PDFC4216

Agency For International Development

# CONTRACT INFORMATION MANAGEMENT SYSTEM (CIMS)

## DIRECT ACTION DATA FORM

*(For awards to U.S. Individuals and Third Country Nationals (not FSNs) with a TEC less than or equal to $25,000, only the shaded items on pages 1-5 of the form need to be completed.)*

NOV 12 1991

### SECTION 1: GENERAL AWARD INFORMATION (All Actions)

| 1a. Basic Award Number | 1b. Basic Mod Number | 1c. Order Number | 1d. Order Mod Number |
|---|---|---|---|
| 511-0780-G-00-1424-00 | 00 | | |

AWARD NUMBER COMPONENTS [Items 2-6] NOTE: For modifications and orders — these items refer to the Basic Award.

| 2. Country/Office *(Award Prefix)* | 3. Project Number |
|---|---|
| 511 | 0780 |

4. Procurement Instrument: Report one of the following codes to identify the type of action. For a work order or a modification to a contract or work order, indicate the category of the basic contract.

- [ ] A - Cooperative Agreement
- [ ] B - Basic Ordering Agreement (BOA)
- [ ] C - Contract (Other than BOA, DQC, IQC, PO, RC, PSC)
- [ ] D - Definite Quantity Contract (DQC)
- [ ] E - Blanket Purchase Agreement (BPA)
- [X] G - Grant
- [ ] I - Indefinite Quantity Contract (IQC)
- [ ] M - GSA Schedule Order
- [ ] N - Other Federal Schedule Order
- [ ] O - Purchase Order (PO)
- [ ] P - Participating Agency Service Agreement (PASA)
- [ ] Q - Requirements Contract (RC)
- [ ] R - Resources Support Services Agreement (RSSA)
- [ ] S - Personal Services Contract (PSC)
- [ ] X - Ribbon PASA
- [ ] Z - Ribbon Contract (Buy-In)

| 5. Participating Agency *(PASA/RSSA only)* | 6. FY of Award |
|---|---|
| | |

7. Award Description

TO PROVIDE FUNDS FOR A BIOLOGICAL AND ECONOMIC ANALYSIS OF SUSTAINABLE SELECTIVE LOGGING IN BOLIVIA'S LOWLAND TROPICAL FORESTS.

| 8. Principal Place of Performance a. A.I.D. Country Code or Name | U.S. ONLY ▶ | b. City | c. State | d. Zip Code |
|---|---|---|---|---|
| 511 | | | | |

9. Beneficiary Country (A.I.D. Country Code or Name)

511

10. Project Officer

| Cntry Code/Org. Symbol or A.I.D./W Org. Symbol | Last Name | First | MI |
|---|---|---|---|
| 511- USAID/Bolivia | SLEEPER | JONATHAN | A. |

| 11. Requirement Received by Procuring Office *(MM/DD/YY)* | 12. Date Award Signed by A.I.D *(MM/DD/YY)* | 13. Effective Date of Award *(MM/DD/YY)* | 14. Estimated Completion Date *(MM/DD/YY)* |
|---|---|---|---|
| 8/27/91 | 9/9/91 | 9/9/91 | 10/30/94 |

BASIC AWARDS ONLY

| 15a. SIC Code | 15b. Is This Vendor a Small Business for the SIC of Award? | 16. Product/Service Code |
|---|---|---|
| | [ ] Yes [X] No | |

BASIC AWARDS AND ORDERS ONLY

17. Procurement Type

- [ ] A - Technical Services To A.I.D.
- [X] B - Technical Services to Host Country
- [ ] C - Commodities
- [ ] D - Training Services to A.I.D.
- [ ] E - Training Services to Host Country
- [ ] F - Participant Training
- [ ] G - Procurement Service Agent (PSA)
- [ ] H - Research
- [ ] I - Architect and Engineering Services
- [ ] J - Construction

| 18. Negotiator *(Last, First, MI)* | Country Code & Org. Symbol or A.I.D./W Org. Symbol | Signature |
|---|---|---|
| ZAMBRANA, MAX | USAID/Bolivia | |

| 19. Contract Officer *(Last, First, MI)* | Country Code & Org. Symbol or A.I.D./W Org. Symbol | Signature |
|---|---|---|
| BUCHER, CLEMENT J. | USAID/Bolivia | |



1x

# CONTRACT INFORMATION MANAGEMENT SYSTEM (CIMS)
# DIRECT ACTION DATA FORM

## GENERAL INSTRUCTIONS

Use this data form for reporting all contracts, DQCs, HCs, GSA and other Federal Schedule Orders, POs, PSCs and Ribbon Contracts with a total estimated cost (TEC) greater than $25,000. Use this form to report all BOAs, BPAs, IQCs, Cooperative Agreements, Grants, PASAs, RSSAs, and Ribbon PASAs, regardless of dollar amount. Use this form to report all awards to U.S. individuals and Third Country Nationals (not FSNs), including PSCs and POs, regardless of the dollar amount. It should also be used to report any orders or modifications to all of the above awards, regardless of the dollar amount of the modification or order. Complete the appropriately labeled sections for different types of awards.

For awards to U.S. individuals and Third Country Nationals (not FSNs) with a TEC less than or equal to $25,000, only the shaded items on pages 1-5 of the form need to be completed. If the TEC is greater than $25,000, all of the items pertaining to awards must be completed.

When all parts of this form have been completed send one copy, along with the requirement document(s) and the award to:

CIMS Section
MS/OP/PS/SUP
Room 1472, SA-14
Agency For International Development
Washington, DC 20523-1418

For detailed instructions, consult the Contract Information Management System (CIMS) Data Form Instruction Manual.

## SECTION 1 - INSTRUCTIONS

1a. **Basic Award Number:** Enter the award number of the award. For a modification, report the basic award number in block 1a. and the modification number in block 1b. For actions such as IQC delivery orders, report the award number of the basic contract in block 1a. and the order number in block 1c. For a modification to an order, report the basic award number in block 1a., the order number in block 1c. and the order modification number in block 1d.

For item numbers 2 through 6, see the latest version of the Contract Information Bulletin (CIB) on the Uniform Numbering System for A.I.D.-Direct Procurement Documents, for instructions and a list of codes. A list of codes is also provided in the CIMS Data Form Instruction Manual. *NOTE: For modifications or orders these items refer to the basic award.*

2. **Country/Office (Award Prefix):** Report the Country or A.I.D./W Procurement Office Code as specified in the CIB.

3. **Project Number:** Enter the last four digits of the seven-digit project number funding the award. For awards funded by operating expense money or money other than project funds, enter "0000" (zeros).

5. **Participating Agency (PASA/RSSA only):** For PASA/RSSA type actions, report the code of the participating U.S. Government Agency providing services under the agreement. A list of codes is provided in the CIMS Data Form Instruction Manual and in the CIB on Uniform Numbering Systems.

7. **Award Description:** The award description shall consist of a brief one-sentence description of the products or services being procured. The sentence shall start with the phrase "Contractor/Grantee/Recipient shall provide/assist/support..." Fill in the Award Description for all basic Awards, Orders, and modifications to PASA/RSSA awards.

8. **Principal Place of Performance (Country):** Report the A.I.D. country code, if available, or the name of the area where the work for this award will be primarily performed. For products, report the code for the country where the product is manufactured. If the place of performance cannot be determined, report the vendor's billing location.

9. **Benefiting Country:** Report the A.I.D. Country Code, if available, or the name of the country receiving technical assistance from this award.

12. **Date award signed by A.I.D.:** Enter the date on which this action (basic award, order or modification) was signed by A.I.D.

15a. **SIC Code:** Enter the Standard Industrial Classification (SIC) code that best describes the product or service acquired in this basic award. See FAR 19.102 for codes. A short list containing the codes most often used in A.I.D. is also provided in the CIMS Data Form Instruction Manual.

15b. **Small Business (Y/N)?:** Check "Yes" if the vendor is classified as "small" for the SIC of the award.

16. **Product or Service Code:** Enter the Principal Product or Service code that best describes the product or service acquired in the basic award. A short list containing the codes most often used in A.I.D. is provided in the CIMS Data Form Instruction Manual. See the FPDS Product and Service Codes Manual for a complete listing, if necessary.

17. **Procurement Type:** Check the box next to the code which best describes the category of service or commodity being procured under this award.

## SECTION 2: DATA REQUIRED FOR SPECIFIC TYPES OF ACTIONS

### GRANTS AND COOPERATIVE AGREEMENTS ONLY

**20. Grant/Agreement Type**

- [ ] A – Disaster Assistance
- [ ] B – American Schools and Hospitals Abroad (ASHA)
- [x] C – Other Specific Support Programs
- [ ] D – Title XII Authority
- [ ] E – Other than A, B, C, or D

**21. Total Amount of Non-Federal Funds pledged to this Grant/Agreement**

$218,352.00

### GSA & OTHER FEDERAL SCHEDULE ORDERS

**22. Schedule Contract Number**

**23. Name of Federal Agency Awarding Schedule**

### IQC BASIC ONLY

**24. IQC Service Area**

**25. Minimum**

$

**26. Maximum (life of contract)**

$

### ORDERS AND CONTRACTS ONLY

**27. Advisory & Assistance Services?**

- [ ] Yes
- [ ] No

### BASIC CONTRACTS ONLY

**28a. Contract Type**

- [ ] A – Cost-Plus (Fixed Fee)
- [ ] B – Firm Fixed Price
- [ ] C – Time and Materials
- [ ] D – Labor Hour
- [ ] E – Cost Sharing
- [ ] F – Cost (No Fee)
- [ ] G – Cost-Plus (Award Fee)
- [ ] H – Cost-Plus (Incentive Fee)
- [ ] I – Fixed-Price Incentive
- [ ] J – Fixed-Price Redetermination
- [ ] K – Fixed Price with Economic Price Adjustment

**28b. If Cost-type Contract, is this a level of effort (term) contract?**

- [ ] Yes
- [ ] No

**29a. Is this a Letter Contract?**

- [ ] Yes
- [ ] No

**29b. Is this a Definitization of a Letter Contract?**

- [ ] Yes
- [ ] No

**30. Preference Program**

- [ ] A – No Preference Program or Not Listed
- [ ] B – 8(a) Program
- [ ] C – Small Business (SB) Set-aside
- [ ] D – Sheltered Workshop
- [ ] E – Tie-bid Preference
- [ ] F – Labor Surplus Area (LSA) Set-aside
- [ ] G – Combined LSA/SB Set-aside

**31. Subject To Labor Statute**

- [ ] A – Walsh-Healey Act, Manufacturer
- [ ] B – Walsh-Healey Act, Regular Dealer
- [ ] C – Service Contract Act
- [ ] D – Davis-Bacon Act
- [ ] E – Not Subject to the Above ( Include PSCs)

**32. Country of Manufacture/Origin of Services (A.I.D. Country Code or Name)**

**33. Subcontract Plan Required?**

- [ ] Yes
- [ ] No

**34. Date Solicitation Notice Published in CBD** *(MM/DD/YY)*

**35. Date Solicitation Issued** *(MM/DD/YY)*



3x

20. **Grant/Agreement Type:** For Grants and Cooperative Agreements, check the box next to the code which best describes the award. Code C-"Other Specific Support Programs" refers to Chapters 4 and 6 of Handbook 13. Use Code E- "Other than A, B, C, or D," for unusual types which are not covered in codes A, B, C or D.

21. **Total Amount of Non-Federal Funds pledged to this Grant/Agreement:** Enter the total amount of matching (non-federal) funds pledged to this Grant or Cooperative Agreement.

22. **Schedule Contract No:** Enter the schedule contract number assigned by GSA or other Federal Agency which awarded the basic schedule contract. Do not use dashes in the schedule contract number.

23. **Name of Federal Agency Awarding Schedule:** Enter the name of the Federal Agency which awarded the basic schedule contract.

24. **IQC Service Area:** For IQC basic awards, enter the code which best describes the services rendered by the vendor. See listing provided in the CIMS Data Form Instruction Manual.

27. **Advisory & Assistance Services? (Y/N):** Check "Yes" if the award is for advisory and assistance services. See FAR 37.2 for definitions and examples.

28a. **Contract Type:** Check the box next to the code for the type of contract. Use code C- "Time and materials" for IQCs. Most PSCs are usually code C or D.

28b. **If Cost-Type Contract, is this a level of effort (term) contract? (Y/N):** If this is a Cost-Type Contract, check the box to indicate whether the award is a level of effort or completion. (See FAR 16.306)

Y - Yes, Level of effort (term)
N - No, Completion

30. **Preference Program:** Check the box next to the code which best describes the preference program used in making this award. Check A if no preference program.

31. **Subject to Labor Statute:** Select the Labor Statute which applies to this award by checking the appropriate box. Most A.I.D. contracts, including PSCs, are code E.

32. **Country of Manufacture/Origin of Services (Country Code or Name):** Enter the A.I.D. country code, if available, or the name of the country where the product is manufactured. For services, report the code for the nationality of the vendor. If there are multiple sources, enter the code of the country that supplies the greatest portion.

33. **Subcontract Plan required (Y/N)?:** Check "Yes" if the vender for this award is required to submit a plan for using small business concerns and small disadvantaged business concerns as subcontractors. (See FAR 19.702(a)).

34. **Date Solicitation Notice Published in CBD:** If applicable, enter the date that a synopsis of the solicitation appeared in the Commerce Business Daily (CBD).

## BASIC CONTRACTS AND NON-COMPETITIVE CONTRACT MODIFICATIONS ONLY

36. CICA Applicability

- [ ] A - CICA Applicable (include 8(a))
- [ ] B - Small Purchase Procedure
- [ ] C - Subject to a Statute other than CICA (use for FAA)
- [ ] D - Pre-CICA

37. Extent Competed

- [ ] A - Competed Action (include Small Business set-aside)
- [ ] B - Not Available for Competition (use for sole-source 8(a))
- [ ] C - Follow-on to Competed Action
- [ ] D - Not Competed

38. Solicitation Procedure

- [ ] A - Full and Open Competition (Sealed Bid)
- [ ] B - Full and Open Competition (Competitive Proposal)
- [ ] C - Full and Open Competition (Combination)
- [ ] D - Architect - Engineer
- [ ] E - Basic Research
- [ ] F - Multiple Award Schedule
- [ ] G - Alternate Source (Reduced Cost)
- [ ] H - Alternate Source (Mobilization)
- [ ] J - Alternate Source (Engineering/R&D)
- [ ] K - Set Aside ( Include competitive 8(a))
- [ ] L - Other Than Full & Open Competition (Include sole-source 8(a), FAA.)

39. Authority — Other than Full & Open Competition (Complete Only if No. 38 = L)

- [ ] A - Unique Source
- [ ] B - Follow-on Contract
- [ ] C - Unsolicited Research Proposal
- [ ] D - Patent/Data Rights
- [ ] E - Utilities
- [ ] F - Standardization
- [ ] G - Only One Source - Other than A-F above
- [ ] H - Urgency
- [ ] J - Mobilization
- [ ] K - Essential R&D Capability
- [ ] L - International Agreement
- [ ] M - Authorized by Statute (inc. sole-source 8(a), FAA.)
- [ ] N - Authorized Resale
- [ ] P - National Security
- [ ] Q - Public Interest

40. A.I.D. Special Authorities — Other than Full & Open Competition (Complete only if No.39 = M)

- [ ] A - Impairment of Foreign Aid Programs: All Personal Services Contracts (PSCs). (See AIDAR 706.302-70)
- [ ] B - Impairment of Foreign Aid Programs: Award of $100,000 or less by an overseas contracting activity. (See AIDAR 706.302-70)
- [ ] C - Impairment of Foreign Aid Programs: Written Determination by Assistant Administrator or Administrator. (see AIDAR 706.302-70)
- [ ] D - Impairment of Foreign Aid Programs: Title XII Selection Procedure-General. (See AIDAR 706.302-70)
- [ ] E - Impairment of Foreign AID Programs: Title XII Selection Procedure-Collaborative Assistance. (See AIDAR 706.302-70)
- [ ] F - Disaster Relief (See Handbook 8, Chapter 2)
- [ ] G - None of the Above Special Authorities

41. Synopsis of Procurement

- [ ] A - Synopsized prior to award
- [ ] B - Not synopsized due to urgency (use only if No. 39 = H)
- [ ] C - Not synopsized for other reason

42. No. of Offers

43. No. of Offers of Non-U.S. Item(s)

## MODIFICATIONS ONLY

44. Modification purpose (Mark all that apply)

- [ ] Incremental Funding
- [ ] Administrative Change
- [ ] Extension of Term
- [ ] New/Revised Scope of Work
- [ ] Increase in TEC
- [ ] Decrease in TEC
- [ ] Overhead Rate Adjustment
- [ ] Exercise of Option
- [ ] Transfer Administrative Responsibility
- [ ] Novation Agreement
- [ ] Termination for Convenience
- [ ] Termination for Default
- [ ] Other: _____

*For a modification which was non-competitive (i.e., which required a non-competitive justification and was outside of the scope of work of the original contract) complete items 36 thru 43. See FAR 6.302 and 6.303.*

36. **CICA Applicability:** Check the box next to the code which describes the applicability of CICA or other statutes to this award. Select code B - "Small Purchase Procedure" if this action is a small purchase pursuant to the procedures in FAR Part 13. Select Code C - "Subject to a Statute other than CICA" if this action is pursuant to the procurement procedures authorized under the Foreign Assistance Act (FAA) for impairment of Foreign Aid Programs, Title XII Selection Procedures, or Disaster Relief. Select code A-"CICA Applicable" for all other procurement actions resulting from a solicitation issued on or after April 1, 1985 and codes B or C do not apply. 8(a) awards are coded as A. Non-competitive modifications are coded as A. Select code D-"Pre-CICA" for new procurements resulting from a solicitation issued prior to April 1, 1985.

37. **Extent Competed:** Check the box next to the code which describes the extent to which this award was competed. Select code A-"Competed Action" for Small Business set-asides and competitive 8(a) awards. Competed actions also include procurements authorized under the Foreign Assistance Act (FAA) for impairment of Foreign Aid Programs, Title XII Selection Procedures, or Disaster Relief, where more than one offer was received. Select Code B - "Not Available for Competition" for sole-source 8(a) awards. Select Code B for procurements authorized under the Foreign Assistance Act (FAA), where only one offer was received.

38. **Solicitation Procedure:** Check the box next to the code which describes the method by which this award was competed. (See FAR Part 6.) Select Code K - "Set-Aside" for small business set-asides and competitive 8(a) awards. Code L - "Other Than Full & Open Competition" includes sole-source 8(a) awards and procurements authorized under the Foreign Assistance Act (FAA) for impairment of Foreign Aid Programs, Title XII Selection Procedures, or Disaster Relief.

39. **Authority — Other Than Full & Open Competition: Complete only if item No. 38 is equal to "L".** For awards exercising other than full and open competition, check the box next to the code which describes the authority by which the award was not fully competed. (See FAR Part 6.) Code M - "Authorized by Statute" includes sole-source 8(a) awards and procurements authorized under the Foreign Assistance Act (FAA) for impairment of Foreign Aid Programs, Title XII Selection Procedures, or Disaster Relief.

40. **A.I.D. Special Authorities — Other Than Full & Open Competition: Complete only if item No. 39 is equal to "M".** For those awards authorized by the Foreign Assistance Act (FAA) for other than full and open competition, check the box next to the code which describes the authority. Select Code G - "None of the Above Special Authorities" for sole-source 8(a) awards.

41. **Synopsis of Procurement:** Check the box next to the appropriate code based on the Commerce Business Daily synopsis requirements of FAR 5.2. Code B - "Not synopsized due to urgency" may be used only if item 39 is equal to "H".

43. **No. of Offers of Non-U.S. Item(s):** Enter the number of bidders offering non-U.S. foreign end items worth 51% or more of the contract value. If the contract is exclusively for services, enter "0".

44. **Modification Purpose (Mark all that apply):** If this action is a Modification to a Basic Award or a Modification to an Order, check all of the Modification Purposes that apply to this action. If the purpose is other than those listed on the form, check "Other" and provide a brief description.

## SECTION 3: VENDOR INFORMATION (All Actions)

45. Prime Vendor: (Full Name and Address)

THE WILDERNESS SOCIETY
900 17th Street, N.W.
Washington, D.C. 20006-2596
U.S.A.

46. DUNS or CEC Number

47. Taxpayer ID No. (TIN)

### BASIC AWARDS AND NOVATIONS ONLY

48. Economic Sector

- [X] A - Private
- [ ] B - International Public Sector
- [ ] C - Federal Government
- [ ] D - State/Local Government

49. Business Organization Type

- [ ] A - Corporation
- [ ] B - Individual
- [ ] C - University or College
- [ ] D - Historically Black College or University
- [ ] E - Educational Organization other than University or College
- [ ] F - International Center
- [ ] G - Research Organization other than International Center
- [X] H - Voluntary Organization
- [ ] I - Foundation
- [ ] J - Hospital
- [ ] K - Partnership
- [ ] L - Proprietorship
- [ ] M - Sheltered Workshop
- [ ] Z - Other

50. For Profit? [ ] Yes [X] No

51. U.S. Nationality? (If U.S. Nationality, then answer items 52-53) [X] Yes [ ] No

52. Ownership Type (Complete only if Item No. 51 = Yes)

- [ ] A - Asian-Indian American
- [ ] B - Asian-Pacific American
- [ ] C - Black American
- [ ] D - Hispanic American
- [ ] E - Native American
- [ ] F - Other Minority
- [X] Z - Non-Minority

53. Woman/Woman-Owned? (Complete only if Item No. 51 = Yes) [ ] Yes [X] No

54. If the Vendor is an individual who is not a U.S. Citizen, is he/she a Green Card holder? [ ] Yes [ ] No

55. If U.S. University, Host Country Counterpart Institution:

56a. Common Parent Organization (tax purposes) [ ] Yes [ ] No

56c. DUNS or CEC Number

56b. Parent Vendor (Full Name)

56d. Taxpayer ID No. (TIN)

57a. Joint Venture? [ ] Yes [ ] No

| 57b. Participant Vendor (Full Name) | 57c. DUNS or CEC No. | 57d. Taxpayer ID No. (TIN) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |



7x

45. **Prime Vendor:** Record the vendor's full name and address in the space provided. For U.S. Universities include participating School/Center/Institute. For PASA/RSSAs include participating Agency and Department. For individuals, record the name as last, first and middle initial.

46. **DUNS or CEC No.:** Enter the 9-digit Dun & Bradstreet number or Contractor Establishment Code for the vendor of this action.

47. **Taxpayer ID No. (TIN):** Enter the 9-digit Taxpayer Identification Number used by the IRS for the vendor of this action. (Note: for individuals, the TIN is the individual's Social Security Number.) Foreign vendors which do not do business in the U.S. do not have a TIN. See FAR 4.9.

48. **Economic Sector:** Check the box next to the code which best applies to the sector in which the vendor of this action participates.

49. **Business Organization Type:** Check the box next to the code which best describes the vendor of this action.

50. **For Profit (Y/N)?:** Check "Yes" if the vendor is a profit organization. Check "No" if the vendor is a non-profit organization. ( Even if a non-profit organization charges a fee, it is still considered to be non-profit).

51. **U.S. Nationality (Y/N)?:** Check "Yes" if the vendor is a U.S. citizen; is a corporation or partnership organized under the laws of the U.S.; is a U.S.- controlled foreign corporation (per 957 et seq. of the U.S. Internal Revenue Service Code); or is a joint venture consisting entirely of individuals, corporations, or partnerships falling into one of the three foregoing categories.

52. **Ownership Type: Complete only if Item No. 51 is equal to "Yes".** If the vendor is a firm or individual of U.S. Nationality, check the box next to the code which best describes the ownership type of the vendor of this action.

53. **Woman/Woman-Owned (Y/N)?: Complete only if Item No. 51 is equal to "Yes".** If the vendor is a firm or individual of U.S. Nationality, indicate whether or not the vendor is a woman or woman-owned. A woman-owned business is a business that is at least 51% owned, controlled, and operated by women who are U.S citizens.

54. **If the Vendor is an individual who is not a U.S. Citizen, is he/she a Green Card holder? (Y/N):** Answer "Yes" if the individual has a green card, even if they are not currently residing in the U.S.

55. **Host Country Counterpart Institution:** If the vendor is a U.S. University, enter the name of the host-country institution receiving technical assistance.

56a. **Common Parent Organization (Tax Purposes):** Answer "Yes" if the firm is a member of an affiliated group of corporations that files Federal Income Tax returns on a consolidated basis. If "Yes", complete items 56b. - 56d. related to the parent firm.

56c. **Common Parent DUNS or CEC No.:** Enter the 9-digit Dun & Bradstreet number or Contractor Establishment Code for the common parent (tax filing) organization.

56d. **Common Parent Taxpayer ID Number (TIN):** Enter the 9-digit Taxpayer Identification Number used by the IRS for the common parent organization. See FAR 4.9.

57a. **Joint Venture?:** Answer "Yes" if the awardee is a joint venture. If "yes", complete items 57b, 57c and 57d for each participant in the joint venture.

57c. **Participant DUNS or CEC No.:** Enter the 9-digit Dun & Bradstreet number or Contractor Establishment Code for each joint venture participant.

57d. **Participant Taxpayer ID Number (TIN):** Enter the 9-digit Taxpayer Identification Number used by the IRS for each joint venture participant.

## SECTION 4: FINANCIAL INFORMATION (All Actions)

58. Total Estimated Cost (TEC)

| a. Previous TEC | b. (Increase/Decrease) This Action | c. Current TEC |
|---|---|---|
| $ | $ 141,000.00 | $ 141,000.00 |

OBLIGATION DATA

59.

| a. Budget Plan Code | b. Project Number | c. Amount Obligated/Deobligated (This Action) | d. Funds Type* |
|---|---|---|---|
| LDNA-91-25511-KG12 | 0780 | $ 98,726.00 | USD |
| LDSA-91-25511-KG12 | 0780 | $ 42,274.00 | USD |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | | $ | |
| | e. TOTAL | $141,000.00 | |

* **Funds Type Codes**
USD: U.S. Dollars
USL: U.S. Owned Local Currency

60. Paying Office: Identify the Office responsible for paying vendor invoices.

For Mission Payments, enter:
USAID/ *(country)* BOLIVIA

For A.I.D./W Payments, check either:
☐ PFM/FM/A/OE ☐ PFM/FM/CMPD/DCB

61a. Incrementally Funded?
☐ YES ☒ NO

61b. If Incrementally Funded;
Date Funded through: (MMDDYY)
_____



9x

*NOTE: All financial information must be in U.S. dollars or U.S. dollar equivalents. All local currency amounts must be converted to the U.S. dollar equivalent. "U.S. dollar equivalent" is the dollar value of the local currency at the time of the action signature.*

58a. **Previous Total Estimated Cost (TEC):** Enter the total estimated cost to be incurred during the expected life of this award, as of the previous action.

58b. **Total Estimated Cost (TEC): (Increase/Decrease) This Action:** Enter the amount of change in the total estimated cost as a result of this action. Use a minus sign to indicate a decrease. If there is no change, enter "0".

58c. **Current Total Estimated Cost (TEC):** Enter the current total estimated cost to be incurred during the expected life of this award.

59a. **Budget Plan Code (BPC):** Enter each Budget Plan Code associated with this action.

59b. **Project Number:** Enter the Project Number associated with each BPC.

59c. **Amount Obligated/Deobligated (This Action):** Enter the obligation amount associated with each BPC. Use a minus sign to indicate a deobligation.

59d. **Funds Type:** Enter the Funds Type Code associated with each BPC. "USD" = U.S. Dollars. "USL" = U.S. Owned Local Currency.

59e. **TOTAL Obligation/Deobligation:** Enter the sum of all BPC amounts found in item 59.c. Use a minus sign to indicate a deobligation.

61a. **Incrementally Funded (Y/N)?:** An award which is not fully funded but will be funded in increments. The award states the amount presently available for payment by the government and alloted to the award, and the period of performance it is estimated the alloted amount will cover.

UNITED STATES AID MISSION to BOLIVIA
c/o American Embassy
La Paz, Bolivia

USAID - BOLIVIA
APO MIAMI 34032

Telephones: 350120, 350251
Casilla 673
La Paz, Bolivia

September 9, 1991

Mr. George T. Frampton Jr.,
President
The Wilderness Society
900 17th Street, N.W.
Washington, D.C. 20006-2596
U.S.A.

Subject: Grant No. 511-0780-G-00-1424-00

Dear Mr. Frampton:

Pursuant to the authority contained in the Foreign Assistance Act of 1961, as amended, the Agency for International Development (hereinafter referred to as "A.I.D." or "Grantor") hereby grants to The Wilderness Society (hereby referred to as "Wilderness Society" or "Grantee"), the sum of $ 141,000.00 to provide support for a Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests, as described in the Schedule of this grant and in Attachment 2, entitled "Program Description."

This Grant is effective and obligation is made as of the date of this letter and shall apply to commitments made by the Grantee in furtherance of program objectives during the period beginning with the effective date and ending on October 30, 1994.

This Grant is made to the Grantee, on condition that the funds will be administered in accordance with the terms and conditions as set forth in Attachment 1, entitled the "Schedule", Attachment 2, entitled "Program Description," and Attachment 3 entitled "Standard Provisions," which have been agreed to by your organization.

You will also find enclosed the forms "Assurance of Compliance with Laws and Regulations Governing Nondiscrimination in Federally Assisted Programs" and "Certification Regarding Drug-Free Workplace" which you are required to fill out and return to the Regional Contracts Office, USAID/Bolivia.

//

Please sign the original and each copy of this letter to acknowledge your receipt of the grant, and return the original and all but one copy to the Regional Contracts Office, USAID/Bolivia.

Sincerely yours,

Clement J. Bucher
Agreement Officer
USAID/Bolivia

FUNDS AVAILABLE
10 SEP. 1991
Signature

Attachments:

1. "Schedule"
2. "Program Description"
3. "Standard Provisions"

ACKNOWLEDGED:
THE WILDERNESS SOCIETY

By: James L Terrill

Title: Executive Vice President

Date: September 20, 1991

FISCAL DATA

| | |
|---|---|
| Allocation: | LAC Environmental Support Project/Biological and Economic Analysis |
| Appropriation: | 72-1111021 |
| Budget Plan Code: | LDNA-91-25511-KG12 and LDSA-91-25511-KG12 |
| PIO/T No.: | 598-0780-3-10125/10126 |
| Project No.: | 0780 |
| Total Estimated Amount: | $141,000.00 |
| Total Obligated Amount: | $141,000.00 |
| DUNS No.: | |
| IRS Employer Identification Number: | |

Funding Source: USAID/Bolivia

GZ/hc/1455I

ATTACHMENT 1
Schedule
Grant No. 511-0780-G-00-1424-00

A. Purpose of Grant

The purpose of this Grant is to provide support for a Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests as more specifically described in Attachment 2 to this Grant entitled "Program Description."

B. Period of Grant

1. The effective date of this Grant is the date of the cover letter. The expiration date of this Grant is 10/30/94.

C. Amount of Grant and Payment

1. A.I.D. hereby obligates the amount of $141,000.00 for purposes of this Grant.

2. Payment shall be made to the Grantee in accordance with procedures set forth in Attachment 3 - Standard Provision entitled "Payment Periodic Advance."

D. Financial Plan

The following is the Grant Budget, including local cost financing items, if authorized. Revisions to this budget shall be made in accordance with Standard Provision of this Grant, entitled "Revision of Grant Budget."

| COST ELEMENT | TOTAL US$ |
|---|---|
| 1. Personnel | 82,500 |
| 2. Transportation | 12,012 |
| 3. Meals & Lodging | 3,778 |
| 4. Equipment & Air Freight | 37,610 |
| 5. Subcontractual Services | 3,000 |
| 6. Administration, Rent and Miscellaneous | 2,100 |
| TOTAL US$ ..... | 141,000 (*) |

(*) This amount represents AID's share at approximately 39% of the total estimated program costs of $359,852 as further detailed in the budget contained in the "Program Description."

E. Reporting and Evaluation

1) Financial Status Report.

a) Grantee is required to use the standardized Financial Status Report, SF 269 (attached) to report the status of funds for the program.

b) The report shall be on accrual basis. If the grantee's accounting records are not normally kept on the accrual basis, the grantee shall not be required to convert its accounting system, but shall develop such accrual information through best estimates based on an analysis of the documentation on hand.

c) The report shall be required quarterly only. A final report shall be required at the completion of the grant.

d) Grantee shall submit the Financial Status Report (original and no more than two copies) no later than 30 days after the end of each quarterly reporting period, and no later than 90 days for submission of the final report, after completion of the grant.

2) Reporting Program Performance.

a) Grantee shall monitor the performance and ensure that time schedules are being met, projected work units by time periods are being accomplished, and other performance goals are being achieved. This review shall be made for each program, function, or activity as set forth in the award document.

b) Grantee shall submit a performance report (technical report) that briefly presents the following information for each program, function, or activity involved:

i. A comparison of actual accomplishments with the goals established for the period, the findings of the investigator, or both. If the output of programs can be readily quantified, such quantitative data should be related to cost data for computation of unit costs.

ii. Reasons why established goals were not met.

iii. Other pertinent information including, when appropriate, analysis and explanation of cost overruns or high unit costs.

c) Grantee shall submit the performance or technical reports to AID and the Financial Status Reports covering the same period in the frequency established by paragraph E.1 of this schedule and a final technical or performance report no later than 90 days after completion of the program.

d) Between the required performance reporting date, events may occur that have significant impact upon the program. In such instances, the grantee shall inform AID as soon as the following types of conditions become known:

i. Problems, delays, or adverse conditions that will materially affect the ability to attain program objectives, prevent the meeting of time schedules and goals, or preclude the attainment of work units by established time periods. This disclosure shall be accompanied by a statement of the action taken, or contemplated, and any AID assistance needed to resolve the situation.

ii. Favorable developments or events that enable time schedules to be met sooner than anticipated or more work units to be produced than originally projected.

F. Special Provision

1. The Wilderness Society shall provide to USAID/Bolivia a list of all personnel to be assigned by the Wilderness Society to Bolivia with both short-term and full-time program responsibilities, including names, professional qualification and a brief scope of work for each.

The Wilderness Society shall submit to USAID/Bolivia a complete annual workplan for planned activities no later than 120 days from the begining of each year comprised in this grant.

Within 120 days from the effective date of this grant, The Wilderness Society shall define, for USAID/B approval, the methods of implementation and financing for the program per USAID/B's payment verification policies.

2. The Wilderness Society is hereby notified that USAID/Bolivia policy prohibits salary compensation in dollars to non-U.S. personnel funded by this grant. All salary compensation to non-U.S. personnel should be in Bolivian currency at annual rates approved by the USAID/B Salary Committee, unless otherwise approved in writing.

3. Customs Clearance of Commodities. USAID will clear program funded commodity shipment through Bolivian customs and bill the grantee for the cost of such services, if any. The grantee is required to notify the USAID/B Executive Office in advance of scheduled shipment arrivals in order to obtain appropriate shipping instructions.

G. Indirect Cost Rate

No indirect cost rate agreement has been proposed by the Grantee. AID's share of the total program costs consists of allowable direct costs only.

H. Title of Property

The grantee will have use of property financed under this grant until the termination of program activities. Upon termination of the program, AID-financed property, other than goods imported for the program, will be turned over to the Government of Bolivia in accordance with Optional Standard Provision No. 22, attached to this grant, unless otherwise agreed to in writing by AID.

Title to AID financed goods imported for the program will be vested in the host country, in accordance with Optional Standard Provision No. 22.

hc/1455I

ATTACHMENT 2

GRANT NO. 511-0780-G-00-1424-00

PROGRAM DESCRIPTION

# Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests

Submitted by:


Dr. Richard E. Rice
Senior Resource Economist
The Wilderness Society
Washington, D.C.

Dr. Jeffrey R. Vincent
Institute Associate
Harvard Institute for International Development
Harvard University
Cambridge, Massachusetts

Raymond E. Gullison
Department of Biology
Princeton University
Princeton, New Jersey

Prof. Stephen P. Hubbell
Department of Biology
Princeton University
Princeton, New Jersey


January 30, 1991

# Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests

## Project Summary

*Achieving sustainability in the management of natural tropical forests is an important objective for both conservation and economic development (USAID 1989, Repetto and Gillis 1988). Efforts to realize this goal have been hampered by a lack of basic biological information and undercut by government policies that encourage wasteful and destructive logging techniques and unsustainably high levels of resource extraction.*

*A program to promote sustainable forest management was recently begun in the lowland tropical forests of Bolivia. Our project will contribute to this effort by 1) developing an ecological basis for the long-term sustainable harvest of mahogany, 2) examining the degree to which current timber pricing policies in Bolivia encourage unsustainable logging and 3) suggesting viable alternative pricing systems that will increase government revenues and reduce environmental damage to the forest. We will also create a computer software program to help managers evaluate the cost-effectiveness and sustainability of alternative forest management plans. Finally, a package of educational materials based on the study will be developed for use in training Latin American conservation professionals in conjunction with the Smithsonian Institution's annual conservation training workshop in Bolivia.*

## Background

### *Logging and Conservation Efforts in the Bolivian Lowlands*

Lowland tropical forests in the Bolivian Amazon are concentrated in the states of Santa Cruz, Beni, Pando, and northern La Paz. The combined forested area of these states is 55.8 million hectares (CDF 1989).

Until recently, much of this land was inaccessible to loggers – a situation that is rapidly changing. Logging rights to nearly 40 percent of the country's tropical forests have been sold to concessionaires, and deforestation from logging and agricultural activities is currently estimated at more than 200,000 hectares per year (CDF 1989). In early 1990, due to rising public concern over the pace and character of forest development, the Bolivian government placed a five-year moratorium on granting additional logging concessions.

The objectives of the moratorium are to reduce the rate of deforestation and provide time to develop a more sustainable approach to managing and conserving the country's remaining tropical forests. An important component of this effort is a government-sponsored research program, known as *Programa Chimanes*, that is currently underway in the Beni Biosphere Reserve (Goitia 1989). Established by administrative decree in 1982, the Beni Biosphere Reserve encompasses 1.6 million hectares of mixed forest and savanna in the central Bolivian lowlands, two-thirds of which is open to controlled utilization. *Programa Chimanes* seeks to develop a biological and economic basis for sustained management of the region's timber resources that can serve as a model for forest development throughout the country.

The program is organized around three general areas of study: forestry, biology, and economics. The forestry component is currently staffed by a team of Bolivians under a grant from the International Tropical Timber Organization. Research in this area has focused on reforestation and general management planning for mahogany (*Swietenia macrophylla*) – the country's primary commercial timber species.

Our objective is to contribute to the biological and economic components of the program by providing an ecological basis for sustainable selective harvesting strategies and by proposing pricing policies for timber that will discourage wasteful and inefficient logging and generate revenues needed for long-term management.

### *Biology and Sustainable Management*

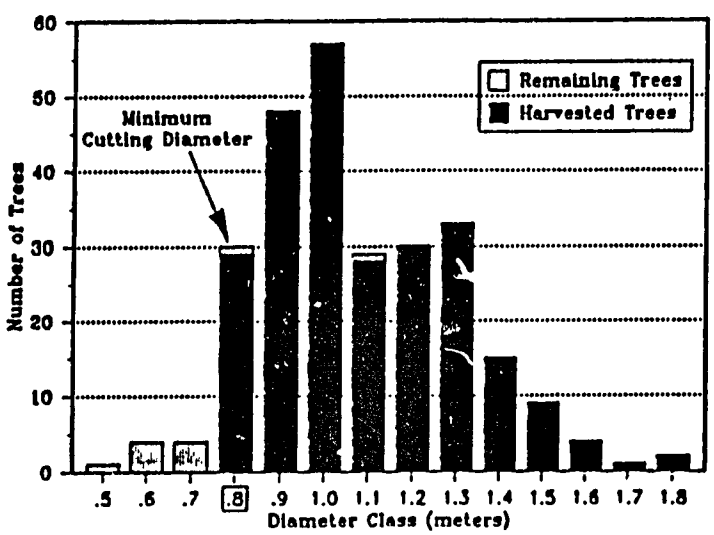
Virtually all hardwood tropical timber production in Latin America comes from selective logging of natural, unmanaged forests. Lack of information on the growth and functioning of these forests combined with government regulation that is either unenforced or nonexistent makes most of this production unsustainable. Because natural forests will likely continue to be the primary source of tropical hardwoods in the future, it is vital that information necessary to manage and protect these lands be developed soon (Grainger 1986).

Existing systems of natural forest management in the tropics were developed primarily in Southeast Asia (*e.g.* the Malayan uniform system) and are not directly applicable to forests in Latin America. New World forests differ from those in Southeast Asia in that commercially valuable species occur at much lower densities and reproduction of these species in large, cut-over areas is typically poor.

An understanding of the factors responsible for the low natural abundance of valuable species such as mahogany is crucial in designing successful long-term management strategies. Information is also needed on natural growth rates, reproduction, age-class distributions and how these factors are affected by logging.

Previous research on mahogany, while useful, is largely anecdotal and of insufficient certainty to form the basis for a quantitative model of sustainable logging (*e.g.* Lamb 1966). Moreover, much of that research was conducted in coastal areas of Central America and Puerto Rico and is therefore of limited value for forest management in the Amazon Basin. Our study will begin to fill this gap by investigating critical aspects of the underlying biology of mahogany in Bolivia.

Preliminary data from *Bosque Chimanes*, the production forest in the Beni Biosphere Reserve, indicates that the age structure of existing stands of mahogany is weighted heavily toward older individuals and that the size and number of trees that remain after logging is insufficient to ensure adequate reproduction. Of 267 mahogany trees in one concession sampled, 256 – or 96 percent of the population – were cut; only 11 were left to provide for future seed crops (Figure 1).




| Diameter Class (meters) | Number of Trees: Harvested | Number of Trees: Unharvested |
|---|---|---|
| 0.5 | 0 | 1 |
| 0.6 | 0 | 4 |
| 0.7 | 0 | 4 |
| 0.8 | 29 | 1 |
| 0.9 | 46 | 0 |
| 1.0 | 57 | 0 |
| 1.1 | 28 | 1 |
| 1.2 | 30 | 0 |
| 1.3 | 33 | 0 |
| 1.4 | 15 | 0 |
| 1.5 | 9 | 0 |
| 1.6 | 4 | 0 |
| 1.7 | 1 | 0 |
| 1.8 | 2 | 0 |
| | 256 | 11 |

*FIGURE 1. Effect of Logging on Mahogany Size-class Structure in Bosque Chimanes.* The distribution of diameters of mahogany trees in *Bosque Chimanes* is weighted heavily toward larger individuals, indicating poor survival in the smallest size classes. In the sample shown above, 96 percent of the population was removed by logging. This reduction in size and number of trees may have serious implications for post-harvest seed production and seedling viability. Without supplementary planting and management, future harvests may be jeopardized. SOURCE: *Programa Chimanes*, 1990.

These data suggest that enrichment planting and a larger minimum cutting diameter may be necessary to ensure that future logging is sustainable. Factors affecting seedling growth and survival in natural populations of mahogany, however, are not well known.

The effects of logging on the genetic structure of mahogany are also uncertain. Post-harvest breeding populations of trees occur at a much lower density than in a natural

forest. Research indicates this can lead to insufficient pollination and a reduction in seedling viability due to inbreeding (Bawa 1976). A better understanding of logging-induced inbreeding in mahogany will be needed to design harvest regimes that minimize losses in genetic diversity.

### *Forest Revenue Systems and Sustainable Management*

Management plans based on even the best biological information can be undercut by government policies that encourage wasteful and destructive logging. Pricing policies are particularly important in this regard.

The forests of Bolivia, as in most of the tropics, are owned and administered by the national government. Timber is sold to concessionaires -- companies that hold harvesting rights -- at rates established by a government agency, not by the market. In Bolivia, logging charges are assessed as a royalty, or a fixed charge for every cubic meter of timber removed from the forest.

In theory, the price of timber should be based on its stumpage value, defined as the residual value of a tree after logging costs are subtracted from the log price paid by a mill. Logging costs include the costs of extraction and delivery, taxes, and normal profits. Stumpage value, in the technical literature, is known as a type of economic rent. In competitive markets, this rent will generally accrue entirely to the owner of the land, thereby alerting the owner to the true financial value of the forest.

A properly functioning price mechanism provides a powerful incentive for long-term sustainable management. It confers on forests a tangible financial value that enables sustained-yield logging to compete with more destructive uses of the land. The incentive structure fails, however, when royalties do not send accurate price signals to those with management authority.

Preliminary indications are that timber royalties in Bolivia are set far below actual stumpage value. This has important implications for conservation and sustainable management because the price charged for timber directly affects the quantity of timber demanded and the rate at which it is cut. Inefficient revenue systems that underprice timber resources encourage unsustainably high levels of logging and allow much of the potential value of the resource to be captured by loggers as windfall profits. This, in turn, deprives the government of revenue needed for long-term management and can create enormous pressures for rapid and destructive exploitation.

Inefficient pricing may also cause a portion of the rent to be dissipated by encouraging concessionaires to "high grade" -- that is, to cut only the largest and most valuable trees -- while providing little incentive to avoid damage to uncut timber. Royalties that do not reflect differences in timber values due to species, grade, or site conditions can

encourage high grading because any tree with a stumpage value less than the royalty is worthless to the logger. When such royalties are assessed only on extracted logs, other trees can be left in the forest with impunity or damaged through careless and inefficient logging.

Past studies of forest revenue systems in the tropics have largely ignored Latin America despite the region's importance to global forest conservation and its emerging role as a timber supplier. Evidence from Africa and Southeast Asia, however, indicates that most forest revenue systems capture only a fraction of available resource rent for the public treasury (Page *et al.* 1976, Repetto and Gillis 1988, Ruzicka 1979, Vincent 1990). By creating a bias against investments in long-term management, these systems undermine efforts to promote conservation and sustainable development.

## Objectives

The objectives of this project are:

1) to identify the biological factors that best predict future mahogany stocking densities, stand distributions, timber quality, and growth rates in selectively managed forests;

2) to use this knowledge to design management strategies that will increase natural and managed regeneration of mahogany, improve restocking success, and maximize timber quality and volume in regenerating stands;

3) to develop quantitative estimates of the components of the economic rent from logging (*i.e.*, government revenue, windfall profits, high grading, logging damage, *etc.*);

4) to suggest guidelines for feasible improvements in the current government pricing system and develop estimates of the amount of revenue that could be generated from logging and used for investments in forest management and other activities if a more efficient pricing system were adopted;

5) to develop a computer planning model to help managers evaluate the economic efficiency and biological sustainability of alternative forest management strategies;

6) to provide training to *Programa Chimanes* forestry personnel in biological and economic data collection, analysis, modeling, and long-term forest monitoring; and,

7) to develop course materials based on the study for use in training Latin American resource professionals in the Smithsonian Institution Man and the Biosphere, Biological Diversity Program's (SI/MAB) annual conservation training workshop in Bolivia.

Figure 2 illustrates how major elements of the project will be integrated.

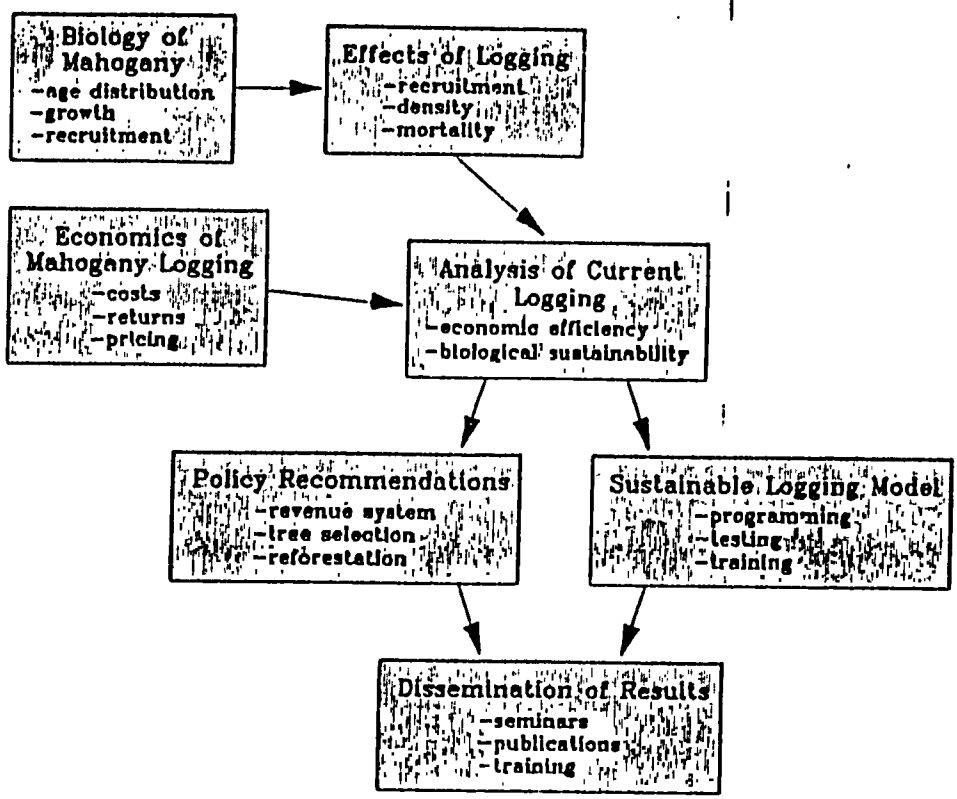



*FIGURE 2. Project Flowchart.*

## Policy Significance

In early 1990, the government of Bolivia issued a decree announcing a five-year program to reevaluate its forestry and natural resource policies (ROB 1990). The decree, entitled *La Pausa Ecológica*, or "ecological pause," specifically cites the need for improvements in managing the nation's logging concessions. It provides an opportune context in which to pursue the study outlined above.

The need for concrete information on which to base policy reforms will be heightened by completion of major improvements to the main highway bisecting the Beni Biosphere Reserve (scheduled for early 1993). These improvements, financed by loans from the Interamerican Development Bank, are expected to reduce log transport costs dramatically, thereby increasing the pressure for more rapid extraction of the region's timber resources.

Forestry officials in *Bosque Chimanes* have expressed a sincere interest in developing management strategies compatible with the overall aims of the biosphere reserve. At present, the forestry program is understaffed, underfunded, and lacks the information needed to establish a biological and economic basis for sustained management. The information

and analysis provided by our study should go a long way towards helping to address this need. In addition, the training and experience we provide to staff of the forestry program in modeling, data collection, and long-term forest monitoring will help ensure that similar information continues to be available in the future.

Success in implementing timber pricing reform based on our analysis depends in large part on whether the various parties involved in Bolivian logging feel their interests will be advanced by a revenue system that increases rent capture by the government. We argue all parties will benefit in the long run: states will receive increased tax revenue; the Bolivian Forestry Department will see progress in achieving its goal of sustainable forest management; and industry will enjoy larger and more dependable supplies of timber due to less destructive logging and to more intensive management made possible by increased forest revenue.

Our pricing reform recommendations will also have direct policy significance for other countries in the Amazon Basin and elsewhere in the neotropics that wish to promote sustained utilization of their natural forest endowments. Similarly, with appropriate modification, our forest planning model and timber management recommendations will be useful for designing sustainable management strategies in other tropical nations.

## Research Design and Data Collection

### *Biological Component*

The impacts of selective logging on the biology of mahogany will be investigated through a comparison of three mahogany populations: 1) a control population of uncut trees, 2) a population logged during the course of the study and 3) a population logged 20 years ago. Candidate study sites for the three populations were identified in *Bosque Chimanes* during the summer of 1990.

Population 1 (the control population) will provide baseline data on the factors and processes that affect mahogany in the absence of management. Population 2 (logged during the course of the study) will provide information on immediate damage and mortality caused by logging operations. Population 3 (logged 20 years ago) will provide information on the long-term response of mahogany to selective logging.

Below is a short discussion of the standard measurements that will be taken from each population.

***Diameters.*** Two 50-hectare areas in each of the study populations will be divided into one-hectare quadrats. All mahogany trees with a diameter at breast height (dbh) of

10 cm or more will be measured, tagged, and fitted with a metal expansion band to monitor growth. The approximate location of all tagged trees will be determined and used to produce maps to facilitate remeasurement. Stumps in the area logged 20 years ago will also be located and mapped.

Enumeration of all seedlings and saplings less than 10 cm dbh is extremely time consuming and beyond the scope of the study. A sampling scheme will be devised for these trees to estimate the number of individuals and their spatial distribution in relation to larger trees.

***Growth Rates.*** Mahogany exhibits distinct growth rings. Preliminary analysis suggests that while the growth rings may not be annual, their formation is consistent between trees. Measurements of growth rings can therefore be used to identify areas of high productivity and to establish relative growth rates for different size classes of trees. We are currently developing an image processing system at Princeton to interpret and analyze growth ring data for large numbers of trees. These data will be used in conjunction with field measurements of growth obtained using the metal expansion bands.

***Mortality.*** Mortality rates will be measured by observing tree mortality over the course of the study.

***Reproductive Biology.*** Fifty reproductive trees from each of the three populations will be studied to quantify the effect of breeding tree density on pollinization success and seedling viability. Pollinization success will be measured by comparing flower-to-fruit ratios and total seed production for similar sized trees on each of the three study sites. We expect to identify a threshold minimum density below which pollinization is seriously impaired.

Reduction in the number of seedlings as a result of decreased seed production will be studied by comparing seedling plots in pristine forest with seedling plots in forest that was logged 20 years ago. As the density of reproductive individuals declines, we expect that the rate of self-pollinization will rise. We will test the effect of increased self-pollinization on seedling viability by comparing growth and mortality of seedlings from trees occurring at high and low densities.

***Genetic Variation.*** Genetic variation in mahogany populations will be studied using isoenzyme analysis. Samples will be taken from a range of sites throughout *Bosque Chimanes* to determine: 1) the overall level of genetic variation, 2) how this variation is partitioned between populations and individuals and 3) to what degree inbreeding increases as a result of logging.

***Economic Component***

Estimating the cu[illegible] distribution of the economic rent from logging is central to achieving all of the ec[illegible]mic objectives of the study. A model of the various components of rent under an inefficient forest revenue system is presented in Figure 3 (Vincent *et al.* 1990).

Potential rent refers to the financial value attainable if all commercial timber on a site were sold at true stumpage value. Under an inefficient pricing system, only a portion of the potential rent is realized through the actual harvest and sale of logs. This rent may be recorded at checking stations or go unrecorded if checking stations are eluded. Rent from recorded harvests is captured either by the government as forest revenues or by loggers as windfall profits.

Unrealized rent consists of residual rent and logging damage. Residual rent refers to the stumpage value of trees left in the forest due to management prescriptions (silvicultural rent) or high grading (failure by the logger to extract marketable trees). Logging damage is the forgone stumpage value of fallen or standing dead trees.

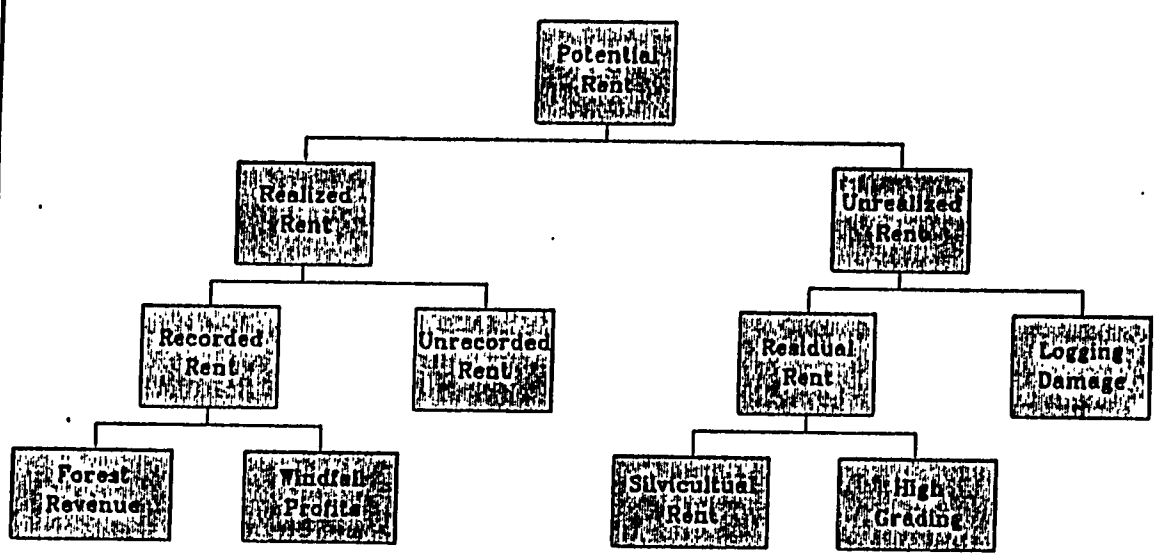



*FIGURE 3. Rent Distribution under an Inefficient Forest Revenue System.* The economic rent from a forest is the total financial value of timber after logging costs and normal profits. Ideally, this rent should accrue entirely to the owner of the land. Inefficient forest revenue systems that underprice timber resources encourage unsustainably high levels of logging and allow much of the potential value of the resource to be captured by loggers as windfall profits. This in turn deprives the landowner of revenue needed for long-term management. As shown above, inefficient pricing may also cause a portion of the rent to be dissipated through high grading or damage to unharvested trees.

The general research design requires selecting a set of forest sites scheduled to be logged in the near future. The distribution of the potential economic rent available from these sites will be estimated through detailed pre-logging inventories along with data collected on logging prices, production costs, harvest volumes, revenue collections, and post-logging inventories.

The individual components of potential rent will be estimated as follows:

- Pre-logging inventory data will allow estimation of potential harvest volume. The sales value (based on log prices) of this volume minus logging costs and profit margins will provide an estimate of potential rent.
- The sales value of recorded harvest minus logging costs (including profit margins) will provide an estimate of recorded rent.
- Forest revenue will be obtained directly from data on royalty collections and windfall profits will be calculated by subtracting forest revenue from recorded rent.
- Silvicultural rent and high grading (together, residual rent) will be determined by comparing pre- and post-logging inventories on the basis of management prescriptions and harvest plans.
- Logging damage will be based on a post-harvest inventory of standing and fallen dead trees of marketable size and species.
- Unrecorded rent will be the residual left after subtracting recorded rent, residual rent, and logging damage from potential rent.

***Inventory Site Selection.*** Inventory sites will consist of previously undisturbed forest to be logged during the fall of 1991. Three areas will be chosen from *Bosque Chimanes*, one of which will correspond to the second population noted above for the biological component of the project (*i.e.*, the area to be logged during the course of the study). Four 50-hectare blocks in each area will be selected for sampling. Site selection will be finalized through consultations with the forestry staff of *Programa Chimanes*.

Selection criteria will include accessibility, site characteristics, and distance to processing facilities. An effort will be made to choose sites that differ as much as possible in terms of the above criteria in order to investigate the effect that these factors have on the quantity of timber harvested, high grading, and damage to residual stands. Our preliminary hypothesis is that high grading and damage to residual timber will be higher in areas that are generally more costly to log.

***Inventories.*** Prior to logging operations, *Programa Chimanes* foresters conduct detailed pre-harvest inventories of timber to be cut, including mapping and marking of trees. While this information will contribute to our data needs, a broader inventory will nevertheless be necessary to determine the potential marketable timber volume, as opposed to the planned volume, available at each site.

Pre- and post-logging inventories will be conducted by forestry crews contracted locally. Inventories will be carried out using a standard line sampling system at a 10 percent intensity. This system was found to be more than adequate in a similar study conducted by Vincent in Malaysia during the summer of 1990 (Vincent *et al.* 1990).

Two or three inventory crews will be used in each area. Experience in Malaysia indicates that one crew of six people (two foresters and four laborers) can inventory five 0.1-hectare plots per day during pre-logging inventories and can double this rate for the post-logging inventories. With four 50-hectare sites at each area, a total of 40 crew-days per area will be required for pre-harvest inventories and 20 crew-days per area for post-harvest inventories.

***Other Economic Data.*** Data on harvest volume and royalties will be obtained from the Bolivian Forestry Department in La Paz. These data are based on records kept at checking stations responsible for scaling logs and assessing timber taxes.

Data on log prices will also be obtained from the Bolivian Forestry Department. Logging and milling costs will be estimated directly through on-site inspection of logging and milling activities. These estimates will be verified by comparing them with standard logging cost-series available for other areas of the Amazon Basin and, if possible, through comparison with detailed cost records kept by the Bolivian International Forestry Council in Santa Cruz.

"Normal" profit margins will be based on average margins for other resource-based industries in Bolivia. Data necessary for calculating these margins are available from bulletins of the Bolivian Department of Statistics. A range of values will be used.

### *Forest Planning Model*

A model of mahogany stand dynamics (Figure 4) will be constructed using information obtained from the research outlined above. The biological component of the model will project timber growth and yield resulting from various management activities such as harvest, thinning, and reforestation. The economic component will incorporate costs and revenues associated with management and will allow managers to compare financial returns available from different investments.

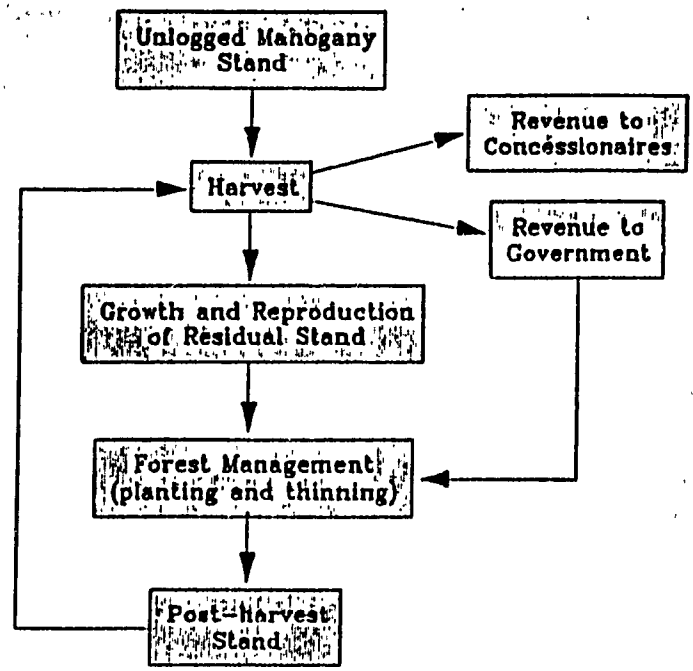



*FIGURE 4. Forest Planning Model.* Schematic representation of forest planning model incorporating economic and biological information obtained during study.

The model will be structured to provide flexibility in the type of analysis performed and in the type of investment or investments to be analyzed. Analysis, for example, will be permitted at spatial scales of one hectare, one stand, or an entire forest and at temporal scales of one or more full rotations or parts of rotations. The model will also permit assessment of a complete forest management plan or marginal analysis of individual treatments added to an existing plan.

The primary objective of the model is to provide managers with a tool that will help them develop economically efficient and biologically sustainable strategies for timber production in *Bosque Chimanes*. The model will also make explicit the implications of various timber pricing strategies and provide a means of comparing investments in sustainable forestry with other potential uses of the land.

## Work Plan

Research will be carried out primarily by Gullison and Rice with assistance from Vincent (econometric analysis and policy implications), Hubbell (biometric analysis and study design) and a Bolivian counterpart (management planning, implementation of field work and policy implications). Workshop materials for the Smithsonian conservation training program will be developed primarily by Rice. The four principal investigators will

be assisted by a botanist in site selection and inventories. All members of the project will work in close collaboration with Ing. Luis Gotia and Ing. Waldo Terceiro, directors of the forestry component of *Programa Chimanes*.

Each year's field work will be carried out during the Bolivian dry season (June through December). Data analysis, computer modeling, isoenzyme lab work, and document drafting will be conducted during the months of January through May.

***Year One.***

Gullison and Rice will visit Bolivia for two weeks in late spring 1991 to identify possible concessions for the remaining inventory sites, select contractors to carry out inventories, and continue the collection of price and cost data begun during the summer and fall of 1990. In June 1991, the four principal investigators will purchase equipment, hire field crews, and finalize selection of inventory sites. Vincent and Hubbell will return to the U.S. after two weeks. Rice, Gullison, and the Bolivian counterpart will spend six weeks collecting data on pre-harvest inventories, royalty collections, harvest levels, logging costs, and log prices. Gullison will remain in Bolivia to begin studies of seed production and seedling viability. Post-harvest inventories will be supervised by Rice, Gullison, and the Bolivian counterpart during the period October to December, 1991. From January to May 1992, inventory data will be analyzed and preliminary isoenzyme work will begin in the United States. Analysis and writing for the economic rent component of the project will be completed by the end of May 1992.

***Year Two.***

From June to December 1992, trees mapped and tagged during the previous year will be monitored for growth and mortality. Seed production and seed viability experiments will be carried out, samples for isoenzyme work will be collected, and thinning and planting trials will be started. Gullison and Hubbell will plan and carry out various manipulations, and Rice will conduct economic evaluations of these management actions. From January to May 1993, growth and mortality data will be analyzed, and leaf samples will be assayed for enzymatic diversity. Work will also begin on a computer simulation model of mahogany population dynamics. Materials for the Smithsonian conservation workshop will be completed by May of 1993. Rice will return to Bolivia to participate in the workshop at the beginning of June.

***Year Three.***

From June to December 1993, trees will again be monitored for growth and mortality. Seed production and seedling viability experiments will be completed and forestry personnel in *Programa Chimanes* will be trained to continue monitoring the plots after the termination of the project. Training will also be provided in use of the forest planning

model, and the model will be tested in the field. From January to June 1994, Hubbell, Rice, Vincent, and Gullison will finish the simulation model. Final policy recommendations will be developed, and publications and training materials will be written and translated into Spanish.

## Work Products

### *Publications*

Two research papers will be prepared emphasizing the economic and biological aspects of the study, respectively. These will be submitted to international forestry/conservation journals such as *Forest Science*, the *Journal of Conservation Biology*, or the *Journal of Environmental Economics and Management*. A separate technical report will emphasize the project's policy and management recommendations. This document will be published by The Wilderness Society (in English) and distributed (in Spanish) to the Bolivian Forestry Department and district forestry offices in the Bolivian states of Santa Cruz, Beni, and La Paz.

### *Software*

Three computer programs will be developed during the study. The first will be a digital-image processing package to enhance and interpret photographs of growth rings in tropical trees. The second will interpret images of the forest canopy to facilitate studies of the role played by light in seedling growth and mortality. The third will be an integrated forest planning model allowing managers to evaluate the biological and economic implications of alternative forest management strategies.

### *Training*

A major aim of the project is to help *Programa Chimanes* forestry personnel obtain the training and experience needed to refine and implement sustainable logging strategies in the future. Towards this end, Bolivians will be involved in all stages of the project. Our Bolivian counterpart, from the forestry staff of *Programa Chimanes*, will gain extensive experience in data collection and analysis, operation of the forest planning model, and interpretation of model's output. In addition, up to six Bolivian university students will conduct research supervised by project personnel for their senior theses. This research will be carried out with the approval and participation of the staff of *Programa Chimanes*. Finally, training will be provided to ensure that long-term monitoring of the research plots continues after the project is finished.

A separate training objective of the project will be to develop course materials in resource policy and economics for use in the Smithsonian conservation training workshops in Bolivia. These workshops provide in-country training to local students and researchers on topics such as field research, collections, and reserve design and management. Resource policy and economics will be a valuable addition to the current curriculum.

## Budget Details and Justification

1. Personnel. We request salary support for a Bolivian counterpart (at $6,000/year), who will supervise the project when the principal investigators are not in Bolivia. Three field assistants (at $300/month each) are needed to assist in plot surveying and data collection for six months each year. Support will also be provided to two graduate students to carry out thesis research on topics related to the project. They will be selected with the help of Dr. Cecelia Moranes, Director of the *Instituto de Ecología, Universidad Nacional de San Andres.* Thirteen months of salary are requested for Rice and three and one-half months for Vincent (both at $5,000/month). Salaries for Hubbell and Gullison are provided by Princeton University and the Canadian Government.

2. Transportation. International airfare includes the following: 1) one flight/year (Newark - La Paz) for Gullison and Hubbell, 2) two flights in Year 1, and one flight/year in Years 2 and 3 for Rice (Washington, D.C. - La Paz), and 3) one flight/year in Years 1 and 2 for Vincent (Boston - La Paz). Airfare in Bolivia ($110/flight, La Paz - San Borja) includes: 1) seven flights/year for Hubbell, Gullison, and the Bolivian counterpart, 2) four flights in Year 1 and two flights/year in Years 2 and 3 for Rice, and 3) two flights/year in Years 1 and 2 for Vincent. The estimated cost of fuel, maintenance and insurance for one four-wheel drive vehicle was provided by L. Goitia (Director of *Programa Chimanes*).

3. Meals & Lodging. Includes city costs (at $345/week) for: 1) a combined total of seven weeks/year for Gullison and Hubbell, and 2) a combined total of three weeks/year in Years 1 and 2, and one week in Year 3 for Rice and Vincent. Field costs are estimated at $10/day/person for 1,230 person-days per year (540 days for field assistants, 360 days for Hubbell and Gullison, and 330 days for the Bolivian counterpart). Field costs for Rice and Vincent include 98 days in Year 1, 35 days in Year 2 and 21 days in Year 3.

4. Field Support. Includes food and labor costs for one field cook for six months in Year 1, and three months each in Years 2 and 3.

5. Equipment & Air Freight. A four-wheel drive vehicle is necessary to access study sites. The estimated price for the vehicle (a 4W-D Toyota imported duty free to La Paz) was supplied by L. Goitia. Surveying gear (two theodolites, stadia, and tapes) is needed to demarcate study plots. A large format camera is necessary to take fine resolution photographs of growth rings for subsequent imaging and analysis at Princeton. Camp equipment includes tents, cots, cooking gear, lanterns, medical supplies, and water filters. Computer equipment includes: 1) two laptop computers for data entry and analysis in the field, 2) two generators for powering the computers (as well as for freeze-drying equipment for isoenzyme samples), 3) batteries and uninterruptible power supply, and 4) one ink jet printer. Field research equipment includes altimeters, compasses, packs, diameter tapes, abney levels, tree tagging equipment, and metal expansion bands. Supplies for isoenzyme analysis assumes analyzing 7,000 seeds or seedlings/year.

6. Nursery and Field Laboratories. A nursery facility is needed to grow 10,000 seedlings/year for experimental planting and to examine the viability of seeds from the three forest types. The estimated cost of this facility was provided by L. Goitia. A field laboratory/dormitory is needed at each permanent study site. These are estimated to cost $1,000 each based on last year's experience.

7. Contractual Services. A botanist is needed to assist in site selection, tree identification, and to prepare sample collections for the herbarium. Dr. David Smith of the Missouri Botanical Gardens has agreed to provide three months of his time for this purpose (at $3,600/month). Soil profiles of the permanent study sites are needed to analyze the role of soil quality in growth rates. $4,000 is the cost of analyzing 400 samples at $10 each.

8. Administration & Rent. Includes funds for: 1) telephone, FAX, and postage for the principal investigators and 2) $6,000/year in rent for a project office in La Paz. Also included is the cost of a two-day planning meeting in Washington, D.C. for the principal investigators in Year 2.

9. Miscellaneous. Miscellaneous costs are for medicine, innoculations, visas, and contingencies.

## Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests (October 1991/October 1994)

| Category | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| 1. Personnel | | | | |
| Bolivian Counterpart (36 months) | 6,000 | 6,000 | 6,000 | 18,000 |
| 3 Field Assistants (54 months) | 5,400 | 5,400 | 5,400 | 16,200 |
| 2 Bolivian Graduate Students | 8,000 | 8,000 | 8,000 | 24,000 |
| Rice (13 months) | 50,000 | 7,500 | 7,500 | 65,000 |
| Vincent (3½ months) | 10,000 | 3,750 | 3,750 | 17,500 |
| Subtotal | 79,400 | 30,650 | 30,650 | 140,700 |
| 2. Transportation | | | | |
| International Airfare | 8,386 | 6,314 | 4,672 | 19,372 |
| Bolivian Airfare | 1,430 | 1,210 | 990 | 3,630 |
| Vehicle Fuel, Maintenance & Insurance | 4,000 | 4,000 | 2,500 | 10,500 |
| Inflation & Contingencies (10%) | 1,382 | 1,152 | 816 | 3,350 |
| Subtotal | 15,198 | 12,676 | 8,978 | 36,852 |
| 3. Meals & Lodging | 16,730 | 16,100 | 15,270 | 48,100 |
| 4. Field Support | 4,000 | 2,000 | 2,000 | 8,000 |
| 5. Equipment & Air Freight | | | | |
| Four-wheel Drive Vehicle | 22,000 | - | - | 22,000 |
| Surveying Gear | 5,000 | - | - | 5,000 |
| Large Format Camera, Film & Processing | 1,800 | 150 | 150 | 2,100 |
| Camp Supplies | 4,000 | - | - | 4,000 |
| Computer Equipment | 12,200 | - | - | 12,200 |
| Software (Statistics & GIS) | 2,500 | - | - | 2,500 |
| Field Research Equipment | 4,250 | - | - | 4,250 |
| Supplies for Isoenzyme Analysis | - | 6,000 | 6,000 | 12,000 |
| Air Freight | 1,500 | 500 | - | 2,000 |
| Subtotal | 53,250 | 6,650 | 6,150 | 66,050 |
| 6. Nursery and Field Laboratories | 16,000 | - | - | 16,000 |
| 7. Contractual Services | | | | |
| Botanical Consultant (3 months) | 10,800 | - | - | 10,800 |
| Soil Analyses | 4,000 | - | - | 4,000 |
| Printing & Translation | - | 2,000 | 4,000 | 6,000 |
| Subtotal | 14,800 | 2,000 | 4,000 | 20,800 |
| 8. Administration & Rent (La Paz Office) | 6,750 | 7,600 | 6,750 | 21,100 |
| 9. Miscellaneous (visas, inoculations, etc.) | 750 | 750 | 750 | 2,250 |
| 10. Total Costs | 206,878 | 78,426 | 74,548 | 359,852 |

**PROJECT BUDGET: Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests** (October 1991/October 1994)

| Category | Year 1 | | | Year 2 | | | Year 3 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TWS/PU HIID[1] | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Project Total |
| 1. Personnel | | | | | | | | | | | | |
| Bolivian Counterpart (36 months) | 6,000 | 0 | 6,000 | 6,000 | 0 | 6,000 | 6,000 | 0 | 6,000 | 18,000 | 0 | 18,000 |
| 3 Field Assistants (54 months) | 5,400 | 0 | 5,400 | 5,400 | 0 | 5,400 | 5,400 | 0 | 5,400 | 16,200 | 0 | 16,200 |
| 2 Bolivian Graduate Students | 8,000 | 0 | 8,000 | 8,000 | 0 | 8,000 | 8,000 | 0 | 8,000 | 24,000 | 0 | 24,000 |
| Rice (23 months) | 0 | 50,000 | 50,000 | 0 | 7,500 | 7,500 | 0 | 7,500 | 7,500 | 0 | 65,000 | 65,000 |
| Vincent (3½ months) | 0 | 10,000 | 10,000 | 0 | 3,750 | 3,750 | 0 | 3,750 | 3,750 | 0 | 27,500 | 27,500 |
| Subtotal | 19,400 | 60,000 | 79,400 | 19,400 | 11,250 | 30,650 | 19,400 | 11,250 | 30,650 | 58,200 | 82,500 | 140,700 |
| 2. Transportation | | | | | | | | | | | | |
| International Airfare | 5,186 | 3,200 | 8,386 | 3,114 | 3,200 | 6,314 | 2,472 | 3,200 | 4,672 | 9,772 | 9,600 | 19,372 |
| Bolivian Airfare | 990 | 440 | 1,430 | 770 | 440 | 1,210 | 550 | 440 | 990 | 2,310 | 1,320 | 3,630 |
| Vehicle Fuel, Maintenance & Insurance | 4,000 | 0 | 4,000 | 4,000 | 0 | 4,000 | 2,500 | 0 | 2,500 | 10,500 | 0 | 10,500 |
| Inflation & Contingencies (10%) | 1,018 | 364 | 1,382 | 788 | 364 | 1,152 | 452 | 364 | 816 | 2,258 | 1,092 | 3,350 |
| Subtotal | 11,194 | 4,004 | 15,198 | 8,672 | 4,004 | 12,676 | 4,974 | 4,004 | 8,976 | 24,840 | 12,012 | 36,852 |
| 3. Meals & Lodging | 15,722 | 1,008 | 16,730 | 14,715 | 1,385 | 16,100 | 13,885 | 1,385 | 15,270 | | 3,778 | 46,100 |
| 4. Field Support | 4,000 | 0 | 4,000 | 2,000 | 0 | 2,000 | 2,000 | 0 | 2,000 | 44,322 | 0 | 8,000 |
| 5. Equipment & Air Freight | | | | | | | | | | | | |
| Four-wheel Drive Vehicle | 0 | 22,000 | 22,000 | - | - | - | - | - | - | 8,000 | | |
| Surveying Gear | 5,000 | 0 | 5,000 | - | - | - | - | - | - | 0 | 22,000 | 22,000 |
| Large Format Camera, Film & Processing | 2,725 | 75 | 2,800 | 75 | 75 | 150 | 75 | 75 | 150 | 5,000 | 0 | 5,000 |
| Camp Supplies | 3,850 | 150 | 4,000 | - | - | - | - | - | - | 2,875 | 225 | 2,100 |
| Computer Equipment | 8,200 | 4,000 | 12,200 | - | - | - | - | - | - | 3,850 | 150 | 4,000 |
| Software (Statistics & GIS) | 2,500 | 0 | 2,500 | - | - | - | - | - | - | 8,200 | 4,000 | 12,200 |
| Field Equipment | 4,250 | 0 | 4,250 | - | - | - | - | - | - | 2,500 | 0 | 2,500 |
| Supplies for Isoenzyme Analysis | - | - | - | - | 6,000 | 6,000 | 765 | 5,235 | 6,000 | 4,250 | 0 | 4,250 |
| Air Freight | 2,500 | 0 | 2,500 | 500 | 0 | 500 | - | - | - | 765 | 11,235 | 12,000 |
| Subtotal | 27,025 | 26,225 | 53,250 | 575 | 6,075 | 6,650 | 840 | 5,310 | 6,150 | 2,000 | 0 | 2,000 |
| 6. Nursery and Field Laboratories | 16,000 | 0 | 16,000 | - | - | - | - | - | - | 26,440 | 37,610 | 66,050 |
| | | | | | | | | | | 16,000 | 0 | 16,000 |

**PROJECT BUDGET: Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests (continued)** (October 1991/October 1994)

| Category | Year 1 | | | Year 2 | | | Year 3 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Project Total |
| 7. Contractual Services | | | | | | | | | | | | |
| Botanical Consultant (3 months) | 10,800 | 0 | 10,800 | - | - | - | - | - | - | 10,800 | 0 | 10,800 |
| Soil Analyses | 4,000 | 0 | 4,000 | - | - | - | - | - | - | 4,000 | 0 | 4,000 |
| Printing & Translation | - | - | - | 1,000 | 1,000 | 2,000 | 2,000 | 2,000 | 4,000 | 3,000 | 3,000 | 6,000 |
| Subtotal | 14,800 | 0 | 14,800 | 1,000 | 1,000 | 2,000 | 2,000 | 2,000 | 4,000 | 17,800 | 3,000 | 20,800 |
| 8. Administration & Rent (Phone/FAX) | 6,425 | 325 | 6,750 | 7,275 | 325 | 7,600 | 6,425 | 325 | 6,750 | 20,125 | 975 | 21,100 |
| 9. Miscellaneous (visas, inoculations, etc.) | 375 | 375 | 750 | 375 | 375 | 750 | 375 | 375 | 750 | 1,125 | 1,125 | 2,250 |
| 10. Total Costs | 114,941 | 91,937 | 206,878 | 54,012 | 24,414 | 78,426 | 49,899 | 24,649 | 74,548 | 218,352 | 141,000 | 359,852 |
| (Percent of Total Project Costs) | 31.94% | 25.55% | | 15.01% | 6.78% | | 13.87% | 6.85% | | 60.82% | 39.18% | 100.00% |

[1] (TWS) The Wilderness Society, (PU) Princeton University, (HIID) Harvard Institute for International Development.

AID 1350-1 (3 87)

*PIO/T

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IMPLEMENTATION ORDER/TECHNICAL SERVICES

1. Cooperating Country: BOLIVIA

Page 1 of 3 Pages

2. PIO/T No. 598-0780-3-10125
598-0780-3-10126

3. [X] Original or Amendment No. ____

4. Project/Activity No. and Title: 598-0780

LAC Environmental Support Project
Biological and Economic Analysis of Sustainable Selective Logging in Bolivia
Limited Scope Grant Agreement No. 598-0780

DISTRIBUTION

5. Appropriation Symbol: 72-1111021

6. Budget Plan Code: LDNA-91-25511 -KG12 $98,726.00
LDSA-91-25511-KG12 $42,274.00

7. Obligation Status: [X] Administrative Reservation [ ] Implementing Document

8. Project Assistance Completion Date (Mo., Day, Yr.): 12/30/94

9. Authorized Agent: USAID/Bolivia RCO

10. This PIO/T is in full conformance with PRO/AG No. ____ Date ____

11a. Type of Action and Governing AID Handbook: [ ] AID Contract (HB 14) [X] AID Grant or Cooperative Agreement (HB 13) [ ] PASA/RSSA (HB 12) [ ] Other

11b. Contract/Grant/Cooperative Agreement/PASA/RSSA Reference Number (If this is an Amendment): N/A

12. Estimated Financing (A detailed budget in support of column (2) is attached as Attachment No. ____

| | | (1) Previous Total | (2) Increase | (3) Decrease | (4) Total to Date |
|---|---|---|---|---|---|
| Maximum AID Financing Available | A. Dollars | | $141,000 | | $141,000 |
| | B. U.S. Owned Local Currency | | | | |

13. Mission References

LSGA 598-0780 dated 9/29/90

14A. Instructions to Authorized Agent

The purpose of this PIO/T is to authorize the USAID/RCO to execute HB-13 Grant with "The Wilderness Society" in accordance with the Grant Agreement in Attachment A. Attachment B shows the budget with the annual distribution of funding; Attachment C is the Selection Memorandum.

ARD:JCalvo:bt

14B. Address of Voucher Paying Office

Controller's Office
USAID/Bolivia
APO Miami, Fl. AA 34032

15. Clearances - Include typed name, office symbol, telephone number and date for all clearances.

A. The Project Officer certifies that the specifications in the statement of work or program description are technically adequate.
ARD:JSleeper
PD&I:EKadunc
Phone No. 347
Date 8/14/91

B. The statement of work or program description lies within the purview of the initiating office and approved agency programs.
DP:FWTate
Date 8/15/91

C. RCO:CBucher
Date 8/14/91

D. Funds for the services requested are available
CONT:JRDavison
Date 8/27/91

E. Date

16. For the Cooperating Country: The terms and conditions set forth herein are hereby agreed to

Signature N/A Date ____

Title

17. For the Agency for International Development

Signature Darell McIntyre Date 08/27/91

Title ARD Director

*See HB 3, Sup. A, App. C, Att B, for preparation instructions. Note: The completed form contains sensitive information whose unauthorized disclosure may subject an employee to disciplinary action.

18. Statement of work or program description for this project is described in Attachment No. _____.

19. Special Provisions

A. [X] Language Requirements (specify) N/A.
(If marked, testing must be accomplished by AID to assure desired level of proficiency.)

B. [ ] Access to classified information [ ] will [X] will not be required by technical specialists. (Indicate level) _____.

C. [X] Duty post(s) and duration of technical specialist(s) services at post(s) (months) Beni - Santa Cruz - TDY.

D. [X] Dependents [ ] will [X] will not be permitted to accompany technical specialist(s).

E. [X] Geographic code applicable to procurement under this PIO/T is [X] 000 [ ] 899 [ ] 935 [ ] 941 [X] Other (specify) Bolivia
(If other than authorized in HB 1, Sup B, Chap 5, Para 5A1d, attach waiver(s).)

F. [ ] Salary approval(s) to exceed FS-1 salary ceiling are [ ] attached [ ] in process [X] N/A.

G. [X] Cooperating country acceptance of this project (applicable to AID/W projects only)
[X] has been obtained [ ] is in process [ ] is not applicable to services required by PIO/T.

H. [X] Justification for use of external resources for consulting services is [ ] attached [X] N/A.

I. [X] Clearance for procurement of ADP equipment, software, and services is [ ] attached [ ] in process [X] N/A.

J. [X] OMB approval of any report to be completed by ten or more members of the general public under the statement of work is
[ ] attached [ ] in process [X] N/A.

K. [X] Participant training [ ] is [X] is not being funded as part of this PIO/T.

L. [X] Requirement (contracts only) is recommended for [ ] small business set-aside [ ] SBA 8(a) Program [X] neither.

M. [ ] Other (specify).

| 20. Provisions for Logistic Support<br>A. Specific Items *(Insert "X" in applicable column at right. If entry needs qualification, insert asterisk and explain below in C. "Comments")* | IN KIND SUPPLIED BY | | FROM LOCAL CURRENCY SUPPLIED BY | | TO BE PROVIDED OR ARRANGED BY SUPPLIER | N/A |
|---|---|---|---|---|---|---|
| | AID | COOPERATING COUNTRY | AID | COOPERATING COUNTRY | | |
| (1) Office Space | | X | | | | |
| (2) Office Equipment | | X | | | | |
| (3) Housing and Utilities | | | | | | X |
| (4) Furniture | | | | | | X |
| (5) Household Appliances *(Stoves, Refrig., etc.)* | | | | | | X |
| (6) Transportation in Cooperating Country | | | | | X | |
| (7) Transportation To and From Country | | | | | X | |
| (8) Interpreter Services/Secretarial | | | | | X | |
| (9) Medical Facilities (Health Room) | | | | | X | |
| (10) Vehicles (official) | | | | | X | |
| (11) Travel Arrangements/Tickets | | | | | X | |
| (OTHER SPECIFY) (12) Nightwatchman for Living Quarters | | | | | | X |
| (13) | | | | | | |
| (14) | | | | | | |
| (15) | | | | | | |

20. Provisions for Logistic Support (Continued)

B. Additional Facilities Available From Other Sources

[X] Diplomatic pouch [ ] PX [ ] Commissary

[ ] Other (specify, e.g., duty free, entry, tax exemption)

C. Comments

21. Relationship of Contractor or Participating Agency to Cooperating Country and to AID

A. Relationships and Responsibilities Contractor will coordinate work with the "Chimanes Program"

B. Cooperating Country Liaison Officials

C. AID Liaison Officials Darell McIntyre, ARD Director
USAID/Bolivia Environmental Officer

22. Background information (additional information useful to authorized agent)

23. Summary of attachments that accompany the PIO/T (check applicable boxes)

[ ] A. Detailed budget estimate in support of increased funding (Block 12)

[ ] B. Evaluation criteria for competive procurement (Block 14A)

[ ] C. Justification for procurement by other than full and open competition or noncompetitive assistance

[ ] D. Statement of work or program description (Block 18)

[ ] E. Waiver(s) justification(s), clearance(s), certification(s) (Block 19) (specify number _____ )

PIO/T No. 598-0780-3-10125
598-0780-3-10126

ATTACHMENT A

# PROJECT PROPOSAL

## Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests


Submitted by:

Dr. Richard E. Rice
Senior Resource Economist
The Wilderness Society
Washington, D.C.

Dr. Jeffrey R. Vincent
Institute Associate
Harvard Institute for International Development
Harvard University
Cambridge, Massachusetts

Raymond E. Gullison
Department of Biology
Princeton University
Princeton, New Jersey

Prof. Stephen P. Hubbell
Department of Biology
Princeton University
Princeton, New Jersey


January 30, 1991

# Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests

## Project Summary

*Achieving sustainability in the management of natural tropical forests is an important objective for both conservation and economic development (USAID 1989, Repetto and Gillis 1988). Efforts to realize this goal have been hampered by a lack of basic biological information and undercut by government policies that encourage wasteful and destructive logging techniques and unsustainably high levels of resource extraction.*

*A program to promote sustainable forest management was recently begun in the lowland tropical forests of Bolivia. Our project will contribute to this effort by 1) developing an ecological basis for the long-term sustainable harvest of mahogany, 2) examining the degree to which current timber pricing policies in Bolivia encourage unsustainable logging and 3) suggesting viable alternative pricing systems that will increase government revenues and reduce environmental damage to the forest. We will also create a computer software program to help managers evaluate the cost-effectiveness and sustainability of alternative forest management plans. Finally, a package of educational materials based on the study will be developed for use in training Latin American conservation professionals in conjunction with the Smithsonian Institution's annual conservation training workshop in Bolivia.*

## Background

### *Logging and Conservation Efforts in the Bolivian Lowlands*

Lowland tropical forests in the Bolivian Amazon are concentrated in the states of Santa Cruz, Beni, Pando, and northern La Paz. The combined forested area of these states is 55.8 million hectares (CDF 1989).

Until recently, much of this land was inaccessible to loggers – a situation that is rapidly changing. Logging rights to nearly 40 percent of the country's tropical forests have been sold to concessionaires, and deforestation from logging and agricultural activities is currently estimated at more than 200,000 hectares per year (CDF 1989). In early 1990, due to rising public concern over the pace and character of forest development, the Bolivian government placed a five-year moratorium on granting additional logging concessions.

The objectives of the moratorium are to reduce the rate of deforestation and provide time to develop a more sustainable approach to managing and conserving the country's remaining tropical forests. An important component of this effort is a government-sponsored research program, known as *Programa Chimanes*, that is currently underway in the Beni Biosphere Reserve (Goitia 1989). Established by administrative decree in 1982, the Beni Biosphere Reserve encompasses 1.6 million hectares of mixed forest and savanna in the central Bolivian lowlands, two-thirds of which is open to controlled utilization. *Programa Chimanes* seeks to develop a biological and economic basis for sustained management of the region's timber resources that can serve as a model for forest development throughout the country.

The program is organized around three general areas of study: forestry, biology, and economics. The forestry component is currently staffed by a team of Bolivians under a grant from the International Tropical Timber Organization. Research in this area has focused on reforestation and general management planning for mahogany (*Swietenia macrophylla*) – the country's primary commercial timber species.

Our objective is to contribute to the biological and economic components of the program by providing an ecological basis for sustainable selective harvesting strategies and by proposing pricing policies for timber that will discourage wasteful and inefficient logging and generate revenues needed for long-term management.

### *Biology and Sustainable Management*

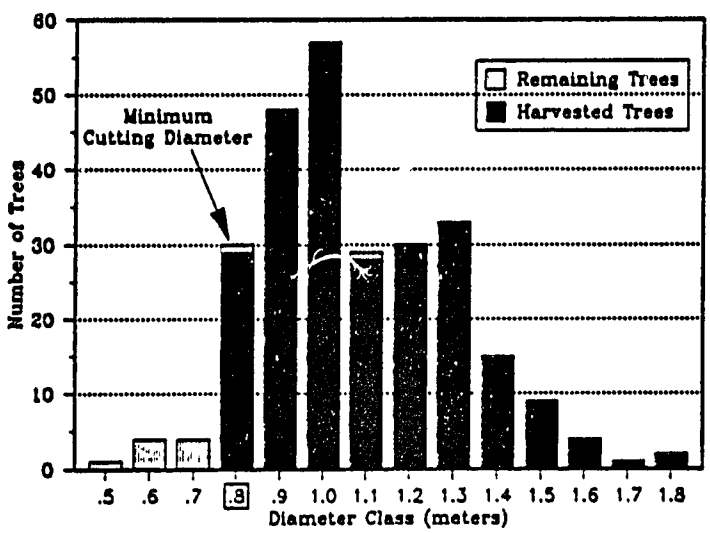
Virtually all hardwood tropical timber production in Latin America comes from selective logging of natural, unmanaged forests. Lack of information on the growth and functioning of these forests combined with government regulation that is either unenforced or nonexistent makes most of this production unsustainable. Because natural forests will likely continue to be the primary source of tropical hardwoods in the future, it is vital that information necessary to manage and protect these lands be developed soon (Grainger 1986).

Existing systems of natural forest management in the tropics were developed primarily in Southeast Asia (*e.g.* the Malayan uniform system) and are not directly applicable to forests in Latin America. New World forests differ from those in Southeast Asia in that commercially valuable species occur at much lower densities and reproduction of these species in large, cut-over areas is typically poor.

An understanding of the factors responsible for the low natural abundance of valuable species such as mahogany is crucial in designing successful long-term management strategies. Information is also needed on natural growth rates, reproduction, age-class distributions and how these factors are affected by logging.

Previous research on mahogany, while useful, is largely anecdotal and of insufficient certainty to form the basis for a quantitative model of sustainable logging (*e.g.* Lamb 1966). Moreover, much of that research was conducted in coastal areas of Central America and Puerto Rico and is therefore of limited value for forest management in the Amazon Basin. Our study will begin to fill this gap by investigating critical aspects of the underlying biology of mahogany in Bolivia.

Preliminary data from *Bosque Chimanes*, the production forest in the Beni Biosphere Reserve, indicates that the age structure of existing stands of mahogany is weighted heavily toward older individuals and that the size and number of trees that remain after logging is insufficient to ensure adequate reproduction. Of 267 mahogany trees in one concession sampled, 256 – or 96 percent of the population – were cut; only 11 were left to provide for future seed crops (Figure 1).




| Diameter Class (meters) | Number of Trees Harvested | Number of Trees Unharvested |
|---|---|---|
| 0.5 | 0 | 1 |
| 0.6 | 0 | 4 |
| 0.7 | 0 | 4 |
| 0.8 | 29 | 1 |
| 0.9 | 48 | 0 |
| 1.0 | 57 | 0 |
| 1.1 | 28 | 1 |
| 1.2 | 30 | 0 |
| 1.3 | 33 | 0 |
| 1.4 | 15 | 0 |
| 1.5 | 9 | 0 |
| 1.6 | 4 | 0 |
| 1.7 | 1 | 0 |
| 1.8 | 2 | 0 |
| | 256 | 11 |

*FIGURE 1. Effect of Logging on Mahogany Size-class Structure in Bosque Chimanes.* The distribution of diameters of mahogany trees in *Bosque Chimanes* is weighted heavily toward larger individuals, indicating poor survival in the smallest size classes. In the sample shown above, 96 percent of the population was removed by logging. This reduction in size and number of trees may have serious implications for post-harvest seed production and seedling viability. Without supplementary planting and management, future harvests may be jeopardized. SOURCE: *Programa Chimanes*, 1990.

These data suggest that enrichment planting and a larger minimum cutting diameter may be necessary to ensure that future logging is sustainable. Factors affecting seedling growth and survival in natural populations of mahogany, however, are not well known.

The effects of logging on the genetic structure of mahogany are also uncertain. Post-harvest breeding populations of trees occur at a much lower density than in a natural

forest. Research indicates this can lead to insufficient pollination and a reduction in seedling viability due to inbreeding (Bawa 1976). A better understanding of logging-induced inbreeding in mahogany will be needed to design harvest regimes that minimize losses in genetic diversity.

### *Forest Revenue Systems and Sustainable Management*

Management plans based on even the best biological information can be undercut by government policies that encourage wasteful and destructive logging. Pricing policies are particularly important in this regard.

The forests of Bolivia, as in most of the tropics, are owned and administered by the national government. Timber is sold to concessionaires – companies that hold harvesting rights – at rates established by a government agency, not by the market. In Bolivia, logging charges are assessed as a royalty, or a fixed charge for every cubic meter of timber removed from the forest.

In theory, the price of timber should be based on its stumpage value, defined as the residual value of a tree after logging costs are subtracted from the log price paid by a mill. Logging costs include the costs of extraction and delivery, taxes, and normal profits. Stumpage value, in the technical literature, is known as a type of economic rent. In competitive markets, this rent will generally accrue entirely to the owner of the land, thereby alerting the owner to the true financial value of the forest.

A properly functioning price mechanism provides a powerful incentive for long-term sustainable management. It confers on forests a tangible financial value that enables sustained-yield logging to compete with more destructive uses of the land. The incentive structure fails, however, when royalties do not send accurate price signals to those with management authority.

Preliminary indications are that timber royalties in Bolivia are set far below actual stumpage value. This has important implications for conservation and sustainable management because the price charged for timber directly affects the quantity of timber demanded and the rate at which it is cut. Inefficient revenue systems that underprice timber resources encourage unsustainably high levels of logging and allow much of the potential value of the resource to be captured by loggers as windfall profits. This, in turn, deprives the government of revenue needed for long-term management and can create enormous pressures for rapid and destructive exploitation.

Inefficient pricing may also cause a portion of the rent to be dissipated by encouraging concessionaires to "high grade" – that is, to cut only the largest and most valuable trees – while providing little incentive to avoid damage to uncut timber. Royalties that do not reflect differences in timber values due to species, grade, or site conditions can

encourage high grading because any tree with a stumpage value less than the royalty is worthless to the logger. When such royalties are assessed only on extracted logs, other trees can be left in the forest with impunity or damaged through careless and inefficient logging.

Past studies of forest revenue systems in the tropics have largely ignored Latin America despite the region's importance to global forest conservation and its emerging role as a timber supplier. Evidence from Africa and Southeast Asia, however, indicates that most forest revenue systems capture only a fraction of available resource rent for the public treasury (Page *et al.* 1976, Repetto and Gillis 1988, Ruzicka 1979, Vincent 1990). By creating a bias against investments in long-term management, these systems undermine efforts to promote conservation and sustainable development.

## Objectives

The objectives of this project are:

1) to identify the biological factors that best predict future mahogany stocking densities, stand distributions, timber quality, and growth rates in selectively managed forests;

2) to use this knowledge to design management strategies that will increase natural and managed regeneration of mahogany, improve restocking success, and maximize timber quality and volume in regenerating stands;

3) to develop quantitative estimates of the components of the economic rent from logging (*i.e.*, government revenue, windfall profits, high grading, logging damage, *etc.*);

4) to suggest guidelines for feasible improvements in the current government pricing system and develop estimates of the amount of revenue that could be generated from logging and used for investments in forest management and other activities if a more efficient pricing system were adopted;

5) to develop a computer planning model to help managers evaluate the economic efficiency and biological sustainability of alternative forest management strategies;

6) to provide training to *Programa Chimanes* forestry personnel in biological and economic data collection, analysis, modeling, and long-term forest monitoring; and,

7) to develop course materials based on the study for use in training Latin American resource professionals in the Smithsonian Institution Man and the Biosphere, Biological Diversity Program's (SI/MAB) annual conservation training workshop in Bolivia.

Figure 2 illustrates how major elements of the project will be integrated.

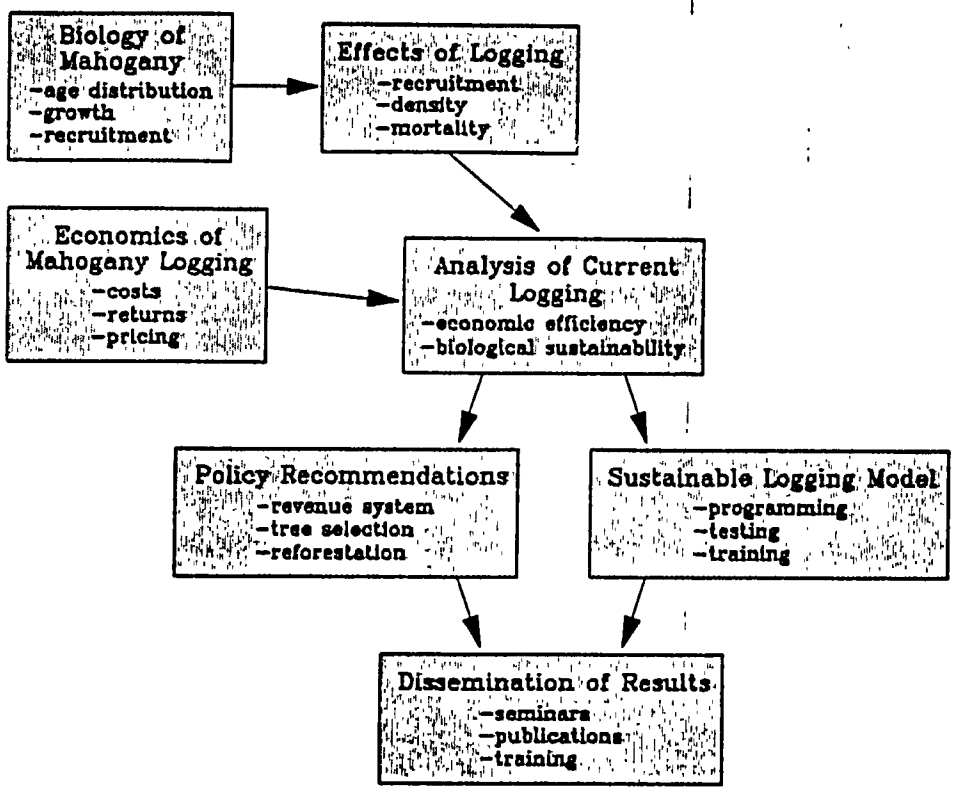



*FIGURE 2. Project Flowchart.*

## Policy Significance

In early 1990, the government of Bolivia issued a decree announcing a five-year program to reevaluate its forestry and natural resource policies (ROB 1990). The decree, entitled *La Pausa Ecológica*, or "ecological pause," specifically cites the need for improvements in managing the nation's logging concessions. It provides an opportune context in which to pursue the study outlined above.

The need for concrete information on which to base policy reforms will be heightened by completion of major improvements to the main highway bisecting the Beni Biosphere Reserve (scheduled for early 1993). These improvements, financed by loans from the Interamerican Development Bank, are expected to reduce log transport costs dramatically, thereby increasing the pressure for more rapid extraction of the region's timber resources.

Forestry officials in *Bosque Chimanes* have expressed a sincere interest in developing management strategies compatible with the overall aims of the biosphere reserve. At present, the forestry program is understaffed, underfunded, and lacks the information needed to establish a biological and economic basis for sustained management. The information

and analysis provided by our study should go a long way towards helping to address this need. In addition, the training and experience we provide to staff of the forestry program in modeling, data collection, and long-term forest monitoring will help ensure that similar information continues to be available in the future.

Success in implementing timber pricing reform based on our analysis depends in large part on whether the various parties involved in Bolivian logging feel their interests will be advanced by a revenue system that increases rent capture by the government. We argue all parties will benefit in the long run: states will receive increased tax revenue; the Bolivian Forestry Department will see progress in achieving its goal of sustainable forest management; and industry will enjoy larger and more dependable supplies of timber due to less destructive logging and to more intensive management made possible by increased forest revenue.

Our pricing reform recommendations will also have direct policy significance for other countries in the Amazon Basin and elsewhere in the neotropics that wish to promote sustained utilization of their natural forest endowments. Similarly, with appropriate modification, our forest planning model and timber management recommendations will be useful for designing sustainable management strategies in other tropical nations.

## Research Design and Data Collection

### *Biological Component*

The impacts of selective logging on the biology of mahogany will be investigated through a comparison of three mahogany populations: 1) a control population of uncut trees, 2) a population logged during the course of the study and 3) a population logged 20 years ago. Candidate study sites for the three populations were identified in *Bosque Chimanes* during the summer of 1990.

Population 1 (the control population) will provide baseline data on the factors and processes that affect mahogany in the absence of management. Population 2 (logged during the course of the study) will provide information on immediate damage and mortality caused by logging operations. Population 3 (logged 20 years ago) will provide information on the long-term response of mahogany to selective logging.

Below is a short discussion of the standard measurements that will be taken from each population.

***Diameters.*** Two 50-hectare areas in each of the study populations will be divided into one-hectare quadrats. All mahogany trees with a diameter at breast height (dbh) of

10 cm or more will be measured, tagged, and fitted with a metal expansion band to monitor growth. The approximate location of all tagged trees will be determined and used to produce maps to facilitate remeasurement. Stumps in the area logged 20 years ago will also be located and mapped.

Enumeration of all seedlings and saplings less than 10 cm dbh is extremely time consuming and beyond the scope of the study. A sampling scheme will be devised for these trees to estimate the number of individuals and their spatial distribution in relation to larger trees.

***Growth Rates.*** Mahogany exhibits distinct growth rings. Preliminary analysis suggests that while the growth rings may not be annual, their formation is consistent between trees. Measurements of growth rings can therefore be used to identify areas of high productivity and to establish relative growth rates for different size classes of trees. We are currently developing an image processing system at Princeton to interpret and analyze growth ring data for large numbers of trees. These data will be used in conjunction with field measurements of growth obtained using the metal expansion bands.

***Mortality.*** Mortality rates will be measured by observing tree mortality over the course of the study.

***Reproductive Biology.*** Fifty reproductive trees from each of the three populations will be studied to quantify the effect of breeding tree density on pollinization success and seedling viability. Pollinization success will be measured by comparing flower-to-fruit ratios and total seed production for similar sized trees on each of the three study sites. We expect to identify a threshold minimum density below which pollinization is seriously impaired.

Reduction in the number of seedlings as a result of decreased seed production will be studied by comparing seedling plots in pristine forest with seedling plots in forest that was logged 20 years ago. As the density of reproductive individuals declines, we expect that the rate of self-pollinization will rise. We will test the effect of increased self-pollinization on seedling viability by comparing growth and mortality of seedlings from trees occurring at high and low densities.

***Genetic Variation.*** Genetic variation in mahogany populations will be studied using isoenzyme analysis. Samples will be taken from a range of sites throughout *Bosque Chimanes* to determine: 1) the overall level of genetic variation, 2) how this variation is partitioned between populations and individuals and 3) to what degree inbreeding increases as a result of logging.

### *Economic Component*

Estimating the current distribution of the economic rent from logging is central to achieving all of the economic objectives of the study. A model of the various components of rent under an inefficient forest revenue system is presented in Figure 3 (Vincent *et al.* 1990).

Potential rent refers to the financial value attainable if all commercial timber on a site were sold at true stumpage value. Under an inefficient pricing system, only a portion of the potential rent is realized through the actual harvest and sale of logs. This rent may be recorded at checking stations or go unrecorded if checking stations are eluded. Rent from recorded harvests is captured either by the government as forest revenues or by loggers as windfall profits.

Unrealized rent consists of residual rent and logging damage. Residual rent refers to the stumpage value of trees left in the forest due to management prescriptions (silvicultural rent) or high grading (failure by the logger to extract marketable trees). Logging damage is the forgone stumpage value of fallen or standing dead trees.

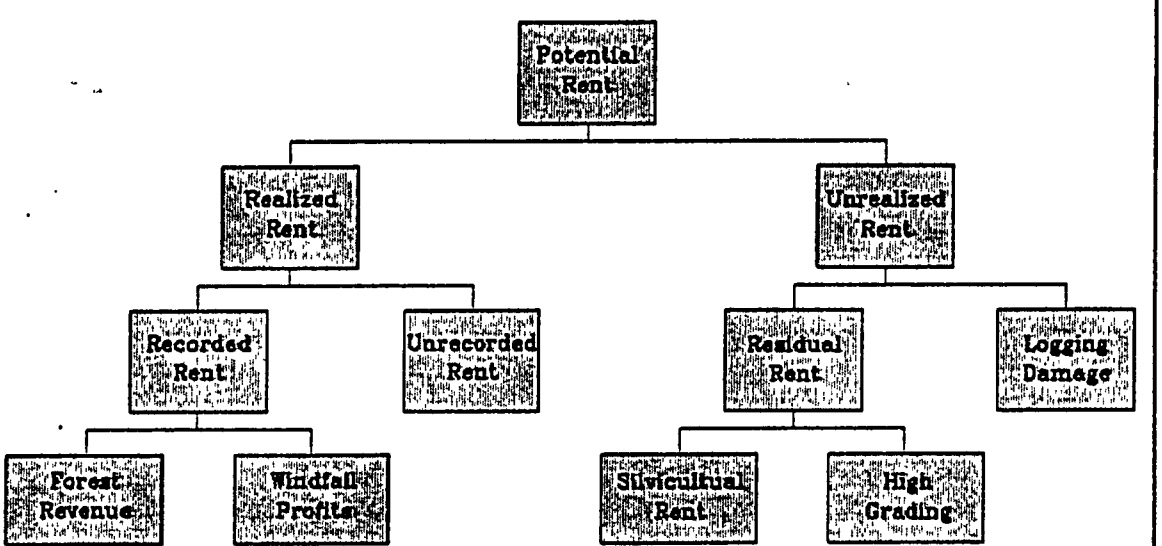



*FIGURE 3. Rent Distribution under an Inefficient Forest Revenue System.* The economic rent from a forest is the total financial value of timber after logging costs and normal profits. Ideally, this rent should accrue entirely to the owner of the land. Inefficient forest revenue systems that underprice timber resources encourage unsustainably high levels of logging and allow much of the potential value of the resource to be captured by loggers as windfall profits. This in turn deprives the landowner of revenue needed for long-term management. As shown above, inefficient pricing may also cause a portion of the rent to be dissipated through high grading or damage to unharvested trees.

The general research design requires selecting a set of forest sites scheduled to be logged in the near future. The distribution of the potential economic rent available from these sites will be estimated through detailed pre-logging inventories along with data collected on logging prices, production costs, harvest volumes, revenue collections, and post-logging inventories.

The individual components of potential rent will be estimated as follows:

- Pre-logging inventory data will allow estimation of potential harvest volume. The sales value (based on log prices) of this volume minus logging costs and profit margins will provide an estimate of potential rent.
- The sales value of recorded harvest minus logging costs (including profit margins) will provide an estimate of recorded rent.
- Forest revenue will be obtained directly from data on royalty collections and windfall profits will be calculated by subtracting forest revenue from recorded rent.
- Silvicultural rent and high grading (together, residual rent) will be determined by comparing pre- and post-logging inventories on the basis of management prescriptions and harvest plans.
- Logging damage will be based on a post-harvest inventory of standing and fallen dead trees of marketable size and species.
- Unrecorded rent will be the residual left after subtracting recorded rent, residual rent, and logging damage from potential rent.

***Inventory Site Selection.*** Inventory sites will consist of previously undisturbed forest to be logged during the fall of 1991. Three areas will be chosen from *Bosque Chimanes*, one of which will correspond to the second population noted above for the biological component of the project (*i.e.*, the area to be logged during the course of the study). Four 50-hectare blocks in each area will be selected for sampling. Site selection will be finalized through consultations with the forestry staff of *Programa Chimanes*.

Selection criteria will include accessibility, site characteristics, and distance to processing facilities. An effort will be made to choose sites that differ as much as possible in terms of the above criteria in order to investigate the effect that these factors have on the quantity of timber harvested, high grading, and damage to residual stands. Our preliminary hypothesis is that high grading and damage to residual timber will be higher in areas that are generally more costly to log.

***Inventories.*** Prior to logging operations, *Programa Chimanes* foresters conduct detailed pre-harvest inventories of timber to be cut, including mapping and marking of trees. While this information will contribute to our data needs, a broader inventory will nevertheless be necessary to determine the potential marketable timber volume, as opposed to the planned volume, available at each site.

Pre- and post-logging inventories will be conducted by forestry crews contracted locally. Inventories will be carried out using a standard line sampling system at a 10 percent intensity. This system was found to be more than adequate in a similar study conducted by Vincent in Malaysia during the summer of 1990 (Vincent *et al.* 1990).

Two or three inventory crews will be used in each area. Experience in Malaysia indicates that one crew of six people (two foresters and four laborers) can inventory five 0.1-hectare plots per day during pre-logging inventories and can double this rate for the post-logging inventories. With four 50-hectare sites at each area, a total of 40 crew-days per area will be required for pre-harvest inventories and 20 crew-days per area for post-harvest inventories.

***Other Economic Data.*** Data on harvest volume and royalties will be obtained from the Bolivian Forestry Department in La Paz. These data are based on records kept at checking stations responsible for scaling logs and assessing timber taxes.

Data on log prices will also be obtained from the Bolivian Forestry Department. Logging and milling costs will be estimated directly through on-site inspection of logging and milling activities. These estimates will be verified by comparing them with standard logging cost-series available for other areas of the Amazon Basin and, if possible, through comparison with detailed cost records kept by the Bolivian International Forestry Council in Santa Cruz.

"Normal" profit margins will be based on average margins for other resource-based industries in Bolivia. Data necessary for calculating these margins are available from bulletins of the Bolivian Department of Statistics. A range of values will be used.

### *Forest Planning Model*

A model of mahogany stand dynamics (Figure 4) will be constructed using information obtained from the research outlined above. The biological component of the model will project timber growth and yield resulting from various management activities such as harvest, thinning, and reforestation. The economic component will incorporate costs and revenues associated with management and will allow managers to compare financial returns available from different investments.

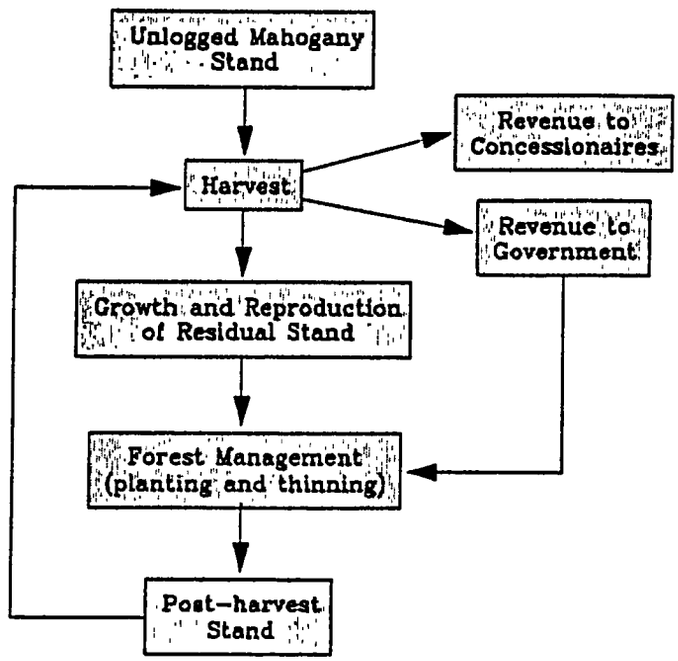



*FIGURE 4. Forest Planning Model.* Schematic representation of forest planning model incorporating economic and biological information obtained during study.

The model will be structured to provide flexibility in the type of analysis performed and in the type of investment or investments to be analyzed. Analysis, for example, will be permitted at spatial scales of one hectare, one stand, or an entire forest and at temporal scales of one or more full rotations or parts of rotations. The model will also permit assessment of a complete forest management plan or marginal analysis of individual treatments added to an existing plan.

The primary objective of the model is to provide managers with a tool that will help them develop economically efficient and biologically sustainable strategies for timber production in *Bosque Chimanes*. The model will also make explicit the implications of various timber pricing strategies and provide a means of comparing investments in sustainable forestry with other potential uses of the land.

## Work Plan

Research will be carried out primarily by Gullison and Rice with assistance from Vincent (econometric analysis and policy implications), Hubbell (biometric analysis and study design) and a Bolivian counterpart (management planning, implementation of field work and policy implications). Workshop materials for the Smithsonian conservation training program will be developed primarily by Rice. The four principal investigators will

be assisted by a botanist in site selection and inventories. All members of the project will work in close collaboration with Ing. Luis Gotia and Ing. Waldo Terceiro, directors of the forestry component of *Programa Chimanes.*

Each year's field work will be carried out during the Bolivian dry season (June through December). Data analysis, computer modeling, isoenzyme lab work, and document drafting will be conducted during the months of January through May.

***Year One.***

Gullison and Rice will visit Bolivia for two weeks in late spring 1991 to identify possible concessions for the remaining inventory sites, select contractors to carry out inventories, and continue the collection of price and cost data begun during the summer and fall of 1990. In June 1991, the four principal investigators will purchase equipment, hire field crews, and finalize selection of inventory sites. Vincent and Hubbell will return to the U.S. after two weeks. Rice, Gullison, and the Bolivian counterpart will spend six weeks collecting data on pre-harvest inventories, royalty collections, harvest levels, logging costs, and log prices. Gullison will remain in Bolivia to begin studies of seed production and seedling viability. Post-harvest inventories will be supervised by Rice, Gullison, and the Bolivian counterpart during the period October to December, 1991. From January to May 1992, inventory data will be analyzed and preliminary isoenzyme work will begin in the United States. Analysis and writing for the economic rent component of the project will be completed by the end of May 1992.

***Year Two.***

From June to December 1992, trees mapped and tagged during the previous year will be monitored for growth and mortality. Seed production and seed viability experiments will be carried out, samples for isoenzyme work will be collected, and thinning and planting trials will be started. Gullison and Hubbell will plan and carry out various manipulations, and Rice will conduct economic evaluations of these management actions. From January to May 1993, growth and mortality data will be analyzed, and leaf samples will be assayed for enzymatic diversity. Work will also begin on a computer simulation model of mahogany population dynamics. Materials for the Smithsonian conservation workshop will be completed by May of 1993. Rice will return to Bolivia to participate in the workshop at the beginning of June.

***Year Three.***

From June to December 1993, trees will again be monitored for growth and mortality. Seed production and seedling viability experiments will be completed and forestry personnel in *Programa Chimanes* will be trained to continue monitoring the plots after the termination of the project. Training will also be provided in use of the forest planning

model, and the model will be tested in the field. From January to June 1994, Hubbell, Rice, Vincent, and Gullison will finish the simulation model. Final policy recommendations will be developed, and publications and training materials will be written and translated into Spanish.

## Work Products

### *Publications*

Two research papers will be prepared emphasizing the economic and biological aspects of the study, respectively. These will be submitted to international forestry/conservation journals such as *Forest Science*, the *Journal of Conservation Biology*, or the *Journal of Environmental Economics and Management*. A separate technical report will emphasize the project's policy and management recommendations. This document will be published by The Wilderness Society (in English) and distributed (in Spanish) to the Bolivian Forestry Department and district forestry offices in the Bolivian states of Santa Cruz, Beni, and La Paz.

### *Software*

Three computer programs will be developed during the study. The first will be a digital-image processing package to enhance and interpret photographs of growth rings in tropical trees. The second will interpret images of the forest canopy to facilitate studies of the role played by light in seedling growth and mortality. The third will be an integrated forest planning model allowing managers to evaluate the biological and economic implications of alternative forest management strategies.

### *Training*

A major aim of the project is to help *Programa Chimanes* forestry personnel obtain the training and experience needed to refine and implement sustainable logging strategies in the future. Towards this end, Bolivians will be involved in all stages of the project. Our Bolivian counterpart, from the forestry staff of *Programa Chimanes*, will gain extensive experience in data collection and analysis, operation of the forest planning model, and interpretation of model's output. In addition, up to six Bolivian university students will conduct research supervised by project personnel for their senior theses. This research will be carried out with the approval and participation of the staff of *Programa Chimanes*. Finally, training will be provided to ensure that long-term monitoring of the research plots continues after the project is finished.

A separate training objective of the project will be to develop course materials in resource policy and economics for use in the Smithsonian conservation training workshops in Bolivia. These workshops provide in-country training to local students and researchers on topics such as field research, collections, and reserve design and management. Resource policy and economics will be a valuable addition to the current curriculum.

## Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests (June 1991 - June 1994)

| Category | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| 1. Personnel | | | | |
| Bolivian Counterpart (36 months) | 6,000 | 6,000 | 6,000 | 18,000 |
| 3 Field Assistants (54 months) | 5,400 | 5,400 | 5,400 | 16,200 |
| 2 Bolivian Graduate Students | 8,000 | 8,000 | 8,000 | 24,000 |
| Rice (13 months) | 50,000 | 7,500 | 7,500 | 65,000 |
| Vincent (3½ months) | 10,000 | 3,750 | 3,750 | 17,500 |
| Subtotal | 79,400 | 30,650 | 30,650 | 140,700 |
| 2. Transportation | | | | |
| International Airfare | 8,386 | 6,314 | 4,672 | 19,372 |
| Bolivian Airfare | 1,430 | 1,210 | 990 | 3,630 |
| Vehicle Fuel, Maintenance & Insurance | 4,000 | 4,000 | 2,500 | 10,500 |
| Inflation & Contingencies (10%) | 1,382 | 1,152 | 816 | 3,350 |
| Subtotal | 15,198 | 12,676 | 8,978 | 36,852 |
| 3. Meals & Lodging | 16,730 | 16,100 | 15,270 | 48,100 |
| 4. Field Support | 4,000 | 2,000 | 2,000 | 8,000 |
| 5. Equipment & Air Freight | | | | |
| Four-wheel Drive Vehicle | 22,000 | - | - | 22,000 |
| Surveying Gear | 5,000 | - | - | 5,000 |
| Large Format Camera, Film & Processing | 1,800 | 150 | 150 | 2,100 |
| Camp Supplies | 4,000 | - | - | 4,000 |
| Computer Equipment | 12,200 | - | - | 12,200 |
| Software (Statistics & GIS) | 2,500 | - | - | 2,500 |
| Field Research Equipment | 4,250 | - | - | 4,250 |
| Supplies for Isoenzyme Analysis | - | 6,000 | 6,000 | 12,000 |
| Air Freight | 1,500 | 500 | - | 2,000 |
| Subtotal | 53,250 | 6,650 | 6,150 | 66,050 |
| 6. Nursery and Field Laboratories | 16,000 | - | - | 16,000 |
| 7. Contractual Services | | | | |
| Botanical Consultant (3 months) | 10,800 | - | - | 10,800 |
| Soil Analyses | 4,000 | - | - | 4,000 |
| Printing & Translation | - | 2,000 | 4,000 | 6,000 |
| Subtotal | 14,800 | 2,000 | 4,000 | 20,800 |
| 8. Administration & Rent (La Paz Office) | 6,750 | 7,600 | 6,750 | 21,100 |
| 9. Miscellaneous (visas, inoculations, *etc.*) | 750 | 750 | 750 | 2,250 |
| 10. **Total Costs** | **206,878** | **78,426** | **74,548** | **359,852** |

56x

## Budget Details and Justification

1. Personnel. We request salary support for a Bolivian counterpart (at $6,000/year), who will supervise the project when the principal investigators are not in Bolivia. Three field assistants (at $300/month each) are needed to assist in plot surveying and data collection for six months each year. Support will also be provided to two graduate students to carry out thesis research on topics related to the project. They will be selected with the help of Dr. Cecelia Moranes, Director of the *Instituto de Ecología, Universidad Nacional de San Andres*. Thirteen months of salary are requested for Rice and three and one-half months for Vincent (both at $5,000/month). Salaries for Hubbell and Gullison are provided by Princeton University and the Canadian Government.

2. Transportation. International airfare includes the following: 1) one flight/year (Newark - La Paz) for Gullison and Hubbell, 2) two flights in Year 1, and one flight/year in Years 2 and 3 for Rice (Washington, D.C. - La Paz), and 3) one flight/year in Years 1 and 2 for Vincent (Boston - La Paz). Airfare in Bolivia ($110/flight, La Paz - San Borja) includes: 1) seven flights/year for Hubbell, Gullison, and the Bolivian counterpart, 2) four flights in Year 1 and two flights/year in Years 2 and 3 for Rice, and 3) two flights/year in Years 1 and 2 for Vincent. The estimated cost of fuel, maintenance and insurance for one four-wheel drive vehicle was provided by L. Goitia (Director of *Programa Chimanes*).

3. Meals & Lodging. Includes city costs (at $345/week) for: 1) a combined total of seven weeks/year for Gullison and Hubbell, and 2) a combined total of three weeks/year in Years 1 and 2, and one week in Year 3 for Rice and Vincent. Field costs are estimated at $10/day/person for 1,230 person-days per year (540 days for field assistants, 360 days for Hubbell and Gullison, and 330 days for the Bolivian counterpart). Field costs for Rice and Vincent include 98 days in Year 1, 35 days in Year 2 and 21 days in Year 3.

4. Field Support. Includes food and labor costs for one field cook for six months in Year 1, and three months each in Years 2 and 3.

5. Equipment & Air Freight. A four-wheel drive vehicle is necessary to access study sites. The estimated price for the vehicle (a 4W-D Toyota imported duty free to La Paz) was supplied by L. Goitia. Surveying gear (two theodolites, stadia, and tapes) is needed to demarcate study plots. A large format camera is necessary to take fine resolution photographs of growth rings for subsequent imaging and analysis at Princeton. Camp equipment includes tents, cots, cooking gear, lanterns, medical supplies, and water filters. Computer equipment includes: 1) two laptop computers for data entry and analysis in the field, 2) two generators for powering the computers (as well as for freeze-drying equipment for isoenzyme samples), 3) batteries and uninterruptible power supply, and 4) one ink jet printer. Field research equipment includes altimeters, compasses, packs, diameter tapes, abney levels, tree tagging equipment, and metal expansion bands. Supplies for isoenzyme analysis assumes analyzing 7,000 seeds or seedlings/year.

6. Nursery and Field Laboratories. A nursery facility is needed to grow 10,000 seedlings/year for experimental planting and to examine the viability of seeds from the three forest types. The estimated cost of this facility was provided by L. Goitia. A field laboratory/dormitory is needed at each permanent study site. These are estimated to cost $1,000 each based on last year's experience.

7. Contractual Services. A botanist is needed to assist in site selection, tree identification, and to prepare sample collections for the herbarium. Dr. David Smith of the Missouri Botanical Gardens has agreed to provide three months of his time for this purpose (at $3,600/month). Soil profiles of the permanent study sites are needed to analyze the role of soil quality in growth rates. $4,000 is the cost of analyzing 400 samples at $10 each.

8. Administration & Rent. Includes funds for: 1) telephone, FAX, and postage for the principal investigators and 2) $6,000/year in rent for a project office in La Paz. Also included is the cost of a two-day planning meeting in Washington, D.C. for the principal investigators in Year 2.

9. Miscellaneous. Miscellaneous costs are for medicine, innoculations, visas, and contingencies.

## References


Bawa, K. S. 1976. Breeding of Tropical Hardwoods: An Evaluation of Underlying Bases, Current Status and Future Prospects. Pages 43-60. In *Tropical Trees: Variation, Breeding and Conservation*. J. Burley and B. T. Styles, eds. London: Academic Press.

Centro de Desarrollo Forestal (CDF). 1989. *Plan de Acción para el Desarrollo Forestal*. La Paz.

Goitia, Luis. 1989. *El Programa Chimanes y el Manejo Sostenido de los Bosques*. Unpublished project summary.

Grainger, Alan. 1986. The Future Role of the Tropical Rain Forests in the World Forest Economy. Ph.D. dissertation. University of Oxford, Department of Plant Sciences.

Lamb, F. B. 1966. *Mahogany of Tropical America: Its Ecology and Management*. Ann Arbor: University of Michigan Press.

Page, John M., Jr., Scott R. Pearson, and Hayne E. Leland. Capturing Economic Rent from Ghanaian Timber. 1976. *Food Research Institute Studies* 15:26-51.

Repetto, Robert and Malcolm Gillis, eds. 1988. *Public Policies and the Misuse of Forest Resources*. Cambridge: Cambridge University Press.

Republic of Bolivia (ROB). 1990. *La Pausa Ecológica*. Decreto Ley Nº 22407.

Ruzicka, I. 1979. Rent Appropriation in Indonesian Logging: East Kalimantan, 1972-73 to 1976-77. *Bulletin of Indonesian Economic Studies*. 15:49-56.

U.S. Agency for International Development (USAID). 1989. *Conserving Tropical Forests and Biological Diversity, 1988-1989 Report to Congress on the USAID Program*. Washington, D.C.: USAID.

Vincent, Jeffrey R. 1990. Rent Capture and the Feasibility of Tropical Forest Management. *Land Economics* 66:212-223.

Vincent, Jeffrey R., Awang Noor Abdul Ghani, Yusuf Hadi. 1990. Revenue Systems, Rent Capture, and Logging Behavior in Peninsular Malaysia. In *Proceedings of XIX World Congress, International Union of Forestry Research Organizations*. Montreal, August 6-10.

## Biographical Information

Dr. Richard Rice is currently Senior Resource Economist with The Wilderness Society in Washington, D.C., where he has been employed since 1983. At The Society, he has worked on a broad range of public land and environmental issues, including grazing, recreation, and subsidized logging on the national forests. Prior to joining The Wilderness Society, he held positions with the Office of Policy Analysis at the U.S. Department of the Interior and Resources for the Future, Inc.

Dr. Rice has extensive experience in the tropics and a background in biology and economics that gives him unique insight into the problems of tropical resource conservation and development.

As an undergraduate at Grinnell College, he spent seven months studying the feeding habits and reproduction of endangered sea turtles in Costa Rica. He returned to Costa Rica as a graduate student at the University of Michigan to study tropical ecology with the Organization for Tropical Studies and later conducted research for his dissertation on the nutritional impacts of rural development in Cameroon, West Africa.

Since 1983, Dr. Rice has been a consultant to the Smithsonian Institution's Man and the Biosphere Biological Diversity Program in Peru, Bolivia, Puerto Rico, and Panama, and in 1990, he served as economist on the design team for the Maya Resource Management (Mayarema) Project, a major USAID-sponsored environmental protection and development project in the Petén province of Guatemala.

Dr. Jeffrey Vincent was an assistant professor of resource economics in the Department of Forestry at Michigan State University from 1987 to 1990. In September 1990, he joined the Harvard Institute for International Development as an Institute Associate.

Dr. Vincent has extensive international experience and an interdisciplinary background in resource economics (Michigan State University and Yale University) and social anthropology (Harvard).

Before entering graduate school, he worked as a research assistant in tropical botany for two years which included fieldwork in Costa Rica for *The Botany of Mangroves* by P.B. Tomlinson (Cambridge University Press, 1985). He conducted research in Malaysia for his dissertation on the optimal taxation of tropical timber products in Southeast Asia.

Since 1985, Dr. Vincent has served as a consultant to the World Bank (Malaysia), USAID/WWF (Thailand), the U.S. Forest Service, the National Research Council, and

Scott Paper Company (Papua New Guinea). Dr. Vincent serves as a reviewer to a variety of scholarly journals and has published widely on tropical timber trade, pricing, and conservation.

Raymond Gullison is a Ph.D. candidate in Ecology and Evolutionary Biology at Princeton University. He is supported by a fellowship from the Canadian Government's National Science and Engineering Research Council.

Mr. Gullison holds an honors degree in biology from the University of British Columbia. As an undergraduate, he was awarded 14 academic scholarships and conducted field research in Kenya, Tanzania, Brazil, and Mexico. His research during this period included demographic studies and modeling of bird, fish, and ungulate populations.

In addition to his experience in the tropics, Mr. Gullison has a strong background in data analysis and computer programming. He is system manager for a database of 250,000 entries used in an ongoing study of forest dynamics in Panama. He has a working knowledge of Spanish and Portuguese, and is currently helping design and develop computer-based image processing systems for tree ring analysis and studies forest understory light regimes.

Dr. Stephen Hubbell is Professor of Biology in the Department of Biology and Evolutionary Ecology at Princeton University. Dr. Hubbell is world-renowned for his work in neotropical and paleotropical forest ecology. In 1990, he was one of ten recipients of a Pew Scholarship in Conservation and the Environment. He has played a leading role in an effort to create a National Institute of the Environment in the United States and recently initiated a proposal to establish a school of environmental studies at Princeton University. Dr. Hubbell holds a Ph.D. in zoology from the University of California, Berkeley, and a bachelor's degree in biology (with honors) from Carleton College.

PIO/T No. 598-0780-3-10125
598-0780-3-10126

ATTACHMENT B

## Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests (October 1991/October 1994)

| Category | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| 1. Personnel | | | | |
| Bolivian Counterpart (36 months) | 6,000 | 6,000 | 6,000 | 18,000 |
| 3 Field Assistants (54 months) | 5,400 | 5,400 | 5,400 | 16,200 |
| 2 Bolivian Graduate Students | 8,000 | 8,000 | 8,000 | 24,000 |
| Rice (13 months) | 50,000 | 7,500 | 7,500 | 65,000 |
| Vincent (3½ months) | 10,000 | 3,750 | 3,750 | 17,500 |
| Subtotal | 79,400 | 30,650 | 30,650 | 140,700 |
| 2. Transportation | | | | |
| International Airfare | 8,386 | 6,314 | 4,672 | 19,372 |
| Bolivian Airfare | 1,430 | 1,210 | 990 | 3,630 |
| Vehicle Fuel, Maintenance & Insurance | 4,000 | 4,000 | 2,500 | 10,500 |
| Inflation & Contingencies (10%) | 1,382 | 1,152 | 816 | 3,350 |
| Subtotal | 15,198 | 12,676 | 8,978 | 36,852 |
| 3. Meals & Lodging | 16,730 | 16,100 | 15,270 | 48,100 |
| 4. Field Support | 4,000 | 2,000 | 2,000 | 8,000 |
| 5. Equipment & Air Freight | | | | |
| Four-wheel Drive Vehicle | 22,000 | - | - | 22,000 |
| Surveying Gear | 5,000 | - | - | 5,000 |
| Large Format Camera, Film & Processing | 1,800 | 150 | 150 | 2,100 |
| Camp Supplies | 4,000 | - | - | 4,000 |
| Computer Equipment | 12,200 | - | - | 12,200 |
| Software (Statistics & GIS) | 2,500 | - | - | 2,500 |
| Field Research Equipment | 4,250 | - | - | 4,250 |
| Supplies for Isoenzyme Analysis | - | 6,000 | 6,000 | 12,000 |
| Air Freight | 1,500 | 500 | - | 2,000 |
| Subtotal | 53,250 | 6,650 | 6,150 | 66,050 |
| 6. Nursery and Field Laboratories | 16,000 | - | - | 16,000 |
| 7. Contractual Services | | | | |
| Botanical Consultant (3 months) | 10,800 | - | - | 10,800 |
| Soil Analyses | 4,000 | - | - | 4,000 |
| Printing & Translation | - | 2,000 | 4,000 | 6,000 |
| Subtotal | 14,800 | 2,000 | 4,000 | 20,800 |
| 8. Administration & Rent (La Paz Office) | 6,750 | 7,600 | 6,750 | 21,100 |
| 9. Miscellaneous (visas, inoculations, *etc.*) | 750 | 750 | 750 | 2,250 |
| 10. **Total Costs** | **206,878** | **78,426** | **74,548** | **359,852** |

**Budget Details and Justification**

1. Personnel. We request salary support for a Bolivian counterpart (at $6,000/year), who will supervise the project when the principal investigators are not in Bolivia. Three field assistants (at $300/month each) are needed to assist in plot surveying and data collection for six months each year. Support will also be provided to two graduate students to carry out thesis research on topics related to the project. They will be selected with the help of Dr. Cecelia Moranes, Director of the *Instituto de Ecología, Universidad Nacional de San Andres*. Thirteen months of salary are requested for Rice and three and one-half months for Vincent (both at $5,000/month). Salaries for Hubbell and Gullison are provided by Princeton University and the Canadian Government.

2. Transportation. International airfare includes the following: 1) one flight/year (Newark - La Paz) for Gullison and Hubbell, 2) two flights in Year 1, and one flight/year in Years 2 and 3 for Rice (Washington, D.C. - La Paz), and 3) one flight/year in Years 1 and 2 for Vincent (Boston - La Paz). Airfare in Bolivia ($110/flight, La Paz - San Borja) includes: 1) seven flights/year for Hubbell, Gullison, and the Bolivian counterpart, 2) four flights in Year 1 and two flights/year in Years 2 and 3 for Rice, and 3) two flights/year in Years 1 and 2 for Vincent. The estimated cost of fuel, maintenance and insurance for one four-wheel drive vehicle was provided by L. Goitia (Director of *Programa Chimanes*).

3. Meals & Lodging. Includes city costs (at $345/week) for: 1) a combined total of seven weeks/year for Gullison and Hubbell, and 2) a combined total of three weeks/year in Years 1 and 2, and one week in Year 3 for Rice and Vincent. Field costs are estimated at $10/day/person for 1,230 person-days per year (540 days for field assistants, 360 days for Hubbell and Gullison, and 330 days for the Bolivian counterpart). Field costs for Rice and Vincent include 98 days in Year 1, 35 days in Year 2 and 21 days in Year 3.

4. Field Support. Includes food and labor costs for one field cook for six months in Year 1, and three months each in Years 2 and 3.

5. Equipment & Air Freight. A four-wheel drive vehicle is necessary to access study sites. The estimated price for the vehicle (a 4W-D Toyota imported duty free to La Paz) was supplied by L. Goitia. Surveying gear (two theodolites, stadia, and tapes) is needed to demarcate study plots. A large format camera is necessary to take fine resolution photographs of growth rings for subsequent imaging and analysis at Princeton. Camp equipment includes tents, cots, cooking gear, lanterns, medical supplies, and water filters. Computer equipment includes: 1) two laptop computers for data entry and analysis in the field, 2) two generators for powering the computers (as well as for freeze-drying equipment for isoenzyme samples), 3) batteries and uninterruptible power supply, and 4) one ink jet printer. Field research equipment includes altimeters, compasses, packs, diameter tapes, abney levels, tree tagging equipment, and metal expansion bands. Supplies for isoenzyme analysis assumes analyzing 7,000 seeds or seedlings/year.

6. Nursery and Field Laboratories. A nursery facility is needed to grow 10,000 seedlings/year for experimental planting and to examine the viability of seeds from the three forest types. The estimated cost of this facility was provided by L. Goitia. A field laboratory/dormitory is needed at each permanent study site. These are estimated to cost $1,000 each based on last year's experience.

7. Contractual Services. A botanist is needed to assist in site selection, tree identification, and to prepare sample collections for the herbarium. Dr. David Smith of the Missouri Botanical Gardens has agreed to provide three months of his time for this purpose (at $3,600/month). Soil profiles of the permanent study sites are needed to analyze the role of soil quality in growth rates. $4,000 is the cost of analyzing 400 samples at $10 each.

8. Administration & Rent. Includes funds for: 1) telephone, FAX, and postage for the principal investigators and 2) $6,000/year in rent for a project office in La Paz. Also included is the cost of a two-day planning meeting in Washington, D.C. for the principal investigators in Year 2.

9. Miscellaneous. Miscellaneous costs are for medicine, innoculations, visas, and contingencies.

PIO/T No. 598-0780-3-1[illegible]25
598-0780-3-1[illegible]26

ANNEX C

Selection Memorandum

DATE : August 12, 1991

TO : Clement Bucher, Grants Officer

FROM : Jorge Calvo, ARD

SUBJECT : Grant Agreement whith the Wilderness Society (TWS)

| | | |
|---|---|---|
| Grant | : | 598-0780-G-00 |
| Project | : | Environmental Support 598-0780 (AID/W) |
| Recipient | : | The Wilderness Society |
| PACD | : | October 30, 1994 |
| Total Amount | : | $141,000 |
| Total Obligated | : | $141,00 (~~Limited Scope~~ Grant Agreement) |
| Technical Office | : | Agricultural and Rural Development |
| Project Officer | : | Jorge Calvo, ARD |
| Grant Officer | : | Clement J. Bucher, RCO |

This grant is funded out of AID/W under the Environmental Support Project 598-0780. An AID/W technical committee selected the TWS from a wide range of proposals submitted to the S&T Natural Resources Office in AID/W. The attached cables describe the awards process: State 088570 announces the invitation for proposals and describes the approval process; State 018688 announces the list of pre-proposals approved by AID/W, and includes the TWS proposal, State 035574 requests Mission concurrence to the TWS proposal; La Paz 018688 endorses it; and State 88570 provides the funding citations.

PIO/T No. 598-0780-10125
598-0780-10126



**PROJECT BUDGET: Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests** (October 1991/October 1994)

| Category | Year 1 | | | Year 2 | | | Year 3 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TWS/PU HIID[1] | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Project Total |
| 1. Personnel | | | | | | | | | | | | |
| Bolivian Counterpart (36 months) | 6,000 | 0 | 6,000 | 6,000 | 0 | 6,000 | 6,000 | 0 | 6,000 | 18,000 | 0 | 18,000 |
| 3 Field Assistants (54 months) | 5,400 | 0 | 5,400 | 5,400 | 0 | 5,400 | 5,400 | 0 | 5,400 | 16,200 | 0 | 16,200 |
| 2 Bolivian Graduate Students | 8,000 | 0 | 8,000 | 8,000 | 0 | 8,000 | 8,000 | 0 | 8,000 | 24,000 | 0 | 24,000 |
| Rice (13 months) | 0 | 50,000 | 50,000 | 0 | 7,500 | 7,500 | 0 | 7,500 | 7,500 | 0 | 65,000 | 65,000 |
| Vincent (3½ months) | 0 | 10,000 | 10,000 | 0 | 3,750 | 3,750 | 0 | 3,750 | 3,750 | 0 | 17,500 | 17,500 |
| Subtotal | 19,400 | 60,000 | 79,400 | 19,400 | 11,250 | 30,650 | 19,400 | 11,250 | 30,650 | 58,200 | 82,500 | 140,700 |
| 2. Transportation | | | | | | | | | | | | |
| International Airfare | 5,186 | 3,200 | 8,386 | 3,114 | 3,200 | 6,314 | 1,472 | 3,200 | 4,672 | 9,772 | 9,600 | 19,372 |
| Bolivian Airfare | 990 | 440 | 1,430 | 770 | 440 | 1,210 | 550 | 440 | 990 | 2,310 | 1,320 | 3,630 |
| Vehicle Fuel, Maintenance & Insurance | 4,000 | 0 | 4,000 | 4,000 | 0 | 4,000 | 2,500 | 0 | 2,500 | 10,500 | 0 | 10,500 |
| Inflation & Contingencies (10%) | 1,018 | 364 | 1,382 | 788 | 364 | 1,152 | 452 | 364 | 816 | 2,258 | 1,092 | 3,350 |
| Subtotal | 11,194 | 4,004 | 15,198 | 8,672 | 4,004 | 12,676 | 4,974 | 4,004 | 8,978 | 24,840 | 12,012 | 36,852 |
| 3. Meals & Lodging | 15,722 | 1,008 | 16,730 | 14,715 | 1,385 | 16,100 | 13,885 | 1,385 | 15,270 | | 3,778 | 48,100 |
| 4. Field Support | 4,000 | 0 | 4,000 | 2,000 | 0 | 2,000 | 2,000 | 0 | 2,000 | 44,322 | 0 | 8,000 |
| 5. Equipment & Air Freight | | | | | | | | | | 8,000 | | |
| Four-wheel Drive Vehicle | 0 | 22,000 | 22,000 | - | - | - | - | - | - | 0 | 22,000 | 22,000 |
| Surveying Gear | 5,000 | 0 | 5,000 | - | - | - | - | - | - | 5,000 | 0 | 5,000 |
| Large Format Camera, Film & Processing | 1,725 | 75 | 1,800 | 75 | 75 | 150 | 75 | 75 | 150 | 1,875 | 225 | 2,100 |
| Camp Supplies | 3,850 | 150 | 4,000 | - | - | - | - | - | - | 3,850 | 150 | 4,000 |
| Computer Equipment | 8,200 | 4,000 | 12,200 | - | - | - | - | - | - | 8,200 | 4,000 | 12,200 |
| Software (Statistics & GIS) | 2,500 | 0 | 2,500 | - | - | - | - | - | - | 2,500 | 0 | 2,500 |
| Field Equipment | 4,250 | 0 | 4,250 | - | - | - | - | - | - | 4,250 | 0 | 4,250 |
| Supplies for Isoenzyme Analysis | - | - | - | - | 6,000 | 6,000 | 765 | 5,235 | 6,000 | 765 | 11,235 | 12,000 |
| Air Freight | 1,500 | 0 | 1,500 | 500 | 0 | 500 | - | - | - | 2,000 | 0 | 2,000 |
| Subtotal | 27,025 | 26,225 | 53,250 | 575 | 6,075 | 6,650 | 840 | 5,310 | 6,150 | 28,440 | 37,610 | 66,050 |
| 6. Nursery and Field Laboratories | 16,000 | 0 | 16,000 | - | - | - | - | - | - | 16,000 | 0 | 16,000 |

PIO/T No. 598-0780-3-10125
598-0780-3-10126



**PROJECT BUDGET: Biological and Economic Analysis of Sustainable Selective Logging in Bolivia's Lowland Tropical Forests** (October 1991/October 1994)
**(continued)**

| Category | Year 1 | | | Year 2 | | | Year 3 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Total | TWS/PU HIID | A.I.D. | Project Total |
| 7. Contractual Services | | | | | | | | | | | | |
| Botanical Consultant (3 months) | 10,800 | 0 | 10,800 | - | - | - | - | - | - | 10,800 | 0 | 10,800 |
| Soil Analyses | 4,000 | 0 | 4,000 | - | - | - | - | - | - | 4,000 | 0 | 4,000 |
| Printing & Translation | - | - | - | 1,000 | 1,000 | 2,000 | 2,000 | 2,000 | 4,000 | 3,000 | 3,000 | 6,000 |
| Subtotal | 14,800 | 0 | 14,800 | 1,000 | 1,000 | 2,000 | 2,000 | 2,000 | 4,000 | 17,800 | 3,000 | 20,800 |
| 8. Administration & Rent (Phone/FAX) | 6,425 | 325 | 6,750 | 7,275 | 325 | 7,600 | 6,425 | 325 | 6,750 | 20,125 | 975 | 21,100 |
| 9. Miscellaneous (visas, inoculations, etc.) | 375 | 375 | 750 | 375 | 375 | 750 | 375 | 375 | 750 | 1,125 | 1,125 | 2,250 |
| 10. Total Costs | 114,941 | 91,937 | 206,878 | 54,012 | 24,414 | 78,426 | 49,899 | 24,649 | 74,548 | 218,352 | 141,000 | 359,852 |
| (Percent of Total Project Costs) | 31.94% | 25.55% | | 15.01% | 6.78% | | 13.87% | 6.85% | | 60.82% | 39.18% | 100.00% |

[1] (TWS) The Wilderness Society, (PU) Princeton University, (HIID) Harvard Institute for International Development.