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IMPLEMENTATION COMPLETION REPORT
(CPL-31600; SCPD-3160S)

ON A

LOAN

IN THE AMOUNT OF US\$ MILLION 33.0

TO THE

FEDERATIVE REPUBLIC OF BRAZIL

FOR LAND MANAGEMENT II - SANTA CATARINA PROJECT
(LOAN 3160-BR)

JUNE 7, 2000

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CURRENCY EQUIVALENTS

(Exchange Rate Effective)

Currency Unit = New Cruzado (NCz\$) (At Appraisal)
Rate at Appraisal NCz\$4.46 = US\$ 1.00
US\$ 1.00 = R\$1.70 Rate at Completion

FISCAL YEAR

January 1 December 31

ABBREVIATIONS AND ACRONYMS

ABEPA	<i>Associação Brasileira de Empresas de Planejamento Agropecuário</i> (Brazilian Consulting Firms Association)
CIDASC	<i>Companhia Integrada de Desenvolvimento Agrícola de Santa Catarina</i> (State Integrated Agricultural Development Company)
DER	<i>Departamento de Estradas de Rodagem do Estado</i> (State's Roads Department)
EPAGRI	<i>Empresa de Pesquis Agropecuariaa e Extensão Rural</i> (State's Agricultural Research and Rural Extension Enterprise)
FATMA	<i>Fundação de Meio Ambiente</i> (State Environmental Management Foundation)
FAO-CP	FAO-World Bank Cooperation Programme
ICEPA	<i>Instituto de Planejamento e Economia Agrícola de Santa Catarina</i> (State Institute of Agricultural Planning and Agro-Economics)
MC	Microcatchment
MTR	Mid-term Review
PROSOLO	<i>Programa de Conservação do Solo</i> (Project Soil Conservation Incentive Fund)
PU	Project Unit
SAR	Staff Appraisal Report
SDM	<i>Secretaria do Desenvolvimento Urbano e do Meio Ambiente</i> (State Secretariat for Urban Development and Environment)
SDA	<i>Secretaria do Desenvolvimento Rural e da Agricultura</i> (Secretariat for Rural Development and Agriculture)

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**LAND MANAGEMENT II - SANTA CATARINA PROJECT
(LOAN 3160-BR)**

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<i>Project ID:</i> P006473	<i>Project Name:</i> BR LND MGMT II-S. CATAR
<i>Team Leader:</i> Graciela Lituma	<i>TL Unit:</i> LCSER
<i>ICR Type:</i> Intensive Learning Model (ILM) of ICR	<i>Report Date:</i> June 7, 2000

1. Project Data

Name: BR LND MGMT II-S. CATAR

L/C/TF Number: CPL-31600;
SCPD-3160S

Country/Department: BRAZIL

Region: Latin America and
Caribbean Region

Sector/subsector: VM - Natural Resources Management

KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>PCD:</i> 05/03/88	<i>Effective:</i> 10/18/91	10/18/91
<i>Appraisal:</i> 04/03/89	<i>MTR:</i> 07/30/94	12/31/95
<i>Approval:</i> 01/30/90	<i>Closing:</i> 09/30/97	06/30/99

Borrower/Implementing Agency: STATE OF SANTA CATARINA/SEC. OF AG. OF SANTA CATARINA

Other Partners:

STAFF	Current	At Appraisal
<i>Vice President:</i>	David De Ferranti	S. Shahid Husain
<i>Country Manager:</i>	Gobind T. Nankani	Phyllis Pomerantz
<i>Sector Manager:</i>	Robert Schneider	N
<i>Team Leader at ICR:</i>	Graciela Lituma	J. Pierre Delsalle
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2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome: HS

Sustainability: HL

Institutional Development Impact: H

Bank Performance: S

Borrower Performance: S

QAG (if available)

ICR

Quality at Entry: S

Project at Risk at Any Time: No

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

The project objective was to increase agricultural production, productivity and farm incomes for some 81,000, mostly small-scale farmers, by promoting the adoption of sustainable, modern forms of land management and soil and water conservation, thus safeguarding farmer incomes and Santa Catarina's natural resources. It would also assist in halting depletion of natural resources, water source pollution and rural road destruction. The project was consistent with local needs to reverse ongoing land degradation resulting from current use of inappropriate technology, added momentum to changes that were already incipient among farmers, and built for the most part on recent research findings and institutional innovations at community level. It accorded with Bank policies that were emerging at the time, to diversify its country support from poverty alleviation in the Northeast to address Brazil's growing environmental problems and the constraints facing small-scale farmers in other regions. The project is the second in a series of pioneer state projects aimed at supporting innovative technical approaches for soil conservation.

3.2 Revised Objective:

The project objective were maintained throughout the life of the project.

3.3 Original Components:

With the aim of halting environmental degradation and declining agricultural productivity, the project sought to introduce methods of land management that would improve soil and water conservation, and disposal of animal, human and pesticide wastes, in 520 of Santa Catarina's 1,700 microcatchments, distributed among 143 of the State's then 199 municipalities. Main components included agricultural extension; research; introduction of incentives to share with farmers the costs of introducing more sustainable and less environmentally damaging land management practices; support for reforestation of critical parts of the landscape; and improvement of rural access roads to prevent the generation of erosive run-off onto farmer's fields and improve year round accessibility. Supporting components included land use planning, mapping and environmental monitoring; training; and project administration. Funding for two State parks and a biological reserve was added at appraisal, at the special request of the State Governor.

3.4 Revised Components:

The components and total funding allocations were maintained throughout implementation. In response to disparities in rates of implementation or differences from unit costs estimated at appraisal, with the agreement of the Bank there was some adjustment of fund allocations between components. In particular, following the Mid Term Review more funds were allocated to adaptive research (+33%), extension (+22%) and land use mapping (+52%), while allocations were reduced to rural roads (-18%), forestry and environmental protection (-40%) and the parks component (-64%). Only in the last case was adjustment linked to major changes in overall physical targets, when it was found that the parks component was partly un-implementable. Though in some cases demanding, after any necessary adjustments the major components proved within the capacity of the main implementing institutions.

Rating	Component		Sector
HS	RESEARCH		8,500,000.00
HS	AGRICULTURAL EXTENSION	XX	17,400,000.00
S	INCENTIVE PROGRAM	XX	9,000,000.00
S	EROSION CONTROL WORKS ALONG RURAL ROADS	XX	21,100,000.00
S	FORESTRY DEVELOPMENT AND NATURAL RESOURCE PROTECTION	XX	8,300,000.00
S	PROJECT ADMINISTRATION	XX	4,000,000.00
HS	TRAINING	XX	3,300,000.00

3.5 *Quality at Entry:*

The project pre-dates the introduction of the QAG process at the Bank. However, it is clear that in general the project objectives responded to urgent needs in the State and were fully consistent with the Country Assistant Strategy for Brazil. Project strategy and components were conducive to the achievement as set objectives and build on experience in neighboring Parana project experience. As was customary at the time, project documentation focused mainly on physical schedules and targets. A detailed monitoring and evaluation system was to be designed and set up by the Project Unit (PU) only during implementation; this and design of the parks component proved unsatisfactory. Nonetheless, overall Quality at Entry is assessed as satisfactory.

4. Achievement of Objective and Outputs

4.1 *Outcome/achievement of objective:*

The overall assessment of the project is highly satisfactory. Although *ex post* evaluations were complicated by drought, productivity of the main crops – maize, wheat and soyabeans – is estimated to exceed without project productivity by 20 to 35%. Soil loss was reduced by between 10 and 50%. Runoff water in streams contained less suspended solids, coliform bacteria and pesticide residues, thus lowering silting and water treatment costs in downstream areas, and reducing the incidence of water borne diseases and pesticide poisoning. Maintenance costs for rural roads were reduced by up to 80%; better all-weather access stimulated both commercial and social activities. Improved land management practices, capable collectively of increasing water retention on crop land, improving soil structure, raising fertility and reducing erosion, were adopted on some 400,000 ha in 534 assisted microcatchments (103% of the appraisal target). About 106,000 farm families were reached with one form or another of project assistance – 131% of the appraisal target and equal to about 35% of all farmers in the State. Spontaneous adoption of improved practices occurred on a further 480,000 ha in non-project microcatchments.

The new land management practices proved more profitable to farmers than the practices they replaced, as well as less labour demanding. The more participatory approaches of government extension and research organisations that were introduced or reinforced under the project have since become the main modes of operation of what is now the State's Agricultural Research and Rural Extension Enterprise, EPAGRI. Farmers, under the initial stimulus of project requirements to form groups in order to qualify for financial incentives for technical change, have not only developed new habits of co-operation but are now using them for a wider range of purposes. Only in environmental monitoring and implementation of the parks component were there serious initial shortcomings. Environmental monitoring became fully effective only in the final project year; it was necessary to transform the implementation approach for the parks component as well as reducing its size.

Paradoxically, despite its impressive physical, productivity and institutional achievements, the project did not succeed in its aim of raising farm incomes. The main causes were events outside project control, in particular Brazil's severe macroeconomic adjustments during the implementation period and its decision to join Mercosul, the South Cone free trade area. At the project level, they had the effect of lowering farm output prices and exposing Santa Catarina's farmers to industrial-scale producers in areas with better climates and soils, with whom they could not compete. Thus much of the financial benefit from the project's gains in productivity accrued to the local urban population in the form of lower prices. The drift of young people from farming into towns slightly accelerated. Analyses made by the project management show, however, that farmers who adopted improved practices of land management suffered substantially smaller declines in income than those who did not. In the circumstances, this financial outcome can be considered satisfactory.

4.2 Outputs by components:

Assessments of the physical and institutional performances of individual components are given below and detailed in the tables of Annex 1, Key Performance Indicators.

Rural Extension. Overall, the component is rated as highly satisfactory. Extension was the pivotal component of the project. Its aim was to communicate to all farmers and communities in project microcatchments a technical strategy based on appropriate choices from a menu of resource management changes with four ultimate aims: to reduce surface sealing of the soil by rain splash; to facilitate percolation and *in situ* retention of rain by improving soil structure; to put in place the physical means to contain any potentially erosive runoff that nevertheless still occurred; and to limit chemical and bacterial contamination of drainage and ground water. Since changes with these aims are only effective if applied to the whole landscape, the microcatchment was chosen as the natural basis for physical planning. Extensionists were required to communicate the technical strategy to the rural population, mobilise communities within each microcatchment, assist farmers to prepare individual farm improvement plans, and then integrate implementation of farm plans within each microcatchment, relying on co-operation between resource users who were grouped into local associations.

Extension assistance was to be provided to farmers from four sources: State public extensionists, co-operatives, agroindustries and private extensionists. Some 150 State extensionists were to take the lead. Using a Technical Manual to be developed by the project, they were to work with local soil conservation commissions and farmers in planning and implementing improvements in land use at microcatchment and individual farm level. They would vet farmer's applications for grants under the incentive scheme, and involve 110 extensionists from the other three sources in project activities as appropriate.

Implementation of the component was hindered initially by several unexpected policy decisions taken by the State or imposed from Federal level. Recruitment by the public service was frozen so that a foreseen 60 incremental government extensionists were not available; Santa Catarina's then separate public extension and research services were merged; and it was decided to make agricultural extension a municipal responsibility, thus distancing the State-level public extensionists from farmers. Municipal extension capacity was extremely limited at this time and unequal to the task of component implementation.

These difficulties were overcome by adjustments to original implementation plans. Municipal extension services were created and trained, with 50% of their funding needs being taken on by the project; State extensionists provided back-up. Although because of these setbacks the extension component only became fully operational in PY3, by completion there were about 100 municipal extensionists in the field. Encouraged by farmers' responses to the project, reversal of the earlier decision to make extension an exclusively municipal responsibility, and the realisation that the group approach initially used to improve land management could be a vehicle for other forms of rural assistance – e.g. to improve household sanitation – the state and municipal authorities eventually had a combined total of 350 extensionists in the field, bringing the total to 240% of the SAR estimate. To further exploit the advantages of the group approach, training in these aspects was strengthened following the Mid Term Review. Extension by agroindustries was part time, but involved the planned number of staff. Direct participation of extensionists from the private sector and co-operatives – at 63% and 23% respectively of appraisal estimates – was less than estimated, although many of them appear to have absorbed and applied the project's technical strategy.

Despite its initial implementation constraints, it assisted 103% of the planned number of microcatchments, 144% of the planned municipalities and 131% of the target number of farmers. Adoption of key

technologies for improved land management mostly exceeded appraisal estimates (see Annex 1), and there were large increases in the uptake of minimum and zero tillage on farms of all sizes. Extension was later widened to cover assistance on domestic sanitation and control of pollution arising from pig/fish farming. Habits of co-operation were created among rural communities with wider future utility for development programmes. There appears scope both to widen the extension approach to assist further microcatchments and communities, and to use the institutional capacity and new skills created to address the problems arising from reduced farm incomes.

Adaptive Research. The component is also rated as highly satisfactory. This component aimed at endorsing the technical strategy by developing and adapting adequate technological solutions to problems identified by the farming community at the microcatchment level. The component achieved appraisal main objective and targets such as numbers of trials to be conducted, upgrading of agro-meteorology stations and creation of processing capacity for seeds of essential green manure crops. Adaptation of minimum and zero tillage machinery to the needs of small-scale farmers was highly successful and stimulated some 60 private companies to start manufacturing this equipment. The State Research/Extension Enterprise also took over some environmental monitoring when this proved beyond the capacity of the environmental authorities, and helped find solutions to the pollution problems arising from pig/fish farming. Greater exposure to farm-level problems following the merger with the State extension enterprise has helped to focus current research on more relevant topics. Nonetheless some emerging technical challenges remain un-addressed. Future programmes could address, for instance, the need to control the new pest and disease complexes that can follow the change to reduced or zero tillage, and the absence of environmentally friendly biological control agents for weeds.

Incentive Program for Land Management, Soil Conservation and Pollution Control. The component aimed to share with groups of farmers at microcatchment level the costs of implementing improved land management and pollution control measures, acting as a demand-driven incentive for change. The program was designed exclusively to support investments identified in the microcatchment management plans supported under the Rural Extension component. To qualify for support, individuals had to be members of groups in which small farmers predominated. The scale of cost sharing depended on the proportion of small farmers in the group and the item to be acquired or constructed; grants were smaller for late-comers than for those joining the project early. Equipment was to be communally owned and operated and all incentives were planned to end with final disbursement.

Start-up of this component was delayed by new policies that restricted direct payment of incentives to farmers. This was eventually overcome by creating a Santa Catarina incentive fund, PROSOLO; however passing the necessary legislation to create the fund through the State Assembly took over a year. Approval and payment procedures specified at appraisal were furthermore found to be excessively cumbersome and had to be streamlined during implementation. Despite these factors PROSOLO turned out to be a very important tool in motivating farmers to discuss the problems of land management in their microcatchments with extension staff, and inducing them to adopt remedies. Soil testing, adoption of conservation tillage practices (particularly zero tillage), green manuring, terracing and reforestation were made possible for some 30,000 farmers, or almost a third of beneficiaries. Over 11,000 items of collectively owned equipment were bought (191% of appraisal targets) and targets for construction of toxic waste disposal pits, agrochemical mixing points, animal waste fermentation tanks, as well as for distribution of green manure seeds and terracing, were all exceeded. Water source protection, water treatment structures and domestic waste disposal were added to the items eligible for support during implementation. No attempt has been made to estimate whether the scale of public goods benefits that were generated by PROSOLO matched the government share of costs. Nevertheless, external benefits in the form of reduced environmental damage and improved potential sustainability of farming systems were considerable. For the

future, the external benefits of PROSOLO public expenditures should be quantified more systematically and compared with the fund's costs, with a view to deciding whether, in the current depressed state of farming, its re-establishment would be justified.

The US\$8.8 million provided by the component was ultimately complemented by commitment of some US\$31 million of private resources. The need for farmers to form groups to receive PROSOLO support, and to operate equipment and facilities collectively, have established habits of co-operation which have persisted and been put to wider use, thus building social capital in rural communities. Therefore this component is rated highly satisfactory.

Forestry Development and Natural Resources Protection. Reforestation was an important part of the project's technical strategy, due to the predominantly hilly terrain and humid climate of Santa Catarina. Operating under the responsibility of the State Integrated Agricultural Development Company (CIDASC) with back-up from State extensionists, implementation of the reforestation sub-component was initially slow. Raising planting incentives and further extension training overcame initial reluctance of farmers and eventually allowed objectives for creation of new forest nurseries and commercial plantings to be reached: 41,600 ha were planted and commercial forestry came to be seen by farmers as a useful means of income diversification. Conservation reforestation with slower growing, native species suffered technical problems and was less well accepted by farmers; only 8,900 ha (73% of the SAR and 148% of the MTR revised target) were planted.

Two other sub-components, one for enforcement of environmental laws and monitoring of project environmental impacts, and the other to create two State parks and a biological reserve, were to be implemented by the Santa Catarina Environmental Foundation (FATMA). FATMA achieved some success in improving the observance of forestry laws using the help of the State's forest police, but failed to monitor the quality of run-off water from a sample of project microcatchments adequately. Monitoring was eventually transferred to the extension and research service, but only became fully effective in the final project year. The parks sub-component, added to the project at the last moment, had been inadequately prepared. While its objectives were relevant to the State's needs, they were overly ambitious, given FATMA's limited institutional capacity. Re-design of this sub-component was necessary at the MTR, which resulted in a reduction in the number of protected areas to be supported under the project from three to one. The Tabuleiro State Park was selected based on the higher degree of threat to its ecological integrity and its size, about 90,000 ha or over 95% of SAR target for conservation units. An approach based on expropriation and policing was eventually replaced by a participatory approach to park management by local communities. This has since been adopted as a model to apply to other protected areas in Brazil. Attitudes in FATMA have radically changed. Draft laws to create and regulate the State Conservation System and to create a pro-ecology tax are now being evaluated by the Legislature; these are expected to facilitate the operation of the park during 2000. Nevertheless, due to the change in scope and the inconclusive work, although very sound and promising, the component is rated overall as only partly satisfactory.

Erosion Control along Rural Roads. The aim of the component was to finance erosion control works along rural roads as part of microcatchment land management plans, so as to prevent runoff from roads initiating erosion on farmers' fields. Works were to be located only at strategic points and varied from re-shaping and gravelling to simple grading, plus the construction of small culverts, soakage pits, etc. The component was not designed to address the problem of runoff from internal farm roads, which also proved to be an important cause of erosion. Implementation was the responsibility of the State's Roads Department, DER. It started slowly due to the inexperience in handling rural roads of the DER engineers, who were more familiar with trunk road construction. With hindsight, the total time needed to adapt an

institution more accustomed to major civil engineering projects to making scattered, simple works appears to have been under-estimated. There followed counterpart funding delays and incompatibilities with Bank procurement procedures that required re-working of some aspects of the bidding process. At the mid-term review some changes to the mix of items were found to be necessary – for instance greater need for gravelling and less for simple grading. A system to allow beneficiaries to select the segments of rural roads to be improved became effective and contributed to improve selection of segments to be rehabilitated and to gain ownership for such works. Overall targets were also revised as considered appropriate following the MTR. Smaller items were often allocated to municipalities for execution, with technical support from DER.

Outcome of this component is rated satisfactory. Despite the difficulties encountered during the initial stage, the component eventually achieved its main objectives and physical targets: 3,385 km of grading (111% of the MTR revised target and 87% of the SAR figure); 2,000 km of re-gravelling (116% of revised, 88% of SAR); 3,798 improvements to intersections (76% of revised and 38% of SAR), and 11,819 culverts (98% of the unaltered SAR target). Subsequent maintenance of road works by some municipalities has found to be poor. In such cases lack of funds, poor monitoring, and limited local skills and motivation, have all played a part. However, DER continues to give further support to municipalities and to encourage the formation of alliances with local residents and communities, to ensure that roads improved by the project do not eventually revert to their original condition and that the methodology for road rehabilitation developed under the project is further expanded with local municipal resources.

Land Use Mapping, Planning and Monitoring. The component is rated unsatisfactory. The aim of this component was to map soil conservation and land use in 520 project microcatchments, creating capacity for an eventual state-wide planning and monitoring system. Implementation was impeded by three constraints: the freeze on public sector recruitment, under which the responsible unit to be created in EPAGRI only became fully staffed in PY4; the State's decentralization which forbade the expansion of any government department in the capital; and a clash between state standardization rules for the supply of geo-processing equipment and Bank procurement procedures. The unit only became operational in PY6. Plans for semi-detailed soil surveys in 72 microcatchments and related monitoring were scrapped. Following the MTR, the target for thematic mapping of microcatchments at 1:50,000 was reduced from 520 to 150 while, the target of 143 climatic maps at 1:250,000 was retained. The unit was also given the task to produce all necessary mapping and related GIS activities to support the parks subcomponent. Regarding the mapping of the Tabuleiro Park, the objective was attained satisfactorily but somewhat late. The two other targets were eventually attained, but the scale of microcatchment mapping was found not to be detailed enough for farm-level planning, one of its main intended uses. More attention should have been given at design to limiting the scale of the component to match limited implementation capacity. In future, operations under this component should give more attention to the real mapping needs of end users.

Training. A comprehensive component aimed to train farmers and extensionists from the public and private sectors in modern land management and soil conservation methods, as well as to boost public awareness of conservation principles particularly among community representatives, politicians and the general public. Training targets among farmers and the general public exceeded appraisal estimates, often by wide margins (see Annex 1). Farmer visits to witness improved land management in action totalled 1,800. There was regular interchange of operational experience with similar projects in Brazil and neighbouring countries. Further important outputs were manuals covering technical principles and practices for improved land management, operation of the PROSOLO incentive fund, and engineering guidance for the road improvement component. Training targets were often fulfilled at below estimated costs due to more extensive use of existing State facilities. The three manuals were produced and regularly updated to reflect accumulating implementation experience. The component was highly satisfactory.

Project Administration, Monitoring and Evaluation. A Project Unit (PU) was set up within the Secretariat of Agriculture, answerable to a Management Committee chaired by the Secretary of Agriculture. The PU effectively handled annual programming, budgeting, project promotion, procurement, disbursement requirements and relations with other implementing agencies. It was an effective primary point of contact with the Bank and directly oversaw PROSOLO and the training component. It was creative in contributing ideas to help resolve the implementation constraints noted above. Various studies were commissioned, including comprehensive socio-economic surveys at the start (1992), mid-term (1995) and completion (1999) of the project, of which highlights are given as Annex 8. Main project outputs were tracked against original SAR or revised targets. However the PU failed to develop the intended comprehensive management information system or to establish more routine ongoing monitoring for items such as water quality, rural road works or socio-economic trends. Overall the component is rated as satisfactory.

4.3 Net Present Value/Economic rate of return:

The economic rate of return of the project was estimated at appraisal as 15%, based on analysis of six representative farm models. Models assumed that improved land management techniques would be adopted on 35% of the productive area. Re-estimation was based on 10 models, revised to reflect changes in typical enterprise compositions using the results of the extensive socio-economic surveys from 1992, 1995 and 1999. These confirmed that improved land management techniques had in practice been adopted on the scale assumed at appraisal. The cost stream included all on-farm investment and operating costs, along with component costs: only PROSOLO payments were excluded. Of off-farm and environmental benefits, only savings in road maintenance costs were included. Due to shortcomings in environmental monitoring only fragmentary data were available to estimate, for instance, benefits from reduced turbidity or bacterial contamination of water. Other benefits that were hard to quantify – for instance from expansion of manufacture of farm machinery, which was estimated to have created over 200 urban jobs – were also excluded. All prices were in constant 1998 terms, appropriately adjusted to economic values. Due to the combination of higher than planned achievements, well controlled costs, and even greater declines in farm income without project than with, the revised overall rate of return was estimated at 20%.

4.4 Financial rate of return:

Crop yields both with and without project exceeded those estimated at appraisal. Productivity of the main crops was estimated to exceed without project productivity by: 50% for beans (mechanised); 35% for soybean (mechanised); 25% for maize (animal traction); 20% for maize (animal traction and low technology); 15% for maize (mechanised); and 20% for beans (animal traction). Without project yields were assumed to equal those in a selection of non-project microcatchments chosen as being least affected by spillover of innovations from project assisted microcatchments. Using constant 1998 financial prices, financial rates of return from the ten models range between 20% and 44%. Returns were highest for milk and beef producers, intermediate for pig producers and lowest for farms dominated by crop production. Total value of incremental output at full development was estimated as US\$53 million/year, of which livestock products account for about 80%.

This favourable picture contrasts with the real financial situation of farmers. Due to external factors farm gate prices for most products have fallen by up to 40%. Average value added for all the main products of the project area has fallen by up to 50%. In real terms, beneficiary incomes were calculated by the borrower to have fallen by about 27% compared to pre-project levels. However, incomes of non-assisted farmers are estimated to have fallen by more than 40%.

4.5 Institutional development impact:

The project helped to catalyse changes in the philosophy and *modus operandi* of Santa Catarina's rural support services and agricultural research towards more participatory approaches, increasing their relevance and impact. It was instrumental in creating new agricultural support capacities at municipal level. DER and municipal capacities for improvement of rural roads were enhanced. The PROSOLO incentive programme, although extinguished at project closure, created new habits of co-operation at microcatchment and community levels that are suitable for other development activities. There was however less success in developing the project institutions responsible for environmental aspects.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

Implementation was at times delayed by lack of prior harmonisation between the borrower's policies and procedures for bidding and procurement, and those of the Bank. The components for land use mapping and monitoring, and the rural roads component both suffered delays of a few months. Financial outcome was also affected by falling international prices of agricultural commodities.

5.2 Factors generally subject to government control:

Brazil's Macro-economic adjustments, the decision by Brazil to join Mercosul, State's inability to make incentive payments to farmers, the freezes on public sector recruitment, restrictions on the location of new government units in the Santa Catarina state capital, as well as the municipalisation of agricultural extension, all impeded project implementation at one time or another. However delayed release of counterpart funds was the main cause for the two extensions of the project.

5.3 Factors generally subject to implementing agency control:

Ineffectiveness of the State's Environmental Foundation was responsible for the inadequate preparation of the parks component and caused large implementation delays or shortfalls for this and environmental monitoring activities.

5.4 Costs and financing:

Project cost was estimated as US\$71.6 million at appraisal, with a loan size of US\$33.0 million. Final cost was US\$69.6 million. The loan was fully disbursed but the borrower's counterpart contribution was US\$2.0 million below the appraisal estimate. Following the MTR, cost allocations between components were adjusted in the light of initial implementation experience. Main changes (see para. 3.4 and Annex 2) were increased allocations to agricultural extension, research and land use mapping. Allocations to rural roads, forestry, environmental activities and the parks component were reduced. Due to cumulative delays, mostly the result of Federal or State government decisions outside the control of the implementers, disbursement was extended twice, for six and then a further 15 months.

6. Sustainability

6.1 Rationale for sustainability rating:

The project's sustainability is rated "highly likely". The project has successfully promoted innovative participatory approaches, to upgrade land management practices among farmers and rural communities. These have accelerated the introduction of improvements that reduce cash costs and labour requirements, give early increases in farm productivity, and improve the chances for farmers of staying in business and on their land in an increasingly unfavourable trading environment. Technology promoted by the project is now a standard part of more profitable and sustainable farming systems. The organisational approaches have become central to the *modus operandi* of the technical and social assistance services. Habits of co-operation required from farmers to participate in PROSOLO have endured because they have proved to be of wider utility for rural development programmes. The external benefits generated by the project, in

terms of reduced road maintenance costs, decreased soil losses, lowered water treatment costs and reduced bacterial and chemical contamination of water supplies, are welcomed by local and State authorities. They have saved public money and at times been able to exploit such benefits to increase their political popularity. For these reasons the technical, institutional and social changes supported by the project are judged highly sustainable.

The immediate challenge for the state is to encourage farmers to stay on their land in the deteriorating macro-economic situation that they now face and, in so doing, maintain the external environmental benefits arising from the improvements in land management that they have adopted. Smaller farmers, along with the landless, are those most likely to be affected by further acceleration of the rural exodus. The focus of a future operation should not only be on the economic benefits of addressing the rising impoverishment of these rural people. Equally important will be to maintain and expand the external environmental benefits that, as the project has shown, can flow from better management of land and water resources. More rigorous measurement is now needed of the external benefits to the national economy that such a two-pronged approach can bring, in the form of reduced environmental degradation and improved sustainability. The main elements needed for on-farm support are now in place but there remains a need to further improve Santa Catarina's capacity for environmental programme implementation and monitoring. Assessment of progress in improving the profitability of farming should be coupled with better identification, and especially quantification, of externalities which should provide a substantial justification for further lending. The aim of a follow-up operation should be of safeguarding the environmental gains made by the present project through addressing the growing impoverishment of Santa Catarina's farmers. In any future operation, the past abrupt fluctuations in counterpart funding must be avoided.

6.2 Transition arrangement to regular operations:

Following the mid-term review of the project, the state extension agency adopted the project's technical and organization strategy as key elements of its overall strategic planning. Similarly, the state's rural road department has fully adopted the project's approach and methodology to rural road rehabilitation as part of its normal operation while the State's environmental agency is taking the participatory approach to park management developed under the project for as a model for other conservation units in the state.

In addition, the successful implementation of the project-induced microcatchment strategy in Santa Catarina, and in its predecessor project in Parana, has become a reference of excellence for a number of countries and for the Bank staff who have carried out a large number of study tours to these States. Two other states (Sao Paulo and Rio Grande do Sul) are already implementing microcatchment development strategies under two state Bank-financed projects based on lesson learned from Parana and Santa Catarina projects. This strategy is also becoming a reference for the national water basin development strategy being prepared by the Federal Ministry of the Environment and for the State of Rio de Janeiro Microcatchment Development Program now being prepared by the Secretary of Agriculture of Rio de Janeiro.

7. Bank and Borrower Performance

Bank

7.1 Lending:

The Bank provided strong *identification and preparation* support from the FAO-CP, including the services of the specialist previously responsible for FAO technical assistance to Brazil for improved land management. Therefore, Bank's performance in these stages is rates "satisfactory". Design assistance built on the experience of previous soil conservation initiatives in the State and elsewhere (including in other countries), accumulating research results, and Parana's Land Management Project, prepared previously also with FAO-CP support.

Bank *appraisal* stressed the provision of cost-sharing incentives to farmers to make their initial commitments to changes in land management, and institutional arrangements, especially at field level, to mobilise collective and individual commitments to change. Macro-economic reforms, including the freezes on public sector recruitment, had not been mooted at the time so were not taken into account, but the risk of a shortfall in counterpart funding was flagged. In the interest of making the project's main components effective, and in the face of political pressures for it to be included, less attention than desirable was given at appraisal to the parks component. Bank's performance is rates "satisfactory".

7.2 Supervision:

Bank supervision was considered by the borrower to be particularly effective. Supervision missions provided the skills needed at the right times, staffing continuity, and were proactive in resolving the many serious obstacles to implementation that occurred. They played a creative role in devising solutions with the borrower and provided advocacy in securing their approval by senior government decision-makers. They were not, however, able to secure waivers for some of the Bank's bidding and procurement procedures, which posed particular problems for projects in Brazil at the time. Supervision reports give accurate assessments of progress and constraints. Supervision forms were found to be realistic, with sufficient attention to the development objectives. Bank's performance is rates "highly satisfactory".

7.3 Overall Bank performance:

Based on the above consideration, the overall performance of the Bank is rated "satisfactory".

Borrower

7.4 Preparation:

Staff of the Secretariat for Rural Development and Agriculture (SRDA) played a leading part in project preparation, for which the Bank also provided support from the FAO-CP. By the time of appraisal there was a good understanding among senior staff of SRDA and most other main implementing agencies of the project objectives, technical strategy for improved land management and erosion control, and implementation requirements. This understanding was not altogether shared at a higher, political, level where there were frequent changes among Secretaries and other decision-makers. The Borrower's performance in terms of quality of project preparation was found to be "satisfactory".

7.5 Government implementation performance:

There were three changes of State government over the course of project implementation and many changes of the Secretary of Agriculture, to whom the project management reported. At this time these high-level individuals, who were for the most part responsible for setting the policy framework governing the project, were often confronting major macro-economic issues related to the financial crises through which Brazil was passing. They took, or were forced into, many of the decisions that interfered with implementation such recruitment restrictions and constraints on counterpart funding etc.

7.6 Implementing Agency:

That the project, although delayed, eventually reached so many of its objectives can be attributed largely to stable and competent staffing of the Project Unit and of the units in all other implementing agencies. Despite the numerous changes at higher levels, there was only one change of Project Manager and some other key members of the PU and implementing agencies remained involved from project identification until closure. They were consistently committed to, and creative in, overcoming obstacles and keeping actions moving. Despite the PU's failure to set up a formal management information system, it complied successfully with requirements for presentation of plans, expenditure statements and audit reports.

7.7 Overall Borrower performance:

Borrower performance is therefore rated as satisfactory.

8. Lessons Learned

The following are the principal lessons learned from the Brazil – Santa Catarina – Land Management II Project. These lessons, as well as the project's outcome, are fully consistent with those of its predecessor, the Parana Land Management I Project, Loan 3018-BR) which closed in March 31, 1997. In addition to these, themes of a more specific nature (component-related themes) are presented in Appendix I.

- To be successful, investments in soil conservation must be based on technical changes that bring recognisable and early productivity benefits to farmers. In this project, technologies with an immediate impact were the most widely adopted, spreading outside as well as inside the project area, while technologies that give benefits only after considerable time was adopted at a slower rate. Even when attractive technical potential exists, it may be necessary initially for governments to share with farmers the cost of introducing new resource management techniques. Such incentives are justified – and not necessarily a subsidy – where on-farm changes generate significant public goods, in the form of decreased soil loss, control of pollution and other environmental benefits.
- The project benefited from a combination of factors that are not commonly found, so although an important source of lessons is unlikely to be widely replicable without adaptation. Floods some years previously had convinced farmers that their existing land management practices were deficient; twenty years of accumulated research and outside technical assistance had demonstrated that viable alternative technology existed; and national policies had recently been introduced to focus public sector technical assistance to farmers on individual microcatchments, that were the natural planning unit for improved land management.
- Despite such favourable factors, the project shows that extensive training and re-training, emphasising group and participatory approaches, maybe necessary before the “mindsets” of many public (and even private) sector research and extension staff are fully adjusted to a participatory project approach to soil and water conservation.
- Skilled and creative project implementation staff, working closely with receptive Bank supervision teams skilled in topics currently needing attention, are important for countering the sorts of constraints to implementation that macro-economic adjustment commonly raises. Willingness by Bank project staff to be flexible and patient, including agreeing to project extension if necessary, are crucial in this respect.
- The project has demonstrated that through improved land management there are important external benefits that may justify further lending in this sub-sector. However, future project design should ensure the inclusion of adequate socio-economic and environmental monitoring activities to provide the necessary basis to quantify these externalities.
- There is a great potential for the microcatchment natural resource management projects to grow into more comprehensive rural development programs. This transformation is likely to occur when social and institutional actions are added to the existing natural conditions at the microcatchment to ensure better agro-environmental conditions of production.

- The methodology and logic of the microcatchment natural resource management projects in the southern Brazil, have great potential to create new forms of cooperation and trust amongst the beneficiaries of a respective microcatchment. It could also stimulate other social initiatives towards more complex rural development strategies. The cases of Parana and Santa Catarina are paradigms of these developments; these social initiatives have been built and are on-going in many rural municipalities of those two states as one of the most noted result of the projects implemented in these states.
- Extension staff plays a key role in the implementation of the microcatchment strategy. In these two states, it was evident the role of the extension workers in areas where the project was more successful (i.e., the "training" dimension is absolutely crucial); in those areas it was also evident the existence of a good inter-institutional coalition, where the local government played a key role. In fact in the absence of an active participation of the local government, project results tend to be less expressive.

9. Partner Comments

(a) Borrower/implementing agency:

The Borrower notes with satisfaction and concurs with the findings of the project's Implementation Completion Report that the project has met its overall and specific objectives and that the project has been a key element in addressing Santa Catarina's agricultural and rural environmental problems. However, they also recognize that in spite of the good progress made so far, resolution of these issues will require substantial additional work in the near future. Therefore, the Borrower has requested Bank support for a follow-up operation.

The Government appreciates that, with the collaboration of the World Bank, it was possible to successfully implement the project and reverse the State's declining agricultural productivity trends due to severe land degradation at a time when society was increasingly more sensitive to agricultural-induced environmental degradation. Brazil was also facing serious financial difficulties and agricultural world market prices were falling. In addition, and due to increasing trade globalization, farmers in Santa Catarina, mostly family farmers, were under heavy pressure to improve competitiveness and minimize production environmental impacts; the project was quite instrumental on this endeavor.

The Borrower notes that the Bank's performance was highly satisfactory in all phases of the project. Since project inception, the Bank has made available well equipped missions with vastly experienced consultants. This has contributed to the establishment of an effective and efficient technical strategy to attend the State's needs. It has also helped to improve the States project design.

It further appreciated that supervision missions visited the state at least twice a year. Without losing sight of the difficulties faced by the Borrower, missions were able to assist the coordinating team to ensure that emerging problems were not left unresolved. The Borrower points out the important role and effort of the World Bank missions, in seeking alternative ways to facilitate State compliance with counterpart funding in particular during periods of State and country financial crisis.

The Borrower recognized that through strong efforts of the well equipped Bank missions, issues related to road rehabilitation and environmental components (park administration, water monitoring and pig/fish production system) were discussed with beneficiaries, and executing agencies and recommendations made to ensure achievement of objectives and targets. Those impediments would have threatened overall project performance if left unresolved.

One problem highlighted by the Borrower was the Bank's complex requirements for hiring services and/or bidding good and works, which are not always in accordance with current local procurement procedures. In the Borrower's view, this procedures required enormous effort, and to some extent contributed to delays in executing the mapping and the roads components. They noted that without ignoring the seriousness of the subject, alternatives should be sought to better accept and adapt local guidelines.

The Borrower notes that the main focus of the project was to address the serious environmental problems affecting the rural areas by reversing the process of soil and water degradation with the objective of establishing sustainable production systems. Project results from the Borrowers ex-ante, mid-term and ex-post evaluations indicate significant reduction in soil erosion in benefited microcatchments due mainly to farmers' better understanding and adoption of project induced conservation practices. These measures provided substantial productivity gains and humanization of farmers' field works.

The Borrower stressed also the importance of the incentive system. Construction of *esterqueiras* (manure piles) aim at handling animal waste, have controlled pollution and provided an alternative for improving the chemical, physical and biological quality of soils, through organic fertilization. Research studies are being continued to provide answers on soils' capacity to receive different loads of organic fertilizer without contaminating the environment, especially the water table. It also highlights the construction of collective toxic waste storage units, which allowed removal of such waste from farms to be deposited in a common place. This action should now be complemented with recycling efforts to dispose of this material.

The Borrower noted the importance of the environmental sanitation activities in rural homes added during project implementation, which were complemented with major efforts on environmental education in schools and the community. This work, promoted broader discussion of environmental issues at farm family, community and municipal levels. Continuation of these activities carried out with participation of stakeholders are now being aimed at preparing proposals for the development of economic alternatives for sustainable use of natural resources, including ecotourism and agroecology in the buffer zones of the State park supported under the project. The Borrower noted also the importance of the ongoing work to complete the State's park zoning which should enable the definitive implementation of such park in the immediate future.

The Borrower stressed the fact that the project was a dynamic force in organizing farmer groups which should evolved, and in a number of cases are already evolving, into new forms of organization needed for a more general rural development strategy. Especial mention is given to the experience gained from the creation of the Intermunicipal Council for the Implementation of the State Park, which is now a strong independent association representative of diverse segments of society working hand by hand with State government entities for the final implementation of the State Park.

It also noted the important contribution of the project to the modernization of the State research and rural extension organization. Influenced by the philosophy of the project's microcatchment work, the mission of this organization is now centered on the sustainable development of rural Santa Catarina. In addition, the preparation of draft laws for the State conservation system and the pro-ecology tax now under discussion by the Legislature will facilitate implementation of State conservation units. The Government appreciates the active interactions promoted under the project between government agencies (state and municipal) and civil society to seek definitive implementation of the State park and of other sustainable development activities; this work has definitively change the *modus operandi* of State institutions.

The Borrower concluded that it is clear that the set of project interventions was essential in creating the bases for sustainable agriculture in Santa Catarina. While recognizing that its benefits must be sustain

over time, it noted that the problems that currently afflict rural communities extrapolate the project's original scope and objectives, making it necessary to continue and expand the project scope with a follow-up operation. A number of recent studies shows that rural areas are undergoing a process of impoverishment and that rural families, who lack prospects for improved living conditions, are migrating to cities, thereby increasing the number of slum-dwellers in urban areas. The State Government is using its own resources and programs to seek alternatives to revitalize the rural sector, but is also asking for Bank financing for a follow-up Microcatchment II Project, to ensure better rural living conditions, by means of social, economic and environmental development.

(b) Cofinanciers:

Not relevant

(c) Other partners (NGOs/private sector):

Not relevant

10. Additional Information

Annex 1. Key Performance Indicators/Log Frame Matrix

Input Indicators	Unit	Targets		Actual
		Appraisal	Mid Term	
Adaptive Research				
- New meteorological stations	Unit	4	4	4
- Meteorological Stations re-equipped	Unit	5	5	5
- Soil laboratory expanded	Unit	1	1	1
- Research station expanded	Unit	1	1	1
- Seed processing unit	Unit	1	1	1
Land Use Mapping, Planning and Monitoring				
- Data processing equipment	Set	1	1	1
- Geoprocessing mapping methodology prep.	Unit	-	1	1
Rural Extension				
- Total extensionists	Unit	256	316	422
- Total public sector extensionists	Unit	147	207	353
- Total private sector extensionists	Unit	109	109	69
- Environmental and Sanitation Education Schools Assisted	Unit	-	4,000	5,229
Soil Conservation Fund				
- Group investments financed	Unit	....	....	3,600
- Individual investments financed	Unit	....	....	43,280
Forestry Development and Natural Resources Protection				
(a) Commercial and Conservation Reforestation				
- New private nurseries in operation	Unit	130	140	137
- Commercial reforestation Area	Ha	40,780	30,000	41,600
- Conservation reforestation Area	Ha	12,136	6,000	8,900
(b) Enforcement of Environmental Law				
- Periodic water sampling Microcatchments Attended	Unit	520	12	16
- Collection points	Unit	2,940	36	48
(c) Parks and Biological Reserves				
- Land recovery discrimination process	Unit	8	8	8
- Area	Ha	88,734	87,400	87,400
- Constructions	M2	1,485	....	....
- Fencing	M	7,535	7,200	300
- Power Line	M	3,150	3,150	1,600
Administration, Monitoring and Evaluation				
- Evaluation (ex ante, m-t, ex-post)	Unit	3	3	3
Training				
- Guidelines for DER-SC	Unit	1	1	1
- Operational Manual for SC Fund	Unit	1	1	1
- Technical Manual	Unit	1	1	1
- Orientation training for non-farmers 4-5 day seminars	Unit	26	26	8,306
- Number of trainees	Unit	536	516	155,763
- Farmer training - 1 day field trips	Unit	1,112	1,280	1,809
- Training for project technicians 3-106 day courses	Unit	56	139	120
- Number of trainees	Unit	1,220	2,919	2,594
- 90-120 day study tours abroad	Unit	14	14	1
- Number of trainees	Unit	26	26	5
- Consultancy				
- consultant time	m-month	40	40	3.8
- number of consultants	Unit	5	5	7

Output Indicators	Unit	Appraisal Target	Mid Term Review Target	Actual/Latest Estimate
Project Area				
- Microcatchments attended:				
New	Unit	520	534	534
Cumulative	Unit	537	551	551
- Related area (new)	Ha	1,855,500	1,855,500	2,428,000
Adaptive Research				
- Trails on project-related themes	Unit	89	127	127
- Trails on soil and crop nutrition	Unit	8	8	33
- Trails on mechanization	Unit	47	47	68
- Trails on agrometeorology	Unit	13	13	9
- Green manure basic seed production	Ton	184.2	260.0	203.4
Land Use Mapping, Planning and Monitoring				
- Climatic maps (1:250,000)	MC	143	143	143
- Various thematic maps (1:50,000)	MC	520	150	150
- Semi-detailed soil surveys	MC	72	0	0
- Land Use monitoring	MC	72	0	0
- State Park thematic map (1:50,000)	Unit	0	1	1
Rural Extension				
- Microcatchment plans	Unit	520	534	508
- Individual farm plans	Unit	56,600	57,000	44,000
- Total Farmers attended a/	Unit	80,900	82,000	106,000
- Municipalities attended	Unit	143	206	206
- No-tillage area	Ha	---	---	245,100
- Minimum-tillage area	Ha	---	---	151,500
- Soil conserv. Mechanical practices	Ha	240,000	240,000	785,000
- Basic sanitation				
- Water source protection	Unit	0	14,400	13,554
- Domestic water treatment	Unit	0	6,400	8,002
- Domestic waste deposits	Unit	0	7,000	2,474
- Environmental and Sanitation Education Schools Reached	Unit	0	92,000	123,843
Soil Conservation Fund				
(a) Collectively owned subprojects				
- Various equipment	Unit	5,952	5,952	11,385
- Toxic waste disposal pits	Unit	520	140	384
- Agrochemical mixing water points	Unit	520	80	382
(b) Individually owned subprojects				
- Animal waste fermentation tanks	Unit	3,985	4,000	5,694
- Green manure seeds	Ton	1,842	750	1,213
- Soil conservation works	Ha	156,000	65,000	111,200
- Commercial reforestation	Ha	40,780	30,000	7,746
Total Fund-Benefit Farmers	Unit	0	0	30,000
Erosion Control Along Rural Roads				
- Microcatchments benefited	Unit	520	400	406
- Improvement of running surface				

INDICATOR	Unit	Without Project	With Project
DIRECT ECONOMIC BENEFITS			
- Revenues of Average Farm			
- On-farm gross revenues	US\$	25,029	25,613
- Production costs	US\$	11,407	13,319
- Net revenues with project	US\$	13,622	12,294
- Net revenues without project	US\$	13,622	-----
- Labor Requirements			
- On-farm labor	Md/year	822	699
- Yields			
- Crops a/			
- Maize A	kg/ha	3,000	3,600
- Maize B	kg/ha	3,600	4,500
- Maize C	kg/ha	4,500	5,200
- Beans B	kg/ha	1,080	1,300
- Beans C	kg/ha	1,200	1,800
- Soybean C	kg/ha	2,000	2,700
a/ Without project reflects data from field survey and not appraisal data. See Economic Analysis			
A = animal traction and low technology; B = animal traction; C = mechanized			
- Livestock			
- Beef cattle: killing age	Days	1,300	1,038
Killing weight	kg	328	293
Average daily weight gain	g	252	282
- Dairy cattle: milk prod./cow/year	kg	1,078	1,743
- Pigs: killing weight at 6 months	kg	98	104
- Benefits from reduced erosion (***)			
- Solids in MC rivers	MG/l	400	112
- Average soil losses in project area	t/ha/year	6.0	4.74
- Total fertilizer losses from erosion in project area	t/year	50.0	39.5
- Total losses from erosion in project area	US\$/ha	40.0	31.6
-Coliform worms in MC rivers	Mg/100l	4,9	13,0
-MC river water treatment costs	R\$/month	3,600	1,800
(***) Data from Lajeado S. José microcatchment (Chapsecó)			
- Benefits from reduced contamination			
Intoxication by agrochemicals			
- light intoxication (% of producers)	%	28.1	12.2
- med. Intoxication (% of producers)	%	5.9	3.6
- serious intoxication (% of producers)	%	0	0.1
-Rural Roads			
- Road maintenance	US\$/km	945	151
- road trafficable under any weather condition	%	....	35.8

Output Indicators	Unit	Projected in last PSR 1/	Actual/Latest Estimate
Project Area			
-Microcatchments attended:			
New	unit	534	534
Cumulative	unit	551	551
-Related area (new)	ha	1,855,500	2,428,000
Adaptive Research			
-Trials on project-related themes	unit	127	127
-Trials on forest husbandry	unit	8	33
-Trials on soil and crop nutrition	unit	47	68
-Trials on mechanization	unit	13	9
-Trials on agrometeorology	unit	21	27
-Green manure basic seed production	ton	260.0	203.4
Land Use Mapping, Planning and Monitoring			
-Climatic maps (1:250,000)	MC	143	143
-Various thematic maps (1:50,000)	MC	150	150
-State Park thematic map (1:50,000)	unit	1	1
Rural extension			
-Microcatchment plans	unit	534	508
-Individual farm plans	unit	57,000	44,000
-Municipalities attended	unit	206	206
- <i>No-tillage area</i>	<i>ha</i>	<i>n.a.</i>	<i>245,100</i>
- <i>Minimum-tillage area</i>	<i>ha</i>	<i>n.a.</i>	<i>151,500</i>
-Soil conserv. mechanical practices	ha	240,000	785,000
-Basic sanitation			
Water source protection	unit	14,400	13,554
Domestic water treatment	unit	6,400	8,002
Domestic waste deposits	unit	17,000	20,587
Domestic cesspits	unit	7,000	2,474
Soil Conservation Fund			
(a) Collectively owned subprojects			

-Various equipment	unit	5,952	11,385
-Toxic waste disposal pits	unit	140	384
-Agrochemical mixing water points	unit	80	332
(b) Individually owned subprojects			
-Animal waste fermentation tanks	unit	4,000	5,694
-green manure seeds	ton	750	1,213
-Soil conservation works	ha	65,000	111,200
-Commercial reforestation	ha	30,000	7,746
Erosion control along rural roads			
Sub-grade reshaping	km	3,040	3,385
With regravelling	km	975	2,324
-Intersections with:			
Farm roads	unit	10,000	3,798
Terraces	unit	780	103
-Surface runoff control:			
Pipe culverts	unit	12,000	11,819
Flood control tanks	unit	9,000	528
Forestry development and natural resources protection			
-Creation Park Committee	unit	1	1
-TORs for Park Zoning	unit	1	1
-Park-centred environmental education program	unit	1	1
-Water monitoring in Park area	unit	1	1

1/ Revised Targets at Mid-Term Review.

Annex 2. Project Costs and Financing

Project Cost by Component (in US\$ million equivalent)

Project Cost By Component	Appraisal Estimate US\$ million	Actual/Latest Estimate US\$ million	Percentage of Appraisal
Adaptive Research	5.20	6.70	127
Land Use Mapping	3.30	4.80	142
Rural Extension	17.40	21.00	121
Soil conservation Fund	9.00	8.80	98
Rural Roads	21.10	16.60	76
Forestry Development and Nat. Res. Protection	8.30	4.80	57
Administration	4.00	5.30	113
Training	3.30	1.60	47
Total Baseline Cost	71.60	69.60	
Total Project Costs	71.60	69.60	
Total Financing Required	71.60	69.60	

Project Costs by Procurement Arrangements (Appraisal Estimate) (US\$ million equivalent)

Expenditure Category	Procurement Method ¹			N.B.F.	Total Cost
	ICB	NCB	Other ²		
1. Works	0.00 (0.00)	18.10 (8.10)	4.00 (1.80)	0.00 (0.00)	22.10 (9.90)
2. Goods	0.40 (0.40)	2.20 (0.80)	0.00 (0.00)	0.00 (0.00)	2.60 (1.20)
3. Services	0.00 (0.00)	0.00 (0.00)	2.10 (1.30)	0.00 (0.00)	2.10 (1.30)
Technical Assistance & Training					
4. Grants	0.00 (0.00)	0.00 (0.00)	8.80 (6.30)	0.00 (0.00)	8.80 (6.30)
5. Operating Costs	0.00 (0.00)	0.00 (0.00)	36.00 (14.30)	0.00 (0.00)	36.00 (14.30)
6. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Total	0.40 (0.40)	20.30 (8.90)	50.90 (23.70)	0.00 (0.00)	71.60 (33.00)

Project Costs by Procurement Arrangements (Actual/Latest Estimate) (US\$ million equivalent)

Expenditure Category	Procurement Method ¹			N.B.F.	Total Cost
	ICB	NCB	Other ²		
1. Works	0.00 (0.00)	15.70 (8.50)	0.00 (0.00)	0.00 (0.00)	15.70 (8.50)
2. Goods	0.00 (0.00)	2.50 (1.20)	0.30 (0.30)	0.00 (0.00)	2.80 (1.50)
3. Services Technical Assistance & Training	0.00 (0.00)	0.00 (0.00)	1.40 (0.80)	0.00 (0.00)	1.40 (0.80)
4. Grants	0.00 (0.00)	0.00 (0.00)	8.20 (6.50)	0.00 (0.00)	8.20 (6.50)
5. Operating Costs	0.00 (0.00)	0.00 (0.00)	41.50 (15.70)	0.00 (0.00)	41.50 (15.70)
6. Miscellaneous					0.00 (0.00)
Total	0.00 (0.00)	18.20 (9.70)	51.40 (23.30)	0.00 (0.00)	69.60 (33.00)

^{1/} Figures in parenthesis are the amounts to be financed by the Bank Loan. All costs include contingencies.

^{2/} Includes civil works and goods to be procured through national shopping, consulting services, services of contracted staff of the project management office, training, technical assistance services, and incremental operating costs related to (i) managing the project, and (ii) re-lending project funds to local government units.

Project Financing by Component (in US\$ million equivalent)

	Appraisal Estimate			Actual/Latest Estimate			Percentage of Appraisal		
	Bank	Govt.	CoF.	Bank	Govt.	CoF.	Bank	Govt.	CoF.
Research	2.00	3.00	5.20	2.10	4.50	6.70	105.0	150.0	128.8
Mapping	1.70	1.60	3.30	2.60	2.20	4.80	152.9	137.5	145.5
Extension	6.40	11.00	17.40	7.00	14.00	21.00	109.4	127.3	120.7
SC Fund	6.30	2.70	9.00	7.00	1.80	8.80	111.1	66.7	97.8
Roads	9.50	11.60	21.10	8.90	7.70	16.60	93.7	66.4	78.7
Forestry & Nat. Res. Protection	3.80	4.50	8.30	2.80	2.00	4.80	73.7	44.4	57.8
Administration	1.40	2.60	4.00	1.70	3.60	5.30	121.4	138.5	132.5
Training	1.90	1.40	3.30	0.90	0.70	1.60	47.4	50.0	48.5
Total	33.00	38.60	71.60	33.00	36.50	69.60	100.0	94.6	97.2

Annex 3: Economic Costs and Benefits

I. SAR Estimates

1. The estimated Economic Rate of Return at appraisal was 15%. Six rainfed farm models representing the river basins with major concentration of microcatchment were analysed to test the impact of the improved land management and soil conservation practices on the yield of major crops and corresponding farm incomes.
2. Financial Rates of Return of the models before financing and subsidies ranged from 17% to 32%. Expected average incremental annual farm benefits resulting from project-introduced practices were estimated to vary from US\$ 285 (21 ha farm with cassava, maize and tobacco) to US\$ 3,325 (65 ha farm with Soybean, wheat and Maize). In the without project situation, a declining trend in productivity for the main crops ranging from 5 to 10% per year was assumed. In the with project situation, the projected increase in crop yields above project levels under the various farming systems ranged from 15% for tobacco to 27-31% for cassava, onion and soybean, 36% for wheat and 43% to 50% for beans and maize.
3. The project was designed to directly/indirectly assist some 520 microcatchments covering 1.8 million ha of farmland with 80,900 farmers. The average adoption rate used for the economic evaluation of the proposed project was 35% for the total area under annual crop which is equivalent to 240,000 ha.

II. Revised Estimates at Completion

4. **Adoption rates and beneficiaries.** The economic re-evaluation of Land Management II Project – Santa Catarina is based on the revised adoption rates using data from 3 field surveys by ICEPA carried out in 1991 (SAR), 1995 (intermediate evaluation) and 1998 (ICR) on a total of 1430 farms covering 224 microcatchments. The resulting number of beneficiaries increased from 80,900 at project appraisal to 106,000 at completion. Project beneficiaries estimates revised at completion are shown in table 1.

Table 1. Project Direct Beneficiaries

Year	1991	1992	1993	1994	1995	1996	1997	1998
Cumulative beneficiaries	8.050	19.440	38.280	47.490	58.480	75.420	95.100	106.000
Incremental beneficiaries	8.050	11.390	18.840	9.210	10.990	16.940	19.680	10.900

5. **The agricultural prices and farm income evolution.** A socioeconomic analysis carried out by ICEPA on a sample of 1,386 producers highlighted a negative evolution of farm income in the project area. The results are shown in table 2.

Table 2. Farm income evolution in the project area (in '000 1998 R\$)

Type of agricultural activity	Initial survey (1991)		Mid-term survey (1995)		Final survey (1998)	
	Average value of production	Average value added	Average value of production	Average value added	Average value of production	Average value added
Animal husbandry (cattle)	26,22	19,01	13,40	9,17	14,06	9,00
Animal husbandry (swine)	134,11	53,21	62,88	22,28	89,52	26,45
Cereals	25,12	17,67	20,47	13,98	20,08	13,22
Vegetables	44,26	39,85	28,22	22,98	31,68	26,76
Mixed	15,15	9,67	15,92	9,84	16,76	10,08

Source: CEPA, Santa Catarina

Results show a declining trend in both the value of production and value added. This decline can be explained by the trend in the main real term agricultural prices shown in table 3.

Table 3. Agricultural prices (in constant 1998 R\$)

	Unit	1991	1995	1998
Outputs				
Milk	Litre	0.32	0.19	0.19
Pork meat	Kg liveweight	1.92	1.20	2.43
Cow meat	unit	651	423	439
Beans	60 kg bag	52.51	28.93	37
Maize	60 kg bag	13.56	6.70	7.69
Soybean	60 kg bag	16.86	10.81	15.75
Inputs				
Urea	50 kg bag	27.34	14.67	14.4
Lime	ton	1.73	1.25	1.28
Superphosphate (simple)	50 kg bag	20.11	9.67	12.13

Source: CEPA, Santa Catarina

Table 3 shows a decline in all agricultural prices between 1991 and 1998 with the exception of port meat. The decline in farm income is mainly due to the effects of the trade liberalization causing declining producer prices.

6. **Farm models.** For the preparation of the SAR, six different farm models were developed which at the time were considered to be representative of the prevailing and future farming systems in the project area. The monitoring activity of the project however has shown that these models do not adequately reflect the existing and improved farming systems in the project area. For this reason, the ICR adopted 10 farm models which were defined on the basis of three field surveys carried out by ICEPA and mentioned in para 4. On the whole, the surveys' sample covered a total of 224 of the 554 total microcatchments in the project area and 1430 producers out of an initially estimated total of 87,265 (see Appendix 1 for crop budgets and cropping patterns).

7. Crop yields estimates differ significantly between SAR and ICR. The latter are derived from the three field survey carried out at project appraisal, intermediate evaluation and ICR respectively. The SAR assumptions and the ICR estimates are shown in table 4.

Table 4. Yield estimates for SAR and ICR

SAR yields (kg/ha/year)				ICR yields (kg/ha/year)			
Crops	Without project	With project	Increm %	Crops	Without project	With project	Increm %
Maize A	Not included	Not included		Maize A	3,000	3,600	20%
Maize B	2,400	3,300-3,400	41%	Maize B	3,600	4,500	25%
Beans B	660	850	28%	Beans B	1,080	1,300	20%
Tobacco B	1,650	1,850	12%	Tobacco B	not included	not included	-
Cassava B	14,000	16,000	14%	Cassava B	not included	not included	-
Soybean C	1,650	2,100	27%	Soybean C	2,000	2,700	35%
Wheat C	1,300	1,700	30%	Wheat C	not included	not included	-
Maize C	2,650	3,650	37%	Maize C	4,500	5,200	15%
Beans C	850	1,150	35%	Beans C	1,200	1,800	50%

A: Animal traction and low technology; B: Animal traction; C: Mechanised

8. Estimated benefits from productive components. The incremental production generated by the project estimated according to farm models is presented in table 5.

Table 5. Total project incremental production of major crops and animal husbandry

CROP	UNIT	WITH OUT PROJECT	WITH PROJECT	INCREMENTS
Maize	Ton	805.143	1.025.225	220.081
Soja	Ton	10.787	17.001	6.214
Beans	Ton	67.036	38.404	-28.631
Cattle	Head	14.547	29.538	14.990
Swines	Head	1.784.354	2.138.024	353.670
Milk	'000 litres	377.811	420.587	42.776

9. **Incremental Production** The total value of production at full development (year 9) has been estimated at US\$ 53 million with beans showing a decline of US\$ 15.8 million. Approximately 80% of incremental production comes from animal husbandry products.

Table 6. Value of Incremental Production

CROP	WITHOUT PROJECT	WITH PROJECT	INCREMENTS
Maize	93.1	118.6	25.5
Soja	2.6	4.1	1.5
Beans	36.8	21.0	-15.8
Cattle	5.8	11.9	6.1
Swine	143.1	171.5	28.4
Milk	64.3	71.6	7.3
Total	345.8	398.8	53

10. **Estimated benefits from non-productive components.** Non-productive benefits include all benefits which are not described in para. 8 and 9. These include reduced loss of topsoil, reduced maintenance of roads, improved water quality, reduced risk of floods and development of an agricultural machinery industry. Of these indirect benefits, only those related to reduced road maintenance were assessed and accounted for in the analysis. Estimates of these savings are shown in Table 7. Average reduction in road maintenance cost associated with improved road conditions is derived from a field study carried out by the project implementation agency (ICEPA).

Table 7. Savings in Road Maintenance

	Unit	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000-2015
Km implemented annual	Km	0	0	138	187	416	806	218	704	916	0
Km implemented cumulated	Km	0	0	138	325	741	1547	1765	2469	3385	3385
Average annual maintenance cost reduction per km	US\$/km	397	397	397	397	397	397	397	397	397	397
Average annual maintenance cost reduction per km	Constant 1998 R\$/km	476,4	476,4	476,4	476,4	476,4	476,4	476,4	476,4	476,4	476,4
Savings in road maintenance	1998 R\$	0	0	65.743	154.830	353.012	736.991	840.846	1.176.232	1.612.614	1.612.614

11. **Financial Prices, Rates of Return and Net benefits.** All financial prices are expressed in constant 1998 R\$ (see appendix 1). In order to account for seasonal fluctuations, financial prices are average monthly farmgate prices for the twelve month of 1998. Analyses show financial rates of return ranging from 19.5% to 44%. Net annual farm benefits from the main crops which before project implementation varied from US\$ 250 to US\$ 14,580 increased to a range of US\$ 850 to US\$ 17,250 at year 9 of the project. Net benefits and FRR are shown in table 8.

Table 8. Farm models. Incremental Net Benefits and Financial Rates of Return

Models	Farm size Without project	Farm size With project	Net benefits Without project	Net benefits With project	FRR
Milk and maize – mechanised -	51	42	2,830	4,100	44%
Milk and maize – animal traction -	37	21	2,000	2,350	30.2%
Milk and maize – animal traction and low technology -	21	19	630	850	19.5%
Swine and Maize – mechanised -	35	35	5,590	8,420	22.5%
Swine and Maize – animal traction -	17	25	1,980	3,720	30.2%
Swine and Maize – animal traction and low technology -	18	10	780	900	21%
Cattle – medium technology -	Non existing	55	600	1,450	40.4%
Milk and swine – high technology	12	28	2,680	7,340	26.5%
Milk and swine – medium technology	4	21	250	2,850	23.3%
Swine - high technology -	11	21	14,580	17,260	20%

12. **Project Costs.** Capital costs in the economic analysis are derived from actual total disbursement per year. Capital cost is in current US dollar disbursed by year converted into 1998 US dollar using USA Consumer Price Index as shown in table 9. Capital cost from year 1 to 9 includes operating and maintenance costs. Project maintenance and operating costs from year 10 to 15 have been estimated at US\$ 3.9 million per year for follow up activities of implementing agencies.

Table 9. Project Costs

COSTS	UNIT	1991	1992	1993	1994	1995	1996	1997	1998	1999
Project costs	Current US\$ '000	1.801.6	4.665.3	6.031.3	9.399.3	14.885.3	12.208.7	8.302.0	7.738.1	4.969.0
Credit component	Current US\$ '000	0	235	237.5	670.9	1.682.2	1.558.8	2.062.1	2.289.8	144.4
Project costs less credit	Current US\$ '000	1.801.6	4.641.8	5.793.8	8.728.4	13.203.1	10.649.9	6.239.9	5.448.3	4.824.6
Inflator		1,22	1,17	1,14	1,10	1,08	1,05	1,02	1,00	0,99
Project costs -- adjusted	Constant 1998 US\$' 000	2.197.952	5.430.906	6.604.932	9.601.240	14.259.348	11.182.395	6.364.698	5.448.300	4.728.108

III. Economic and sensitivity analysis.

13. The overall rate of return of the project is estimated to be 20% over a 15 years period as compared to ERR estimated at appraisal of 15% (see appendix 1 showing the results of the FARMOD simulation). The cost stream of the economic analysis is based on the following elements: (a) all on-farm investment and operating costs are estimated for every farm model on a per hectare basis for the development of 254,000 ha resulting from an adoption rate of 35% on the total area under annual crop within the project area; (b) all project costs were adjusted as described in para. 10 and table 9 (the soil conservation fund was not included in project total costs); (c) all prices are 1998 constant prices; economic prices of main traded goods and inputs (maize, soybean, UREA) were derived taking into account international border prices, freight, insurance, port handling, internal transport and processing (see appendix 1); farm labour was priced at 0.9 of its financial wage rate. Economic prices of non-traded goods were calculated as the foreign exchange portion plus the non-tax portion of local costs multiplied by the standard conversion. Foreign exchange content per input category were derived from appraisal data.

14. **Sensitivity analysis.** The effect upon the project economic rate of return under various sensitivity tests is shown in table 10.

Table 10. Project Sensitivity Analysis

Costs	Benefits	ERR (%)
Plus 10%	Unchanged	16%
Plus 20%	Unchanged	12%
Less 10%	Unchanged	24%
Unchanged	Plus 10%	24%
Unchanged	Less 20%	17%

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle Month/Year	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation Identification July-1988	1	Sr. Agric., Soil Scientist	S	S
	1	Civil Engineer	S	S
Appraisal/Negotiation Appraisal - Apr. 1989 Negotiations- Oct.1989	1	Sr. Agriculturalist	S	S
	1	Sr. Agriculturalist	S	S
Supervision				
April-90	1	Sr. Agriculturalist	S	S
April-91	1	Sr. Agriculturalist	S	S
July-91	1	Agriculturalist	S	S
October-91	1	Sr. Agriculturalist	S	S
April-92	1	Sr. Agriculturalist		S
December-92	2	Agriculturalist, Soil Scientist	S	
May-93	1	Sr. Agriculturalist	S	S
October-93	3	Sr. Ag. Econ. Agriculturalist, Soil Scientist	S	S
June-94	1	Sr. Ag. Economist	S	S
November-94	1	Agriculturalist	S	S
April-95	1	Sr. Ag. Economist	S	S
September-95	1	Ecologist	S	S
October-95	1	Civil Engineer	S	S
November-95	2	Sr. Ag. Economist Agriculturalist	S	S
June-96	4	Sr. Ag. Econ. Agriculturalist, Ecologist, Rural Sociologist	S	S
July-96	2	Ecologist, Rural Sociologist	S	S
Nov-Dec-96	3	Sr. Ag. Economist, Agriculturalist, Ecologist	S	S
January-97	3	Sr. Ag. Economist, Agriculturalist, Ecologist	S	S
April-97	3	Sr. Ag. Economist, Ecologist, Agriculturalist	S	S
September-97	1	Sr. Ag. Economist	S	S
December-97	1	Sr. Ag. Economist	S	S
April-98	1	Sr. Ag. Economist	S	S
November-98	4	Sr. Ag. Economist, Ecologist, Water Res. Specialist, Agriculturalist	S	S
March-99	5	Sr. Ag. Economist, Ecologist, Water Res. Specialist, Agriculturalist, Sociologist	S	S

ICR November-99	5	Sr. Ag. Economist, Sociologist, Water Res. Specialist, Rural Sociologist, Agriculturalist	S	S
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(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US\$ (,000)
Identification/Preparation	36.6	66.40
Appraisal/Negotiation	9.1	24.30
Supervision	151.9	525.3
ICR	7.6	34.7
Total	205.2	650.70

NOTE: Actual/Latest Estimate includes US\$90,200 from FAO/CP.

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

Rating

Macro policies

Sector Policies

Physical

H *SU* *M* *N* *NA*

Financial

H *SU* *M* *N* *NA*

Institutional Development

H *SU* *M* *N* *NA*

Environmental

H *SU* *M* *N* *NA*

Social

Poverty Reduction

H *SU* *M* *N* *NA*

Gender

H *SU* *M* *N* *NA*

Other (Please specify)

H *SU* *M* *N* *NA*

Community Involvement

Private sector development

H *SU* *M* *N* *NA*

Public sector management

H *SU* *M* *N* *NA*

Other (Please specify)

Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance

Rating

- Lending
- Supervision
- Overall

HS S U HU
 HS S U HU
 HS S U HU

6.2 Borrower performance

Rating

- Preparation
- Government implementation performance
- Implementation agency performance
- Overall

HS S U HU
 HS S U HU
 HS S U HU
 HS S U HU

Annex 7. List of Supporting Documents

1. Staff Appraisal Report
2. Loan Agreement
3. Borrower's Progress and Annual Reports
3. Aide-Mémoires
4. Forms 590
5. Letters to the Government
6. Back-to-Office Reports (Bank and FAO-CP)
7. Borrower's Implementation Completion Report
8. Ex-ante Evaluation Report
9. Mid-term Evaluation Report
10. Borrower Completion Report (Summary and by Project Component)
11. Ex-post Evaluation Report (available on the internet www.icepa.com.br)
12. Economic Analysis (carried out at ICR mission)
13. Specific ex-post analyses/studies (also available on the internet www.icepa.com.br)
 - (a) PROSOLO (*Soil Conservation Incentive Fund*)
 - (b) Controle de Erosão ao Longo de Estradas Rurais (*Erosion Control along Rural Roads*)
 - (c) Análise Comparativa do Plantio Direto com o Sistema Convencional de Manejo do Solo em Sistemas de Produção de Lavouras em Santa Catarina (*Comparative Analysis of No-tillage With Conventional Cultivation in Santa Catarina*)
 - (e) Impacto do Projeto na Indústria Catarinense de Máquinas e Equipamentos Agrícolas (*Project Impact on Santa Catarina Agricultural Equipment Industries*)
 - (f) Mudança Comportamental das Pessoas e Instituições (*Behavioral Changes of Individuals and Institutions*)
 - (g) Qualidade da Água no Meio Rural (*Water Quality in Assisted Microcatchments*)
 - (i) A Experiência da Criação Combinada de Suínos e Peixes (*The Pig-Fish Culture Experience*)
 - (j) A Experiência da Implantação do Parque da Serra do Tabuleiro (*The Serra do Tabuleiro Park Implementation Experience*)

Annex 8. Beneficiary Survey Results

1. Project files contain extensive documentation generated by the socio-economic surveys carried out by the borrower at project start-up (1992; 90 farmers in 14 microcatchments), mid term (1995; cumulative 620 farmers in 90 microcatchments) and completion (1999; cumulative 720 farmers in 120 microcatchments). These studies are all in the website of the Borrower at www.ICEPA.com.br. Highlights of survey findings, based on the Executive Summary of the final report, are given below.
2. **Improvements in Land Management.** Areas receiving liming, organic manuring, direct drilling and subsoiling exceeded appraisal estimates; green manuring, minimal tillage and stone or vegetative barriers fell short of appraisal estimates. Crop yield gains exceeded appraisal estimates for the main crops by from 12% to 41%, and exceeded completion estimates of without project yields by 15% to 50%. Weights at slaughter for cattle and pigs rose, and ages at slaughter ages fell; milk productivity increased. Rural sanitation improved but further gains are needed. Despite productivity gains, farm incomes fell due to declining prices; but falls were less for adopters of land management improvements than for non-adopters. Farm family attitudes changed: there was greater willingness to co-operate in solving problems; women and other family members tended to have a greater say in economic decisions.
3. **Erosion Control on Rural Roads.** Delays in release of funds slowed implementation of this component. Implementation also suffered initially from unfamiliarity of DER engineers with methods needed to upgrade minor roads, but awareness of the needs to dispose safely of runoff from roads was improved. Municipalities offered less co-operation than assumed, often due to lack of their own funds. DER at times ignored the locations of greatest need for upgrading (often difficult of access) in favour of maximising the number of municipalities in which work was done. Transitability of rural roads greatly improved with better erosion control, and was considered by communities a major project benefit. Maintenance costs fell by as much as 80%. The component should have been complemented by actions to control erosion derived from on-farm roads.
4. **Monitoring Water Quality.** Monitoring of bacterial contamination in 14 microcatchments showed variable results, at times due to the influence of non-agricultural activities and the choice of sampling point. In one microcatchment that was monitored in great detail, turbidity reduced by 61% and suspended solids by 70%. Needs for aluminium sulphate to clean this water up to standards needed for domestic supply fell by 46%.
5. **Case Study: Environmental Problems arising from Pig/Fish Farming.** Contamination problems that emerged during implementation were given project support. The Bank was judged to have had a decisive influence in helping the State towards a successful solution.
6. **The Serra do Tabuleiro Park.** Local communities and authorities were initially little involved in planning and implementation of this surviving part of the original parks component. During initial years relations with the public state authorities were declining. An educative approach combined with the formation of local stakeholder bodies changed this relationship with the authorities, and created a local sense of ownership which after much delay is expected to lead to the setting up of a viable conservation area. Replication of this model is suggested. The Bank was judged to have a decisive role in helping the State reformulating the strategy for the implementation of this Park.
7. **Changes in Behaviour.** At institutional level, understanding of environmental issues and the benefits of closer interactions with communities are judged to have increased. Municipalities have committed their own resources where those of the project were inadequate. Self esteem of technical staff

has been raised due to project involvement. Farmers' practices are gradually changing and habits of greater consultation within the family are increasing slowly; their awareness of environmental issues is also increasing. Co-operation among farmers for marketing or joint farming activities remains incipient. While much therefore remains to be done in terms of community and farmer behaviour, it is nevertheless judged that a useful start has been made.

8. **PROSOLO.** The fund provided incentives for over 40,000 items of investment by 30,000 farmers, at a total cost of US\$8.75 million. Some 3,600 farmer groups were formed, which in many cases also undertook non-project activities; further groups formed spontaneously outside the project. PROSOLO gave a strong incentive both for group formation and technical change. Supporting State documents, but not the executive summary, note, however, that application procedures for PROSOLO were cumbersome until revised, amounts were smaller than farmers would have preferred, and funds were slow to arrive.

9. **Industrial Impact.** Manufacture of equipment adapted to the project technical strategy under the research component was taken up by 9 large and 46 small firms. Turnover in sales of adapted machines in 1998 was estimated at US\$3.7 million and about 240 jobs had been created.

10. **The Change to Zero-Tillage.** In the State of Santa Catarina the area of zero-tillage increased from an estimated 120,000 ha in 1993/4 to 880,000 ha in 1998/9. The area under conservation management practices now totals an estimated 60% of the State's cropped area. The main constraint to more rapid uptake cited by farmers was unavailability of the necessary machinery. Zero-tillage reduced traction needs by between 19% (tractor cultivation) and 66% (animal cultivation). Labour requirements fell by between 16% (onions) and 59% (beans). Dosages of lime and inorganic fertilisers could be reduced. Lowered sensitivity of crops to short-term drought was reported by 90% of farmers and 2/3 also reported reduced sensitivity of crops to heavy rains. On the other hand, there were more pest and disease problems in zero-tillage crops and a correspondingly greater need for insecticides. Farmers were unanimous in considering zero-tillage crops easier to manage, but felt that further improvement of machinery was still needed.

Annex 9. Stakeholder Workshop Results

1. Documentation of the Evaluation Workshop held on 26/27 October, 1999 is on project files. The Workshop was attended by almost 100 people, some 40 of whom were from the Santa Catarina Research and Extension Enterprise, 10 from the Project Unit or Secretariat of Agriculture, 7 each from municipalities, State natural resources/environment organisations or planning groups for a proposed follow-up project, and 5 each from other state governments or non-governmental development organisations. Four were from the private sector and two each from the State roads department and the Bank.
2. Six Working Groups considered respectively the project's parks component, reforestation, extension/mapping/roads, agricultural research, water monitoring, and the incentive fund for soil conservation.
3. Positive aspects identified by participants included the mobilisation for development of community leaders, participation and behaviour change among producers and rural communities, the stimulus to joint action provided by the project approach and financial incentives, and the greater credibility it had given to technical assistance staff within rural communities. The project was judged to have brought a new vision of environmental and natural resource management and created widespread awareness of, and commitment to, the new approaches. Improvements were noted to rural roads, domestic sanitation, the disposal of animal waste, and water quality. The continuity of project management, the project's inter-institutional nature and its concentration of resources and efforts were also considered positive aspects.
4. Lessons learned included the value of using a catchment/microcatchment approach for planning and implementation; the importance of listening to farmers, focusing on a few attainable objectives and planning within available capacity; the fundamental importance of institutional integration and community participation; and the difficulty of involving the private sector.
5. It was hoped by the participants that a follow-up project would retain most of the characteristics of the first project, with even greater co-operation between institutions and disciplines. There should be further cost-sharing incentives for farmers' improvements in resource management and better environmental monitoring. Mechanisms to resolve environmental conflicts should be improved.
6. Fears for a follow-up project centred on risks of political interference and discontinuity of funding, approval delays, and constraints arising from shortage or poor quality of the human resources needed for implementation.