini and Patlikuhl in Kullu district, Barot in Mandi district and Dhamwari in Shimla district, while carp seed production is carried out at Deoli in Bilaspur district, Sultanpur in Chamba district, Kangra in Kangra district, Alsu in Mandi district, Nalagarh in Solan district and Gagret in Una district. The last two carp farms have been leased out to private entrepreneurs for the period of 10 years from 2001 to 2011 under such condition as an annual lease fee of Rs. 50,000 per farm and 10 % annual increase in lease amount. Alsu carp farm is exclusively reserved for producing seed of Indian major carp and other carp farms produce common carp seed. The total rearing area available under these 12 farms is 18 ha, and the total seed production capacity is

about 9 million spawn. Assuming a spawn survival rate of 30 %, a total of 2.7 million fish fries can be annually produced. In the current year, 1.7 million standard fish fries in total were produced by 10 fish farms of the DOF, and another 1.8 million fish seeds were procured by the DOF from private suppliers, aiming to meet the stocking requirements of the reservoirs.

Aiming at protection of natural spawning grounds of fishes to allow the fish to breed naturally and to increase natural stocking of the reservoir, fishing is legally closed for two months from June 1 to July 31 every year.

The DOF has fixed a flat rate for different species irrespective of its size. The fixed rate of seed for common carp and Indian major carp is fixed at Rs. 100 per thousand, while that for grass carp is Rs. 200 per thousand. Under such flat rate system, private producers supply commonly smaller size of seeds in order to earn more profits, while farmers are unable to get bigger size of fingerlings required for table size fish production by using such smaller size of seeds. In addition, the existing huge gap of seed demand and supply condition triggers sharp increase in actual prices of fingerlings ranging from Rs. 750 to 1,000 per thousand.

(3) Germ Plasm of Common Carp

Common carp of Bangkok strain was firstly introduced in India in 1957 and it was distributed to ³various states of the country by the Central Fisheries Research Institute for the culture purpose. This fish is voraciously omnivorous and can withstand wide fluctuation in temperature. Further, it is hardy in nature especially in cold water and has prolific breeding propensity with shorter maturing period. With high consumers' preference, farmers have chosen this fish for carrying out pond/tank fisheries.

Of late, this species has shown signs of genetic fatigue in Himachal Pradesh. This genetic fatigue is considered to occur due to repeated in-breeding as well as cross-breeding with the gold fish. Resulting from the genetic fatigue, common carp growers are confronted with slower growth, low survival rate and poor health of cultured fishes.

To overcome such situation, the DOF has recently procured Amur common carp (*Cyprinus carpio haematopterus*) from Bangalore. This fish has known to be more resistance to low temperature. As the seed has been stocked at Alsu carp farm in Mandi district, results on growth and survival test are awaited.

(4) Fish Sanctuaries

The State has many fish sanctuaries on certain stretches. Deep pools of important streams locally known as “*Machhiyal*” are used as abodes of fishes and preserved as fish sanctuaries. These are the places of religious interests and importance. People throng these places and feed fishes. Nobody is allowed to catch fishes in these places. This has helped in preservation of mahseer and common carp as well as snow trout (*Schizothorax. spp*) in some deep pools. There are 17 sanctuaries, spreading nine in Kangra district, two in Kullu district, four in Mandi district, and one each in Sirmaur and Una districts.

These sanctuaries can be used for obtaining the gravid female of mahseer during spawning season. Male mahseer can be reared at farms, and artificial propagation can be done through stripping. Due to overcrowding, overfeeding caused by no control over quality and quantity of feeding, and poor water quality management, however, the stocks face danger of mass mortality.

³ Fish and Fisheries of India- V. G. Jhingran

CC-2.6.2 Harvesting, Post-harvest and Marketing Activities

(1) Harvesting

Harvesting is done by only those individual farmers who have small size ponds with outlets for draining out the water. All other farmers are dependent on outside netting teams usually controlled by the contractors. These contractors have their own netting teams and sometimes take about 30 % of the stock value. Most of the farmers have no gill nets, cast nets, hand nets and drag nets to harvest their stock. Lack of harvesting resources and skills makes farmers sell their entire stocks at once. As a result, they are not in a position to decide their harvest time to earn more benefit by considering supply-demand fluctuations in local fish markets. Some of farmers purchase usually their fish seeds from the contractors so that they are forced to sell their stocks at cheaper prices to the contractors.

(2) Post-harvest, Processing and Value Addition Activities

An organized retail chain system of fishes is completely absent in Himachal Pradesh. The retail and wholesale markets are unhygienic and have no basic facilities. So far no efforts have been made to tap international and domestic tourists. Only the fresh fish is sold in market, but processing and value addition activities to carps and rainbow trout are negligible small. In Mandi district, some shops located along the national highway No, 21 are selling home made fish pickles. There are also some small farmers who run small kiosks to sell cooked and fried chicken along with fish. No mince products like “Surimi”, sausage, battered fingers, sticks, streak, cakes and smoked fishes are supplied, although these can offer good opportunities for value addition at good prices targeting international tourists. There is also demand for frozen, value added packed and processed fishes and fish products, as domestic tourist’s food habits are changing and they have more purchasing power now.

One farmer in Kullu district has opened one restaurant in his farm and served customers with exclusively different dishes of rainbow trout, resulting in realization of three times price compared with selling of his stock. The fish is selected by the customer from the raceway and live fish is taken out for cooking before the customer.

The DOF is implementing its fish cart scheme. As the objective of this scheme is to cater local markets only, there is no attempt to extend the fish cart scheme to small-scale aquaculture farmers. Further, no training has been imparted to the beneficiaries of this scheme.

(3) Marketing

Both inside and outside of Himachal Pradesh, there are good markets for freshwater fishes traditionally captured from rivers and reservoirs as well as increasingly cultured in ponds. Fishes are usually consumed by the community people, although most of the Hindus who are non-vegetarian refrain from eating fish on Tuesday Thursday and Saturday. During the fishing close months and some other parts of the year fishes are brought in Himachal Pradesh from Punjab and other states. It is estimated that about 60% of the fish is consumed locally and the rest is marketed to other states. A total of 818-ton fishes worth Rs. 2.72 million were supplied into the State from the outside, while 802-ton fishes worth Rs. 4.99 million were sent to outside markets from the State.

Those contractors who purchase fishes from the societies of the Gobind Sagar Reservoir send fresh fishes to the fish market at Nangal in Punjab. These fishes are sorted out and graded in this market. The big size fish is then sent to New Delhi or sometimes directly to Tinsukia in Assam where higher price is secured. The small size fish is repacked and then sent to Pathankot, Dehradun and Jammu. Cat fishes are preferably sold in Punjab.

The market prices range from Rs. 60/kg to Rs. 100/kg in local markets. Fresh fish commands the highest premium, but fishes of all sizes are sold at similar rates. Fish from the Pong Reservoir commands higher price as compared to other two reservoirs. Exotic species like common carp, silver carp and grass carp also fetches good price. Cat fishes fetch at a price of Rs. 100/kg to Rs. 120/kg in retail market. The wholesale prices of fishes from the Gobind Sagar and Pong Reservoirs during summer and winter seasons are given in Table 2.6.1.

Table CC-2.6.1 Seasonal Fluctuation of Fish Wholesale Prices at Two Main Reservoirs

Unit: Rs./kg

Reservoir Fish species/Season	Gobind Sagar		Pong	
	Summer	Winter	Summer	Winter
Indian major carps	31 - 45	40 - 52	55 - 62	56 - 89
Mahseer, silver carp, common carp, grass carp & Kalbasu	25 - 30	35 - 40	55 - 62	56 - 89
Cat fish	31- 45	40 - 52	55 - 62	56 - 89

Source: Department of Fisheries, Himachal Pradesh State Government

In case of fishes cultured in community ponds, backyard ponds and other impoundments, big farmers sell their stock at the farm to the contractors who harvest, carry and sell fishes in outside markets. The current prevailing price offered by these contractors is Rs. 30/kg for all variety of fishes with the weight of 0.7 to 1.2 kg. On the other hand, small farmers who have less quantity of their produce sell fishes in the local market at a price ranging from Rs. 40/kg to Rs. 50/kg after harvesting their stock by themselves. There is very little market intelligence for fish demand especially in rural areas.

CC-2.7 Fishery Administration

(1) Department of Fisheries

The Department of Fisheries (DOF) of the State Government is fully responsible for carrying out the following mandates:

- a. To increase fish production in the State by judicious management of all the culturable water resources;
- b. To develop reservoir fishery of the State with an aim to increase per hectare production from the open impoundments;
- c. To undertake breeding program of Indian and exotic carps, mahseer, trouts and other sub-temperate species for augmenting the seed stocking program in reservoirs, rivers and streams, and tributaries;
- d. To protect and conserve reservoir and lacustrine fisheries resources of the State;
- e. To promote game fishery in the State with particular emphasis on promotion of tourism;
- f. To promote commercial farming of rainbow trout in the high altitude areas;
- g. To promote aquaculture in the State by providing technical and financial assistance to the fishermen and rural youths; and
- h. To generate employment opportunities in the fishery sector and ameliorating the condition of fishermen in the State.

Organization of the Department of Fisheries is given below:

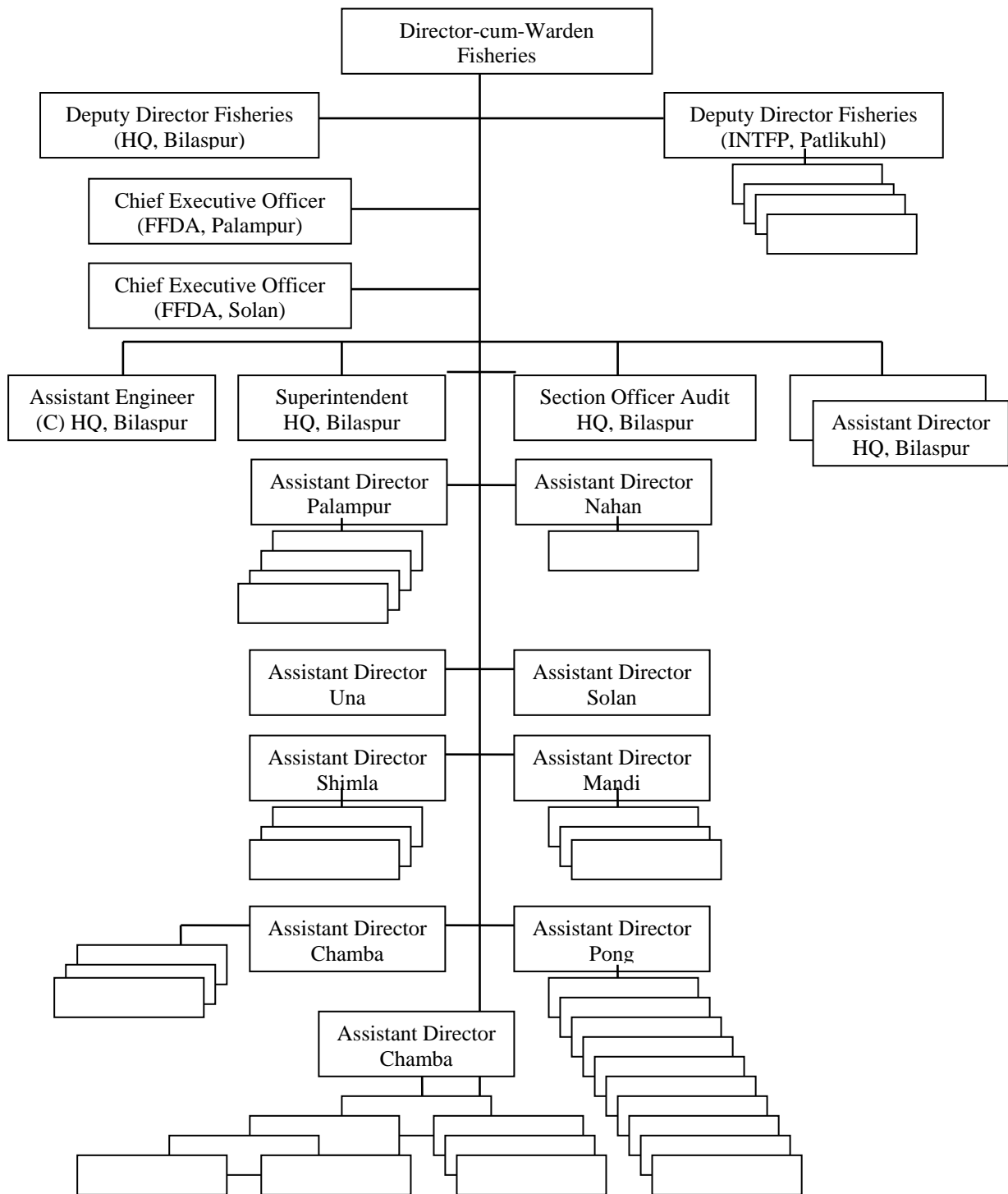


Fig. CC-2.7.1 Organization Chart of Department of Fisheries under Himachal Pradesh State

The DOF is headed by the Director cum Chief Warden of Fisheries with headquarters at Bilaspur. Its organization is illustrated in Fig. CC-2.7.1. In the headquarters, one Deputy Director assists the Director and another Deputy Director manages the Patlikuhl trout farm. In order to implement the Central Government sponsored schemes, two Chief Executive Officers are stationing in the Fish Farmers Development Agency (FFDA) offices at Palampur and Solan. A total of nine Assistant Directors is appointed at district level, staying in Bilaspur, Chamba, Mandi, Shimla, Solan and Una as well as Nahan, Palampur and Pong.

Major works of the DOF are reservoir management and control. Up to date, the DOF has taken many

steps to maintain the fisheries status of the reservoirs by adopting sound management and development policies including formulation and implementation of Fisheries Act, regulating mesh size of the fishing nets to allow control fishing and observance of fishing closed season. Further, the DOF has a stringent watch and ward system in places. At each landing centre, weighing of the daily catch and species-wise record activities are maintained by the DOF staff. Strict surveillance on mesh sizes and illegal poaching is also maintained. Regular seed stocking of Indian major carps and common carps is done. As a result, the fish fauna in the reservoirs has been able to be controlled and conserved to a considerable extent.

(2) Fisheries Research

The DOF has been providing regular grant to the Fisheries Department of College of Veterinary and Animal Science under Himachal Pradesh Agriculture University at Palampur in Kangra district since 1981/82. The grant for 2006/07 is Rs. 4.48 million. The mandate of the university is to conduct researches on fish culture technology suitable for different agro-climatic conditions of the State as well as fish pathology. Along with the mandate, the university has propagated exotic carps for mid-hill regions of the State.

(3) Fisheries Extension

The DOF has provided farmers with in-house training activities and exposure visits. Funds for training, exposure and demonstration are covered by the Central Government sponsored schemes like Fish Farmers Development Agency (FFDA) and Agriculture Technology Management Agency (ATMA). Once, a group of farmers was also sent to the Central Institute of Freshwater Aquaculture (CIFA) at Bhubaneswar in Orissa for training and exposure visit on carp farming.

Despite all these efforts of capacity building, farmers have usually no awareness on various aspects of integrated aquaculture and composite carp farming. They have also not undergone any refresher training course. Further, many farmers lack awareness on production and nursing of fish seeds, importance of stocking fingerlings, better management practices and feed quality. They have no skill for harvesting fish from their ponds, resulting that they are completely dependent on outside fish contractors for harvesting and marketing their stock.

Even though such cases are limited that some farmers are interested in learning the seed production and air breathing farming system of cat fish like magur (*Clarioides betrachus*) and pangasius (*Pangasius pangasius*). Other farmers want to introduce a package of practices for better growth of carps and to know about high growth booster quality feeds, as the carp farming practice has not been standardized in India like Japan and China. In Una district, those who have undergone training programme at CIFA have also tried to practice freshwater pearl and prawn culture. Some farmers are also interested in species diversification for ensuring sustainable and increasing fish production as well as risk hedging.

(4) Himachal Pradesh Aquaculture and Marketing Society

Himachal Pradesh Aquaculture and Marketing Society (HPAMS) is a registered organization under full control of the DOF. It is headed by a chief executive officer who works under the chairmanship of the Director of the DOF. This society receives all the sale proceedings from all trout and carp farms of the DOF as well as funds for compensating and mitigating fisheries losses from different agencies who implement power generation schemes on rivers. These funds are used for implementing different schemes for the overall growth of fisheries in the State.

In 2006/07, the total revenues of trout and carp farms of the DOF were Rs. 12.5 million, while the total amount of funds received was Rs. 78.8 million comprising Rs. 65.8 million from 27 hydro projects and Rs. 13 million from three government sponsored schemes. The HPAMS released Rs. 43.9 million in total from these funds to 24 projects and schemes including mahseer fish seed project, strengthening of post-harvest infrastructure scheme and establishment of pathological laboratory project.

(5) Fishermen Cooperative Societies

At present there are 38 fishermen cooperatives societies operating in the three Reservoirs of Gobind Sagar, Pong and Chamera. Those fishermen who are interested in fishing in these reservoirs have to get a yearly license for fishing from the DOF by paying a nominal fee of Rs. 100 every year. The license is issued on the recommendations of the fishermen cooperatives society management committee. The reservoirs have been divided into different beats, and the societies are allowed to allot fishes in their respective beats. This avoids conflict amongst the different societies. Every societies call open bids before the beginning of fish harvesting from different contractors. The society collects fish catches from the individual members and weighs collected fish catches at a fixed landing centre. Payment is received from the contractor usually within 10 days. The society charges 5 % commission from its members to meet the overhead and operational cost. A royalty of 15% is also paid to the DOF. At the end, the individual member receives 80% of total sale price of fish catch, which is relatively high as compared to other states.

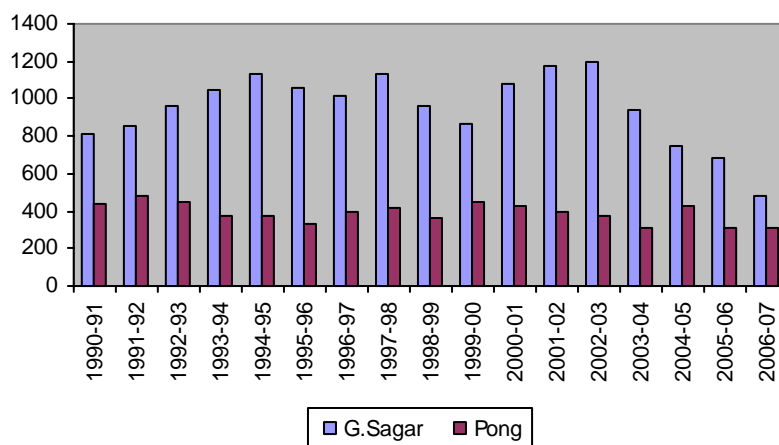
The fishermen of these reservoirs are full time licensed fishermen. The monthly income ranges from Rs. 800 to Rs. 3,000. On an average, each fisherman has one boat with the size of 16 x 3 x 2 feet and costing approximately Rs. 2,000. On an average, every fisherman has 3 to 4 nylon gill nets with about 40 kg of weight and 100 to 140 mm size mesh. Although useful life of the net is about 1 to 2 years, the fishermen spend about Rs. 10,000 every year for repairing nets. In 2006/07, the average annual fish catch was 240 kg per fisherman for the period of 300 fishing days. The average income of the fishermen was estimated at around Rs. 10,600.

CC-2.8 Analysis of Current Fisheries Situation in Himachal Pradesh

CC-2.8.1 Current Trends and Change in Fish Production

(1) Capture Fisheries Production

By analyzing the fish landing records in the Gobind Sagar and Pong Reservoirs for the past 17 years from 1990/91 to 2006/07 as illustrated in Fig. CC-2.8.1, it is found that fish production in the Gobind Sagar Reservoir shows sharp declining trend after achieving the highest production of 1,202 tons in 2002/03 and also the production of the Pong Reservoir has been stagnant at 400 kg level. Annual fish catch of riverine fisheries has been stable at a level of 4,000 tons.



Source: Department of Fisheries, Himachal Pradesh State Government

Fig. CC-2.8.1 Long-term Fish Landing Trend in Gobind Sagar and Pong Reservoirs

Many factors can be considered to trigger such occurrence of noticeable declining trend of fish production especially in the Gobind Sagar Reservoir. These are heavy silting, pollution, water level fluctuations, illegal and uncontrolled mining, increase in construction activities of dams and hydro power stations at upstream, and erosion of banks due to flooding and rains coupled with throwing of the overburden and other waste materials into the river bed.

All of such adverse activities are out of control by the DOF, resulting in the loss of breeding ground of fish. Therefore, the both schemes sponsored by the Central and State Governments rather stress to improve welfare of fishermen who engaged in capture fishing in the reservoirs than to implement physical countermeasures to reduce the said adverse effects on the existing reservoir fisheries. Although the DOF has received funds for compensating and mitigating fisheries losses from hydro power developers, these funds are principally utilized for implementation of projects/schemes to promote/support culture fisheries activities, and fish farmers depending on riverine fisheries are limitedly benefited by utilizing outputs of these projects/schemes. However, no action has been so far taken aiming at establishment of new resource management system such as co-management of reservoirs and collaboration with other stakeholder departments in the State.

(2) Pond/Tank Fisheries Production

Aquaculture consists of the following four components:

- a. Spawning of brood fish and hatching of eggs;
- b. Nursing of the hatchlings to ensure a timely supply of fish fry and fingerlings;
- c. Growing of fish to market size in water stored in dug-out ponds, small backyard ponds, storage tanks constructed under different schemes, and seasonal and perennial community ponds; and
- d. Harvesting and marketing of fish.

It is apparent that the both reservoir and riverine fisheries activities are under perpetual threats for the reasons beyond the control of administrative actions. In the present scenario, therefore, fish production from ponds/tanks seems the only viable option in the State. However, no inventory survey has been made by the DOF to grasp distribution of water bodies suitable for practicing culture fisheries. Further, no fish farmers are involved in the first two components, while almost all of fish farmers practice the

last two components.

(3) Carp Farming Production

Most of pond/tank fish culture farmers have been able to grow carps and cat fishes by utilizing locally available feeding materials, but those who are doing small-scale aquaculture in small ponds confront with harvesting problems because they have no fishing nets and no contractors show their interests in harvesting works due to too small size of the ponds. In medium size ponds, contractors who are ordered by fish farmers to harvest their stock face problems caused by irregular or too deep bottom of the pond for netting works.

(4) Trout Farming Production

With continuous efforts of the DOF, trout farming system has become established in Himachal Pradesh so that individual farmers have commercially practiced table size trout production at places where perennial cold water resources are available. However, there remain some barriers for further exploitation of trout farming potentials in the State as follows:

- a. Trout farming requires heavy capital investment in the initial stage as well as high operational cost to procure the inputs like fish fry and special feed. In trout farms, the stock is always susceptible to diseases and there is no insurance system to cover such risks. All these constraints make trout farming a “high risk high gain” type of investment and act as the impediment in taking up this farming by small and marginal farmers;
- b. There is only one feed mill in Kullu district catering to all the trout growers in the State. The special feed for trout has a limited shelf life, posing problems to those growers who are based far away from this feed mill; and.
- c. Even though the farm gate price of table size trout ranges from Rs. 300/kg to Rs. 330/kg, the common market channel has not been developed. At present, trout farmers send their stock upon irregular orders from specific restaurants in Delhi and Mumbai through commission agents or their own channels established by themselves.

CC-2.8.2 Current Trends and Change in Ancillary Fishery Activities

(1) Fish Seed Production

The current flat rate policy of fish seeds applied by the DOF is one of the reasons why no entrepreneur enters into fish seed production activities although there has been a huge gap of demand and supply situation of fish seeds in the State. Insufficient technical support also makes privately operated carp seed farms produce seeds of common carps without any requirement of high level technologies like Indian major carps and exotic carps for which big demands have been continuously available.

The usual practice in other state is that rates are fixed on the size basis, as this can help administrative sides conduct better regulation and control of fish seed quality as well as seed producers also get good price for bigger size of the fish seed. Under this system, private seed producers are encouraged to grow bigger fingerlings for longer period, and fish farmers also get fingerlings which can be grown for shorter period with higher survival rate.

(2) Information Source and Marketing and Value Addition

At present, there is no service provider operated either public institutions or private organizations like NGO in the State to respond grass-roots requests from fishermen in terms of inputs and supply for fish culture, information on access to micro-credit sources and advanced fisheries schemes, networking of

reference information and other supporting services.

No action has been officially taken to encourage small fish farmers to shift from traditional self-supply based fish culture to market-based modern aquaculture based on marketing and value addition activities.

(3) Leasing System of Ponds

The present leasing tenure prevailing in Himachal Pradesh is based on the 5-year term which is very short to generate sustainable income of leaseholders. Initial years have to be spent for unproductive activities like cleaning and repairing the ponds, getting information about inputs, arranging credit to buy fish seeds. In many leasing cases, the focus of Gram Panchayat for leasing out community ponds is put on the maximization of revenues without any attention to betterment of access and conservation conditions. For the purpose of securing sustainable pond management in an adequate manner, the 10-year term is usual for leasing out community ponds in other states.

(4) Local Advisory Services and Formation of Producers Organization

Due mainly to the shortage of staff and lower policy priority, there is no local advisory service system in the State. Therefore, those fish farmers who have newly started pond/tank fish culture have very less chance to obtain such aquaculture information which is the pressing need of them as information supply sources, logistical supports, financial supports, input material resources and adverse factors to reduce production.

Although the existing federation of the 38 fishermen cooperative societies called Bilaspur Fisheries Marketing and Supply Federation has dissolved huge losses, it has no management and financial energy at present enough to spare for upgrading input supply, technical support and marketing services upon the requests of member fishermen cooperative societies.

CC-3 Fish Culture Development Potential

CC-3.1 Development Potentials

CC-3.1.1 Criteria for Identification of Fisheries Development Potentials in Himachal Pradesh

As discussed in Chapter 2, there are two types of fisheries in Himachal Pradesh. One is capture fishery and the other is culture fishery. Further, fish seed production is the prerequisite for supporting fish production. Specific features of agro-climate and geography particular to the State have contributed to create a wide range of fisheries development potentials in terms of fishery activity and fish seed production. However, the scope of enhancement of fish production from reservoirs and rivers/streams is limited in the State, because adverse effects on capture fishery production are mostly out of control by the DOF. In this regard, it is important to lay stress on aquaculture which is fish farming by use of water bodies available in the form of pond and tank as well as water course with constant running water.

Aiming to formulate a potential development plan in line with the above consideration, criteria for identification of culture fishery development and fish seed production potentials are set up as summarized in Table CC-3.1.1.

Table CC-3.1.1 Criteria for Identification of Fisheries Development and Fish Seed Production Potentials

Item	Criteria
Culture fishery	<ul style="list-style-type: none"> • Existence of ponds, tanks and/or check dams with regular and/or seasonal source of water as well as waterlogged, derelict, swampy and marshy land • Availability of running water bodies with either cold or warm perennial water sources • Presence of successful and replicable cases of fish culture farms
Fish seed production	<ul style="list-style-type: none"> • Existence of continuous seed demand and supply gap • Availability of progressive fish farmers willing to be involved in fish seed production in an entrepreneur manner

Source: JICA Study Team

CC-3.1.2 Identified Fisheries Development Potentials

Fish culture development potentials are to be identified by each type of culture fisheries activities listed up Table CC-3.1.2, based on the above criteria presented in Table CC-3.1.1. The identified potentials of each type as summarized on district basis in Table CC-3.1.3 have a wide range according to the availability and condition of water bodies. Therefore, the level of potentials is shown in four ranks such as high, medium, low and none.

Table CC-3.1.2 District-wise Potentials of Culture Fisheries in Himachal Pradesh

Type	BP	CH	HM	KG	KN	KU	LS	MD	SH	SM	SO	UN
Pond and tank fisheries	-	-	-	-	-	-	-	H	-	M/H	M/H	H
Carp culture in running water	M	H	-	L/M	M	-	-	M	-	-	-	-
Trout culture in raceway	-	M	-	-	M	H	-	M/H	L	L	-	-
Integrated fish farming	-	-	-	L/M	-	H	-	M/H	-	M/H	M/H	H
Check dam fisheries	-	-	H	-	-	-	-	-	-	-	-	-

Note: BP; Biraspur, CH; Chamba, HM; Hamirpur, KG; Kangra, KN; Kinnaur, KU; Kullu, LS; Lahaul-Spiti, MD; Mandi, SH; Shimla, SM; Sirmaur, SO; Solan, and UN; Una as well as H; high, M; medium, L; low and blank; none for fish culture potential.

Source: JICA Study Team

Table CC-3.1.3 District-wise Potentials of Fish Seed Production and Nursing in Himachal Pradesh

Type	BP	CH	HM	KG	KN	KU	LS	MD	SH	SM	SO	UN
Fish Seed Production												
• Indian major cap	M	-	M/H	M	-	-	-	M	-	H	H	H
• Common carp	H	H	M/H	M/H	-	-	-	L/M	-	H	H	H
• Cat fish	-	-	H	M	-	-	-	M	-	H	H	H
• Mahseer	H	-	-	-	-	-	-	-	-	M	-	-
• Ornamental fish	H	H	M	H	-	-	-	L/M	-	-	-	-
Fish Seed Nursing												
• Indian major cap	-	-	-	-	-	-	-	-	-	-	-	-
• Common carp	-	-	-	-	-	-	-	M	-	M/H	M/H	H
• Ornamental fish	-	-	-	-	-	-	-	M	-	-	-	M

Note: BP; Biraspur, CH; Chamba, HM; Hamirpur, KG; Kangra, KN; Kinnaur, KU; Kullu, LS; Lahaul-Spiti, MD; Mandi, SH; Shimla, SM; Sirmaur, SO; Solan, and UN; Una as well as H; high, M; medium, L; low and blank; none for fish culture potential

Source: JICA Study Team

CC-3.2 Constraints to Exploitation of Fisheries Development Potentials

In general, constraints for exploiting development potentials of fish production are closely related to various issues of the both ancillary fisheries activities and institutional arrangements. From this viewpoint, various constraints which need to be overcome in exploiting development potentials of fish production in Himachal Pradesh are listed up as shown in Table CC-3.2.1.

**Table CC-3.2.1 Constraints for Exploitation of Development Potential
of Fishery Sector in Himachal Pradesh**

Item	Constraints
Fish Culture	<ul style="list-style-type: none"> • Limited or lack of knowledge about small-scale aquaculture including importance of stocking fingerlings for better growth and survival, importance of stocking fingerlings for better growth and survival, and fish diseases • Limited awareness about water resources and quality as well as sedimentation of silt and choking of weeds in ponds • Shortage of required size of fish fingerlings • Non availability of quality concentrated feeds at affordable costs • No knowledge and skills to operate modern crafts and gears for fish harvesting among farmers
Fish Seed Production	<ul style="list-style-type: none"> • Shortage of seed supply due to less capacity of existing DOF fish seed farms than the demand • Lack of knowledge and skill for seed production and limited awareness about low cost seed production methods among the farmers • Very limited area with available water sources for rearing the seed produced up to fingerling stage • Lack of demonstrations units for fish seed production and rearing • Limited understanding about value of fish seeds among farmers • Lack of organized fish seed market
Ancillary Activities	<ul style="list-style-type: none"> • No institutions of undertaking training on aquaculture, disease investigation and surveillance, and demonstration of fish seed nursing • Lack of access to credit as well as organized retail market and supply chains as well as unavailability of insulated vans and cold storage • Limited capacity and knowledge about processing, and lack of domestic markets for the processed products • Lack of support agency to motivate unemployed youth with initial reluctance to take up the role

Source: JICA Study Team

CC-3.3 Necessity and Requirements for Rational Plans of Potential Development

(1) Fish Culture and Fish Seed Supply

Taking into account development potentials of fish culture and fish seed production as well as constraints for exploitation of such potentials prevailing in Himachal Pradesh, the necessity and requirements for drawing up rational plans of potential development are taken up as shown in Table CC-3.3.1.

Table CC-3.3.1 Necessity and Requirements for Rational Plans of Potential Development

Item	Development Potential	Necessity and Requirements
Fish Production	Pond/tank fisheries production	<ul style="list-style-type: none"> • Necessity: Promotion of low cost small-scale fish culture using simple technology with a target of local markets expecting high value returns to farmers • Requirement: Fish culture storing fishes in various water bodies including check dams for minimum 6-month period as well as preferable possibility of being integrated with crop cultivation and livestock rearing to generate high productivity and profitability of pond/tank fisheries culture
	Carp farming in running water	<ul style="list-style-type: none"> • Necessity: Introduction of common carp species with adaptability to a wide fluctuation of water temperature and hard nature as well as having a feature of short maturity period • Requirement: Transplant of improved strain of common carp to be implemented only after the success of rearing fingerlings at the Alsu carp farm of the DOF in Mandi district
	Trout Farming in raceways	<ul style="list-style-type: none"> • Necessity: Enhancement of fish species suitable for economical culture of table size fish in cold water areas • Requirement: Transplant of Arctic char to be implemented only after the success of rearing fingerlings at the Patlikul trout farm of the DOF in Kullu district

Item	Development Potential	Necessity and Requirements
Fish Seed Supply	Fish seed production	<ul style="list-style-type: none"> • Necessity: Narrowing of demand and supply gap of carp and cat fish seeds • Requirement: Medium-scale investment to meet moderate size infrastructure requirement for Indian major carp and cat fish seed production
	Fish seed nursing	<ul style="list-style-type: none"> • Necessity: Stocking of a large size of fingerlings in small scale fish farms aiming to shorten feeding period of fishes growing up to table size • Requirements: Availability of hatcheries nearby as a supply source of fish seeds and water bodies with regular water supply source

Source: JICA Study Team

(2) Ancillary Activities

In order to make fish production and fish seed supply sustainable, it is indispensable for taking various actions in terms of technical and financial supporting services, marketing and value addition, institutional arrangements and organizational aspects. The necessity and requirements of such ancillary activities for backing up potential development are summarized in Table CC-3.3.2.

Table CC-3.3.2 Necessity and Requirements for Ancillary Activities for Potential Development

Item	Activity	Necessity and Requirements
Supporting Services	One-stop aqua shops	<ul style="list-style-type: none"> • Necessity: Establishment of a local public or private institution under one roof to provide various supporting services to fish farmers involved in small scale fish culture • Requirement: Participation of NGO and other local institutions/authorities acting as micro-enterprises coupled with linkage with different financial institutes
	Marketing and value addition	<ul style="list-style-type: none"> • Necessity: Linking up of small-scale aquaculture farmers with market based aqua economy • Requirement: Linkage with tourism promotion, marketing and financial institutions
	Local advisory services	<ul style="list-style-type: none"> • Necessity: Strengthening of technical supports close to local conditions focusing on small scale fish culture in community ponds/tanks • Requirement: Capacity building of local youths to enable them to act as block level cadre
Institutional Arrangements	Leasing system of ponds	<ul style="list-style-type: none"> • Necessity: Improvement of community pond lease conditions to secure leaseholders' earnings • Requirement: Renovation of awareness on leasing period required for realization of sustainable fish production among all stakeholders
	Formation of producers organizations	<ul style="list-style-type: none"> • Necessity: Organization setting up among fish farmers engaged in small scale fish culture in community ponds and other water bodies • Requirement: Mutual consent among all small fish farmers concerning establishment of a new organization and function towards formation of regional federation

Source: JICA Study Team

CC-3.4 Identification of Fisheries Development Potential Areas

As the availability of water bodies within each of 12 districts in Himachal Pradesh varies, the district-wise development potentials identified as shown in Tables CC-3.1.2 and CC-3.1.3 are re-examined on the block basis considering physiographic conditions of the respective blocks. The list of blocks where development potentials are identified is presented in Table CC-3.4.1 for the small scale fish culture.

Table CC-3.4.1 Block-wise Potentials of Small Scale Fish Culture (1/2)

District	Block	Pond and Tank Fisheries	Carp Culture in Running Water	Trout Culture in Raceways	Integrated Fish Farming	Chek Dam Fisheries	
Bilaspur	1 Bilaspur Sadar	-	M	-	-	-	
	2 Geharwin	-	-	-	-	-	
	3 Ghumarwin	-	-	-	-	-	
	Whole District	-	M	-	-	-	
Chamba	4 Bharmour	-	-	M	-	-	
	5 Bhatiyat	-	-	-	-	-	
	6 Chamba	-	H	-	-	-	
	7 Mehla	-	-	-	-	-	
	8 Pangi	-	-	-	-	-	
	9 Salooni	-	-	-	-	-	
	10 Tissa	-	-	-	-	-	
	Whole District	-	H	M	-	-	
	Hamirpur	11 Bamsan	-	-	-	-	H
		12 Bhoranj	-	-	-	-	H
13 Bijhri		-	-	-	-	H	
14 Hamirpur		-	-	-	-	H	
15 Nadaun		-	-	-	-	H	
16 Sujanpur Tira		-	-	-	-	H	
Whole District		-	-	-	-	H	
Kangra	17 Baijnath	-	-	-	-	-	
	18 Bhawarna	-	-	-	-	-	
	19 Dehra	-	-	-	-	-	
	20 Fatepur	-	-	-	-	-	
	21 Indora	-	-	-	-	-	
	22 Kangra	-	-	-	-	-	
	23 Lamba Gaon	-	-	-	-	-	
	24 Nagrota Bagwan	-	M	-	M	-	
	25 Nagrota Surian	-	L	-	M	-	
	26 Nurpur	-	-	-	L	-	
	27 Panchrukhi	-	-	-	L	-	
	28 Pragpur	-	-	-	L	-	
	29 Rait	-	-	-	L	-	
	30 Sulah	-	-	-	L	-	
Whole District	-	L/M	-	L/M	-		
Kinnaur	31 Kalpa	-	M	M	-	-	
	32 Nichar	-	-	-	-	-	
	33 Pooh	-	-	-	-	-	
	Whole District	-	M	M	-	-	
Kullu	34 Ani	-	-	-	-	-	
	35 Banjar	-	-	H	H	-	
	36 Kullu	-	-	H	H	-	
	37 Naggar	-	-	H	H	-	
	38 Nirmand	-	-	-	-	-	
	Whole District	-	-	H	H	-	

Remarks: H – High, M – Medium, L – Low Potential Area

Note: The potential given in Table CC 3.4.1 has been grasped in the interview from fishery department and workshops in the 12 districts. However some more potential areas might be found through the future study.

Table CC-3.4.1 Block-wise 2003 Livestock Population Primary Data (2/2)

District	Block	Pond and Tank Fisheries	Carp Culture in Running Water	Trout Culture in Raceways	Integrated Fish Farming	Chek Dam Fisheries
Lahaul-Spiti	39 Lahaul	-	-	-	-	-
	40 Spiti	-	-	-	-	-
	Whole District	-	-	-	-	-
Mandi	41 Chachyot	M	-	-	-	-
	42 Chauntra	L	M	M	M	-
	43 Dharampur	-	-	-	-	-
	44 Drang	-	M	H	-	-
	45 Gopalpur	-	-	-	-	-
	46 Karsog	-	M	H	M	-
	47 Mandi Sadar	H	-	-	-	-
	48 Rewalsar	-	-	-	-	-
	49 Seraj	-	M	M	M	-
	50 Sundernagar	H	-	-	H	-
Whole District	H	M	M/H	M/H	-	
Shimla	51 Basantpur	-	-	-	-	-
	52 Chhohara	-	-	-	-	-
	53 Chopal	-	-	-	-	-
	54 Jubbal	-	-	-	-	-
	55 Mashobra	-	-	-	-	-
	56 Narkanda	-	-	-	-	-
	57 Rampur	-	-	L	-	-
	58 Rohroo	-	-	-	-	-
	59 Theog	-	-	-	-	-
	Whole District	-	-	L	-	-
Sirmaur	60 Nahan	-	-	-	-	-
	61 Pachhad	-	-	-	-	-
	62 Paonta Sahib	H	-	-	H	-
	63 Rajgar	M	-	L	M	-
	64 Sangrah	-	-	-	-	-
	65 Shillai	-	-	-	-	-
	Whole District	M/H	-	L	M/H	-
Solan	66 Dharampur	M	-	-	M	-
	67 Kandaghat	-	-	-	H	-
	68 Kunihar	M	-	-	M	-
	69 Nalagarh	H	-	-	H	-
	70 Solan	-	-	-	-	-
	Whole District	M/H	-	-	M/H	-
Una	71 Amb	H	-	-	H	-
	72 Bangana	H	-	-	H	-
	73 Gagret	H	-	-	H	-
	74 Haroli	H	-	-	H	-
	75 Una	H	-	-	H	-
	Whole District	H	-	-	H	-

Remarks: H – High, M – Medium, L – Low Potential Area

Note: The potential given in Table CC 3.4.1 has been grasped in the interview from fishery department and workshops in the 12 districts. However some more potential areas might be found through the future study.

CC-4 Recommended Fish Culture Development Plan

CC-4.1 Tentative Fishery Sector Development Concept

Fish provides a high biological-value protein food with additional benefits such as calcium, vitamin A, omega-3 fatty acids and iron. Deficiencies of these are detrimental to the physical and mental development of all people, especially women and children. It has been reported that 89% of the children in Himachal Pradesh suffered from mild to moderate degree of malnutrition. Many tribal diets have been found to be grossly deficient in calcium, vitamin A, vitamin C, riboflavin, animal protein and iron. Aquaculture can contribute significantly to food security and related multidimensional aspects of vulnerability associated with nutrient deficiencies and diminished scope for livelihoods.

In view of limited scopes of fish production from reservoirs and rivers/streams in Himachal Pradesh, it is important to lay stress on aquaculture which is specified as fish farming in ponds and raceways. In fact, fish production from dug-out ponds, community ponds, running water raceways and small backyard ponds has registered an impressive growth during the last decade. In order to select such a viable option for fish production in the State, therefore, it is indispensable to separate the fish culture process into three stages consisting of seed production, seed nursing and fish production. The practice of this separation enables fish culture farmers to stock bigger size of fingerlings produced in the seed nursing stage and also to increase stocking density of fingerlings in their water bodies. In addition, ancillary activities should be practiced in the form of package to support culture fisheries focusing on institutional and organizational issues.

CC-4.2 Recommended Fish Culture Development Plan

CC-4.2.1 Fish Culture

It is evident that Bilaspur, Hamirpur, Kangra, Mandi, Sirmaur, Solan and Una districts have scope and potential for fish production from various types of ponds and impoundments. If running water sources are available for some period, fish culture in these ponds and impoundments can be more efficiently carried out. In addition, the State has more than 700 check dams at present and will have another 500 check dams in near future.

To develop fish culture potentials by utilizing these water bodies, the following types of fish culture is to be promoted in Himachal Pradesh:

- a. Composite culture to grow two or three different fish species in one water body including Indian major carps, grass carp, cat fish and mahseer;
- b. Culture of exotic carp in hilly regions including silver carp;
- c. Culture of common carp in running water using streams and irrigation canals;
- d. Trout culture in raceways where perennial cold water sources are available; and
- e. Integrated agriculture-aquaculture by means of waste recycling focusing on such capacity of fishes to convert efficiently low-grade feeds and wastes into high-value protein.

CC-4.2.2 Fish Seed Supply

(1) Fish Seed Production

Assuming that about 500 ha will become available for fish culture in the near future in addition to the existing area of 675 ha under the pond fish culture, the total annual seed requirements for fish culture will increase to 38.75 million fingerlings based on stocking rates of 50,000 small fingerlings for the

existing ponds and 10,000 small fingerlings for new water bodies. Further, 25 million fingerlings are needed for the reservoir fisheries. Against such a large volume of fish seed requirements, the DOF can annually supply 3.5 million fish fries comprising 1.7 million fish fries produced in 10 fish seed farms of the DOF and 1.8 million fish fries procured from private nurseries.

In this State, common carp of Bangkok strain introduced in 1957 in India and now preferably selected in small scale fish culture has shown a sign of genetic degradation caused by repeated in-breeding and cross breeding with the gold fish. As a result, fish farmers are facing such problems as slower growth, low survival rate and poor health. In this regard, introduction of a new species is to be promoted.

Considering the existence of such big gap between demand and supply, the following types of fish seed production farm are to be developed in the form of private enterprises:

- a. Indian major carp seed production;
- b. Cat fish seed production;
- c. Common carp seed production, and introduction of a new species of Bangkok strain;
- d. Mahseer seed production; and
- e. Ornamental fish seed production.

(2) Fish Seed Nursing

In Himachal Pradesh, a survival rate from fish fry to fingerling is around 50%. In addition, fish farmers prefer to stock small fingerlings of 10 to 15 mm in size, resulting in that the feeding period in their ponds is prolonged. The practice to stock larger fingerlings of 40 mm can improve fish productivity in the pond.

Taking this situation into account, a new avenue to bridge a niche is to promote fish seed nursing activities in an entrepreneur manner for small fish farmers. This activity will have captive markets and require simple skills, little resource inputs and short period of maximum 60 days. Based on the current demand situation, the following types of fish seed nursing are to be developed:

- a. Nursing of Indian major carp;
- b. Nursing of common carp; and
- c. Nursing of ornamental fish.

CC-4.2.3 Fish Culture Supporting Services

(1) One-Stop Aqua Shop

Aiming at provision of various supporting services to fish farmers involved in small scale fish culture, a one-stop aqua shop is to be established and operated either publicly or privately. In operating this one roof shop, it is promoted to encourage NGO and other local institutions/authorities to participate, act as micro-enterprises and make linkages with different financial institutes. The one-stop aqua shop is basically established on the block basis. The functions of this one-stop aqua shop are as follows:

- a. Provision of information on access to technical support and advices;
- b. Arrangement of special fish feeds and materials; and
- c. Supply of any services matching the specific local conditions and fish farmers' needs.

(2) Marketing and Value Addition

In order to enable fish farming groups with a channel to fish markets or agents as well as tourist

centers, it is promoted to develop fish marketing system and simple fish processing system with an assistance from relevant agencies.

CC-4.2.4 Institutional Arrangements

(1) Leasing System of Ponds

These water bodies are mostly managed by the local community like Gram Panchayat. As these ponds and impoundments are usually not maintained well, there exist many problems such as overgrowth of weeds, silting and choked water bodies. Normally, it takes at least one year to solve such problems prior to introduction of fish culture in these water bodies. The present policy to lease out these ponds and impoundments for fish culture purpose is formed of two issues. One is the lease period which is usually fixed at five-year term and the other is the leaseholder which is limited to the individual.

For the purpose of securing sustainable and productive fish culture in water bodies under the management of Panchayat or Water Users Association, it is promoted to improve legal backgrounds through line departments for extending the lease period to 10 years similar to other states and also for leasing out to a group of fish farmers. Another legal promotion is to enable small-scale fish farming groups to use the source of irrigation water aiming at betterment of water management in ponds/tanks.

(2) Local Advisory Services

It is prerequisite for providing small-scale fish farming groups with technical supports to strengthen extension activities on fish culture matching with local conditions. Under the limited availability of fisheries extension staff in the DOF, it is promoted to encourage unemployed local youths to work as an aquaculture cadre at the block level through offering the opportunity for capacity building.

(3) Formation of Producers Organization

Apart from the reservoir fisheries, no fishermen cooperatives and federations have been organized among fish farmers who are engaged in pond/tank fish culture. To enable these fish farmers to carry out water management of pond/tanks in a proper manner with necessary frequency as well as to undertake marketing and value addition activities in an efficient and effective manner, it is promoted to encourage them to set up producers group at each water body and federation at block or district basis.

CC-4.3 Recommended Action for Fish Culture Development

Among the development plans on fish seed production, fish seed nursing and fish production fisheries taken up in the Master Plan, principal requirements for the promotion of fish culture are group activities by participants of fish farming in a local community. In due consideration of the current level of farmers' awareness and skills about the fish culture in Himachal Pradesh, it is prerequisite to commence various actions in advance aiming to create the basis to encourage farmers to start small scale fish farming as a group activity.

These actions are composed of two stage-wise groups. The following actions need to be taken in the initial stage especially for the farmers group to enter fish culture first time:

- a. Identification of resource persons;
- b. Formation of a group under the guidance of resource persons and selection of a group leader;
- c. Formulation of a shared vision for mission and goal of the group;

- d. Preparation of logical frame work (LFA) plan;
- e. Development of monitoring and learning tools;
- f. Detailed resource mapping in identified select candidate sites;
- g. Selection of candidate sites for piloting activities;
- h. Operation of pilot fish culture activities; and
- i. Learning of feed back items from success and failures of pilot activities and fine tuning of approach and strategies.

Actions listed up below need to be taken by all stakeholders including individual fish farmers who have experienced fish culture activities with unsuccessful operation as well as the DOF and other public and private institutions:

- a. To design and offer capacity building programs for training trainers in terms of small-scale fish farming practices including negotiation and valuation skills, operation of aquaculture micro-enterprises, marketing fish, organization of local advisory services and running of a one-stop aqua shop;
- b. To design and launch advocacy campaigns for the above activities in order to raise awareness;
- c. To encourage a fish farmers group to keep convergence with other fish farmers groups, FFDA, ATMA, and other institutions as well as to practice weeding, dredging and digging of pond as labor schemes;
- d. To design and offer capacity building program to engineers in terms of water harvesting structures to be used for small-scale aquaculture;
- e. To manage an empowerment program in selected locations; and
- f. To conduct awareness raising and sensitization among private sector suppliers, the DOF and line departments in terms of the concepts of small-scale aquaculture, integrated agriculture-aquaculture and one-stop aqua shop as well as building of links with suppliers and rural banks.

It is desirable to take the above actions prior to the promotion of small-scale fish culture development policy in the State.