3. Regional Agricultural Development Plan

(1) Integration of Agriculture and Livestock

(1.1) Farming System

The current program aims at introducing the production of grains in areas of extensive pasture in order to promote the farming diversification. In other words, the degraded pasture will be improved and along with the improvement of the cattle variety the fattening period will be shortened and the milk production will be increased. Furthermore, the producers seeking land to produce grains will have a chance to find such land in the Study Area. If grains are thus produced in the Study Area, the construction of the related infrastructure and the development of the related industries will be promoted and consequently the regional economy will be activated.

As a practical measure, activities on the formulation of land use plan, the establishment of model farm for crops rotation and the development of crops rotation model will be promoted as already mentioned in item 6.3.2. The land use plan was already discussed in item 7.2. There are two ways to introduce the crops rotation system in the Study Area, one is to initiate by the landowner him/herself and the other is through contracts (leasing). Considering that most of the livestock farmers in the northern part of the State doesn't have experience nor machinery, the best way would be to combine livestock farmers and crop production farmers who would bring the machinery to produce grains for a certain period of time thus promoting the rotation system of crops and pasture.

The variety of grains and the cropping pattern depends on each farmer. If the farmer has enough capacity, it is possible to cultivate for 3 years in a fixed area upland rice/corn (safrinha)/ millet (in the dry period) or soybean/corn (safrinha)/millet (dry period). But in case of contract farming, the contracted farmer has enough capacity to cultivate grains in a way that soybean is cultivated in the 1st year, rice in the 2nd and soybean again in the 3rd year. There are producers who prefer to plant soybean for 3 years. In the first year, the conventional plowing cultivation will be employed for the improvement of soil. Non-plowing cultivation (direct planting) will be introduced from the second year on.

Concerning the suitable variety of soybean and rice, medium cycle variety of EMBRAPA cross was recommended, but the final selection shall be carried out by EMBRAPA considering the soil, climate and other conditions. Even though, several varieties shall be introduced for dispersing risks and also for comparing local adaptability. Specifically, rice shall be selected from the improved varieties of EMBRAPA cross that shows better quality and high yield (max. 8 ton/ha).

The soil reclamation and fertilization practices will be carried out in accordance with the result of soil analysis. Soil analysis and fertilization design will be carried out under the support of RURALTINS and other organizations. Generally, the soil correction with lime is necessary. The main reason of the pastures degradation is the reduction of nutrients contents, especially the contents of phosphate. This is one of the important points for the management of cerrado soil. If grains are planted before renewing the pasture, it was reported that the phosphate contents raises with residual phosphate of the fertilizer for grains cultivation without special fertilization for the pasture. This is one of the merits of crops rotation system with grains and pasture reducing the cost for the renewal of pasture. Furthermore, CEC (Cation Exchange Capacity) is low in the sandy soil with high saturation of Al. It is therefore common to apply 450 kg/ha of compound fertilizer (2-20-18) for soybean cultivation and 200kg/ha of superphosphate for pasture.

Rice and soybean shall be cultivated in the rainy season and attention shall be paid to the damages caused by the veranico. The dry spell during rainy season sometimes causes severe damage on the crops and this phenomenon is called veranico. EMBRAPA carried out the studies for each municipal district and the most appropriate sowing period against veranico is recommended according to the location, soil and variety. One of the other measures against veranico is non-plowing cultivation that

can maintain high soil moisture. In case of wasteland, at least 5 years of ordinary cultivation is needed before introducing non-plowing cultivation. Continuous non-plowing cultivation sometimes raises the acidity of soil surface and the productivity drops after 5 years. Another measure against veranico is to develop deeper root system. Application of gypsum at a rate of 1.5 ton/ha once each 3-4 years is effective for the utilization of deep layer moisture by deep root system.

The operation scale of contracted farming depends mainly on the machines possessed by the contractor. The tractors from 100 to 130 HP have capacity for 300 ha in the case of the conventional plowing cultivation and 500 ha for non-plowing cultivation. However, if the tractor capacity is doubled as well as the field spacing, the capacity can raise up to 600 ha and 1,000 ha respectively. In the first year, the conventional plowing cultivation will be employed for the improvement of soil. Non-plowing cultivation (direct planting) will be introduced from the second year on. But this practice depends on whether the farmer possesses the appropriate machinery for the direct planting.

The use of this capacity of machinery can be planned for the renewal of pasture and the cultivation of grains. In case of 9 years plan, for instance, the plantation schedule with the use of tractor from 100 to 130 HP is presented as follows;

	1	2	3	4	5	6	7	8	9	10	11	
Year 1	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	Soy	
Year 2	Soy	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	
Year 3	Soy	Soy	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	
Year 4	Pasture	Soy	Soy	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	
Year 5	Pasture	Pasture	Soy	Soy	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	
Year 6	Pasture	Pasture	Pasture	Soy	Soy	Soy	Pasture	Pasture	Pasture	Pasture	Pasture	
Year 7	Pasture	Pasture	Pasture	Pasture	Soy	Soy	Soy	Pasture	Pasture	Pasture	Pasture	
Year 8	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	Soy	Soy	Pasture	Pasture	Pasture	
Year 9	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	Soy	Soy	Pasture	Pasture	
Year 10	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	Soy	Soy	Pasture	
Year 11	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Pasture	Soy	Soy	Soy	
	150ha	150ha	150ha	150ha	150ha	150ha	150ha	150ha	150ha	150ha	150ha	

The total area would be 1,650 ha where every year 450 ha would be cultivated with grains, and the remaining 1,200 ha for pasture. There would be a reduction of 28% in the pasture area, but this would not be a disadvantage because the areas with grains would return in better conditions than before.

Provided that a livestock farmer of this scale signed the contract with a farmer who has the necessary set of machines, the crop production farmer would not need to seek for other land to produce grains because this land will be enough. If the pasture is not degraded even after 9 years, however, the crop procuction farmer will have to sign a contract with another livestock farmer.

As for the implementation, it would be necessary that the livestock farmer carry out this practice himself or request the task to the rice producing farmers within the State, PRODECER, or from other States such as Goiás who have appropriate machinery.

In Araguaína, where the livestock husbandry is more intense, there are livestock farmers who are against the crops rotation system, but many others agree with this practice and intend to cooperate for the introduction of this system. Besides, these livestock farmers intend to arrange meetings among interested livestock farmers and soybean producing farmers, showing that they have a positive attitude in relation to this system. However, most of the livestock farmers are requesting a demostration of this practice before adopting it.

On the other hand, the soybean production is intensive in the states of Maranhão and Piauí and it is only a matter of time to incorporate this production in Tocantins. These investors are the crop production farmers who have their own resources in business scale, and not the small-scale producers of Paraná. With the construction of the North-South railway, this area will become privileged for the production of grains and there is a great possibility that the extensive pastures of the northern part shall be transformed into soybean fields.

(1.2) Promotion Plan

The Agriculture and Livestock Husbandry Integration shall be introduced through the following methods. However, a detailed plan shall be carried out through a feed-back carried out during the feasibility study.

- •To install farming practices models of this alternative. The model location shall be that where the demonstrative effect is maximized.
- •To create a Municipal Agricultural Committee that makes possible the introduction of the integration of activities, supporting the contracted cultivation and supplying the necessary information for the start of activities.
- •To establish the cultivation technologies so that the produced products can have high competitiveness.
- •To enable the necessary infrastructure, maximizing the private capital investments through specific credit lines.
- •Considering that the cattle husbandry is the most important economic sector of the region, the intention is to preserve this activity though it is necessary to raise its productivity through a more intensive production.

The contract farming between livestock farmers and crop production farmers is recommended as a farming system and such kind of contract farming can be promoted in the following manner. The contract for the production of grains shall be carried out based on the mutual merits for both the livestock farmers and the crop production farmers. The livestock farmers shall have the merit of renewal of the pasture through proper soil management based on the results of soil analysis. The crop production farmers shall have the merit of increasing the area of soybean production within their capability.

The contract needs to be legal containing the following items:

- Responsibilities and measures against breaks of contract;
- Plan on pasture renewal and plan of grains cultivation;
- Annual soil analysis, soil management plan and conditions after 3 years of grains cultivation;
- Finance and benefits to be rendered by the livestock farmer to the grains producer; and
- Shed for equipment, employees' dormitories, dinning rooms, bathrooms, use of water, use of electricity, use and maintenance of private roads, shed for machines and other facilities.

It is also necessary to carry out measures to alleviate the following constraints:

- In order to activate various sectors related to the agricultural activity in the area through the contract farming of grains production within the crops rotation system, the state and municipal governments along with the private sector need to maintain the highways during rainy season, to install silos and other necessary storage facilities of temporary stockpiling, to structure the distribution of inputs and to structure the system of maintenance of machines. The private sector and the public agencies shall cooperate for the State development;
- To promote the crops rotation system, political measures shall be arranged to protect the system for 10 years;
- EMBRAPA shall give necessary support services on the soil analysis, selection of promising cultivars and technical transfer. The state government, RURALTINS, UNITINS and the agricultural schools shall also render supporting services.

The Integrated System of Agriculture and Livestock is a project at the federal level and the first trial will be carried out at the northern region of the state of Tocantins. As it is a method still not experienced in the state, the state government shall give technical and financial support to the activity.

Considering that this is an area with great potential, this investment will certainly bring return in the future by upgrading the living standards of inhabitants and also by turning the poverty areas into grains producing areas. Therefore, the following government supporting measures will be needed for the proper implementation of the project:

- Government support to the first experimental model;
- To secure necessary funds for investments (federal, international or private resources);
- To promote the improvement of the necessary infrastructure (silos and highways) for the production of grains;
- To create policies to enable an effective land use;
- To spread the knowledge about the geographical advantages of this area compared to other more developed areas;
- Strengthening of the technical support and research activities.

The first experimental model needs various supports such as improvement of infrastructure what shall considerably increase the production cost. Therefore, the public support might be needed for this activity until its stabilization. The following promotion plan is therefore proposed:

1. At first 3 contracts shall be established.
2. These 3 groups shall be within the area of a 50 km radius from the location of the silo. For instance, if a silo is established in the industrial complex of Araguaína, these 3 contracts shall be in municipal districts such as Carmolândia, Aragominas, Muricilândia or Santa Fé do Araguaia.
2. If the crop production farmer use a set of machines for the cropping pattern of soybean–rice–soybean, 1,350 ha of land will be used in one year, 2,250 tons (average of 2,5 ton/ha) of soybean and 2,700 tons of rice (average of EMBRAPA cultivar is 6 ton/ha) will be produced. Therefore, a silo with the capacity of 3,000 tons would be necessary. This silo is for the drying and temporary stockpiling and the products shall be transferred to a great load silo in the state of Maranhão at Estreito, Porto Franco or Imperatriz. For the construction of such silo, the government's financial support will be necessary. Also, the livestock farmers syndicate shall totally cooperate with the administration services and maintenance of silos, as well as solving commercialization problems.
3. The 3 grains producing farmers are expected to be from Formoso do Araguaia. This is because of the problem of taxation in the transportation of machineries between different States.
4. The cooperation between state government and private sector is needed to improve the roads during rainy season, and to assure the maintenance of machineries.
5. The cooperation between government and private sector is also needed for structuring the tranportation and supply systems of necessary inputs to the production of grains.
6. Although the detailed conditions on the work and living atmosphere will be discussed under the contract, a special understanding from the livestock farmers is needed.
7. The cooperation of organizations and private companies is needed besides the cooperation of specialists of SEPRO and RURALTINS. Therefore, the government shall create an organization including private, public and of research sectors.
8. EMBRAPA is expected to supply technological support related to the cultivation of pastures and grains.

(1.3) Target Areas

The priority areas of this alternative are shown in Fig. 7.3.1, and the distribution of suitable areas in the table below;

Possible Areas for the Application of this Alternative (km^2)

Region	Priority 1	Priority 2	Total
REGION I - ARAGUATINS	1,308.8	368.5	1,677.3 (34.5%)
REGION II - AUGUSTINÓPOLIS	838.0	148.8	986.8 (45.9%)
REGION III-TOCANTINOPOLIS	980.0	1,191.3	2,171.3 (32.1%)
REGION IV - XAMBIOA	2,643.3	208.0	2,851.3 (51.6%)
REGION V - ARAGUAINA	3,176.3	5,050.5	8,226.8 (46.3%)
Total	8,946.4	6,967.1	15,913.5 (42.9%)

Note: Figures between ( ) represent the percentage of area.

The possible areas for the application of this alternative account for 16,000 km^2. The priority 1 areas can be developed with less input than priority 2 due to fertility difference.

(1.4) Priority Areas for Development

The conditions of the cattle farmer that will contract with the grain farmer for the intergation are as follows;

- In order to mitigate the risk of drought damage caused by Veranico during the rainy season, it is recommended to avoid the sandy soils that have low water holding capacity for cultivation. Also, the EMBRAPA's recommendations about agricultural practices to combat the Veranico damages shall be taken into consideration, in case the contract is made for a sandy soil land.
- Necessary characteristics of a land in order to obtain a good cultivation are as follows: to have a mild slope less than 10%, to be close to an area of degraded pasture, and that guarantees an annual production area of 150 ha.
- There are several areas in the region with these characteristics. If it is possible to guarantee more than 1,000 ha of these degraded pastures, the construction of silos and storehouses shall be easier by companies due to the scale.
- To increase the production of grains, the chosen lands shall be located in high altitudes, avoiding humid and low places.
- In terms of transport of agricultural implements and grains, it is viable to choose a location close to the paved highways.
- It is important to have nearby workshops for the maintenance of machines, agricultural implements and facilities.

These are the conditions of the pasture areas mentioned by the producers of grains. It is thus necessary to find cattle farmers who have land with these characteristics and interested in the recovery of their pastures through the implementation of crops rotation. In the Study Area, there are not many places with large flat areas; however we can mention some locations that correspond to these characteristics:

- Araguaína
- The area between Ananás and Angico;
- Surroundings of Carmolândia;
- The region of Aragominas, Muricilândia and Santa Fé do Araguaia.

These areas close to Araguaína shall be the 1st priority areas.

It would be convenient for the producers to find flat areas near the region encompassing the municipal districts of Wanderlândia and Piraquê, and these areas can also be found in the Bico do Papagaio region. If the cattle raiser himself purchases machinery and facilities, he can plan the ideal location for the crops rotation, avoiding high gradient areas. Analyzing from this point of view, there are several places where the implementation of crops rotation is possible.

However, one of the main objectives of the crops rotation is to incentive the small and medium-scale producers to introduce grains such as soybean, constructing facilities for this purposed and searching for ways for its commercialization, which can incentivate the collective production.

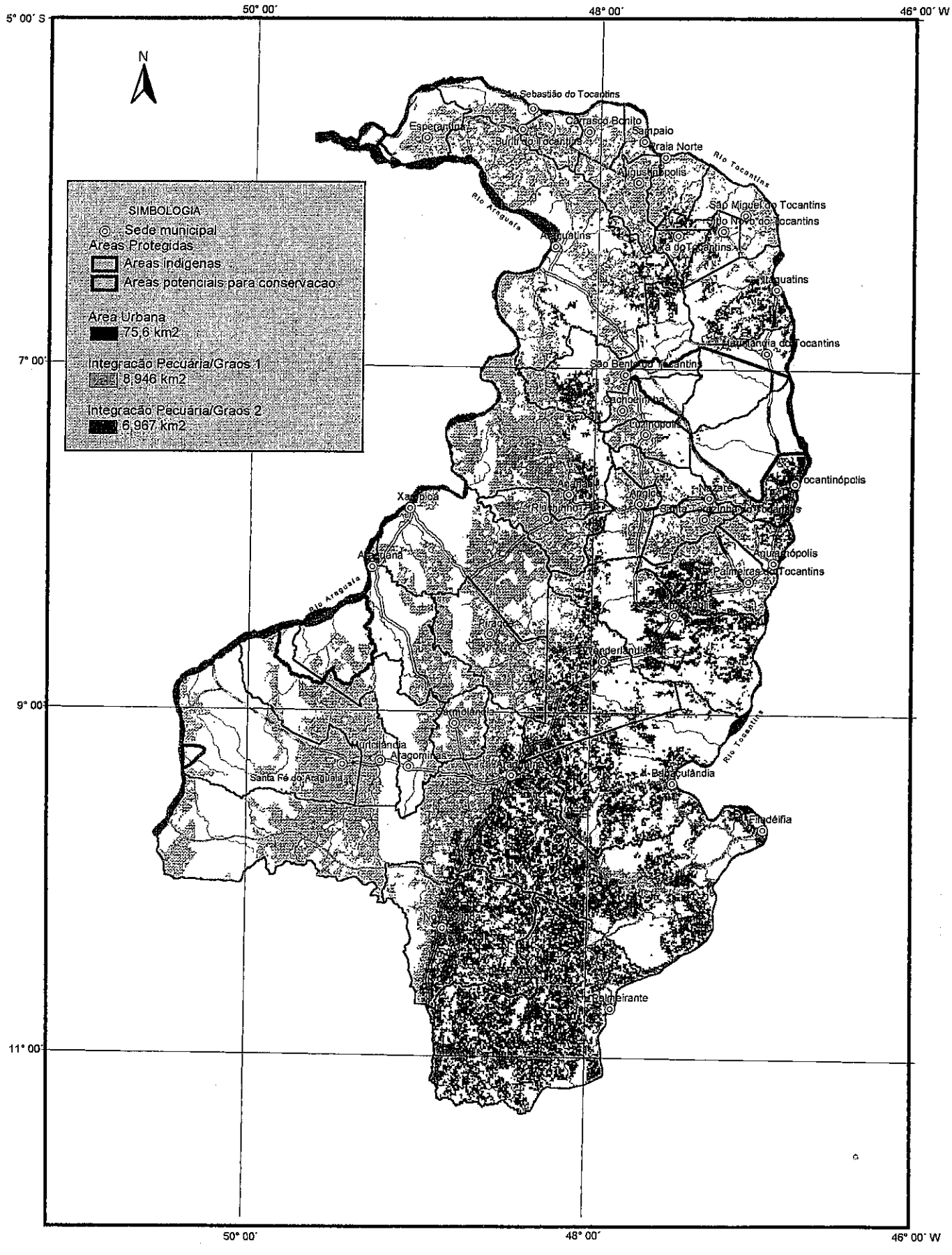


Fig. 21.3.1 Target Areas of Alternatives for Agriculture and Livestock Integration

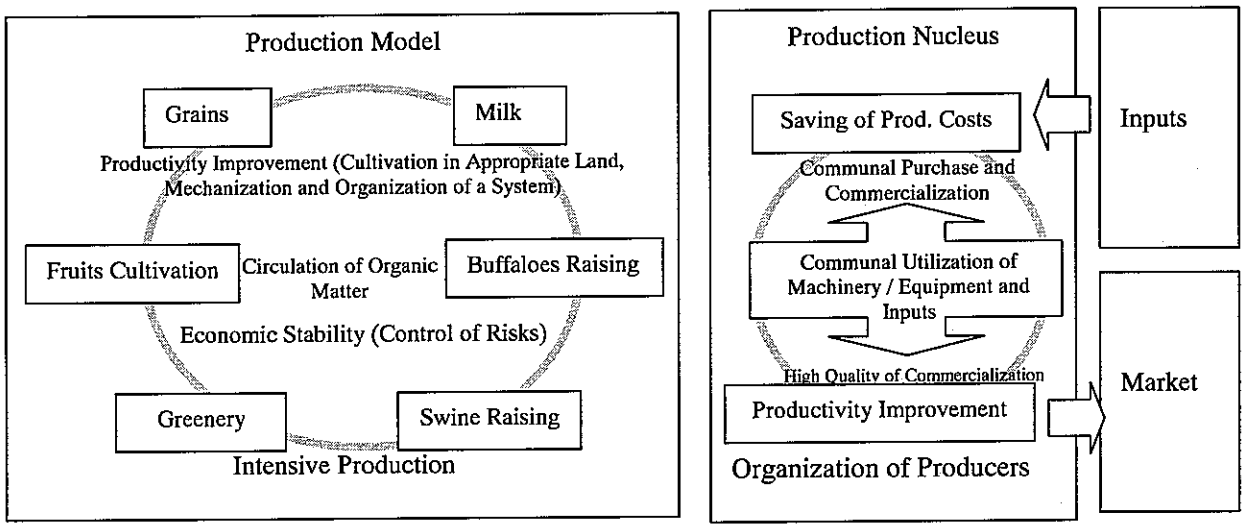
(2) Production Nucleus

(2.1) Farming System

As already mentioned in item 6.3.3, this program aims at raising the life standards of the mini and small-scale producers through their organization into groups for production. The short term objective is to allow them to produce more than only for self-consumption. Whereas, the long term objective is to form producers capable to compete at the international market.

As promotion method, various models shall be elaborated to be suitable to each regional condition. The models shall have as main products the grains, vegetables, fruits, milk, buffalo and swine. These products shall be produced by a group of organized producers, in a given production nucleus, however the production is carried out individually by each producer.

In accordance with the definition mentioned in item 3.10.4, the group formation of farmers and the intensive agriculture shall be developed as shown in the figure below.



(2.1.1) Model of Grains Production

Associations of small and medium-scale farmers that currently carry out subsistence agriculture and calves production in low potential land can be formed in order to promote the jointly production of grains and calves through the communal utilization of machinery and facilities. In this manner, these farmers' life conditions and income shall be raised. Currently, the grains production is carried out only for self-consumption, and rice, maize and feijão beans are cultivated. However, the productivity is extremely low since they do not utilize irrigation, fertilizers or herbicides. In order these farmers can overcome this situation, two development stages are proposed: the preparatory stage and the development stage itself.

(2.1.2) Model of Vegetable Production

The demand of vegetables such as lettuce, green onion and others in the cities has already been satisfied by a small number of farmers. Regarding the tomato processing, the processing factory built in the industrial complex in Araguaína shall be regenerated and the raw material shall be obtained from these local farmers. Also, if the cassava milling industry starts its activities, the demand of cassava will be greatly increased. Therefore, the present model aims at the tomato and cassava production for the processing industries in addition to the production of watermelon for direct sale.

The small-scale farmers who have around 20 to 50 ha of land would produce vegetables in a small area avoiding the successive cultivation in the same area. A local and simple irrigation system would

be introduced to make possible the cultivation during the dry period. In the remaining area, maize would be produced during rainy season and millet during the dry season in order to avoid the erosion and to conserve the organic matter in the soil. The association would take the responsibility for the operation and maintenance of the agricultural machineries and of the pump for irrigation which would be used commonly. Besides, the association shall promote the group purchasing of seeds and fertilizers and the group selling of agricultural products.

(2.1.3) Model of Fruit Production

The fruits selected by EMBRAPA for the fruits cultivation projects are banana, caju, coconut, etc. These crops are already being introduced by progressive farmers, and thus useful knowledge are already accumulated regarding cultivation methods and varieties. By utilizing this knowledge, the production shall be improved. It is not necessary to stick on only these species, and suitable species shall be selected according to the land conditions. Promising crops are orange, mango, pineapple, acerola, guava, and others.

Since the target farms have unfavorable land conditions, the orchard shall be planted following the contour lines and vegetal coverage shall be provided between the trees lines. The association shall take the responsibility for the machineries and facilities to be used. More concretely, the control of pests and weeding services shall be carried out jointly as well as the acquisition of inputs and the commercialization. Especially for the fruit production, the selection, packing and temporary stockpiling shall be an activity of great importance for the associations.

(2.1.4) Model of Milk Production

Small-scale producers or producers interested in the production of milk are creating new associations for purchasing the necessary equipment using the existing credit lines. The association shall collect useful technological information and also secure the land for the production in community, production of the feed for animals, seeking the production increase and improvement of milk quality.

Nowadays, the price of milk at the farm gate is very low of about R$ 0.2/liter. To increase their earnings, small producers sell milk directly for the consumer and manufacture cheese. In this model, the association can introduce the processing facilities of dairy products, factories of cookies made of milk by-products, transport to collect the milk in the farms, administration of the facilities and commercialization of the manufactured products.

(2.1.5) Model of Buffalos Production

The recommended variety of the Buffalo is Murrah that usually lives in rivers. High quality stud bull shall be purchased by the group and a responsible person shall be assigned for the handling and cares with the animal. The stud bull rental charge for breeding shall be collected from the member when utilized. This charge shall include the expenses necessary for the cares with the animal, including the payment for the responsible person's work. Using the stud bull communally by the group, many calves shall be reproduced from the same bull, and thus this bull capability can be evaluated, promoting the selection of animals within a shorter period of time. Also, by using the same stud bull, it will be possible to keep the uniformity of produced meat. After 2~3 years using this method, each producer's herd shall increase, and depending on the number of females, each producer can decide the acquisition of a stud bull.

The cooperative can perform the animal health activities through the purchase, control and application of vaccines and other products for animal health. The cooperative can also promote the debate of ideas among its members aiming at the improvement of production and increase of productivity. The cooperative could also make an agreement with a dairy factory and sell the buffaloes milk by a price more expensive than that of cow. Since this is already carried out in Colinas do Tocantins, it will also be possible in the Study Area provided that a certain amount of milk will be steadily supplied by the

cooperative members. As for the male calves to be produced, they can be marketed to the northeastern Brazil where the demand is high. The creation of Buffalos for meat production is not still active in the area. If produced, it can become one of the main products of the State. The male buffalo, as in the Asian countries, can be used as draft animal for the transportation of products and land preparation activities which will assist the workability of the small-scale farmers.

(2.1.6) Model of Swine Production

Rice bran, cassava, fruits (banana, papaya) and many other materials can be used as feed for swine. If these materials are mixed with the serum which is the by-product of cheese processing, the nutritional value will be increased and that improves the growth of the animals. Similar to the case of Buffalos, the acquisition of stud swine is important for the farmers. The purchasing and caring shall be carried out through the group by the collection of a charge for the utilization of the stud swine from each member when necessary. As the swine have a very fast reproductive cycle, the stud swine shall be changed periodically in order to avoid consanguinity among the herd. The cooperative shall be responsible for the purchase, control and application of vaccines and other products for animal health.

A hybrid variety is recommended to breed by crossing a diseases resistant local species suitable for tropical climate called Piau as female and a modern variety Large White as male. The raising system is of semi-confinement, partly on cement and partly on earth. The produced swine manure can be used as organic fertilizer increasing the productivity in the crop production.

Como foi mencionado no item 6.3.3, este programa pretende elevar o nível de vida dos mini e pequenos produtores através da organização dos agricultores, promovendo a produção comunitária. A longo prazo, pretende-se formar produtores capazes de competir no mercado internacional e a curto prazo, retirá-los do nível de produção de subsistência.

Como método de promoção, pretende-se elaborar modelos que se ajustem a cada realidade local. Os modelos terão como produtos principais os grãos, verduras, frutas, leite, búfalos e suínos. Estes serão produzidos por um grupo organizado de produtores, em um determinado núcleo de produção, mas individualmente por cada produtor.

A organização dos produtores, que deve ser preferencialmente na forma de associações, e a produção intensiva mencionada no item 3.10.4 é apresentada na figura a seguir.

(2.2) Promotion Program

In this program, the models indicated before shall be applied, according to the characteristics of each area, taking into consideration the models which can be better accepted by the community. The evaluation shall be made for each municipal district.

For the implementation of Intensive Agriculture development models through farmers' associations in the target areas, agricultural extension services shall be required. The models shall serve as examples for the other farmers in order to show the intensified agricultural practices and the operation method by the associations. For the success of these models, the participation of farmers, specialists, technicians and innovative farmers is necessary. The final objective of the program is to spread the system of intensive agriculture through organized farmers' groups all over the neighboring region. Therefore, a plan for the technical extension services strengthening shall be carried out jointly with the plan of agricultural promotion for the effectiveness of this last one.

(2.2.1) Formation and Strengthening of Associations and Groups for each Model

The intensive agriculture through the formation of groups or associations shall be effectively introduced by utilizing the potential of the Study Area and by minimizing the constraints. The activities of the existing associations that are already executing the intensive and group agriculture

shall be strengthened. Attention shall be given in the following items for the development of these groups.

- A database on the detailed information about associations that already execute the communal production under the collaborative use of machineries and facilities shall be established. It becomes then possible through this database to distinguish the real problems each association is facing and to establish appropriate solutions for such problems.
- A good example of community production system shall be selected and the efficiency of this system shall be advertised and expanded. At this time, it shall be emphasized that the merit is mutual for the tenant and for the landlord due to the appropriate farming practices such as proper fertilization and crops rotation effects.
- For example, groups using PRODIVINO funds for milk production through communal intensive agriculture can be used as example. The efficiency of this system shall be advertised and expanded. In this process, the extension method shall be improved in order to facilitate the farmers' understanding of each financing system details.
- Various events such as observation tours shall actively be carried out for the ordinary farmers to observe the techniques and new crops cultivated by progressive farmers who have higher technical level. A database about these progressive farmers shall also be prepared and the utilization of such data on the agricultural extension could allow a more practical extension activity.
- To promote the organization of small-scale producers, a capable leader is indispensable. The training of such leaders shall be included in the extension activities. Since there are several capable leaders in the Study Area, associations operated by such leaders shall receive special support, because these associations can serve as models for future projects of communal production.

The selection of groups and associations that are suitable for the proposed production models is an important factor for the success of the project. Some necessary conditions for a careful selection are presented as follows;

- In groups, it doesn't matter new or existent, those shall be formed by own will of the group;
- A leader that has popularity and leadership;
- To have farmers in the group with technical experience in order to aid the other members.

(2.2.2) Establishment of a Supporting System for Groups and Associations

The supporting structure for groups and associations shall be constituted in the following manner;

- RURALTINS shall play the main role in the organization and implementation of the production models. The support of SEPRO, NATURATINS and IBAMA shall also be taken into consideration.
- To learn from previous experiences of agricultural strengthening through the use of a database containing information about innovative farmer's experiences and previous experiences in the State regarding to models of agricultural invigoration.
- To obtain information from institutions, companies, groups, universities, such as EMBRAPA, UNITINS and making the maximum use of this information.

(2.2.3) Technical Support for the Groups and Associations

After the choice of the model, selection of farmers and of the supporting group, the following items shall be studied for the start of the agricultural administration guidance.

- As for the administration manner, the ideas of all group's members shall be taken into consideration;
- The supporting group shall give the guidance with an easy vocabulary to explain, for example, the

financing system, which is usually difficult to be understood by the farmers, and the penalties of IBAMA;

- The choices of varieties and farming practices shall be carried out based on the data and information from companies and research institutions previously supplied by the supporting group. However, the final decision shall be taken considering the group's will.
- As for using machines, implements and facilities, purchase of materials, and commercialization, the support group shall present the data for innovation and development, provide lectures by experienced farmers. However, the final decision shall be taken by the group of farmers.
- It is important to awake the members of the group for the fact that they are the main elements of this activity.

(2.2.4) Development of New Models through Acquired Experience

Once the model and the group start to stabilize, the supporting group shall make the revision of the work, withdrawing the experiences obtained in the activity, and using them as parameters for the following production model. Once this cycle is carried out several times, an innovative technique of ointly production shall be developed, improving the performance and quality of the actions.

(2.3) Target Areas

The target areas of the project are presented as follows:

Region and Probable Area for the Intensive Agriculture (km2)

Region	Total
REGION I - ARAGUATINS	298.8
REGION II - AUGUSTINÓPOLIS	62.0
REGION III-TOCANTINÓPOLIS	621.8
REGION IV - XAMBIOÁ	157.8
REGION V - ARAGUAÍNA	193.5
Total	1,333.9

According to the GIS calculation, the target areas encompasse 1,300 km^2. The municipal districts of Aguiarnópolis and São Bento to Tocantins the pontential is high

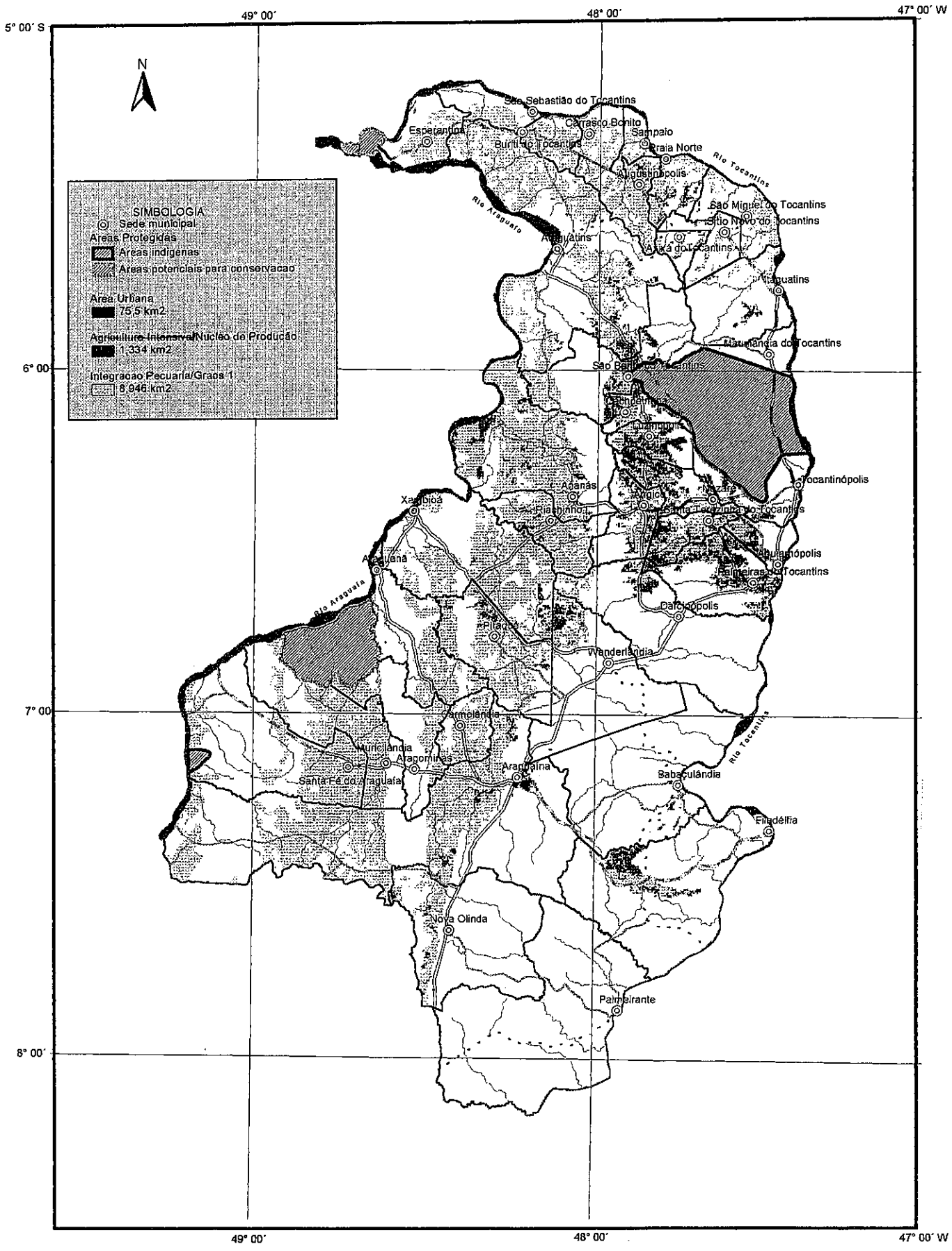


Fig. 21.3.2: Potential Areas for the Introduction of Intensive Agriculture

(2.4) Priority Areas for the Development

The priority areas for production nuclei development are presentede as follows:

(2.4.1) Grains Production Model

The municipal districts of Filadélfia, Nova Olinda and Palmeirante are proposed as priority areas for the following reasons:

- •The sandy soil is inappropriate to growing cattle, and those areas depend on self- consumption agriculture and calves production;
- •The farmers of the area are interested in the production of grains;
- •When the crops rotation system starts full operation, it is important that those areas are close to Araguaína where necessary facilities shall be built for the commercialization of grains. It shall be easy to access these facilities.

(2.4.2) Vegetable Production Model

Araguaína and its surroundings are proposed as priority areas for the following reasons:

- •Proximity to the industrial compound that includes a tomato processing factory and starch factory of cassava which makes possible to supply them with raw material;
- •Proximity to the consumption place of fresh vegetables;
- •Information from tomato producers in Aragominas and from experienced producers and associations in the field of fresh vegetables is easy to access.

(2.4.3) Fruits Production Model

The southeastern portion of the Extreme Northern Region is proposed as priority area for the following reasons:

- Araguatins is recommended as most suitable area for banana production;
- There are plenty of sloped areas in municipal districts of Angico and Nazaré. In Angico, there are already oranges plantations, and in Nazaré, cookies are already being produced with fruits;
- The apiculture association movement is very strong. In the future, it must be considered the associative management with fruits production;
- The municipal districts of Wanderlândia and Darcinópolis have sandy soils and already have coconuts plantations;
- Thinking about distribution of production, the location is easy to access Estreito (Maranhão State) from where it shall be transported to other regions.

(2.4.4) Milk Production Model

The municipal district of Augustinópolis is proposed to be the center of the priority areas which are proposed for the following reasons;

- With the construction of a dairy processing plant in Augustinópolis, built in 1996, the number of dairy farmers increased.
- In Itaguatins, Axixá, Sítio Novo, Buriti and Araguatins, there are groups that produce communally using the financing of PRODIVINO and their experience can be used as example;

- Thinking about distribution of production, the location is easy to access Imperatriz (Maranhão State) from where it shall be transported to other regions.

(2.4.5) Buffalos Production Model

The priority areas for buffalos production model are the neighboring municipal districts of Araguatins in the Extreme Northern Region, and Xambioá, Nova Olinda and Filadélfia in the Northern Region. The reasons are as follows;

- In Araguatins, EAFA motivates the project intensive production of Buffalos and can give orientation for the interested farmers;
- The municipal districts of Nova Olinda and Filadélfia are close to Colinas do Tocantins and Brasilândia do Tocantins where there is a dairy product plant that understanding the high commercial value of the buffaloes milk pays for it a price 40% over the cow milk price.

(2.4.6) Swine Production Model

The swine production can be introduced in any of the areas mainly for commercial purposes (breds from the crossing of local race female with PO male). Their feed can be the by-products resulting from the processing of milk such as whey, or tubercles such as cassava and sweet potato. These products are available in Araguatins, in the Extreme Northern Region, and also in Nova Olinda and Filadélfia in the Northern Region, which are proposed as target areas. Guidance on raising management can be obtained at EAFA which has an experimental raising plant.

Os municípios de Filadélfia, Nova Olinda e Palmeirante foram propostos como áreas objeto pelos seguintes motivos:

- O solo é arenoso, sendo impróprio para a engorda, sendo uma área de produção agrícola de subsistência e produção de bezerros;
- Os agricultores da região estão interessados na produção de grãos;
- Quando o sistema de rotação de culturas entrar em plena atividade, é importante o fato de que estas áreas estão situadas numa região perto de Araguaína onde, no futuro, deverão ser construídas as instalações necessárias para a comercialização de cereais, facilitando o acesso para a sua utilização.

(3) Environmental Conservation Project

(3.1) Project Formation

Various alternatives are recommended for the producers to reach an economical independence within the restrictions of the forest laws in the current program. The areas regulated under the forest law are as follows;

- Conservation area based on the Forest Laws (now 50% shall be reserved in agreement with the State law. 80% to be reserved for forests and 35% to be reserved for Cerrado within the Amazônia Legal Region in accordance with the temporary law established in 2000);
- Properties that don't reach the demanded percentage of conservation areas shall recover them.
- Conservation of areas around water resources such as rivers and springs (permanent preservation area);
- Areas protected by law - slope more than 45 % (permanent preservation area).

The present program aims at the formation of a sustainable agriculture through the appropriate

selection of crops for the areas to be developed. The following 5 measures are intended to be proceeded:

- Promotion of agro-forestry activities,
- Promotion of silvi-pastoral activities,
- Promotion of reforestation activities,
- Reforestation projects in conservation areas; and
- Support to natural resources exploitation activities.

(3.1.1) Promotion of the Agro-forestry Activities

The agro-forestry activities area appropriate for areas with small productivity due to mechanization difficulties. This practice shall make a sustainable agriculture with efficient land use possible. Basically, diversified species of native trees and crops shall be introduced. There are only limited researches so far carried out, thus it is necessary to implement this program step by step. Besides, the cooperation of EMBRAPA shall be necessary to evaluate the best methodology for the area. The cooperation of the local governments and other public organizations shall also be necessary.

(3.1.2) Promotion of Silvi-pastoral Activities

The silvi-pastoral activities shall be promoted in areas used as pastures at the moment but not economically favorable due to slope and low fertility. There are insufficient technology and information so far obtained, however the establishment of a model farm to acquire such information and technology in the future is proposed.

(3.1.3) Promotion of Silviculture

The silviculture shall be promoted with the objective of using the land resources of this area efficiently. As the investment is direct from the producers, species with high commercial value and with an economically viable cycle shall be selected.

Time of Formation	Species
10 to 15 years	Parica, Marupa, Sumauma, Paumucato, Virola, Parapara, Taxi-white, Freij Cinza
15 to 30 years	Mahogany, African Mahogany, Andrioba, Cedar, Tauari, Yellow Wood, Castanae
30 years or more	Massandura, Ipé, Angelim, Acapu, Jatoba, Sucpira

The following types of silviculture can be carried out:

Alternative 1: A single species (for furniture, construction material, cellulose, fuelwood, processing, coal, etc.)
Alternative 2: Several species (of varied cycles)

Depending on the selected species, there may be a great variation in future demand. Therefore, the evaluation of this future condition is necessary in the elaboration of the plan.

The main uses for each species are shown as follows;

Use by Species

Use	Species
Furniture	Parica, Morototo, jatoba, Mahogany, Angelim Vermelho, Yellow Wood, Purple Wood
Construction Material	White taxi, Parica,Morototó, Teak, Jatobá,Maçaranruda, Ipé, Angelim Vermkho, Tatajuba, Quarubaana Piqui, Angelim Pera,Louro Vermelho, etc.
Navigation	Parica, Sumauta, Ipé, Tatajuba, Cedrorna, Piqui, etc.
Processing	Sumauma,Mogono, Virola, Mandioquueira, etc.
Coal	Taxi-white, etc.
Cellulose	Moroto, Marupa, Tauari, Quarubarana, Sucutiba, etc.
Firewood	Taxi-white, Parica,

(3.1.4) Reforestation Project in Conservation Areas

The recovery of native forest means recovering the secondary forest initially and than it will be necessary to know the methodology to make such recovery possible. Therefore, in the occurrence of degraded lands, the resistant species to degraded soils shall initially be planted. After the recovery of soil, the native plant would be introduced step by step for recovering the native forest. This methodology shall be discussed with EMBRAPA evaluating their possibilities.

1st Phase: Introduction of resistant species to degraded soils (Taxi-Branco, E Cridora, Acacia Manguim etc.)

2nd Phase: Introduction of native species

Appropriate technology for the recovery shall be found, besides evaluating which could be the responsible financial and executing agents.

- Strengthening of Forestry Management

The forestry management is a method used in areas that would be deforested in future, and areas that should be recovered through an obligatory reforestation. The following is evaluated in this subject:

1. Regulations and formalities related to the forestry sustainable management;
2. Appropriate species for the reforestation;
3. Characteristics of the seeds;
4. Management technology.

- Control of Forest Fires

Another forests degradation factor in this area is the forest fires besides deforestation. A large forest area is lost due to fire during dry season. The effective control measures should therefore be introduced in the area as follows:

1. To install protection belts against fires;
2. To substitute the slash and burn farming, finding alternatives for this system; and
3. To support the natural resources exploitation activities.

(3.1.5) Promotion of Natural Resources Exploitation

The sustainable development in connection with the environmental conservation is the key issue in the Study Area. The natural resources exploitation traditionally carried out shall be promoted for the environmental conservation. The following activities shall be promoted in this project.

1. Exploitation of babaçu palm;
2. Exploitation of other native fruits;
3. Activation of Apiculture;
4. Utilization of medicinal and other useful plant species.

a) Exploitation of Babaçu Palm

In order to utilize th potential value of babaçu, the basic research activities carried out by UNITIN shall be promoted and the practical activities shall be developed jointly with the existing association that already work with babaçu exploitation.

b) Exploitation of Other Native Fruits

Reforestation projects using Cupuaçu, Bacuri and Açaí are seriously being discussed in Esperantina. Such reforestation projects using native fruits shall be promoted for land that is not suitable for crop

and livestock production and also for land that need conservation due to topographic characteristics. The system including selection of suitable area, production and distribution of seedlings shall be therefore strengthened. Furthermore, a structure that allows the processing or semi-processing of products in the site shall be planned. Besides, processing facilities for fruits' flesh and sweets production shall be implemented to be easily managed by the associations.

c) Activation of Apiculture

The promotion of reforestation and crop production activities shall directly and indirectly affect the apiculture. There is already an apiculture association established in the Study Area and its number of members is increasing. Moreover, various financing systems are supporting apiculture. The association shall therefore be activated for the utilization of such financing systems and for contributing to increase the income of small-scale farmers.

d) Use of Medicinal Plants

EMBRAPA - Amazônia Oriental (CPATU) is performing research activities on the medicinal plants and more than 60 plant species are now planted in its botanical garden. The program POEMA (Programa Pobreza e Meio Ambiente na Amazônia) is being carried out in the State of Pará in collaboration with Pará University and Mercedes Benz. The program POEMA was begun in January 1992 in the Amazonian area to accomplish the sustainable development in the area. This is considered as a potential model for the industrial use of native material and for solving the poverty and environmental problems. The industrial use of native material contributes a lot in the increase of the people's income. The important point is to process the native materials in the collection site in order to aggregate value to the product. The industrial use of native material shall be promoted according to the experiences of the program POEMA.

(3.2) Promotion Program

(3.2.1) Silviculture

The promotion of the Silviculture shall be carried out through financing for the producer, support for the distribution of seedlings, technical support and support to obtain market information and data.

The seedlings shall be supplied to the small-scale farmers for free, and sold to the large-scale farmers. Considering that the supply of seedlings for free during a long period of time is difficult, it shall be distributed this way until the activity becomes stable.

As for technical support, information about cultivation methods and method for obtaining the cutting license, besides marketing information shall be supplied. In order to define the financing limit, the issue shall be studied carefully so that the producer can manage the activity without difficulties, and so that the financing doesn't become the main reason of the activity.

(3.2.2) Strengthening of the Seedlings Distribution Systems

Strengthening of the current seedlings distribution system shall be carried out, establishing distribution sites at each municipal district and villages. The size of each establishment shall be calculated according to the potential of natural resources, area, besides the probability of changes in each municipal district. In these establishments, seedlings of trees not only for commercial value but also for conservation areas shall be available.

The location and the scale of the seedlings supply center shall be decided according to the reforestation program and the distribution requirement of seedlings.

The seedlings supply center shall have the facilities necessary for nurseries, soil preparation, irrigation, packing, transportation and management.

(3.2.3) Establishment of Technical Support Systems

The technical support shall be carried out through the seedlings distribution establishments and the contents of the technical support shall be as follows;

- Information about the appropriate varieties for the interested farmers;
- Planting methods and cares;
- Methods to obtain the cutting license;
- Measures to prevent forest fires.

The varieties of seedlings shall be chosen based on the forestry potential map, verifying the aptitude and objective of each species.

(3.2.4) Market Information Supply

The information regarding the market is very important and the viability of the wood commercialization shall be always verified and informed to the producers.

(3.2.5) Margin of Credit to Promote the Forestry Activities

The forestry activity is an activity of slow economic return, so it is very difficult to accomplish without the government's aid. The long term financing interest rates are usually to high for this activity. Thus, the definition of appropriate interest rates for the activity shall be studied.

(3.2.6) Support to Natural Resources Exploitation Sector

The activation of the existing associations is the basic objective and thus the supporting system shall be strengthened so as to improve the facilities as well. The proposals are presented as follows;

a) Management System of Associations

Regarding the management system of associations, similar to the case of group and intensive agriculture, the activities accompanied with the agricultural extension services shall be developed.

b) Support on facility utilization

Farmers supporting activities shall be carried out as a part of extension activities. The supporting activities include the introduction and operation of various facilities such as seed obtaining and oil extracting facilities for babaçu and fruit flesh processing and sweet confectionary preparation facilities for other native fruits. Furthermore, the assistance to the improvement and development of necessary machinery to increase the aggregate value of products at the site shall also be carried out.

c) Access to the Marketing

One of the important supports is to develop the products by locally increasing the additional value. The other important support is the market finding with the collaboration of private firms interested in the utilization of native materials.

d) Support on Products Improvement

The improvement of the products and the development of new products shall be promoted in collaboration with not only research organizations such as EMBRAPA and UNITINS but also private firms for the effective utilization of babaçu and other promising plant resources (dye, medicinal, oil

and fiber crops).

(3.3) Target Areas

The target areas of the project are shown in Figures 7.5.1-7.5.3 and the acreage is shown in the following table;

Possible Area for Implementation (km^2)

REGION	Reforestation Activities	Silvi-pastoral Activities	Hazard Areas	Conservation Areas
REGION I - ARAGUATINS	817.0	20.0	928.0	1,082.5
REGION II - AUGUSTINÓPOLIS	201.5	234.0	131.3	555.3
REGION III-TOCANTINÓPOLIS	1,598.0	91.8	1,508.5	518.0
REGION IV - XAMBIOÁ	280.5	294.3	731.3	1,111.8
REGION V - ARAGUAÍNA	3,188.0	1,676.5	812.5	3,446.3
Total	6,085.0	2,316.5	4,111.5	6,713.8

The target areas aforementioned are not suitable for the agricultural production and livestock raising, but possible places for the implementation of forestry activities. The target areas for the Silvi-pastoral activites shall have as main characteristic a strong steepness. These areas are mostly located at the margins of the Araguaia river. The hazard areas indicated by SEPLAN / DZEE shall be taken into consideration. The conservation areas shall have stronger steepness than that for Silvi-pastoral activities, requiring conservation practices.

The target area for the promotion of natural resources exploitation is considered to be the whole Study Area. The priority shall be given to the areas where babaçu palm is extensively growing and also to the areas where an association is already established.

(3.4) Priority Conservation Areas

The Study Area has a percentage of land transformed into pastures higher than that necessary to conservation and included in the conservation laws of the Amazônia Legal region. Therefore, this issue shall be developed in the whole Study Area according to the necessity. .

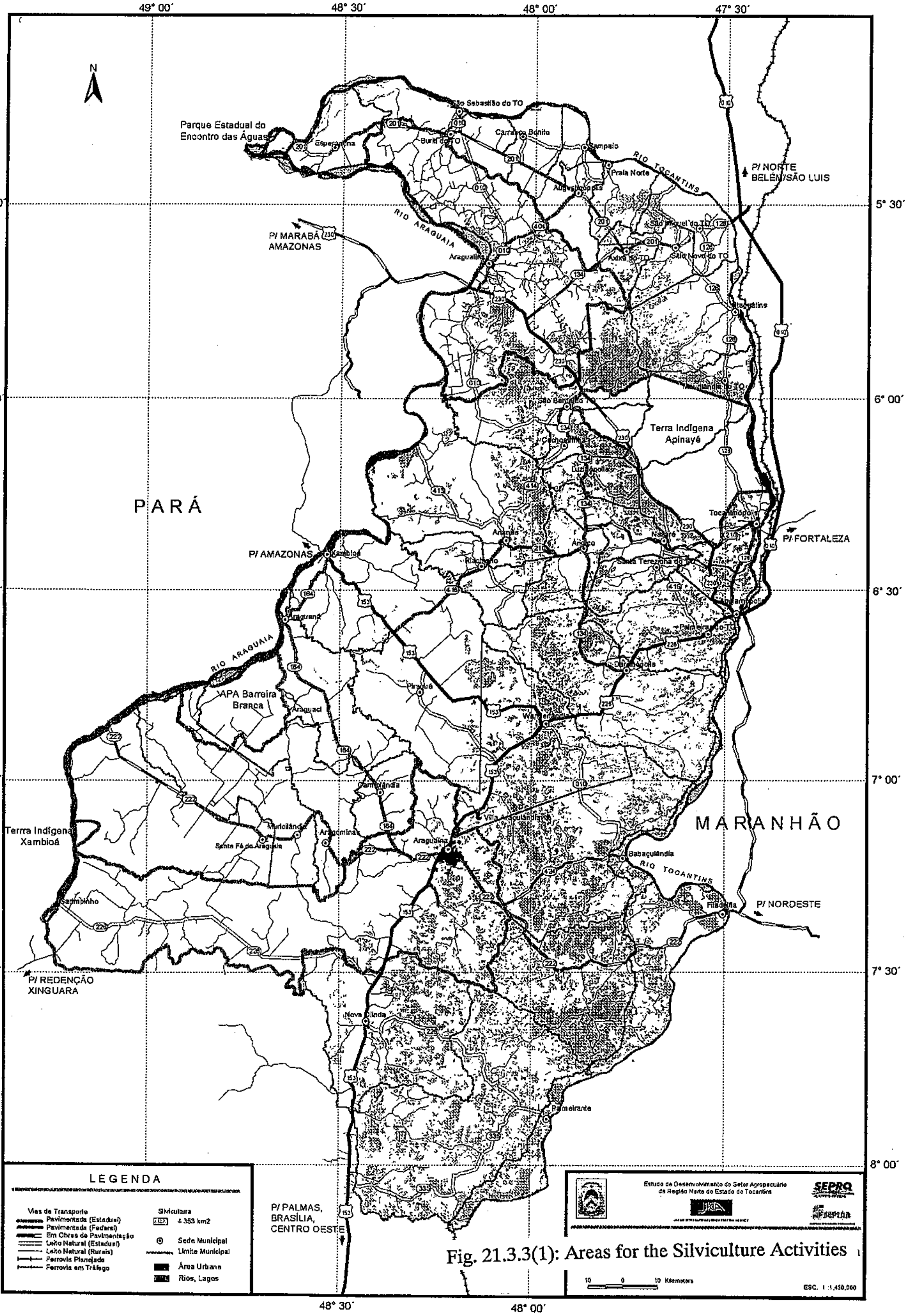


Fig. 21.3.3(1): Areas for the Silviculture Activities

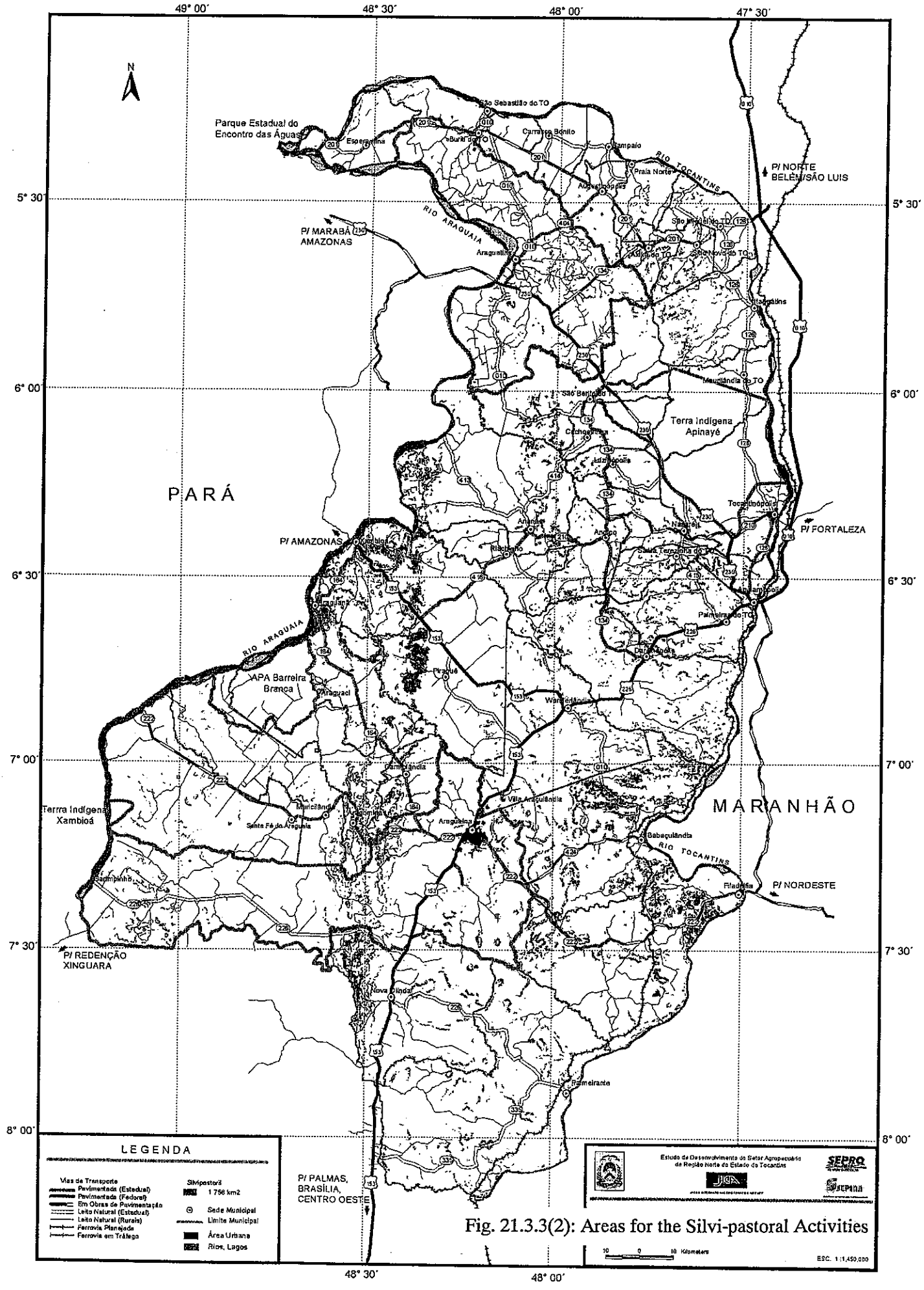


Fig. 21.3.3(2): Areas for the Silvi-pastoral Activities

Summary of Priority Areas for Regional Agricultural Development

Various information on agricultural conditions and trends in each municipal district were collected through visits to all the RURALTINS offices distributed in the Study Area. Moreover, mini-workshops were held in order to obtain information on associations operated by small-scale farmers and rural syndicates operated by the livestock farmers. Based on the information thus collected, the distribution map for the agricultural development potential in the Study Area was prepared and shown in Fig. 7.3.4 (1).

By considering the aforementioned agricultural development potentials in the Study Area, the distribution map for the priority areas of each proposed plan under the regional agricultural development plan was prepared .

According to the distribution map of the priority areas, it is observed that the priority areas for each proposed plan are concentrated into two areas that are Araguaína in the northern region and Araguatins in the extreme northern region.

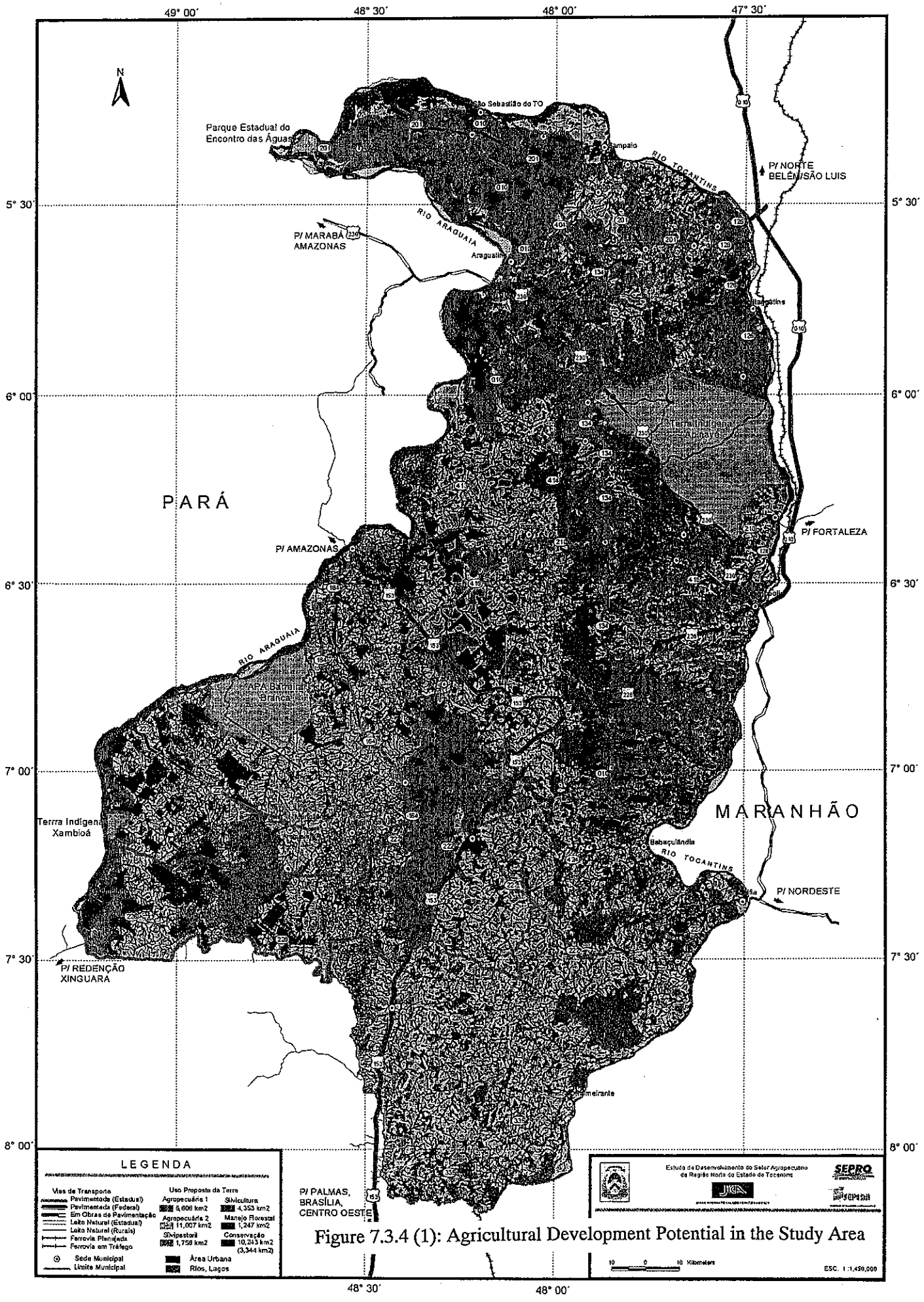


Figure 7.3.4 (1): Agricultural Development Potential in the Study Area

4. Strengthening Plan of Agricultural Research and Technical Support

In order to attain the agricultural development in the Study Area, it is necessary to level up the techniques of crop production and livestock raising of farmers. Although activities on research and technical support are important, such a supporting system is so far not established. Consequently the necessary techniques are not being smoothly transferred to the farmers.

The strengthening of research and technical support needs to be carried out not only in the Study Area but at the whole State. Several strengthening plans were elaborated in the Master Plan and some of the plans are already in progress.

(1) Plan for the Human Resources Development

It is important to bring up basic human resources on the strengthening of the activities of research and technical support. Accordingly, the plan for the human resources development in the Master Plan was reviewed under this Study. The following new plans are proposed in addition to the Master Plan.

(1.1) Establishment of Agricultural High Schools in the Northern Region (Araguaína)

There is an agricultural high school in Araguatins in the extreme northern region, and the school is contributing to the agricultural development of the area. There is no agricultural high school in the northern region although it has the largest livestock area in the State. It is one of the causes for the restriction of the agricultural and livestock development in this region.

(1.2) Training of Specialists: staff of SEPRO and RURALTINS

The Master Plan suggested the establishment of an experimental station in Tocantins State for research and training of specialists belonging to the SEPRO and RURALTINS staffs. However, due to the difficult prospect of the establishment of this station and also due to the establishment of a branch office (UEP) of EMBRAPA in Palmas, for the time being, a plan was made for the training of specialists and demonstration through verification research to be carried out mainly at the branch of EMBRAPA.

(1.3) Training of Farmers: Middle / Large Scale Farmers and Small Scale Farmers

Training of these farmers shall be implemented at the same experimental station for the training of specialists and at the demonstration field mainly under UEP.

2 Strengthening Plan of Agricultural Extension

In the State of Tocantins, the traditional pasture management and the beef meat production of Nerole are falling into financial difficulties. Consequently, the cattle raising which is the main industry of this State is declining. In order to solve such problems, various methods such as the improvement of the cross-bred from the European bred, strict enforcement of soil analysis, the resulting grazing and pasturing control and so on are required. But only large and medium scale farmers are applying these methods. Some of those farmers are obtaining modern technologies by participating into several seminars held inside and outside the State through EMBRAPA as counterpart agency. But most of the farmers, even middle- and large-scale farmers are left at the same situation as ever.

The plan encompasses the introduction of new technologies proposed in this Study. These technologies are as follows: integration including crop rotation; group and intensive farming; cultivation of grains, vegetables, fruits, and other new crops; scientific land use management; grazing control techniques; upbringing of new kind of meat and milk cattle; introduction of small animals and poultry; apiculture and so on. The general opinion of ordinary farmers and extension agents in the

Study Area for the agricultural extension activities is as follows. The most effective method for the extension of modern technologies is the practical demonstration (until the degraded pasture land is reclaimed through 3 years cultivation of grains crops in case of crop rotation) by deploying the necessary specialist in each region of the State.

In this Study, we propose the following methodologies regarding the utilization of specialists and the enhancement of technical demonstration practices.

- Gathering information on farmers and associations that are applying good technology in the Study Area. This activity shall be carried out by extension agents from the RURALTINS regional offices;
- Listing the several specialists in each field who live in the Study Area, such as: retired scientists of EMBRAPA, universities and technological schools, or the specialists of private companies. This activity shall be carried out by extension agents from the RURALTINS regional offices;
- This data collection shall be accomplished by the regional technicians of RURALTINS and shall be finalized by the main office in Palmas with the collaboration of other relevant organizations. The collected information can be utilized extensively within the State through the information network of RURALTINS;
- The State Governor shall recognize such specialists as authorized technicians and certain reward shall be given to those who contribute to the development and the extension of agriculture in the State;
- The demonstration projects shall be examined by the State Committee of Science and Technology. The selected projects shall be financed with the State budget making their accomplishment possible;
- RURALTINS shall be the core agency for the practical implemention of the demonstration activities.
- The demonstration activities shall be assistend not only by EMBRAPA and UNITINS but also by other research institutes inside and outside the State, by private companies, by civil society groups and others;
- Each demonstration activity shall always have a responsible specialist in charge;
- RURALTINS shall be strengthened in the following manner;

  a) The information system shall urgently be established by connecting the headquarters and the local offices through a network and by unifying the information items;

  b) The specialists of each field, such as grains, pasture, vegetables, fruits, silviculture, environmental conservation, stockbreeding, animal diseases, fishery, apiculture and so on, shall be distributed among the regional offices;

  c) A system shall be established to promote the transmission and constant exchange of information from and with EMBRAPA;

  d) The extension activities of RURALTINS shall target not only the small scale farmers and INCRA settlers, but also the middle / large scale farmers as well;

  e) The technical demonstration shall be implemented at the farm land as the most suitable place. RURALTINS shall positively act as a core of large scale demonstration.

  f) The effective method for the extension is not only the available audiovisual resources, but also demonstration activities in which farmers take part;

  g) Women participation as trained specialists shall be stimulated.

3 Strengthening Plan of Agricultural Research

(3.1) Review of the Master Plan

In the Master Plan, various programs such as the strengthening of UNITINS for agricultural research, the preparation of demonstration program and the establishment of a research center for programs implementation were planned. This was carried out because it was not considered at that time that EMBARAPA was considering the establishment a branch in Tocantins. UEP (Unidade de Execução de Pesquisa e Desenvolvimento do Tocantins) which is the first branch of EMBRAPA Cerrado (CPAC) was established at Palmas in July, 2000. UEP consists of 4 departments that are grains, stockbreeding (meet and milk cattle), fruits and soil. State and UNITINS staff members will be engaged in as counterparts of CPAC researchers. At the initial stage, one researcher is allocated for each department, and the construction of building facilities will be started in UNITINS, Palmas, on September 2000. UEP's activity is the extension of EMBRAPA's basic research to farmers and the development of applied techniques. Research on agriculture and livestock farming will thus be started in Tocantins mainly carried out by the UEP from now on.

(3.2) Urgent Technical Development for Tocantins Agricultural Development

The results of research on Cerrado by CPAC and the results of the project-type technical cooperation by the Japanese team shall be effectively utilized. As an extension of the research activities, the application of sustainable agriculture technique, which is appropriate to the Tocantins conditions, shall be carried out taking into consideration the environmental conservation. UEP shall act as the leading agency for the development of useful planning and promotion techniques.

All the results so far obtained are the basic research on experimental level. New techniques to be applied in the general management scale shall be developed under this program.

The research on applied technology and the experiments for verification shall be performed not only at the UEP farm in Palmas but also at the veterinary faculty farm of UNITINS in Araguaína. UEP shall collaborate with the UNITINS veterinary faculty on the research of crops rotation (including grains production), livestock breeding and raising. On the other hand, the research on applied techniques for grains and fruits is proposed to be carried out at the Palmas located UEP farm. The contents of technical development and experiments for verification are as follows;

1) Development of Environmental Monitoring Technique

- Measurement and evaluation of the impacts of agriculture and stockbreeding on natural environment (soil, rivers, air, etc.);
- Experiment and evaluation of forest conservation methods;
- Experiment and evaluation of soil conservation methods.

2) Technical Development for Sustainable Agriculture and Stock Farming

- Crops rotation (renewal period, fertilization system, cultivation method, farming practice) and evaluation from the viewpoint of soil conservation;
- Evaluation of non-tillage cultivation technique in large scale farms;
- Effective mechanized cultivation method of ground cover plants (including selection of varieties) and management;
- Selection of varieties for grains, vegetables and fruits considering their practical use;
- Selection of grasses for grazing, breeding and cultivation method against erosion;
- Improvement of mechanized cultivation method and establishment of mechanized system;
- Development of farm designing based on the environmental conservation and designing

method of farm management planning.

3) Development of New Stockbreeding Technology to Support the Sustainable Agriculture

- Development of intensive grazing techniques under large scale irrigation;
- Improved technique of meat cow raising by introducing European type;
- Improved technique of hog raising by introducing European type;
- Improvement of livestock breeding technique;
- Formulation of effective prevention plan for livestock epidemics.

5 Infrastructure Improvement Plan

The infrastructure improvement plan shall be established in order to promote the 3 major plans proposed in this Study namely integration of agriculture and livestock, group and intensive farming and conservation project. The agricultural products expected under each plan are as follows;

Plan	Expected products
Integration of agriculture and livestock	➢ Beef meat ➢ Grains (Soybean, Maize, Rice)
Group and intensive farming	➢ Milk, Products from water buffalo, Livestock products ➢ Grains (Maize, Rice) ➢ Cassava ➢ Vegetables and Fruits (Tomato, Banana, etc.)
Conservation project	➢ Wood ➢ Special products (honey, babaçu)

The infrastructure improvement plan will be implemented basically as a side support for the farmers' production activities.

(5.1) Transportation Facilities

Since the development of the transportation facilities will largely affect the proposed plan, the development plan for the necessary facilities will be formulated for the medium- and long-term perspectives. The facilities necessary for the commercialization are as follows;

1. Loading facilities for railway: for rational transportation of products;
2. Collection silo (drying and storing facilities): as mentioned in item 7.3.1, if 3 different crops are cultivated through one contract, a 3,000 ton capacity silo will be necessary;
3. Maintenance of roads: a permanent maintenance structure for roads is necessary so that the traffic is not interrupted specially during the rainy season.

(5.2) Storing Facilities

Establishment of marketing flow system is very important to increase the competitiveness of the region. Construction of the storing system is therefore necessary and this construction program will be formulated based on the future cropping pattern within the long-term plan.

(5.3) Irrigation Facilities

The most important factor for the agricultural production is water supply. Although very limited, the dry season vegetable production is being carried out by utilizing water resources pumped up from streams within the Study Area. Some farmers are performing irrigation practices without considering the risk of soil erosion. A survey is therefore needed for the construction of irrigation facilities such as

reservoir and also for the introduction of the drip irrigation system. The construction plan will then be formulated for potential areas. This is especially important for the promotion of group and intensive farming system.

(5.4) Rural Electrification

The rural electrification is now under execution at a fast pace. Although this program covers a large area, there are many areas not yet covered. Some facilities such as milk processing and cassava milling facilities were introduced under the agricultural financing system, but many of them are not yet in operation due to lack of electrification. The prompt electrification is required especially for those areas in where such facilities were built and also for those areas with high productivity.

(5.5) Processing Facilities

The establishment of various processing facilities becomes important in order to add value to the agricultural products in parallel with the development of agricultural production. It is very important for the promotion of group and intensive farming to introduce facilities such as fruit flesh processing and confectionary processing. For the promotion of the conservation project also, it becomes very important to perform local processing for the industrial use of native materials. This program will be formulated within medium- and long-term perspectives.

(5.6) Research and Extension Facilities

In order to investigate the suitable farming practices and varieties and to extend the results obtained to the producers, relevant organization and facilities will definitely be needed. As already mentioned in this report, the future research and extension activities of Tocantins will be carried out mainly by UEP and RURALTINS. In addition to various audiovisual methods, the demonstration in the experimental field will be performed as an effective extension activity. Facilities necessary for such activities including equipment, transportation facilities and others shall also be considered.

6 Project Implementation System

(1) Establishment of the Northern Region Agricultural Development Committee

In order to execute the smooth promotion of the Northern Region Agricultural Development Plan, an active supporting system is needed based on the mutual cooperation among relevant organizations. It is therefore proposed to establish Northern Region Agricultural Development Committee.

The committee members will be selected from SEPRO, SEPLAN, ADAPEC, RURALTINS, NATURATINS, UEP and UNITINS and the chief of the committee will be the Secretary of Production.

This committee will establish the regional committee at the city of Araguaína as a base for the development of the northern region. The committee members will be selected from the regional offices of SEPRO, SEPLAN, RURALTINS, NATURATINS, UNITINS (Faculty of Veterinary), Agricultural School of Araguatins, Rural Syndicate of Araguaína, Araguaína and Araguatins minicipal offices and the chief of this committee will be the regional director of SEPRO.

The headquarters of the committee and the regional committee will be established at the head office of SEPRO and Araguaína office of SEPRO, respectively.

The main activities of the offices are as follows;

- Implementation request and execution confirmation to the relevant organizations regarding the enforcement of the decision taken by the Committee;

- Formulation of various plans in relation to the development;
- Consultation services to those who wish to participate in the development;
- Formulation of basic strategy on technical guidance by RURALTINS;
- Necessary advises for infrastructure development to be carried out by the State or municipal offices;
- Measures for effective and smooth implementation of financing support, and
- Other necessary matters.

The staff of the offices will be temporarily transferred from SEPRO, SEPLAN, RURALTINS and NATURATINS. Those shall be small in number and efficient in activity.

(2) Establishment of the Municipal Development Committee (provisory name)

Each municipal district shall organize a Municipal Development Committee directed by the Municipal District Mayor. The members of this committee are the chief of the Municipal Agriculture Department, a member of the district chamber of representatives, RURALTINS staff and representative of cooperatives and associations of local producers.

The office of this committee will be located at the agriculture department. Active agricultural support services including the formulation of land use plan and the infrastructure development shall be performed through the mutual cooperation with the Northern Region Agricultural Development Committee.

The "Fundo de Aval" is one of the most important requirements for the smooth procurement of agricultural credit. If the establishment of the "Fundo de Aval" is required by the State, the farmers shall be organized in order to participate in this fund to get the credit in a smooth manner. The Municipal Development Committee has the role of guiding and organizing the farmers to participate in this process.

(3) Strengthening of RURALTINS Supporting System

The role of RURALTINS is very important and the activity of RURALTINS will largely affect the results of this project. When the model area is decided, RURALTINS shall arrange the perfect formation by assigning competent technicians accustomed to the regional agriculture.

Furthermore, the establishment of an information system including the introduction of advanced technologies and quick information exchange shall be promoted through the mutual cooperation between UEP and UNITINS.

The Northern Region Agricultural Development Committee shall carry out an appropriate support to the strengthening of RURALTINS and also to the budgetary arrangement including salary improvement.

(4) Participation of UEP

The functions of UEP are the extension of the results obtained by EMBRAPA and the development of application technology. It means that the practical study on agriculture and livestock in Tocantins State is going to be started.

The field for the studies and the experiments shall be thus not only the field of UEP at Palmas but also the UNITINS station (Faculty of Veterinary) in Araguaína.

In order to develop agriculture and livestock in the northern region, UEP and UNITINS shall collaborate for the crop rotation and animal breeding development and the results shall be transferred to the farmers directly or through RURALTINS.

7 Implementation Schedule

(7.1) Basic Strategy of Implementation Schedule

Although all the project proposals are indispensable for the agricultural development in the northern region of Tocantins State, a huge amount of fund might be needed in order to implement all the programs at the same time. This is difficult to accomplish considering the economic situation of the region and also the prersent situation of human resources. Therefore, for the implementation of each program a balanced schedule shall be formulated by dividing the whole project period (until the year 2020) into 3 stages namely short, medium and long terms as presented as follows.

The following items were considered in the division of the implementation stages;

	Items to be Considered in the Division of the Implementation Stages
Short-Term	• Problems that shall be solved as soon as possible not to give any detrimental impacts on agriculture and environment of the area; • Programs that can be a model for application to other areas; • Programs that can accomplish direct results within a short period; • Programs that can reveal prompt effects with minimum investment; • Programs that are indispensable for the implementation of related program; • Programs that present high accomplishment possibilities; • Programs that are sustainable and harmonize with the local environment; • Programs that can contribute to the improvement of farming; • Programs that have high implementation effect due to wide range of beneficiaries.
Medium - Term	• Programs that will expand the agricultural supporting services and will promote the conservation; • Programs that can create a multiplication effect with other programs; • Programs that are effective to improve the private investment situation; and • Programs that contain social improvement factors such as the correction of regional gap.
Long-Term	• Programs that can contribute to the establishment of sustainable agriculture; • Programs that are not urgent but necessary for the balanced agricultural development; and • Programs that need long preparation period for the implementation.

(7.2) Implementation Schedule

The implementation schedule was formulated in order to allow each project to accomplish a comprehensive effect. Implementation schedule is shown in Table 7.7.1.

Cronograma de Execucao do Plano de desenvolvimento da Agropecuaria na Regiao Norte