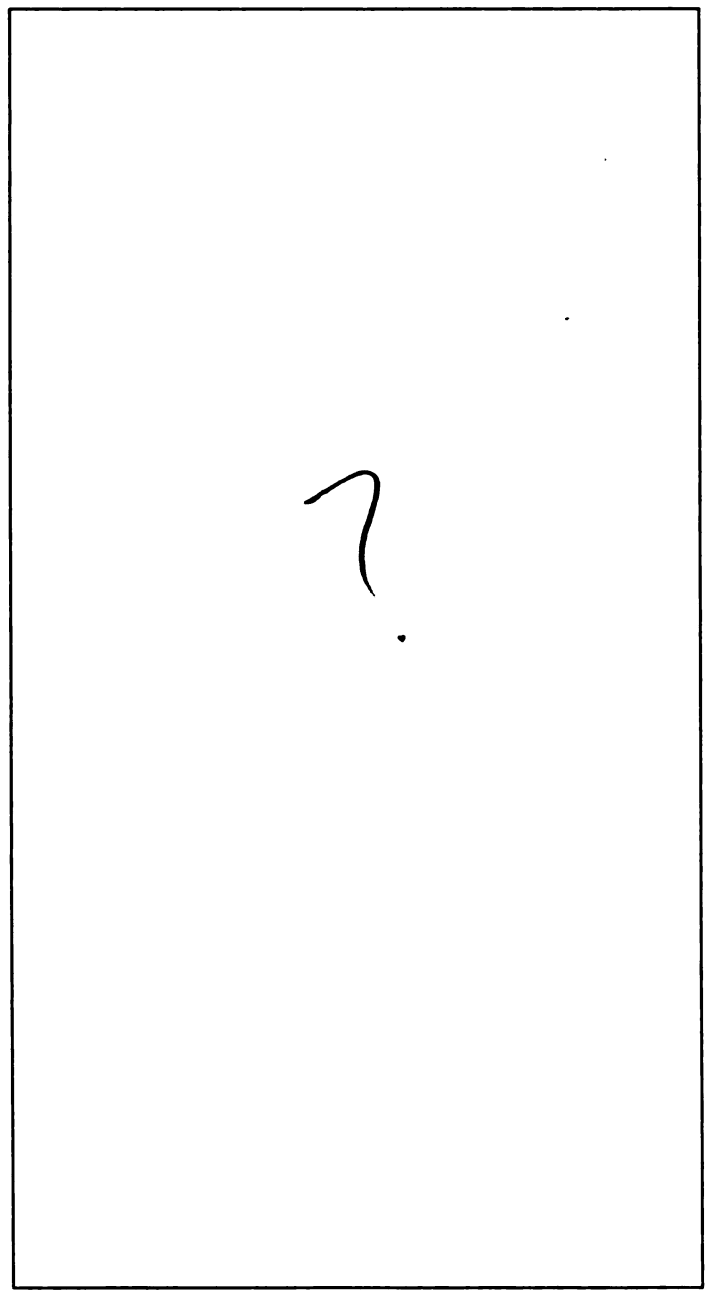
CATIE

Annual Report



1997

Tropical Agricultural Research and Higher Education Center

TABLE OF CONTENTS

FOREWORD

INFORME ANUAL 1997

RESUMEN EJECUTIVO

CATIE

INFORME ANUAL DEL CATIE 1997

RESUMEN EJECUTIVO

Durante 1997, la situación financiera del Centro se mantuvo dentro de los márgenes esperados, lo que permitió concentrarse en la consolidación de las actividades previstas en el Plan de Desarrollo Institucional y avanzar significativamente en la consecución de las metas del Plan Estratégico.

Los aspectos más relevantes y en los cuales se centralizará este informe son los aspectos financieros y el desarrollo administrativo, las políticas de planificación estratégica y cooperación externa, la consolidación del Programa de Investigación y sus líneas prioritarias de acción, la consolidación del Programa de Proyección Externa y los avances logrados en la Escuela de Postgrado.

I. Situación Financiera.

En los cuadros 1 y 2 se presenta el resumen de los estados financieros del Centro al 31 de diciembre de 1997, los cuales aún no han sido auditados y su comparación con el año 1996. El cuadro 1 muestra que los ingresos totales del año 1997 fueron de US$ 21,921.301.49, mientras que los gastos totales alcanzaron la suma de US21,547.212.39, con lo que existió un superávit de US$ 374.089.10. En el cuadro 2 se muestra el balance general combinado del año 1997 y su comparación con el año 1996.

II. Area de Administración

En el Area de Administración durante 1997 se logró consolidar algunas actividades de gran importancia para el mejoramiento de los servicios que ofrece el CATIE para el desarrollo de las actividades de investigación y enseñanza. Gracias a estos esfuerzos, el CATIE cuenta a partir de 1998 con salas de eventos e instalaciones de hospedaje con capacidad para albergar 80 personas en condiciones muy bien calificadas, pues el servicio de hotelería que se ofrece está en óptimas condiciones, luego de las remodelaciones y mejoramiento de los servicios. Incluso actualmente se realiza un intenso programa de venta de servicios para lograr incrementar la ocupación.

En el aspecto de remodelaciones de instalaciones, se logró concluir las planificadas para los Apartamentos Irazú, la Sala de Sesiones de la Junta Directiva en el tercer piso del Edificio Henry Wallace, la Cafetería del Hotel de la Comunidad Europea, la Escuela Interamericana, la Escuela de Postgrado y el edificio de Capacitación. También se inició la remodelación de la Biblioteca Conmemorativa Orton.

En el proyecto de construcción del Edificio de Teleconferencias, se realizó el proceso de licitación y adjudicación de las obras, así como algunos cambios y recomendaciones en los planos originales, lo que permitirá iniciar su construcción durante 1998.

En otros aspectos administrativos, se ha avanzado en la implementación de algunos procesos de descentralización de actividades para mejorar la eficiencia en los servicios proveeduría y de planta física, simplificando los sistemas de órdenes de compra y órdenes de trabajo. También ha sido importante el nivel logrado en cuanto a la coordinación con los diferentes asistentes administrativos de las unidades y proyectos que permiten mayor fluidez en los trámites. También se logró consolidar el sistema de control de activos institucionales.

III. Programa de Planificación Estratégica y Cooperación Externa

Durante 1997, las actividades de cooperación externa se centralizaron en el mantenimiento de las relaciones con los gobiernos, agencia e instituciones donantes, en la negociación de donaciones y contribuciones al presupuesto básico, en la elaboración y negociación de proyectos, en la negociación de convenios institucionales y en la preparación de propuestas para la participación en licitaciones de los gobiernos de los países de la región y en consultorías. Las actividades de planificación estratégica incluyeron el seguimiento de la implementación del Plan de Desarrollo Institucional, la elaboración de los planes bianuales de trabajo para el bienio 1998-1999 y los pasos iniciales para la elaboración de planes individuales de trabajo para 1998 por parte de todo el personal técnico del Centro. También se inició la revisión del Plan Estratégico Institucional y un primer borrador del Plan ya revisado se presentó a la Junta Directiva.

Como resultado de estas actividades, muchas instituciones y países contribuyeron significativamente en el financiamiento de las actividades de investigación, enseñanza y proyección durante 1997, contribuciones que alcanzaron la suma de US$ 9,254,469 y que en el Cuadro 3 se presentan en detalle. Los principales países donantes fueron Dinamarca, Suecia, Noruega, Holanda, Suiza, Alemania, Francia y Estados Unidos.

En cuanto a la negociación de nuevos proyectos, durante 1997 se logró suscribir exitosamente 41 proyectos por un monto total de US$ 8,751,965.

Se firmaron también 25 nuevos convenios de cooperación con diferentes instituciones y países miembros para el logro de una gran variedad de metas y necesidades, lo cual es indicativo del creciente interés y la buena imagen del CATIE en la región. Algunos de los convenios más importantes fueron los referidos al desarrollo de los estudios doctorales, como los firmados con las universidades de Texas A&M, Freiburg, Hohenhein y Helsinki. En el cuadro 4 se

presenta un estimado financiero que, como contrapartida, significan un aporte financiero importante para la Institución.

IV. Programa de Investigación y Enseñanza

El Programa de Investigación y Enseñanza, durante el año 1997 estuvo integrado por cuatro Areas Técnicas: Area de Agricultura Tropical Sostenible, Area de Cuencas y Sistemas Agroforestales, Area de Manejo y Conservación de Bosques y Biodiversidad, Area de Economía y Sociología de la Producción y la Conservación y el Area de Postgrado.

El trabajo más importante realizado a nivel del Programa, fue la definición y priorización de las líneas de investigación, para lograr mayor eficiencia en la utilización de los escasos recursos disponibles para esta importante función del CATIE y también para orientar todos los trabajos de investigación de tesis de los estudiantes de la Escuela de Postgrado hacia la consecución de metas específicas que tengan verdadero impacto en la realidad de la región tropical de América. Este proceso fue largo y nada fácil, debido a que la definición y priorización de las líneas de investigación, tenía, una vez definidas, una incidencia importante en la permanencia o necesidad de contratación del personal técnico (junior y senior) que se haría cargo de estos trabajos.

Una vez lograda una propuesta de las líneas de investigación satisfactoria para el staff del Programa, la misma fue sometida al Comité Científico - Académico de la Junta Directiva para su aprobación final. En resumen, las grandes líneas de investigación son las siguientes:

Línea 1: Mejoramiento y conservación de germoplasma de especies forestales y agrícolas seleccionadas

Línea 2: Manejo integrado de plagas en sistemas forestales y agroforestales.

Línea 3: Sistemas Agroforestales.

Línea 4: Desarrollo de tecnologías para el manejo de bosques naturales y su biodiversidad.

Línea 5: Análisis socio económico y valoración de políticas, del manejo y los bienes y servicios de los ecosistemas tropicales.

Dentro de cada una de estas líneas se definieron los componentes y sublíneas más importantes en las que el CATIE concentrará en el futuro sus esfuerzos de investigación.

1. Area de Agricultura Tropical Sostenible.

El Area de Agricultura Tropical Sostenible (AATS) persigue como objetivos generar, validar y promover opciones tecnológicas que mejoren la productividad de los sistemas de cultivo, haciendo uso sostenible de los recursos naturales, incrementando los ingresos de los productores y la oferta de alimentos para la población en general. La existencia del AATS se justifica por la necesidad de compatibilizar la producción de alimentos con el bienestar de las generaciones futuras.

La agricultura sostenible se considera como un conjunto de tecnologías que, integradas en sistemas de producción, satisfacen las necesidades productivas en íntima relación con la conservación y rehabilitación de los recursos naturales, dentro del entorno cultural, social, económico y ecológico prevaleciente.

El AATS está constituida por tres Unidades básicas: a) la Unidad de Biotecnología que persigue como objetivo principal caracterizar molecularmente los recursos genéticos y micropropagar materiales selectos de cultivos de importancia económica y especies forestales; b) la Unidad de Recursos Fitogenéticos, que apoya la colección, conservación, evaluación, caracterización, documentación y distribución de germoplasmas y la Unidad de Fitoprotección que genera tecnologías de manejo integrado de plagas, extrapolables a diferentes sistemas de producción.

A continuación se presentan las conclusiones y logros más importantes del AATS de sus actividades realizadas durante 1997.

- Los resultados obtenidos en el campo de la micropropagación de café permiten la difusión de las primeras plantas híbridas mejoradas (F_1) a través del programa de mejoramiento regional del cultivo (PROMECAFE). El futuro de esta actividad será la validación de los resultados a mayor escala (producción piloto) en los próximos dos años.

- El cultivo del plátano en el año 1997 se caracterizó por un esfuerzo particular para el desarrollo de un sistema eficiente de regeneración celular mediante suspensiones celulares. Este sistema es indispensable para seguir sobre la vía del mejoramiento no convencional. Para asegurar el futuro de este programa se buscó la integración regional, con el apoyo de INIBAP, con la que se logró la aprobación, en 1997, de dos proyectos (el programa INCO-Musa 1998-2001 y el proyecto BID-INIBAP) para apoyar esta integración.

- El programa de investigación con especies forestales es un programa emergente en la Unidad de Biotecnología (UB). En 1997, ambos trabajos de investigación y esfuerzos para desarrollar nexos de colaboracion institucional y regional fueron realizados. En este sentido, se ha previsto la contratación de otro investigador en el campo de la caracterización molecular, para reforzar el trabajo del investigador encargadop de los aspectos celulares.

- Durante 1997 la enseñanza de posgrado se fortaleció con el ingreso de cuatro

estudiantes de maestría a la UB, con el cargo de asistentes de investigación, lo que incrementó los recursos humanos existentes. Para esto fue necesario redefinir los contenidos de los cursos de la especialidad. En años anteriore, el ingreso de estudiantes al la UB había sido mínimo.

- En 1997, ante la gran demanda de materiales mejorados, con el apoyo de la Dirección General, se inició un proceso de desarrollo de la UB. El punto de partida fue una evaluación externa de la Unidad, ralizada por los Drs. W. Roca y J. Tohme, y como resultado de ella se produjeron varios documentos que resumen las medidas a tomar, tanto a nivel de las líneas de investigación, de los recursos humanos, de la colaboración externa, así como también del presupuesto que la institución debe asignarle a estas actividades. El objetivo es hacer de los laboratorios dedicados a la biotecnología, una Unidad de investigación modelo, al servicio de los países miembros del CATIE, en los aspectos de la caracterización, conservación, multiplicación y difusión de los recursos genéticos agrícolas y forestales. Durante 1997 se inició el proceso de desarrollo de la Unidad con cambios principalmente a nivel de infraestructura y equipos.

- Las actividades de manejo y conservación de germoplasma han mejorado significativamente mediante una planificación pormenorizada de las actividades y aprovechamiento de los recursos.
- Se concluyeron los proyectos de jícama y sapotáceas, los cuales cumplieron con los objetivos propuestos y se lograron resultados útiles para promover su desarrollo. Los informes finales fueron recibidos a satisfacción, manifestando los donantes su complacencia por la calidad de los productos logrados.
- Se realizó una evaluación externa del Proyecto Sapotáceas (IPGRI-CATIE) y del Proyecto para el mantenimiento de la colección de cacao (ACRI), cuyos cuyo objetivo fue valorar el estado actual y proyecciones respecto al uso y manejo del germoplasma existente y el interés institucional por promover estas actividades. Los resultados satisfactorios de las evaluaciones estimularon a los donantes para continuar brindando su apoyo.
- El Proyecto "Evaluation, Regeneration and Enhanced Database of Unique Genetic Resources from Meso-America" (CATIE-USDA), ha permitido disponer de mayores facilidades para el manejo, procesamiento y caracterización del germoplasma de las colecciones del CATIE e incrementar las actividades de recursos fitogenéticos.
- Se logró un mayor refinamiento del modelo de capacitación participativa basada en las reuniones de productores y extensionistas por tipo de cultivo. De esta forma, el Proyecto MIP en Nicaragua, financiado por NORAD, extendió su cobertura de entrenamiento a 1400 hombres y 450 mujeres. Este enfoque participativo por tipo de cultivo, ha sido también probado en trabajos agroforestales y será utilizado en el nuevo programa que se ha presentado a la Agencia donante. Los estudios de impacto han mostrado que el entrenamiento participativo por tipo de cultivo basado en la variabilidad ecológica de las

plagas, conlleva un trabajo de extensión más efectivo y un mejoramiento en el manejo de las plagas por parte del agricultor.

- Se han mejorado los métodos de planificación participativa con las instituciones contraparte del Proyecto MIP en Nicaragua. Este nuevo enfoque puede fortalecer los procesos de planificación con los socios permanentes, lo cual es una piedra fundamental para la emergente estrategia de proyección externa del CATIE. Estos métodos incluyen tanto estrategias bilaterales como multilaterales.
- Con apoyo del Proyecto MIP - Nicaragua, se prepararon manuales para el manejo integrado de plagas en café, hortalizas y plátano. Estos manuales combinan las prácticas de manejo con la información ecológica que mejora la calidad del trabajo de extensión, considerando la variabilidad local para mejorar el proceso de toma de decisiones por parte del agricultor.
- Se presentaron los resultados de investigación en Manejo Integrado de Plagas en diferentes reuniones científicas. Esto incluyó el Congreso Regional de MIP en Matagalpa, Estelí y León en Nicaragua y el Congreso MIP de Nicaragua, en el mes de noviembre, donde se presentaron 17 trabajos. También se presentaron cinco trabajos en el XVIII Simposio Latinoamericano del Café, en Costa Rica. Una delegación participó en el Taller anual sobre mosca blanca para Centroamérica y el Caribe, realizado en República Dominicana en noviembre y nueve trabajos se presentaron en la Reunión de la Sociedad Americana de Patología – Sección del Caribe, realizada en Costa Rica.

2. Area de Cuencas y Sistemas Agroforestales.

El Area de Cuencas y Sistemas Agroforestales (ACSAF) incluye dos unidades técnicas: Desarrollo de sistemas Agroforestales y Manejo de Cuencas, cuyo mandato es desarrollar, validar y transferir el uso de tecnologías para el uso sostenible de la tierra, en particular, metodologías que utilizan vegetación leñosa. La principal fuente de recursos financieros para ACSAF durante 1997 fue el presupuesto básico del CATIE, principalmente en el rubro de salarios del personal técnico permanente, DANIDA que financió la unidad de coordinación del Area y el programa de postgrado y BMZ/GTZ (Alemania) que financió estudios piloto para desarrollar y transferir tecnologías AF para las zonas del trópico húmedo bajo de Centroamérica.

El trabajo se concentró, durante 1997, en tres líneas prioritarias (sistemas agrosilviculturales para cultivos anuales en zonas húmedas de ladera, árboles de sombra en cultivos perennes y sistemas silvopastoriles), cuyos resultados más importantes se sintetizan en los siguientes párrafos.

Agrosilvicultura. Combinando la labranza con los cultivos en callejones se incrementan considerablemente los beneficios del cultivo por reducción de la

competencia de los cultivos bajo la tierra y la aceleración del proceso de liberación de nutrimentos de la materia orgánica acumulada. La información de la arquitectura de las raíces (del árbol y del cultivo) sugiere que la competencia por nutrimentos y agua puede controlarse por medio de la selección de especies y el manejo del cultivo (cosechar y labrar simultáneamente). Una evaluación de enmiendas orgánicas en Turrialba, mostró resultados muy interesantes: "Bocashi" y otros estiércoles animales fueron la mejor fuente para suplir fósforo. Utilizando estas enmiendas, fue posible producir cultivos anuales, aún en un subsuelo extremadamente ácido e infértil que no tenia bases pero sí un alto contenido de aluminio. Se requiere mayor investigación para determinar el efecto de los árboles asociados sobre la acidez del suelo y la disponibilidad de nutrimentos para los cultivos. También se desarrollo un modelo dinámico de la producción de biomasa y nutrimentos de la bracatinga (*Mimosa scabrella*) en barbechos naturales.

Sombra en cultivos perennes. Se desarrolló una fórmula utilizando la medida del cuello de las raíces para estimar la extensión y densidad de las raíces del árbol, como un indicador de competencia, en las plantaciones de café sombreadas con árboles maderables tales como *Eucalyptus deglupta*. El desarrollo temporal y espacial de las raíces se estudia para desarrollar intervenciones de manejo en los sistemas que permitan reducir la competencia de realces. Seis sistemas agroforestales con cacao (*Theobroma cacao*), plátanos (*Musa* AAB) y laurel (*Cordia alliodora*), fueron probados para determinar su habilidad para incrementar la estabilidad de los ingresos del productor, de cara a la inestabilidad de precios en el mercado. Los modelos de simulación indicaron una alta expectativa de ingresos y un menor riesgo con las tecnologías diversificadas, comparadas con los correspondientes monocultivos. Se desarrollaron modelos para el análisis sistemático (por planta, por hilera y por lote) y por rama de los sistemas de cosecha en plantaciones de café, los que mostraron que pueden determinar el 75% de los rendimientos de café observados.

Sistemas Silvopastoriles. Durante 1997, la prioridad de investigación en los sistemas silvopastoriles cambió de un énfasis en los árboles forrajeros a un énfasis en la reforestación de pasturas degradadas integrando tanto árboles de uso múltiple como árboles maderables. Estudios en Panamá y Costa Rica se realizaron en los sistemas silvopastoriles existentes de *Acacia Mangium*, *Gliciidia sepium* o *Erythrina berteroana* con pasturas de *Brachiaria* para determinar su potencial para recuperar suelos marginales. *Cratylia argentea* es un arbusto leguminoso bien adaptado a los suelos ácidos infértiles y produce significativas cantidades de forraje durante la estación seca. El consumo de su forraje fresco por parte de los rumiantes es muy bajo, pero puede ser significativamente incrementado con un marchitamiento previo o mezclándolo con melaza. La sustitución del 33 y del 66% del concentrado de terneras de lechería con morera (*Morus alba*), resulta en ganancias diarias de peso de 0.67 y 0.53 *vs* 0.71 kg./día con el 100% de concentrado, respectivamente, pero no hay diferencias significativas entre los tratamientos. Incrementando los niveles de morera en la dieta, se mejoran los parámetros de fermentación ruminal de tres pastos tropicales (*Hyparrenhia rufa*, *Pennisetum clandestinum* y *Brachiaria brizantha*).

Misceláneos. Se determinaron índices de sitio para laurel, considerando la profundidad del suelo, el pH y el riesgo de inundación, con base en datos de 50 parcelas permanentes de investigación. El crecimiento fue principalmente determinado por el nivel de manejo de la plantación. Un análisis de la literatura sobre sistemas agroforestales en América central, mostró que la mayoría de los estudios se han centralizado en experimentos de campo en vez de utilizar los sistemas agroforestales ampliamente difundidos entre los agricultores y que se ha sobre enfatizado en los análisis financieros. La pulpa de café debe tener al menos dos semanas de descomposición antes de poder ser utilizado como sustrato alimenticio en el desarrollo de lombrices de tierra (24.000 *Eisenmia fetida*/m^3). Ochenta y cinco documentos (incluyendo las tesis de maestría) fueron revisados y publicados por los técnicos y estudiantes de ACSAF. Las principales publicaciones se incluyeron en la Revista Agroforestería en las Américas y artículos en revistas científicas internacionales. Durante 1997, ACSAF mantuvo 27 estudiantes regulares inscritos en su maestría, 15 de primer año y 12 de segundo año, siendo que todos estos últimos presentaron sus tesis de grado en tiempo en diciembre de 1997.

3. Area de Manejo y conservación de Bosques y Biodiversidad.

El objetivo de esta Area es identificar y desarrollar opciones de manejo forestal, ecológicamente sostenibles, económicamente atractivos y socialmente aceptables y aplicables a diferentes tipos de bosques. Durante 1997, se trabajó en la consolidación de las tres Unidades que componen el Area: Unidad de Manejo de Bosques Naturales, Unidad de Manejo y Conservación de la Biodiversidad y Unidad de Silvicultura de Plantaciones y en la definición de las líneas de investigación y sus componentes.

A continuación se presenta una síntesis de los principales logros de las Unidades del Area durante 1997:

Unidad de Manejo de Bosques Naturales.

- La caracterización del crecimiento y producción comercial del bosque tropical húmedo de la vertiente Atlántica de Costa Rica y Nicaragua, bajo diferentes intensidades de intervención.

- Con los datos de la caracterización anterior, se inició un proceso de conceptualización y búsqueda de parámetros para generar un modelo de simulación y predicción del crecimiento, rendimiento y regeneración natural en bosque húmedo primario y secundario.

- La caracterización ecológica y estacional de productos no maderables del bosque bajo regímenes de manejo con y sin aprovechamiento.

- Los análisis financieros y económicos de bosques manejados para la producción de madera y otros bienes, así como de servicios.

- Caracterización de la dinámica del rodal y de las relaciones sitio – vegetación en bosque secundario establecido en terrenos agrícolas abandonados, con suelos ácidos de baja fertilidad.

- Caracterización de la respuesta de la diversidad vegetal del bosque a la cosecha de madera y a los tratamientos silviculturales.

Los resultados prácticos más importantes y los impactos de la investigación del CATIE en este campo pueden resumirse en:

- Las técnicas de aprovechamiento de bajo impacto desarrolladas están siendo incorporadas en las políticas y prácticas de manejo de bosques naturales en la región.

- La UMBN coordinó un proceso de refinamiento y simplificación de los requisitos para elaborar planes de manejo en los países centroamericanos e incorporó su propia experiencia en el proceso.

- La UMBN ha desarrollado y puesto a disposición de profesionales y dueños de bosques técnicas para el inventario, silvicultura y aprovechamiento sostenible de productos no tradicionales del bosque.

- Se han adaptado técnicas de tratamiento silvicultural para bosques primarios húmedos de la vertiente Atlántica de Costa Rica y Nicaragua.

- Los análisis financieros y económicos, junto con determinaciones y simulaciones de crecimiento y rendimiento representan guías invaluables para la elaboración de políticas y prácticas de manejo forestal a mediano plazo.

- El Sistema de Manejo de Información Científica de la UMBN (SciBos), actualmente en uso interno restringido, será puesto a disposición de las contrapartes regionales a partir de 1998.

Unidad de Manejo y Conservación de la Biodiversidad

Durante 1997, esta Unidad operó principalmente por medio de los proyectos OLAFO Y MANGLARES, cuyos principales resultados se centraron en las metodologías generadas y las experiencias obtenidas en el proceso del diseño e implementación de áreas demostrativas con comunidades rurales, lo que incluye lo siguiente:

Experiencias en manejo sostenible de recursos naturales en el ámbito comunitario e individual:

- Con *Quassia amara* se ejecuta un plan de manejo y se evaluaron las propiedades insecticidas de extractos etanólicos y acuosos en plagas como *S. Fugperda*, *H. Grandella* y *B. Tabaci* en Costa Rica.

- Con *Carludovica palmata*, se definieron elementos de muestreo para el diseño de inventarios de poblaciones naturales en Costa Rica y Panamá.

- Se implementaron planes de aprovechamiento experimentales forestales comunitarios en manglares de Nicaragua.

- Concesión comunitaria para el manejo diversificado del bosque en La Pasadita y aprovechamientos forestales en las concesiones comunitarias de La Pasadita y San Miguel en Guatemala.

Metodologías para el manejo sostenible de recursos naturales:

- Para aspectos biológicos, productivos y de procesamiento para recursos no maderables – ornamentales, medicinales, insecticidas naturales y fibras para artesanía – en Costa Rica, Guatemala y Panamá.

- Para maderables en manglares en Nicaragua.

- Diseño e implementación de un Sistema de Información Geográfico para el manejo sostenible de los recursos del Estero Real en Nicaragua.

- Se actualizó el modelo de desarrollo rural basado en el manejo de ecosistemas naturales, donde se explicita el tema de evaluación de la sostenibilidad y monitoreo.

Aplicación del modelo Olafo de desarrollo rural basado en el manejo de ecosistemas naturales mediante capacitación y aprendizaje, a técnicos de ocho instituciones, tomando en cuenta los modelos desarrollados a nivel de comunidad, de clan, individual y de ordenamiento, en Honduras.

En todos los aspectos se han registrado resultados e impactos significativos. En el nivel de organización, fueron mayores en Guatemala, Honduras y Panamá (legalización de grupos, mayor capacidad de gestión y de resolución de conflictos). En el manejo y uso de la biodiversidad, se registra la adopción de alternativas productivas (fibras para artesanía, apicultura, manejo forestal maderable en manglar y bosque latifoliado).

Unidad de Silvicultura de Plantaciones.

El Proyecto de Semillas Forestales (PROSEFOR) tuvo acciones en Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panamá y República Dominicana y su principal objetivo es el de fortalecer el desarrollo forestal de los siete países, asegurando la disponibilidad de semillas de mejor calidad genética y fisiológica para las especies prioritarias. Los objetivos específicos fueron los bancos de semillas nacionales y conformar una red regional de productores y consumidores de semillas forestales. El año 1997 fue el último año de la primera etapa de PROSEFOR y se logró alcanzar los objetivos ya mencionados. Hoy los siete países cuentan con fuentes semilleras seleccionadas para la mayoría de las especies prioritarias, algunas de las cuales ya fueron técnicamente manejadas y el resto está en proceso de manejo. Los bancos de semillas mejoran su sistema

operativo y están dando un mejor servicio a los usuarios. La Red Regional – REMSEFOR – inició sus actividades en 1997.

4. Area de Economía y Sociología de la Producción y la Conservación.

Los actuales problemas relacionados con la sostenibilidad económica y ambiental de las áreas y sistemas de producción, el uso sostenible de los recursos naturales y la conservación del ambiente, se deben, en parte, a la falta de alternativas que sean económica y socialmente apropiadas para las familias de los productores y las comunidades rurales de la América Tropical.

Sin embargo, esta problemática tiene también profundas raíces en las políticas estructurales y macroeconómicas de la sociedad. En muchos casos, las tecnologías apropiadas ya existen, pero los sistemas usuales de incentivos o desincentivos o las políticas institucionales del ambiente no favorecen su adopción. De allí que es obvio que una solución permanente y global debe también incluir una adaptación de estos aspectos críticos, de tal manera que promueva condiciones individuales que sean compatibles con el objetivo de un desarrollo sostenible y ambientalmente sano, una meta compartida por todos los países miembros del CATIE.

Un rédito, relativamente importante, es la valoración económica de las cifras, públicamente disponibles, para los recursos naturales; las externalidades que resultan de los métodos utilizados para su explotación (contaminación, pérdidas netas de las reservas de los recursos naturales, etc.) y de los bienes y servicios ambientales producidos por estos, tales como la fijación de dióxido de carbono, la infiltración y almacenamiento de agua, la conservación de la biodiversidad, el ecoturismo, etc., son las bases para la formulación de políticas que promuevan su uso racional.

Adicionalmente, también es lamentables la falta de información sobre qué métodos de desarrollo y transferencia de tecnologías son los más eficientes y efectivos bajo nuestras condiciones y el poco entendimiento de los factores socioeconómicos que limitan la adopción de tecnologías y los procesos de diseminación. Las necesidades se hacen sentir sobre las familias campesinas, sus propios conocimientos y maneras de experimentación, y sus prioridades en general, muchas veces son ignoradas al momento de definir el tema, objetivos y métodos de investigación y extensión.

Durante 1997, el Area de Economía y Sociología de la Producción y la Conservación, realizó numerosas actividades de cooperación técnica, de entrenamientos de corto plazo, de producción y diseminación de materiales informativos, de investigación, de educación de postgrado y desarrollo de recursos humanos, con el fin de ayudar a los países miembros del CATIE a encontrar e implementar soluciones a esos problemas. Los logros más importantes se resumen a continuación:

- Se continuó brindando cooperación técnica a cuatro programas nacionales en Guatemala, Honduras, Nicaragua y Costa Rica:

  - Comisión Nacional de Areas Protegidas, CONAP, Guatemala.

  - Programa ODA/CONSEFORH/COHDEFOR, Honduras.

  - Instituto Nacional de Tecnología Agropecuaria, INTA, Nicaragua.

  - Proyecto de Desarrollo Rural (DRIP) de la Península de Guanacaste, Costa Rica.

  Esta cooperación fue brindada por cuatro expertos del Area por medio de 15 visitas de una semana de duración promedio. Estos programas se estima que conservadoramente llegan en forma directa a más de 4.000 agricultores a través de una red de más de 150 extensionistas y técnicos de campo

- Se brindó una consultoría técnica al Centro Universitario Regional del Litoral Atlántico (CURLA) de la Universidad Nacional Autónoma de Honduras para elaborar una revisión de los cursos y el pensum de la carrera de Economía Agrícola.

- En el campo de la investigación, 24 eventos distintos de colección de datos, ensayos y actualizaciones. También 9 métodos de investigación fueron adaptados o validados para su uso en el análisis o evaluación de procesos económicos o sociales en los países miembros. Algunas de estas investigaciones estarán pronto disponibles para diseminarse mediante publicaciones científicas.

- Los resultados de las investigaciones del Area fueron presentados en diversas instancias tales como:

  - Reunión Anual de la Asociación Americana de Economía Agrícola, Toronto, Canadá, 27-30 de julio de 1997.

  - Taller del Beijer Institute sobre Investigación en Economía Ambiental, Punta Leona, Costa Rica, 6-8 de noviembre de 1997.

  - Taller del Beijer Institute sobre Enseñanza de la Economía Ambiental, CATIE, Turrialba, 11-13 de noviembre de 1997.

  - III Congreso Forestal Centroamericano, San José, Costa Rica 15-17 de setiembre de 1997.

  - Simposio sobre la Dimensión Humana del Desarrollo Forestal Sostenible para El Cambio Global Climático, CATIE, Turrialba, 29 de febrero-1 de marzo de 1997.

- Simposio sobre la Dimensión Humana del Manejo de los Recursos Naturales, Belice, 26-28 de febrero de 1997.

- III Semana Científica del CATIE, Turrialba, 3-5 de febrero de 1997.

- Se graduaron los primeros nueve estudiantes de la Escuela de Postgrado, cinco mujeres y cuatro hombres, con la Maestría en Economía y Sociología Ambiental y 14 nuevos estudiantes ingresaron en el Programa, para el período 1998-1999.

- Se consolidó el pensum de la Maestría en Economía y Sociología Ambiental.

5. Area de Postgrado

El Programa de Estudios de Postgrado se inició en el año de 1947 y hasta la fecha ha graduado a más de 1.400 profesionales. Durante el año de 1997, la estructura institucional incluyó a la Escuela de Postgrado como una Area dentro del Programa de Investigación, para lograr una estrecha integración de ambos Programas, lo que permitirá que los estudiantes logren por su parte mayores destrezas en los procesos de investigación y que la Institución fortalezca los procesos de investigación a través de las tesis de grado integradas dentro de las líneas prioritarias establecidas en la agenda de la investigación.

A continuación se resumen los principales logros de la Escuela de Postgrado durante el año 1997:

Programa de Doctorado

- Se reorganizó el Comité de Doctorado.

- Se reorganizó y automatizó el proceso de admisión, el cual consistió en la ubicación del proceso dentro de la Oficina de Admisiones dentro de la Escuela de Postgrado, ya que anteriormente se realizaba a través de la Dirección del Programa de Investigación.

- Desarrollo e implementación de los criterios específicos de admisión y del proceso de selección de los candidatos a estudios doctorales.

- Planificación y ejecución de la difusión y mercadeo del Programa de Doctorado en los países miembros del CATIE, así como en otros países del hemisferio y fuera del Continente.

- Tres estudiantes iniciaron sus estudios doctorales, dos en la Universidad de Gottingen y uno en la Universidad Estatal de Colorado.

- Se firmaron acuerdos para la realización conjunta del Programa de Doctorado con las Universidades de Honhenheim, Texas A&M, Feiburgh y Helsinki y se iniciaron conversaciones con Louisiana State University. En el caso de Gottingen, aunque no se ha firmado ningún convenio formal, existen excelentes relaciones que han contribuido al envío de los dos primeros estudiantes.

- Mejoramiento de las relaciones con los posibles donantes para becas doctorales, tales como DAAD, GTZ, DANIDA y Suiza. De parte de la DAAD se tiene la promesa de 5 becas para el primer año en Alemania de los estudiantes de doctorado para 1998.

Programa de Maestría (en los cuadros 5, 6 y 7 se muestran algunas estadísticas de la admisión al Programa de Maestría):

- Graduación de los 53 estudiantes del segundo año de la Maestría en el mes de diciembre, cumpliendo el tiempo estipulado de 24 meses. Este logro se da por segundo año consecutivo.

- Rediseño del *pensum* de las viejas Maestrías y su consolidación en cuatro grandes Areas para ajustarlas más eficientemente a las nuevas líneas de investigación priorizadas por el Programa de Investigación.

- Suspensión de la Maestría en Sociología Ambiental, hasta contar con el cuerpo de profesores adecuados.

- Definición del Claustro de Profesores de la Escuela de Postgrado, para asegurar la calidad y continuidad de las actividades de Enseñanza.

- Graduación del primer grupo de estudiantes en el Area de Economía y Sociología Ambientales.

- Diseño e implementación de un Programa Intensivo de Inglés para los estudiantes que ingresan al Programa de Maestría, ofrecido conjuntamente con el Instituto Británico de Costa Rica, para el logro de formar profesionales bilingües al final de los 24 meses de duración de las Maestrías.

Vida Estudiantil:

- Puesta en operación de un Centro de Cómputo para los estudiantes dentro de la Escuela de Postgrado, equipado con 5 computadoras y una impresora láser para imprimir sus trabajos de tesis y otros documentos importantes.

- Incremento del número de actividades sociales y culturales para mejorar la calidad de vida del estudiantado.

- Celebración de los Primeros Juegos Olímpicos del CATIE, con la participación del personal del Centro y estudiantes de otras universidades públicas y privadas de Costa Rica.

- Promoción y financiamiento parcial de estudiantes graduados para participar en cursos y seminarios organizados por otras instituciones como complemento de su formación académica.

- Incremento de la cobertura de la Póliza Básica de Accidentes con el Instituto Nacional de Seguros de Costa Rica, de C$ 100.000 a C$ 1,000.000 por estudiante.

- Mejoramiento de las instalaciones de alojamiento de los estudiantes (pintura, cortinas nuevas, muebles y más) en estrecha colaboración con el Area de Administración.

Aspectos Administrativos

- Mejoramiento de la infraestructura física de la Escuela, principalmente obras para el cierre del Edificio.

- Remodelación del Area de Registro.

- Mejoramiento de las facilidades audiovisuales de las Aulas, mediante la adquisición de computadoras, proyectores y equipos multimedia.

- Mejoramiento de las herramientas de cómputo de todo el personal administrativo y secretarial (8 equipos de cómputo).

- Mejoramiento y actualización de las bases de datos para el manejo de registros académicos, de admisión y de seguimiento a egresados.

V. Programa de Proyección

La misión del Programa de Proyección es la de fortalecer la efectividad y eficiencia de los programas nacionales de investigación y desarrollo y diseminar tecnologías mejoradas en el área de la agricultura sostenible y el manejo de los recursos naturales del Trópico Americano. Igualmente debe promover el apoyo del CATIE entre sus socios y donantes de la comunidad internacional.

Bajo esta perspectiva, el Programa debe ser un facilitador para la diseminación y el entrenamiento de los recursos humanos, una plataforma para el desarrollo de proyectos de investigación y desarrollo, de redes con énfasis en Centroamérica y promover al CATIE entre sus socios y donantes de la comunidad internacional.

Desarrollo del Programa

- Consejos Asesores Nacionales (CAN). Los CAN se encuentran en operación en El Salvador, Guatemala, Honduras y Nicaragua. El de El Salvador fue establecido e inició operaciones en 1997.

- Las Oficinas Técnicas Nacionales (OTN) que se encuentran funcionando eficientemente son las de El Salvador, Guatemala, Honduras y Nicaragua. La de Panamá tuvo dificultades para sostenerse y se encuentra temporalmente cerrada. El trabajo de las OTN se ha concentrado en 11 actividades primarias:

  - Mercadeo de productos y servicios del CATIE.
  - Desarrollo de relaciones públicas con las instituciones nacionales.
  - Supervisión estratégica de las actividades del CATIE en el país.
  - Consecución de fondos para nuevos proyectos.
  - Desarrollo de nuevas alianzas institucionales.
  - Soporte y coordinación de las actividades del CATIE en el país.
  - Administración e implementación de proyectos.
  - Actividades de información.
  - Desarrollo de mecanismos institucionales.
  - Asistencia Técnica.
  - Administración de la Oficina.

- Desarrollo del Sistema de Información ILIS (Institutional Linkages Information System). Durante 1997 se lograron avances importantes en el desarrollo de ILIS como una herramienta de información y monitoreo de a quién el CATIE brinda productos y servicios (tipo de cliente, cobertura geográfica, tiempo, servicios rendidos, productos enviados), al igual que los servicios que el CATIE recibe. ILIS es una serie relacionada de bases de datos que pueden informar sobre organizaciones y personas que tienen relaciones con el CATIE y sobre el tipo de estas relaciones. Contiene una base de datos de organizaciones, otra de personas y una para cada tipo de relaciones.

- Durante 1997 se realizaron esfuerzos importantes en el campo del desarrollo de la telemática y teleconferencias. Se finalizó el año con los planos del nuevo edificio de Teleconferencias y el cartel de licitación adjudicado. Se completó la conectividad de la red interna de cómputo por medio de fibra óptica y se logró

un convenio con RACSA-ICE para incrementar a 256 kbps la red de Internet, lo cual se implementará en 1998.

- El proyecto de hacer del CATIE en un centro de información seleccionada (information clearing house), impulsado por la Dirección General, tiene cuatro componentes básicos, accesibles "on – line": la página web, los servicios de información científica, los servicios de apoyo a decisores y una pizarra de información para la comunidad científica y tecnológica. Se han logrado avances significativos en su desarrollo, pero no será hasta 1998 que una versión preliminar podrá estar disponible a la comunidad internacional.

- En cuanto a las acciones de Capacitación, el año 1997 mostró cifras importantes:

  - Se realizaron 348 eventos con participación de 7.221 personas.

  - De esos eventos, 88 se realizaron en el CATIE (1.209 participantes) y 260 en los países miembros (6.012 participantes).

- En cuanto a servicios informáticos de soporte, la Unidad respectiva atendió durante 1997 un promedio de 12 solicitudes diarias. Igualmente ofreció a lo interno de la Institución 37 cursos cortos en 5 diferentes temas que fueron atendidos por 323 participantes.

- Los servicios brindados por la Biblioteca Conmemorativa Orton alcanzaron las 18.00 solicitudes, siendo el 83% de ellas solicitadas por los estudiantes y miembros del personal técnico de la Institución y el 17% restante Se brindó a usuarios externos. Más de 60.000 documentos fueron circulados y se registraron más de 20.000 consultas a las bases de datos.

- Se publicó el primer catálogo de publicaciones del CATIE y se cuenta actualmente con más de 2.000 suscripciones en las Revistas Técnicas del Centro (MIP, RAFA y RFCA).

- Se canalizaron a través del Programa de Proyección 77 consultorías para misiones en los países miembros.

- Se atendieron más de 1.000 visitantes en la sede del Centro en Turrialba.

- Se participó en dos ferias científicas y seis exhibiciones en eventos nacionales e internacionales. Para ello se adquirió un conjunto de anaqueles móviles en los que se ha estandarizado este tipo de presentaciones, tanto en el idioma español como en inglés.

ANNUAL REPORT

WHAT IS CATIE?

CATIE, headquartered in Turrialba, Costa Rica, is an International non-profit institution for research and graduate studies in agricultural sciences, management of natural resources and related environmental matters in the American Tropics.

Our mission is to **improve the well-being of humankind by applying scientific research and higher education to the development, conservation and sustainable use of natural resources.**

Our commitment **is to make a substantive, measurable impact on economic growth and social development in Tropical America and on the conservation of its natural resources and environment.**

Our strengths:

- Our three basic activities, research, teaching and outreach, are strongly integrated.

- We cooperate closely with national, regional and international organizations and institutions, whether public, private, non governmental or academic, in our Member Countries and other nations throughout the world.

Our motto:

"Producing while Conserving, Conserving while Producing"

guides our work.

RESEARCH

Our research generates knowledge, methods and technologies with the ultimate aim of fighting poverty and arresting the deterioration of natural resources and the environment.

We focus on:

- FORESTRY AND AGROFORESTRY SYSTEMS
- STRATEGIC INPUTS FOR SUSTAINABLE AGRICULTURE
- VALUATION OF NATURAL RESOURCES

Our **Forestry and Agroforestry** research generates technologies and incorporates them into the management of agroforestry systems, natural forests and forest plantations.

Beneficiaries of this work include: forest communities, small farmers, commercial production enterprises and urban consumers.

Our research on **Strategic Inputs for Sustainable Agriculture** follows two lines:

- We hold collections of plant genetic resources, including coffee, cacao, pejibaye (peach palm, or Bactris spp.) and tropical fruits. Managed with technical excellence and economic and biological effectiveness, the collections constitute an asset that constantly grows and renews itself. From the collections we distribute superior germplasm to user institutions and organizations in client countries, where it is used for the development and selection of varieties with improved performance under the many varied local conditions.

Final beneficiaries of the plant improvement cycle are peasant farmers, agricultural and forestry production enterprises, rural communities and urban consumers.

- Integrated pest management (IPM) research cuts the costs of agricultural production and reduces the risk of poisoning people and contaminating the environment. In close cooperation with farmers, IPM prudently balances:

- Breeding of pest-tolerant and resistant plant varieties;

- Biological pest control, using natural enemies of pests rather than toxic chemicals;

- Crop management practices that impede the development and spread of pests;

- Minimum use of pesticides, with the understanding that some pesticide use is generally unavoidable;

- Economic studies to develop the most profitable combinations of pest-control options; and

- Social research to identify pest-control methods that are acceptable to farmers, especially peasant farmers.

Researching the **Valuation of Natural Resources**, we investigate the value to society of:

- Soil conservation, to maintain soil productivity and prevent environmental damage from soil erosion.

- Recreation and ecotourism, to safeguard the welfare and mental health of an increasingly urban world.

- Carbon fixation by forests and tree plantations, to prevent global warming.

- Preservation of biodiversity, to protect species that, in the future, may help us ward of pests and diseases and provide us with new services.

- Protection of the water cycle through conservation of forests and reforestation, to avoid interrupting the cycle, which would impoverish us and lead to desertification.

Appropriate valuation of natural resources underpins further research which is aimed at developing mechanisms that governments and institutions can use to encourage conservation, reduce social and market pressures on ecosystems, charge other countries and organizations for the cost of ecological and environmental damage they have caused, and generate wealth and distribute it equitably.

Our research on the valuation of natural resources is motivated by the lack of incentives for communities and producers to take better care of natural resources and by the absence of mechanisms which would force those responsible for resource damage to bear the costs. Consequently, we seek ways to:

encourage conservation,
generate wealth and
discourage damage.

CUTTING-EDGE TECHNOLOGY SUPPORTS RESEARCH

Our research draws on appropriate methods from many disciplines. However, CATIE excels in two specific areas of research support technology:

Biotechnology, and
Geographic Information Systems (GIS).

Biotechnologies deployed in our laboratories include tools for characterizing our germplasm collections at the molecular level, as well as techniques for genetic transformation of high-priority species through gene splicing.

With our GIS infrastructure, we geo-reference not only biophysical and environmental information, but also social and economic data, as a routine input to our research. At the same time we advise and train colleagues from institutions and organizations in the region that are developing their own GIS capabilities.

AN ARSENAL OF TECHNOLOGICAL OPTIONS

Over the years, CATIE has equipped national organizations and institutions, whether public, private, non-governmental or academic with a veritable arsenal of technological options. Receiving institutions deploy these tools, improving production and productivity in farms and forests, and conserving natural resources and the environment.

We offer a broad range of solutions, including:

- Varied approaches for managing complex systems, such as watersheds, natural forests, and natural protected areas;
- Methods for conserving biodiversity in ex situ germplasm collections and in situ natural vegetation;
- Improved production systems for small- and medium-scale farmers, including agroforestry and integrated pest management systems for vegetable and coffee growers, and agroforestry and livestock systems for dairy and goat producers;
- Multi-purpose trees for diversifying the income base of both small-scale farmers and larger scale enterprises;
- Community management of natural resources based on participatory methods; and
- Participatory incorporation of women into resource use and conservation.

GRADUATE STUDIES

Our graduate school educates professionals so that they may become committed to sustainable development and equipped with the knowledge and skills necessary to be effective and efficient agents of change for the productive, conservation-oriented use of natural resources and protection of the environment.

Graduate education operates in close cooperation with our research work. We offer Master of Science and doctoral degrees in two broad areas:

Sustainable Tropical Agriculture with

- Ph.D. in agroforestry and
- Master of Science in:
  - Ecological agriculture, and in
  - Agroforestry systems; and

Integrated Management of Natural Resources with

- Ph.D. in tropical forestry and
- Master of Science in:
  - Management and conservation of tropical forests and biodiversity, and

- Environmental economics.

Our Masters degree has a long tradition: with over fifty years of experience, it is the oldest and longest-running program of its kind in Latin America and the Caribbean. It boasts more than 1000 alumni active in the region, with over 50 more being added every year. Our doctoral degree is offered through a cooperative program with universities in the United States, Canada and Europe; the first students were admitted in 1996.

ALUMNI: LEADERS AND AGENTS OF CHANGE IN THE AMERICAN TROPICS

National alumni associations offer graduates a forum where they can keep in touch with one another and with their alma mater. Our graduates have excelled as innovative professionals promoting better use and conservation of resources while teaching others to organize such activities more effectively. Holding prominent positions in public, private, non-governmental and academic institutions, they serve as leaders and agents of change, both in their home countries and in regional and international organizations. Our alumni roster features the names of cabinet ministers, university presidents and deans, directors and general managers.

OUTREACH

We project ourselves in society through services, products and activities that foster economic growth, social development and conservation of natural resources and the environment throughout the region.

Our efforts focus on three strategic functions:

- Management and dissemination of information,
- Development of human resources through training and
- Dissemination of land-use technologies and management systems.

We closely monitor the ever-changing needs of the countries and their institutions and organizations to make sure our services, products and activities continue to be relevant.

DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION

We compile, integrate, publish and disseminate information produced by CATIE and others to support the activities and, especially, the decision-making processes of those engaged in agricultural and forest production or in the conservation of natural resources and the environment.

Information users include:

- Farmers and foresters, especially small-scale or resource-poor producers,
- Technical experts,
- Scientists,
- Community leaders,
- Institutional leaders,
- Opinion makers,
- Legislators and policy makers.

We deploy a broad range of modern media, including: Printed, Electronic and Optical media; Audiovisuals and Multimedia.

The Orton Memorial Library at CATIE offers documentation services in agriculture, forestry and natural resources. Jointly owned by CATIE and the Inter-American Institute for Cooperation on Agriculture (IICA), it is the largest library of its kind in Tropical America.

TRAINING AND CONFERENCES

We provide training services to develop the cognitive abilities and technical skills of professionals as a means to strengthen the operating capacity of organizations and institutions for agriculture and forestry and for the conservation of natural resources and the environment.

Training

Our courses carefully balance theoretical and practical instruction. They last from a few weeks to several months. Additionally, we offer shorter events (up to one week long). Together, these training activities number some 200 events per year. Our research programs also offer in-service training opportunities.

Conferences

Conferences are an important communication tool. They provide a forum to exchange information and knowledge; build consensus; and plan, follow-up and evaluate projects and programs.

We not only hold many events of our own but also offer services and infrastructure (meeting rooms, communication facilities, dining rooms, lodging) for non-CATIE events.

TECHNOLOGY DISSEMINATION

To improve agricultural and forestry production and conserve natural resources and the environment we promote the adoption and use of:

- Knowledge, information, and technologies, as well as
- Model management and organization systems

This is accomplished by means of various mechanisms such as:

- Technical advisory assistance,
- Research and development projects and
- Multilateral cooperation.

Technical advisory assistance

We offer technical advisory assistance both to research and development institutions and organizations, extension services and development projects and to planners and policy makers.

Research and development projects

We implement demonstration and development projects in our fields of technical expertise, including projects for the communal management and diversified use of natural forests, reforestation, and integrated pest management.

The term "research and development" (R&D) was originally coined in the industrialized world to refer to two phases of a single process: basic research and the application of research for the development of new marketable services and products.

In the rural sector of developing countries, the "D" of R&D actually has two different meanings that exist side by side and are generally indistinguishable from one another: development of new services and products, and social and economic development based on the use and application of know-how and technology.

CATIE regularly cooperates with national organizations and institutions to carry out projects funded by national, regional and international development agencies, official development aid programs in industrialized countries, and philanthropic organizations. These projects conduct fundamental research, develop and test methods, technologies, services and products, and contribute directly to social and economic development for the populations involved. The balance between "R" and the two types of "D" varies among projects. Some focus more on research, others on technology development, still others stress socioeconomic development based on the adoption of technologies, organizational methods and policies.

Recent R&D projects in the Central American isthmus and Panama have addressed, and continue to deal with, natural forest management, forestation and reforestation, integrated pest management and watershed management. In

addition to the projects' direct impact, there is a twofold outcome: firstly, proven models of social and economic development projects that the countries can replicate confidently; secondly, new research issues that address previously unnoticed problems as well as second generation problems.

Multilateral cooperation

We are involved in many cooperation networks assuming various roles such as those of participants, coordinators, facilitators or leaders. In particular, we encourage networks of development projects as a way to:

- Facilitate the exchange of information among members.
- Promote the standardization of methodologies, so that: results are comparable; shared information systems can be established; and technologies and management systems can be adopted more widely.
- Capture economies of scale in publishing, in the use of resources and in the development of human resources.
- Ensure the support of local organizations and decision makers through their commitment to multilateral initiatives which bind more strongly than local ones.

KEEPING SIGHT OF NATIONAL NEEDS

We are committed to achieving a verifiable impact on economic growth, social development and conservation of natural resources and the environment in the American tropics. This means that we must respond to the priority needs of the region's countries so that our actions are consistent with them and our services and products are relevant.

To keep abreast of the countries' needs we are attentive to a number of sources of information:

- Producer associations,
- CATIE's authorities (Council of Ministers, Board of Directors),
- Our National Advisory Councils,
- Our National Technical Offices,
- Organizations and institutions with which we cooperate,
- National, inter-governmental, regional and international fora,
- Alumni associations and
- Our own technical staff

We tap these sources through surveys, meetings and visits.

National Technical Offices

CATIE has National Technical Offices in El Salvador, Guatemala, Honduras, Nicaragua and Panama. They are the Center's permanent base of in-country operations and provide a key link to national institutions and organizations.

Under the leadership of a National Technical Coordinator, each Office coordinates CATIE's in-country activities. They identify opportunities to provide more and better services and products and to strengthen and broaden technical cooperation. The also serve as a permanent liaison with national institutions and organizations, local offices of international development agencies, and the media; and distribute CATIE's products and services.

BALANCE BETWEEN HEADQUARTERS AND DECENTRALIZED ACTIVITIES

We are very attentive to the need for a healthy balance between activities at headquarters, maintaining our presence in the countries, and distributing our services and products among clients and partners. We strive to avoid excessive concentration at headquarters by maintaining National Technical Offices, participating in networks and decentralized projects, and making use of electronic communications and teleconferences. At the same time, we endeavor to reap the benefits and capture the economies of scale associated with:

INSTITUTIONAL DEVELOPMENT AND FUNDING

As any institution, CATIE needs to look to its own development and remain sustainable. This entails three groups of activities: strategic surveillance, external cooperation and procurement of financial resources.

Strategic surveillance means that CATIE constantly collects, analyzes and interprets information on macro-political, economic, social and institutional trends so that it can then adjust appropriately to the ever-changing institutional context.

External cooperation seeks to build alliances with advanced organizations and institutions to strengthen and enhance our own capacities.

To procure resources, we prepare project proposals and cooperation plans and submit them to development agencies (national, regional and international). These projects expand the funding base required to discharge our duties.

STRATEGIC ALLIANCES FOR RECIPROCAL STRENGTHENING

We combine efforts with the following strategic partners, to jointly pursue our mission:

AGRARIAN UNIVERSITY OF WAGENINGEN	The Netherlands.
CIAT	International Center for Tropical Agriculture.

CIFOR	International Center for Forestry Research.
CIRAD	Center for International Cooperation in Agricultural Research for Development, France.
COLORADO STATE UNIVERSITY	USA.
COSUDE	Swiss Cooperation for Development.
DGIS	General Directorate of International Cooperation, The Netherlands.
GTZ	German Agency for Technical Cooperation.
ICRAF	International Center for Research in Agroforestry.
IDRC	International Development Research Center.
IPGRI	International Plant Genetic Resources Institute.
ISNAR	International Service for National Agricultural Research.
IUCN	International Union for the Conservation of Nature
MAE	Ministry of Foreign Affairs, France.
NRI	Natural Resources Institute, United Kingdom.
ORSTOM	Office of Overseas Scientific and Technical Research, France.
TEXAS A&M UNIVERSITY	USA.
UNIVERSITY OF ALBERTA	Canada.
UNIVERSITY OF FLORIDA	USA.
UNIVERSITY OF HELSINKI	Finland.
UNIVERSITY OF HOHENHEIM	Germany.
UNIVERSITY OF LAVAL	Canada.
UNIVERSITY OF VETERINARY MEDICINE	Denmark.
UNIVERSITY OF WISCONSIN	USA.
WWF-US	World Wildlife Fund, USA.

SPONSORS AND DONORS

CATIE is a non-profit organization. With its various activities, it generates income to cover some of its expenses, but it could not possibly survive without the generous support of many sponsors and donors across the world, committed to our shared mission. To them we extend our gratitude!

MEMBER COUNTRIES

CATIE's member countries are: Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Venezuela. Several other countries - Bolivia, Brazil, Colombia, Ecuador, Peru, and several nations of the Caribbean have expressed interest in becoming members of CATIE.

Sources of funding
Investments in 1996, which topped US$16 million, came from the following sources:

SOURCE	% OF BUDGETED INCOME
Annual quotas from member countries and the	

Inter-American Institute for Cooperation on Agriculture	11.9
Projects funded by donors and development agencies	40.7
Donor contributions (Denmark, Sweden, Switzerland) to CATIE's core budget	14.9
Resources generated by CATIE activities	26.0
Fundatropicos (CATIE support foundation)	6.5
TOTAL	**100.0**

FINANCIAL SUPPORT

The following countries honor us with generous financial support, through various institutions and organizations:

CANADA
DENMARK
FINLAND
FRANCE
GERMANY
JAPAN
THE NETHERLANDS
NORWAY
SWEDEN
SWITZERLAND
THE UNITED KINGDOM
THE UNITED STATES OF AMERICA

We also receive financial support from the European Union, the World Bank, the Inter-American Development Bank, and the American Cacao Research Institute.

To this we must add human, physical and financial resources worth approximately three million dollars, deployed yearly in the framework of technical cooperation with over 200 public, private, non-governmental, and academic institutions and organizations in CATIE's member countries.

INFRASTRUCTURE

CATIE's infrastructure is tailored to its activities. The campus, experimental plots and farmland at headquarters in Turrialba cover nearly one thousand hectares. An experimental farm near Port Limon in the Atlantic Zone of Costa Rica covers another 100 hectares. Headquarters' buildings cover over 45,000 square meters including fully equipped laboratories and greenhouses, class and conference

rooms for the graduate school and training program, an up-to-date computer center, offices, housing for researchers, senior faculty and graduate students, lodging and dining facilities for participants in conferences and training, and the Orton Memorial Library.

The Center also houses an international club for recreational and social activities, sports facilities including an excellent swimming pool, and a bilingual primary school.

AUTHORITIES AND MATRIX ORGANIZATION

CATIE's governing authorities are the Inter-American Board of Agriculture (IABA), the IABA Council of Ministers, and the Board of Directors. The Director General follows their guidelines and he, in turn is supported by a staff specialized in finance and administration, strategic planning, and external cooperation. The Director General heads an organizational matrix made up of the Research Program, the Graduate School and the Outreach Program. Scientific and academic staff are assigned to administrative units called technical areas that permit close coordination among research, education and outreach activities. This organizational structure is summarized below.

IMPACT: OUR "RAISON D'ÊTRE"

...If the know-how, technologies and alternative practices are not available and are not put into the hands of end users...there is hardly a justification for the Center to exist...

...Clear, measurable indicators should show whether we have truly contributed to the sustainable use of ecosystems and, therefore, to breaking the cycle of rural poverty and degradation of the land...

Agenda for a Critical Decade
CATIE Strategic Plan, 1993-2002

I. RESEARCH AND EDUCATION ACTIVITIES

SUSTAINABLE TROPICAL AGRICULTURE AREA

The Sustainable Tropical Agriculture Area (AATS) has as its objectives, to generate, validate, and promote technological options that improve farming productivity, making sustainable use of available resources while increasing income to farmers and food to the population in general. The existence of AATS is justified by the increase in the demand for food in a population that is continually growing, and by the need to make food production compatible with the well-being of future generations.

Sustainable Agriculture is considered to be an amalgam of technologies that when integrated into productions systems, satisfies production needs in close harmony with conservation and rehabilitation of natural resources. All this is viewed within a context of prevailing cultural, social, economic and ecological turmoil.

The following units are included in AATS:

- Biotechnology Unit: whose main objective is the molecular characterization of genetic resources and to micro-propagate selected materials.

- Plant Genetics Resource Unit: supports the collection, conservation, evaluation, and molecular characterization, documentation and distribution of germplasms.

- Plant Protection Unit: generates integrated pest management technologies, which can be extrapolated into different production systems.

The financial situation of the Area during 1997 is shown in Table 1.

Table 1. Financial situation of AATS during 1997 (in thousands $US)

Item	Core	Projects	Custodial Funds	Total
Headquarters	242,336.78	639,018.95	----------	881,355.73
Biotechnology	229,235.91	16,093.76	60,033.64	305,363.31
Plant Protection	85,095.41	318,328.52	34.914.39	438,338.32
Genetic Resources	79,078.11	86,078.80	14,503.83	179,660.74
Others	148,665.01	----------	54,326.86	202,992.57
TOTAL	784,441.92	1,059,520.03	163,778.72	2,007,710.67
%	39.06	52.77	8.17	100

BIOTECHNOLOGY UNIT

Coffee Program

The main objective of this program within the Unit is to support the Regional Crop Improvement Program (PROMECAFE). The program is run by IICA and the member countries' Coffee Institutes through their extension and cooperation programs and by CATIE in its fundamental component of researching cultivar improvement.

There are two components within the Biotechnology Unit: i) the identification of the molecular character of genetic resources in support of parent plant selection for hybrids, ii) the development of an *in vitro* multiplication methodology for improved F1 hybrids that cannot be seed propagated.

With regard to "characterizing molecules", during 1997 several activities were completed:

- 30 molecular markers were evaluated (RAPD) to detect polymorphism of 130 *Coffea arabica* individuals in the CATIE collection.

- 80 new ORSTOM individuals were introduced into the CATIE collection.

- Four wild coffee plants in the CATIE collection were identified as sterile males.

- Genetic resources continue to be studied for their resistance to rust, nematodes and CBD.

- The first stage of the INCO project (Sustainable improvement of nematode resistance in coffee cultivars (*Coffea arabica* L.) of Central America: enhanced use of genetic resources by the development of marker-facilitated selection programs) was started. Within the framework of this program, nematode resistance in an F2 population (*Meloidogyne exigua*) and the *in vitro* introduction of 48 F1 hybrids to see future resistance were evaluated.

The micro-propagation component's work during 1997 opened the door to two important achievements in improved material dissemination:

- Using "bioreactor" simplified RITA, coupled with the two stage improvement that is key to the somatic embriogenesis protocol (embryo development and maturation) permit, for the first time, the complete development of somatic embriogenesis in suspension until germination. The only manual intervention necessary in this process is a change in medium.

- The second important achievement last year was the development of direct somatic embryo acclimatization. This process enables them to mature in a nursery.

These achievements are new results in the field of micro- propagation. Because of these, an important decrease in production costs is expected; which is essential to the successful distribution of improved materials in the regional countries. During 1997 the first 5 improved hybrids were multiplied. These hybrids were planted to verify their genetic characteristics ergonomically. This test is part of a regional network of tests (25 sites) to validate improved hybrids and diffusion methodologies. It is estimated that two more years of research and validation are needed in order to develop a protocol for the large-scale production of medium material.

Forest Species Program

This program seeks to develop a cellular regeneration system that supports the dissemination of information on genetic improvement, forest species conservation, and molecular characteristic identification. These aspects support selection, conservation and improvement programs. Both components are new, only a little more than a year old.

During 1997, an attempt was made to develop a multiplication system for micro stakes of *Swietenia*. The results showed the feasibility of the process. In addition, the same embriogenesis regeneration model that is used on coffee was adapted to mahogany. This work has not been completed. One important task this year was the attempt to develop collaboration between CATIE's other forestry units. Until now, the idea of using biotechnological tools to support the conservation of endangered forest species had not been identified as a possible point of integration. A proposal was written on the subject. Additionally, as part of the work, a workshop was structured on the Central and Latin American levels to be held at the next BioNet conference in Havana in 1998.

With regard to the identification of molecular characteristics, in 1997, efforts were made to develop an efficient DNA isolation technique for *Swietenia sp.* Also the PCR protocols were defined and the selection of polymorphic primers was started. Valuation of these results is expected in 1998.

Plantain Program

The objective of the program is to develop the necessary biotechnological methodologies to develop a non-conventional improvement program. The specific objectives for 1997 were: i) The improvement of the first stage of the regeneration process (callogenesis). ii) The development of genetic transformation tests using the proliferate embryo regeneration system developed in CATIE. iii) Adaptation of a cultivation technique in cellular suspension of the genotypes of interest in the region, in support of the INCO project which was

started at the end of the year ("Optimization of new strategies for local market banana improvement"). iv) Development of a new embriogenesis technique, using female flowers as the initial explant.

Among the more than 20 treatments that were evaluated, three were found to improve the callogenesis phase; although this stage is still a weak point in the regeneration system. The fertile embryos do not show promise as genetic transformation material. Based on the 1997 results, it is believed that cellular suspensions are better-adapted for this purpose.

The Unit was successful in adapting the cellular suspension methodology; and as a result, four genotypes were regenerated using this technique. The results are important for the INCO program's success, which has the objective improving the fusion of cellular suspension protoplasts. Also, for the first time, feminine flowers were successfully used as explants in callogenesis. This result opens new opportunities for non-conventional improvements of plantain genotypes that do not have masculine flowers.

Fruit Program

The research on the micro-propagation of *Sapotaceas* has developed within the framework of the project on Conservation and Use of -American Native Species (CATIE/IPRI-BID Agreement). The objective of the project is to develop micro propagation techniques for "caimito" and "zapote" for the conservation and use of germplasm. Among the results obtained during 1997, the progress made in the propagation of "caimito" micro stakes stands out. A satisfactory response in axially budding was found using different combinations of auxins. The response was not so favorable in "zapote." Continued research is necessary.

The results show that exposing the explants for a prolonged period of time to crops with high auxin levels induces the formation of callouses at the base of the explants. More research is necessary to find the best auxin levels to promote axial budding and prevent callous formation which makes the micro stake root-forming process more difficult.

PLANT GENETICS RESOURCE UNIT

The Yam Bean Project

This project finished its activities in February, 1997, after the second phase that began in October of 1992. The project received economic support from Denmark through the Royal Agricultural and Veterinary University with financing from the European Economic Community. The general objective of this project was to characterize and evaluate the yam bean germplasm, integrating research on agricultural practices to select genotypes for future improvement studies and

also to offer management recommendations for obtaining adequate yields under specific climate and soil conditions.

Efforts during the first months of the year concentrated on the preparation of the final report presented in May.

Native Tropical-American Fruit Project, Sapotaceas Sub-Project

This project was financed through the International Plant Genetics Resources Institute (IPGRI/BID Agreement) and completed its activities in March. The established objectives for the development of the project were: characterization of sapotaceas, conservation, regeneration and management of the collection and training personnel in regional countries about the grafting system developed in CATIE.

35% of the zapote collection was characterized, 18% of the chicozapote variety and 61% of the caimito collection. For this reason it is important to continue with this task to determine the total existing variation in the collections.

Some flavorful genotypes were preliminarily identified. These trees should be propagated asexually (especially zapote) in order to study production behavior and resistance to pests and disease as well as to verify that they maintain their quality.

The implementation of several management practices has improved the general condition of the collections, nevertheless, it should continue with all the activities to diminish damage caused by disease in the zapote collection .

Training on the grafting technique developed in CATIE showed that there is great interest in zapote in this region. At the same time, it is necessary to develop other asexual propagation techniques that would facilitate the distribution of better genotypes.

A propagation process continued for *Pouteria sapota* trees preliminarily selected for their quality. Two hundred and sixty four trees were grafted from 16 individuals in the nursery. Eight hundred trees remain in the nursery to use in the multiplication process. The grafted trees have two main objectives, first to complete a trial for selected genotypes, and second to establish a shade fruit tree in the cocoa hybrid experiment in La Lola.

In June, the Project's external evaluation was carried out with the participation of Dr. Mikkel Grum (Project Coordinator), Dr. Ramon Lastra (Regional Director of IPGRI), Dr. Luigi Guarino (of IPGRI), Dr. Freddy Leal Pinto (evaluator), M.Sc. Patricia Quesada (University of Costa Rica) and M.Sc. Luis Guillermo Gonzalez (consultant) who analyzed the Project results. The Project's achievements and the final report were presented during this visit.

Maintenance and Conservation of the International Cocoa Collection

These activities are made possible by the $20,000 annual donation of the American Cocoa Research Institute (ACRI) to maintain the International Cocoa Collection. All management labor was covered by these funds including: weed, disease and pest control, fertilization, pruning of both the cocoa and shade trees, cleaning of the drainage ditches, and fruit harvesting. The cocoa collection has expanded with 87 individuals collected last year in the Experimental Station of Mayaguez, Puerto Rico. At the same time, the cocoa nursery continues preparing rootstock for grafting selected resistant black pod and Moniliasis genotypes in order to establish a cloning experiment in La Lola early next year. Other activities renewed cocoa clones affected by *Rosellinia spp.*

From August 5-7, an ACRI mission visited CATIE to see and evaluate the maintenance work done on the cocoa collected and the advances of the ACRI-Moniliasis Project. The visitors were pleased by the general condition of the collection and by the interest CATIE showed in cocoa plant genetics as well as the recent introduction of germplasm from Puerto Rico.

Evaluation, Regeneration and Enhanced Database Management of Unique Resources from Mesoamerica

This project, financed by the United States Department of Agriculture (USDA) began its activities in January 1997 although its administration was established in October 1996.

One of the main objectives of the project is the regeneration and characterization of the Capsicum and Cucurbita collections, and to establish a database compatible with the USDA-ARS GRIN system. This would include newly collected data and older passport information.

The first project was the planting of 121 *Capsicum spp.* and 75 *Cucurbita spp.* plants to identify their characteristics. Of the pepper plants acquired, 15 died (12.4%) mainly because of germination problems. A relatively high number of plants had poor germination, which indicates an urgent need for a complete monitoring of this collection. Most of the squash plants achieved higher than 60% germination. Although 14 of the plants showed germination levels lower than 60%, none was less than 35% which favors the conservation of these plants. Using a germinator with 100% relative humidity and temperature controlled at 26°C, additional germination tests were done on a sample of the *Capsicum, Solanum, Physalis* and *Lycopersicon* plants. The results can be seen in Table 2. Most of the *Solanum* plants have germination levels less than 50% and 4 of them did not germinate at all. The original *Capsicum* samples also showed low germination levels. Of the 51 plants evaluated, 32 did not reach 50% germination levels and 4 did not germinate at all. The *Capsicum* samples

that had already been regenerated were in better condition. These germination tests help identify the plants that urgently need regeneration.

Table 2: Seed germination results of the genus *Physalis, Lycopersicon, Solanum* and *Capsicum*, in controlled temperature and humidity conditions.

Genus	Frequency Classes %					Total number of plants evaluated
	0	1-25	26-50	51-75	76-100	
Physalis spp.	0	1	3	6	3	13
Lycopersicon spp.	0	0	0	1	9	10
Solanum spp.	4	7	3	1	0	15
Capsicum spp. (original sample)	4	12	20	10	5	51
Capsicum spp. (regenerated sample)	0	7	11	9	6	33

Because the old 5□C freezer no longer functioned properly, a new freezer was installed at the beginning of October. The active tomato, pepper, cucurbitaceas and other smaller collections were moved. In addition, some remodeling was done in order to have two offices and a laboratory for seed management and processing as well as for characterization. Ordering and purchasing paperwork continues to acquire necessary equipment like electronic scales, recipients, thermometers, lab oven, dryer and glassware.

To bring the database up to date, a space was equipped with new furniture and an ALR computer loaded with an Intel Pentium CPU, 166MHz, CHIPS SIMM 16 MB, 2.5 G hard disk, 6X reading kit and 8X writing kit.

Area of Watersheds and Agroforestry Systems

The Watersheds and Agroforestry Systems Area (ACSAF) which includes the technical units Agroforestry Systems Development and Watershed Management, has the mandate to develop, validate and transfer sustainable land use technologies; particularly those methods that use woody vegetation. The principal funding sources for ACSAF in 1997 were: CATIE core budget, mainly permanent staff salaries; DANIDA (Denmark), which supported the coordination unit and the postgraduate program; and BMZ/GTZ (Germany), which funds pilot studies to develop and transfer AF technologies for the tropical humid lowlands of Central America. The Wageningen Agricultural University also continued to support the REPOSA team in Costa Rica. Work was concentrated in three priority sub-lines: agrosilvicultural systems for annual cropping of humid hillsides; shade trees with perennial crops; silvopastoral systems. These themes also form the basis for the specialized agroforestry postgraduate courses and short courses. In 1997, the principal activities were carried out in Costa Rica, El Salvador, Guatemala, Panama, Nicaragua, Honduras and Belize by 12 professional staff (Ph.D. or M.Sc).

Advances in Research

Agrosilvicultural systems for annual cropping of humid hillsides

Combining ploughing with alley farming brought considerable benefits by reducing below ground competition and accelerating nutrient release from accumulated organic matter. There might also be benefits through a reduction of accumulated soil pest populations: e.g. birds eat the white grubs (*Phyllophaga sp.*) brought to surface by ploughing. Preliminary results suggest that *E. poeppigiana* develops major roots all over the below ground surface of vegetatively propagated stakes, many of them growing horizontally. *Gliricidia sepium* develops major roots only at the lowest point of the stake in which mainly grow vertically. *Calliandra calothyrsus* seedlings develop vertical and horizontal roots and frequent pruning results in an accumulation of new sprouts close to the soil surface, which are able to develop their own root system. Thus frequent pruning of this species seems to favor the development of a very dense root system. According to the different root patterns of the three species, it is expected that soil tillage will affect *C. calothyrsus* more than *E. poeppigiana*, and will not affect *G. sepium*, because the major part of the root system of this species is concentrated below the plough-horizon. The bean crop developed a very superficial root system and it is expected that most bean roots will be found in the mulch layer.

An evaluation of organic amendments in Turrialba brought several interesting results: Bocashi -Japanese compost based on chicken manure- and other animal manures were best for supplying P. Using these amendments, it was possible to produce a crop even on extremely acid and infertile sub-soil that had

no bases and high aluminum content. Animal manure also increases earthworm populations. *Erythrina berteroana* mulch can be a good source of K and other bases. *Mucuna* (*Mucuna spp.*) is somewhat disappointing since it supplies only a limited amount of P and was an inadequate source of bases. The poor corn production obtained with *Mucuna* may also be due to increased disease incidence (excessive moisture) and pest build up (it may attract *Phyllophaga sp.* even more than *E. berteroana*). A combination of organic farming techniques to produce corn were successful (bocashi- supplied adequate nutrients; a mixture of garlic, peppers, and soap controlled pests; *Canavalia ensiformis* controlled weeds). Organically produced corn was of high quality and readily sold on the local markets. Work in Panama showed problems with *Acacia mangium*; it appears to acidify soil, contributing to a build up of toxic Al and Mn. *Canavalia ensiformis* was a very promising cover crop for corn.

A biomass and nutrient dynamics model was developed for bracatinga (*Mimosa scabrella*) natural fallow using published data. In a six-year fallow cycle, the model predicts nutrient exports in firewood of 751 kg/ha N, 43 kg/ha P, 300 kg/ha K, 285 kg/ha Ca and 103 kg/ha Mg. These quantities are larger than the amounts of nutrients returned to the soil at the time of harvest, suggesting that a build-up of soil reserves during the first five years of the cycle supply the deficit. Farm records have shown sustained firewood and crop yields in second rotation fallows. No data is available on atmospheric nitrogen fixation by bracatinga, nor on the nutrient contents in bark and wood of dead bracatinga trees. Biomass dynamics in bracatinga fallows is driven by strong self-thinning, a situation poorly documented in other fallow systems.

Shades trees with perennial crops

Formulae have been developed to use root collar measurements to estimate tree root length density, an indicator of competition, in coffee plantations shaded by timber trees such as *Eucalyptus deglupta*. Provisional results of a study of fine root distribution indicate that coffee roots are more responsive to localized soil nutrient concentrations, and hence fertilizer distribution, than are the tree roots. Quantification of the relative spatial distribution of fine roots of the two components will be used to develop provisional management recommendations that reduce nutrient competition between the trees and the coffee.

Under close-to-optimal conditions (1100 masl, deep volcanic soil), first-year production of coffee after complete pruning was 80% higher under heterogeneous (<30%) shade of pollarded *E. poeppigiana* than under homogenous (40 60%) shade. Although this difference is likely to become smaller with increasing age of the new coffee stems, the observed tendency corroborates the reduced shade requirement of coffee under good environmental conditions. The recommended shade level is central to the choice of species, spacing and management of trees.

Six agroforestry systems with cocoa (*Theobroma cacao*), plantains (*Musa AAB*), laurel (*Cordia alliodora*) were tested for their ability to increase income stability in the face of unstable market prices. Both cocoa and plantain had decreasing real prices, non-normal price distribution and auto-correlated data series. Non-normality (right skewness) results in a larger probability of the occurrence of low prices. Laurel prices also show auto-correlation, but they had both a normal distribution and a tendency to increase in the future in terms of real prices. Simulation models indicated higher expected incomes and less risky performance of diversified technologies as compared to the corresponding monocrops.

Models were developed for the analysis of systematic (per plant, row or plantation block) and per-stem pruning systems in coffee plantations. Model predictions adjusted remarkably well to observed yield patterns (model errors were estimated at 25% of observed yield) indicating that pruning alone can account for 75% of observed coffee yields.

Silvopastoral systems

During 1997, the research priority for silvopastoral systems was changed from an emphasis on forage trees to an emphasis on restoration of degraded pastures and integrating multipurpose as well as timber trees. Joint research activities with IDIAP in Panama were started with existing silvopastoral systems of *A. mangium* with *Brachiaria humidicola* to determine their potential in recovering marginal soils characterized by high acidity and Al saturation (see also above section on agrosilvicultural systems). An experiment was planted to study the ecological combining ability of trees and herbaceous grass-legume mixtures that have the potential to restore degraded sites. A research simulation to evaluate silvopastoral alternatives for recovering degraded lands, using linear programming as a tool to study land use and economic and ecological consequences is being prepared. A Ph.D. research proposal is currently being prepared to study tree- animal interactions and the socioeconomic value of timber trees in pastures.

A study was conducted to determine the effect of leguminous trees (*G. sepium* and *E. berteroana* pruned every four months) on soil fertility when they are planted in rows five meters apart in *B. brizantha* pastures. It is hypothesized that soil nutrient gradients exist in silvopastoral systems where trees are planted in rows. Results are currently being analyzed. After two years of rotational grazing the mortality of the original stem populations of *G. sepium* was greater than 90% whereas it was only 35% for *E. berteroana.* Moreover, *E. berteroana* maintained a stable population through new stem regrowth unlike *G. sepium*, which practically disappeared during the second year of grazing.

Commercial concentrates for feeding dairy heifers represent more than 10% of total operational cost. Heifers grazing African star grass (*Cynodon nlemfluensis*)

as a basal diet and supplemented with 100% concentrate (1 to 2 kg/animal/day) had mean daily live weight (LW) gains of 0.71 kg. Substitution of 33 and 67 % of the concentrate with morera (*Morus alba*) resulted in daily gains of 0.67 and 0.53 kg, respectively, but differences were not significant. Economic data is presently being analyzed.

Cratylia argentea is well adapted to acid infertile soils and it produces significant quantities of fodder in the dry season. However, intake of fresh forage fed to ruminants is very low. Intake of *C. argentea* increased significantly by 32.4 and 40.6% when it was previously wilted or treated with molasses. Furthermore, increased N intake from *C. argentea* in the diet resulted in a linear increase in the intake of the *Hyparrenhia rufa* basal diet ($Y = 1.423 + 0.0639 X$; $R2 = 0.89$).

An experiment was conducted to study the effect of increasing levels of morera in the diet, on rumen fermentation parameters and degradability of three tropical grasses (*H. rufa, Pennisetum clandestinum, and B. brizantha*) of contrasting quality. The hypothesis formulated was that increasing levels of morera in the diet would improve rumen fermentation parameters and this would contribute to increased degradability of fibrous species. The results showed that ammonia levels (N-NH3) of rumen liquor increased from 48.0 to 115.7 mg/l as the level of morera in the diet was varied from 0 to 100%. Molar proportions of propionic acid also increased (17.45% with 0% morera to 22.45% with 100% morera) which should contribute to increased milk production.

Miscellaneous

Survival, growth and site index studies for laurel (*Cordia alliodora*) in 50 permanent research plots were evaluated. Mortality rates were highest (up to 100%) in sites subjected to occasional flooding or with impeded drainage. Effective soil depth, pH, and risk of flooding determined a site index for laurel. Growth rates were mainly determined by the management intensity of the agroforestry systems in which laurel was planted. At the reference age of 5 years, high site indexes were found in young, managed cocoa plantations; low site index classes were found for pure laurel plantations, even on good soils.

An analysis of the socio-economic literature on agroforestry systems in Central America shows that most studies have focused on experimental rather than on widely used agroforestry systems. More research should be directed towards prevalent systems in the region, giving more attention to the evaluation of the benefits of agroforestry in terms of environmental improvement and risk handling due to product diversification. Existing literature has given too much weight to the financial analysis of agroforestry.

Humus from earthworm compost of coffee pulp contains 2.5 and 3% of nitrogen, 47 to 68% organic matters and has a pH between 7 and 8. Coffee pulp should have at least a two-week decomposition period before being provided to

earthworms as a feeding substrate. In general, the best physic-chemical characteristics of the humus were obtained by offering the earthworms coffee pulp, which previously had been decomposed for 28 days. Earthworm (*Eisemia fetida*) biological response (biomass and reproduction) was highest with densities of 24 thousand earthworms/m3. Humus production was higher at 24 and 48 thousand earthworms/m3 compared to 72 thousand earthworms/m3. 35 to 40% of pulp dry weight, previously decomposed for two or more weeks, is transformed into humus by the earthworms at densities of 24 and 48 thousand individuals/m3 of pulp but only 20 to 25% was obtained with 72 thousand individuals/ m3. To obtain greater efficiency in humus production (amount of humus per unit time) earthworms must be gradually given 10-cm deep coffee pulp layers.

As a result of several years of research on traditional tropical home gardens, an approach was developed to analyze them from a holistic and interdisciplinary perspective, taking into consideration their dynamic character. The starting point is the inter-relationship between the human environment, where the management decisions are made, and the natural environment (in this case the traditional agroforestry system). This approach differs from the classical characterizations of these systems into vertical strata, which are not representative of their real structure.

An interdisciplinary research group, Ecological production of annual crops on hillsides, has prepared a listing of relevant CATIE activities, organized collaboration with national organizations (projects in Costa Rica) and planned new interdisciplinary research. Collaboration with the national coffee institutes of the Central American countries (members of PROMECAFE) has begun with a special training course on research methodologies for their staff and a strong CATIE participation in the Latin American Coffee Symposium. Plans for joint applied research on timber trees in coffee plantations are being drawn up for two scenarios: using existing resources of these institutes and CATIE; and in the event of obtaining additional outside funding. Internal collaboration has been established between ACSAF and the Area of Sustainable Agriculture (MIP for Coffee-Shade and for Hillside Production Systems) and with the Area of Socio-economics (evaluation and classification of traditional shade coffee management systems).

Eighty-five documents (including thesis) were reviewed and published by ACSAF staff and students. The principal publications include the journal "Agroforestería en las Américas" and articles in international scientific journals. Formal scientific presentations were made on four articles at international or regional symposiums/congresses in addition to participation in many national meetings.

Conclusions

Significant steps were made (as in all of CATIE's technical areas) to reorganize, prioritize, integrate and improve the efficiency of ACSAF's higher education and research activities. Although the nature of research involving trees, and of a post-graduate program, is that impact is only achieved in the medium-long term, quality improvements in ACSAF's products (e.g. journal publications co-authored by students) are already demonstrated. The adoption of a new focus on the importance of shade trees in coffee cultivation by the leading Latin American coffee organizations, documented during the 1997 Latin American Coffee Symposium, demonstrates that CATIE's results are relevant, influential and of high interest to its clients. This is also demonstrated by the fact that, in recent years, ACSAF has had approximately 80 applicants per year for the Agroforestry M.Sc. program, of whom half fulfill all of CATIE's requirements (including an entrance exam) but only 8-15 can be accepted because of a shortage of resources. Outreach activities during 1997 have not been neglected as is demonstrated by the listing of over 100 activities (Table 1). Including the new phases of the GTZ and DANIDA Projects, and an estimate of the new resources in the agroforestry component of the CATIE-NORAD IPM/AF Project, a total of $6,000,000 additional funds were approved for ACSAF in 1997. This fact demonstrated that international support for CATIE's 20 years old agroforestry program was in no way reduced but rather increased.

MANAGEMENT AND CONSERVATION OF FOREST AND BIODIVERSITY AREA

During the last 50 years, CATIE has earned clear leadership in research, instruction and training in tropical forest management, biodiversity management and conservation, and plantation silviculture. This Area's objective is to identify or develop options for ecologically sustainable forest management, that are, at the same time, economically attractive, socially acceptable and applicable to different types of forests.

In 1997, research lines, sub-lines and components were defined. They are detailed in the attached work scheme. It is understood that the research is done in a multidisciplinary framework, and that the biophysical aspects are interrelated with the social and economic aspects. In this way, there are no rigid divisions between research lines and sub-lines; on the contrary, it is hoped that there will be a certain level of overlap between them. The emphasis on participative research is added to the multidisciplinary methodology framework, which is especially relevant in rural development research schemes.

The Area has the following technical units:

- Natural Forest Management Unit (UMBN)
- Biodiversity Management and Conservation Unit (UMCB)
- Plantation Silviculture Unit (USP)

Within each Unit there are components or projects that correspond mainly to Research Line 4: Development of technologies for the sustainable management of forests and their biodiversity. Nevertheless, as mentioned above, the multidisciplinary character of the research is such that within each Unit there are also components that correspond to Research Line 1: improvement and conservation of agricultural and forestry species germplasms; and Research Line 5: socioeconomic valuation and analysis.

During 1997 the process began to consolidate the Area components to form and integral part of the three Technical Units. This manifested itself mainly in the Biodiversity Management and Conservation, and Plantation Silviculture Units. These two units had no formally appointed unit chief in 1997. The Unit consolidation phase began at the end of 1997 with the arrival of the Area chief and is still going on.

The Area has a total of 32 technicians, of which 13 have their doctorates and 19 their M.Sc. Of the 13 with doctorates, 6 are permanent personnel (Core Budget), and 7 are financed by the projects.

NATURAL FOREST MANAGEMENT UNIT

The mission of the UMBN is to foster, promote, and perform research, validation and technological dissemination activities appropriate to natural forest management. These activities are oriented toward reducing the level of forests converted to other uses, and increasing the area of managed natural forests in tropical America through a concept of diversified management. This contributes to the sustainable and fair development of the Region's countries. The Unit tries to fulfill its mission through its personnel and projects, in a stimulating and participative work environment that promotes creativity and personnel advancement.

The ultimate beneficiaries of the UMBN activities are the rural communities found within and around natural forests as well as other social agents that use the goods and services produced by the natural forests. Because of the obvious limitations of trained people and financing, the Unit cannot do its work directly with these beneficiaries; for this reason it works with institutions, technicians and organizations that, in turn, duplicate these activities.

The general objective of UMBN is to contribute to the development and adoption of natural neotropical forest management systems that are ecologically sustainable, technically feasible and economically and socially viable. To reach this general goal, the UMBN proposes the following specific objectives:

1. To establish the ecological, technical and socioeconomic bases necessary to develop and operate sustainable natural forest management systems.
2. To develop, and validate natural forest management operations that integrate ecological, technological and socioeconomic considerations.
3. Collect, process and make available to technicians, researchers and institutions, the information produced by the Unit's research and validation activities.
4. Increase the number of people skilled in the research and technological development of planning, performing and monitoring neotropical natural forest management in the region's countries.
5. Ensure the availability of qualified people and financing that will allow the integrated fulfillment of the UMBN mission and objectives.

The UMBN has two components: Research and Dissemination of information, which at the same time are composed of different projects and actions as described below:

Research Component

- Chair of the Ecology of Diversified Forest Production Systems (FUNDATROPICOS/COSUDE)

- CATIE/COSUDE Natural Forest Silviculture Project (PROSIBONA)
- CATIE/CIFOR Secondary Forest Production Project - PBS (BID and CIFOR funds)
- CATIE/UCR Forest Site Quality Cooperative Project (funded by PROSIBONA)
- Associated Expert in Secondary Forest Ecology (CIFOR)
- Dissemination Component
- CATIE/CONAP El Peten Forest Management Project (USAID funded)
- CATIE/COSUDE Project for the Technological Dissemination and Fostering of Professional Training in Natural Forest Management (TRANSFORMA)
- International Course on Silviculture and Natural Tropical Forest Management (CATIE strategic course)
- Expert in Natural Forest Management assigned by the Dutch government

Associate from ASDI in forestry extension

Main achievements of the period

A. Research

Studies done:

The level of achievement of the UMBN Research Component was evaluated in three meetings held during the year, one per quarter. In the first two meetings the level of advancement of programmed work was measured and in the last meeting, in December, the Project's overall fulfillment of projected goals was evaluated in terms of the results produced as outlined in the 1997 Annual Plan of Operations.

The following are the results of the work group evaluation.

Basic and applied research

Product 1.1. Models to simulate and predict: growth, yield and natural regeneration of primary and secondary forests.

Based on soil, growth, yield and natural regeneration information in primary and secondary tropical humid forests, a simulation and prediction model was created (model SIRENA) for one of the key sites. This model was developed with the help of Dr. Denis Alder, a specialist in natural forest modeling. A doctoral student was contracted to assist following-up the model for the next three years.

Product 1.3. Knowledge gained about the effects of silvicultural treatments on the soils and fauna of the forests studied.

A particularly important aspect of the Research Component of UMBN is the application of silvicultural treatments on all the key sites. In this moment, we have one of the most complete sets of information on forest response to these interventions.

During the year, information has been generated in a young secondary forest (El Roble farm): soils, distribution, and seed biology of forest species.

Adaptive research

Product 1.4. Knowledge gained on the economic and financial feasibility of the proposed management systems.

During the year, a financial analysis was done on Corinto and El Cerro farms. The first was completed and will be published during the first quarter of 1998. The second was not finished but the analysis will be available in the first quarter of 1998.

In 1997, characteristics of secondary forest use in the countries were identified, ending the fieldwork phase and beginning the analysis of the data acquired. The expected results were found: secondary forest should not be used if for soil recovery. Nevertheless, they can be harvested. One finding in Peru showed that in the closed frontier, a larger extension of secondary forest had longer rest cycles that appear dependent on the soil degradation.

Dr. Joyotee Smith and her collaborators in Peru and CIFOR presented their characterization results at the IUFRO workshop on secondary forests in CATIE in November. The talk will form part of the workshop report published as a book by CIFOR. In addition, a seminar was presented in November in Nicaragua, funded by UCA, PBS, TRANSFORMA and CCAD-BN.

Product 1.5. Knowledge was gained and preliminarily quantified on the ecological services that managed natural forests provide: biodiversity conservation, and atmospheric CO2 fixing and capturing.

Three research proposals were completed:

- Service as Carbon Drain: Valuation of the net CO2 captured in managed natural forests and secondary forests, carbon liberation cycles outside the forests and the associated economic value.
- Service in Biodiversity Conservation: Willingness of foreign and national tourists to pay for the use of sustainable managed natural forests as a form of guaranteeing minimum deterioration of the biodiversity in these ecosystems.

- Service Providing a Continuous Quality Water Source: There are differences in water quality in the different watershed areas, according to the land use.

The first proposal was put into action in collaboration with the Socioeconomic Environmental Area. With data on the key sites and by means of the SIRENA model, the carbon flows have been estimated in relatively long terms and financial analysis has been done that shows the costs and benefits of wood production with possible payment for carbon fixing and capture. The preliminary results of this research were presented in the Ecology and Management of Tropical Secondary Forests Conference (CATIE, November 10-12) and in the Environmental Economists Seminar organized by the Swedish Beijer Institute (San Jose, November 6-9).

The second proposal is in revision and is awaiting MINAE's signature, as SINAC will be a partner in the action. The third proposal was canceled, on the grounds that there was not enough time to adequately cover all three proposals.

Pro**duct 1.6.** Recommendations on operational techniques for the management of different forests.

Operational research in the key sites has reached stages in the management process that have rarely been achieved in tropical America. The recommendation phase moved into one of action and later to validation of management operations. In achieving this product, not only technical evaluations have been considered, but also a cost benefits analysis.

During the year, the protocol for a secondary forest plant inventory and a management plan for Villa Mills were drafted. Operational recommendations have been made based on the effects of ringing as measured in Corinto.

Product 1.7 A valid methodology for monitoring natural regeneration as applied to an operational level.

Due to the fact that the operational management models implemented are based on natural regeneration, information on the silvicultural state of that regeneration is particularly important in the planning stages. To take such information, a methodological proposal has been adapted from the Southeast Asian school and is being undertaken in collaboration with CODEFORSA.

The methodology was validated and is regularly used by postgraduate students and in the International Silviculture and Tropical Forest Management Course.

Information management

Product 2.1. A long-term regional network of research sites on natural forest management.

The network currently has 8 key sites: five in Costa Rica and one in Panama in three life zones. These are administered directly by CATIE; two in Nicaragua are administered by UCA.

During the year, work with UCA was strengthened through the support offered to one master's thesis. With regard to the other sites, measuring and maintenance continues.

Product 2.2. An information management system specialized to support Tropical American Natural Forest Management

With the help of Tomas de Camino, consultant specialist in information systems, SciBos was created: The management and forest information analysis system. A program was designed that allows one to take information by logging into a data metabase. All the information was reviewed to purify the quality, and the logic system was changed to improve its operation. Now it remains to validate the system, to do this, the users should adopt a new work method. A meeting was called for all the UMBN personnel, to present the system and give instructions on its use in order to begin the validation.

In addition, to avoid the introduction of inappropriate information, the Information Management Unit has prepared a Procedures Manual for Inputting Data.

Technical Disclosure

Product 3.1. Project results published in scientific, technical and popular print media.

The UMBN has developed an important task in the dissemination of its results above all in different national and international forums and days in the field. Nevertheless, the production of formal publications has not gone according to plan, in part because the writing process is slow and requires blocks of time that permit concentration and follow-up. The lack of awareness about the real work required for information analysis and writing processes negatively influenced the final production of publications. Nevertheless, the outlook is not entirely discouraging, and the level of progress on the papers slated for publication along with the consciousness gained on how to confront the process, suggest an excellent editorial production in 1998.

It was decided that the book on natural latifoliate forest management in tropical America, co-funded by CATIE, CIFOR and WWF, be restructured in such a way that only CATIE professionals would be responsible for chapter writing. This decision was made when the former method of sharing the responsibility with professionals from other institutions failed; that is to say, no progress was made on the book. The goal is to have a first draft by June, 1998. A meeting was held

at the beginning of the year for all those involved, to plan a work schedule and define responsibilities.

Networks:

Latifoliate Forest Management Network in Honduras (REMBLAH)

Its headquarters is in La Ceiba, Honduras. It is made up of 14 organizations from the public and private sectors involved in the forestry, social, and economic problems in this region of Honduras. The objective of the Network is to foster cooperation between the actors involved in the management of moist latifoliate forest for the enrichment of the sector." They propose to do this by:

- Planning, performance, follow-up and participative evaluation of the common processes in the generation of experiences.
- Supporting documentation activities, dissemination and interchange of experiences obtained by the members of the Network.

The institutions and member projects that provide funding for the Network are:

COHDEFOR	PDBL	COATLAH	PROINEL
CURLA	WARP	ESNACIFOR	Mocoron/MOPAWI/WWF
COSPE	CATIE(TRANSFORMA y OLAFO)		
FUPNAPIB	Sociedades Colectivas		

Rio San Juan Management and Conservation Network (REMARIO)

Its headquarters is in Rio San Juan, Nicaragua. The objective of this network is to be "an organization that disseminates information in a broad participative way that strengthens interchange and experience, information and training outlined in the Sustainable Development Strategy SI-A-PAZ, for the protection and conservation of latifoliate forests." The institutions and projects that provide funding for this network are:

Castillo Mayor's Office	ASODELCO/ACRA	Fundación del Río
ROCODEFOR	INRA	UNA
INTA	Escuela de Ciencias Forestales	
MARENA/SI-A-PAZ	Proyecto MADERAS	MEP
Proyecto Cuenca del Rio San Juan		MAG
CATIE (TRANSFORMA)		

Natural Forest Management Network for the Autonomous Region of Nicaragua's North Atlantic (REMAB-RAAN)

Its headquarters is in Puerto Cabezas, Nicaragua. This Network strives to be an "organization which fosters and coordinates technical cooperation and technological transfer efforts by means of training, disclosure, and technical assistance to promote an integrated management of the natural latifoliate forests in the region."

The institutions, NGO's, businesses and projects that provide funding for this Network are:

Municipal Mayor's Office	DANIDA	ADFOREST/MARENA
IDSIM	AFONIC	MARENA/ASDI
FADCANIC	SOLCARSA	MARENA/RAAN
WWF/Mikupia	Secretaria de Recursos Naturales	
RAAN	CATIE (TRANSFORMA)	URACCAN

BIODIVERSITY MANAGEMENT AND CONSERVATION UNIT

For several decades, CATIE has made important contributions to the fostering of adequate management of forest ecosystems, in harmony with biodiversity conservation. However, limited knowledge about tropical biodiversity, land tenancy insecurity, and unsustainable human intervention in the natural ecosystems has complicated this task. The objective of the Unit is to promote the sustainable use of tropical America's natural ecosystems and biodiversity in order to foster the economic and social development of rural and national communities and sponsor the conservation of natural resources.

The Unit develops its activities in latifoliate forest and mangrove ecosystems, as well as in buffer zones and biological corridors, protected areas and areas with non-timber forest products. The beneficiaries of the Unit are small farmers and forest harvesters, governmental and private organizations at a local, regional and national level, extensionists and decision-makers on both the technical and political planes. The research/validation, instruction, training and technical assistance activities are developed in demonstration areas with the direct participation of the beneficiaries.

The Olafo Project, an important component of this Unit, began the phasing-in process to absorb many of its activities into CATIE's permanent structure, concluding the financing phase in December. Additionally, a bridge phase was designed to permit the absorption of these activities. Technicians were retained to transfer the information into CATIE's main structure. These processes require considerable amounts of time as it is vital to continue the activities in which CATIE wants to maintain its leadership role within the Unit.

The component that studies genetic diversity as a basis for conservation and management, has as one of its objectives to detect the genetic variability of forest species with economic importance, such as mahogany, and more recently other native species. Other important projects within this same component are:

the study of the effects of forest fragmentation on biological reproductivity and the variability of species present in these forest fragments.

CATIE supports the consolidation process of the Central American Regional System and the national systems of protected areas, the conservation of biodiversity in the national parks and related areas, the training and instruction of human resources in the area, and the fostering of planning and management methodologies and techniques in the areas in question. The purpose of this component is to make protected area management more technical. To this end, it trains people in planning and environmental management methods and supports institutional fortification. In addition, it disseminates those results from the Center's research program that are applicable to the protected area and zones of influence management schemes. Interactions with the Central American representatives for WWF, which has its headquarters in CATIE, support the education and training activities in the Protected Areas.

As mentioned above, an effort was made to consolidate the Unit as an Area in 1997, and in the end it was integrated as a Unit in the Forests and Biodiversity Area, but without formal leadership. A Unit chief should achieve the objective of integrating and maintaining continuity among such diverse Unit components as: the compatibility between development and conservation; and the effects of forest management and fragmentation on biodiversity.

The Conservation for the Sustainable Development of Central America Project (Olafo) began its activities in 1989 (89-92, first phase; 92-95, second phase; and 96-97 third phase); and the Appropriate Use of Mangrove Resources Project (Manglares) began in 1992 (92-94, first phase and 94-97 second phase). During the last phase, Olafo developed its activities in three demonstrative areas (Peten, Guatemala; Leon, Nicaragua and Bocas del Toro, Panama) and two application areas (Atlantida, Honduras and Peten-La Pasadita, Guatemala). In addition, research was done in the Talamanca, Costa Rica area. The Manglares Project centered its activities in Estero Real, Nicaragua and Terraba-Sierpe, Costa Rica (until December 1995). Both projects have their headquarters in CATIE, Turrialba.

The general objectives of each of the projects are as follows:

- *Olafo Project:*

"To implement, with the support of the organizations responsible for natural resources, sustainable management models for natural ecosystems representative of the Central American frontier agriculture zone, taking into account the specific conditions in each area."

- *Mangroves Project:*

"The local population in the mangroves of Estero Real and Terraba-Sierpe make sustainable use of the natural resources."

Activities:

The main lines of activities done by Olafo and Manglares during 1997 are presented in Table 1.

Table 1. Main activities of the Olafo and Mangrove Projects during 1997.

Type of activities	Lines of activities
Research	• Management of non-timber forest plant resources (ecology/production through cultivation under natural conditions) • Diversified forest management (timber and non-timber) (evaluation of impact of management against products) • Economic evaluation of ecosystems (methodology and case studies) • Participative Ordinances
Validation	• Agroforestry and sustainable agriculture • Strengthening of the organization for natural resources management and production.
Projection to Communities:	• Training and technical assistance
Projection to Institutions:	• Training and technical assistance • Technical support to improve policies

Advancements of the Period

- The validation of alternative products was completed. The beneficiaries have incorporated these products.
- Community associations and families in the Olafo/Manglares work area have strengthened their skills to manage native natural resources (forests and agricultural areas) in a sustainable manner, with the support of national institutions.

- Ordinance proposals have been completed for Nicaragua's and Guatemala's natural resources.
- The methodology for the Olafo natural resources management is being replicated.
- The Project results have been disseminated to decision-makers, communities and CATIE and regional technicians.
- CATIE, through its Management and Conservation of Forests and Biodiversity Area has incorporated into its permanent structure the project's methodologies on natural ecosystem management.

Main Research Achievements in 1997

Considering that Olafo/Mangroves was in its final phases and according to the specifications in the Project document agreed to by CATIE and the donors, no study was initiated. The following results correspond to the 1997 achievements for work started previously.

Quassia amara

The amount of light a reproductive individual is exposed to influences the tree's flowering and fruit production, but not its seed fertility. This relationship does not imply that maximum light exposure is favorable to achieve optimum results. In both areas of this study, direct overhead light in high forest conditions promotes the greatest levels of reproductive activity. This result stands out with respect to favorable environments for production. Perhaps, *Q. amara* produces markedly fewer quasinoids in open fields than when used as a living fence post. In addition, this result helps to refine the concept of the silvicultural system and direct the use of the species in agroforestry systems.

The physiological quality of the seed and whether it can be conserved vary according to the maturity of the fruit harvested and post harvest processing. A successful germination methodology for *Q. amara* has been validated which defines the type of seed and necessary post harvest treatments.

This result demands attention in so far as favorable environments for the production of these plants is concerned: perhaps *Q. amara* produces markedly less quasinoid in open areas (for example, as a live fence post).

Knowledge to refine the concept of the silvicultural system and orient the introduction of the species in agroforestry systems.

A successful germination methodology for *Q. amara* has been validated (definition of the type of seed and post-harvest treatment).

Use of *Q. amara* as a natural insecticide

The final results of these evaluations were: all the doses of the water and ethanol extracts (concentrations of 5, 10, 15, 20, 25 and 50%), killed the adult *Bemisia tabaci*, especially in the higher does of 20, 25, and 50 ml per liter of water. Nevertheless, the methanol extracts worked better. The highest concentration of methanol extract killed *Spodoptera frugiperda* larva, on contact, but the two highest concentrations killed when ingested. In the case of *Hypsiphiyla grandella*, none of the methanol extract concentrations killed on contact, but there was an anti-feeding effect that increased with the concentration levels.

At this point, the preliminary conclusion was made that the crude extracts do not easily kill lepidoptera larva like *S. frugiperda* and *H. grandella*, but will kill a sucking insect like *B. tabaci*. In addition, there are other effects like the anti-eating effect that merit more extensive research, especially with *H. grandella* that causes severe problems even in small populations.

Cardulovica palmata

Sampling elements were defined to design an inventory of the natural populations of *C. palmata*. The methodology was validated in Costa Rica and Panama.

It can be used to define statistically valid estimates of harvestable product. This is necessary in order to define the sustainable harvesting process of a species.

Nicaraguan Pacific Mangrove Forests

There was evidence in the *ageli* forest that the volume of *Laguncularia racemosa* increased by 7.74 m3/ha/year, but the firewood harvesters' practices are quite damaging: 5 dead individuals per every 2 individuals harvested. That is to say, there is a "dead" base area greater than the area harvested.

It is essential to decrease the negative impact of harvesting in order to take full advantage of the forest's biological potential. In the mean time, the technical potential will have to stay well below the biological potential.

Determination of development levels in shrimp farming in Estero Real, Nicaragua

Based on the present value of the net social benefits, the areas destined for shrimp farming (by type of area and productive system) and the employment generated, five scenarios have been developed: current, intensive, conservative, intermediate and optimistic. These make clear that to achieve an additional benefit of US$20 million an additional US$13.7 million must be invested.

The results contribute technical economic and environmental elements to make the decision. There is a particular conflict between generating jobs through less intensive activities, which take up more land in the mangrove forests, and generating higher economic benefits through intensification (and great investments).

San Miguel, Guatemala, evaluation of the 1997 forest harvest

Of a harvestable area of 125ha, the volume of timber sold was 38.13m3 (90% non-traditional species). From a financial standpoint, the net earnings stand out as they were approximately US$7,000. That is to say that after covering labor costs, net earnings were US$6.5 per shift. These figures are lower than in 1995 (US$12) and 1996 (US$7) but still higher than the opportunity cost of the manual labor in the area. These species generate only half the gross earnings and the cost of harvesting per board foot is higher than the price paid: US$0.54 and US$0.50 respectively. Nevertheless, the forestry activity was positive for the San Miguel families, where 80% participated for 2 months. Income was higher than labor opportunity costs, and covered operation and harvesting expenses. The benefit per hectare was approximately US$57, but that represents an important percentage of the families' monetary income.

The low volume sold reflects the Association members' still-limited forestry management skills, the low marketing potential of the non-traditional timber species, and the level of degradation in the San Miguel forest. In practice, only 5 of the 31 species classified as "non-traditional with commercial potential" were accepted in the market. This suggests the urgent need to follow-up with development activities in two ways: i) consolidate the group's forestry skills, and ii) develop products/markets for the commercialization of non-traditional species.

Rural development model based on natural ecosystem management

Following the systems analysis of the experiences in each area, the Olafo model was re-designed. This updated version explicitly evaluates sustainability and monitoring within a general scheme.

The evaluation/systematization activities in all the areas and designing a monitoring system in Nicaragua's mangroves provided the necessary elements to create a monitoring/evaluation system for the *in situ* development models which should be advanced upon in the next phase of the project.

Creation of a GIS (Geographic Information System) for the sustainable management of natural resources in Estero Real

A GIS was designed and implemented for Nicaragua's institutions. These organizations actively participated in the process to define their criteria/needs, which in turn helped to further fine-tune the GIS program to the objectives (decision-making).

Information generated by the field research (forest, socioeconomic in particular) has been given to the participative - governmental and non-governmental institutions, communities, and distributed in the private sector.

GIS has become a valuable decision-making tool and has given guidelines to the national institutions so they can up-date the information used in the process of designing a territorial ordinance strategy for the Nicaraguan Pacific Mangroves.

Research on forest growth (mangrove, sub-tropical latifoliate, and non-timber species)

Up dating of the databases made up of about 40 permanent measured plots.

With these devices, unique information is being generated on forest growth in different ecosystems and species that contribute to the definition of guidelines for sustainable harvesting.

Networks in which the Project participates

RIPROFITO: Plant Pharmaceutical Product Network

Objective: To sponsor international cooperation between academic, business, and governmental sectors, to stimulate the industrialization of medicinal plants, with the end of taking full advantage of the native plant resources in Iberoamerican healthcare.

Forty-four institutions from 18 countries work in this network integrating more than 250 researchers, workers and businesspeople.

September 22-25, 1997, RIPROFITO supported Olafo (organizationally and financially) in the Mesoamerican Meeting on medicinal plants of the genus *Smilax*.. Follow-up agreements and a push for more activities on *Smilax* came out of this meeting on the part of CATIE as well as RIPROFITO and the members involved in this subject.

MESOAMERICAN AND CARIBBEAN HERBARIUM NETWORK

This network has the following purposes:

- To support the stability and solidity of the herbariums
- Stimulate and propagate the research and training of new researchers in the field of botany.
- Support education related to basic and applied botany.
- Perform scientific and social studies together in the region.

- Act as scientific and social information center (biodiversity, natural resources conservation, sustainable development, and environmental education).

The Olafo Project continues to act as an advisor and member of the Mesoamerican and Caribbean Herbarium Network. At the end of 1997 (November 17-20) it provided technical and financial support to the Third Network Meeting carried out in San Jose, Costa Rica. The following proposals were made there:

Systematization of Herbarium Information (Regional System) by means of the database BG-BASE. This proposal was done in conjunction with CATIE-World Conservation and Monitoring Center (WCMC) and the Royal Botanical Garden at Edinburgh. A rough draft of the proposal was presented which is being prepared to apply for funding through a GEF project that includes the installation of the database, training activities and follow-up on its use.

Regional Biodiversity Information System. Another proposal was presented about a Network of information in Central America on Biodiversity. The initial proposal is to try to implement the BIODATA Project experience (currently the BIODATA Network) in Central America in cooperation with the Central American Commission on the Environment and Development (CCAD), the Biodata Network and INBio in Costa Rica that permit the implementation of methodologies that facilitate the exchange of information. It was suggested in the herbarium meeting that the regional herbariums play a very important role in the identification of regional biodiversity and also possess a great deal of valuable information.

BIODATA Network

The object of this network is to facilitate the administration, generation and exchange of information in order to conserve, know, disseminate and use our biodiversity in a sustainable form. CATIE continues to be part of the Advisory Group for the Biodata Network and participates actively as one of its main members. The Network currently has no funding; for this reason, the decision was made that INBio would keep the Network active while a stable funding source was being found. At the same time, its coordinators continue seeking financing. If a proposal is made, like that for the Regional Biodiversity Information System, CATIE would possibly be able to assume the BIODATA project not only for Costa Rica but for all of Central America, given the existing infrastructure in the institution and the abilities to do training and dissemination activities, but also because it is a leader in research on the region's native biodiversity.

Conclusions:

The three indicative aspects of the impact of the results of the Olafo and Mangroves Projects are:

Demonstration of development in the field.

This includes several aspects: community organization, management and use of biodiversity, level of income generated by the beneficiaries, and institutional involvement.

In all aspects significant results and impacts have been noted. At the organizational level the greatest results were in Guatemala, Honduras and Panama (group legalization, greater management and conflict resolution training). In the management and use of biodiversity, some productive alternatives were adopted (wicker for craftwork, bee keeping, and timber management in mangrove and latifoliate forests).

Research on non-traditional/non-timber products still does not confirm the existence of adaptable management systems. Nevertheless, the results obtained have helped advance basic definitions about: the harvesting possibilities for *Quassia amara, Desmoncus sp, Smilax sp.* and the harvest planning tools for the management of mangrove forests and *Cardulovica palmata.*

With regard to the generation of income (monetary and non-monetary), the results were positive in Guatemala and Panama. Finally the efforts to involve national institutions bore fruit at the end of the year: such is the case in Guatemala, Panama and Nicaragua with the involvement of the institutions (decision-makers and technicians) on the field level and in the definition of the Project's orientation and lines of action.

The incorporation within CATIE of the lines of work and project results

Various lines of work were incorporated within CATIE's internal scope (Diversified Forest Management, rural development schemes based on the management of natural ecosystems, evaluation of direct and indirect forest benefits). With great effort in training and graduate activities, the topic "Community Organization Promotion" was introduced. Also, within the International Course on Natural Forest Silviculture, the Olafo and Mangroves Project technicians made important contributions to the class, introducing more strongly the themes of diversified forest management, economic farm analysis, forest management and community organization.

Another indicator of success has been the wide participation of technical teams in presentations in technical meetings, congresses and conferences on regional, Latin American and International levels. These activities represent an effort to synthesize results for dissemination purposes.

CATIE's external projection in the member countries and in general outside CATIE.

In the external scope, the strong dissemination work of the Project and in particular of the national coordinators has not only spurred interest among governmental and non-governmental institutions on the work themes of the projects but has also facilitated getting concrete results, such as the approval of the Community Concession of La Pasadita, or for a mangrove management plan, on the part of MARENA. It is important to note that the national field teams have been strengthened as a team (in particular in Nicaragua and Guatemala) allowing for the decentralization of decisions and initiatives.

Olafo's results and methodologies are taken as a reference in regional and international forums. For example, CIFOR selected, on an international level, the San Miguel Community Concession case to be incorporated within its Social Research Program.

PLANNING AND MANAGEMENT OF PROTECTED AREAS

For more than 20 years the Protected Areas component of CATIE has performed a task which is widely recognized in Central America. The selection, establishment, planning and management of systems and subsystems of protected areas have been fundamental actions from which training research and technical assessment have developed.

These same actions have created new conditions and circumstances that make an analysis of the situation necessary, as much from the institutional point of view as from the individual country needs.

This component has a medium-term Strategic Plan that was in action until 1996. This strategy defined the objectives and goals of the Protected Areas Unit as follows:

To support national efforts to consolidate the Central American Regional System and the national systems of protected areas, biodiversity conservation in national parks and related areas, training of human resources, and the improvement of planning and management methodologies and techniques for these areas.

Activities

With limited resources, according to the aforementioned objectives, a series of activities was undertaken that could be listed under the following headings:

Support for the consolidation of protected areas systems:

Carrying out the activities follows the need to comply with technical lines developed in the demonstrative areas. Four studies were undertaken in Costa

Rica (in the Osa Conservation Area and in the Central Volcanic Chain Conservation Area) and four studies were done in Honduras (Cerro Azul Meambar, Comayagua Mountain, Pico Pijol and Yoro Mountain National Parks).

Training of technicians and professionals

Continuity of the training program was assured with the XIX Annual International Protected Areas Course (one of CATIE's strategic courses) and with the finishing up of the Regional Strategy for Protected Areas Training (presented and discussed in May at the First Latin American Congress of Protected Areas in Santa Marta, Colombia).

A training program was designed and carried out in Honduras with the participation of the EDUCA Foundation (4 national protected areas planning courses) and the National Training Program for Panama was designed and will be put in force through a contract signed by USAID.

Management techniques and methodologies

Validation studies continue on strategic planning techniques designed to solve management problems faced by the protected areas when they assume the role of sustainable development facilitators. Particular attention was given to the attempts to integrate the local communities in management and assure environmental management for the local governments.

PLANTATION SILVICULTURE UNIT

Since the 50's, CATIE has developed activities in the selection of species, silviculture and management of multi-use forest plantations. Since the 80's, CATIE has strengthened and promoted multi-use tree silviculture, as a means to meet the growing demand for diverse forest products, minimize the destruction of natural forests and recover degraded lands and biodiversity. To this end, the Unit seeks to develop silviculture and forest extension activities complemented by social and economic evaluations.

CATIE endeavors to characterize and conserve forest genetic resources, as an indispensable condition for the improvement and optimum use of resources in the short, medium and long terms. The purpose of this research component is to identify and select better genotypes, through origin trials, progeny tests, and clone selection, in addition to conservation and improvement of plant genetic forest resources and the establishment and management of seed sources for collection, storage, and encouraging the use of high genetic quality forest seeds.

In 1997 it was attempted to consolidate this Unit rescuing experiences from such projects as Madeleña, whose network is still active in the countries, as well as by integrating the individual research projects that several CATIE researchers had

carried out separately. In the Biodiversity Unit, a formal leadership in the figure of the Unit Chief should achieve the objective that the Unit components stay integrated as a whole with a common mission and objectives.

PROCEFOR Project

The Danish Agency finances the Forest Seeds Project (PROSEFOR) for International Development (DANIDA). It began its activities in October 1992 and finished in December 1997. The Project was carried out in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama and the Dominican Republic.

The main objective of PROSEFOR was to strengthen forest development in the seven countries, assuring the availability of seeds with high genetic and physiological quality in the priority species.

The specific objectives were to back-up the establishment of seed sources, improve the running of national seed banks, personnel production training, seed collection and processing, in conjunction with a regional network of producers and consumers of forest seeds.

1997 was the last year of the first stage of PROSEFOR and the objectives stipulated by the project were achieved. The seven countries have seed sources selected for the majority of priority species. Some of these sources were technically managed and the rest are in the management process. The seed banks improve their operative system and are giving better service to their users. The Regional Network (REMSEFOR) began operations in 1997.

Networks

PROSEFOR has promoted the formation of National Networks of Producers and Consumers of forest seeds in Guatemala, El Salvador and Nicaragua. In the Dominican Republic and Costa Rica Support Groups for Forestry Professionals have been formed.

The objectives of these groups are to foster the production of forest seeds with better genetic and physiological quality and to promote their use on a national level. These groups meet several times per year to analyze progress and promote activities. PROSEFOR provides technical assistance and support for these meetings. The members of these groups are representatives of the governmental and non-governmental institutions that are related to the forestry sector.

Regional:

The Forest Seed Network of Central America and the Caribbean (**REMSEFOR**), was created at the initiative of PROSEFOR in October, 1997 in Guatemala with

the participation of representatives from El Salvador, Costa Rica, Nicaragua, Panama the Dominican Republic and Honduras.

The general objective of the Network is to support and strengthen the continuous and timely storing of good genetic and physiological quality reproductive forest material to support regional forestry development.

The Network's General Secretary is Lucia Rodriguez of the "Instituto Tecnológico de Costa Rica". PROSEFOR provides technical and economic support.

REMSEFOR periodically publishes an informative note and recently produced a document outlining the need for forest seed research in Central America and the Dominican Republic.

REMSEFOR is composed of the following 12 institutions. In order to become a member of the Network, the individual or legal representative must apply to the country representative. The application is studied and sent to the Director for approval.

- AGROSELVA
- Banco de Semillas Forestales - ESNACIFOR
- CATIE - Banco de Semillas Forestales
- Centro Agricola Cantonal de Hojancha - (CACH)
- Direccion General Forestal (DGF) - BASEFOR
- Direccion General de Recursos Naturales Renovables (DGRNR) CEDEFOR
- Instituto de Ciencia y Tecnologia Agricola - ICTA
- Instituto Nacional de Bosques - (INAB - BANSEFOR)
- Instituto Nacional de Recursos Naturales Renovables (INRENARE) - Banco de Semillas
- Laboratorio de Semillas Forestales. Instituto Tecnologico de Costa Rica (ITCR)
- Ministerio de Recursos Naturales y del Ambiente (MARENA) - CMG & BSF
- Semillas Tropicales S. de R.L. - SETRO

Conclusions

With the support of the Forest Seed Project in the seven member countries more than 310 seed sources of priority species have been selected. Some have already been technically managed and are being used to satisfy part of the national seed demand. The rest are in the process of being managed.

Depending on their facilities, the countries' seed banks have improved their operating systems and are providing better services to their clients.

In the different forest seed production, collection and processing activities, 176 technicians were trained in the seven member countries.

The Regional Forest Seed Network was created and is making an effort to consolidate.

PRODUCTION AND CONSERVATION ECONOMICS AND SOCIOLOGY AREA

The member countries of CATIE face a dual problem during the present decade: poverty and the deterioration of their natural resources and environment. This same deterioration makes the poverty more acute, which in turn results in a greater depredation of the few resources that are left. Such process can be observed in the majority of the Tropical American countries, with the poverty even more heavily concentrated in the rural zones.

Agricultural and livestock production activities, being inefficient and non-sustainable, expand rapidly over marginal soils and areas considered fragile from the ecological and environmental standpoints; generally at the expense of the destruction of secondary and primary forests. Other characteristic effects of this process: Under-employment and worsening poverty, worrisome losses in bio-diversity, massive and non-planned migration towards the urban zones and new agricultural frontiers, flooding of the lowlands, etc.; imply high costs for society in general.

The rate of utilization/degradation of natural resources and the environment in Tropical America has increased because of the rising demand for food, and the need to provide income and employment opportunities to our constantly expanding populations. Annually demographic growth in Central America, for example, is around three percent, one of the highest in the world.

The actual problems related to the economic and environmental sustainability of agricultural production areas and systems, the sustainable use of our natural resources and the conservation of the environment are due, in part, to the lack of technological alternatives that are economically and socially appropriate for the farm families and indigenous communities of rural Tropical America.

This problematic, nevertheless, also has profound structural and macroeconomic & social policy roots. In many cases, appropriate technologies already exist, but the current systems of incentives/disincentives and/or other policy/institutional environments do not foster their adoption. Therefore it is obvious that a global, permanent solution must also include an adaptation of these critical aspects, so that they promote an individual behavior that is more compatible with the objective of a sustainable and environmentally sound development; a goal shared by all of CATIE's member countries.

A related important issue is the economic valuation of key publicly available natural resources. The externalities resulting from the methods being used to exploit them (contamination, net losses on the stock of natural resources, etc.), and of the environmental and other goods and services provided by these, such as carbon dioxide fixation, water filtration and storage, bio-diversity conservation, ecotourism, etc. The former is used as a basis for the formulation of policies to promote their rational use.

In addition, lack of rigorous information on what technology development and transfer methods are most efficient and effective under our conditions, and little understanding of other key socioeconomic factors limiting technology adoption and dissemination processes are also worrisome. The scarce participation of the rural population in research and development programs has also resulted in a low sustainability of their accomplishments, once the external inputs are no longer available. The necessities most felt by the peasant families, their own knowledge and ways of experimentation, and their priorities in general, many times are ignored at the moment of defining the focus, objectives and methods of investigation and extension.

During 1997, CATIE's Production and Conservation Economics and Sociology Area conducted research, postgraduate education and outreach activities aimed to support member countries in finding and implementing solutions to those problems.

RESEARCH

Current Situation of the Research Line "Economic Analysis and Valuation of Productive Activities and Environmental Services from Ecosystems"

A research line on "Economic Analysis and Valuation of Productive Activities and Environmental Services from Ecosystems" is now well defined, organized and is fully functional. It consists of two operational groups of scientists.

The year 1997 was very productive for this research line. Five studies were published or accepted for publications in prestigious international Journals such as the *American Journal of Agricultural Economics*, the *Agricultural Finance Review, Environmental and Development Economics* and *Natural Resources and Society*. As well, several studies were published and accepted for publication in the CATIE regional Journals *Manejo Integrado de Plagas*, *Revista Forestal Centroamericana* and *Agroforestería de las Américas*.

One of the Area's experts contributed with a chapter in the recently published book "Environmental Sustainability: Practical and Global Implications" by a group of world-renowned environmental economists. Also, a Spanish language edition of the textbook "Economic Analysis of Environmental Impacts" (John Dixon *et al.*, The World Bank) that includes Latin American research case studies was started.

With regard to specific research advances during 1997, important results are reported in the themes of *monitoring and economic valuation of carbon storage*, *assessing non-market valuation studies in Central America and the Caribbean*, and *tropical commodity price analysis and simulation*:

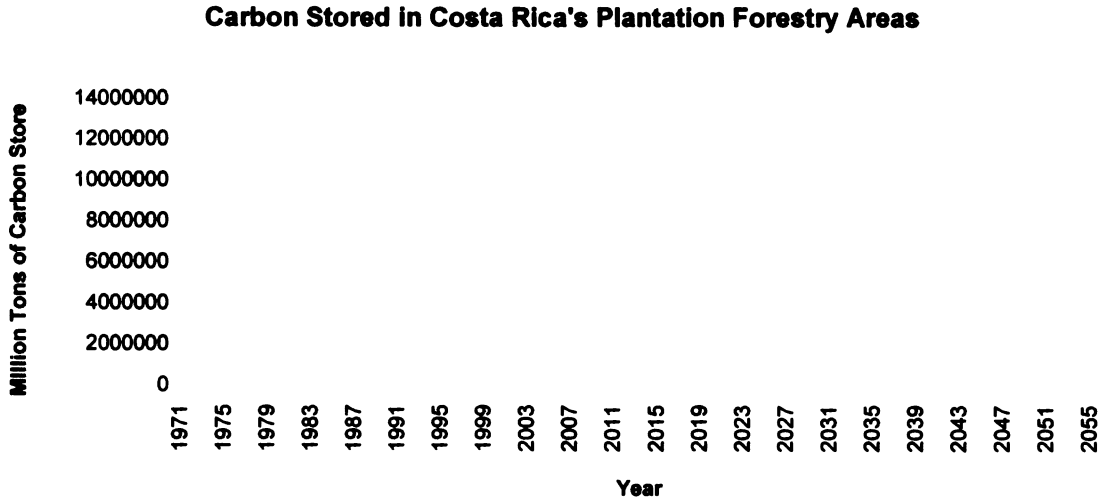
Monitoring and Economic Valuation of Carbon Storage

Several new studies on this subject began in 1997, and some important research advances can be reported. Wood carbon content was measured in Costa Rica's high Oak (*Quercus* sp.) forest (robledales de altura), from a random sample of whole trees including roots, trunk, branches and leaves. The average carbon content found was 43%, in contrast with the 48-52% usually reported in available literature. If this pattern continues in future studies, with other species and types of forest, it would have significant implications for the calculation of the economic value of the carbon stored in the tropical forests.

In another study, the growth functions of the main species used for plantation forestry in Costa Rica were estimated. Of the models assessed a third-degree polynomial that accounts for species and index-site effects through a shifter in the linear trend term coefficient performed best, yielding coefficient of multiple determination (R^2) of 95% and highly significant estimates for all of the model's parameters. Although the original objective of this study is to calculate the financial and economically optimal harvest cycle for these species, the functions will also be used to improve current estimates and projections of the amounts of carbon stored in plantation forestry areas through time. Presently, a constant mean annual increment (IMA) is being assumed for necessity's sake.

The graph below shows our best current estimates and projections. After 1995, a stable area of 128,000 hectares periodically harvested and replanted *ad infinitum* with the present mix of species composition is assumed. Notice that after that year, a relatively stable average is reached of about 8.4 million tons of carbon permanently stored. Under Costa Rica's joint implementation proposal, this would have an economic value of between U.S. $84 and U.S. $168 million every twenty years, or approximately U.S. $33-$66 per ha per year. The impact of making an effective payment to the farmer for providing carbon storage services at the former rate on the profitability of plantation forestry under different conditions is being explored.

Similar work has advanced in the case of tropical natural forests. Time-dependent carbon storage functions per hectare of natural forest are being estimated under different scenarios: no-logging, low-impact logging, low-impact logging + a minor silvicultural treatment and low-impact logging + a major silvicultural treatment. The silvicultural treatments under investigation are those that have been proposed by CATIE. In addition, post-harvest carbon release functions are being estimated for the main species/wood uses. The medium-term objective of this group of research projects is to be able to estimate and predict the net amount of carbon stored, through time, in/by all forests of a given tropical area, country or region.



Assessing Non-Market Valuation Studies in Central America

An inventory and assessment has been made of 15 non-market valuation studies in Central America and the Caribbean countries. Most utilized the contingent valuation method to determine willingness to pay for potable water or protected areas and suffered from: a reliance on open ended bidding, information framing and contingent scenarios lacking detail, limited population samples, and possible cultural-strategic biases associated with surveying local residents.

Problems with the one travel cost method reviewed were a reliance on poor quality census data rather than visitor survey data, and unrealistic assumptions regarding: transportation cost estimates, single-destination visitors, and consumer surplus levels of international visitors. The two hedonic valuation methods reviewed suffered from the existence of heterogeneous neighborhood market segments and the inability to obtain reliable property values.

Finally, various strategies and a research agenda to improve non-market valuation studies in Central American and Caribbean countries have been proposed. The results of this research have been accepted for publication in the CEPAL Review.

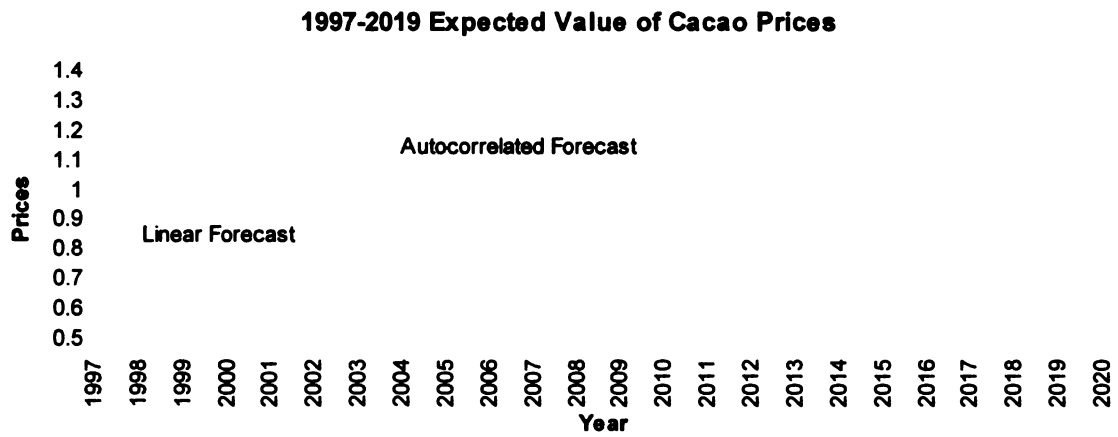
Tropical Commodity Price Analysis and Simulation

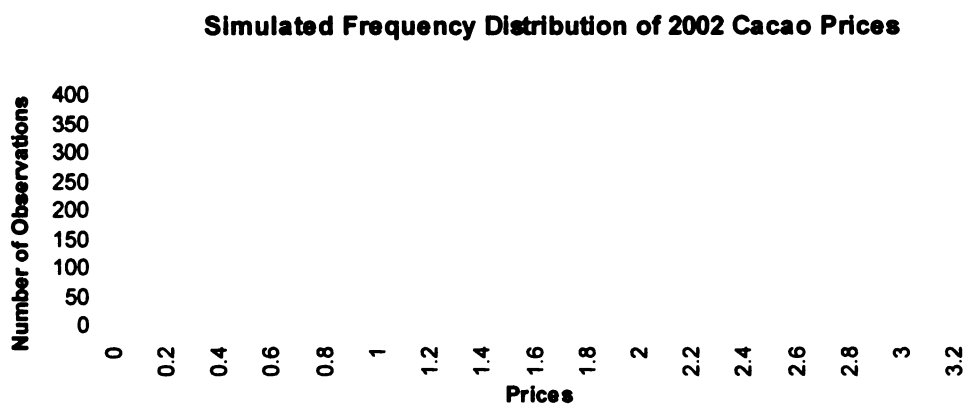
It is often argued that an important attribute of diversified, sustainable production schemes such as agroforestry systems is the reduced risk to the farmer. An example is the lower variance on his/her net income and a lesser probability of obtaining earnings below a certain threshold level during one or more consecutive time periods). Knowledge about the probable commodity price and yield joint probability distribution functions are essential to analyze the former.

A previous study of the Area, published in the *American Journal of Agricultural Economics*, developed and used a method for modeling and simulating correlated,

non-normal and heteroscedastic random variables. In the case of commodity price time-series, the additional possibility of error-term autocorrelation can be anticipated. The formerly mentioned method was adapted to be able to model and simulate autocorrelation as well, and applied to the cases of cacao world prices and laurel and plantain Costa Rican prices. It will also be used with coffee world prices as part of another M.Sc. Thesis.

The first figure below shows the difference between a linear and an autocorrelated forecast of 1997-2019 expected cacao prices. The autocorrelated forecast captures the later cycle of low but increasing real prices. However, a statistically significant declining long-term trend was clearly detected. The second and third figures show simulations of 1997 and 2002 price frequency distributions. Non-normality, in the form of kurtosis and right skews, are obvious characteristics in this case, as well.





The analysis of real plantain prices rendered somewhat similar results: Declining, positively autocorrelated, kurtotic but not skewed probability distribution functions through time. Real Laurel prices, on the other hand, were found to be increasing, normally distributed and not autocorrelated. The three sets of simulated price distribution functions through time will be used in a M.Sc. thesis to evaluate the potential of agroforestry systems composed of different mixtures of these crops for reducing income-related risk at the farm level.

GRADUATE STUDIES AREA

The Graduate Study Program began in CATIE in 1946, with the first Master's degree awarded on July 8th 1947, to a Mexican professional. The Graduate School, with its 51 years of continuous operation, is the oldest one in Latin America in the fields of agriculture and natural resources management.

During its existence, the Graduate School has undergone several transformations to improve its operation and to achieve its aims. In this context, as of April 1st 1997, the Education for Development and Conservation Program (EDECO) was formally changed, as a result of the decision to transfer the Training Unit to the Outreach Program, and the Graduate School was incorporated as part of the Research Program. The objective was to guarantee the full coordination of the thesis research, leading to M.Sc. or Ph.D. degree, within the research priorities of the institution as laid down in 1996.

Before making a report on the progress of the institution's education plans, it is important to point out that the activities executed during 1996 and 1997 fell within the brief of, and were approved by, both the Academic Committee and the Executive Board. The following is a short summary of the major targets that were proposed at that time:

1. *Consolidate a teaching staff.* This has, in fact, occurred through two major actions executed during this period. The faculty and the DANIDA program, as well as the absorption by CATIE of a number of specialists has consolidated the teaching staff.

2. *Begin a Doctoral Program.* The program is now set up, and moving along within the known limitations of the availability of general resources.

3. *Analyze the possibility for the creation of a Professional- type Master's degree.* This idea was abandoned completely after it was felt that it had no place in scientific CATIE in the form it had been conceived.

4. *Curriculum revision and adjustment.* We have, at this point, completed such a revision and have given ourselves a year of application of the new *pensum* before a major new revision is undertaken.

5. *Promote the enrollment of women and other minorities.* This has been fulfilled in the area of women, which now make up 30% of the enrollment; we have also enrolled Afro American and other minorities.

6. *The exchange of professors and development of strategic alliances.* The area of strategic alliances is one that we feel is very well covered among the USA and European universities with which we are presently cooperating.

7. *Development of a faculty and tenure idea.* The faculty has already been selected and the idea of tenure is now being applied in the new contract system.

8. *Marketing and promotion.* This is well on its way and, as a proof of that, is the increase in the number of applicants and admissions to the Graduate School.

9. *Promotion and printing of thesis research results.* This has had some problems due to both the language difficulties and the limited number of reference-type Journals printed in Spanish.

10. *Search for new and fresh money for assistantships.* This has been, and continues to be, a problem; especially with the decreasing number of donors interested in this kind of financing. Greater effort is required here. The idea of a small endowment fund that would build up slowly could provide the crucial element towards a solution.

11. *Development of teaching materials.* In this area we have encountered the problem of the general lack of materials, in spite of the offers that have been made. In the personnel valuation, the problem is that preparing of teaching materials do not receive the high credence that a reference journal article or a proceeding journal in a world conference receives.

Major achievements of the M.Sc. Program during 1997.

- Management of the DANIDA's M.Sc. Support Project Program.

- The redesign of the *pensum* of the old, existing M.Sc. programs, and consolidation into four major areas to adjust them more efficiently to the new existing research lines.

- Consolidation of the *pensum* of Forestry and Biodiversity into a single *pensum* more in line with the new orientation of the institutional research lines.

- Temporary suspension of the M.Sc. in Environmental Sociology, until the appropriate technical personnel for such a major has been secured.

- Defining the Faculty in the Graduate School, in order to ensure future quality and continuity of activities.

- Graduation of the first group of students in the area of Environmental Economics and Sociology.

- Continued operation of the Academic Coordinators Committee for the M.Sc. in each of the scientific areas at a satisfactory level.

- The design and implementation of an Intensive English Program for students entering the M.Sc. Program, in association with the British Institute of Costa

Rica, in order to improve the proficiency of the English language among the students of the School.

Status of the Doctoral Program

The Doctoral Program, in 1997, went through a major reorganization, which was deemed necessary by the individual responsible for its activities. Major achievements of the Doctoral Program were:

- The reorganization of the Doctoral Committee.
- The reorganization and automation of the admission process. This consisted in the consolidation of the doctoral admissions' process within the Graduate School's office of Admission and Registration, as a normal and routine activity.
- The development of a specific set of criteria both for admission and for the selection process of doctoral candidates.
- The planning and execution of the Ph.D. Program marketing within CATIE's member countries, in the other countries of the hemisphere and elsewhere.
- Three students began their Ph.D. work: two in Gottingen and one in Colorado State University.
- Improved relations with donors for scholarships (DAAD, GTZ, DANIDA and SWISS).
- Signed agreements with Hohenheim, Texas A&M, Freiburgh and Helsinki, and negotiations with LSU. In the case of Gottingen, although no formal agreements exist, there is an excellent working relationship. Through this relationship two of the present students have been sent there.
- Promise of 5, "one year sandwich" assistantships on the part of DAAD beginning in 1998. The major limitation of this promise is the availability of matching funds from CATIE.

Major achievements in the admission process.

- The reorganization of the Unit and the appointment of a full time M.Sc. staff member, Emilio Mora who, in previous years, served as an assistant to the Director of EDECO.
- The revision and redesign of the SIEP (Graduate School Information System Program) to allow much of the admission process to be done electronically and automatically.

- The redesign of the traditional catalogue in order to make it more user-friendly.
- The preliminary design of a Web-site for the Graduate School and the preliminary implementation of the new catalog for more complete information.
- The implementation of four annual sittings for the admission exams, for the first time in the Graduate School's history.

Major achievements at the registration process.

- Developed a SIEP version for registration and for the maintenance and storage of graduate records.
- Effective coordination of the course scheduling in each of the scientific areas, as a result of the partial rationalization of the *pensum* within the general reordering of the courses, initiated in 1997.
- Redesigned the Course Registration Form.

Major achievements in the Student Activities.

- Operation of a Mini Computing Center for Students' use, equipped with 5 upgraded computers and a laser printer for printing their final thesis draft.
- An increase in the number of social and cultural activities to improve students' the quality of life.
- Celebration of the First CATIE's Olympic Games. Students and personnel from CATIE, as well as other Costa Rican private and public universities participated.
- Improvement of the students' living quarters (painting, new curtains, total repair of students' living quarters' furniture and more) in close cooperation with the Administrative Units.
- Promotion and partial financial support for the graduate students' participation in various training courses and seminars, in order to complement their education.
- Increased counseling in personal and non-academic related activities.
- An increase in coverage and the updating of the insurance policies that cover medical and hospitalization services from C$ 100,000 to C$ 1,000,000.
- The creation of a database of former graduates; that is already beginning to be used for a number of follow up activities.

Major achievements in the Administrative Area.

- Improvement in the physical infrastructure of the school in order to guarantee its physical integrity.
- Modernization of the Admission and Registration Area's physical facilities.
- Improvement of teaching conditions through the improvement of computer facilities and multimedia equipment, thereby enhancing the teaching capacities in each classroom.
- Set aside and redesigned an area for a staff meetings and conferences (Sala Venezuela).
- Upgraded the personnel computing facilities; and re-used the replaced, upgraded equipment as part of the new mini- computing center for first year students.
- Administrative and secretarial support to other units of CATIE.
- Efficient and effective administration of the financial components of REDCA, Holland, DANIDA, ODA, DAAD projects.

III.

STRATEGIC PLANNING AND EXTERNAL COOPERATION

STRATEGIC PLANNING AND EXTERNAL COOPERATION

The Strategic Planning and External Cooperation Office was created in 1994. It is responsible for all external cooperation on a day-to-day basis, including donor relations, formulation and negotiation of project proposals, fund raising, government relations, consultancies, and corporate image with our peers, and with the international community.

The objective of the Office is to lead and supervise the institution's continuous planning, monitoring and evaluation processes.

Table 1 shows the Office's main activities during the year 1997.

Table 1. Main activities of the Strategic Planning and External Cooperation

DATE	ACTIVITY
January-December	-Core budget support. Creation/negotiation of projects and consultancies. -Institutional strategic planning and alliances. -Coordination of the Institutional Development Plan. -Monitoring of CATIE's Work Plan 1997.
May, Sept., Dec.	Visits to CATIE by ISO Consultants
May-June	Official visit to Europe (Germany)
October-November	Drafting the Work Plan 1998-1999.
November	Revision of the Strategic Plan.
December	Collection of Individual Annual Work Plans of international professional staff members
December	Official visit to ISNAR, The Netherlands
December	Donor Support Meeting.

CATIE received funds from various countries during 1997 in order to carry out its main education and research activities. We wish to thank all the governments and people involved that contributed to the development and conservation of the American tropics. Table 2 shows contributions by country.

Table 2. Contributions to CATIE's research and education activities by country/institution, 1997

COUNTRY/INSTITUTION	CONTRIBUTION Amount US$
Canada (IDRC, CIDA)	33,701.00
Denmark (DANIDA)	2,466,178.00
Finland (FINNIDA)	135,712.00
France (MAE, ORSTOM and CIRAD)	65,000.00
Germany (GTZ, BMZ)	223,323.00
Guatemala (UNEPROCH/MAGA)	542,123.00
The Netherlands (Ministry of Foreign Affairs)	442,225.00
Norway (NORAD)	699,684.00
FUNDATROPICOS	795,111.00
Sweden (SIDA)	1,448,013.00
Switzerland (COSUDE)	900,230.00
United Kingdom (ODA, NRI)	324,253.00
United States of America (AID)	519,862.00
Other Institutions (WWF, IPGRI, BID-CIAT, CIFOR, ACRI, European Community)	659,054.00
TOTAL	**9,254,469.00**

Table 3 shows in detail all the new projects that were successfully negotiated during 1997.

Table 3. Projects successfully negotiated, 1997

PROJECT	SUBJECT	DONOR	TIME FRAME	AMOUNT US$
Proceedings from the Seminar/Workshop on Practical Silviculture Research Experiences in Natural Forests in Tropical America	Publication of the Proceedings.	CIFOR	1997-1998	3,500
Regional Project for Natural Resources and Environmental Management	Approval of the final reprogramming of funds to cover final expenditures.	USAID		85,136
Addendum to the Agreement 28-96	To increase the amount to be transferred to CATIE.	MAGA/Guat.	1997	200,000
XIX Int. Protected Areas Course	Support to the XIX International Protected Areas Course.	WWF	1997	20,000
Agreement No. 39/96	Administration of financial resources of Guatemala's various projects within Forestry Plan of Action (PAFG).	MAGA	1997-1998	196,683
Musa Research and Technology Transfer Network Project	Execute activities related to the duplication and *in vitro* conservation of banana and plantain germplasm from the IPGRI-INIBAP-CATIE (ITC) Transit Center.	IPGRI INIBAP	1996-1998	14,000
XIX Int. Protected Areas Course	Support to the XIX International Protected Areas Course	UNESCO	1977-1998	30,000
Support training in Environmental Economics in Central America	To improve the environmental economics skills of CA M.Sc. students, and broaden the abilities of environmental economics educators and policy makers in CA.	Environmental Economics Unit EEU	1997	101,744
Project on the Management of Secondary Forests in the Humid Tropical Lowlands of Latin America	To provide the services of a Scientific Coordinator for the joint research Project.	CIFOR IDB	1997-1998	110,800
Mayan Biosphere Project	Administration of funds	AID	1997-1999	1,166,666

PROJECT	SUBJECT	DONOR	TIME FRAME	AMOUNT US$
	of the National Advisory for Protected Areas (CONAP) for the Mayan Biosphere Project.	CONAP		
Support in Environmental Economics training in Central America Project	To improve the environmental economic skills of CA M.Sc. level students, to broaden the abilities of environmental economics educators in CA and to increase environmental economics knowledge among policy makers.	EEU	1997	91,146
Strategic Course "Environmental Watershed Management."	Support to the Strategic Course "Environmental Watershed Management"	WWF-US COSUDE	1997	5,000
Addendum No. 48-97 to the Agreement 36-92 between MAGA/CATIE	Modification of the Agreement.	MAGA	1997-1999	321,027 (Q 2,000.000)
Agreement CATIE/INAB	Administration of funds to facilitate the execution of twelve INAB Projects in Guatemala.	INAB	1997-1998	459,652 (Q 2,863.630)
Addendum No. 47-97 to the Agreement 18-93 between MAGA/CATIE	To increase the amount to be transferred to CATIE.	MAGA	1997	160,514 (Q 1,000.000)
Addendum No. 19-97 to the Agreement 31-94 between MAGA/CATIE	To increase the amount to be transferred to CATIE.	MAGA	1997	802,568 (Q 5,000.000)
Addendum No. 46-97 to the Agreement 98-95 between MAGA/CATIE	To increase the amount to be transferred to CATIE.	MAGA	1997	160,514 (Q 1,000.000)
Letter of Understanding UICN-ORMA/CATIE	To map the Gulf of Fonseca for the Geographical Information System.	UICN-ORMA	1997	52,000.00
Addendum No. 53-97 to the Agreement 99-95 between MAGA/CATIE	Transfer of money for administrative support to the Managing Unit of Chixoy River High Watershed Project	MAGA	1997	355,492 (Q 2,214.716)

PROJECT	SUBJECT	DONOR	TIME FRAME	AMOUNT US$
Integrated Crop Management of Vegetable and Tropical and Sub-tropical fruits	To provide the third-year funding for a 3-year project and any additional fund.	USDA	1997	46,000
Economic Analysis of Environmental Impacts Project	To translate into Spanish, edit and publish the book Economic Analysis of Environmental Impacts.	SIDA ASDI	1997-1998	13,000 (SEK100,000)
Agreement No. PIF-02-97 CATIE/INAB	To administrate financial resources of projects benefiting from the Fiscal Incentives Program, specifically in the area of supervision and fiscalization.	INAB	1997-1998	160,514 (Q 1,000,000)
Amendment CATIE/USDA	Development of Crop Associations for Managing geminivirus vectored by white flies in Tomato.	USDA	1997-1999	154,605
Agreement CATIE/IPGRI/INIBAP	To execute activities related to the beginning of a Regional Center for the *in vitro* Multiplication and Distribution of banana and plantain cultivars resistant to Black Sigatoka.	IPGRI INIBAP	1997-1998	15,000
Contract Management CATIE/USAID	The project has three components: Panama Canal Watershed Management; National Parks and Wild lands Management and a Conservation Foundation.	USAID	1997-1998	246,627
Contractual Agreement CATIE/CIFOR	For the implementation of the *"Regional Workshop on Marketing of Non-traditional Central America Timber Species"*	CIFOR	1997	5,000
Subsidy Agreement No. PW44 CATIE/WWF/ COSUDE	To support the Workshop on *"Commercialization of non-traditional timber species of the tropical forests of Central America"*	WWF/COSUDE	1997	4,100

PROJECT	SUBJECT	DONOR	TIME FRAME	AMOUNT US$
Grant No. FB02 CATIE/WWF	To support *"LAC Regional Certification Conference"*	WWF	1997	31,945
Contract CATIE/CIFOR	To cover activities for the Project *"The role of remote sensing in monitoring tropical forest fragments in Costa Rica"*	CIFOR	1997	15,000
Letter of Agreement CATIE/FAO	Activities to be developed within the framework of the collaboration Network on Genetic Resources of the species *Cedrela* and *Swietenia* in the Neotropics	FAO	1997	5,000
Addendum No. 129-97 to the Agreement No. 100-97 CATIE/MAGA	To augment the initial amount	MAGA	1997	197,258 (Q 1.228,915)
Subsidy Agreement No. PW53 WWF/CATIE	Support to the *"III International Course on Rural Development based on Natural Tropical Ecosystems Management"*	WWF	1997	8,000
Contract CATIE/CEE-INCO-DG	Develop activities of the Project *"Optimization des nouvelles stratégies d'amélioration de bananiers pour les marchés locaux".*	EC	1997-2001	645,161 (ECU580,000)
Agreement CATIE/DANIDA	To execute the *"Bridge Phase of the Agroforestry Project"*	DANIDA	1997	71,475
Agreement No. 001-97 CATIE/ICTA	Administration of funds by CATIE for the technical and administrative functioning of Integrated Pest Management in Non-traditional export crops Project in Guatemala.	USAID/ICTA	1997	490,883 (Q 3,058,204)
Technical Cooperation Project CATIE/EMBRAPA-CPATU	Productive forest management at the small producers' level in the Micro-region of Bragantina, northeast Pará.	EMBRAPA CIFOR	1997-2002	907,000 899,960

PROJECT	SUBJECT	DONOR	TIME FRAME	AMOUNT US$
Agreement CATIE/ CIFOR/IPGRI	To strengthen the conservation of genetic forest resources, mainly the development of a methodology for *in situ* conservation in tropical forests.	IPGRI	1997-1998	25,000
Grant Agreement CATIE/CIFOR	To carry out a socioeconomic survey on the use of secondary forests by small farmers and rural communities in three locals in the Department of Rio San Juan, Nicaragua.	CIFOR	1997	7,500
Collaboration Agreement CATIE/IFAS (University of Florida)	For the execution of the Project *"Development of Crop Associations for Managing Geminiviruses Vectored by White flies in Tomato"*.	IFAS/UF	1997-2000	46,050
Contract between CATIE/CIFOR	For further development of the MIRASILV system.	CIFOR	1997	20,000
TOTAL				**8,751,965**

During 1997 twenty-three new agreements were signed with different member Country institutions to achieve a large variety of goals and needs, where CATIE can play a very important role as a leader institution in agricultural development and natural resources conservation. Table 4 below, shows these agreements in detail.

Table 4. Institutional agreements signed with CATIE in 1997

AGREEMENT	OBJECTIVE	TIME FRAME
Inter-institutional Collaboration Agreement CONSEFORH/ COHDEFOR/CATIE	Support CONSEFORH in socio-economic aspects.	Jan. 1997 - Dec. 1997
Annex to the Letter of Understanding CIFOR/CATIE	To extend the Letter of Understanding for conducting collaborative research on the Silviculture and Ecology of Lowland Secondary Forest for an additional period of two years beginning 1 January, 1997.	Jan. 1997 - Dec.1998
Letter of Understanding CATIE/ Orgut Consulting AB	Cooperation to organize the second part of the International Training Program on Forest Certification that will take place in Costa Rica November 27-December 26, 1997.	Feb. 1997 - Dec. 1997
Memorandum of Understanding CATIE/UF	For the publication of a book on tropical agroforestry.	Mar. 1997 - Dec. 1997
Letter of Understanding COHDEFOR/CATIE	To implement the Third Phase of the Conservation for Sustainable Development Project in Central America (Olafo) in Honduras.	Mar. 1997 - Dec. 1997
Letter of Understanding CATIE/ UCA (Nicaragua)	Collaboration in the development of research on sustainable management of broadleaf natural forests, and curricular strengthening.	Mar. 1997 - Dec. 1998
Contract Central Azucarera Turrialba/CATIE	Planting, purchase and delivery of sugar cane.	Mar. 1997 - Dec. 1998
Agreement CATIE/Inter-American School Association	To lend the school grounds to the Inter-American School Association.	April, 1997
Addendum No. 63-97 to the Agreement 100-95 between	Modify No. 3, Clause 3.1, part c) of Contract No. 100-95.	May, 1997

AGREEMENT	OBJECTIVE	TIME FRAME
MAGA(Guatemala)/CATIE		
Letter of Understanding CATIE/Natural Sciences and Mathematics Dept. of the University of El Salvador	Explore possibilities for research projects between CATIE and the ITIC Herbarium.	May, 1997
Collaboration Agreement CATIE/EAP	To conduct collaborative work between the institutions for the ODA/NRRD, Great Britain Project: "HOLDBACK PROJECT R6405 (H): Development and Adaptation of Novel Microbial Biological Control Technology for Whitegrubs in Tropical America".	May, 1997
Addendum No. 2 to the Cooperation Agreement ORSTOM/ CATIE/IICA	To execute an Applied biotechnology project in coffee	Jul. 1997 - Jun. 1999
Institutional Cooperation Agreement CATIE/UNALM/FDA	Cooperate in the execution of activities in the "Secondary Forest Management in Tropical America" Project	Aug. 1997
Agreement of Collaboration between CATIE/University of Helsinki (UH)	To enhance academic, scientific, and technical collaboration within their respective training and research.	Aug. 1997
Contract No. 540597 CATIE/CESA	Preventive and corrective maintenance of the numbered sections of Annex A of the Contract.	Aug.1997 - Jul. 1998 Automatically renewable for equal periods
Memorandum of Understanding CATIE/EMBRAPA	Establish cooperation in science and technology through the identification and execution of joint projects in the areas of agriculture and natural resources, to amplify basic knowledge to encourage sustainable development of agriculture in both countries and strengthen the cooperation program between the institutions.	Aug. 1997 - Jul. 2002

AGREEMENT	OBJECTIVE	TIME FRAME
Letter of Understanding CATIE/UICN-HORMA	To cooperate in forestry training activities.	Aug. 1997 - Jul. 1998
Agreement CATIE/AFE-COHDEFOR	To execute the Project *"Technology Transfer and Promotion of Professional Formation in Natural Forest Management"* (TRANSFORMA)	Sept. 1997 - Jun. 2000
Agreement of Cooperation CATIE/Faculty of Forestry, Albert Ludwigs-University of Freiburg	To encourage closer ties in education and research.	Sept. 1997 - Aug. 2001
Memorandum of Understanding CATIE/INDUFOR OY	To cooperate in the bidding for the Biodiversity Support and Protected Areas Project for Nicaragua, tendered by the Govemment of Finland.	Oct. 1997
Agreement Framework CATIE/INIAP	To cooperate in training, research and sustainable development activities in the Andean region of South America.	Nov. 1997 - Oct. 2002
Memorandum of Understanding between CATIE/University of Hohenheim	To intensify their existing scientific co-operation in teaching, research, and training, specifically in the area of tropical agriculture.	Dec. 1997 - Nov. 2000
Cooperation Agreement between CATIE/IICA/IPGRI/ INIFAP/ICTA/DICTA/ CENTA/INTA/MAG/ IDIAP	To create and operate the Mesoamerican Network of Plant Genetic Resources (REMERFI)	Dec. 1997 - Nov. 2002
Cooperation Agreement between CATIE/MAG-Nicaragua.	Establish and strengthen, formal technical and scientific relationships, to coordinate joint activities to improve agrosilvopastoral production in Nicaragua.	Dec. 1997 - Nov. 2002 Automatically renewable every five years

Table 5. Bids under negotiation or won in 1997

TITLE	*SENT TO*	*AMOUNT US$*	*STATUS*	*RESPONSIBLE*
Plan Nacional de Investigación y Transferencia de Tecnología y Recursos Humanos de Honduras DICTA	FOHPREI	200,000	Pre-qualification stage	C Leon P Ferreira
Programa de Manejo Ambiental de las Islas de la Bahía de Honduras. CATIE/FORESTA consortium	IDB SRN	undefined	Pre-qualification stage.	C León J Faustino H Solis
Plan de Manejo Integral de la Cuenca del Río Grande de Tárcoles, Costa Rica	IDB	800,000	ABT Associates won the bid, and sub-contracted CATIE to conduct various studies.	J Faustino H Solís
Management of the Lempa River Watershed, El Salvador. CATIE-IICA-CRS-UCA consortium. PAES	IDB	30,000,000	Pre-qualification stage. Agroforestry is the largest component.	H Solís J Faustino P Ferreira M Juárez
Socio-environmental and forestry development project for the Carazo River Watershed (Nicaragua) POSAF	IDB MARENA FND	340,000	Sub-contract offered to CATIE.	M Gomez A Otárola
Nicaragua's Environmental Program	MARENA FINNIDA	2,967,311	Won by the INDUFOR/CATIE/ Biota Consortium	J Villa P Ferreira
Thematic Evaluation on Environment and Development in the Finnish Development Corperation (Nicaragua)	Ministry of Foreign Affairs, Finland	undefined	Finnish Environmental Institute has pre-qualified and invited CATIE to join efforts	P Ferreira
Formulation of the Soils, Water and Agroforestry Program (Nicaragua)	INTA IDB	45,000	Concluded: Sub-contract by Texas A&M	L Szott
PROSESUR	PNDR IDB	undefined	Proposal presented to PNDR	K Prins A Otárola

Table 6. Budget of current projects during 1997, in US$

PROJECT	DONOR	BUDGET
CATIE's CORE BUDGET		
Swedish Contribution to CATIE for Untied Budget Support	SIDA	1,450,000.00
Deferred Swedish contribution from 1996	SIDA	384,681.00
Maintenance and scholarships	FUNDA-TROPICOS	859,869.00
Professorship/FUNDATROPICOS	COSUDE	145,007.00
Support to the Masters Program	DANIDA	500,000.00
EDUCATION FOR CONSERVATION AND DEVELOPMENT		
ALFA Project	EC	17,295.00
Support to CATIE's scholarship Program	WWF	10,300.00
Environmental Certification on Sustainable management of tropical forests	McArthur Foundation	15,000.00
University of Alberta/University of Laval. Development of Postgraduate Studies	IDCR-CIID	48,448.00
RESEARCH PROGRAM		
Sustainable Tropical Agriculture Area		
White fly-vectored geminivirus in Tomatoes	USDA	51,535.00
Database for Genetic Resources	USDA	114,000.00
Selection and Generation of *Moniliasis* Resistant Cocoa Genotypes	ACRI	30,000.00
Maintenance of Cocoa Collections at CATIE	ACRI	20,000.00
Nematodes in Coffee (CIRAD)	EC	6,459.00
Support to the Integrated Pest management (IPM) Project for Nicaragua, Phase II	NORAD	611,460.00
Research on *Musa*	INIBAP	15,000.00
Sapotaceas	BID-IPGRI	21,125.00
Tropical Fruit and Vegetable crops	USDA	46,136.00
Development of an Integrated Management Strategy for *Rottboellia cochinchinensis* (itch grass) in Corn-Based Cropping Systems in Selected Areas of Latin America	NRI	99,336.00
Management of Herbicide Resistant Weeds in Rice X0336.	NRI	51,710.00
Biological Control of *Phyllophaga*	ODA/NRI	58,995.00
Sustainable improvement of coffee in Central America	EC/INCO	16,000.00
Genetic Improvement of Coffee	PROMECAFE, CIRAD, MAE, ORSTOM	90,000.00
Agroforestry System Area		
DANIDA Agroforestry Coordination	DANIDA	136,238.00
GTZ Agroforestry Systems	GTZ	311,030.00
GTZ Goats	GTZ	24,000.00
Chixoy Forestry Extension	IDB	471,254.00
Use of Live Barriers in Central America	NRI	8,700.00
Farming Systems in the Cayo, Stann Creek and Folido Districts, Belize	USAID	31,358.00
U. of Wageningen Project	UAW	45,800.00

PROJECT	DONOR	BUDGET
Tropical Forest Management and Silviculture Area		
CATIE/CONAP Project	USAID	416,260.00
Modeling the Genetic Effects of Forest Fragmentation	CIFOR/IPGRI	96,900,00
Treatment and Silviculture Technical Assistance, STP/CATIE/BELICE	USAID	31,358.00
Handling and storage of recalcitrant and intermediate forest tree seeds	IPGRI	4,135.00
DANIDA Seeds	DANIDA	636,582.00
Genetic Diversity of Mahogany	EC	77,480.00
Silviculture of Natural Forests, PROSIBONA	COSUDE	342,862.00
Technology Transfer and Promotion of Professional Formation and Natural Forest Management, TRANSFORMA	COSUDE	528,363.00
Secondary Forest Management in the American Tropics. Collaborative Research with Emphasis on the Forest Margins	CIFOR	156,403.00
Biodiversity Management Area		
Assistance for Training in Protected Areas in Panama	USDA	49,325.00
WWF Regional Coordination	WWF	25,900.00
Mangroves	DANIDA	254,879.00
Sustainable Development (OLAFO)	DANIDA/ NORAD	1,070,171.00
Production & Conservation Economic and Sociology Area		
Translation and edition of Economics book	SIDA	13,000.00
Support to Research and Training in Environmental Economics in Central American Development	SIDA	136,361.00
OUTREACH PROGRAM		
Communication and Information Area		
Forestry Journal	FINNIDA	109,300.00
Agroforestry in the Americas Journal	DANIDA	31,989.00
Further Development MIRA System Consistent with the Requirements of the TROPIS	CIFOR	20,000.00
Training and Conferences Area		
Training courses	USDA	44,000.00
Forest Certification Seminar	ORGUT	33,500.00
TOTAL		6,429,947.00

Table 7. CATIE's Associated Principal staff (APS) assigned by different countries and institutions in 1997

Country or Institution	No. of APS	Country or Institution	No. of APS
Denmark	1	World Wildlife Fund	2
France		INIBAP	2
CIRAD	3.5	PNUD	1
ORSTOM	1	IUCN	1
Germany	1	CIFOR	1
Netherlands	7	CIM	2
Switzerland	1		
United Kingdom	2		
Sweden	1	TOTAL	26.5

Table 8 shows an estimate of the contributions received through the strategic alliances with donor institutions and which include the staff from table 6 above.

Table 8. Counterpart contributions of strategic allies during the period 1992-1997, in US$ thousands

INSTITUTIONS	1992	1993	1994	1995	1996	1997
CIRAD-France	600	850	850	850	600	600
IPGRI/INIBAP	150	150	150	150	200	249
NRI-United Kingdom	250	300	250	250	180	180
COSUDE-Switzerland	495	495	400	495	300	100
GTZ-Germany	500	400	400	400	250	250
ODA-United Kingdom	200	200	200	200	50	---
UA Wageningen-The Netherlands	45	45	70	70	70	70
DGIS-The Netherlands	150	150	150	150	150	200
MAE-France	90	90	90	90	80	80
WWF-United States	140	140	200	250	250	250
ORSTOM-France	150	346	385	405	315	200
FINNIDA-Finland	---	180	300	300	300	50
Penn State University	---	125	125	75	20	---
ICRAF	---	---	25	30	30	30
ISNAR	---	---	20	50	---	---
CIFOR	---	---	30	125	200	300
UICN	---	---	25	25	40	40
CIAT	---	---	---	75	75	---
Laval University/University of Alberta-CIID	---	---	---	35	40	40
University of Veterinary Medicine-Denmark	---	---	---	50	75	40
DANIDA-Denmark	---	---	---	---	200	200
CIM	---	---	---	---	100	150
SIDA-Göteborg	---	---	---	80	125	200
TOTALS	**2,770**	**3,471**	**3,670**	**4,155**	**3,650**	**3,229**

Table 9 shows the total investment in research, graduate education, training and outreach during 1994, 1995, 1996 and 1997 considering the estimate of contributions received as strategic allies as presented in table 7 above.

Table 9. Total investment in research, graduate education, training and outreach, during 1994, 1995, 1996 and 1997, in US$ thousands.

DESCRIPTION	1994	1995	1996	1997
Core budget	5,613	5,667	7,482	10,266
Projects	11,170	10,980	7,145	6,430
Strategic alliances	3,670	4,155	3,650	3,229
TOTALS	**20,453**	**20,802**	**18,277**	**19,925**

VI. FINANCING

Summary of Accounting Activities and Policies.

CATIE is a legal, international, non-profit institution. CATIE was founded in 1973 and in 1983 a new contract was signed for an additional twenty years period.

CATIE's resources originate from regular incomes, agreements and productive activities. Its financial management information has been into five funds, according to their purpose and source (independent or consolidated financial statements): Basic Activities Fund, Trust Fund, Retirement Fund for Principal Professional Staff, Plant Fund and Agricultural Activities Fund. The accounting records and financial statements are expressed in US dollars (US$).

The regular incomes for the Basic Activities Fund are formed by the membership payments from member countries which are US 50.000 a year and a regular payment from the Inter American Board of Agriculture through the IICA, which arrives up to US$ 1,361.700 for 1997. The fees paid as inscription of regular students on the Master's and Doctoral Programs and for participants in training courses represent other important incomes for Basic Activities Fund.

This Fund also was strengthening by the contributions made by the Honorable Governments of Sweden and Denmark, which represented US$ 1,347.773, and US$ 500.000, respectively for 1997. Also for 1997, accounts showed an income of US$ 434.000 that was previously transferred by the Government of Sweden to CATIE in 1995.

Under the item "Trust Fund Income" it is included the funds received to execute specific research, education and development projects and are managed under the concept of "Custody Funds". The majority of this funds are keeping in "Quetzals" due to the large amount of the projects administrated for the Government of Guatemala (Minister of Agriculture and Livestock).

The incomes generated by the item "Productive Activities" are formed by two principal activities: Institutional Services and Commercial Farms. The first incomes represent the activity of housing and hotel services and are the biggest amount. Production of sugar cane, milk and coffee are the most important agricultural activities of the commercial farms. As a result of these activities, during 1997 US$ 527.480 contributed to the Basic Fund of CATIE.

All institutional accounts are annually auditing by an international famous Auditing Firm selected by the Inter American Board of Agriculture in its biannual meeting. By the other hand, all special funds for projects are periodically audited by different external auditing firms hired by the donors.

The item "Depreciation" was represented as an expense in previous years and that was affecting the General Balance. Since 1997 this item is registered directly in the Basic Fund as an exclusive item to register and control of the immovable, machinery and equipment.

As showed in tables 1 and 2, the total consolidated incomes during the period of 1997 were US$21.921.301,49 and the total expenses were US$21.547.212,39 and the balance were positive on the amount of US$ 374.089.10

Table 1. Income and Expense balance up to December 31, 1996 and 1997. Amounts expressed in US $.

	1996	1997
INCOME		
Membership	1,811,700.00	1,861,700.00
Technical Support Service	158,972.22	232,684.26
Teaching Activities	533,811.74	627,515.93
Productive Activities	2,019,231.51	2,105,939.58
Logistical & Administrative Support	943,312.12	689,509.83
Exchange differences	8,993.81	(18,476.19)
Other incomes	418,584.87	240,320.46
Donation and contribution specific	2,187,547.77	2,401,419.65
Subtotal	8,082,154.04	8,140,613.52
Trust Funds Income	13,147,601.66	13,780,687.97
Total Income	**21,229,755.70**	**21,921,301.49**
EXPENSES		
Director Office/Senior Management	824,429.89	916,782.99
Administration and Services	1,098,410.04	1,093,685.94
Technical Programs	4,139,970.65	4,177,595.88
Productive Activities	1,419,636.64	1,578,459.61
Depreciation	267,408.29	
Subtotal	7,749,855.51	7,766,524.42
Expenses in Trust Funds	13,147,601.66	13,780,687.97
Total expenses	**20,897,457.17**	**21,547,212.39**
Income - Expenditures Surplus	**332,298.53**	**374,089.10**

Table 2. Asset liability and balance combined statement of funds to December 1996 and 1997. Amouts expressed in US $.

	1996	1997
ASSETS		
Current Assets		
Cash	3,136,056.86	4,437,541.67
Negotiable assets	2,459,398.55	2,661,855.59
Document and account receivable:		
CATIE´s members	610,550.89	872,597.12
Other entries	173,736.64	133,408.20
Total account receivable	**784,287.53**	**1,006,005.32**
Inventories	435,186.05	160,891.49
Expenses paid in advance	27,545.43	4,138.07
Total current assets	**6,842,474.42**	**8,270,432.14**
Building, machinery and equipment	3,445,095.01	3,411,659.82
Member long term account receivable	1,427,132.27	1,303,879.93
Other assets	12,723.69	2,361.26
TOTAL ASSETS	**11,727,425.39**	**12,988,333.15**
FUND LIABILITIES & BALANCES		
Current liabilities:		
Document and account payable:		
Account payable	359,730.05	451,976.02
In Trust Funds	120,242.37	599,795.85
Accrued expenses	43,069.37	53,363.16
Supplies	212,146.06	442,047.65
Total current liabilities	**735,187.85**	**1,547,182.68**
Long term liabilities:		
Documents payable	59,131.23	33,478.43
Social benefits	108,178.61	90,185.66
Deferred credits, other liabilities	678,782.95	817,646.24
Total long term liabilities	**846,092.99**	**941,310.33**
Total Liabilities	**1,581,280.64**	**2,488,493.01**
Fund Statement	10,146,144.75	10,499,840.14
TOTAL LIABILITIES & WORK FUNDS	**11,727,425.39**	**12,988,333.15**

V. ADMINISTRATION

1. Improving and up dating administrative services.

During this period the improvement of procedures and information system continued and an inventory and purchase systems were implemented. With those tools, administrative procedures were simplified and the time to respond was reduced. The generation of an efficient database of inventories will permit to have immediate reports to improve decision-making actions.

2. Maintenance of infrastructure.

The following buildings or places were remodeled or repaired or refurbished: Irazú Apartments, Casa del café, meeting room at the third flour at Henry Wallace Building, Inter American Primary School, Graduate School, Training Building and the process of remodeling Orton Memorial Library was initiated.

3. Landscape program

A landscape program for CATIE's campus was design by an specialist during 1997 and the firsts steps of the program were accomplished. In fact, the surroundings of the Casa del Café Building, as well as those from the parking lot of the Orton Memorial Library, Graduate School and Training Center were redecorated.

4. Cafeteria

Since April 1997 a new concessionaire is operating the Institutional Cafeteria which is a very important service to our students and visitors, as well as for our personnel. The quality of the food and service was significantly increased.

5. Vehicles and other equipment

20% of the vehicles from the core budget were renewed to maintain quality of services as well to maintain the total value of the investment. A new whirl chart was purchased, as well as new mowing machines for maintenance of the green areas. This make considerable reduction on personnel.

6. New roles and procedures on working

- *Purchasing Unit*: A rotation of the personnel was implemented to enhance the polyfunctionality of functionaries that during years were doing the same job.

- *Dispatch services*: A new roll was established to the messengers that carried internal communications between different offices and buildings at campus. Time was reduced and eliminating a fix position at the different offices increased cover.

7. Commercial Activities

During 1997 there were an increase on the incomes regarding 1996 (5%), basically from the renting of houses and from the hotel activities. It is remarkable that this happened while a reduction on activities was significantly because of ending of some projects. A marketing program for the European Community Hotel was initiated with some travel agencies that result in a significantly occupation increase.

FARM ACTIVITIES

VI PUBLICATIONS

JOURNALS

AMMOUR, T. 1997. La foret en jeu l'extractivisme en Amazonie Centrale. Reseña de libro. Agroforesteria en Las Américas (4) 14:29-30.

ANTHONY, F.; BERTRAND, B.; LASHERMES, P.; CHARRIER, A. 1997. La Biologie Moléculaire en appui a l'amélioration génetique du caféier Arabica. Plantations, Recherche, Développement 4(6):369-377.

BEEK, R. aus der, SÁENZ, G. 1997. Impacto de las intervenciones silviculturales en los robledales de altura: estudio de caso en la Cordillera de Talamanca, Costa Rica. Revista Forestal Centroamericana 17:30-37.

BEER, J. (Editor Técnico). 1997. Café con Sombra. Agroforestería en las Américas 4 (13). 34 p.

BERTRAND, B.; AGUILAR, G.; BOMPARD, E.; RAFINON, A.; ANTHONY, F. 1997. Comportement agronomique et résistance aux principaux prédateurs de lignées de Sarchimors et Catimors (*Coffea arabica* L.), évaluées au Costa Rica. Plantations, Recherche, Développement 4(5):312-321.

CAMERO, A. 1997. Tesis de grado de Maestría en agroforestería realizadas en el CATIE de 1954 a 1996. Agroforestería en las Américas 3(11-12): 45-49.

CUBILLO, D.; SANABRIA, G.; HILJE, L. 1997. Mortalidad de adultos de *Bemisia tabaci* con extractos de hombre grande (*Quassia amara*). Manejo Integrado de Plagas (Costa Rica) 45:25-29.

CUERVO, J.; RIVAS, G.G. 1997. Biota rizosférica: un recurso para promover la protección y el crecimiento de las plantas. Hoja Técnica No. 21. Manejo Integrado de Plagas (Costa Rica). 44:i-iv.

CHAVES, L.; VALVERDE, B.E.; GARITA, I. 1997. Efecto del tiempo y la profundidad de entierro sobre la persistencia de la semilla de *Echinochloa colona* (L.) Link. Manejo Integrado de Plagas 45:18-24.

CHAVES, L.; VALVERDE, B.E.; ROJAS, C.E. 1997. Resistencia de *Ixophorus unisetus* a herbicidas inhibidores de la sintetasa del acetolactato. Manejo Integrado de Plagas 44:20-25.

DETFELSEN, G.; CARRERA, F. 1997. CATIE en Petén: las concesiones comunitarias como alternativas para el Desarrollo y la Conservación. Revista Bosques, Arboles y Comunidades Rurales(Quito, Ecuador), no. 29.

DUFOUR, M.; ANTHONY, F.; BERTRAND, B.; ESKES, A.B. 1997. Identification de caféiers mâles-stériles de *Coffea arabica* au CATIE, Costa Rica. Plantations, Recherche, Développement 4(6):401-407.

DUSSERT, S.; CHABRILLANGE, N.; ANTHONY, F.; ENGELMANN, F.; RECALT, C.; HAMON, S. 1997. Variability in storage response within a coffee (*Coffea* spp.) core collection under slow growth conditions. Plant Cell Reports16: 344-348.

DUSSERT, S.; CHABRILLANGE, N.; ENGELMANN, F.; ANTHONY, F.; HAMON, S. 1997. Cryopreservation of coffee (*Coffea arabica* L.) seeds: importance of the precooling temperature. Cryo-Letters 18:269-276.

EIBL, B.; MONTAGNINI, F.; GRANCE, L; MAIOCCO, D; NOZZI, D. 1997. Técnicas de enriquecimiento de bosques degradados en la selva Paranaense de Misiones, Argentina. Yvyrareta (Argentina) 8:100-101.

ENGELMANN, F.; LARBAUD, M.; CHARBRILANGE, N.; CARRON, M.P.; ETIENNE, H. 1997. Cryopreservation of embryogenic calluses of two commercial clones of *Hevea brasiliensis*. Cryo-Letters 18:107-116.

ESPINOZA, E.; BENAVIDES, J. 1997. Efecto del sitio y la fertilización nitrogenada sobre la producción y calidad del forraje de tres variedades de morera. Agroforestería en las Américas 3(11-12):24-27.

ETIENNE, H.; LARBAUD, M.; CARRON, M.P.; MICHAUX-FERRIERE, N. 1997. Use of calcium to optimize long-term proliferation of friable embriogenic calluses and plant regeneration in *Hevea brasiliensis* (Müll Arg.). Journal of Experimental Botany 48:129-137.

ETIENNE, H.; LARBAUD, M.; MICHAUX-FERRIERE, N.; CARRON, M.P.; BERTHOULY, M.; TEISON, C. 1997. Improvement of somatic embryogenesis in *Hevea brasiliensis* (Mull Arg.) using the temporary immersion technique. In Vitro Cell-Development Biology Plant 33:81-87.

FAUSTINO, J. 1997. Agua: Recurso estatégico en el futuro de América Central. Revista Forestal Centroamericana 18:6-12.

GÓMEZ, M.; SHULTZ, S.; RAMÍREZ, O.A. 1997. Contribución de las Plantaciones Forestales a las Cuentas Nacionales de Costa Rica. Revista Forestal Centroamericana 18:23-27.

GONZALEZ, J.; BENAVIDES, J.; KASS, M.; OLIVO, R.; ESPERANCE, M. 1997. Evaluación de la calidad nutricional de la morera (*Morus alba* L.) fresca y ensilada, con bovinos de engorda. Agroforestería en las Américas 3(11-12):20-23.

GUARIGUATA, M. R.; CHAZDON, R. L.; DENSLOW, J. S.; DUPUY, J. M.; ANDERSON, L. 1997. Structure and floristics of secondary and old-growth forest stands in lowland Costa Rica. Plant Ecology 132:107-120.

GUARIGUATA, M.R.; DUPUY, J.M. 1997. Forest regeneration in abandoned roads in lowland Costa Rica. Biotrópica 29(1):15-28.

HEREDIA, J.; KASS, D. 1997. Cambios en las propiedades físicas del suelo después de seis años de cultivo en callejones con dos sistemas de labranza. Agroforestería en las Américas 3(11-12):6-19.

HERNÁNDEZ, I.; BENAVIDES, J.; SIMON, L. 1997. Manejo de las podas de *Leucaena leucocephala* para la producción de forraje en el período seco en Cuba. Agroforestería en las Américas 3(11-12):28-31.

HERNÁNDEZ, O.; BEER, J.; VON PLATEN, H. 1997. Rendimiento de café (*Coffea arabica*) cv Caturra, producción de madera (*Cordia alliodora*) y análisis financiero de plantaciones con diferentes densidades de sombra en Costa Rica. Agroforestería en las Américas 4(13):8-13.

HUANG, W.; KANNINEN, M.; XU, Q.; HUANG, B. 1997. Agroforestry in China: Present state and future potential. Ambio 26(6):394-398.

IBRAHIM, M. (EDITOR TÉCNICO). 1997. Sistemas Silvopastoriles. Agroforestería en las Américas 4(15). 32 p.

IBRAHIM, M.; BOTERO, J.; CAMERO, A. 1997. Pasturas en Callejones. Agroforestería en las Américas 4(15):23-25.

JANSEN, H.; NIEUWENHUYSE, A.; IBRAHIM, M.; ABARCA, S. 1997. Evaluación económica de la incorporación de leguminosas en pasturas mejoradas comparado con sistemas tradicionales de alimentación en la zona Atlántica de Costa Rica. Agroforestería en las Américas 4(15):9-13.

JANSEN, H.G.P.; IBRAHIM, M.A.; NIEUWENHUYSE, A; MANNETJE, L. T; JOENJE, M.; ABARCA, S. 1997. The economics of improved pasture and silvipastoral technologies in the Atlantic Zone of Costa Rica. Tropical Grasslands 31:588-598.

JIMÉNEZ, J.M.; OÑORO, P.; VÍQUEZ, E. 1997. Producción de ñampí (*Colocasia esculenta* var. *Antiquorum*) y maíz (*Zea mays L.*) en asocio con *Erythrina fusca* y *Calliandra calothyrsus*. Agroforestería en las Américas 4(14):6-11.

KAPP, G.B.; BEER, J.; LUJAN, R. 1997. Timber tree mortality and growth on farm boundaries in the Atlantic lowlands of Costa Rica and Panama. Agroforestry Systems 35:139-154.

KASS, D.(EDITOR TÉCNICO). 1997. Cultivo en callejones. Agroforestería en las Américas 4(14). 32 p.

KASS, D.; JIMÉNEZ, J.; SCHLÖNVOIGT, A. 1997. Como hacer el cultivo en callejones más productivo, sostenible y aceptable a pequeños productores. Agroforestería en las Américas 4(14):21-23.

KASS, D.; SYLVESTER-BRADLEY, R.; NYGREN, P. 1997. The role of nitrogen fixation and nutrient supply in some agroforestry systems of the Americas. Soil Biology Biochem. 29(5-6):775-785.

LEAH, J.; CASELEY, C.; RICHES, R.; VALVERDE, B.E. 1997. Effect of mono-oxygenase inhibitors on uptake, metabolism and phytotoxicity of propanil in resistant biotypes of junglerice, *Echinochloa colona*. Pestic. Sci 49:141-147.

LÓPEZ, F., KASS, D. 1997. Efectos de enmiendas orgánicas en la dinámica del fósforo e indicadores de actividad biológica sobre el rendimiento del frijol en un suelo Acrudoxic Melanudand. Agroforestería en las Américas 3(11-12):12-15.

LOPEZ, P.J.; JARA, L.F.; MESEN, F. 1997. Variación en resistencia de *Cedrela odorata* al ataque de *Hypsipyla grandella*. Revista Forestal Centroamericana 19:20-25.

MENDEZ, E.; LOK, R., SOMARRIBA, E. 1997. Análisis agroecológico de huertos caseros tradicionales en Nicaragua. Agroforestería en las Américas 3(11-12):36-40.

MESEN, F.; NEWTON, A.C.; LEAKEY RRB. 1997. The effects of propagation environment and foliar areas on the rooting physiology of *Cordia alliodora* (Ruiz & Pavon) Oken cuttings. Trees 11:401-411.

MESEN, F.; NEWTON, A.C.; LEAKEY, R.R.B. 1997. Vegetative propagation of *Cordia alliodora* (Ruiz & Pavon) Oken: the effect of IBA concentration, propagation medium and cutting origin. Forest Ecology and Management 92:45-54.

MONTAGNINI, F.; EIBL, B.; GRANCE, L.; MAIOCCO, D.; NOZZI, D. 1997. Enrichment planting in overexploited subtropical forests of the Paranaense region of Misiones, Argentina. Forest Ecology and Management 99:237-246.

MUSCHLER, R.; BONNEMANN, A. 1997. Potentials and limitations of agroforestry for changing land-use in the tropics: experiences from Central America. Forest Ecology and Management 91:61-73.

ORCHERTON, D.; SOMARRIBA, E. 1997. El huerto casero y otros sistemas de producción dentro del sistema finca: el papel del hombre y la mujer. Agroforestería en las Américas 3(11-12):32-35.

PEREZ, O.; RAMIREZ, O.A.; HILJE, L.; KARREMANS, J. 1997. Potencial de Adopción de dos Opciones Tecnológicas de Manejo Integrado de Plagas (MIP), Aplicando Tres Técnicas de Extensión con Productores de Tomate en el Valle Central Occidental, Costa Rica. Manejo Integrado de Plagas 43:19-30.

RAMIREZ, O.A. 1997. Estimation and Use of a Multivariate Parametric Model for Simulating Heteroscedastic, Correlated, Non-Normal Random Variables: The Case of Corn-Belt Corn, Soya Beans and Wheat Yields. American Journal of Agricultural Economics 79:191-205.

RAMIREZ, O.A.; MOSS, C.; BOGGESS, W. 1997. Debt and Consumption Responses to Changes in Agricultural Policies. Agricultural Finance Review (forthcoming)

RAMIREZ, O.A.; OLIVO, R. 1997. Metodologías para Asignar Prioridad a Proyectos de Investigación y Extensión en Programas de Agricultura Sustentable. Manejo Integrado de Plagas (forthcoming).

RIVAS, G.G. 1997. Micorrizas. Hoja Técnica No. 20. Manejo Integrado de Plagas (Costa Rica). 43:i-iv.

RIVERA, J.O. 1997. El rol de los entes externos en las comunidades. Una experiencia con los artesanos Teribe en Panamá. Desarrollo Agroforestal y Comunidad Campesina, no.30.

ROJAS, T.; MARBÁN, N.; VÁSQUEZ, N. 1997. Adherencia y parasitismo de *Pasteuria penetrans* en *Meloidogyne incognita* y *Meloidogyne arabicida*. Manejo Integrado de Plagas Nº 44:7-13.

SAENZ, F.; SHULTZ, S.; HYMAN, G. 1997. El Uso de un Sistema de Información Geográfica (SIG) en la Identificación de Degradación de Tierras y Recursos Hídricos. Revista Forestal Centroamericana 18:18-22.

SHULTZ, S. 1997. Assessment of Non-Market Valuation Studies in Developing Countries of Central America and the Caribbean. UNDP Journal of the Latin American Economic and Planning Commission (CEPAL) (forthcoming).

SHULTZ, S.; FAUSTINO, J.; MELGAR, D. 1997. Agroforestry and soil conservation adoption and profitability in El Salvador. Agroforestry Today, 9:16-18.

SHULTZ, S.; PINAZZO, J. 1997. Opportunities and Limitations of Contingent Valuation Surveys to Determine National Park Entrance Fees: Evidence from Costa Rica. Environmental and Development Economics (forthcoming).

SHULTZ, S.; SAENZ, F.; HYMAN, G. 1997. Linking People to Watershed and Protected Area Planning with a GIS: A Case Study of the Rio Pacuare, Costa Rica. Society and Natural Resources (forthcoming).

SIMON, M.; IBRAHIM, M. 1997. Manejo del Monte en la Cuña Boscosa Santafecina: aplicación de un tratamiento silvicultural en sistemas silvopastoriles en el Chaco Argentino. Agroforestería en las Américas 4(15):14-19.

SOMARRIBA E. (EDITOR TÉCNICO). 1997. Edición Especial Tesis de Maestría en Agroforestería, 1996. Agroforestería en las Américas 3(11-12). 49 p.

SOMARRIBA, E. 1997. ¿Se puede aprovechar árboles maderables de sombra sin dañar el café? Agroforestería en las Américas 4(13):28-29.

SOMARRIBA, E. 1997. Lineamientos para la preparación de artículos basados en tesis, para publicar en las revistas especializadas del CATIE. Agroforestería en las Américas 3(11-12):41-42.

SOMARRIBA, E. 1997. Pastoreo bajo plantaciones forestales. Agroforestería en la Américas 4(15):26-28.

VASCONCELOS, J.; KASS, D.; SOMARRIBA, E.; MORERA, J. 1997. Efectos de los cultivos en callejones y otras enmiendas orgánicas sobre las fracciones de fósforo del suelo. Agroforestería en las Américas 3(11-12):8-11.

I. BOOKS

ANTHONY F.; DUSSERT S. 1996. Descriptors for coffee (*Coffea* spp. and *Psilanthus* spp.). IPGRI ed., Roma, Italia, 36 p.

BOSHIER, D. H.; BEER, J. 1997. Genetic improvement of *Cordia alliodora*. *In*: Boshier D.H. and Lamb A.T. (eds.). *Cordia alliodora*: genetics and improvement. Tropical forestry paper. No. 36. Oxford Forestry Institute. Oxford, UK. Pp. 83-89.

BOSHIER, D.H.; BEER, J. 1997. Genetic improvement of Cordia alliodora. *In*: Boshier D.H. and Lamb A.T. (eds.) Cordia alliodora: genetics and improvement. Tropical Forestry paper. N°36. Oxford Forestry Institute. Oxford, UK. pp 83-89.

DUSSERT, S.; CHABRILLANGE, N.; ENGELMANN, F.; ANTHONY, F.; NOIROT, M.; HAMON, S. 1997. In vitro conservation of coffee (*Coffea* spp.) germplasm. In: Conservation of genetic resources in-vitro, Vol. 1, (Eds. M.K. Razdan & E.C. Cocking). Science Publishers, New York. Pp 287-305.

FAUSTINO, J. 1997. Rainwater harvesting from rooftop catchments. Source book of alternative technologies for freshwater augmentation in Latin America and Caribbean. Washington, OAS-UNEP. pp 33-45.

FAUSTINO, J. 1997. Water conveyance by pipelines, aqueducts, and water tankers. Source book of alternative technologies for freshwater augmentation in Latin America and Caribbean. Washington, OAS-UNEP. pp 85-89.

MESEN, F. 1997. Propagación vegetativa (Capítulo 8). *In*: *Cordia alliodora*, Genética y Mejoramiento de Arboles. Tropical Forestry Papers No. 36. Boshier DH and Lamb AT (eds), (Traducido por Francisco Mesén y Helga Blanco), Oxford Forestry Institute, Department of Plant Sciences, University of Oxford. pp. 77-86.

MESEN, F. 1997. Vegetative propagation (Chapter 8). *In*: *Cordia alliodora*, Genetics and Tree Improvement. Tropical Forestry Papers No. 36, Boshier DH and Lamb AT (eds), Oxford Forestry Institute, Department of Plant Sciences, University of Oxford. pp. 73-81.

VOGT, K.; ASBJORNSEN, H.; ERCELAWN, A.; MONTAGNINI, F.; VALDES, M. 1997. Roots and mycorrhizas in plantation ecosystems. *In*: Better Management of Soil, Water and Nutrients in Tropical Plantation Forests (Eds. Nambiar, E. K. S. and Brown, A. G.). ACIAR/CSIRO/CIFOR. ACIAR, Canberra, Australia. pp. 247-296.

WORKSHOPS, MEETINGS, SEMINARS

AGUILAR, M. E.; ASTORGA, C.; ORELLANA, M.; VAZQUEZ, N.; PEREZ, L.; SALAZAR, K.; COTE, F. 1997. Potencial del cultivo de tejidos para la conservación y el mejoramiento de especies arbóreas: caoba, cedro, zapote y caimito. *In*: BIOVEG´97. Técnicas de avanzada aplicadas a la propagación masiva de plantas. Ciego de Avila, Cuba 2-5 de Abril de 1997. Pp. 128.

ALVARADO, A.; HERRERA, B. 1997. Calidad de sitio y factores ambientales en bosques coetáneos de Centroamérica: experiencias y perspectivas futuras. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B.,

Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 62-64.

BARRERA, J. E. 1997. Herramientas para la ordenación forestal del manglar del Pacífico Norte (Estero Real) de Nicaragua. *In*: Resúmenes de ponencias. (Eds. E. Morales M. & F. Cartin B.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. Pp. 55-58.

BEEK, R. aus der; SAENZ, G. 1997. Lineamientos para la planificación del manejo forestal sostenible y diversificado. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 53-54.

BERNINGER, F.; KANNINEN, M. 1997. Módelos ecofisiológicos para los bosques de plantaciones. *In*: Resúmenes de ponencias (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 125-127.

BERTRAND, B.; AGUILAR, G.; SANTACREO, R.; ANTHONY, F.; ETIENNE, H. 1997. Comparación de híbridos F1 con variedades de *Coffea arabica*. XVII Simposio Latinoamericano de Caficultura, 16-19 setiembre, 1997. San José, Costa Rica. PROMECAFE ed. Pp. 245-251.

CAMACHO, M.; FINEGAN, B.; OROZCO, L. 1997. Crecimiento de bosques húmedos tropicales manejados del noreste de Costa Rica: primera década de investigación. *In*: Resúmenes de ponencias. (E. Morales M. & F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp.39-41.

CAMERO, A. 1997. Cuatro Décadas de Experiencia Agroforestal en CATIE. *In*: Memorias Seminario Nacional sobre Agroforestería. Fundación Loma Quita, Espuela, Santo Domingo, República Dominicana, 6 de junio, 1997. Pp.1-20.

CAMINO, T. de. 1997. Uso de sistemas de información para el procesamiento y análisis de información. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 278-280.

CAMPOS, J. J. 1997. Sostenibilidad del manejo de bosques naturales en Costa Rica: posibilidades dentro del bosque (Ponencia motivadora). *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 2-16.

CARAZO, E.; VALVERDE, B.E.,; RODRÍQUEZ, O.M.; BARQUERO, M. 1997. Persistence of terbufos and its metabolites in soil and maize. *In:* Proceedings International Symposium on the Use of Nuclear and Related Techniques of Crop Protection Chemicals, Vienna, Austria. Pp. 215-222.

CORNELIUS, J.P. 1997. Mejoramiento genético forestal para finqueros pequeños y medianos. I. Resultados y experiencias de 17 años de investigación del CATIE en Costa Rica. *In*: Avances en la producción de semillas forestales en América Latina (R. Salazar, Ed.). pp. 31-42.

CORNELIUS, J.P. 1997. Mejoramiento genético forestal para finqueros pequeños y medianos. II. Necesidades actuales y futuras en América Central. *In*: Avances en la producción de semillas forestales en América Latina (R. Salazar, Ed.). pp. 43-50.

CUBILLO, D.; SANABRIA, G.; HILJE, L. 1997. Disminución de la severidad del mosaico amarillo del tomate mediante coberturas al suelo. *In*: IV Congreso Costarricense de Entomología. San José, Costa Rica. 17-21 Noviembre, 1997. Pp. 46.

CUBILLO, D.; SANABRIA, G.; HILJE, L. 1997. Mortalidad de adultos de *Bemisia tabaci* (*Homoptera: Aleyrodidae*) con extractos de hombre grande (*Quassia amara*). *In*: IV Congreso Costarricense de Entomología. San José, Costa Rica. 17-21 Noviembre, 1997. Pp. 74.

DELGADO, D.; FINEGAN, B.; ZAMORA, N. 1997. Efectos del aprovechamiento forestal y el tratamiento silvicultural en un bosque húmedo del noreste de Costa Rica: cambios en la riqueza y composición de la vegetación. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 47-49.

ETIENNE, H.; PEREIRA, A.; SOLANO, W.; AGUILAR, M.E.; CÔTE, F.; BERTRAND, B.; BERTHOULY, M. 1997. Micropropagación masiva de híbridos élites F1 de *Coffea arabica* por embriogénesis somática. Congreso BioVeg'97. Advances techniques applied to mass clonal propagation of plants, 2-5 Abril 1997, Ciego de Avila (Cuba). 52 p.

ETIENNE, H.; SOLANO, W.; PEREIRA, A.; BARRY-ETIENNE, D.; BERTRAND, B.; ANTHONY, F.; COTE, F.;k BERTHOULY, M. 1997. Utilización de la embriogénesis somática en medio líquido para la propagación masal de los híbridos F1 de *Coffea arabica*. XVIII Simposio Latinoamericano de Caficultura, 16-19 setiembre, 1997. San José, Costa Rica. PROMECAFE (ed.). Pp.. 253-261.

ETIENNE, H.; SOLANO, W.; PEREIRA, A.; BARRY-ETIENNE, D.; BERTRAND, B.; ANTHONY, F.; COTE, F., BERTHOULY M. 1997). Utilización de la

embriogénesis somática en medio líquido para la propagación masal de los híbridos F1 de *Coffea arabica*. PROMECAFE ed., Proceedings. Pp. 253-261.

FASSAERT, C. 1997. Gender and Natural Resources Management. Paper presented at the 1997 Symposium on Human Dimensions of Natural Resources Management in the Americas. Belize City, Belize, February 26-28, 1997.

FINEGAN, B.; CAMACHO, C.; DELGADO, D.; OROZCO, L. 1997. Producción y conservación eb bosques húmedos de Costa Rica: los efectos del aprovechamiento y la aplicación de los tratamientos silviculturales sobre el crecimiento de los árboles y la biodiversidad vegetal. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 59-61.

GALLOWAY, G. 1997. El fomento de plantaciones forestales en América Central. (Ponencia motivadora). *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 66-85.

GALLOWAY, G. 1997. Proyecto Regional TRANSFORMA (CATIE/COSUDE): Transferencia de tecnología y promoción de la formación profesional en manejo de bosques naturales. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 188-190.

GOMEZ, M.; RAMIREZ, O.A. 1997. Valoración de Opciones de Venta de Productos Maderables y sus Implicaciones sobre la Rentabilidad de las Plantaciones Forestales en América Central. Estudio presentado en el III Congreso Forestal Centroamericano. San José, Costa Rica, 15-17 de septiembre de 1997.

GOMEZ, P.; CUBILLO, D.; MORA, G.A.; HILJE, L. 1997. Evaluación de productos comerciales como posibles repelentes de *Bemisia tabaci* (*Homoptera: Aleyrodidae*). In: IV Congreso Costarricense de Entomología. San José, Costa Rica. 17-21 de Noviembre, 1997. Pp. 73.

GOMEZ, P.; CUBILLO, D.; MORA, G.A.; HILJE, L. 1997. Evaluación de sustancias vegetales como posibles repelentes de *Bemisia tabaci* (*Homoptera: Aleyrodidae*). *In*: IV Congreso Costarricense de Entomología. San José, Costa Rica. 17-21 de Noviembre, 1997. Pp. 75.

GRANADOS, G.; HILJE, L. 1997. Informe de Costa Rica. VI Taller Latinoamericano y del Caribe sobre Moscas Blancas y Geminivirus. Santo Domingo, República Dominicana, 18-19 Agosto, 1997. Pp. 3-4.

GRAPIN, A.; ORTIZ, J.L.; CÔTE, F.X. 1997. El programa de investigación en *Musa* del CATIE. Sexta reunión del Comité Asesor Regional INIBAP-LACNET. Turrialba, Costa Rica, del 03 al 08 de agosto de 1997.

GUILLEN, L. 1997. Resultados preliminares de investigaciones en un bosque secundario de la tercera fase sucesional: estudio de caso Finca El Cerro, San Carlos, Costa Rica. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 31-33.

GUTIERREZ, M. 1997. Proceso metodológico del ordenamiento de los recursos naturales de los manglares del Pacífico Norte (Estero Real), Nicaragua. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 51-54.

HERRERA, B; CAMPOS, J.J. 1997. Evaluación del efecto del sitio en la población de Vochysia ferruginea en un bosque tropical secundario de Costa Rica. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 9-11.

HILJE, L. 1997. Delay of geminivirus dissemination in tomato fields by interfering with *Bemisia tabaci* adults. *In*: 5th Annual Progress Review of the 5 Year National Research and Action Plan for Development of Management and Control Methodology for Silverleaf Whitefly. San Diego, California. January, 1997. Pp. 180.

HILJE, L. 1997. Hacia un esquema de manejo sostenible de plagas de hortalizas: el caso del complejo mosca blanca-geminivirus en tomate. *In*: IV Congreso Costarricense de Entomología. San José, Costa Rica, 17-21 Noviembre, 1997. Pp. 43-45.

HILJE, L. 1997. Posibilidades para el manejo integrado del complejo mosca blanca- geminivirus en tomate, en América Central. *In*: XVI Congreso Brasileño de Entomología. Salvador, Bahía, Brasil, 2-7 Marzo, 1997. pp. 9.

HILJE, L. 1997. Prácticas agrícolas para el manejo del complejo mosca blanca-geminivirus en tomate. I Taller Internacional sobre Geminivirus en el Caribe. Quivicán, La Habana, Cuba. 27-28 de noviembre de 1997. Pp. 72.

HILJE, L.; CUBILLO, D.; SANABRIA, G. 1997. Evaluación de repelencia y mortalidad de varios insecticidas blandos sobre *Bemisia tabaci*. VI Taller

Latinoamericano y del Caribe sobre Moscas Blancas y Geminivirus. Santo Domingo, República Dominicana, 18-19 Agosto, 1997. Pp. 33.

HILJE, L.; CUBILLO, D.; SANABRIA, G. 1997. Mortalidad de adultos de *Bemisia tabaci* con extractos de hombre grande (*Quassia amara*). VI Taller Latinoamericano y del Caribe sobre Moscas Blancas y Geminivirus. Santo Domingo, República Dominicana, 18-19 Agosto, 1997. Pp. 35.

KANNINEN, M. 1997. Los bosques y el cambio global. (Ponencia motivadora). In: Resúmenes de ponencias. (Eds. E. Morales M. & F. Cartin B.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. Pp. 2-5.

KANNINEN, M.; AGUILAR, M.E.; NAVARRO,C.; COTE, F. 1997. Networking the research in biotechnology and forest tree improvement in Central America and the Caribbean. Workshop on recent advances in biotechnology for tree conservation and management. Florianopolis, Brazil (15-19 september) 1997 (Lecture).

KASS, D. 1997. How important is the BNF of woody legumes and nitrogen fixing trees. *In*: Proceedings International Congress on Biological Nitrogen Fixation: The Global Challange and Future Needs. Bellagio, Italia. 8-12 Abril. Pp. 56-58.

KENT, J.; AMMOUR, T.; MARMILLOD, D.; VILLALOBOS, R. 1997. Research and Development: Towards the Sustainable Management of a Nutural Insecticide in Talamanca, Costa Rica. *In*: Washington State University (comp.). Proceedings, IUFRO All Division 5 Conference. Forest Products for Sustainable Forestry. July 7-12, 1997. Pullman, USA, Washington State University. pp.272.

KENT, J.; STANDLEY, S.; MARMILLOD, D. 1997. Evaluación de la factibilidad financiera de tratamientos silviculturales en una concesión comunitaria en Petén, Guatemala. In: Sabogal, C.; Camacho, M.; Guariguata, M. (eds). Experiencias prácticas y prioridades de investiación en silvicultura de bosque naturales en América Tropical; Actas. Turrialba, Costa Rica. CIFOR/CATIE/INIA. Pp. 201-205.

LOBO, I.; KENT, J.; AMMOUR, T. 1997. Evaluación de aspectos financieros y técnicos en el aprovechamiento artesanal en un bosque latifoliado de la zona norte de Honduras. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 34-36.

MADRIZ, J.P. 1997. Exploración etnobotánica de la flora silvestre comestible en los bosques húmedos tropicales de la Reserva Aborigen Tayni, Limón, Costa Rica. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B.,

Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 agosto, 1997. pp. 198-200.

MARMILLOD, D. 1997. Incorporación de especies no maderables en procesos productivos de bosques: metodologías e implicaciones sobre el quehacer forestal tradicional. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 40-43.

MARMILLOD, D.; CACERES, F.; RAMÍREZ, R.; BARRERA, J.E.; AGUILAR, B.; PANIAGUA, C. 1997. Aprovechamientos experimentales de lena en manglares: una herramienta en el anAlisis de la viabilidad de la propuesta de manejo forestal. *In*: Resúmenes de ponencias. (E. Morales M. y F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 47.

MARMILLOD, D.; GALVEZ, J. 1997. Efecto del aprovechamiento maderero sobre la población de bayal; implicaciones para una silvicultura con fines de producción diversificada. *In*: Sabogal, C.; Camacho, M.; Guariguata, M. (eds). Experiencias prácticas y prioridades de investiación en silvicultura de bosque naturales en América Tropical; Actas. Turrialba, Costa Rica. CIFOR/CATIE/INIA. pp. 209-220.

MONTIEL, H.; VILLALOBOS, R.; MARMILLOD, D.; OCAMPO, R.; VALERIO, J. 1997. Identificación de herramientas para la estimación de existencias de *Smilax chiriquensis* (recurso no maderable medicinal) en bosques naturales. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.) III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp.37-39.

MORATAYA, R., GALLOWAY, G. 1997. Relaciones entre follaje y albura e implicaciones en el manejo de plantaciones en *Tectona grandis* L.F. y *Gmelina arborea* Roxb. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.), III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 111-114.

MUSCHLER, R.G. 1997. ¿Sombra o sol para un cafetal sostenible?: un nuevo enfoque de una vieja discusión. *In*: Memorais del 18vo Simposio Latinoamericano de Caficultura. San José, Costa Rica. IICA/PROMECAFE. Pp.. 471-476.

MUSCHLER, R.G.; RAMIREZ, R.A.; BAKER, C.G. 1997. Efectos de sombra de *Erythrina poeppigiana* sobre *Coffea arabica* vars. Caturra y Catimor. *In*: Memorias del 18vo Simposio Latinoamericano de Caficultura. San José, Costa Rica. IICA/PROMECAFE. Pp.. 157-162.

NAVARRO C.; GILLIES A.; WILSON, J.; HERNANDEZ M. 1997. Resultados del proyecto Evaluación de la Diversidad Genética de Caoba, en Centroamérica y México. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 106-107.

NAVARRO C.; HERNANDEZ M. 1997. Variación genética en *Swietenia macrophylla* en Upala, Costa Rica. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 42-44.

NAVARRO, O.; CARTÍN, V.; HILJE, L.; CUBILLO, D. 1997. Eficacia de insecticidas no convencionales para el control de *Bemisia tabaci* (*Homoptera: Aleyrodidae*) en chile dulce, en Pérez Zeledón. IV Congreso Costarricense de Entomología. San José, Costa Rica. 17-21 de noviembre, 1997. Pp. 72.

PANIAGUA, C. 1997. Aprovechamiento experimental de leña en manglares: una herramienta en el análisis de la viabilidad de la propuesta de manejo forestal. *In*: Resúmenes de ponencias (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 44-47.

QUIROS, D. 1997. Efectos de la desvitalización de árboles mediante tratamientos silviculturales: estudios de caso en bosques húmedos tropicales de bajura. In: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. pp. 23-24.

RAMIREZ, O.A. 1997. Linear Regression with Non-normal Error Terms Using the Inverse Hyperbolic Sine Transformation. Paper presented at the annual meetings of the American Agricultural Economics Association. Toronto, Canada, July 27-30, 1997.

RAMIREZ, O.A. 1997. Monitoring and Valuating Carbon Storage in Costa Rica's Forestry Plantations. Paper presented at the symposia Human Dimensions of Sustainable Forestry Management for Global Climate Change. CATIE, Turrialba, Costa Rica, February 29 to March 1, 1997.

RAMIREZ, O.A.; GOMEZ, M.; SHULTZ, S. 1997. Valuing the Contribution of Plantation Forestry to the National Accounts of Costa Rica from the Ecological Economics Perspective. Paper presented at The Beijer Institute Research Seminar, Punta Leona, Costa Rica, November 6-8, 1997.

RAMIREZ, O.A.; SHULTZ, S.; FASSAERT, C. 1997. Experiences of the CATIE Environmental Economics and Sociology Area in Training Students from Central America and the Caribbean. Paper presented at the 1997

Symposium on Human Dimensions of Natural Resources Management in the Americas. Belize City, Belize, February 26-28, 1997.

RAMIREZ, O.A.; SHULTZ, S.; GOMEZ, M. 1997. Alternative Model Specifications to Explain the Adoption of Pest Management, Agroforestry and Soil Conservation Technologies in Developing Countries. Paper presented at the annual meetings of the American Agricultural Economics Association. Toronto, Canada, July 27-30, 1997.

RICHES, C.R.; KNIGHTS, J.S.; CHAVES, L.; CASELEY, V.; VALVERDE, B. 1997. The role of pendimethalin in the integrated management of propanil-resistant *Echinochloa colona* in Central America. Resistance 97 Programme and Abstracts, p.23.

ROBLES, G. 1997. Elementos ecológicos para la silvicultura de *Zamia skinneri*. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 19-21.

SAENZ, G.; BEEK, R. aus der; VILLEGAS, G. 1997. Impacto de las intervenciones silviculturales en robledales de altura: estudio de caso en la Cordillera de Talamanca, Costa Rica. *In*: Resúmenes de ponencias. (Eds. E. Morales M. & F. Cartin B.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 42-44.

SANCHEZ, V.; BUSTAMANTE, E.; ZÚÑIGA, C. 1997. Avances sobre el control biológico de *Rottboellia cochinchinensis*. *In*: Congreso APS, División del Caribe, San José, Costa Rica, 10-12 Noviembre, 1997. Pp. 75.

SEPULVEDA, N.; MARMILLOD, D.; SEDILES, E. 1997. Crecimiento de rodales naturales de *Laguncularia racemosa* y *Avicennia germinans* en la zona pacífica norte de Nicaragua. *In*: Resúmenes de ponencias. (E. Morales M.; F. Cartin B., Eds.). III Congreso Forestal Nacional. San José, Costa Rica. 27-29 de agosto, 1997. pp. 36-38.

SHULTZ, S. 1997. An Assessment of Non-Market Valuation Techniques in Central America. Paper presented at the 1997 Symposium on Human Dimensions of Natural Resources Management in the Americas. Belize City, Belize, February 26-28, 1997.

SHULTZ, S. 1997. Integrating Socioeconomic and Biophysical Data with a GIS to Plan, Monitor and Evaluate Reforestation Efforts. Paper presented at the symposia Human Dimensions of Sustainable Forestry Management for Global Climate Change. CATIE, Turrialba, Costa Rica, February 29 to March 1, 1997.

SHULTZ, S.; PINAZZO, J. 1997. The Contingent Valuation Method to Determine National Park Entrance Fees in Costa Rica. Paper presented at the annual meetings of the American Agricultural Economics Association. Toronto, Canada, July 27-30, 1997.

SOMARRIBA, E. 1997. Contribución de la agroforestería a la economía de la región Centroamericana. *In*: Resúmenes de ponencias. (Eds. E. Morales M. y& F. Cartin B.). III Congreso Forestal Centroamericano. San José, Costa Rica. 15-17 setiembre, 1997. Pp. 144-153.

SOMARRIBA, E. 1997. Modelaje de varios sistemas de poda de café: efectos sobre el patrón de producción. *In*: Memorias del 18 Simposio Latinoamericano de Caficultura. San José, Costa Rica. IICA/PROMECAFE. Pp.. 99-104.

ZUÑIGA, C.; GONZÁLEZ, R.; BUSTAMANTE, E. 1997. Comportamiento de cuatro introducciones del género *Brachiaria* a la influencia de hongos fitopagógenos bajo dos niveles de humedad en el suelo. *In*: Congreso APS, División del Caribe, San José, Costa Rica, 10-12 Noviembre. Pp. 76.

INSTITUTIONAL SERIALS

CAMACHO, M.; FINEGAN, B. 1997. Efectos del aprovechamiento forestal y el tratamiento silvicultural en un bosque húmedo del noreste de Costa Rica: crecimiento diamétrico con énfasis en el rodal comercial. Colección Silvicultura y Manejo de Bosques Naturales. CATIE. Serie Técnica. Informe Técnico no. 295. 38 p.

COTO, T.D. 1997. *Lepidoptera* en cultivos anuales y perennes. Manual para su reconocimiento. CATIE. Serie Técnica. Manual Técnico No. 26. 63 p.

DELGADO, D.; FINEGAN, B.; ZAMORA, N.; MIER, P. 1997. Efectos del aprovechamiento forestal y el tratamiento silvicultural en un bosque húmedo del noreste de Costa Rica: cambios en la riqueza y composición de la vegetación. Colección Silvicultura y Manejo de Bosques Naturales. CATIE. Serie Técnica. Informe Técnico No. 298. 43 p.

GALLOWAY, G.; BEER, J. 1997. Oportunidades para fomentar la silvicultura en cafetales en America Central. Turrialba, Costa Rica. CATIE. Serie Técnica. Informe Técnico No.285. 168p.

GOMEZ, M.; RAMIREZ, O.A. 1997. Una Metodología para el Análisis Financiero de las Concesiones Forestales en el Petén, Guatemala. Serie Técnica del CATIE (CATIE-CONAP) (forthcoming).

LUJAN, R.; BEER, J.; KAPP, G. 1996. Manejo y crecimiento de linderos de tres especies maderables en el valle de Sixaola, Talamanca, Costa Rica. CATIE. Serie Técnica. Informe Técnico No. 241. 73 p.

LUJAN, R.; BEER, J.; KAPP, G. 1997. Manejo y crecimiento de linderos de tres especies maderables en el distrito de Changuinola, Panamá. Turrialba, Costa Rica. CATIE. Serie Técnica. Informe Técnico No. 242. 41 p.

REYES, R.R., AMMOUR, T. 1997. Sostenibilidad de los sistemas de producción en la concesión comunitaria de San Miguel, Petén, Guatemala, CATIE. Serie Petén, no. 1.

SOMARRIBA, E.; MELENDEZ, L.; CAMPOS, W.; LUCAS, C.; LUJAN, R. 1997. Cacao bajo sombra de leguminosas en Talamanca, Costa Rica: manejo, fenología, sombra y producción de cacao.. Turrialba, Costa Rica. CATIE. Serie Técnica. Informe Técnico No. 289. 40 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en El Salvador. CATIE. Serie Técnica. Informe Técnico no. 291. 189 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en Guatemala. CATIE. Serie Técnica. Informe Técnico no. 287. 300 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en Honduras. CATIE. Serie Técnica. Informe Técnico no. 288. 160 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en Costa Rica. CATIE. Serie Técnica. Informe Técnico no. 290. 162 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en Nicaragua. CATIE. Serie Técnica. Informe Técnico no. 292. 292 p.

UGALDE, L. (Ed.). 1997. Resultados de 10 años de investigación silvicultural del proyecto MADELEÑA en Panamá. CATIE. Serie Técnica. Informe Técnico no.293. 110 p.