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FINAL REPORT ON FORESTRY AND LAND USE TECHNICAL
ADVISORY SERVICES RENDERED TO THE CENTRAL SELVA
RESOURCES MANAGEMENT PROJECT, PALCAZU VALLEY, PERU

A Summary Report Rendered to the United States Agency
for International Development Mission to Peru

By:

The Tropical Science Center, San José, Costa Rica

Under USAID Contract No. 527-0240-C-00-4013-00

Dated February 1, 1984

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FINAL REPORT ON FORESTRY AND LAND USE TECHNICAL ADVISORY
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1.0 INTRODUCTION

Guidelines for AID/Peru participation in the Palcazu Valley Rural Development Program explicitly state that "because so much of the land in the Palcazu has the capacity for forestry production, and because most of the valley lands are still forested, production forestry holds the greatest potential for (its) development. These guidelines further state: "A thorough environmental assessment was carried out in the Palcazu watershed by a team of experts in natural resources and environmental management,.....and anthropology. Their findings.....describe the fragile conditions of the watershed in great detail and outline a course of action for long-term development and management of the area based upon sustained productivity consistent with land use capability."¹

In early 1982, the Tropical Science Center (TSC) was contracted by the Office of Development Resources of USAID/Peru to design and justify a forestry subcomponent for the Palcazu Valley project. TSC's innovative design², with few substantive changes, was subsequently incorporated into the Project Paper. Following signing of the Project Agreement with the GOP in late 1982, AID/Peru initiated actions to directly contract Tropical Science Center (a foreign entity) to provide all forestry and land utilization technical assistance to the Project. However, not until February 1, 1984, almost a year after the effective start-up of agricultural technical assistance to the project, was a contract signed with TSC, a delay which was to have negative impacts on implementation of the forestry and land use aspects of the project, as originally designed.

¹ USAID/Peru. 1982. Project Paper.

² Tropical Science Center. 1982. Sustained yield management of natural forests; Forestry Subproject, Central Selva Resources Management Project, Palcazu Valley, Peru. Consultant Report under Contract No. 527-01166-C-2009-00. San Jose, Costa Rica.

1.1 Objectives

Forestry and land use technical assistance to be provided by TSC to the Palcazu Regional Development Sub-section of the Pichis-Palcazu Special Project (PEPP) had as its objectives (a) the introduction and implementation of both the ecologically-based continuous land use inventory and the sustained-yield forest management and wood conversion systems described in the Project Paper, (b) the training of Peruvian technical personnel as well as colonists, timber operators, and native Indians in the relevant philosophies and techniques, and (c) the continuous review and evaluation of the systems being introduced and of their acceptance and application by both the target populations and those responsible for their propagation and long term application to Valley development.

1.2 Staffing and Administration

Originally, TSC was to achieve the above goals through the provision of 142 person-months of technical advisory services, including two long-term and ten short-term advisors.³ The two long term advisors were to cover (1) natural forest management, and (2) wood industrial engineering, respectively. The short-term specialists were to cover: (1) general forestry, (2) land use ecology, (3) land use capability classification, (4) forest inventory, (5) tropical dendrology, (6) logging and forest road construction, (7) draft animals, (8) forest industrial engineering, (9) wood preservation, and (10) forest products and marketing. The short-term advisor in general forestry and land use ecology (same person) was to work intermittently throughout the project in the capacity of team leader/coordinator. No chief-of-party was included.

In a modification to the Contract dated May 20, 1987, the technical level-of-effort was increased to 158.2 person-months, and a forest business administration advisor, short-term, was added. In a further modification, dated January 12, 1988, the level-of-effort was increased to 205.2 person-months and short-term advisors in forest research, wood conversion plant management, forestry cooperative administration, sawmill and lumberyard supervision, Pres-Cap plant supervision, and woodworking were added. This and a further modification, extended the effective closing date of the Contract first, from January 31, 1988 to June 30, 1988 and, subsequently, to September 30, 1988.

Work under the Contract began in February 1984 and continued through the effective closing date on September 30, 1988, a period of four years and eight months. For lack

³ One, half-time bilingual secretarial person was also authorized for the San

of obligated funds, however, no TSC advisor was present in Peru between July 24 and September 18, 1988. On September 30, 1988, TSC had provided 198.68 person-months of technical assistance to the project, distributed as shown in Table 1.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	SUM	F/85	
Level of Effort	Technical															
Technical Position	Technical					84	34	184	4		14			YR 1		
Chief-of-Party	Tosi	8	22	10	2					15				57	16	
Land Use Ecologist	Tosi						11	20				17		48		
Forest Mgt. Specialist	Simeone	8	22	21	23	21	22	23	20	23	22	21	23	249	20	
Wood Ind. Eng.	Krones				23	21			16	20	23	7		110		
Trop. Dendrologist	Hartshorn				5	21	10				9	10		55		
Land Use Capab.	Bolanos					21	22	6						49		
Logging Engineer	Aspinall						22							22		
Draft Animals	Cordero						13							13		
Forest Products	Greub									19	22	17		58		
Wood Preservation	G. Gonzalez											15		15	6	
Forest Inventory	Aspinall								23	20	23	22	10	98		
Forest Bus. Admin.	R. Gonzalez															
M. Conv. Plt. Adm.	N. Illsley															
M. Pres. Plt. Spv.	J. Torres															
Sawmill Adv.	C. Nieto															
Master Carpenter	M. Aspaiz															
For. Coop. Adm.	V. Cueva															
		0	16	44	31	53	95	109	68	60	103	99	73	23	774	42

'85	MY/	JN/8	JY/8	AG/8	S/E	O/E	N/85	D/85	J/86	SUM	F/86	M/E	R/86	MY/	JN/	JY/8	AG/8	S.
	'85	5	5	5	5	5				YR2		16		'86	'86	6	6	
8				15	20					75	20		2	13			21	
	5				1	23	1			36		21			17			
22	23	20	21	22	21	23	21	22	23	261	20	21	22	22	21	23	21	
	21			13	21	23	21	22	23	149	20	21	22	22	21	23	21	
	21						9	15		47	1	10		1	14		11	
				6	21	8				40	1	15		12	5			
			12		11	23	21			70				22	21	23	11	
	21	14			2	10				50	1	15		11	1	18		
							20	5		30	1	11				15		
										11								6
22	23	20	11	22	10					126	1	21	22					
52	114	54	44	78	107	110	93	64	46	895	65	135	68	103	115	87	87	

N/86	D/86	J/87	SUM	F/87	M/87	R/87	MY/8	JN/	JY/8	AG/	S/E	SUM	SUM	O/87	N/E	D/87	J/88
			1 YR3				7	'87	7	'87	17	YR4	1234		17		
		12	90	1	1	1	5	17	5	10	20	60	282		12	2	1
5			55									0	139				
20	23	22	260	12				8	13		19	52	822	1			6
20	23	22	260	20	22	22	21	22	23	9		139	658		2	18	4
			42			4	20	6	8	10	4	52	196	12			
10			54			5	11			16		32	175				
			85	20	22	22	21	22	14	21	22	164	341	26		18	
			46					6	6		13	25	134		19		
			43								18	18	149				
			27		4		9	18		19	14	64	117	5	18		
13			69									0	293		25		
			0					22	23	21	22	88	88				
			0									0			14	16	5
			0									0		1	14	16	
												0					
68	46	56	1027	53	49	54	87	121	92	106	132	694	3390	46	104	81	39

M/E	R/E	MY/	JN/	SUBS	R SUP	3-4					CON	
#	#	'88	'88	UM Y	I 1-5	M/M84	M/M85	M/M86	M/M87	Sum 1-2-	M/M87-88	TRACT BAL/JN88
	12			27	309	2.630777	3.461549	4.153858	2.769239	13.01542	1.038461	13.3 -0.75388
				0	139	2.215391	1.661543	2.538469	0	6.415404	0	8 1.584595
				16	838	11.49234	12.04619	12.00003	2.400007	37.93857	0.615384	40 1.446037
	4			28	686	5.076938	6.876944	12.00003	6.415404	30.36932	1.076923	32.5 1.053752
10	24	20		66	262	2.538469	2.169237	1 338467	2.400007	9.046181	2.538461	12 0.415356
	12			12	187	2.261545	1.846159	2.492315	1.476927	8.076947	0.461538	11 2.461513
22	26	12		104	445	1.015387	3.230779	3.923088	7.569254	15.73850	4.000015	19 -0.73852
				19	153	0.600001	2.307699	2.123083	1.153049	6.184634	0.730769	8 1.084596
			16	16	165	2.676931	1.384619	1.984621	0.830771	6.876944	0.615384	9.9 2.407671
	4			28	145	0.692309	0.507693	1.246157	2.953855	5.400016	1.076923	9 2.523060
				25	318	4.523090	5.815402	3.184625	0	13.52311	0.961538	12 -2.48465
				0	88	0	0	0	4.061550	4.061550	0	4 -0.06155
27	16	12	26	142	142					0	5.461538	6.5 1.038461
17	24	26	16	133	133						5.115384	5 -0.11538
21	20	20	26	105	105						4.038461	5 0.961538
26	24	23	26	110	110						4.230769	5 0.769230
25	26	24	17	151	151						5.807692	5 -0.80769
148	192	137	127	982	4372	35.72318	41.30781	47.58476	32.03086	156.6466	37.76924	205.2 10.78411

Throughout the life of the contract, the work was administered and monitored from the San Jose, Costa Rica office of TSC, and considerable technical work and report preparation also took place there. (The contract did not provide funds for the maintenance of an administrative office in Peru.) When the General Forester/Land Use Ecologist was present in Peru as a short term technical advisor, he also performed the duties of Team Leader/Coordinator for the group. Whenever he was absent, these duties were delegated, usually to one of the long term advisors.

One or more advisors were present at the duty station in Iscozacin continuously from early March 1988 through late July 1988 when, for lack of obligated funds, these services were curtailed. The General Forester in his dual capacity as Team Leader/Coordinator returned to Lima on September 18, 1988 for the purpose of closing down the field operation and transferring property to PRD/Palcazu but, for security-related reasons, was refused authorization to return to the duty station in the Palcazu Valley.

1.3 Relationship with AID and Other Contractors

A multi-faceted and non-hierarchical command chain involving AID, TSC, other AID contractors, and the Palcazu Valley Rural Development Project (PRD/Palcazu) and PEPP (Lima) greatly complicated what might otherwise have been a simple act of providing technical assistance under this contract. The largest number of specialist advisors as well as the greatest level of effort was provided by TSC. Another firm (RONCO Consulting Co.) as well as two individual direct-hire contractors were involved concurrently, yet no Field Coordinator or Chief-of-Party was provided for the group as a whole.

Seen in retrospect, the absence of a full-time field supervisor for all AID technical advisors appears to have weakened coordination within the group as well as leaving it without a high-level spokesperson capable of dealing effectively with the politically-sensitive directors and administrators of PEPP and PRD/Palcazu.

A more direct constraint on the TSC team's effort was its own lack of a full-time Chief-of-Party with the status and authority to deal forcefully with the Peruvian directors. This debility was exacerbated by the very nature of the AID mandate, i.e., that TSC advisors introduce radically-innovative, ecologically sustainable development models such as natural forest management and land use capability-based regional planning into a conventional, politically-motivated, jungle colonization project, a project, moreover, already well underway at the time of their arrival. Acting also to undermine efforts, particularly during the first two years, was the initial conviction of other AID advisors as well as PRD/Palcazu technicians that commercial agricultural development in this Valley was a realistic expectation, both ecologically and economically, and that such development would be fully sustainable while forestry, as proposed, would not be acceptable to the people there.

Generally speaking, however, within the structural constraints noted (and spelled out in more detail in some of the following sections of this report) the TSC team had a positive and effective working relationship both with other technical advisors to the project and with the Lima office of AID. This was particularly so up to mid-1986, when the AID Project Manager was changed and the new Peruvian government began to exercise its prerogatives in Project management. Following that date, the situation deteriorated progressively as AID withheld funding from PEPP in an (unsuccessful) attempt to force its compliance with project design and administration covenants established in the original Project Agreement.

1.4 Relationships with PEPP

In the four years between its founding in 1980 and 1984, the Proyecto Especial Pichis-Palcazu (PEPP) evolved into a many-layered bureaucratic hierarchy of exceptional complexity, obtuseness, and questionable fiscal probity. By 1984, PEPP had grown to comprise seven distinctive but geographically contiguous regional projects, amongst which the Palcazu Valley Rural Development Project (PRD/Palcazu) was only one. The Palcazu project had been chosen by AID for its development assistance without establishing any formal mechanism for relating its work there, either directly or indirectly, to the remaining six regional projects, although all were geographically contingent and directed and administered concurrently by PEPP/Lima. Given that these

⁴ (Along with APODESA, an organization, like PEPP under the jurisdiction of INADE, created to evaluate development opportunities and design development models for the High Jungle).

other projects were being funded and provided technical assistance by various other bi-lateral and international assistance agencies, and given that each agency had its own distinctive operational procedures and objectives, it is remarkable that no liaison or coordination existed, formally or otherwise, amongst any of them with respect to their goals and activities or to their relationships to PEPP. It does explain in part why PEPP had greater-than-usual power to manipulate the various donors while, concurrently, finding difficulty in managing its own affairs, especially finances.

The TSC team of advisors arrived in the Valley in early March 1984. At the time, the Project was rapidly expanding, personnel-wise, and the headquarters camp then under construction at Iscozacin had insufficient housing as well as no available office space, equipment, secretarial services, or transport within the Valley for the TSC advisors, all of which was to have been provided by the GOP under the Contract. This situation prevailed for more than a year while, with RCO permission, advisors designed and supervised their own privately-contracted construction of necessary housing facilities and pressured the PRD/Palcazu directors to provide minimal office space and a secretary for the Forestry Development Unit (FDU) as well as dugout canoes and motors for transport of the forestry technicians and their advisors within the Valley.

Concomitantly with the unavailability of the above-mentioned facilities and services, the advisors were confronted with an under-manned and under-equipped Forestry Unit. This unit, (through which their advisory services were to be channeled), had no office, no field transport, virtually no technical counterpart personnel or field workforce, and an acting director (at the time serving simultaneously as Chief of the Forest District of Iscozacin, a non-project post). This situation, overall, reflected the agricultural development priorities of the PEPP directors.

In the Fall of 1983, the PRD/Palcazu had initiated a program of land classification in the Valley for the purpose of titling and cadaster. The program was underwritten by an agreement between PEPP and the Agrarian Reform and Catastral Divisions of the Ministry of Agriculture in Lima and was staffed by personnel on loan from those two agencies. On the pretext that earlier land capability maps of the Valley⁵ had been drawn up at too-small scales, with inappropriate techniques, and failed to cover the total area of the Project, the Catastral Unit of the PRD/Palcazu was directed by PEPP to prepare a new land capability map as well as an actual land use map, both at 1:10,000 scale. This work had a blatantly political bias:

⁵ ONERN and JRB Reports, see Bibliography

its intention was to show that Valley lands were imminently agricultural in quality rather than of mostly forestry and protection quality, as had been determined previously but at smaller scale in the JRB-conducted AID Environmental Evaluation (1981). (Lands classified as of non-agricultural quality would not be eligible for titling in a program of traditional agricultural colonization.)

Protests made by the AID Regional Environmental Advisor in the Fall of 1983 with respect to the low technical quality and overt misuse of the official Peruvian land capability classification in this program had been officially disregarded by PEPP and discounted as unimportant at the time by the AID Project Manager. When TSC's land use ecology and land capability advisors arrived on the scene, the land titling and cadaster program had been underway for more than nine months and was well-entrenched.

In the absence of an overall Chief-of-Party for advisors, their own initial efforts to rectify the land use situation were effectively blocked by the titling program (working through the PEPP beaucroatic system) supported by the pro-agronomy and livestock attitudes of all PRD/Palcazu agronomists, including its Director and even the AID advisor in this field. This situation led to confrontations lasting more than a year between the TSC advisors, PEPP, the PRD/Palcazu directorship. Attempts at its resolution required the intervention of the AID Mission Director and the creation by the Ministry of the Presidency (through INADE) of a high-level official investigative commission. The commission's report, while ruling favorably on the position of the advisors (AID), was never effective in modifying the de facto situation due to the long time lapse involved, the conclusion of the biased map, and the hasty granting of titles based thereon prior to the elections leading to the change of the GOP government's administration in 1985.

The Garcia administration which followed Belaunde's in 1985 was never cognizant of this official report which recommended a return to earlier maps or total re-mapping of land capability in the valley and cessation of all titling underway on the basis of the defective PEPP-sponsored map. It had, furthermore, even less capacity than its predecessor to appreciate the ecological fragility of the Palcazu Valley, while its representatives in PEPP were equally motivated, politically, to promote agriculture rather than forestry as the basis for Valley development. With the change of project directors, PEPP embarked upon a program of full-scale titling of forest grade lands and the development of its program of "Chacras Integrales" (Integrated Farms), a program totally deaf to land use ecological considerations.

By the end of 1986, given PEPP's overt unwillingness to implement the continuous land use inventory program called for in the Project Agreement, it was clear that ecologically-based land use capability classification would not be acceptable to the GOP in the economic development of the Valley's natural resources. The prolonged struggle to implement this mandate, nevertheless, was both a source of disguised (but real) irritation to both parties and a psychological strain on the entire TSC technical staff.

1.5 Relationships with Palcazu Valley Residents

TSC advisors were able to establish a positive and productive relationship with valley residents from an early date in the program. This relationship was well-cemented prior to the arrival of the AID-provided anthropologist (through RONCO Consulting Co.), and particularly so as regards local leaders of the cattle-raising, German-Austrian-descended colonists and the native Amuesha Indians, the two most important social groups in the southern half of the valley.

Early attempts to introduce the natural forest management system included inventory and management planning on residual forest areas of selected colonists as well as with the Amuesha communities of Shiringamazu and Loma Linda. These early demonstrations set the stage for the eventual development of the first strip clearcuts and of the Yanesha Forestry Cooperative.

2.0 EVOLUTION OF THE PROGRAM

2.1 First year

Thirty-six total man-months including eleven specialties were applied to the project by the TSC team in the period between February 1, 1984 and January 31, 1985. The period was marked by great enthusiasm of the advisory team members, an enthusiasm and dedication to pursuit of projected goals which tended to offset the disguised antagonism and often overt obstructionism they encountered in Peruvian Project leadership and amongst the PRD-Palcazu's administrative and non-forestry technical staffs.

In the period February-April, long and short term advisors were formally engaged and, following RCO and GOP approvals and organizational meetings and briefings in TSC's San Jose headquarters, were mobilized to Lima and thence to the Duty Station at Iscozacín, Pasco, Peru. By June, six advisors were in the Valley and this level of effort was maintained through staff rotations fairly continuously through mid-December. The long term advisor in

natural forest management (R. Simeone) took up residence in Iscozacin in March and remained in the Valley fairly continuously until the termination of his contract in January 1987. Whenever the short term advisor in general forestry and land use ecology (J.Tosi) was away, Simeone acted as team leader and spokesman for the group.

Initially, the group worked in small, ad hoc parties or teams to reconnoiter the Valley, evaluating forests and land use, and visiting local communities both of colonists and of indigenous Amuesha, listening to their perspectives on development, discussing the AID-proposed program for forestry and land use, and identifying and establishing firm relations with the leaders and decision makers of each social unit. At numerous Amuesha community gatherings, they gave talks explaining the forestry alternative to cattle and shifting cultivation. In addition, the forest industrial advisor explored the Valley to locate and evaluate existing forest industries and evaluate the potential for small as well as large scale industrial development of its abundant wood resources. His contacts were primarily with long term colonists, owners and operators of the scattered, small milling and processing facilities.

In a parallel program, nearby regions and activities were evaluated in a series of team visits: for forestry to the geographically contiguous Oxapampa and Villarica regions as well as to the Pachitea and Von Humboldt projects of PEPP in all of which forestry programs were underway. These same areas were scrutinized separately by the wood industrial and forest products and marketing advisors who, in company with the general forester and the logging engineer, also made an extensive survey of wood industries and markets in the Huancayo, Aguaytia, Pucallpa, and Iquitos districts of Peru. Numerous special reports were prepared reporting on the findings of these visits. These provided a basis for informed group decisions on practical goals and operative guidelines for the forestry and land use programs developed by the advisory team prior to the end of the first year (see Informes del Ano 1984 , Nos. TSC-001 a TSC-043).

Specialized work in forestry undertaken this first year included forest inventory, draft animal logging, tropical dendrology, wood products marketing, and wood preservation. The wood industrial engineer began his design for a major wood industrial conversion facility for the valley. Much of this work proceeded without or with only partial counterpart participation and training due to the failure of the Project to adequately staff the Forestry Unit or to contract a senior professional forester with experience in tropical forests to be the regular chief for this unit. Considerable time was spent, in fact, in

Project leadership to rectify these deficiencies and, subsequently, in interviewing candidates for the many vacant posts.

In this first year, an indifferent, unresponsive, and not infrequently resistant Project leadership and administration acted to reduce advisor efficiency in counterpart training and pursuit of project objectives in general. Field work by counterparts during the first year was limited by alleged budgetary insufficiencies and such administrative obstacles as obtaining local transportation and field per diem for them on a timely basis, all attributable to the lack of a positive commitment to the forestry component of the project by its own director and administrative staff.⁶

A major objective of the development planned for the Palcazu Valley was to achieve maximum sustainable production from each ecologically-distinctive land unit therein based upon its scientifically determined long term land use capability. Because forestry -- or absolute protection -- were determined to be the most permanently efficient land use options for a large part of the valley land (environmental assessment: JRB Study, 1981); technical assistance in land use ecology and land capability classification had been assigned to the forestry advisory team of TSC. During the first year, specialists in these closely related fields were active in the valley, evaluating the on-going program of land classification and mapping of the Cadaster and Land Titling Unit of the PRD/Palcazu. As mentioned heretofore, their observations indicated that this program was technically unsound and, indeed, fraudulent, with underlying political rather than development objectives.

⁶ The foregoing is understandable because, in the first three years of Project existence, and almost two years since the signing of the Project Agreement with the GOP, there had been no attempt on the part of AID to make sure that the Peruvian Project leadership understood the philosophy, ecological rationale, and natural resources management goals of the project as set forth in the Project Paper. Neither that document nor its predecessor, the JRB Environmental Assessment, had even been translated into Spanish nor circulated amongst Project technicians. Inasmuch as almost two years elapsed between the signing of the PA and the contracting of the forestry and land use technical assistance team, it is understandable why the Project simply went ahead on the basis of its traditional understanding of what constituted a High Selva colonization and development project.

The problem encountered was taken to the Director of PEPP by AID officials in August 1984 along with a recommendation that the Continuous Land Use Inventory Program described in the Project Paper be executed. At the close of the year, however, no action had been taken by PEPP on either of these related issues.

2.2 Second year

Steps taken to deal with the adverse situation described above bore fruit in the second, a year of comparative accomplishment and the first of the two most fruitful years of the entire TSC participation in the Project. A total of 41.5 man-months of technical assistance were provided by TSC during this year, with all eleven specialties represented in the effort. By the end of this year (January 31, 1986):

(1) the Forestry Unit (FDU) of PRD/Palcazu was almost fully staffed with reasonably competent and motivated national forestry technicians, including a Unit Chief of high calibre;

(2) the PRD/Palcazu provided opportune logistical support and the equipment requested by the FDU in 1984, including a portable sawmill to be installed in the Amuesha community of Shiringamazu;

(3) pressured by the AID Mission, the Peruvian government represented by INADE appointed a formal commission to investigate on-going land classification and titling procedures of PEPP and PRD/Palcazu in the valley. This commission, after examining the evidence, presented a report verifying the irregularities alleged to exist by TSC advisors and INADE ruled: (a) a halt to all land titling based on the PRD/Palcazu land capability map and (b) re-classification of lands employing objective and legal criteria;

(4) two trial and demonstration strip clearcuts and an arboretum were established on privately owned forest lands close to the Iscozacin project headquarters;

(5) these demonstration strips were utilized for intensive on-the-job training of both national counterpart technicians and natives, public education through extension, wood preservation trials (Pres-Cap), and economic feasibility analyses. Draft animal (oxen) logging trials and training were begun on the second and larger of the two strips;

(6) studies were completed on potential markets in Peru for the output of a variety of wood products from common valley tree species (as determined by dendrological investigations and forest inventories);

(7) plans were scrapped for the very expensive industrial wood processing plant recommended in the Project Paper and designed by the wood industrial engineer in the first year and replaced by a plan for a more modest enterprise to be set up in Shiringamazu as a donation of the Project to forestry development by the native Amuesha communities;

2.3 Third year

Project activities and achievements reached a zenith in the first half of this third year, declining thereafter. TSC advisors applied 47.5 man-months of technical assistance, had the added support of a senior specialist in anthropology, while an almost full complement of national counterpart technicians in the FDU of PRD/Palcazu worked with them. Among the joint accomplishments were:

(1) Negotiations leading up to and formal organization of the Yanesha Forestry Cooperative;

(2) An agreement between the native Amuesha community (FECONAYA) in representation of the Yanesha Forestry Cooperative and the Project (PRD/Palcazu) for the provision to the former of necessary equipment, supplies, salaries, and technical assistance for the development of a commercial sustained yield forest management and wood conversion enterprise on community-owned forestry lands;

(3) An agreement by the Amuesha communities to participate in the cooperative and to set aside permanently agreed areas of community lands exclusively for sustained yield production forestry and adherence to forestry models and techniques proposed and taught by the Project and its advisors;

(4) Establishment of a forest management and woodlands operations division in the CFY and training of native Amuesha in and development of a management plan for lands belonging to the Shiringamazu community, including topographic surveying, land capability classification and mapping, tree identification and forest inventory, strip-clearcut layout, road and trail survey and layout, initial road construction, and selection and training of work oxen;

(5) Identification and marking of all trees in the arboretum, covering some 1200 native species; training of national counterparts and native tree identifiers in tropical dendrology; establishment of an herbarium for tree species specimens in the new forestry building of the PRD/Palcazu;

(6) Full development of the draft animal program, including training of national counterparts and native cooperative members in selection, care, training, and use of draft animals (oxen) and in draft animal logging techniques. A Costa Rican style oxcart was built by the Project and its use was demonstrated widely to both natives and colonists in the Valley.

(7) Initial steps in the establishment of an integrated wood conversion facility at Km.41 of the Carretera Marginal on lands of the Shiringamazu Amuesha community, including delivery and installation of a Mighty Mite portable sawmill, design, fabrication, and delivery of 44 Pres-Caps and ancillary equipment for the pressure treatment of posts and poles, site preparation and beginning construction of wood preservation, sawmill, and administration buildings for the Yanesha Forestry Cooperative (CFY); construction and gravelling of first access road into Shiringamazu managed forest, logyard, lumber drying area, and pole depository at the plant site. A portable charcoal kiln was acquired and another model designed, the first being tested on the biomass wastes generated on the two demonstration strips at Iscozacin. CFY personnel were given hands-on training in construction and operation of this plant and in strip clearcut techniques.

(8) Overall plant design-engineering and equipment procurement requirements were completed and costed for expanded production in the wood conversion facility (projected to be completed at the end of five years) on the presumption that AID would extend the Project support for three-years beyond the original PACD.

(9) A carpentry and manual training facility was designed and constructed at the field station in Iscozacin.

Much of the progress during the latter part of this third year was contingent on direct advisor leadership and personal labor and on logistical carryover from the preceding three semesters rather than on new Project inputs: by October 1986, mass resignations of experienced personnel both in PEPP and PRD/Palcazu began to affect the program negatively, while AID (with a new Project Manager) simultaneously took a harder line with respect to

loan fund disbursements to the Project, thereby exacerbating problems of finance for the budding Cooperative as well as blocking replacement of the experienced but politically displaced FDU counterpart personnel.

Actually, by August of 1986, political rather than technical and administrative competence became paramount criteria for PEPP selection of all Project personnel, reaching up to director levels in both the PRD/Palcazu and Forestry Development Unit. By the end of January 1987, work on the CFY wood processing plant had come to a virtual standstill for lack of materials, supplies, and salaries for the Coop's labor force while FDU technical services had been largely curtailed due to the re-assignment of almost all counterpart forestry personnel in the FDU to politically oriented activities elsewhere in the Valley.

This year was notable also for Project concentration on execution of the new PEPP Director's personal program for "Chacras Integrales" (Integrated Farms), a politically-motivated, popularist program lacking clear economic focus and possessing no ecological content. Forestry was not an element of importance in this program, directed primarily to recent colonizers in the valley. Its immediate consequence was to suppress all interest in and action towards implementation of the continuous land use inventory program and the INADE directive of 1985 to remap land capability in the Valley. Efforts of the land use advisors to bring actual land use into harmony with land capability were totally frustrated by both Project leadership and the absence of significant further AID influence over PEPP.

To compensate, insofar as possible, for this intentional re-orientation of Project goals, the land use advisors undertook to provide a simple, practical, easily-understood handbook covering land capability and its application to specific Valley conditions. Following field studies to establish firm bases, an illustrated booklet was prepared, printed, and its contents explained to Project social and extension technicians in a series of short intensive courses. Large numbers of this booklet were printed (in 1987) in order to permit individual farmers to obtain copies.

Finally, this year saw preoccupation with and planning for a possible three-year extension of the Project (i.e., financed by AID). The original AID Project Manager had foreseen this need and before his departure, prepared the

7 Bolaños, Rafael, 1987. Manual de orientación para determinar la capacidad de uso de la tierra en las chacras del Palcazu. PEPP-CCT-USAID. Programa de Desarrollo Rural Palcazu, Iscozacin-Pasco-Peru.

ground for such an eventuality. His replacement, while seemingly favoring said extension, called for further evaluations and outside expert opinions. Difficulties experienced by AID at this time regarding PRD/Palcazu accounting in past use of loan funds created a climate of further indecision in this respect, all of which made the advisors work and planning for the development of the forestry cooperative more difficult and frustrating.

2.4 Fourth year

The original PACD for this Project was September 30, 1987, or only eight months from the beginning of the fourth year of TSC's contract with AID (which extended formally to January 31, 1988). Between February and the original PACD, a total of 694 man-days (32.1 man-months) of technical assistance were provided covering ten specialties. In May of this year, the level-of-effort and budget had been increased and an additional advisor (in forest business administration) added to the team. In August 1987, the PA was hastily extended to June 30, 1988 (nine months) but only in January 1988 was the AID/TSC contract amended to provide additional obligated funds and 47 man-months (6-day week at duty station) more of TA. This last included the addition of one expatriate and five Peruvian short term advisors, all to assist with the development and safe operation of the wood conversion facility nearing completion at Shiringamazu.

For these reasons, plus AID's insistence on U.S. standards of environmental and plant safeguards with respect to the use of CCA wood preservatives (a toxic substance), TSC operated without additional funding and with no additional authorized man-power between September 1987 and mid-January 1988 on the simple verbal promise (by the AID Project Manager) that the pending contract amendment was assured. In this period, moreover, the PRD/Palcazu provided little technical, financial, or logistical support for the CFY. Forest road construction and leveling and gravelling of the ~~Pres-Cap plant site promised from the Highway~~ Maintenance Pool ran behind schedule and construction materials, machinery for the plant, and contractor's and native workers salaries could not be paid. Hence construction and equipment installation ran at a snail's pace. (PEPP alleged that it could not meet these costs for lack of AID loan fund disbursements).

Under these circumstances, TSC was obliged to hold down advisor participation in the latter part of the year. In October and early November 1987, only one advisor remained on site, overseeing all aspects of plant

construction as well as forest road engineering.⁸ In the month preceding the end-of-year holidays, the AID Project Manager pressured TSC to have the wood preservation system run on a test-and-personnel-training basis previous to a re-scheduled early 1988 start-up of commercial production. (The Coop's inability to process posts and poles was holding up commercial strip clearcutting on the managed forest, originally scheduled for 1987.) Several advisors returned to the Valley at this time but full trials could not be run: essential equipment for the plant being manufactured in Lima had not been paid for by PEPP and had not been delivered in a timely fashion.

2.5 Fifth year

In late January 1988, with an amended contract finally in place, TSC contracted and fielded a full team for support of activities at the wood conversion plant in Shiringamazu but was provided insufficient obligated funds to implement the complimentary forest management aspects of the Cooperative's operations. (Obligated funds were, at this time, roughly 100,000 dollars short of the amended contract limit.) Short term advisors in forest management, tropical forest research (dendrology), draft animal logging, logging and road engineering, general forestry, and land capability classification either did not receive AID clearance to return to the Project for projected activities or had their time allowances severely reduced.

In May 1988, the PACD was extended again, to September 30, 1988, and about 50,000 additional dollars were obligated in a final contract amendment, but this added funding was totally consumed in extending the level-of-effort of advisors already at the Shiringamazu plant. For lack of sufficient funds, however, even these advisors were terminated in late July 1988. In a final short visit, intended among other things to close down TSC operations in the Valley and to turn over TSC controlled equipment and housing in Iscozacin to the PRD/Palcazu (as required under the contract), AID denied authorization to the general forester and team leader to visit the Project for security reasons. Consequently, a report on the *de facto* situation as regards the Cooperative and its operations at the PACD cannot be rendered in this report.

⁸ The long term advisor in wood industrial engineering who designed this plant (M. Kroner) supervised construction and equipping of same until July 1987, at which time his allotted time under the contract terminated. He was replaced by the short term advisor in road engineering (Wm. Aspinall) who oversaw final stages of this activity.

3.0 SUMMARY OF ACHIEVEMENTS AND SETBACKS

3.1 Research Aspects

Formal research activities were not, categorically, included by AID in the original terms of the contract with TSC. Yet by its very nature, as a totally innovative and professionally controversial approach to the development of ecologically fragile and mostly virgin lands in the upper Amazon region, the project was experimental in nature, a venture in applied research. In the original sustained yield forest management proposal prepared by TSC for AID (Tosi, 1982), a number of research questions were broached whilst others were implied. These related to the ecological and socio-economic feasibility of the harvesting and wood processing systems to be applied and to the potential of the integrated system as an socially and economically viable alternative development model for tropical moist and wet forested regions worldwide.

Although "research" was belatedly introduced into the project with the inclusion of a short term tropical research advisor in 1987, the advisory team had always been aware of and made provision for the recording of experiences and field observations which would or could be used to test the viability of the systems they introduced. Their on-going experience and observations were fully described in a lengthy series of specialist reports and technical bulletins distributed both within and outside the Project area. (These materials are listed in Appendix A of this report). In addition, early or preliminary findings and experiences on the total methodology were presented in national and international conferences on a number of occasions and several papers have been published or accepted for publication in technical journals.

It should be emphasized, however, that most experimental aspects of this project should be viewed, like its development objectives, as necessarily long-term in nature. Recognition of this fact in conjunction with the well-known short term context of AID assistance projects obviously discouraged any inclusion, by the design team, of serious research or even full testing of the development model in the Project Paper. The strip-clearcut method of timber harvesting and natural forest auto-regeneration requires that permanent study plots be maintained and periodically remeasured for at least a full rotation (30-40 years). The economics of a vertically-integrated, cooperatively owned and operated forestry and wood products business can only be tested once the plant is established and in full operation for a considerable number of years. AID projects are limited normally to five years.

AID made no provision for long-term follow-up in this project and should not expect that conclusions of great reliability can be wrung from the short-term experience. Given the abrupt and unexpected foreclosure of all work in the Palcazu Valley, much basic data could not even be retrieved from files maintained in Project headquarters in Iscozacín, while work in progress was preemptorily cut off. It is currently doubtful that the demonstration strips and arboretum will be maintained: the lands involved are privately-owned and the Project never acceded to advisor's recommendations that they be acquired permanently.

3.2 Training of National Technical Personnel

Technical assistance to the Project by TSC advisors, while oriented to the introduction and implementation of ecologically sound land utilization, the sustained yield system of natural forest management, and integrated commercial wood utilization, was to achieve these goals through the training of national technicians (of the Project) in the philosophies and techniques associated therewith. The Forestry Development Unit of the PRD/Palcazu was to be the instrument for the transfer of this technology to valley residents. Given the inconstancy of national counterpart employment due to political and administrative distortions in PEPP, this training ran an uneven and not wholly satisfactory course. For instance, no advisor had the same counterpart for more than two years time and the average duration was much less due to repeated resignations and hirings. Four of the original advisors never had a counterpart at all (land use ecology, land capability classification, wood products and marketing, and wood preservation). The long term advisor in wood industrial engineering had a counterpart only briefly and not at the most critical time. The dendrology advisor's first counterpart applied for and received a grant for study abroad lasting for almost all the time she was employed by the Project.

Advisors reviewed applicants for counterpart positions only in the first two years (Belaunde Administration period) and most well-trained and experienced counterparts resigned or were not re-hired (an annual administrative prerogative) by the Garcia administration after 1986. This resulted in the need to begin training anew with raw and unselected recruits when the project was well advanced and required already trained and experienced technicians to direct the work. Furthermore, only one of the five new short-term advisors who came on board in 1988 was assigned a national counterpart technician. Although the FDU

hired a large contingent of recently-graduated foresters at this time, most were assigned to politically "more important" work by the Project leadership. AID protests were disregarded in this matter.

Many of the national technicians assigned to advisors early in the contract period were highly motivated and took enthusiastically to the work, benefitting substantially from the training as well as from direct professional association with TSC advisors. A few of the best went on to graduate school, such that the training and appreciation of the new technologies should have an influence on Peruvian forestry in the longer term.

3.3 Training of Target Populations

More than any other population group, the native Amuesha seem to have benefited from the training efforts of advisors. Almost from the outset, the native population was strongly motivated to learn the sustained yield forest management system they espoused at weekly Amuesha communal assemblies. This motivation stemmed in part from native recognition of the inherent logic of the system for communal development in their wet, primary forest environment and mixed subsistence-farming-forest hunter socio-economic cultural context. It appears to have been fortified by those aspects of their culture which emphasize group-consensus in decision-making and individual service to the community as the primary means to achieving prestige and power in the society (Moore,1987).

It didn't take long for the more perceptive leaders of the community to realize that the TSC forestry advisors were offering an economically reasonable and more culturally-acceptable alternative to the commercial crop and cattle systems being promoted by the Project and to their existing paid-labor serfdom on the large colono cattle ranches. This sparked a total group identification with and acceptance of forestry as the Amuesha economic development goal, one to which everyone could and did adhere and contribute. This identification was played upon by TSC forestry and land use advisors, as well as by the AID advisor in cultural anthropology and a few interested Project extensionists and sociologists. As a mass movement, it culminated in the creation by the Amuesha of their own Forestry Cooperative.

Training began in 1985 with the employment of a considerable number of younger men from several Amuesha communities as salaried "laborer-trainees" of the FDU. In this capacity, they assisted with the creation of the two trial-and-demonstration strip clear-cuts in the Paulino Yantas-owned primary forest near Iscozacin. The work programs were diversified, including both simple theoretical explanations and extensive on-the-job practice in tree identification, felling and bucking, wood scaling, chain sawing, on-site lumber-milling with makeshift portable equipment, forest road construction, wood hauling, charcoal making, and preservation of posts and poles with Pres-Caps. This same year an intensive short-course in chain saws was held. The course, completed satisfactorily by some 25 men, mostly Amuesha, covered chainsaw use and safety, maintenance, and repair.

More specialized training was provided to smaller, selected groups. One of these focused on draft animal (oxen) logging and covered the selection, training, housing, feeding, and health aspects of the work animals,

animal logging, and construction and use of oxcarts. Each community today counts one or more members who have mastered this technology and who are in charge of the communities' oxen.

Land capability and land use mapping and planning were similarly taught. Inasmuch as the Project had not bothered to map land capability or actual land use on the Amuesha communally-held properties, a first step towards sustained-yield forest management was to achieve community consensus on the area and location of communal lands to be reserved exclusively to forest production over the long term. Each community was asked to name a group of younger men to participate in land use planning to whom the techniques would be taught. The maps they drew up after training by the advisors were then taken to the community in assembly for final use-allocation decisions. Having made their maps and decisions, lands reserved to forestry are fully respected by all community members.

A third and very important specialized field of training for the Amuesha was in forest management itself. This involved the creation of a "forest management division" in the incipient Yanesha Forestry Cooperative. The brightest and most educated younger men were assigned to this division where they were given both theoretical and on-the-job training in surveying, tree identification, forest inventory, cartography, and forest management techniques. At the end of 1987, the native staff of the forest management section of the YFC was doing work normally requiring graduate foresters. By early 1987, when the long term advisor in forest management terminated his assignment, they were able to do this work without further advisor assistance or supervision in the woodlands with which they were familiar. Personnel of this same section were subsequently given advanced training in the strip-clearcut harvest and extraction technology and were conducting this work without supervision of advisors when plant startup began in early 1988. High motivation, acute forest observational skills, plus inherent native intelligence were noteworthy among the Amuesha, most of whom had completed only elementary school.

3.4 Economic and Social Development

The environmental assessment prepared for AID in 1981 by JRB concluded that forest-based industry afforded the only opportunity for sustainable economic development on at least 50 percent of all lands in the Palcazu Valley. This turned out to be an overly-optimistic appraisal: the extremity of rainfall and edaphic conditions were significantly under-estimated in that study. Observations through the period 1984-1988 confirmed the land use ecologist's worst case scenario: the best alluvial lands

in the Valley were visibly deteriorating and their productivity had reached an economically marginal state after no more than 20 years of extensive grazing; the colonos with cattle ranches were being forced to convert more and more land -- taken from originally less-productive but forested uplands -- to grazing use simply to maintain existing levels of beef production. These newly opened lands were degrading to useless condition in two-to-four years after conversion.

Furthermore, the Project's agricultural development projects -- Black Belly sheep, coffee, cacao, tropical fruit crops, swine, and basic grains were demonstrated to require heavy and uneconomic feed and fertilizer subsidies simply to survive. Most simply were outright failures when evaluated objectively. Native populations by long experience and colonos learning from them customarily utilized and would not abandon their traditional system of forest felling, burning, and shifting cultivation on the better soils. Even with this system, only a few family subsistence crops such as upland rice and manioc could be grown successfully. Sustained commercial production was out of the question. Only forestry seemed to offer any possibility for sustainable commercial production from most of the land but, for a variety of reasons, including the lack of a road to external markets, forestry had never been attempted.

When the forestry and land use advisors arrived on the scene with a proposal to develop sustained-yield wood production from the abundant and rich virgin tropical hardwood forest resource base, little of the original natural forest remained on lands belonging to the colonos. Conversely, nearly all the forest was intact on the lands titled to the 12 native communities in the southern half of the valley. The only opportunity for application of the sustained-yield forestry system described in the Project Paper was, obviously, with the native Amuesha. As noted above, a program so-oriented was conceptualized, drawn up, and initiated in the first work year.

Among requirements seen for a successful forestry-based economic system was low cost access to local and national markets for wood products. This requirement would be met in mid-1985 with the completion of the branch line of the Marginal Highway from Villarica into the valley. Other requirements were (a) large and continuous tracts of accessible, well-stocked, primary natural forest, (b) a harvesting system which would permit rapid natural regeneration of the primary-type forest on a short, regularized cutting cycle or rotation, (c) a wood processing center, located close to or within the forest being managed, capable of converting all biomass, irrespective of tree species and sizes, into saleable wood products, (d) an

enterprise organization exclusively owning and operating the entire, vertically-integrated economic system, from woodlands to marketing, thus assuring long-term stewardship of the forest resource.

Early forest inventories indicated that requirement "a" would be met on several of the native community holdings, especially Shiringamazu, Alto Iscozacin, 7 de Junio, and Sta. Rosa de Chuchurras. The total area of production forestry class lands in primary condition in the twelve Amuesha communities was determined to be around 8,500 hectares⁹. The new highway was to pass directly through the best forest production lands of the Shiringamazu community, a location roughly mid-way between the other community lands to the north and south. A plant site at this location would, clearly, serve all communities in the longer term. Moreover, Shiringamazu was the first community with interest in the forestry project and had offered land for a plant site at Km. 41, some 16 kilometers south of Iscozacin, fronting on both sides of the new highway. This site was accepted for the first wood conversion facility and adjacent forest lands were set aside at this time for the first managed forestland unit to supply the plant with raw material.

Following completion of the modified plant design in 1986, the economics of the operation were worked out on a hypothetical basis. Calculations were based upon advisor studies of product demand and markets within Peru, designed mill capacity at three stages of development, forest inventories of wood output by species and sizes, allowable annual cut in the managed forest under a 40 year rotation, and estimated future market prices for each product line (sawn and dressed lumber, preserved posts and poles, and charcoal). An average net income equivalent to U.S.\$29,441 per hectare harvested and equal to \$736 per hectare per year of productive forest under management given a forty year rotation was predicted for the operation when its third stage of modular plant development had been completed and was fully and efficiently operational¹⁰. This (conservative) figure supercedes by more than 1500 percent, actual net income to cattle ranching on this same quality of land.

⁹ Simeone, R., 1987. "Land use planning and forestry-based economy: the case of the Amuesha Forestry Cooperative". Paper presented at the American Anthropological Association Conference- Chicago, Illinois. Nov. 18-22, 1987.

¹⁰ Simeone, R., Aspinall, Wm., Krones, M. and H. Greub. 1986. Propuesta para la ampliacion del Centro de Transformacion Integral de Productos Forestales en el Valle del Palcazu. Informe TSC-083-C. San Jose, Costa Rica.

The Yanasha Forestry Cooperative, established formally in 1986, was to be the exclusive owner, operator, and beneficiary of this vertically-integrated wood production system. Delays (described heretofore) incurred in completion of the physical plant, particularly the Pres-Cap pole and post preservation unit, held up full commercial start-up of the first stage of operations (limited undressed sawnwood production, 22 Pres-Caps post and pole output, charcoaling of sawnwood residues) until almost March of 1988. Other problems, including unreasonable delays in procurement, delivery and Peruvian Customs release of heavy machinery and equipment for the plant, and presumed robbery of some of this equipment in or enroute to the Project headquarters, wreaked havoc with schedules for all phases and aspects of commercial operations in Shiringamazu while simultaneously reducing the effectiveness of the costly advisory services being provided by TSC and other AID-contracted advisors.

Although the sawmilling operations were initiated in mid-1986, these were devoted largely to training of personnel and to production of lumber used in the construction of the cooperative's plant and administrative buildings. Logs for milling were salvaged from the highway right-of-way and from the burned-over fields of native farmers. A contract for sawn lumber was made and completed with PEPP's highway construction unit for scaffolding and forms on bridges, and some wood was custom-sawn for individual Amuesha from their own logs, but the mill did not and could not perform integrally as projected in this period. Strip-clearcuts planned for 1987 under the management plan were deferred to 1988 due to the unfinished and inoperable state of the Pres-Cap wood preservation unit as well as for lack of log-hauling equipment ordered in 1985 for procurement by AID in the U.S. When this equipment finally arrived, it sat in the Customs warehouse in Callao for months awaiting Project payment of storage charges. Attempts to substitute second hand hauling equipment as a stop-gap measure were frustrated by a totally uncooperative PRD/Palcazu administration.

Regular production at the conversion facility began in late February 1988. This start-up operation went slowly inasmuch as it was intended to test the equipment and to train the native operators. At this time, a charcoaling operation was initiated using sawmill wastes, and some eight of the smaller-sized Pres-Caps were put into operation to produce treated posts and small poles. Wood supply came from the first of two strips programmed for the first year's harvest, but large sawlog-sized trees could not be harvested on this strip for sawmill processing because the large pole-sized trees which precede them in the cutting sequence could not be processed in the Pres-Cap facility, the installations of

transported to the mill on a borrowed flat-bed truck in lieu of the equipment procured for this purpose by AID. This situation persisted up to the time of the last advisor's departure from Shiringamazu in mid-July, 1988.

In summary, the economic and social goals of the Project, through the Yanasha Forestry Cooperative, had not been reached when the TSC contract finally terminated at the end of September 1989. A planned two-year extension of support to this cooperative through the PEPP, given appropriate steps to neutralize the politically-motivated obstructionism of AID assistance by the PRD/Palcazu, might have permitted the Cooperative to achieve a reasonably secure financial and technological operation of the projected Stage One of their business¹¹.

To everyone's consternation, however, the entire operation in the Palcazu Valley was aborted by AID in late September 1988. This was due to alleged unacceptably hazardous work conditions consequent on rumored guerrilla activity in the area. The withdrawal of all advisory personnel was so abrupt, unanticipated,¹² and total that not even essential current data and records¹² could be salvaged for outside analysis.

In this case, then, five years of difficult, dedicated, and costly efforts to demonstrate the economic and social feasibility of this alternative tropical wet forest economic and social development model was largely annulled. It is extremely doubtful that the Cooperative can long survive without the expected continuation of technical assistance and logistical support in these formative years. Perhaps more significantly to the U.S. image and reputation abroad, a major commitment to a large and influential native Amazonian minority group was unilaterally broken. TSC doubts that this will be soon forgotten, or forgiven, by the Amuesha and other Amazonian indigenous groups.

3.5 Ecological Sustainability of Development Model

The forestry development model's potential for sustainability appears to be considerably greater than its socio-political potential in the ferment of cultural cross currents of present day Peru. Technically speaking,

¹¹ Op.cit.

¹² The secrecy requirements of AID for the withdrawal operation precluded any removal of TSC files or equipment from Iscozacin, copying of computer disks with arboretum, dendrological, and inventory data from the FDU database, or abstracting from the Cooperative's accounts and administrative files on operational costs, sales, and the

the two trial strip clear-cuts at Iscozacin, while lacking necessary follow-up measurements over a full forest rotation, suggest early on that this method promotes outstanding natural regeneration of hundreds of native tree species at no cost for initial establishment, that the use of draft animals is both feasible for strip harvesting and leaves the forest soil in an essentially unaltered or originally productive state, and that all wood can be removed economically and (presumably) marketed given appropriate, integrated processing. The first of these assertions is fully documented in the summary paper on natural regeneration of trees on these two demonstration strips¹³. Other points are documented in reports by Cordero, Aspinall, Simeone, and Greub (see Bibliography).

4.0 RECOMMENDATIONS

TSC recommends the following based upon the preceding summary:

1/ Legal transfer, from PEPP to the Yanasha Forestry Cooperative, of title to all machinery, tools, and other hardware, including the secondary road building and log transport equipment (originally intended for the EDU but turned over to the Road Maintenance Unit of the PRD/Palcazu), both that now on-site in Shiringamazu and that in-transit or ordered by AID for the Project through the PRD/Palcazu.

2/ Arrangements with a local beneficial organization for indirect subsidy by AID of an effort to directly assist the Yanasha Forestry Cooperative, both technologically and with working capital, over at least a five year period, following the general plan proposed by the TSC advisors for this cooperative business venture.

3/ An effort by AID through PEPP to salvage TSC and CFY records in files and on computer disks at Project headquarters in Iscozacin.

4/ Further analyses of field data and the preparation of technical and scientific resumes and summaries as part of the proposed two-year extension of the project to be financed by AID. This would include the editing and compilation of a comprehensive "how-to do-it" manual, in Spanish and English, from technical documents and reports generated by the forestry and land use advisors over the past five years. This manual would be published as a guide to application of the methodology both in Peru and elsewhere in the American wet tropical region.

¹³ See: Hartshorn, G. 1988. Natural regeneration of trees on the
ion

5/ An effort through an intermediary group, perhaps the Forestry Department of one of the Peruvian universities, to acquire a long term lease on (or buy) the lands of Paulino Yantas in Iscozacin which contain the arboretum and two trial-and-demonstration clearcuts, and to conduct long-term follow-up research thereon by professors and/or students (i.e., continue to monitor growth and regeneration on the strips and study the dendrology, phenology, fruiting habits, and wood characteristics of the individual tree species in the arboretum).

5/ Encourage researchers from Peruvian national institutions, through the two-year follow-up program, to monitor and report upon all future developments, positive or negative, with respect to the Yanasha Forestry Cooperative as a social, economic, and ecological (forest management) experience in development.

5.0 APPENDICES

5.1 Technical Reports by TSC Advisors, 1984-88

Aspajo V., M. Informe del asesor en carpinteria. (Unnumbered TSC field report; VI-88).

Aspinall, Wm. Bolaños, R., Cordero, Wm., y R. Simeone. Reconocimiento de la Carretera Marginal desde Nueva Aldea hasta Puerto Herrera. (TSC-012-C;4-VIII-84).

Aspinall, Wm., Cordero, Wm., Kronos, M., y R. Simeone. Plan de trabajo; agosto 1984-diciembre 1985, asesoramiento del CCT. (TSC-018-C;22-VIII-84).

Aspinall, Wm. Inventario forestal Valle Palcazú: Shiringamazú-Pto. Herrera-Eje de la Carretera Marginal. (TSC-021-C;20-IX-84).

Aspinall, Wm. 1984. Informe de campo: asseraderos de Huancayo, Aguaytia, Pucallpa, e Iquitos. (TSC-022-C).

Aspinall, Wm. Hojas de inventario: regeneración y morfología. (TSC-031-C;XII-84).

Aspinall, Wm. Uso de la tabla de pendientes. (TSC-032-C;XII-84).

Aspinall, Wm. Informe de inventario y aprovechamientos forestal. (TSC-033-C;XII-84).

Aspinall, Wm. Informe de viaje; Ciudad Constitución.

- Aspinall, Wm. Informe de viaje: Fundo Roca Lux, Alto Iscozacin. (TSC-052-C;VII-85).
- Aspinall, Wm. Informe de viaje: Mashuhazo. (TSC-055-C; VII-85).
- Aspinall, Wm. Informe sobre la segunda visita al Proyecto Especial Pichis-Palcazú como especialista en inventarios forestales. (TSC-056-C;VII-85).
- Aspinall, Wm. Informe sobre la segunda visita al PEPP como especialista en extracción y caminos forestales. (TSC-074-C; XI-85).
- Aspinall, Wm. Informe sobre la tercera visita al PEPP como especialista en extracción y caminos forestales. (TSC-077-C; VI-86).
- Aspinall, Wm. Informe sobre la tercera visita al PEPP como especialista en inventario forestal. (TSC-078-C;VI-86).
- Aspinall, W, Greub, H., Kronen, M and R. Simeone. Plan para la ampliación del Centro de Transformación Integral de Productos Forestales en el Valle del Palcazú. (TSC-083-C; 17-VI-86).
- Aspinall, Wm. Guía: drenajes para caminos de la zona Valle Palcazú. (TSC-091-C; VIII-86).
- Aspinall, Wm. La faja de corta en un rodal productivo (folleto). (TSC-092-C; IX-86).
- Aspinall, Wm. Informe sobre la cuarta visita al PEPP como especialista en inventario forestal. (TSC-093-C; VIII-86).
- Aspinall, Wm. Informe sobre la cuarta visita al PEPP como especialista en extracción y caminos forestales. (TSC-094-C; IX-86).
- Aspinall, Wm. Hoja del campo: Inventario. (TSC-097-C; VIII-86).
- Aspinall, Wm. Informe de la quinta visita al PEPP como especialista en inventario forestal. (TSC-102-C;XI-86).
- Aspinall, Wm. Informe trimestral; 15 febrero al 15 de mayo. (TSC-113-C;VI-87).
- Aspinall, Wm. Informe de avances del 15 de mayo al 30 de octubre 1987. (TSC-129-C; 22-XI-87).

- Aspinall, Wm. Quinto informe del especialista en extracción y caminos forestales. (TSC-130-C; XII-87).
- Aspinall, Wm. Trabajo en la planta Pres-Cap. (TSC-131-C; 22 -XI-87).
- Aspinall, Wm. Informe sobre la sexta visita del especialista en extracción y caminos forestales. (TSC-01-88-CF; V-88).
- Aspinall, Wm. Informe final sobre actividades de inventario forestal. (TSC-135-C; 87).
- Bolaños, R. Visita a la C.N. 7 de junio con grupo de Catastro. (CCT-027-C; 01-07-84).
- Bolaños, R. Informe de labores del asesor en capacidad de uso de la tierra; segundo período. (TSC-061-C; X-85).
- Bolaños, R. Informe de labores del asesor en capacidad de uso de la tierra; tercer período. (TSC-086-C; VI-86).
- Bolaños, R. Informe de labores del asesor en capacidad de uso de la tierra; cuarto período. (TSC-101-C; IX-86).
- Bolaños, R. Informe de labores del asesor en capacidad de uso de la tierra; quinto período. (TSC-112-C; V-87).
- Bolaños, R. Manual Técnico: Manual de orientación para determinar la capacidad de uso de la tierra en las chacras del Palcazú. (TSC-119-C; VI-87).
- Bolaños, R. Informe de labores del asesor en capacidad de uso de la tierra; sexto período. (TSC-122-C; IX-87).
- Bolaños, R. Informe de la asesoría en inventario continuo de uso de la tierra; séptimo período. (IV-88).
- Cordero, Wm. Cuidados básicos que se deben dar a los bueyes. (TSC-013-C; VIII-84).
- Cordero, Wm. Entrenamiento de bueyes par extracción forestal. (TSC-015-C; VIII-84).
- Cordero, Wm. y Wm. Aspinall. Informe sobre gira de campo a la zona de Villarica y Oxapampa. (TSC-016-C; VIII-84).
- Cordero, Wm. Programa: Uso de Bueyes en Extracción Forestal. (TSC-019-C; VIII-84).
- Cordero, Wm. Informe sobre la primera visita al Proyecto Palcazú como Especialista en Animales de Tiro: "Directrices para la extracción forestal con bueyes": (TSC-020-C; 20-IX-84).

- Cordero, Wm. Informe sobre la elaboración de los planos de la Carreta para Bueyes. (TSC-048-C;V-85).
- Cordero, Wm. Informe sobre la segunda visita al Proyecto Palcazú como especialista en animales de tiro. (TSC-053-C;VI-85).
- Cordero, Wm. Informe sobre la tercera visita al Proyecto Palcazú como especialista en animales de tiro. (TSC-060-C;23-X-85).
- Cordero, Wm. Plan de trabajo: marzo 1986-febrero 1987. (TSC-075-C;III-86).
- Cordero, Wm. Informe de la cuarta visita al PRD-Palcazú. (TSC-076-C; III-86).
- Cordero, Wm. Informe sobre la quinta visita al Proyecto Palcazú como especialista en animales de tiro. (TSC-082-c;9-VI-86).
- Cordero, Wm. Informe sobre la sexta visita al Proyecto Palcazú como especialista en animales de tiro. (TSC-088-C; VII-86).
- Cordero, Wm. Séptima visita del asesor en animales de tiro. (TSC-118-C; VII-87).
- Cordero, Wm. Octava visita del asesor en animales de tiro. (TSC-125-C;X-87).
- Cordero, Wm. Novena visita del asesor en animales de tiro. (TSC-133-C; 15-I-88).
- Cueva B., V. Apoyo a la Cooperativa Forestal Yanesha por el especialista en administración de cooperativas. (Unnumbered TSC field report; 30-III-88).
- Cueva B., V. Informe final del especialista en administración de cooperativas forestales: asesoramiento administrativa a la Cooperativa Forestal Yanesha. (Unnumbered TSC field report; VI-88).
- Gonzalez, Gmo. Primero resumen de estadía: 23-XI-21-XII-84. (TSC-037-C).
- Gonzalez, Gmo. Informe del especialista en preservación de maderas. (TSC-038-C;XII-84).
- Gonzalez, Gmo. Preservación de madera. (TSC-096-C; IX-86).
- Gonzalez, Gmo. Tercer informe preliminar (manejo y uso seguro de preservantes de la madera en al Palcazú).

- Gonzalez T., Gmo. Cuarto informe preliminar (Manejo y uso seguro de preservantes de la madera en el Palcazú. (TSC-136-C;87).
- Gonzalez T. and M. Krones. Guía para la operación del equipo y el uso seguro de los preservantes en la planta PRESCAP de la Cooperativa Forestal Yanesha. (V-88).
- Gonzalez C., R. Primer informe preliminar sobre auditoría administrativa y operativa, análisis y recomendaciones: Cooperativa Forestal Yanesha Limitada. (TSC-127a-C;VII-87).
- Gonzalez C., R. Informe preliminar de costos de la planta de aserrío de la Cooperativa Forestal Yanesha: Curso de capacitación a trabajadores. (TSC-127b-C;VIII-87).
- Gonzalez C., R. Reglamento interno de trabajo para la Cooperativa Forestal Yanesha Ltda. (TSC-127c-C;IX-87).
- Gonzalez C., R. Informe final sobre la función administrativa desarrollada en la Cooperativa Forestal Yanesha Ltda. (TSC-127d-C;IX-87).
- Greub, H. Hoja informativa sobre viaje de investigación de industrias madereras a Huancayo, Huanuco, Pucallpa e Iquitos. (TSC-024-C;3-XI-84).
- Greub, H. Resumen de la primera estadía en el Perú. (TSC-034-C;XII-84).
- Greub, H. Resumen de la segunda estadía en el Perú. (TSC-035-C; XII-84).
- Greub, H. Informe preliminar de productos forestales y mercados. (TSC-036-C;XII-84).
- Greub, H. Segundo informe sobre productos forestales y mercadeo. (TSC-058-C;10-VI-85).
- Greub, H. Informe técnico del asesor en productos forestales y mercadeo. (TSC-066-C;I-86).
- Greub, H. Viaje efecturado por el asesor Heinrich Greub del 1-VI al 20-VI-86. (TSC-087-C; VI-86).
- Greub, H. Informe parcial técnico. (TSC-093-C;IX-86).
- Greub, H. Informe del asesor en productos forestales y mercadeo. (TSC-100-C; IX-86).
- Greub, H. Informe sobre la quinta visita del asesor en pro-

- Greub, H. Informe de la sextas visita del asesor en productos forestales y mecadeo. (12-30 VIII-88).
- Hartshorn, G. Reconocimiewnto de la cuenca de la Quebrada Alcantarilla. (TSC-009-C;13-VII-84).
- Hartshorn, G. Nombres locales de los arboles del Palcazú, Peru. (VIII-84).
- Hartshorn, G. 1984 .Dendrology advisor's first report. (TSC-010-E).
- Hartshorn, G. Dendrology advisor's second report. (TSC-039-C/E; XII-84).
- Hartshorn, G. Dendrology consultant's third report, (with tree list). (TSC-049-E; VI-85).
- Hartshorn, G. Dendrology consultant's fourth report. (TSC-070-E; I-86).
- Hartshorn, G. Dendrology consultant's fifth report. (TSC-084-E; III-86).
- Hartshorn, G. Dendrology consultant's sixth report. (TSC-085-E; VI-86).
- Hartshorn, G. Report on the dendrology consultant's seventh visit. (TSC-095-E; VIII-86).
- Hartshorn, G. 1987. Dendrology consultant's eighth report. (TSC-111-E).
- Hartshorn, G., Simeone, R. and J. Tosi. Sustained-yield management of natural forests: A synopsis of the Palcazu Development Project in the Central Selva of the Peruvian Amazon. (TSC-115-E, TSC-116-C; IX-87).
- Hartshorn, G. Dendrology consultant's ninth report. (TSC-117-E; VII-87).
- Hartshorn, G. Dendrology consultant's tenth report. (TSC-123-E; XI-87).
- Hartshorn, G. Natural regeneration of trees on the Palcazú demonstration strips. (TSC'GH:88-2-E; VIII-88).
- Hartshorn, G. Informe del consultor en Manejo Forestal para el Plan de Acción Forestal Tropical, Peru. (26-V-87).
- Illsley, N. Quarterly report of the wood conversion plant supervisor; PEPP forestry project: January -March 1988. (Unnumbered TSC field report; IV-88).

- Krones, M. First report of the advisor in forest industries. (TSC-008E/C; 28-VI-84).
- Krones, M. Industrialización y manejo sostenido de los bosques naturales del Valle del Palcazú: Plan de trabajo, agosto 1984-diciembre 1985. (TSC-018-C).
- Krones, M. 1984. Plan anual de trabajo: noviembre 1984-mayo 1985. (TSC-028/029-C).
- Krones, M. Resumen informativo del Ing. Forestal Michael Krones, asesor en industria forestales del CCT. (TSC-047-C; 9-XI-84).
- Krones, M. Primer informe sobre especificaciones técnicas y ubicación de las plantas industrializadoras. (TSC-043-C; IX-84).
- Krones, M. Resumen de actividades realizadas durante el mes de diciembre hasta la fecha. (TSC-072-C; II-86).
- Krones, M. Proyecciones para el trimestre marzo-mayo: sector industrias de la UDF. (TSC-073-C; II-86).
- Krones, M. Informe bi-mensual, mayo-junio, 1986. (TSC-090-C; VII-86).
- Krones, M. Informe trimestral enero-marzo 1987. (TSC-110-C; 31-III-87).
- Krones, M. Informe trimestral: enero-marzo 1987. (TSC-110-C; 31-III-87).
- Krones, M. Informe final sobre las actividades desarrolladas en la implementación y puesta en marcha del primer núcleo de transformación en la CFY. (TSC-114-C; VII-87).
- Krones, M. Informe técnico sobre la primera visita a corto tiempo del asesor en industrias forestales. (TSC-134-C; XII-87).
- Krones, M. Informe general de la segunda visita del asesor en industrias forestales: 27 de enero al 2 de marzo de 1988. (TSC-MK-01; IV-88).
- Nieto H., C. Informe final del asesor en supervisión del planta de aserrio de la Cooperativa Forestal Yanesha. (TSC-01.88A; VI-88).
- Recuenco R., V. Informe : Computer T.A.: Introducción a la computación y D.O.S. (TSC-109-C; 17-XII-86).

- Sanchoma, E., Simeone, R., Velis, M. y H. Vilchez. Plan de manejo forestal: Bosque de producción de la Comunidad Nativa Shiringamazu; 1987-89. (TSC-105-C; 30-XII-86).
- Simeone, R. and J. Tosi. Field trip to Oxapampa, Huancabamba, Villa Rica,, Cacazu and Pichinaz. (TSC-002-E; 5 IV-84).
- Simeone, R. Viaje a CN Sta. Rosa de Pichinaz y CN San Pedro de Pichinaz. (TSC-003-C; 9-V-84).
- Simeone, R. Viaje a CC.NN. Loam Linda y Puerto Laguna. (TSC-004; 20-VI-840).
- Simeone, R. Viaje a CN Alto Iscozacín. (TSC-005-C; 20-V-84).
- Simeone, R. Viaje a CN 7 de Junio. (TSC-006-C; 20-VI-84).
- Simeone, R. Viaje a CN Shiringamazu. (TSC-007-C; 10-VII-84).
- Simeone, R. Viaje a Pto. Mairo. (TSC-011-C 1984).
- Simeone, R. Folleto: Los bosques de producción forestal. (TSC-025-C; IV-84).
- Simeone, R. Pros and cons, from a forest management perspective of the proposed change of the carretera marginal from crossing the Rio Iscozacín at Pan de Azucar vs. crossing the Rio Iscozacín at it's confluence with the Rio Palcazu. (TSC-026-E' 18-V-84).
- Simeone, R. Quarterly report: October-December 1984.
- Simeone, R. Informe de viaje: Quebrada Dantas y Bosque Nacional Von Humboldt: proyectos silviculturales en la Selva Central. (TSC-040-C; XII-84).
- Simeone, R. Informe anual del especialista en manejo de bosques naturales. (TSC-041-C; XII-84).
- Simeone, R. Plan de la organización y subdivisión de manejo y producción forestal en el Valle del Palcazu. (TSC-042-C; XII-84).
- Simeone, R. Informe de viaje: Asentamiento Rural Forestal Von Humboldt. (TSC-044-C; 21-IV-85).
- Simeone, R. Informe trimestral: enero a marzo, 1985, del especialista en manejo de bosques. (TSC-050-C; IV-85).
- Simeone, R. Guia para la preparación de planes de manejo forestal para el técnico forestal. (TSC-054-C; VII-85).

- Simeone, R. Informe trimestral: abril a junio 1985 del asesor especialista en manejo de bosques naturales. (TSC-057-C; VII-85).
- Simeone, R. Bi-monthly briefing: TSC/AID, July-August 1985. (TSC-059-E; 1-IX-85).
- Simeone, R. Informe trimestral: julio a setiembre 1985. (TSC-062-C; 6-XI-85).
- Simeone, R. Bi-monthly briefing: TSC/AID, September-October 1985. (TSC-063-E; 11-XI-85).
- Simeone, R. Informe trimestral: octubre-diciembre 1985. (TSC-067-C; I-86).
- Simeone, R. Guia para el manejo de pesticidas. (TSC-068-C; XII-85).
- Simeone, R. Informe anual del especialista en manejo de bosques naturales. (TSC-069-C; XII-85).
- Simeone, R. Bi-monthly briefing: TSC/AID, January-February 1986. (TSC-071-E; II-86).
- Simeone, R. Bi-monthly briefing: TSC/AID, March-April 1986. (TSC-079-E; V-86).
- Simeone, R. La empresa maderera de la comunidad nativa Menonimee de Wisconsin, EE.UU. (TSC-081-C; V-86).
- Simeone, R. Informe bi-mensual, mayo-junio, 1986. (TSC-089-C; VII-86).
- Simeone, R. Informe trimestral: julio a setiembre, 1986 de especialista en manejo de bosques naturales. (TSC-098-C; X-86).
- Simeone, R. Informe final 1986. (TSC-107-C; II-87).
- Simeone, R. Primera visita del asesor de corta duraci3n de manejo de bosques naturales. (TSC-120-C; VII-87).
- Simeone, R. Segunda visita del asesor de manejo de bosques naturales. (TSC-124-C; X-87).
- Simeone, R. Tercera visita del asesor en manejo de bosques naturales. (TSC-132-C; 23-XII-87).
- Simeone, R. Informe de la cuarta visita del asesor en manejo de bosques naturales. (TSC-140-C; 18-II-88).

- Torres V., J. Informe de la visita a la Cooperativa Forestal Yanasha Ltda.-PEPP-Peru. (Unnumbered TSC field report; XII-87).
- Torres V., J. Viabilidad economica financiera de las unidades de produccion de la Cooperativa Forestal Yanasha Ltda. (Unnumbered TSC field report; XII-87).
- Torres V., J. El abastecimiento sostenido de madera a la Cooperativa Forestal Yanasha Ltda. (Unnumbered TSC field report; I-88).
- Tosi, J. and R. Simeone. Field trips to Oxapampa, Huancabamba, Villa Rica, Cacazú and Pichinaz. (TSC-002-E; 5-IV-84).
- Tosi, J. Inspection and evaluation of forest industrial centers in Huancayo, Aguaytia, Pucallpa and Iquitos, Peru. (TSC-023-E; 6-XI-84).
- Tosi, J. First semi-annual report on forestry technical advisory services rendered to PEPP by the Tropical Science Center under **Contract. (TSC-017-E/C; VIII- 8 4).
- Tosi, J. 1985 .Second semi-annual report on forestry technical advisory services rendered to the PEPP by TSC under the contract... (TSC-064-E/C).
- Tosi, J. 1985. Third semi-annual report on forestry technical advisory services to PEPP by TSC under the Contract.
- Tosi, J. Fourth semi-annual report on forestry technical advisory services to PEPP under the Contract. (TSC-080-E/C; II-86).
- Tosi, J. Fifth semi-annual report of forestry technical advisory services rendered to the PEPP by TSC under the Contract. (TSC-099-E/C; IX-86).
- Tosi, J. Sixth semi-annual report on forestry technical advisory services rendered to the PEPP by TSC under the Contract. (IV-87).
- Tosi, J. Seventh semi-annual report on forestry technical advisory services rendered to the PEPP by TSC under the Contract. (IX-87).

5.2 Special reports and scientific papers by TSC advisors published or accepted for publication.

Hartshorn, G. Simeone, R. and J.Tosi, Jr. 1987. "Manejo para rendimiento sostenido de bosques naturales: Un sinopsis del proyecto de desarrollo del Palcazú en la Selva Central de la Amazonia Peruana." In: Management of the Forests of Tropical America: Prospects and Technologies. Proceedings of a Conference, September 22-27, 1986. Institute of Tropical Forestry, Rio Piedras, Puerto Rico.

Hartshorn, G. 1988: Keynote address: International Hardwood Product's Association Annual Convention, Naples, Florida, 2 March 1988.

Simeone, R. 1987. Land use planning and forestry-based economy: the case of the Amuesha Forestry Cooperative. Paper presented at the American Anthropological Association Conference - Chicago, November 18-22, 1987.

5.3 Bibliography

- Brunker, Richard, Gill, Geoffrey and Lane Krahl, 1987. Report on the field visit to the Prescap wood preservation plant in Shiringamazu, Peru, June 21-26, 1987. Prepared for the USAID Mission, Lima, Peru.
- Clark, Howard L. 1988. Environmental assessment: The Central Selva Resources Management Project, Phase II; Project No. 527-0321. USAID/Peru, Lima, Peru. April 1988.
- Hartshorn, G. 1981. Forestry Potential in the Palcazú Valley. In, JRB Associates.(1981). Op. cit.Vol. 2.
- JRB Associates. 1981. Central Selva Resources Management. Vols. I and 2. (Various authors). JRB Associates, Inc., McLean, Virginia, U.S.A.
- Moore, Thomas. 1987. La Cooperativa Forestal Yanasha: una alternativa autogestionaria de desarrollo indigena. Amazonia Indigena 13 (Octubre 1987):18-27.
- ONERN.1982. Inventario y evaluaci3n semi-deetallada de los recursos naturales de la zona del Rio Palcazú. Oficina de Evaluaci3n de Recursos Naturales, Lima, Peru.
- Tosi, Joseph A., Jr. 1981. Land use capability and recommended land use in the Palcazú Valley. In, JRB Associates.(1981).Op.cit. Vol. 2.

Tosi, Joseph A., Jr. 1982. Sustained yield management of natural forests. Forestry Sub-project, Central Selva Resources Management Project, Palcazú Valley, Peru. Tropical Science Center, San José, Costa Rica.