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PROJECT COMPLETION REPORT

BHUTAN

**SECOND FORESTRY DEVELOPMENT PROJECT
(CREDIT 1900-BHU)**

May 28, 1996

**Agricultural and Water Operations Division
Country Department II
South Asia Regional Office**

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PROJECT COMPLETION REPORT
BHUTAN
SECOND FORESTRY DEVELOPMENT PROJECT
(Credit1900-BHU)

CURRENCY EQUIVALENTS

Project Year	Conversion Rate (Nu./US\$)	Conversion Rate (US\$/SDR)
1987/88	13.0	1.30
1988/89	13.0	1.25
1989/90	16.7	1.32
1990/91	18.3	1.42
1991/92	25.8	1.38
1992/93	29.9	1.34
1993/94	31.4	1.38

FISCAL YEAR OF BORROWER

July 1-June 30

WEIGHTS AND MEASURES

The International Metric System is Used Throughout This Report.

ABBREVIATIONS

BLC	Bhutan Logging Corporation
DCA	Development Credit Agreement
DFO	Divisional Forest Officer
ERR	Economic Rate of Return
FAO	Food and Agriculture Organization
FD	Forest Department
IDA	International Development Association
IRR	Internal (Financial) Rate of Return
Nu	Bhutan Ngultrum
RGOB	Royal Government of Bhutan
SAR	Staff Appraisal Report
SDC	Swiss Development Cooperation
SDR	Special Drawing Rights
SwF	Swiss Franc
TA	Technical Assistance
UNDP	United Nations Development Program
US\$	United States Dollars
WB	World Bank

May 28, 1996

**OED EVALUATIVE MEMORANDUM
ON PROJECT COMPLETION REPORT**

Bhutan: Second Forestry Development Project (Credit 1900-BHU)

The Bhutan Second Forestry Development project, supported by Credit 1900-BHU for SDR 0.8 million (US\$1.06 million equivalent) and US\$1.03 million reallocated from the Bhutan First Forestry Development project, Credit 1460-BHU, was approved in FY88. The credit closed on schedule in FY94. The project was cofinanced with a contribution of SwF8 million (US\$5 million equivalent) from the Swiss Development Corporation (SDC). The credit was not fully disbursed because foreign exchange gains made more local currency available than expected, and implementation proceeded faster than planned. At completion, an undisbursed balance of SDR 198,000 (US\$262,000 equivalent) was canceled. The Project Completion Report (PCR) was prepared by the South Asia Regional Office. Comments by the borrower are included as Part 2.

The project was prepared in response to borrower concern over increased degradation of Himalayan forest areas caused by insect infestations that endangered tens of thousands of hectares of forest in three western districts of Bhutan. The objectives of the project were to: (i) strengthen the capacities of the Bhutan Logging Corporation (BLC) and the Forest Department (FD) in the fields of forest pest management, forest management planning, reforestation and harvesting; (ii) salvage and market insect-damaged trees before they deteriorated; and (iii) reforest affected areas. These objectives were to be met through project components for forest pest management; mechanized logging; road construction; workshop provision and upgrading; forest nursery development; reforestation; marketing support; and strengthened management of the BLC.

The project had a satisfactory outcome, was well designed, with a clear conceptual foundation and pragmatic objectives. A pre-project year in which several start-up activities were initiated provided experience from which subsequent implementation benefited. Experience gained by SDC, in the Integrated Forestry Development Project in Central Bhutan, and technical assistance provided by UNDP/FAO, also provided valuable experience on aspects of project design and implementation. As a result, the project achieved most of its major objectives, establishing a capacity to monitor and control forest pests, introducing mechanized logging, building roads in ways that limit erosion, and strengthening management of BLC. Forest nursery and road construction exceeded their targets substantially, and forest regeneration approached 92 percent of the planned target. Accounting and management information systems were established. Logging activity was below expectations, however, achieving only 68 percent of the planned area and 35 percent of the planned volume. But this was partly a result of the project bringing pest infestations under control quickly, and partly the result of changes in government policy which placed a moratorium on logging in areas without forest management plans. The Economic Rate of Return was reestimated to be 39 percent, slightly below the 42 percent estimated at appraisal, but still very high. The Financial Rate of Return, however, was reestimated to be only 2 percent, well below the 55 percent estimated at appraisal. The cause of this decline was the government requirement that BLC price its domestic products well below the market price, providing a substantial,

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uncompensated subsidy to domestic consumers of logs and timber, and undermining prospects for sustainability.

The Operations Evaluation Department (OED) rates the outcome of the project as satisfactory and institutional development as substantial. Sustainability is rated as uncertain because BLC has been unable to set prices for its products which cover its operating costs, plus a reserve for equipment financed under the project, and a modest profit.

Lessons learned from this project are: (i) high quality at entry and borrower commitment contribute to satisfactory project outcome; (ii) cofinancing and technical assistance can contribute to effective project performance, but the details of these relationships should be defined during project preparation, not after credit approval; and (iii) clear definition of, and commitment to, policies on natural resource use and pricing must be sought during project preparation to avoid disagreements during implementation.

The PCR is satisfactory, providing a comprehensive account of project preparation, implementation, results and future outlook. The PCR includes project performance indicators, the aide memoire of the PCR mission, an operational plan for the post-project period through 1997, and a post-implementation assessment of the forest pest management situation. Part 2, however, fails to address the issue of financial sustainability of BLC.

No audit is planned.

Robert Picciotto
by Ulrich Thumm

Attachment

PROJECT COMPLETION REPORT
BHUTAN
SECOND FORESTRY DEVELOPMENT PROJECT
(Credit 1900-BHU)

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PROJECT COMPLETION REPORT

BHUTAN

SECOND FORESTRY DEVELOPMENT PROJECT (Credit 1900-BHU)

PREFACE

This is the Project Completion Report (PCR) for the Second Forestry Development Project in Bhutan, for which IDA Credit 1900-BHU in the amount of SDR 0.8 million was approved on May 9, 1988. The project was co-financed by a contribution from the Swiss Development Cooperation (SDC) in the amount of Swiss Francs (SwF) 8 million. Final disbursement from the Credit was made on April 14, 1994 at which time the undisbursed balance of SDR 198,004.91 was cancelled. Of the Swiss Francs (SwF) 8 million grant contribution from SDC, a total of SwF 5,603,061.60 (70%) was disbursed, leaving an undisbursed amount of SwF 2,396,938.40 which was cancelled.

Parts I and III of the PCR were prepared by a mission from the Asia Technical Department's Environment and Natural Resources Division which visited Bhutan in June 1994. Part II was prepared by the Borrower. The PCR was based on a review of the Staff Appraisal Report (SAR) and legal documents, supervision reports, project files and correspondence, field visits and discussions with beneficiaries, the Borrower and implementing agency representatives, the co-financier, and Bank staff associated with the project. SDC was consulted during the preparation and review of the PCR and their comments have been taken into account.

PROJECT COMPLETION REPORT

BHUTAN SECOND FORESTRY DEVELOPMENT PROJECT (CREDIT 1900-BHU)

EVALUATION SUMMARY

Objectives

1. The objectives of the Second Forestry Development Project were to strengthen the managerial and technical capacity of the Bhutan Logging Corporation (BLC) and the Forest Department (FD) in the fields of forest pest management, forest management planning, reforestation, harvesting and marketing of timber products and financial control.

Implementation Experience

2. The project was implemented over a six-year period between 1988 and 1993. During the first three years, project activities were concentrated on salvage of timber killed by an infestation of bark beetle and in reforestation of the affected areas. The pest attack was controlled earlier than expected and at the mid-term review it was decided that the project should shift from salvage of dead and dying trees to selective harvesting of mature and over-mature trees, as prescribed by forest management plans.

Project Results

3. Project actions led to a solution for the emerging environmental problems stemming from degradation of natural forests through an epidemic of bark beetle infestation brought on by unsanitary logging in settled areas of western Bhutan.

4. The process of training Bhutanese nationals in the fields of forest management planning, road construction, logging, forest nursery and plantation establishment, and commercial aspects of forest enterprise management was initiated by the project and is continuing.

5. **Project Costs and Financing.** Estimated project cost at appraisal was US\$ 31.29 million. Actual project cost was US\$ 21.45 million, including an estimated US\$ 5 million in foreign exchange. Of the total project expenditure, IDA provided 8% (compared to 11%, estimated in the SAR), or a total of US\$ 1.81 million (US \$ 1.03 million - Credit 1460-BHU; US\$ 0.78 million - Credit 1900-BHU). IDA Credit funds were on-lent from the Royal Government of Bhutan (RGOB) to BLC under a Subsidiary Loan Agreement at 12% interest. The grant from the Swiss Development Cooperation (SDC) financed 16% or US\$ 3.34 million in equipment, technical assistance and training. RGOB and BLC financed staff and other local costs, estimated at US\$ 16.2 million (75%). Although not included in the project costs, UNDP/FAO Technical Cooperation Program funded additional Technical Assistance and training which complemented project activities.

6. **Physical Targets.** The Staff Appraisal Report (SAR) forecast 2,640 ha of forest infested by bark beetle would be harvested during the project (1989-93) producing a total of 600,000 cu.m. of logs. Actually, 1,800 ha were harvested, producing 187,000 m³ of logs and 12,000 cu.m. of sawntimber, or a total roundwood equivalent of 211,000 m³ -- one-third of that estimated in the SAR. These reductions in physical achievements reflect reduced salvage logging due to earlier than expected control of the bark beetle. SAR technical assistance (TA) targets (250 man-months) were slightly exceeded with a total of 255 man-months of TA being provided by the project. SAR road construction targets of 20 km were exceeded. A total of 92 km of road were constructed. SAR forest plantation targets of 1,350 ha were reduced due to better than expected

natural regeneration. Only 940 ha were planted. An additional 800 ha regenerated naturally -- double the 400 ha planned in the SAR.

7. **Financial Benefits.** Significant financial benefits accrued from the timely salvage and sale of beetle-killed timber. Revenues from the sale of forest products by BLC totalled Nu 400 million. After deducting its costs, and retaining a portion of earnings as working capital, BLC contributed Nu 170 million - Nu 30 million per year - to Bhutan's Treasury in timber royalties, dividends, corporate income taxes, and principal, interest and exchange rate fluctuation payments on the subsidiary loan.

Project Outcomes, Findings and Lessons Learned

8. The project succeeded in achieving its major objectives of strengthening the managerial and technical capacity of BLC and FD in the fields of forest pest management, forest management planning, road planning, construction and maintenance, forest harvesting, reforestation, marketing of timber products and financial control.

9. Potential environmental problems arising from a bark beetle epidemic were resolved by bringing the epidemic under control through removal of infested trees, arresting the spread of infestations and facilitating timber recovery before excessive loss of value. Introduction of mechanized logging, utilizing low-impact, overhead cableways, was very timely; reducing dependence on scarce, imported labour and ending the traditional practice of manually rolling logs down steep hillsides, damaging or killing residual trees and leading to future erosion problems.

10. The project was successful in differentiating and strengthening the institutional capacity of FD and BLC in their separate, but complementary roles, and in developing efficient procedures for forest and pest management, reforestation, marketing, national revenue generation and financial control. In five years, BLC has developed remarkably from its former status as the Logging Division of the Forest Department, to a semi-autonomous corporation and an important source of national revenue. BLC presently has a staff of 300, plus equipment operators, logging and road crews who work on contract. This staff will provide a nucleus from which to expand BLC operations to eastern Bhutan under the current Bank-funded Third Forestry Development Project (Credit 2533-BHU).

Sustainability

11. Although the project succeeded in achieving its major objectives, a number of problem areas jeopardize the sustainability of institutions and activities initiated by the project. Particularly troubling are the interconnected issues of BLC profitability, RGOB resource pricing policies and BLC status as a semi-autonomous body. RGOB is urged to review BLC's role and mandate and to clarify these in light of the incompatible demands being placed on it. Other institutional issues requiring attention include the continuing need to strengthen BLC and FD management skills and the degree to which BLC functions should be privatized. Technical factors requiring strengthening include pest control, road construction and equipment maintenance.

PROJECT COMPLETION REPORT

BHUTAN

SECOND FORESTRY DEVELOPMENT PROJECT (Credit 1900-BHU)

PART 1: PROJECT REVIEW FROM IDA'S PERSPECTIVE

1. Project Identity

Project Name: Second Forestry Development Project

Credit No.: 1900-BHU

RVP Unit: South Asia Region

Country: Bhutan

Sector: Agriculture

Sub-sector: Forestry

2. Background

2.1. **Forestry Sector.** Bhutan is abundantly endowed with forest resources which cover 2.4 million ha, representing 59% of the land area. Bhutan's forests have always played a prominent role in the economy and culture of the nation. Bhutan's per capita consumption of timber and fuelwood is one of the highest in Asia at 0.9 m³ and 1.66 m³ respectively. Most of Bhutan's wood supply comes from natural forest. There are only 12,000 ha of forest plantations. Most of the people live in rural areas and meet their requirements for forest products by accessing the forest directly. Traditionally, the forest of Bhutan have been used for domestic building materials, fuelwood, fodder and non-timber forest products, including wildlife, medicinal and edible plants, and essential oils.

2.2. During the last two decades commercial use of wood has increased and today represents about 60% of total annual roundwood production. It is estimated that commercial timber production can be doubled to about 350,000 m³ within the next ten years. The current contribution of forest products manufacturing to the economy is about 15% of gross domestic product (GDP). Forestry taxes and royalties account for 5% of the Royal Government of Bhutan's (RGOB) receipts. Exports of forest products account for 20% national exports.

2.3. **Forest Degradation in Project Area.** Bhutan's forests contain a great many mature, overmature and diseased and dying trees. Commencing in the mid-1980s, epidemic outbreaks of bark beetle (*Ips* spp.) attack, triggered by unhygienic logging practices in coniferous forests, had killed several thousand hectares of spruce forest and were threatening tens of thousands of hectares more in the three western districts of Bhutan which, collectively, account for

half of Bhutan's forest area. There was evidence that the attack could spread to other coniferous forests which, due to overmaturity, were also susceptible to attack.

2.4. **Project Rationale.** RGOB's concern over increasing degradation of forest areas due to the serious outbreak of bark beetle attack attributed to a drought immediately preceding and associated risks of ecological damage to the relatively fragile Himalayan environment, coupled with the need to ensure long-term wood supply to existing and planned users, prompted the decision to request the International Development Association's (IDA) assistance to combat the spread of the bark beetle, reduce its population to normal levels, salvage the dead trees, and recover their value before they deteriorated. In addition, areas degraded by the insect attack were to be reforested, and forest management controls were to be introduced to prevent further insect outbreaks. Beyond the need for pest management, a comprehensive forest resource management and development program was identified to address fundamental forest resource issues facing Bhutan.

2.5. **IDA's Involvement in Bhutan's Forestry Sector.** Early 1982, IDA began preparing a Wood Industries Project in Bhutan. However, about one year later, RGOB's Planning Commission identified forestry plantation for the denuded and degraded forests in the foothills as a higher priority. IDA's assistance was requested to fund these plantations. The first Forestry Development Project (Credit 1460-BHU) undertook afforestation of large areas in Southern Bhutan commencing in 1984. The United Nations Development Program (UNDP) funded a parallel program of technical assistance consultancies, coupled with overseas training of Bhutanese staff. The Second Forestry Development Project (Credit 1900-IN), the subject of this PCR, followed in 1988. In 1993, the Third Forestry Development Project (Credit 2533-BHU) was initiated which will strengthen forest management capacity of local government units in Eastern Bhutan.

3. **Project Objectives and Description**

3.1. **Objectives.** The objectives of Bhutan's Second Forestry Development Project (Credit 1900-BHU) were: (a) to strengthen the managerial and technical capacity of the Bhutan Logging Corporation (BLC) and the Forest Department (FD) in the fields of forest pest management, forest management planning, reforestation, harvesting, and marketing of timber products and financial control; (b) to salvage and market insect damaged trees; and (c) to reforest affected areas.

3.2. **Location and Implementing Agencies.** The project covered three districts (Paro, Haa, and Thimphu) in Western Bhutan and was implemented jointly by the Bhutan Forestry Department and Bhutan Logging Corporation.

3.3. **Project Description.** The project's eight components were implemented over six years, commencing in 1988 and ending in 1993.

- Pest and Forest Management - pest surveys and bark beetle management program in affected areas including preventive and counteractive measures which are closely linked to general forest management;
- Mechanized Logging - salvage of dead trees on approximately 2640 ha of mixed coniferous forest, within the context of a forest management plan based on sound silvicultural principles;

- **Road Construction** - construction of 15 km of permanent forest access roads and 5 km of spur roads, in areas selected for salvage logging as part of a long-term management plan;
- **Workshop Facilities** - provision of a modern workshop at Paro to repair BLC equipment, and training to upgrade skills of mechanical and supervisory staff to enable them to maintain and repair project equipment procured for roads and logging and roads components;
- **Forest Nursery Development** - establishment of permanent forest nurseries at central locations to serve the reforestation needs of the areas where salvage logging was undertaken;
- **Reforestation** - regeneration (natural and artificial seeding and replanting) of native tree species in clearcut areas with provisions for controlling grazing and wild fires, to ensure regeneration;
- **Marketing Support** - provision of sheds, equipment, and technical assistance and training to assist in developing a more active marketing strategy for timber products; and
- **Support to BLC Management** - provision of technical assistance, vehicles, and other facilities to strengthen management skills, including assistance for setting up a commercial accounting system.

3.4. **Project Costs and Financing Plan.** Total project cost was estimated at US\$31.3 million including US\$8.6 million of foreign exchange. The project was cofinanced by IDA, the Swiss Development Cooperation (SDC) and the Royal Government of Bhutan (RGOB) and Bhutan Logging Corporation (BLC). IDA would fund \$3.56 million (11%); SDC - \$5 million (16%); and RGOB/BLC - \$22.73 million (73%). IDA and SDC funds were on-lent from RGOB to BLC under subsidiary loan agreements.

3.5. **Project Startup and Subsidiary Financing.** The project included a pre-project year (1987-88) during which a number of start-up activities were carried out, funded in part through reallocation of US\$2.5 million (SDR 1.923 million) from the first Forestry Development Project (Credit 1460-BHU).

4. **Project Concept and Design**

4.1. **Project Concept.** The project's conceptual foundation was clear, well understood and in conformity with RGOB's development strategy of ensuring environmental stability and wood security for present and future domestic and industrial users. The objectives were clear and pragmatic. The project helped to organize systematic production of timber under strict guidance of forest management plans, and to maintain pest control measures to help ensure the health of the forest resource -- the second most important contributor to national revenue.

4.2. Recognizing the need to maintain efficient production operations, the Project assisted RGOB to set up the BLC - an autonomous Corporation that did not depend on budgetary allocations to undertake its work, that could transact business and undertake revenue generation and maintain detailed cost accounting records of its operations.

4.3. Systems instituted under the Project were complex, relative to the earlier rudimentary systems of harvesting and accounting. The Project helped modernize operations and establish

these systems, based on sound management and control procedures, to guide future growth and development, paving the way for proposed future privatization of selected aspects of BLC's operations.

4.4. **Project Design and Timing.** The project was responsive to RGOB's changing circumstances and priorities. From 1979, RGOB banned logging by commercial operators (which were thought to be over-exploiting the forest), and entrusted logging to the Forest Department's Logging Division - which was later to develop into BLC. RGOB's Fifth and Sixth Five Year Plans (1981/82 - 1991/92) viewed the forests as a natural resource that needed to be managed and conserved, and recognized the need for selective access road construction and phased timber extraction, together with systematic reforestation to restore the ecology of exploited forests. The project took up these concerns from 1988 and helped to establish the institutional capacity through the Forest Department and BLC to undertake these functions.

5. Project Implementation

5.1. **Credit Effectiveness and Project Start-up.** Following negotiations in January 1988 and signing of the Credit agreement on May 9, 1988, the Credit became effective in October 1988.

5.2. **Project Staffing and Technical Assistance.** Project staff and technical assistance consultants were engaged in a timely manner in accordance with the negotiated timetable. With the exception of accounting staff, project management were recruited from within Bhutan. A total of 255 man-months of consultant TA were utilized - approximately equal to that envisioned in the SAR. Additional training was provided by equipment suppliers as part of their procurement contracts and by FAO as part of their cooperative program. The Forest Engineer and Logging supervisor were extended beyond the periods envisioned in the SAR, reflecting a need for more assistance in planning and supervision of mechanized logging.

5.3. **Equipment Procurement.** A large quantity of road and logging equipment was purchased by international competitive bidding (ICB) in mid-1989 and arrived at the project site in late 1989 or early 1990. Procurement was delayed due to expiration of letters of credit caused by delays in Credit effectiveness and slow customs clearance procedures at Calcutta port. Initially road and log depots were constructed using contracted equipment, while awaiting delivery of equipment purchased by the project.

5.4. **Timber Yields From Log Salvage Operations.** In the SAR annual log production were estimated to average 130,000 m³ per year for the project period. Actual annual log production during initial years of the project (1989-1990), when beetle-killed timber was being salvaged, was 66,000 m³ - about half of the SAR estimates.

5.5. The shortfall was due to FD's refusal to permit clear felling of affected areas¹, limiting salvage operations to harvesting dead or dying trees. This policy reduced the timber volume recovered per hectare and BLC's annual timber production and sales volume. It also led to relogging of many areas as beetle attacks reoccured and further salvage had to be undertaken. FD followed a conservative policy of limited clearfelling and the use of pheromone traps, which was FD's preference. Despite ambivalence about extensive clearfelling, the epidemic was largely

¹ Even though clearfelling was recommended by entomologists as a bark-beetle control measure.

contained after three years. The combined strategy seemed to work, helped by the relatively low levels of logging and BLC's scrupulous debarking and forest hygiene prescriptions.

5.6. Forest Management Planning. In 1990 the FD declared a moratorium on logging in forests for which forest management plans had not been prepared. This meant that when the insect epidemic was brought under control half-way through the project, BLC's operations became entirely dependent on timely preparation of forest management plans. As a result of delays in preparation of these plans, BLC's log production and sales declined to levels far below those projected in the SAR. With log production limited to salvage of remaining beetle-killed timber, annual volumes which had averaged 66,000 m³ per year during log salvage in 1989-1991, fell to 43,500 m³ per year in 1992-1993.

5.7. Declining Profitability. Because project investment in equipment, infrastructure and Technical Assistance were all based on SAR forecasts of log production volumes and sales revenues, declining sales volumes and revenues adversely affected the project's financial viability. The transition from log salvage (1989-91) to selection cutting based on management plans (1992---onwards) saw BLC's log sales revenues decline from Nu 90 million to Nu 76 million and before tax profits fall from Nu 12 million, to a loss of Nu 7 million in 1993.

5.8. Although the project was generally implemented within the framework of the SAR, the above situation required some changes to be made. Since preparation of forest management plans was entrusted to other donor supported projects, without formal linkages to IDA's Second Forestry Project, the project sought agreement to initiate mitigating measures. In order expedite forest management plan preparation, BLC engaged specialists in interpretation of air photos, mapping and forest management planning to assist FD in this task. Group selection logging trials were also initiated during this period, which provided BLC with logging sites to continue its operations until the required additional forest management plans were prepared.

5.9. RGOB Policy of Subsidized Forest Products Sales. Throughout the project, BLC has not been able to pass along the increased costs of operating at lower levels of production to consumers, due to RGOB policy of administratively fixing forest product prices. Approximately half of BLC's log production is sold to local rural and urban consumers at prices which, on average, represent only 13% and 30% respectively, of auction (free market) prices. During the years 1990 to 1992, the total value of this subsidy amounted to approximately Nu 200 million. Several supervision missions noted that BLC should account for this subsidy as a separate budget allocation, possibly entitled "social welfare subsidy", rather than permit this unidentified cost to negatively affect its profitability.

5.10. Road Construction. The SAR road construction target of 20 km was exceeded, with a total of 69 km of primary road and 23 km of secondary road constructed by BLC during the project.

5.11. Forest Nurseries and Regeneration of Logged Areas. Four nurseries were established by the project, compared to three specified in the SAR. A total of 2 million seedlings were raised at these nurseries during the project. The need for nursery-raised planting stock was reduced compared to SAR estimates, due to successful natural regeneration of logged forest areas. This success resulted in the planned 480 ha of natural regeneration being increased to 800 ha during implementation. A total of 940 hectares were planted compared to 1350 ha planned in the SAR. An average survival rate of 90% was achieved on the plantations. SAR plans for 70 ha of direct seeding were abandoned after unsuccessful initial trials. Problems included seed losses to rodents and birds, poor germination and poor survival.

5.12. Silviculture. The project silviculturist initiated group selection felling trials as an alternative to the single tree selection felling which had been the standard silvicultural system for

regenerating natural forests. Natural regeneration on these small openings², which approximate natural forest openings caused by wind, fire or insect damage, was so successful that this system is now being widely adopted throughout the country. Although there were initial problems in achieving sufficient volumes from group selection fellings to warrant setting up of cable crane lines, this is being overcome by including in the harvest individual mature/overmature trees which lie along the cable ways between group selection openings.

5.13. Mechanical Workshops. It was noted by successive supervision missions that workshop operations were failing to maintain BLC equipment in good operating condition. Reasons for this included problems in obtaining funds for spare parts, fuel and lubricants and in funding transport and subsistence allowances of workshop personnel for travel to field sites. As a result there were considerable delays and frequent inaction.

5.14. Project Equipment. Project equipment is, for the most part in operating condition. This is in part due to the lower than expected log production, as equipment was under-utilized. Most equipment purchased under the project was appropriate, however, some items were not required or proved to be unsuitable. During the project BLC disposed of a number equipment items. (see Annex 3 for additional information on project equipment)

5.15. Project Costs and Financing. Estimated project cost at appraisal was US\$ 31.29 million. Actual project costs were US\$ 21.45 million, including an estimated US\$ 5 million of foreign exchange. Of the total project expenditure, IDA provided 8% (compared to 11%, estimated in the SAR), or a total of US\$ 1.81 million. IDA credit funds were on-lent from RGOB to BLC under a Subsidiary Loan Agreement. SDC financed 16% or US\$ 3.34 million in equipment, technical assistance and training. RGOB and BLC financed staff and other local costs of US\$ 16.3 million (75%). UNDP/FAO cooperation program funded additional Technical Assistance and training which, although not included in project cost, complemented the project.

5.16. Credit Disbursements. Credit disbursements proceeded smoothly, though slightly behind the appraisal schedule. At mid-term, US\$ 3 million of the three credits had been disbursed, compared to US\$ 5 million estimated at appraisal. At credit closing - April 14, 1994 - US\$ 5.15 million (62%) had been disbursed from the total US\$ 8.29 million available from the three credits. The rate of disbursal to credit total for each credit was as follows: IDA Cr.1900-BHU - 73.6%; IDA Cr.1460-BHU - 46%; and SDC Cr.14-01660 - 70%. From the CHF 8 million, SDC credit, CHF 5.6 million (70%) was disbursed.

5.17. Credit Allocation Revision. Under a Credit allocation revision in 1987, IDA approved reallocation of US\$ 2.5 million from the First Forestry Development Project (Credit 1460-BHU) to permit preparatory works and equipment purchases for start-up activities in areas covered by the Second Forestry Project (IDA Cr.1900-BHU). The funds (SDR 1.923 million) were on-lent from RGOB to BLC under a subsidiary loan agreement. Only US\$ 1.03 (41%) of this was utilized and BLC subsequently returned the balance to RGOB.

5.18. Project Completion and Credit Closing. The project was completed, as planned, on December 31, 1993. IDA accepted applications for credit withdrawal (Cr.1900-BHU) up until April 14, 1994, at which time all pending applications had been paid and the remaining undisbursed balance of SDR 198,004.91 was cancelled.

² Group selection involves harvesting all of the trees on small opening of 0.23 to 0.3 ha. Approximately 25%-33% of the standing volume is removed.

5.19. **Compliance with Legal Covenants.** The majority of covenants in the DCA were complied with. In the early years of the project there were delays in submission of audited account statements. This has now been remedied.

5.20. **Project Risks.** Project risks were accurately identified at appraisal. The risk of the pest attack being more wide-spread than observed was dealt with by ensuring that project equipment had a capacity to harvest 10% more than required to salvage the observed pest attack. In implementing the project, the area infested was less than predicted. This, combined with FD policy disallowing clearfelling of infested areas, resulted in volumes available for harvest being less than the production capacity of project equipment. The second risk, that of delays in mapping, planning, road construction causing project benefits to be reduced was addressed by having advance financing reallocated from Credit Cr.1460-BHU. This permitted timely salvage of insect-killed timber thus minimizing value losses and the risk of further spread of insect attack. However, post salvage delays in mapping, forest inventory and forest management planning, as discussed earlier, resulted in reduced project benefits at a later stage.

6. Project Results

6.1. In general the project has achieved its major objectives of strengthening the managerial and technical capacity of BLC and FD in the fields of forest pest management, forest management planning, road planning and construction, forest harvesting, reforestation, marketing of timber products and financial control. The project demonstrated that efficiently managed mechanized logging, undertaken by a parastatal body, specialized in and exclusively dedicated to forest harvesting and timber disposal, can ensure wood supply to existing and planned users while at the same time avoiding the considerable environmental damage associated with previous, adhoc timber removals using manual methods. Another major achievement is the introduction of forest planning as an operational tool for FD. A brief overview of project accomplishments is included below. Further details are included in Appendices 3 and 4.

- (a) **Pest Control.** The project developed the capability to mount pest surveillance and control programs which arrested the epidemic within three years, salvaged pest attacked timber in a timely manner, ensuring that its value contributed to the national economy rather than being lost due to further deterioration.
- (b) **Bark Beetle Epidemic Control.** The project resolved environmental problems caused by a bark beetle epidemic, over 3,000 ha of coniferous forest. The epidemic was triggered by a combination of drought, which further weakened already overmature forest, and unsanitary, ad-hoc timber removals in settled areas of Western Bhutan. The project controlled the epidemic by removal of infested trees, minimizing the spread of infestations and facilitating timber recovery before excessive loss of value. Ongoing controls include debarking and removal or burning of slash material to eliminate favourable breeding sites and prevent further increase in beetle population levels.³
- (c) **Environmental Benefits.** Introduction of mechanized logging, based on low density road networks built to specifications which control erosion was very timely. The use of low-impact, overhead cableway logging systems reduced dependence on scarce, imported labour. It also eliminated the previous destructive, manual systems

³ The entomologist's report states that ..."there are no epidemic infestations of bark beetles in the forests of western Bhutan. The current absence of serious bark beetle attack can be attributed to the bark beetle management program established under the project. Major benefits of the project were: prevention of the spread of infestations to adjacent susceptible forests and recovery of timber values before losses occurred due to degrade."

in which logs were rolled down steep mountainsides, resulting in killing residual trees and leading to future erosion problems.

- (d) **Institutional Strengthening.** The project was successful in differentiating and strengthening the institutional capacity of FD and BLC in their separate, but complementary roles. It developed efficient procedures for pest management, forest management and planning, reforestation, marketing, national revenue generation and financial control. In five years, BLC has developed remarkably from its former status as the Logging Division of the Forest Department, to a well managed, financially viable (at least until recently) semi-autonomous Corporation and an important source of national revenue.⁴ BLC presently has a staff of 300 plus equipment operators, logging and road crews who work on contract. This staff will provide a nucleus from which to expand BLC operations to eastern Bhutan under the Third Forestry Development Project.
- (e) Established workshop facilities to train technicians to maintain logging and road equipment in working order.
- (f) Strengthened BLC capacity to transport and market timber products in an efficient and timely manner, thus avoiding pre-project delays which resulted in loss of value due to product deterioration.
- (g) Strengthened BLC capacity in cost accounting and preparation of financial statements.

6.2. **Benefits from Salvage Operations.** Considerable financial and economic benefit accrued to Bhutan from timely log salvage and marketing, much of which would have been lost due to deterioration if its salvage had been limited to manual road construction and logging, utilizing a diminishing labour supply, due to RGOB's ban on importation of foreign workers.

6.3 **Re-evaluation of BLC's Financial Rate of Return (IRR).** BLC's financial rate of return was recalculated using actual project implementation experience in place of SAR estimates. The recalculation showed that the SAR estimated IRR of 55% was not borne out by implementation experience. The actual IRR was only 2%. Based on the assumption that BLC sales of logs and sawn timber to local consumers at prices below BLC's costs and auction prices have led to this unacceptably low financial performance, the IRR was recalculated, this time adding the value of the subsidy, as a "social welfare" contribution instead of an unidentified source of negative financial performance. When this subsidy, which was calculated to be in excess of Nu 200 million during the project, is credited to BLC, the IRR over a 10 year period increase to 26%, illustrating BLC's inherent financial viability.

6.4 **Re-evaluation of Project Economic Rate of Return (ERR).** A re-evaluation of the project's economic rate of return (ERR), resulted in a small decrease in ERR, from 42%, estimated in the SAR, to 39% based on project implementation results. The effects of subsidized log sales does not enter into the ERR calculation as all production is assumed to be sold at auction (border) sales price (see Part III, Table 3 for further details).

⁴ During the project (1989-93) BLC contributed, on average, Nu 21.1 million annually (maximum of 38.4 million in 1990) to RGOB in the form of royalties, dividends and corporate taxes. BLC has also borne exchange rate fluctuations on foreign exchange costs, totalling 12 million, and repaid subsidiary loans from RGOB including 12% interest, totalling Nu 17 million.

6.5 **Additional Project Benefits.** BLC's financial rate of did not meet SAR expectations, it should be noted that BLC contributed a large portion of its earnings to Bhutan's treasury. Between 1988 and 1993 these contributions included:

- Royalty on Timber Removed by BLC - Nu 56.66 million
- Dividends to RGOB as shareholder - Nu 37.10 million
- Corporate Income Taxes on profits - Nu 11.87 million
- Principle Repayment on Subsidiary Loan - Nu 34.49 million
- Interest Payments on Subsidiary Loan - Nu 17.11 million
- Exchange Fluctuation Payment on Loan - Nu 11.98 million
- Total Contribution of BLC to RGOB - Nu 169.21 million

6.6 The project also produced many benefits which elude quantification.

- Improved access in the project areas due to roads constructed by the project benefit FD as resource management agency as well as rural settlements in the project areas.
- Forest Protection. Presence of project activities acted as a deterrent to unapproved extraction of forest products.
- Reforestation of beetle-killed forests by the project reduced erosion and enhancing seasonal distribution of water supplies.
- Environmental Benefit Elimination of manual rolling of logs reduced erosion and degradation of soil and water resource.
- Additional supplies of fuelwood and poles from project areas reduced pressure on areas available as sources of these products.
- Human resources development Employment and training benefits continue to accrue in operation and maintenance of road and logging equipment, forest inventory, forest management planning and harvest, transport and marketing of forest products.
- Institutional Strengthening. The project resulted in strengthening of the FD's capability to plan and execute forest plantation projects. However, as previously mentioned, further training in growth and yield surveys as well as planning and management of forest plantations on a commercial basis are required.

7. Sustainability of Future Operations

7.1 Bhutan's forestry sector institutions have demonstrated their ability to control forest insect infestations, salvage and market timber in an efficient manner and rehabilitate affected forest areas. They have further shown an emerging capability in preparing and implementing forest management plans. These observations indicate that forest sector development will follow a positive trend for the foreseeable future, although its need for technical and financial assistance may continue.

7.2 However, commercial exploitation of forest resources may face problems and BLC may fail to continue as the major state entity charged with forest production and development. Some of the items affecting the sustainability of BLC's future operations are discussed below.

7.3 BLC Profitability. In 1993, BLC experienced its first loss since it was formed in 1978. Financial projections indicate continuing losses if steps are not taken to improve BLC's profitability, which is dependent on the following:

- (a) Sufficient annual volumes must be harvested to keep equipment operating at capacity. At present BLC's breakeven annual production is estimated to be about 50,000 m³.
- (b) Construction of road to a standard where long-term maintenance costs are minimized. BLC should also receive some credit for its primary roads, many of which provide access to rural communities and other government and private resource users.
- (c) BLC equipment must be maintained by ensuring that BLC retains adequate reserves for spare parts, transportation and field allowances for its staff. Purchasing procedures must be modified to expedite supply of spare parts. Costs of foregone production far outweigh minor losses due to possible misuse of funds.
- (d) BLC should receive a credit from RGOB equal to the subsidy provided to rural and urban consumers to which its products are sold.

7.4 BLC Autonomy. Although BLC's charter states that it should function as a semi-autonomous body within RGOB guidelines, it is clear that BLC's operations are constrained by RGOB's restrictive wood pricing policy as well as excessive control over operational procedures of state corporations. BLC should be given a clear mandate to handle its own affairs, including: (a) setting sales prices for its products at levels covering operating costs, a reserve for equipment replacement and a modest profit; and (b) more autonomy in decisions regarding staff remuneration and promotion and in payment of competitive rates to contractors who carry out a large portion of its work.

7.5 Continuity of BLC Management Skills. RGOB should ensure continuity of management skills, either through extension of tenure of the incumbent managing director, and/or recruitment of a well-qualified deputy as understudy. Given the role BLC plays, selection of such a candidate should include candidates with forestry backgrounds as well as those with commercial and business management experience. Strong, experienced management will be required to ensure a smooth expansion of BLC operations to Eastern Bhutan where BLC will provide road construction, logging, reforestation and timber marketing services under the Third Forestry Development project (IDA Credit 2533-BHU).

7.6 Status and Sustainability of Pest Control Programs. Continuation and sustainability of the bark beetle control programs established under the project is dependent on adequate support and training. BLC has adopted an aggressive campaign of debarking and disposing of host material capable of producing bark beetles. However, continued removals of local building materials, firewood, prayer flags, etc. by territorial divisional forest officers and local communities have not been debarking and disposing of logging wastes. This maintains insect populations at unacceptably high levels. There is a general lack of systematic survey of the land base for forest health concerns, as well as a systematic monitoring of insect population. As a result, only extensive infestations are noticed and there is little opportunity to deal with small infestations before they develop into major (epidemic) proportions. Enforcement of regulations and pest surveillance will ensure sustainability of this component during the post-project period. Under the agreed operational plan, FD would maintain standards for sanitary logging developed under the project. Also, an environmental monitoring capability is being developed in the FD which should include monitoring of insect population.

7.7 Forest Management Planning. With completion of forest inventory and management plans in western Bhutan in 1993, it appears that annual net recoverable log production from this region, will continue to be less than BLC's estimated financial breakeven level of 40,000 to 50,000 m³ per year. Unless production levels can be increased or productivity improved,

continued poor financial performance is expected to continue, at least until management plans and road access are completed for the remaining forest management units in Western Bhutan.

8. Bank Performance

8.1 Activities funded by the IDA Credit have made a positive contribution to forest sector development through physical works and institutional and human resources development. IDA provided a total total of 310 staff weeks in preparation, appraisal and supervision of this project, over the six-year period of the project (1988-93). Preparation and appraisal accounted for 190 staff-weeks (61%) providing a sound framework and guidelines for project implementation. A further 80 staff weeks (27%) were provided in 10 supervision missions - an average of two missions annually. These operational inputs were provided with a high degree of staff continuity. A review of project implementation utilized an additional 20 staff weeks.

9. Borrower Performance

9.1 The Borrower's performance in carrying out its obligations resulted in project targets for road construction, forest nurseries and reforestation, and engagement of technical assistance, being met or exceeded. This demonstrated RGOB's capacity to undertake challenging projects involving new technologies, under difficult field conditions. In particular the Borrower showed ability to react positively to adverse factors which threatened the project's ability to achieve its objectives. Adoption by the implementing agency, of group selection silvicultural trials, at a time when BLC's existence was threatened due to a lack of available operating areas (due to delays in management plan preparation), maintained BLC production at reduced levels and permitted BLC and saw-mill operations which they supply to survive. The decision to salvage degraded material from logged sites and to utilize it at Bhutan Board Product Ltd., illustrated Bhutan's desire to maximize utilization of its resources. Early delays in submitting audited accounting statements were overcome by developing more efficient accounting systems and training in their use.

10.1 Performance by Co-Financiers and Others

10.1 **Swiss Development Cooperation (SDC)**, as project cofinanciers, participated in project preparation, appraisal and supervision. SDC's experience in the Integrated Forestry Development Project (IFDP) in central Bhutan proved invaluable in designing and implementing the Second Forestry Development Project. During the project, technical interchanges between staff of the two projects facilitated exchange of experience and technical data. As a result, the experience of Bhutanese foresters was broadened by exposure to alternative forest management systems.

10.2 **UNDP/FAO and Cooperating RGOB Agencies.** UNDP/FAO provided additional technical assistance consultancies to FD which supported project activities by training Bhutanese project staff. Under FAO's Technical Cooperation Program (TCP) consultants were engaged in the fields of forest entomology, forest nursery practice, forest inventory, mapping and forest management planning.

11 Project Relationship

11.1 IDA's relationship with RGOB and its implementing agencies and UNDP/FAO and was generally good and provided the basis for cooperation on subsequent projects. During the project, unavailability of forest management plans limited BLC's post-salvage logging operations. An IDA proposal to expedite the process by contracting out the work, was rejected in favor of continuing with FAO's consulting services. BLC eventually funded additional consultants to complete essential management plans.

12. Lessons Learned

12.1 **Lessons Learned** from project implementation experience include:

- (a) To avoid delays in project implementation, arrangements should be made to utilize credit funds for short-term contract hire of essential equipment, while awaiting purchase and shipment of permanent project equipment.
- (b) Projects involving bilateral co-financing should ensure that timing of involvement of the parties is clearly defined during project preparation and not after negotiations. This can avoid delays.
- (c) Project preparation should seek clear definition of Government policies regarding natural resources use and pricing in order to avoid misunderstandings during implementation. RGOB's conservative forest resource utilization policies and intervention in forest product marketing, prevented BLC from achieving the full autonomy and financial independence originally envisioned in its charter.

13. Project Documentation and Data

13.1 The Development Credit Agreement, project covenants and subsequent amendments were appropriate for achieving project objectives. The SAR provided an adequate framework and guidelines for project implementation. BLC prepared the required progress reports in advance of IDA missions, permitting missions time for field visits, discussions with stake holders and further analysis of the data.

PROJECT COMPLETION REPORT**BHUTAN****SECOND FORESTRY DEVELOPMENT PROJECT
(Credit 1900-BHU)****PART 2. PROJECT REVIEW FROM BORROWER'S PERSPECTIVE**

**Prepared by: Mr. Tara Giri, Managing Director,
Bhutan Logging Corporation
Thimphu, Kingdom of Bhutan
June 1994**

PROJECT STATUS

1. An amount of SDR 0.8 million (USD1.060 million) was approved on April 19, 1988. The credit was declared effective on October 4, 1988 and the project is scheduled to close for disbursement on December 31, 1993. The SDC has originally allocated an amount of Swfr 8000,000 (USD5.00 million) to finance the technical assistance, training and purchase of equipment.

PROJECT OBJECTIVES

2. The objectives of the project are to strengthen the managerial and technical capacity of Bhutan Logging Corporation and the Department of Forestry to:

- (a) control the epidemic pest outbreak in coniferous forest areas by undertaking a program of road building, salvage logging and reforestation;
- (b) coordinate management planning, pest management, harvesting and reforestation;
- (c) produce and market wood; and
- (d) institute effective financial control.

The project covers Paro, Haa and Thimphu districts in Western Bhutan and it is a six year project.

PROJECT IMPLEMENTATION

3. The project has carefully harvested trees affected by bark beetle in the districts of Paro, Haa and Thimphu. BLC as the harvesting and utilisation wing of the Royal government has been strengthened considerably with modern equipment as well as self-sustaining workshops. Counterparts are trained in logging, forest road construction, operation and maintenance of equipment, pest management and control, and marketing of timber. There has been considerable improvement in the organizational skills of the field staff and their approach to planning and control of BLC's work. The administration and management of BLC as a RGOB corporation has improved significantly.

PROJECT COMPLETION REPORT

BHUTAN

SECOND FORESTRY DEVELOPMENT PROJECT (Credit 1900-BHU)

PART 3. STATISTICAL INFORMATION

Table 1. Related Loans and Credits

Loan/Credit	Purpose	Year of Approval	Status	Comments
First Forestry Development Project (Cr. 1460-BHU)	To strengthen managerial and technical capacity of BLC and FD in the fields of forest pest management, forest management planning, reforestation, harvesting and marketing of timber products, and financial control. To demonstrate that efficiently managed mechanized logging undertaken by an efficient parastatal body could ensure long term, sustainable wood supply.	1987	Completed in 9/92	Measurable physical targets were met or exceeded. Development of skills in logging and plantation development were also met. During 1989/92, quality of plantation declined due to poor maintenance. This, coupled with inappropriate species mix contributed to pest attack and climber infestation. Recently, pest attack has subsided and climbers have been controlled by weeding.
GEF-Funded Trust Fund for Environmental Conservation	To support bio-diversity conservation in Bhutan	1992	Ongoing	The project is progressing well and has so far achieved all monitorable indicators for conserving RGOB's rich biodiversity in three years, less than the anticipated timeframe.
Third Forestry Development Project (Cr. 2533-BHU)	Support for an integrated program of improved utilization, protection and multiple use forest management. BLC responsible for logging, marketing, roads, depots and reforesting logged areas. Additional cable cranes and technical to be provided to expand BLC's operations to Eastern Bhutan.	1993	Ongoing	Overall project implementation is satisfactory, despite initial startup delays, and is consistent with the project's development objectives. There are issues and problems but most of them have been identified and remedial measures and actions are being taken.

Table 2. Project Timetable

Project Cycle	Date Planned	Actual Date
Identification (IEPs)	1985	Nov. 85
Preparation	1986	Jan.-April 1986
Appraisal	May 1987	Mar. 1988
Negotiations	Jan. 1988	Jan. 19-22, 1988
Board Presentation	May 1987	April 19, 1988
Credit Signing	June 1987	May 9, 1988
Credit Effectiveness	Aug. 4, 1988	Oct. 4, 1988
Mid-Term Review	Dec. 1990	Dec. 1990
Closing Date	Dec. 31, 1993	Dec. 31, 1993
Final Disbursement Date	April 14 1994	April 30, 1994
Project Completion Mission	June 1994	June 1994

**Table 3. Credit Disbursements
(Cumulative)**

There were three sources of funding for this project. US\$2.5 million were transferred from the First Forestry Development Project (Credit 1460-BHU, closed on September 30, 1992) to assist in start up activities of the Second Forestry Development Project (Credit 1900-BHU). The Second Forestry Development Project (Credit 1900-BHU) was financed jointly by an SDR 0.8 million credit (US\$1.06 million equivalent) and a Swiss Franc (SwF) 8 million contribution from the Swiss Development Cooperation (SDC) (No. 14-01660). Final disbursement on the Second Forestry Development Project was made on April 14, 1994 and the undisbursed balance cancelled. Summaries of disbursements from the two IDA credits and the SDC contribution are summarized below:

IDA Fiscal Years	88/89	89/90	90/91	91/92	92/93	93/94	Total Cumulative
A. Credit 1460-BHU (US\$ m)							
Appraisal Estimate	0.3	1.3	2.3	2.5	2.5	2.5	2.5
Actual	0	0.39	0.56	0.59	1.02	1.03	1.03
Actual as % of Appraisal Estimate	0%	30%	24%	24%	41%	41%	41%
B. Credit 1900-BHU (US\$ m)							
Appraisal Estimate	0.2	0.4	0.6	0.8	1	1.06	1.06
Actual	0	0.17	0.21	0.31	0.72	0.78	0.78
Actual as % of Appraisal Estimate	0%	43%	35%	39%	72%	74%	74%
C. SDC Grant 14-01660 (SwF m)							
Appraisal Estimate	0.6	2.5	3.9	5.6	6.7	8	8
Actual	0	2.2	3.6	4.5	4.8	5.6	5.6
Actual as % of Appraisal Estimate	0%	88%	92%	80%	72%	70%	70%

Table 4. Project Implementation**Key Indicators of Project Implementation and Operation**

Program	Unit	SAR Target	Actual Achieved	Actual as % of Target	Comments
Forest Nurseries	number	3	4	133%	
Seedlings Produced	millions	not stated	2		
Roads:					
Primary	kilometers	15	69	460%	
Secondary	kilometers	5	23	460%	
Total		20	92	460%	
Logging	hectares	2,640	1,800	68%	
	cubic meters	600,000	211,000	35%	
Forest Regenerated:	hectares				
Natural Regeneration		480	800		
Direct Seeding		70	5 to 10		
Plantations		1,350	940		
Total		1,900	1,750	92%	
Technical Assistance:	man-months				
Pest Management:					
Rangeland Specialist 1/		6	0		
Entomologist 1/		10	1		
Silviculturist		24	24		
Forest Harvesting:					
Logging Engineer		24	42		
Logging Supervisor (3)		72	68		
Road Supervisor		24	24		
Workshop Supervisor		0	24		
Nursery Specialist 2/		12	0		
Sawmilling:					
Sawmilling Expert 3/		24	5		
Sawyer		12	0		
Saw Doctor		12	0		
Project Management Consultant 2/		24	24		
Unspecified Others:					
Financial Advisor		6	13		
Management Planner		0	21		
Airphoto Interpreter		0	6		
Log Loader Trainer		0	2		
Total Technical Assistance		250	254	102%	

Training: 5/

Road/Logging Component:	number		
Equipment Operators 4/		46	Trained on
Tradesmen		23	the job
Loggers		72	
Total		141	

Workshop Component:			Trained on
Mechanics	man months	64	the job

Marketing/Sawmilling 6/	no. of study tours	12	
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Note:

Log Production	m3	1988-93		187,000
Sawntimber Production	m3	1988-93	12,000	24,000 (log equiv.)
Total Log production				211,000 (plus/minus)

Footnotes:

1/ Specialists in Rangeland management and Entomology who were in Bhutan working on other projects were made available to assess grazing and forest pest issues.

2/ Forest nursery and forest inventory and management planning specialists were posted to FD by FAO under cooperative agreements.

3/ Sawmill expert did not complete his assignment. This impacted negatively on recruitment of saw doctor and sawyer training programs which he was to have organized.

4/ Some equipment training was provided by equipment suppliers under their equipment purchase contracts, e.g. log loader training.

5/ No records were kept on numbers of people trained in individual categories. Advertisements to fill workshop and sawmill training positions met with little response.

6/ Study tours proved difficult to organize and therefore were not held.

Table 5. Project Cost and Financing
(US\$ million)

A. Project Cost

	SAR Estimate	Actual	Actual as % of SAR Estimate
I. Support to Forest Department			
Pest Control and Forest Management	8,202.40	1,290.00	16%
II. Support to Bhutan Logging Corporation (BLC)			
Logging	200,777.10	215,346.00	107%
Road Construction	56,649.80	10,157.00	18%
Workshops	16,830.10	16,356.00	97%
Nursery Development 1/	6,397.20	0.00	0%
Reforestation	12,454.70	7,783.00	62%
BLC Marketing Support	25,045.90	17,130.00	68%
BLC Management Support	14,530.60	90,946.00	626%
Total Base Cost	340,887.80		
Physical Consingency	6,615.70		
Price Contingency	43,679.00		
Total Project Cost	391,182.50	359,008.00	92%

B. Project Financing

	Planned	Actual	Actual as % of Planned
Source:			
Credit 1900-BHU	1.06	0.78	74%
Credit 1460-BHU	2.50	1.03	41%
SDC Contribution	5.00	3.34	67%
RGOB	0.11	0.10	91%
BLC 2/	22.62	16.20	72%
Total	31.29	21.45	69%

Footnotes:

1/ Disbursements under this component are shown under the Reforestation component.

2/ BLC's contribution was financed out of the Corporation's Income (see BLC Profit & Loss account "With Project" scenario.

Table 6. Project Results

	SAR Estimate		PCR Estimate	
	Volume (M3)	Net Revenue (Nu/M3)	Volume (M3)	Net Revenue (Nu/M3)
A. Direct Benefits				
From Timber Volume and Sales Revenue				
Logs	600,000	1,200	187,000	2,370
Sawn Timber	200,000	700	12,000	1,200
B. Financial and Economic Impact				
Internal Rate of Return (IRR) (with subsidies unidentified, i.e. reducing BLC's profits)	55%		2%	
Internal Rate of Return (IRR) (with subsidies identified, and credit to BLC)	not identified in SAR		26%	
Economic Rate of Return (ERR)	42%		39%	

C. Studies

Title	Purpose	Status	Impact
Logging Waste	To determine waste, decay and breakage factors for forest inventory data	To be done by FAO but was not done	Difficult to relate inventory data to net log out-turn
Marketing	To study technical properties and potential uses for Bhutan timber	to be done by sawmill consultant but was not done	Full potential of timber value not realized
Forest Engineering Procedures	To prepare a manual of procedures for BLC field staff	Manual completed by Engineering consultant in 1992	Manual of procedures not in use by field staff
Reforestation Surveys	System for measuring restocking levels to plan nursery and plantation programs	Completed by BLC Silviculture and Engineering consultants in 1992	Established criteria for decisions on reforestation
Silviculture	Study systems for managing Bhutan's forests and prepare field manual for marking crews	Completed by BLC Silviculture and Engineering consultants in 1992	Revolutionized forest management in Bhutan; group selection adopted
Forest Management Planning	To develop method for preparing forest management plans	Gidacom Plan done by FAO team in 1990/93; Chamgang and Zonglela Plans prepared by BLC consultants in 1992	Management plan preparation method standardized and clearly documented
Pest Control	To define the magnitude of the bark beetle attack and develop control mechanisms	9-month FAO study at a cost of US\$106,000; Forest Entomology studies on bark beetles by BLC consultant; both the above studies were completed in Nov. 1989	Magnitude of problem and control methods defined

Table 7. Status of Covenants

Development Credit Agreement Section	Description	Compliance
2.02 (c)	Open and maintain in dollars a special account in the Bank of Bhutan	In compliance
3.01 (a) (i-iii)	Declares its commitment to the project objectives	In compliance
3.01 (b) (i-iii) and (c)	Relend proceeds of the Credit to BLC under a subsidiary loan agreement approved by the Bank	In compliance; executed subsidiary loan agreement with BLC vide No. 116/MF/PD/88/4590 dated Dec. 20, 1988.
3.02	Procurement of goods, works and consultants' services required for the project and financed out of credit proceeds and Swiss contribution to be governed by provisions of Schedule to the Project Agreement	In compliance
3.03	Obligations set forth in General Conditions related to insurance, use of goods and services, plans and schedules, records and reports, maintenance and land acquisition, in respect of Parts B through H shall be carried out by BLC pursuant to Section 2.03 of the Project Agreement	In compliance
3.04	The Borrower, BLC, the Association and SDC to carry out a mid-term review by 31-Dec-90	In compliance. Mid-term review carried out in November 1990.
3.05 (a-b)	For the purposes of effective coordination of all projects in the forestry sector, the Borrower shall organize a joint review of forestry projects among donors, BLC and FD; and hold an annual workshop	In compliance
3.06 (a-b)	Furnish semi-annual progress report and mid-term project review report	In compliance

3.07	Instruct BLC regarding cutting area priorities for the following year	Not done, major problems encountered.
3.08 (a-b)	Appointment of one additional ranger and two additional foresters to assist with pest management and research program, and four additional foresters to carry out markings of trees in priority areas for cutting	One Forest Entomologist and rangers hired.
3.09	Carry out a pre-harvest inventory; a waste and defect study; and furnish to the Bank	BLC undertook pre-harvest inventory; waste study not done.
3.10	Employ consultants satisfactory to the Bank	In compliance
4.01 (a-b)	(a) Maintain records and accounts in accordance with sound accounting practices; (b) have records and accounts audited each fiscal year by independent auditors acceptable to the Bank; furnish to the Bank certified copies of audit as well other information concerning records, accounts and audit	In compliance
4.01 (c)	For withdrawals on the basis of statement of expenditures, maintain records as in (a) above, retain records until at least one year after receipt by Bank of audit for last fiscal year; enable Bank representatives to examine such records; and ensure such records and accounts are included in the annual audit referred to in (b) above)	In compliance

Table 8. Use of Resources

A. Staff Inputs (in Staffweeks)					Actual Utilized		
Through Appraisal							190
Appraisal through Board							5
Board through Effectiveness							17
Supervision							80
Project Completion							18
Total Staffweeks							310

B. Missions					Performance Rating b/ Implem- Develop- ment Status Objectives			Types of Problems c/
Stage of Project Cycle	Month/ Year	No. of Persons	Days in Field	a/ Specialization	Implem- ment Status	Develop- ment Objectives	Types of Problems c/	
Preparation (by FAO/CP)	Dec-85	4	28	E,F,R/L				
Preappraisal	May-June-86	6	28	E,F,S,En,I				
Preappraisal follow-up	Feb-Mar-87	1	5	E				
Appraisal	May-87	6	28	E,F,S,En,I,P				
Post Appraisal	Nov-87	6	22	E,F,S,En,I				
Supervision	Jun-88	1	16	AgE	1	1	none	
Supervision	Jul-89	2	20	F,AgE	2	2	F	
Supervision	Mar-90	2	12	F,AgE	2	2	F	
Supervision	Nov-90	5	30	F,I,L,AgE	2	2	F,I	
Supervision	Jun-91	1	14	F	2	2	F,I	
Supervision	Nov-91	4	16	F,P	2	2	F,I	
Supervision	Dec-92	3	14	F,P	2	2	I	
Supervision	Mar-93	1	10	I	2	2	I	
Supervision	Jul-93	2	12	F,I	2	2	I	
Supervision	Nov-93	4	13	F, AgE	2	2	I	
Project Completion	Jun-94	4	19	F,En,AgE				

a/ Specializations: E=Economis, F=Forestry, En-Entomology, I=Institutions, P=Procurement
S=Sociology, Ag=Agriculture, L=Legal.

b/ Performance Ratings: 1=Problem Free or Minor Problems, 2=Moderate Problems, 3=Major Problems.

c/ Problem Types: F=Financial, M=Management, I=Institutional,

APPENDIX 1. RE-EVALUATION OF ECONOMIC AND FINANCIAL RATES OF RETURN

TABLE 1: SECOND FORESTRY DEVELOPMENT PROJECT
Economic Rate of Return (ERR)
1988-2007
(Million Ngultrum)

BENEFITS	Calendar Year →→	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
	Project Year →→	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Volume of Wood Sold (000 Cu.M. H)																						
a) Logs - "with project" (1)		0.00	26.00	32.00	41.80	47.00	40.29	40.00	40.00	40.00	45.00	50.00	50.00	50.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	
Logs - "without project" (2)		0.00	21.00	26.00	20.00	16.00	16.00	16.00	16.00	16.00	16.00	14.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	
Incremental - Logs Sold		0.00	5.00	6.00	21.80	31.00	24.29	24.00	24.00	24.00	29.00	34.00	34.00	34.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	
b) Incremental - Sawwood Sold (3)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Average Depot Price Nu/Cu.M.H (4)																						
Logs		4800	4800	4800	4800	4800	4800	5110	5420	5730	6030	6330	6850	6980	7330	7700	8080	8490	8910	9360	9820	
Sawwood		4940	4940	4940	4940	4940	4940	5260	5580	5900	6210	6520	6840	7190	7540	7920	8320	8730	9170	9630	10110	
Incremental Revenues (Nu million)																						
Logs			24.00	28.80	104.64	148.80	116.59	122.64	130.08	137.52	174.87	215.22	232.90	237.32	263.88	277.20	290.88	305.64	320.76	336.96	353.52	
Sawwood			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL BENEFITS - Nu Million		0.00	24	28.8	104.64	148.8	116.592	122.64	130.08	137.52	174.87	215.22	232.9	237.32	263.88	277.2	290.88	305.64	320.76	336.96	353.52	
COSTS (SCF = 0.90)																						
Investments (5)		14.52	53.3	20.94	33.03	36.25	47.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Replacements (6)		0.00	0.00	0.00	0.00	0.00	0.00	36.31	32.36	24.45	13.55	26.16	35.91	32.37	39.14	25.07	17.05	22.87	19.5	12.75	11.93	
Recurrent Costs (7),(8),(9) with Contingency		0.00	26.94	33.06	44.30	44.86	41.01	53.36	60.26	64.49	69.16	74.16	74.16	74.16	74.16	74.16	74.16	74.16	74.16	74.16	74.16	
TOTAL COSTS - Nu Million		14.52	80.24	54.00	77.33	81.11	88.30	89.67	92.62	88.94	82.71	100.32	110.07	106.53	113.30	99.23	91.21	97.03	93.66	86.91	86.09	
NET BENEFITS (Nu Million)		-14.52	-56.24	-25.20	27.31	67.69	28.29	32.97	37.46	48.58	92.16	114.90	122.83	130.79	150.58	177.97	199.67	208.61	227.10	250.05	267.43	
ERR (10)		39.24%	ERR of (incremental) benefits ("with" minus "without" project)																			
NPV @ 15%		256.06	Million Ngultrum																			

Notes:

- (1) Logs produced by project taken as 50% of BLC total production in 1990, 75% in 1991 and 100% in 1992 and onward.
- (2) Production based on existing equipment with no manual logging due to labour shortages. Salvage logging in early years. Logging by management plan/prescription thereafter.
- (3) Sawwood sales would be the same with and without the project. In recent years BLC sells logs to sawmills and sawmills convert and market sawwood.
- (4) Average depot price taken from actual auction sales at Phantsholing (border price). Very little price fluctuation during project. Post project prices inflated at predicted inflation rates.
- (5) Investment costs actuals from project (excluding rentals) Adjusted by foreign and local conversion factors of 1.0 and 0.9 respectively.
- (6) Replacement costs from 1994, are estimated for equipment to maintain log production and roads, (implementation schedule attached to Post Project Operational Plan)
- (7) Post project recurrent costs based on actuals up to 1993, less transfer payments (rent, taxes, royalty) and modified for local/foreign conversion factors and for inflation.
- (8) In with project case, actual costs used up to 1993 then projected with contingencies following expected inflation thereafter.
- (9) In without project case, recurrent costs based on SAR estimates for 1988 and prorated for following year based on estimated production levels for without project case.
- (10) ERR in SAR was 42%.

APPENDIX 1 RE-EVALUATION OF ECONOMIC AND FINANCIAL RATES OF RETURN

TABLE 2: BHUTAN LOGGING CORPORATION
Financial Rate of Return With Subsidies on Local Timber Sales Unidentified
1988-1998
(Million Ngultrum)

Calendar Year ---->	----->	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Project Year ---->	----->	1	2	3	4	5	6	7	8	9	10	11
With Project Outflows												
BLC Investments (1)		40.50	8.70	3.40	4.20	11.60	0.00	0.00	0.00	0.00	0.00	0.00
TA Costs (not expensed) (2)		6.00	7.70	6.60	3.80	2.60	0.00	0.00	0.00	0.00	0.00	0.00
Equipment Replacements (3)		0.00	0.00	0.00	0.00	0.00	0.00	34.63	31.15	23.75	13.29	25.65
Total - Outflows		46.50	16.40	10.00	8.00	14.20	0.00	0.00	0.00	0.00	0.00	0.00
With Project Inflows												
Net Profit After Tax (4),(5)		3.40	6.70	13.30	9.00	-7.70	-7.70	-7.70	-7.70	-7.70	-7.70	-7.70
Depreciation (4)		12.10	11.50	9.60	7.80	8.10	7.50	7.50	7.50	7.50	7.50	7.50
Interest on Loans (4)		4.20	4.50	3.40	2.20	3.80	0.00	0.00	0.00	0.00	0.00	0.00
Sub Total - Inflows		19.70	22.70	26.30	19.00	4.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20
Without Project Inflows												
Net Profit After Tax (6)		2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Depreciation (7)		2.68	2.68	2.68	2.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on Loans (8)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub Total - Inflows		5.58	5.58	5.58	5.58	2.90	2.90	2.90	2.90	2.90	2.90	2.90
INCREMENTAL FLOWS FROM OPERATIONS		14.12	17.12	20.72	13.42	1.30	-3.10	-3.10	-3.10	-3.10	-3.10	-3.10
Residual Value of Equipment												50.00
Net flows from BLC Operations		-32.38	0.72	10.72	5.42	-12.90	-3.10	-3.10	-3.10	-3.10	-3.10	46.90

IRR (9) 2.06% IRR of (incremental) inflows ("with" minus "without" project)
NPV -13.11 Million Ngultrum

- Notes:
- (1) Annual increase in fixed assets from BLC financial statements
 - (2) TA Costs offset against Grant-in-Aid - portion of TA costs not already "expensed" in BLC financial statements.
 - (3) From PCR mission estimates - replacements were not included in SAR financial analysis therefore, for consistency, they were also excluded in the PCR financial re-evaluation.
 - (4) Profits, Depreciation and Interest taken from BLC financial statements. Post-project depreciation estimate is based on depreciation of remaining undepreciated assets plus modest annual replacements. Interest added back to be consistent with the SAR financial analysis (IRR) calculation.
 - (5) Although PCR mission projected BLC's post-project losses to increase, it is assumed that BLC will take the necessary steps reduce costs and/or increase revenues and as a result losses will not exceed 1993 levels.
 - (6) Based on BLC profit levels in the 3 pre-project years (assumed to represent "without project" case.
 - (7) From Staff Appraisal Report financial analysis "without" project case.
 - (8) No interest - in "without" project case it is assumed BLC remains debt free.
 - (9) In the SAR, BLC's IRR is estimated at 55%. If the subsidy to local timber sales is identified and credited to BLC, the IRR recalculated in based on data available to the Project Completion mission, is 26.07%. (see Table 2)

APPENDIX 1. RE-EVALUATION OF ECONOMIC AND FINANCIAL RATES OF RETURN

TABLE 3: BHUTAN LOGGING CORPORATION

Financial Rate of Return - Subsidies on Local Timber Sales Identified & Credited to BLC.
1988-1998
(Million Ngultrum)

Calendar Year ----->	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Project Year ----->	1	2	3	4	5	6	7	8	9	10	11
With Project Outflows											
BLC Investments (1)		40.50	8.70	3.40	4.20	11.60	0.00	0.00	0.00	0.00	0.00
TA Costs Offset Against Grant-in-Aid (2)		6.00	7.70	6.60	3.80	2.60	0.00	0.00	0.00	0.00	0.00
Equipment Replacements (3)		0.00	0.00	0.00	0.00	0.00	34.63	31.15	23.75	13.29	25.65
Total - Outflows		46.50	16.40	10.00	8.00	14.20	0.00	0.00	0.00	0.00	0.00
With Project Inflows											
Net Profit After Tax (4) (5)		3.40	6.70	13.30	9.00	-7.70	-7.70	-7.70	-7.70	-7.70	-7.70
Depreciation (4)		12.10	11.50	9.60	7.80	8.10	7.50	7.50	7.50	7.50	7.50
Interest on Loans (4)		4.20	4.50	3.40	2.20	3.80	0.00	0.00	0.00	0.00	0.00
Subsidy on Local Rural/Urban Sales (6)		40.00	41.00	47.30	65.80	28.60	28.60	28.60	28.60	28.60	28.60
Sub Total - Inflows		59.70	63.70	73.60	84.80	32.80	28.40	28.40	28.40	28.40	28.40
Without Project Inflows											
Net Profit After Tax (7)		2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Depreciation (8)		2.68	2.68	2.68	2.68	0.00	0.00	0.00	0.00	0.00	0.00
Interest on Loans (9)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidy on Local Rural/Urban Sales (10)		48.19	37.07	29.66	29.66	29.66	27.80	27.80	27.80	27.80	27.80
Sub Total - Inflows		53.77	42.65	35.24	35.24	32.56	30.70	30.70	30.70	30.70	30.70
INCREMENTAL FLOWS FROM OPERATIONS		5.93	21.05	38.36	49.56	0.24	-2.30	-2.30	-2.30	-2.30	-2.30
Residual Value of Equipment											50.00
Net flows from BLC Operations		-40.57	4.65	28.36	41.56	-13.96	-2.30	-2.30	-2.30	-2.30	47.70
IRR (11)	26.07%	IRR of (incremental) inflows ("with" minus "without" project)									
NPV	21.85	Million Ngultrum									

- Notes:
- (1) Annual increase in fixed assets from BLC financial statements
 - (2) TA Costs offset against Grant-In-Aid
 - (3) From PCR mission estimates - replacements were not included in SAR financial analysis therefore, for consistency, they were also excluded in the PCR financial re-evaluation.
 - (4) Profits, Depreciation and Interest taken from BLC financial statements. Post-project depreciation estimate is based on depreciation of remaining undepreciated assets plus modest annual replacements. Interest added back to be consistent with the SAR financial analysis (IRR) calculation.
 - (5) Although PCR mission projected BLC's post-project losses to increase, it is assumed that BLC will take the necessary steps reduce costs and/or increase revenues and as a result losses will not exceed 1993 levels.
 - (6) From report prepared by BLC to illustrate the magnitude of subsidies on local sales to Rural/Urban timber consumers.
 - (7) Based on BLC Profit levels in 3 years prior to project. (representative of "without project" case.
 - (8) Taken from Staff Appraisal Report financial analysis "without" project case.
 - (9) No interest - in "without" project case it is assumed BLC remains debt free.
 - (10) Estimates of Subsidies "without project" are based on difference between prices received by BLC at auction sales and statutory sales to local rural/urban consumers (assumed at 50% of total timber volume "without project").
 - (11) If the subsidy to local timber sales is not identified and credited to BLC then IRR, recalculated by the PCR mission is 2.06%. The SAR estimate of BLC's IRR was 55%.

PROJECT COMPLETION REPORT

APPENDIX 2

BHUTAN

SECOND FORESTRY DEVELOPMENT PROJECT (Credit 1900-BHU)

**Aide Memoire of the Project Completion Mission
June 5 - 24, 1994**

Introduction

1. An IDA Project Completion mission visited Bhutan from June 5 to 24, 1994, to undertake a comprehensive review of implementation experience related to the above referenced project, which was completed December 31, 1994. Mission team members included: Mr. Jay Blakeney, ASTEN, Forestry Specialist and Team Leader; Ms. Ai-Chin Wee, Senior Agricultural Economist (SAINE); Mr. John Rithaler, Forest Engineer; and Dr. Daniel R. Miller, forest entomologist. Mr. Peter Staeli, representing Swiss Development Cooperation (SDC), project co-financiers, also provided insights and opinions. The mission expresses its appreciation to the Bhutan Logging Corporation (BLC), the Forestry Department (FD) and other agencies of the Royal Government of Bhutan (RGOB) for their cooperation and assistance during the mission's visit in Bhutan. The findings and recommendations expressed in this Aide Memoire are preliminary and subject to confirmation by IDA management.

Implementation Completion Report

2. On return to headquarters, Mr. Blakeney, will assemble the inputs of the mission members and prepare the report. The Borrower (RGOB) contributes to the report by preparing its own final report on the project, together with a summary of it. The mission urges RGOB to complete its assessment of Borrower Performance in preparing, implementing and operating the project and forward it to IDA, c/o Mr.J.Blakeney at Fax No. 1-(202) 522 1664, by July 15, 1994.

Project Concept and Objectives

3. The project objectives were clear and pragmatic. The project helped to organize a systematic timber production under strict guidance of forest management plans, and to maintain pest control measures to help ensure the health of Bhutan's forest resources, the second most important contribution to the nations's revenues. Recognizing also, the need to maintain efficient production operations, the project assisted RGOB to set up an semi-autonomous Corporation that did not depend on budgetary allocations to undertake its work, that could transact business, and undertake revenue generation and proper cost-accounting of its operations. The systems instituted under the project were complex, relative to earlier rudimentary systems of harvesting and accounting. However, the project helped to modernize the operations and establish these functions on sound management and control procedures which will guide future growth and development, and pave the way for RGOB's intention to selectively privatize BLC's operations.

Project Timing

4. The project was responsive to RGOB's changing circumstances and priorities. From 1979, RGOB banned logging by commercial operators, which were thought to be over-exploiting the forest resource, and entrusted logging to the Forest Department's Logging Division - which was later to develop into ELC. RGOB's Fifth and Sixth Five Year Plans (1981/82 - 1991/92) viewed the forests as a natural resource which needed to be conserved and managed, and

viewed the forests as a natural resource which needed to be conserved and managed, and recognized the need for selective access road construction and phased timber extraction, together with a systematic reforestation to restore the exploited forests. The project took up these concerns in 1988 and helped to establish the institutional capacity (through the Department of Forests and Bhutan Logging Corporation) to undertake these functions.

Project Components and Achievements

5. In general the project has achieved its major objectives of strengthening the managerial and technical capacity of BLC and FD in the fields of: forest pest management, forest management planning, road planning and construction, forest harvesting, reforestation, marketing of timber products and financial control. The project demonstrated that efficiently managed mechanized logging, undertaken by a parastatal body exclusively dedicated to forest harvesting and timber disposal, can ensure wood supply to existing and planned users while at the same time avoiding the considerable environmental damage associated with previous, adhoc timber removals using manual methods. Specifically the project:

- (a) addressed the immediate need to arrest forest degradation due to a Bark Beetle epidemic in Western Bhutan, which had arisen due to adhoc, uncontrolled logging which generated high concentrations of forest debris providing ideal breeding grounds for a Bark Beetle population explosion. The capability to mount pest surveillance and control programs were widely instituted in the project area. These measures arrested the epidemic within three years.
- (b) salvaged of pest-attacked timber in a timely manner, ensured its value contributed to the national economy rather than being lost due to further deterioration.
- (c) introduced mechanized timber extraction systems based on low density road networks built to specifications which would control erosion, and the use of low-impact, overhead cable way logging systems in place of the previous destructive, manual systems in which logs were rolled down steep mountainsides, resulting in killing residual trees and leading to future erosion problems.
- (d) strengthened FD's capacity to make sound management plans to guide road construction, harvesting and regeneration and required BLC to protect, regenerate and replant logged-over areas.
- (e) established workshop facilities to train technicians to maintain logging and road equipment in working order.
- (f) clarified functions of FD as a resource regulatory agency and BLC, as a financially autonomous entity entrusted with and specialized in extraction and marketing timber from public lands.
- (g) strengthened BLC capacity to handle the efficient and timely transport and marketing of timber products at auction yards, thus avoiding the pre-project delays of up to two years which resulted in considerable loss of value to product deterioration.
- (h) strengthened BLC capacity in the field of cost accounting and preparation of financial statements.

Project Outcomes

6. The project succeeded in achieving its major objectives of strengthening the managerial and technical capacity of BLC and FD in the fields of: forest pest management, forest management planning, road planning, construction and maintenance, forest harvesting, reforestation, marketing of timber products and financial control. The project has demonstrated that efficiently managed mechanized logging, undertaken by a parastatal body exclusively dedicated to forest harvesting and timber disposal, can ensure wood supply to existing and planned users, while ensuring a minimum of environmental damage.
7. The project resolved environmental problems caused by a bark beetle epidemic, over three thousand hectares of coniferous forest. The epidemic was triggered by a combination of drought, which further weakened already overmature forest, and unsanitary, ad-hoc timber removals in settled areas of Western Bhutan. The project controlled the epidemic by removal of infested trees, minimizing the spread of infestations and facilitating timber recovery before excessive loss of value. Ongoing controls included surveillance and debarking and removal or burning of slash material to eliminate favorable breeding sites and prevent further increase in beetle population levels.
8. Introduction of mechanized logging, utilizing low-impact, overhead cableways, was very timely. It not only reduced dependence on scarce, imported labour, but also ended the traditional practice of manually rolling logs down steep hillsides, damaging or killing residual trees and leading to future erosion problems.
9. The project was successful in differentiating and strengthening the institutional capacity of FD and BLC in their separate, but complementary roles, and also developing efficient procedures for forest and pest management, reforestation, marketing, national revenue generation and financial control. The pest epidemic has been substantially brought under control, although infestation has again been noted in non-BLC operations where territorial and local harvesting have not been diligent in debarking and disposing of logging wastes. Strict instructions and pest surveillance should continue in the post-project period.
10. In five years, BLC has developed remarkably from its former status as the Logging Division of the Forest Department, to a semi-autonomous Corporation which is well-managed, financially accountable, efficient in its operations, and an important revenue source. Over the five-year project period (1989-93) BLC has contributed, on average, Nu 21.1 million annually (maximum of 38.4 million in 1990) to RGOB in the form of royalties, dividends and corporate taxes. During the project period 1989-93, BLC has also borne exchange rate fluctuations on foreign exchange costs, totalling 12 million, and repaid the subsidiary loan from RGOB including 12% interest¹, totalling Nu 17 million.
11. National timber production is far below estimated annual sustainable harvest of 1 million cu.m./year. BLC has an operating capacity (42,000 cu.m./year), but due to the limited number of forest management plans which have been completed, current production, in the three western districts (the project area), is limited to about 25,000 cu.m./year. Further evidence of the under-utilization of BLC's capacity can be found in the low machine operating hours on most project equipment. The mission recommends FD give priority to completion of more management plans quickly, to that BLC's wood harvesting and supply operations remain viable.

¹ BLC commenced Loan repayment, with interest, in 1989 without using the grace period allowed under the Subsidiary Loan Agreement

12. Low production volumes and a necessarily capital intensive production system (given local labour shortages) has contributed to a higher than expected unit production cost. Besides high operating costs, BLC's revenues have been squeezed by several factors:

(a) About 50% of BLC's production is sold to local rural (20%) and urban (30%) consumers at RGOB-determined subsidized prices which average, respectively 13% and 30% of the equivalent auction (free market) price. For 1990-92, this subsidy totalled Nu 155 million. This could be accounted for in a separate budget allocation entitled: "social welfare subsidy", instead it is borne directly by BLC as "revenues forgone", negatively affecting BLC's financial performance.

(b) BLC continues to maintain forest roads which are now effectively public access roads. The annual cost of such road maintenance is about Nu 2 million and should legitimately be borne out of general revenues of RGOB.

(c) Since February 1993, royalty rates doubled (relative to 1986/92 rates), for all categories of wood products.

(d) Since the project commenced BLC's annual contribution to national revenue, in the form of royalties, corporate income taxes and dividends has averaged Nu.21.1 million. BLC currently maintains a reserve of about Nu.20 million. This is required for capital replacements (estimated at Nu.90 million over the 3 year post-project period, and operating costs (estimated at Nu.55-70 million at present operating capacity of 40-45,000 cu.m./year). However, BLC has just been notified by the Revenue Department that it owes Nu.20 million in back taxes from 1989-92. The effect of this requirement will be to wipe out the operating capital of BLC, and immobilize an efficient and potentially profitable production operation.

(e) While IDA funds are provided to RGOB at < 1% interest, payable over 50 years, with a 10 year grace period, BLC repays its subsidiary loan to RGOB at 12% interest, over a 9 year repayment period with only 2 years grace period. BLC recently contracted with FD to undertake logging operations in Eastern Bhutan under the IDA assisted Forestry III project. Although BLC will be provided with additional equipment for this purpose, it will have to repay the cost of the equipment in 2 years.

Implementation Experience

13. **Technical Assistance** Following initial delays in project effectiveness due to ongoing discussion of terms and conditions of IDA and SDC project participation, problems with expiration of letters of credit and slow customs clearance procedures at Calcutta port, the project proceeded, more or less as planned, with 255 man-months of TA utilized. Additional training was provided by equipment suppliers as part of their procurement contracts. The positions of Forest Engineer and Logging supervisor were extended beyond the periods envisioned in the SAR, reflecting a need for more assistance in the planning and supervision of mechanized logging operations.

14. **Equipment Procurement** A large quantity road and logging equipment was purchased by international competitive bidding (ICB) in mid-1989 and arrived at the project site in late 1989 or early 1990. With the exception of the Poclair Backhoe Excavator and rock crushers, most equipment functioned well and met project specifications.

15. The Poclair loader failed to perform to expectations as the equipment supplier did not provide an experienced operator to train BLC personnel. The machine suffered numerous mishaps due to the inexperience of BLC operator. These mishaps led to long idle periods while awaiting parts and repairs. At the time of the mission the machine is still not operating, awaiting spare parts. BLC management would like to dispose of this machine and purchase a similar model

made by Caterpillar, for which parts are more readily available. This fact was recognized at the time of procurement, but due to ICB requirements, the Poclair excavator was selected. The rock crushers also failed to meet expectations. The specifications for the original tender were changed by BLC from those prepared by the project's consultants, to those which met specifications of rock crushers being purchased by the Roads Department. As a result the equipment proved unsuitable and rock crushers of Roads Department and BLC are seldom used.

16. Log Salvage Program Annual log production, during the initial years of the project (1989-1990) when salvage of beetle killed timber reached its peak, averaged 66,000 cu.m. resulting in annual sales revenues of 90 million Nu. Considerable financial and economic benefit accrued to Bhutan from the timely salvage and marketing of this timber, much of which would have been lost due to deterioration if its salvage had been limited to manual methods, utilizing a diminishing labour supply, due to RGOB's ban on importation of foreign workers.

17. Post-Salvage Log Production In 1990 the FD declared a moratorium on logging in forests for which forest management plans had not been prepared. Delays in completion of forest inventory and management plans for the project, which were to have been undertaken with the assistance of Forest Inventory, Data Processing and Management Planning specialists, provided under UNDP/FAO project BHU/85/016, resulted in BLC operations being limited to salvage of beetle killed timber. Group selection harvesting trials provided BLC with a limited number of harvesting sites in live, healthy forests. However, the number of areas approved were insufficient to utilize the full capacity of BLC's equipment. Timber production from project equipment, some of which has been deployed in other divisions, declined to an annual average of 43,500 cu.m. in 1992/93, with sales revenues of Nu 76 million.

18. Status of Forest Management Planning With completion of forest inventory and management plans for 4 Forest Management Units (FMUs) in western Bhutan in 1993, it is clear that annual net recoverable timber harvests will be 25,000 cu.m. - at least until remaining FMUs in the Western Districts (Haa West FMU, FMU above Chuzom, FMUs near Thimphu) have been inventoried, management plans prepared and road access constructed. The mission estimates that BLC's annual production capacity at 42,000 to 46,000 cu.m.²

19. BLC Profitability Declining sales volume has adversely affected BLC's profitability. Increased costs of operating at lower levels could not be passed on to consumers due to RGOB policy of fixing prices on about 75% of BLC's production at below costs and below the market values. Net profits before taxes, averaged Nu 12 million annually during the log salvage period (1989-91). These dropped to a loss of Nu 7 million in 1993. Unless measures are taken to accelerate forest inventory and management planning to make more area (and timber volume) available for harvesting and/or to redistribute BLC's equipment and manpower resources to these areas, BLC will remain unprofitable.

Operational Issues

20. Road Conditions Although drainage and right-of-ways are being constructed and maintained satisfactorily, road surface conditions continue to be substandard. This not only limits timber production rates, but also results in inflationary pressure on contract trucking rates, as

² Based on 13 cable cranes at an average annual production of 2,000 m³ each; 2 tower yarders at 5,000 m³ each; and 3 skidders at 2,000 m³ each. In 1996, this will increase to 46,000 m³ with 2 more cable cranes scheduled for purchase under Forestry III.

SAR estimates of 3,000 to 4,000 m³ per annum per Cable Crane, were based on higher yields per ha from salvage logging.

trucking contractors seek to cover the high costs of equipment maintenance attributable to the poor roads. The lack of suitable road surface material makes it impossible utilize BLC's road graders. The mission recommends that BLC continue to seek sources of crushed or pit run surfacing material to improve the running surfaces of its roads.

21. Forest Pests The assessment by the mission's forest entomologist is that there no bark beetle damage in standing trees. However, there is incidence of bark beetle infestation in felled trees, particularly trees felled under fuel wood operations and adhoc timber removals by local residents for home construction. These removals, which leave large accumulations of logging waste, risk increase in beele populations and a repeat of the 1980's epidemic. It is not sufficient for BLC to comply with regulations regarding debarking of logs and disposal of logging waste, if these regulations are not being followed by others.

22. Additional forest pests identified by the entomologist during his visit include dwarf mistletoe - causing considerable loss in pine timber value and aphid infestation in forest nursery stock which is under stress after being held too long in nursery beds. Local cases of plantation mortality and die-back were examined and found to be attributable to drought rather than pests. The entomologist's report is annexed to the ICR.

23. Nurseries and Regeneration of Logged Areas The need for nursery raised planting stock has been reduced due to successful natural regeneration of the logged forest. Plantation stocking surveys indicate a 90% survival rate, attributable, in part, to micro-site protection of seedlings from livestock. There are large stocks of seedlings (especially fir) in the nurseries which are not required for BLC's reforestation program. Some of this stock has been kept in the nurseries far too long and the trees, which have been raised in small planting pots which are adequate only for one growing season are now several years old and are stressed due to confined root systems. This stress has led to aphid attack which is not only killing the nursery seedlings but is also building up a potentially dangerous population of aphids which could attack mature forest trees. The mission recommended that seedlings excess to BLC requirements be disposed of immediately by donation to urban plantings or burning.

24. Silviculture In response to rather disappointing results in natural regeneration using the previous single tree selection felling system, the project silviculturist introduced the concept of group selection felling on a trial basis. The results of this system under which about one quarter to one third of the standing volume is removed in groups measuring one-quarter to one third hectare in size. Natural regeneration on these openings, which approximate natural openings in the forest caused by wind, fire or insect damage, has been so successful that this system is being widely adopted throughout the country as the silvicultural system of choice. There have been some initial problems in achieving sufficient volumes from group selection fellings to warrent setting up of cable crane lines. The FD and BLC plan to overcome this problem by selecting individual mature/overmature trees along the cable ways between group openings to augment the volume harvested.

25. Workshops Although there has been considerable improvement in workshop operations in recent years, there is still ample opportunity to improve operating techniques. The mission was concerned with poorly stored equipment at Paro workshops; lack of timely tire and wire rope replacement on skidders; and broken glass on the backhoe. Some equipment has been repaired in a relatively "makeshift" fashion and future failures will almost certainly be incurred. A program of equipment replacement should be prepared and followed, as indicated in the attached operational plan.

Issues Related to BLC's Sustainability

26. **BLC's Role as an Autonomous Corporation** Although its charter states that it should function as an autonomous body, it is clear that BLC is still governed to a large extent by RGOB officials and procedures. BLC's board of directors is exclusively made up of government officials. Evidence of BLC's lack of independence in decision making can be seen in its inability to set sales prices for its products at a level which cover its operating costs, plus a reserve for equipment replacement, and a modest element of profit on its investment. Another example of a lack of independence is in remuneration and promotion of staff. BLC must follow government policy, which has resulted in loss of staff, due to an inability to pay competitive salaries. Training efforts have also been set back and valuable trained manpower lost when experienced BLC staff are transferred out of BLC service. The current lack of flexibility in rules results in BLC DFOs being unable to pay competitive rates to contractors. This results in-sufficient labour to undertake, road construction and logging operations. In selecting future staff, BLC should be committed to engaging (and keeping) a high quality and committed staff, through provision of competitive benefits, training and regular advancement. Only in this way can it avoid the trend, evident throughout the project, which saw a 50% turnover in high quality staff, through transfers and resignations.

27. During the project there was considerable progress toward broader representation on BLC's Board of Directors. However, there is still an opportunity to make the Board more representative of stake holders in the forestry sector. Possible changes to the board include representation from timber processors and merchants who process logs and distribute sawn timber originating from BLC operations, as well as from Ministry of Trade and Industry which governs their activities. At appraisal, it was envisaged that the chairman would appoint technical advisors from outside FD and BLC who would be invited to visit the project activities periodically, and to offer suggestions for improving BLC operations. This has not yet happened.

28. **BLC's Corporate Mandate Conflicts with Social Welfare Role** In addition to being expected to provide considerable financial resources to RGOB's treasury, through royalties, dividends and taxes, BLC is also expected to provide a number of "social benefits". Examples include: providing free road access to rural communities and other resource users. (Territorial DFO's, Mining Operators, firewood gatherers, etc.) It is also expected to provide large volumes of timber to rural and urban users at prices well below either BLC's cost or true market value.

29. The mission observed that these additional "social benefits" which BLC is required to provide in addition to its primary role in harvesting and marketing of commercial timber, are proving to be too heavy a burden and are leading to a loss of BLC's financial viability. This is particularly true in light of the fact that timber volumes available have been reduced, leaving little volume for auction sales at higher (market) prices. Local purchasers also get priority to select prime timber and the "picked over" timber is sold at auction. Hence the price premium for better quality timber is not captured through BLC's auction sales. It is these export sales that provided sufficient surplus profits to enable BLC to subsidize timber supplies to rural and urban users in past years, when production rates were higher.

30. Recent demands by the Revenue and Customs Department of the Finance Ministry for payment of Nu 20 million in back-taxes, related to Exchange Fluctuation and Depreciation expenses, have further aggravated BLC's financial performance. If met, these demands would wipe out BLC's remaining reserves and leave it with insufficient working capital to continue operations. Alternatively BLC would have to sell off much of their equipment to meet these demands, thus returning the corporation to the "pre-project" state of depending on environmentally damaging, and socially unacceptable use of imported labour and manual logging systems.

31. The mission is concerned that the factors highlighted above may jeopardize BLC's sustainability in the post-project period and therefore urges RGOB to conduct a review of BLC's role and mandates and clarifies BLC's role in light of the seemingly incompatible demands being placed on the corporation.

32. Suggested solutions include:

(a) RGOB subsidies to BLC road construction, particularly in new FMUs where long access roads are required to reach harvestable timber and where there are other road users are involved;

(b) allow BLC to operate at sufficient timber production volume to have surplus to sell at auction and make enough surplus profit to be able to subsidize costs incurred in selling wood at below cost to rural and urban users; and,

(c) Reexamination of Ministry of Finance request for BLC to pay Nu 20 million in back taxes, despite the fact that BLC's financial statements for the period in question have been audited and certified by Royal Audit Authority.

Looking to the Future

33. Clarification of marketing, pricing and subsidy policies. It is recommended that these issues be carefully examined and decisions to be taken soon. RGOB could decide for instance, that:

(a) all BLC sales be conducted through auction, open to all Bhutanese buyers (on a preferred basis) to realize true market prices for products.

(b) all residue wood, not sold through local auctions, would be sent for auction in Phuntsholing or Geylephug to outside buyers.

(c) the ban on export of logs would continue, thus requiring at least initial processing to take place in Bhutan.

(d) price subsidies on wood for rural and urban populations be given as a budget allocation, possibly through social service sector, as a welfare subsidy (the annual amount can be determined using BLC's supply figure. These subsidies should not continue to reduce revenues to BLC. In this way subsidies would be explicitly recognized, market prices would not be distorted, and Bhutan's wood buyers would still get preference, but would be made to saw wood competitively in order to sell to outside buyers of sawnwood.

34. Need to Replace Equipment Some of the equipment BLC is operating has exceeded its economic life and needs to be replaced, otherwise production capacity will gradually decrease and maintenance costs will mount. A proposed conservative replacement schedule, based on the low predicted operating capacity, will be included in the ICR. Immediately required is the replacement of five Nester Cable Cranes, one bulldozer and three air compressors.

35. Need to Train FD and BLC Operating Staff Technical assistance in Forest Inventory Forest Management Planning were provided to FD under UNDP/FAO programs and by the SDC under Forestry II. Technical Assistance in Operational Forest Management Planning is currently being provided by the Netherlands. Likewise, Forestry III provides BLC with additional cable cranes and some technical assistance in road and logging planning for its expanded operations in Bhutan's Eastern divisions. At present, there are no plans for continuing technical assistance to existing BLC operations in Western Bhutan. The mission concludes that there is there is an ongoing need to strengthen the capacity of BLC's DFOs in planning and executing forest harvesting and marketing, as well as the deployment, operation and maintenance of mechanized road and logging equipment. The mission recommends that RGOB explore the possibility of obtaining technical

assistance through a bilateral technical cooperation agency (Germany, Austria, Canada, etc.) with experienced field personnel who could be deployed to assist/train BLC's divisional DFO's in carrying out their responsibilities.

36. Need to Ensure Continuity of BLC Management Skills

BLC's present managing director capably guided BLC through the project implementation period. (as he did the first IDA assisted Forestry Development Project Cr.1460-BHU). The mission recommends that RGOB ensures that there will be continuity of management skills, either through extension of tenure of the incumbent managing director, and/or recruitment of a well-qualified deputy as understudy. These decisions should be taken soon to ensure continuity. Given the role that BLC plays, it is recommended that in selecting such a candidate, RGOB consider both candidates with a strong forestry background as well as those with strong commercial and business management experience.

Report Prepared by: Implementation Review Mission

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BHUTAN
SECOND FORESTRY DEVELOPMENT PROJECT

IDA Credit 1900-BHU

OPERATIONAL PLAN FOR POST PROJECT PERIOD (1994-1997)

BHUTAN FOREST SERVICES DIVISION

1. Operational Plans for Forest Management Units (FMUs) - complete and commence implementation of Operational Plans for the 7 FMUs for which Management Plans have been completed, at an average annual rate of 2 operational plans per year for the next 3 years.
2. Forest Inventory and Management Planning - completion of these aspects for the remaining 7 FMU for which management plans have not been completed at the rate of FMUs per year for the next 3 years.
3. Pest Surveys and Control FD will ensure that its territorial officers will continue a program of sanitary logging including: prompt debarking and disposal of logging wastes through burning.

BHUTAN LOGGING CORPORATION

1. Procurement - Two new cable cranes are to be purchased under the Third Forestry Development Project for BLC's harvesting operations in Eastern Bhutan. In addition to this equipment, the mission will prepare estimates of replacement equipment to be procured during the operational plan period. These will be provided to BLC on completion of the ICR.
2. Equipment Retirement And Sale - A large number of equipment items have already been retired from service and sold at auction, resulting in approximately \$170,000 in revenue to BLC. Additional items planned for retirement and sale include the Poclain Excavator and three rock crushers.
3. Staff Training and Technical Assistance - During the operation plan period BLC in cooperation with RGOB will investigate the possibility of obtaining technical assistance from bilateral donor to strengthen the capabilities of BLC's DFOs in BLC operations in Western Bhutan.
4. Road Construction - During the Plan Period BLC will need to develop forest road to service approximately 16,000 cu.m. of timber which BLC has the capacity to harvest. This is estimated to be approximately 7 km. of road annually, consisting of: Main Access Road - 2 km and Spur Road - 5 km.
5. Forest Harvesting - in the three western divisions BLC will harvest and market 25,000 cu.m. of logs annually. This will be augmented by an additional 17,000 cu.m. of logs from BLC operations in other divisions during 1994 and 1995, and an additional 4,000 cu.m. from 1996 onward when the two additional cable cranes financed under Forestry III arrive.
6. Forest Nursery and Plantation - stocking surveys conducted 3 years following harvesting, will continue to indicate area requiring planting. Based on recent experience, BLC will require a forest nursery capacity of approximately 40,000 to 50,000 seedlings/year in order to plant the 40 to 50 hectares per year which will require planting during the plan period.
7. Pest Surveys and Control BLC will continue a program of periodic survey for pest out-breaks and its present sanitary logging program of prompt debarking and disposal of logging wastes through burning.

Equipment Replacement Schedule
1994-2008

EQUIPMENT	No.	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
		million Nu.														
Nester Winch	6	11.16	11.16	11.16												11.16
Gantner Winch	9					10.86	10.86	10.86	10.86							
D6D Bulldozer	1								3.72							
D5D Bulldozer	1	3.72										3.72				
Penz Hy. Loader	6							3.4	3.4	3.4						
Ashok-Leyland	6	0.86	0.86	1.72	1.72					0.86	0.86	1.72	1.72			
Tipper Truck	2									0.64	0.64					
4*4 Truck	1											0.52				
Ford tractor	3					0.28	0.28	0.28						0.28	0.28	0.28
928E floader	3										1.8	1.8	1.8			
928E Bucket Load	1						1.6									
125E Dresser	2							2.1	2.1							
E-500 Tower Yard	2								4.42	4.42						
A-L Trucks	2					0.84										0.84
Clark Skidder	2									2.05	2.05					
Cat 618 Skidder	1								2.05							
Vibromax Compact	2						0.68	0.68								
Air Compressors	3	1.26						0.42	0.42	0.42				0.42	0.42	0.42
Poolain Excavato	1											2.9				
580E Backhoe	1						1.3									
Nissan Double Ca	5				0.4	0.8	0.8					0.4	0.8	0.8		
Nissan Single Ca	2			0.37	0.37	0.37					0.37	0.37				
Nissan Patrol	1								0.42							0.42
Maruti	2		3					3					3			
A450E Grader	1															
Gantner winchs		6.43	5.43													
Misc.		5.4	5.4	5	5	5	5	5	5	5	5	5	5	5	5	5
Road Construction		6.8	5.3	5.5	5.8	6	6	6	6	6	6	6	6	6	6	6
YEARLY TOTAL		34.63	31.15	23.75	13.29	25.85	25.22	31.74	38.39	24.59	16.72	22.43	16.8	12.5	11.7	23.84

ELC Staffing

No.	Position	No. of Staff
1	Managing Director	1
2	DFO	4
3	ADF	1
4	Forest Ranger	13
5	F.R. Trainee	2
6	Forester	28
7	Forest Guard	71
8	Asst. Admin. Officer	1
9	Stenographer	1
10	U.D.C.	3
11	L.D.C. I	11
12	L.D.C. II	7
13	C.A.O.	1
14	Dy. C.A.O.	1
15	Finance Officer	2
16	Asst. Accts. Officer	3
17	Dy. Chief Acct.	2
18	Sr. Acct.	4
19	Assist. Acct.	4
20	Acct. Clerk	4
21	Sr. Computer Op.	1
22	Store Officer	1
23	Foreman	5
24	Mech. Engineer	1
25	JCTS	1
26	D/man	1
27	Mechanic	7
28	Electrician	2
29	M.O.	44
30	Store I/C	1
31	Driver	17
32	Welder	1
33	Peon	2
	Total	254
	Temporary Staff	49
	Grand Total	303

The yarding and loading is on contract.

BHUTAN**Second Forestry Development Project
Cr.1900-BHU****Bark Beetle Management Program in Bhutan**

Prepared by
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24 January 1996

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SUMMARY

The bark beetle management program, established by the World Bank and the Bhutan Logging Corporation (BLC), appears to be an effective and sustainable program against the Himalayan bark beetle, *Ips stebbingi* (Strohmeyer). Sanitation/salvage logging, coupled with debarking and full utilization of harvested pines and spruces, has mitigated the impacts of past infestations. Removal of infested trees has minimized the spread of infestations and facilitated recovery of timber values before excessive degrade. Debarking and reduction in slash material removed favourable breeding sites and prevented further increases in population levels. However, serious risks from the Himalayan bark beetle will arise again due to a lack of similar practices by independent house builders and firewood cutters. At present, BLC has the expertise and infrastructure to deal with infestations as they arise. However, such management practices will result in added expenses to BLC and loss of high-value non-timber stands. A comprehensive land-use management plan would greatly aid in minimising liabilities from forest pests.

INTRODUCTION

Infestations of bark beetles in western Bhutan have occurred continually between 1982 and 1990. The primary species attacking blue pine, *Pinus wallichiana*, and spruce, *Picea spinulosa*, was the Himalayan bark beetle, *Ips stebbingi* (Strohmeyer)¹. By 1985, infestations of bark beetles covered over three thousand hectares, with an estimated timber volume loss of over 2 million cubic metres².

Control programs began in 1985, with developments occurring over the next four years through efforts of the Food and Agriculture Organization (FAO) and the World Bank. Several entomologists were brought in to Bhutan as consultants. These included Prof. H.

¹ Recently, the foremost taxonomist and systematicist of bark beetles in the world, Dr. S.L. Wood, Brigham Young University, has reviewed the type specimens of *I. stebbingi* and *I. schmutzenhoferi*. He recognizes *I. schmutzenhoferi* as a synonym for *I. stebbingi*.

² Schmutzenhofer, H. 1985. Consultancy in forest entomology in Bhutan. Technical Advisory Services for Forestry Development, Food and Agriculture Organization. FO: BHU/83/022. Field document 8.

Schmutzenhofer, Prof. H. Eidmann and Dr. J. Regnander. Prof. H. Schmutzenhofer has had the longest continual role in developing a pest management program against the Himalayan bark beetle, with his last visit in 1992. Through his efforts and support from the World Bank, a program was developed that continues to be practiced by the Bhutan Logging Corporation (BLC).

During epidemics, the program has three phases. Beetles have two generations per year, with flights starting in April and ending in October. During the winter months, beetles overwinter under the bark in standing trees³. Phase one consists of the identification of such trees by forestry staff. Infested trees are felled and debarked. The bark is destroyed since many of the beetles may have completed their development, especially by March. The purpose of this tactic is direct population reduction. Such methods generally fail to kill all beetles. Efficacies of 60-80% are common among other species of bark beetles. However at high population levels, this still leaves a substantial number of insects.

The second phase is therefore a reduction of breeding material for the residual population. *Ips* species generally prefer recently-downed trees, due to reductions in defenses by the trees. Attack success and brood survivorship in standing trees are generally lower than in downed material. All trees felled by BLC are quickly debarked to prevent beetles from attacking and developing during the summer months. The need for debarking is urgent since generation times are less than two months, with at least two generations per year. If logs were not debarked quickly after felling then beetles could attack and emerge by mid to late summer and attack standing trees.

The third phase is provision of an alternate host, rather than standing trees in order to contain the infestations and protect adjacent stands. Trap logs are set in easily-accessible areas. Debarking occurs after they are fully attacked. The bark is left to dry, with the innermost surface exposed to the sun. Most of the progeny at this time are larval and highly susceptible to desiccation. An alternative method is the use of pheromone-baited traps. This reduces the need to use trees and does result in high trap catches. Catches of up to 93,000 beetles per trap have been recorded in Bhutan over a summer⁴. However, the appeal is low among BLC staff due to high incidence of attacks on trees adjacent to baited traps.

During non-epidemic years the program is simple ... reduction of host material that could initiate a bark beetle epidemic. The past epidemics occurred as a consequence of excessive slash material left by house builders and drought conditions in overmature stands. BLC debarks all pines and spruces, as a general practice, in order to prevent an opportunity for beetles to develop. In addition, BLC maximizes the use of all trees by removing all logs (not just squared timbers) and utilizing smaller diameter tops. In contrast, house builders have traditionally left slabs from the use of pit saws as well as tops of large-diameter trees. These are ideal breeding grounds for beetles.

REVIEW METHODOLOGY

Assessment of the program was determined by a review of previous reports, discussions with BLC personnel and site visits to Thimphu, Paro and Haa forest districts during the period of 6-11 June 1994. John Rithaler (World Bank) and personnel from BLC were always present during site visits. Stands treated with sanitation/salvage logging in the past due to infestations of the Himalayan bark beetle were the principal areas of concerns. We also visited current logging

³ Schmutzenhofer, H. 1988. Mass outbreaks of *Ips* bark beetles in Bhutan and the revision of the genus *Ips* de Geer for the Himalayan region, pp 345-355. In T.L. Payne and H. Saarenmaa (eds.). Integrated control of scolytid bark beetles. Virginia Polytechnic Institute and State University Press, Blacksburg VA.

⁴ Schmutzenhofer, H. 1989. Draft report on forest entomology. Bhutan, World Bank, Forestry II - BHU-1900.

operations employing group selection cuts with a cable logging system. In all cases, I looked for evidence of recently attacked trees as well as other forest health problems such as dwarf mistletoes. Regeneration in harvested areas and seedling stock in nurseries were examined for impacts from forest pests.

TIMBER HARVESTING AREAS

There are no epidemics or infestations of bark beetles in western Bhutan at present. I was unable to find any trees recently killed by the Himalayan bark beetle at any of the sites. During the past bark beetle epidemic, BLC staff identified and removed all dead or dying trees. Trees with brood were debarked to kill offspring. Due to a lack of infestations, all activity by BLC has been geared to normal production systems using group selection harvesting. There has been very little beetle chasing of late. In fact, the only beetles that I was able to find were in trees felled by home builders and firewood cutters.

The current state of the forests in western Bhutan can be attributed to the bark beetle management plan established by the World Bank. The major benefits of the program were most likely the prevention of the spread of infestations to adjacent susceptible stands and the recovery of timber values before degrade losses occurred. Beetles were contained in infested stands by baited traps and trap logs. Adjacent stands were susceptible to beetles. In addition, the slash created by house builders would have fuelled the infestations in a fashion similar to high fuel loads and fire. Sanitation/salvage logging further aided in maximizing recoverable wood volume before degrade losses occurred.

Additional benefits to resource values within stands are probably not very significant. It is possible that tree mortality was reduced in infested stands. It is also possible that infestations collapsed earlier than if no program had been implemented. However, the magnitude of these possible benefits were probably not very great. Infestations of *Ips* bark beetles do not generally last very long. Mortality within the stands was already quite high. In my opinion, the opportunity to gain benefits from either of these parameters was never very large.

Continuation and sustainability of the bark beetle program is dependent on adequate support and training. Levels of both are currently good for BLC staff. However, I recognize two areas of concern. First, the incentive to continue debarking pines and spruce may decline without infestations occurring in other areas. All pines and spruces were debarked at all sites operated by BLC. Visits to sorting areas and mills revealed that the inventory of pine and spruce had been similarly debarked during previous harvest operations. It appears that BLC has adopted an aggressive campaign of debarking all hosts capable of producing bark beetles. Infestations arising from the actions of house builders may serve to keep the bark beetle management program active and viable.

Second, there is a general lack of systematic survey of the land base for forest health concerns. It is inevitable that future infestations will have to be quite large again before they are noticed. There is no opportunity at present to deal with small spot or single-tree infestations before they develop into a major problem.

NURSERIES

The mission visited two nurseries established by the World Bank. One was located near Thimphu while the second was in the Haa valley. One observation was clear for both sites. Management had failed to maintain an equitable distribution of stock by age. There was an abundance of old stock (4-6 years old), especially at the Haa nursery. There was little if any recruitment on line to replace the stock. The nurserymen have not prepared new seedlings, while disposing of old stock. The reason was simple. Natural regeneration reduced the need for seedlings. Funding levels were

insufficient to plant existing seedlings in alternate areas, not covered by the project.

It is counter to human nature to destroy healthy seedlings. However, the liability of not removing old stock was evident at the Haa nursery. There was at least 300,000 seedlings of fir, aged 4-6 years. Almost all the stock was infested with an adelgid aphid, resulting in reduced growth and vigour. These seedlings should have been culled as soon as they reached 4 years and opportunities for planting were minimal. An abundance of old stock, constrained by containers, inevitably results in a breeding ground for forest pests.

The mission recommended that the stock of fir (4-6 years) be piled and burnt as soon as possible. If some stock is required for the current year then these should be identified and retained for planting. Pesticide for aphid control should be applied by back-pack sprayer only after planting to minimize exposure to planters.

PLANTATIONS

Most plantations were found to be healthy and diverse in species composition. There was no evidence of any major forest pest as discerned by walk throughs and discussions with BLC staff. The only exceptions were plantations of pine near Chumjon and the confluence (see attached letter). This area is dry and mesic, with insufficient precipitation for survival of blue pine. Mortality and top kill has occurred ever since the plantation was installed in 1988, with repeated mortality of subsequent plantings in 1989 and 1993. The reason is moisture stress from drought conditions. These trees were planted off site.

However, it is likely that problems will arise in the future due to dwarf mistletoe. Blue pine was a common seedling, often from natural regeneration. Many of the residual trees have obvious signs of mistletoe infection, evidenced by multiple brooms in the branches of mature trees. The sanitation/salvage operation did not apparently identify mistletoe infection as a reason for removal. This is a serious shortfall. Timber production in these areas will suffer, although these areas may satisfy non-timber requirements. A land management plan would clearly identify appropriate levels of sanitation, given timber or non-timber requirements.

CONCERNS FOR THE FUTURE

There are three major concerns for forest health problems in the future. The foremost one is related to the activities of home builders. These activities, coupled with drought conditions, precipitated past epidemics. House builders do not appear to have changed their practices, often leaving logs and slash material in which beetles can breed. These materials are left for long periods of time, enough that beetles can complete their development. Drought conditions will occur again in the future. It is only a matter of time until the next infestations plague Bhutan.

The project as funded by the World Bank has provided a means to minimize the extent of these problems. The BLC can be used to conduct sanitation/salvage operations. The downside is that normal operations and rotations are impacted. Infestations often occur in areas not necessarily scheduled for logging.

The second liability is the lack of a systematic survey system. Infestations have to become quite large before they are noticed from highly-travelled areas, unless a knowledgeable person is actually working in the area. The opportunity to deal with small problems is very limited. Treatments have to be aimed at larger problems with an associated lower rate of efficacy.

The third liability concerns another forest health problem ... dwarf mistletoe. It is obvious to all that dwarf mistletoe is prevalent in all stands of blue pine. Infection of regeneration generally occurs within 7-10 years and is correlated with distance from infected trees. Greater distances

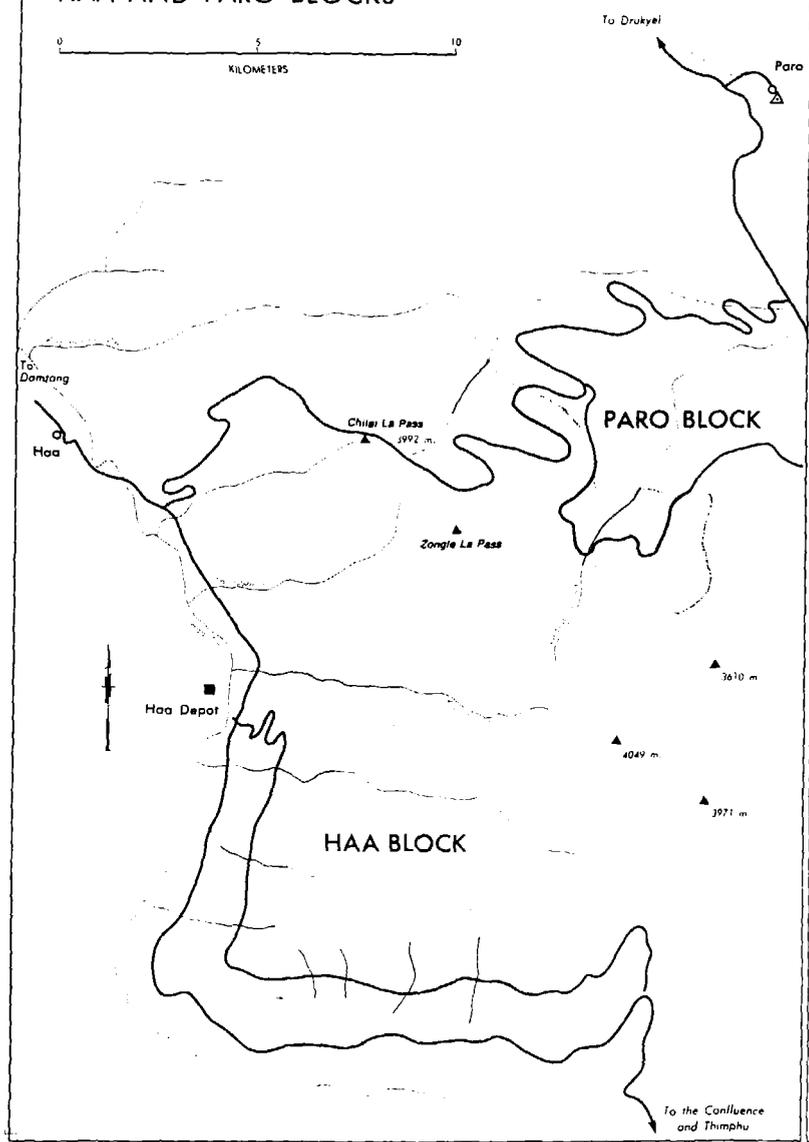
between regeneration and infected trees would reduce the risk of infection. Cuts should be larger in size to promote this aspect. The consequence is reduced volume growth, and possible increases in mortality. However, it is important to note that mistletoe is a timber problem, not a forest problem. Non-timber values are rarely impacted by mistletoe.

CONCLUSIONS

All management actions require a clear identification of the relative worth of resources for all areas to be managed. Pests that impact timber values do not necessarily impact on riparian or wildlife values. Tolerances for disturbances are lower for areas with high visual quality than those seldom seen by travellers.

A comprehensive, land-use plan would permit managers to make informed decisions. Discussions with stakeholders would establish thresholds for various forest values. Impacts upon communities downstream of forest operations would be considered. Forest managers would be able to present the tradeoffs and, in consultation with representative stakeholders, plan for future developments and actions. Pest management in the future would be more proactive with a clearer understanding of consequences.

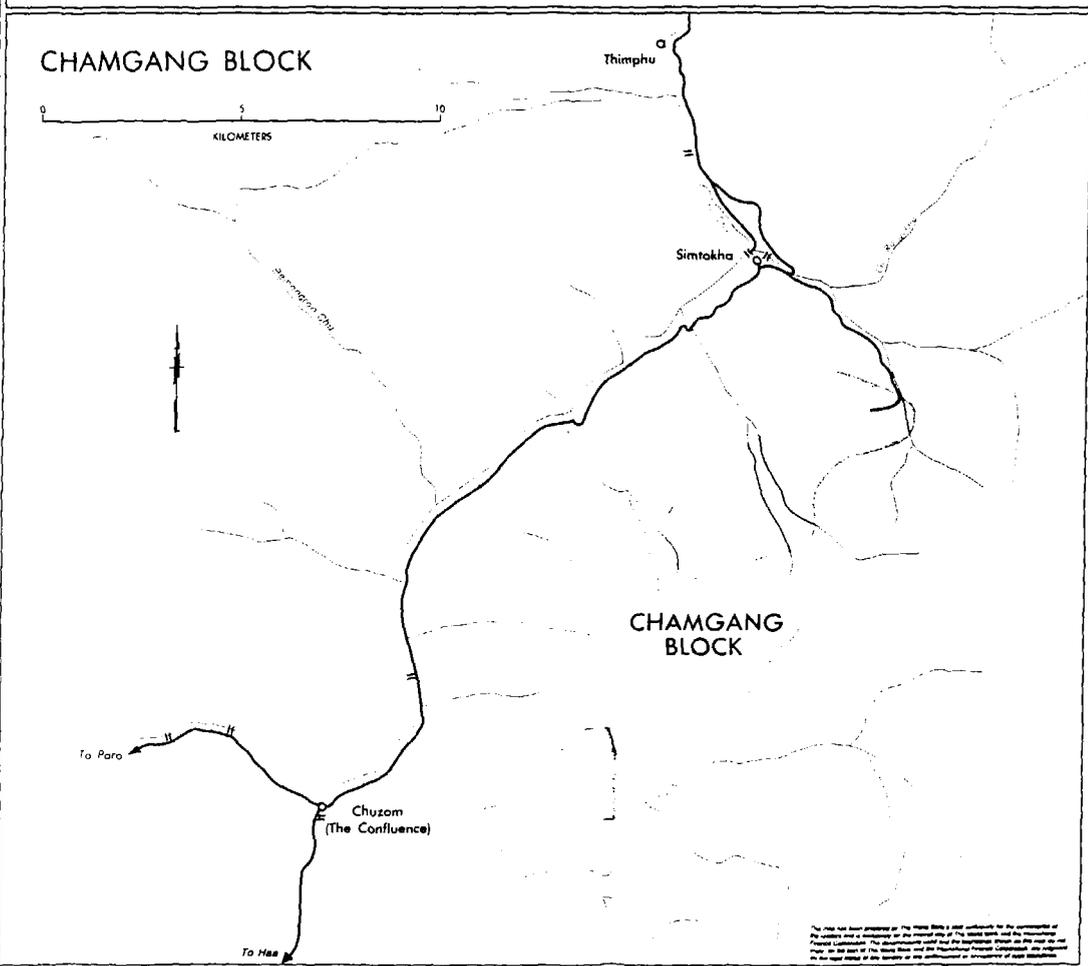
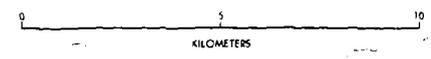
HAA AND PARO BLOCKS



BHUTAN BHUTAN FORESTRY II PROJECT PROJECT AREAS

- | | | | |
|--|---------------------------|--|---------------------------------|
| | PROJECT COMPONENTS | | TOWNS |
| | PROJECT AREAS | | PASSES AND ELEVATIONS IN METERS |
| | PROPOSED ROADS | | ROADS |
| | PROPOSED DEPOT | | RIVERS |
| | PROPOSED WORKSHOP & STORE | | BRIDGES |

CHAMGANG BLOCK



This map has been prepared on the basis of a map submitted by the Government of Bhutan and is intended for the general use of the World Bank and the International Finance Corporation. The Government will not be held responsible for any errors or omissions in the map or for any use of the map or for any consequences or damages arising therefrom.

BHUTAN BHUTAN FORESTRY II PROJECT PROJECT LOCATIONS

PROJECT LOCATIONS

ROADS *

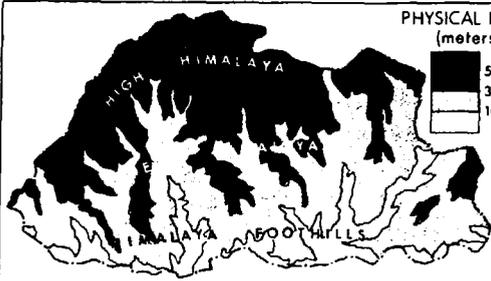
- PAVED ROADS
- UNPAVED ROADS
- ROADS UNDER CONSTRUCTION
- - - ROADS UNDER IMPROVEMENT
- - - ROADS PROPOSED UNDER FIFTH PLAN

ELEVATION POINTS IN METERS

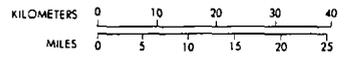
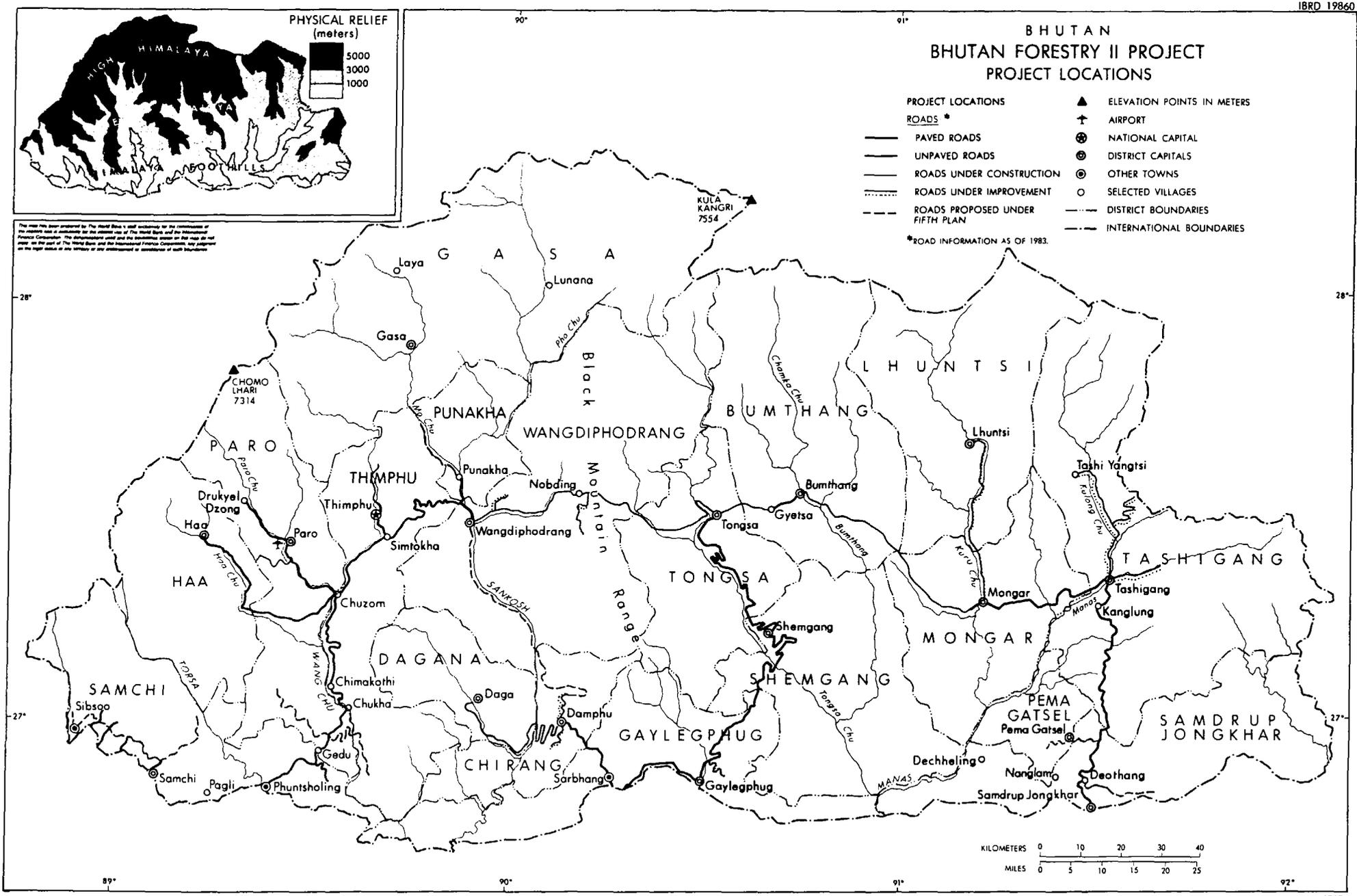
- ▲ AIRPORT
- ⊕ NATIONAL CAPITAL
- ⊙ DISTRICT CAPITALS
- ⊙ OTHER TOWNS
- SELECTED VILLAGES
- - - DISTRICT BOUNDARIES
- - - INTERNATIONAL BOUNDARIES

*ROAD INFORMATION AS OF 1983.

PHYSICAL RELIEF (meters)



The map has been prepared by The World Bank in collaboration with the Government of Bhutan for the Forests II Project. The map is a generalization of the information available in the country's official maps and the International Geographical Commission. The Government of Bhutan and the International Geographical Commission are responsible for the accuracy of the information on the ground.



IMAGING

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Type: PCR