

INDIANS OF THE SOUTH OF BRAZIL - ENVIROMENT DIAGNOSIS
OF THE INDIAN RESERVES OF THE PARANA STATE

Francisco Lothar Lange Jr.
Sandor Sohn
Celso Dias Júnior

INSTITUTO DE TERRAS, CARTOGRAFIA E FLORESTAS - ITCF
Rua Desembargador Motta, 3384 - Mercês
80430 - Curitiba - PR
Brazil

ABSTRACT

The process of taking possession of land in the Paraná State determined it's primitive inhabitants to live in a few indian reserves. The extractive culture of these indians and the limitation of the areas in use, imposed by the reserves, has determined a growing degradation of their environment resources. This work shows, by the use of satellites, data of earth observation, the levels of environmental degradation in 5 indian reserves, looking for subsidize the government of the state, to adopt measures to improve the reordaining in the use and in the occupation of reserves, to assure better live condition to the indians and a better conservation of the environmental resources.

This work concluded that the allocation of the indian reserves was effected in areas of high environmental risks, of ecological tension, with a low potential of land application, which have been utilized without any technic of control and conservation of environmental resources. At the International Year of space, 500th Anniversary of the discovered of America, the spacial technology allow the americans make their own evaluation of the impact of this occupation.

KEY WORDS: Remote Sensing Application, Image Interpretation, Land Applications, Human Settlement, Renewable Resource.

1. INTRODUCTION

The indigean topic in Brazil have been the object of international attention, generally linked to the preservation of the Amazonic Forest. The reserves demarcation, the integrity of the culture and of the nations, the disorganized occupation of the land by the farmers and prospectors, and the consequences for the indians, are the most evident problems.

However it appears as a current problem, the indian problematic in Brazil go back, since the discovered and initial occupation by the europeans, and also, doesn't confine to remaining of this process of occupation - the amazonic region.

Also in the south extreme of Brazil, region already submitted by 4 centuries of occupation, and actually one of the most economic developed regions of the country, the indian problematic in Brazil, appears through a reality of absolute cultural degradation, marginalia, alcoholism and prostitution, with stages of much deterioration than those presented in the north of the country.

The history of destruction imposed by the europeans and their descendents to the primitive inhabitants of America, by a non simultaneous form, had failed the same sign of sacking, slavery, illnesses and death.

At the south of Brazil, specifically in the state of Parana, the subject of this work (fig. 1), the initial occupation of the territory happens by the searching of metals and precious stones, and also the indians capture for the slave-work in farmers of sugar cane.

Nevertheless, ocured that the indians not survived at the slave-work. Later, in the 18th century, missions of "Jesus Company", by the jesuits, begining works of catechism for the indians throughout the territory, establishing many "reduções", villages

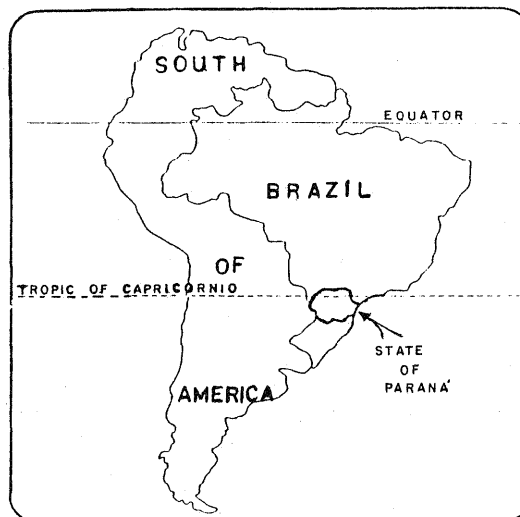


Figure 1 - Paraná State localization in Brasil

and cities, and even threaten the portuguese political control limited to the coastal of the country. Thus, by the determination of portuguese government, when saw threatened his sovereignty by the jesuits with spanish orientation, the government determined the expulsion of the "Jesus Company" (the jesuits) and his colonies from Portugal, otherwise they will attack and destroy every jesuitic "redução".

The fewer indians that survived, scaped to the missions to the south and Uruguay, while, the others went to the jungles. When the indians were captured, the illnesses became the worst enemy. At last, in the begining of this century, the remaining indians were confined in indians

reserves that also became remainings of formerly riches state forest. Nevertheless, many of these areas have suffered a continuous process of degradation, without any kind of control, with the aggravating of be generally areas of possible environmental attention.

In Brazil, the indigean topic is responsibility exclusive of the central government the "Fundação Nacional do Indio" (National Indian Foundation) FUNAI. In spite of doesn't have legal qualification to interfere on the indigean topic, even if in his territory, the government of the state of Parana has adopted a defensive position and incorporation of the indians fight for the improvements of live conditions, rescue of their culture and in the determination of their problems.

The necessity to obtain basic informations about the environmental conditions of the indians reserves in the state, in a short period of time in an economic form and based in current data, indicating the possibility of the use of images from satellites, still garanting the sistematic monitorament of the use of indians lands and the results of the public actions in the improvements of environmental conditions of these reserves.

So, the option in develop a work that envolve the intense use of technics of "remote sensing" applied and data obtained by orbital sensors that Hernandez et alli (1990), Heller (1975), Disperati (1981) had demonstrated a high level of efficiency for the applications in environmental activities, as inventory, handling, and control and monitorating of environmental resources, beyond to permit the generation of current informations, with low costs and reducion of land work.

This work has a main objective, the elaboration of thematic maps about the levels of environmental degradation in indians reserves at the state of Parana, using basically data of "cobertura florestal" and the current use of land, obtained by the satellite images. As a secondaries objectives, the elaboration of an evaluation about the viability of the use of this technology, in differential conditions of physical environmental, like dimensions of the areas, topography, kinds of "forest cobertura" of use in land - to develop and adapt methodology to the differents conditions - to consolidate basis for the elaboration of plans of landing use, and ambiental control, as a condition of rescue of the indian culture and environmental recuperation; - to generate subsidies to the ampliation of the works through others indians reserves in the state; - and finally, to demonstrate and propagate the importance and facilities of the use of spacial technology in obtaining the informations about physical environmental, and his disponibility by the society in general.

The state of Parana, has in his territory, 17 indians areas, with areas that varied between 23 to 18.000 hectares, in a total of 66.095 hectares, distributed irregularly through the territory. Considering as one of the objetives of the work, the development and adaptation of methodologies, and considered the heterogenicity of indians areas, as much as in areas as in environmental characteristics, we chose 5 representative reserves of different "geo-ambientais", social-economic and area conditions, to serve as a test-areas for the development of the works.

This work intend to be the introductory of a serie of actions that involve the utilization of satellite

data and technics of "remote sensing", applied to the indigean topic with emphasis in the environmental and integrator factor of public and private actions that objectifying the rescue of the indians identity with their physical environmental.

Nothing better that, in the 500th aniversario of the occupation of the America by the europeans, also the International Year of space, appropriating of modern spacial technology for one evaluation of the consequences of the discovery of the America in a original peoples, primitive habitants of this continent, and in the environmental that geranted them the survival and development as a culture.

2. STUDY AREAS

On the 17 indigean areas that exist in the state territory, 5 units were defined for the study, considering geographic criterion and area expression. (Plant, area and population) were donne by FUNAI. Figure 2 shows the distribution of these areas in the state.

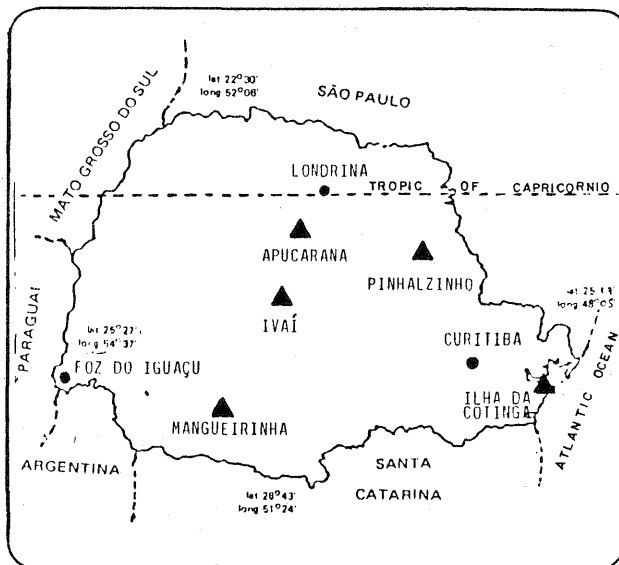


Figure 2 - State of Parana - Localizacion of the study areas.

The table 1, shows the areas chosen and some general informations related with the area, council localization, population and population density.

We obtained important informations for specific characterization of each study area, as a geographic location (DSG, 1965), climate (MAACK, 1981), soils (Embrapa, 1981), Geology (Mineropar, 1989), Geomorphology and Vegetation (MAACK, 1981) and social-economic data, organized for each homogenous region where are located the indians reserves.

2.1 Mangueirinha Indian Area

Area Localization

Latitude S - 25°44' to 25°59'39"

Longitude W - 52°12' to 52°24'51"

Southwest Parana, 3ª tablehand.

TABLE 1 -

NAME OF INDIAN AREAS	MUNICIPAL PLACES NAME	POPULATION	ÁREA	POPULATION SENSITY (hab/km ²)
Mangueirinha	Mangueirinha/Chopinzinho/Cel.Vivida	1.443	17.308	8
Ivaí	Manoel Ribas/Pitanga	898	7.306	12
Apucarana	Londrina	492	5.574	9
Ilha da Cotinga	Paranaguá	70	1.685	4
Pinhalzinho	Tomazina	93	593	16

Climate

The study area is a transition area between two climates, as Koeppen classification

Cfa = "climate mesotérmico sub-tropical úmido", without dry season, with a hot summer (hottest month 22°).

Cfb = "climate mesotérmico sub-tropical úmido", without dry season, with a not summer (hottest month 22°).

Geology

- . Geological features: Mesozoic period, jurassic, "Grupo São Bento, formação serra geral".
- . Stones: "derrames and sills de basalto and andesitos".

Soils

- . "litólicos entrófilos" associated with rich soil and "estruturada entrófica", both of them with "chernozênico texture argilosa".
- . "cambissolo álico" Tb associated to "solos litólicos álicos", broth of them "A proeminente".
- . "latossolo roxo álico A proeminente textura argilosa".
- . "latossolo roxo distrófico A proeminente textura argilosa".

Geomorphology

A plane topography and soft undulation in the south of the area, "pouco dissecada", with the maximum quota of 923 m above the ocean level. At the north, with more detailed relief and more amplitude "altimeter", with a minimum quota of 480 m.

Vegetation

2 floristic tipologies composition characterizing the forestal covering in the study area:

- "floresta ambrófila mista" (Araucaria Forest), tipic of more than 500 m altitude with kinds of the "pinheiro-do-paraná" (Araucaria angustifolia) and the "folhosas" as the Imbuia (Ocotea porosa), cedro (Cedrela fissilis) and others.

- "floresta estacional semi-decidual" (pluvial forest) that is more internal than the atlantic forest, following the "big rivers" valley, associated to the "clima sub-tropical úmido quente". Presents some kinds of Peroba (aspidosperna), canofistula (Peltophorum dubium), and others.

This indian area is the great forest of pine tree of Paraná tree (Araucaria angustifolia) in the planet. It is a forestal specimen with a very high market and practically extinct as a forestal tipology. The integrity of this reserve become suffer with judicial actions for its possession.

2.2 Ivaí - Indian Area

Area Localization

Latitude S - 24°35'00" to 24°37'30"
Longitude W - 51°37'30" to 51°35'30"
Centrical Parana, 3° tableland.

Climate

Cfb - always wet, hottest mont 22°C, 11 months 10°C, with at least 5 rimes/year.

Geology

- Geological features: Mesozoic period, jurassic, "série São Bento", "derrame de Trapp".
- Stones: "derrames" and "sills de basalto a andesitos".

Soils

- "latossolo roxo distrófico" associated to rich soil "estruturada distrófica, both of them with A moderado, textura argilosa".
- "latossolo roxo álico A proeminente, textura argilosa".

Geomorphology

Plane topography and soft undulation, uniform, pouco dissecada", presents a surface "pediplanada", "tipificada", pelo "aplainamento" surface conservated. Median altitude 900 m above ocean level.

Vegetation

- "floresta ombrófila mista" (araucaria forest), typical in altitudes more than 500 m, with some kinds of Parana pine (Araucaria angustifolia) and some "folhosas" as the imbuia (Ocotea porosa), "cedro rosa" (Cedrela fissilis), "erva-mate" (Ilex paraguariensis) and others.

This is a transitory area of ecology between the araucaria forest and the pluvial forest, with the predominancy of "folhosas" of the Parana pine.

2.3 Apucarana - Indian Area

Area Localization

Latitude S - 23°50'00" to 23°45'00"
Longitude W - 50°52'30" to 50°58'00"
North Parana, 3° tableland.

Climate (as W. Koeppen)

Cfa(h): hottest month 22°C, always wet, "precipitação" 600 mm, "clima tropical quente-temperado".

Geology

- Geological features: Mesozoic period, "serie São Bento", Jurassic, "formação serra geral".
- Stones: "efusivas básicas com basaltos maciços e amigdalóide, raramente andesitos, intercalados de arenitos finos".

Soils

- "latossolo roxo entrófico, A moderado, textura argilosa".
- "estructures rich soil "entrófico, A moderado, textura argilosa".
- "solos litólicos entróficos A chernozenico, moderado, associated to a Brunizen soils "avermelhado raso", both of them with "textura argilosa".

Geomorphology

Plane topography and soft undulation at the north area, "pouco dissecada", while at the south, the relief is more detailed with erosion surfaces, with more altimetric amplitude, with a median quota of 800 m above the ocean level.

Vegetation

- "floresta estacional semi-decidual" (pluvial forest), associated to "clima sub-tropical úmido e quente". Presents some particular kinds as peroba (*Aspidosperma*), canafístula (*Peltophorum dubium*), figueira-brava (*Ficus* sp.) and still the angico, pau-d'alho, ingá, palmito, etc..

In social-economics terms, the area is at the south of one of the most prosperous regions of the state, with technical agriculture, a modern agro-industry, and with great urban structures. The specific location of the indian reserve is transitional for miserable areas, in function of the geological transition between the second and the third tableland, that determines a more accidental relief and poor soils.

2.4 Ilha da Cotinga - Indian Area

Área Location

Latitude S - 25°30'00" to 25°30'30"
Longitude W - 46°25'00" to 46°25'30"
East Parana, island of Guaratuba Bay, coast of Parana.

Climate

Af(t): a transition tropical zone, always wet, median annual temperature 21.1°C, "precipitação" annual of 1976, 400 mm.

Geology

- Geological features: Cenozoic period, quaternary period, "sedimentos recentes".
- Stones: "sedimentos arenosos indiferenciados de origem marinha, e sedimentos atuais de deposição

Soils

- "podzol A hístico associated to podzol A moderado, both of them with "textura arenosa".
- "solos hidromórficos de mangue, textura argilosa".

Geomorphology

Plane with some elevations in sand deposition of ancient beaches.

Vegetation

- "floresta ombrófila densa, de Restinga ou das terras baixas", with some kinds of cedro-rosa (*Cedrela fissilis*), cupiúva (*Tajeira guionensis*), figueira (*Ficus organensis*), olandi (*Calaphyllum brasiliensis*), and palmito, guajurovú and others.
- "mangreve", typical in flooded areas with tide influence. The pedonant specimens are Cantabubá (*Rhizophora mangle*), mangue-manso (*Loguncularia rocenosa*), siriuba (*Avicennia* sp.) and others.

The study area is formed by 2 islands in the begining of Paranaguá, in a protective area in onde of the most complex "lagunar-estuarinos", nevertheless with a lack of financial resources. The majority population survive because of the fishing and extractival activity.

2.5 Pinhalzinho - Indian Area

Area Localization

Latitude S - 23°35'00" to 23°35'30"
Longitude W - 50°02'00" to 50°02'30"
North Parana, 3^o tableland.

Climate

Cfa - hottest month 22°C, always wet, precipitation 600 mm, "clima pluvial quente temperado".

Geology

- Geological features: Paleozoic period, "carbonifero superior, série Tubarão, grupo Itararé".
- Stones: "folhetos" and "siltitos cinzentos", and thin and medium arenitos.

Soils

- "Podzolic vermelho" - amarelo álico Tb medium, texture argilosa associate to fatossolo vermelho-escuro álico textura argilosa".

Geomorpholgy

Soft undulation, presenting a "pediplanada" surface, with median altitude 500 m.

Vegetation

- "Floresta estacional semi-decidual" (pluvial forest) associated to sub-tropical hot wet climate. Typical specimens: canafistula (*Peltophorum dubium*) cedro-rosa (*Cedrela fissilis*), figueira (*Ficus* sp.), angico and ingá.

The region where is the study area, is agricultural, however the soils are feeble and with survival agriculture with low technology associated to pastoral activities.

3. MATERIAL AND METHODS

3.1 Material

For the development of the works, we used initially the descriptive memorials and maps of the studied areas to make the delimitation in the "planialtimétricas" maps and find a better localization. For a better characterization of the areas, many diferents geological maps, soils and "fitogeografia" were utilized and a great number of bibliographic material too.

The main work occurs by the use of satellite images in a photographic paper form, in a scale 1:250.000 for preliminary study, and in a multispectral digital form in Streamer cassette, to analyse, interpretation and automatic classification.

The main characteristics of digital products used in this work are in the table 2.

TABLE 2 - Main characteristics of digital images used in this work

SATÉLITTE	ORBITA/ PONTO	DATE	BANDS RGB	STUDY AREA
Spot	706/402	23/08/88	1/3/2	Mangueirinha
Landsat TM5	222/77	20/05/90	3/4/5	Ivaí
Landsat TM5	222/76	20/05/90	3/4/5	Apucarana
Landsat TM5	220/77	12/09/90	3/4/5	Ilha da Cotinga
Landsat TM5	221/76	07/02/90	3/4/5	Pinhalzinho

The satellite data used in this work, as much in photographic paper as digital images were be given by the Instituto Nacional de Pesquisas Espaciais - INPE (National Institut of Spacial Research).

The analyse, interpretation and classification of digital images were processed by the Sistema Interativo de Tratamento de Imagens - SITIM 150 (Interative System of Treatments Images), with a rapid numerical processor PNR (accelerator plate) installed in a PC-AT microcomputer with rigid disc of 55MB and digital tables A1 and A2.

3.2 Methods Utilized

The method of work used in localization of study areas in the planialtimetric maps (DSG 1965) and a preliminar recognition of the areas in the photographic paper images with these elements become possible to recognize the areas in the digital images.

A lot of methods have been utilized to the interpretation of orbital and the most accurate have been the digital analyse (Disferati, 1981). The main advantages of the digital images process have been the versatility, "refetividade", and the preservation of the original data, that consist mainly in the analyse and manipulation of the digital pixels values, utilizing computer systems. According with the proprieties of digital numbers, we recognize the objects in scene, and we classifie the images.

After recording the digital images in SITIM 150, the evaluation of the combination products of the bands used, occurs respectively manipulation of the colors contrast, brightness and/or off set.

After the images processing by the software, the interest areas were delimited at the computer image, emphasizing them of the rest of the study areas. With a new treatment and manipulation operations of

the color and contrast, we try to generale a product that allows a greater distinction in relation of the soil use and stratification forest, an important aspect in this study.

After a preliminary analyses of the images and recognition of the potential classes identified, stablishing of training areas where the evaluation of the forest tipology and current use of the land.

By thse informations, the automatic image classification of SITIM 150 occurred by a demonstrated knowed points in the training area, using the "Maxima Verossimilhaça" - MAXVER, that agroups similars pixels in defined classes.

Once the area image is classified, the integration of these data at SGI for comparting these data with other information of hidrography, "declividade" and soils.

4. RESULTS AND DISCUSSION

4.1 Description of using classes

The analyses and interpretation of digital images allowed the identification of followings classes of land application or forestal extracts:

1) Primary Forest

The areas are with a preservall forest covering, without exploration, that conserves their own forestal tipology specimens in a original of primitive state.

This class could be sub-divided according to the identified tipologies by the images, mainly between araucaria forest/pluvial forest/mangroves, because of the architectural "foliar" of characteristics specimens.

This condition was possible to detect in only 2 areas among those that were studied, as observing Table 3

2) Disturbed Forest

This class characterize itself by having your original forest covering partially modified by the selective extraction of trees with greater market, presenting characteristics of degradation in their tipology.

The Table 3 shows the high levels of this occurring in the study areas.

3) "Capoeira" or Secondary Forest

This class is represented by areas where destruction of the forest was total, following or not by a fire, generally used as agriculture technic in a short period of time, and them abandoned, where a dense vegetation grows, with a tipical specimens of this study.

The Table 3 shows the importance of its occurency, common in all study areas because of this land application system used by the indians.

4) Dirty fields

They appear in extremely degraded areas by continuous cultivation, fire that impedes the soil regeneration or miserable soil. The presence of this class, indicates the fragility of the invironmental to the traditional using process by the indians and the non utilization of conservatory technics in the land application.

5) Agriculture

They are areas utilized to the annual cultivates, to the provisioning of the indians and their animals. It consists basically of corn cultivations, in a greater scale, and manioc, traditionally cultivated by the indians. This class involves exposed soil areas, prepared for the cultivation, and even burned areas because of the lack of protection in the preparation of the land by the fire.

4.2 Results

By the applications of legends, organized by identified and common classes in all study areas. The result are on the Table 3.

TABLE 3 - Results by classes of land application, expressed in ha, and in area percentual of each reserve and the total area

INDIAN AREA	CLASSES OF LAND USE									
	PRIMARY FOREST		DISTURBED FOREST		"CAPOEIRA"/ 2º FOREST		DISTY FIELDS		AGRICULTURE	
	ha	%	ha	%	ha	%	ha	%	ha	%
Mangueirinha	6.620	38,4	4.400	25,5	1.880	10,9	1.724	10,0	2.616	15,2
Ivaí	-	-	3.682	50,4	1.352	18,5	1.710	23,4	563	7,7
Apucarana	-	-	4.019	72,1	362	6,5	273	4,9	920	16,5
Ilha da Cotinga	1.345	79,8	-	-	88	5,2	165	9,8	88	5,2
Tomazina	-	-	97	16,3	155	26,2	268	45,2	73	12,3
	7.965	24,5	12.198	37,6	3.837	11,8	4.200	12,9	4.260	13,1

Thematic maps were generated with the classes of current land application, from vegetation extracts of each studied area, as much maps of ambiental risks, by comparing georeferenc data of drainage, soils, declivity, etc.

4.3 Discussion

The characteristics observed in each study area, should be specifically considered because they demonstred special peculiarities in environmental terms and land application.

4.3.1 Mangueirinha indian area

The studies of this area were effectived usig data obtained by Lange Jr. and Maximiano (1991), by the SPOT sensor. The preferency of this product happened because of your spacial resolution (20 m), and of good results demonstrated in the identification and delimitation of different forest tipologies, as pluvial forest, and araucaria forest (parana pines) that occurs in this area. The utilization of SPOT images allowed the identification of 6 using classes, because of the sistematization, were gruped in common classes to all areas.

Because of the importante of the area in ecological aspect, the last great remainings of Araucaria forest, it becomes necessary a detailed study in different tipologies.

It was observed that the concentration of Primary forest remaning, in special the Araucaria forest that was in totality on the litigation area, while the rest of the area was eliminated. Because of the unstable conditions in the infra-structure in the indians life, we noted that the exploration of excellence woods of indians reserves, doesn't assure any improvement to the indian community. Another important aspect, was the high rate of destroyed areas by fire, only at the observal period, in a total of 1330 ha of or 7,72% of total area.

The control of the land application in the reserve

is the main factor of environmental degradation and destruction of Parana pine. The non disponibility of machines and agriculture implements and the soil corrective and technical orientation are important in this process, despite the majority areas already devastated having a good potential of agriculture use and agriculture mechanization.

Among worked areas, Mangueirinha is the one that presents the greatest and most important biome in conservation terms, although it was been where the degradation process occurs in greather intensity.

Integration actions of indians to the regional productive process, a planning land application, handling and forestal protecting, areas recovering, alternative profits by ecological turism would be recuse instruments of the identity and indian culture as the last great population of Araucaria forest, an humanity property.

4.3.2 Ivaí Indian area

Practically without your original covering forest, by the tradition based on the necessity of make the abandom in areas after each cultivate. This abandom is called "pousio", and it is necessary in 5 to 10 years to regain the soil by the cultivate and fire. The cleannes area by fire, destroy the soil, but also assure the soil fertilization in the first year, by the ashes and eliminates the harmful plants. The indian degradation technics, ist he only possible technic to their survival, considering the lack of suppor and a confinement consequencey in a limited area.

The Ivaí indigean area is in an ecological tension area, between the predominance of Araucaria forests, and the pluvial forest, that predomines the other. Thus, the devastation of Araucaria forest have been opening the way, to the introduction of the pluvial forest, in a irreversible way. The agricultural activity is the corn cultivation, and in a smaller scale, manioc and bean cultivation. The rest of environmental characteristics, although in a differen-

tial region, in the relation of the land application and environmental impacts, is in the same form that was in Mangueirinha. This area presents the smaller areas of cultivates, nevertheless, a high rare of occurrence of "dirty fields", indicating a reducing tendency in the plantation or in the recovering capacity of the soils.

4.3.3 Apucarana indigean area

Placed in a marginal area between the second and the third tableland of Paraná, it presents a transition between poor soil and productive soil, however with high "declividade". Presents, a great part of the occupied area with degraded forest, even by the non possibility of cultivate in these accidental areas.

The land application in agriculture areas, happens by the traditional process and the high percentual of the agriculture land occurs because of the burned areas in this class.

The general conditions in this follow the regional use, with low agriculture tendence of the soils, and continuous forestal degradation by the fire mainly.

4.3.4 Ilha da Cotinga indigean area

The place of this area is singular in the state of Paraná, because it places in 2 closely islands, placed in the entrance of Paranaguá Bay, near the city. The environmental conditions of the island in conservation terms is good, with 80% of original forestal covering still intact, distributed in 2 tipologies: mangrove, one of the most important bioma in ictiologial fauna, typical in flooded areas, and the "restinga", a variation of atlantic forest in the sondy soils and dunes, with an important role of stabilization of soils.

The agriculture activity is the manioc, planting for consume, the only one viable planting for that "sandy" soils, and with a low fertility; and it's this factor that assume the conservation of the forestal environmental in the islands, because the indians fish too, reducing the pressure of the forest. The cultivate system is similar to the utilized in other areas.

The more degraded areas, involved by the class "dirty fields", are limited to the hillside of the mountain, probably submit to the continuous use and after the development of "gramineas", in the low productive soil, fired every year. The conditions on these areas and their habitants could be improved by the recuperation of the areas "dirty fields" palmitto cultivation (*Euterpe edulis*), craftsmanship, and the ecological tourism.

4.3.5 Pinhalzinho indigean area

Placed in a poor region of soils, the conventional cultivation system of the indians determined, the depletion of soils and a great pressure over the remaining forests, constituted one of the most degraded reserves in that evaluated. The agricultural activities are based in the corn cultivation, bean, rice and manioc.

The fragility of the region is determined by the soils, with low fertility. The recovery of the area is linked at the rescue to the marginality of the

indians, and investment in alternative technology, like the energetic reforestation.

5. CONCLUSIONS

Although only 5 indian areas were defined for the study, there are 17 indian areas in the state of Paraná, they confirmed to be the representatives and the conclusions would be applied to the others, specially to the recomendation terms.

This study allows to conclude of the opportunity of data use of satellite for the diagnosis of the ambiental conditions and the land application applied to indigean reserves, utilizing digital products, to a detailed level, considering the limit of the scale 1:50.000 in products term, LANDSAT TM5, for accidental areas and 1:30.000 for SPOT product, applied in plane areas to the undulating areas, and to the separation of forestal tipology, as we can see in the camp verification.

The work indicates in a clear and conclusive form, the levels of ambiental degradation in the evaluated reserves, demonstrating that;

- in 3 of the indigean areas studied, the degradation process already determined deep alternations of "biomes" and it's necessary an emergencial plan to control the application land.

- that in the other 2 studied areas, specially Mangueirinha, the existence of important remainings of Araucaria forest (Parana pine) in a deterioration process and the disponibility of areas with potential use, determine protective actions to the remainings and zoning plans of land application, to indicate possibles areas for the agricultural necessary use to the indians of that reserve and maybe of those doesn't present conditions. That the indian area Ilha da Cotinga presents the best conservatory conditions, although it is the most fragile area in the ecological point of view. This relative conservation, probably be related to the physic area, and the alternative of fishing to survival.

- The confinement represented by the indian studied reserves, is incompatible with the maintenance of traditional cultivate systems, in the that determine the continuous degradation of the environmental resources.

- At least 4 of the studies reserves are marginal areas, ecological tension, and extreme fragility for fundamentated in agricultural conventional activity. We note a tendency of allocation of indigean reserves in areas with low potential of agricultural use and high ambiental risk.

- The Mangueirinha indigean reserve demonstrates the contrast representd by high levels of degradation, verified in areas of public administration, with the area in judicial process, almost intact, because of its undisponibility. The process of systematic extraction of the Parana pine, is the responsibility of the public administration, wit many allegations.

- A great lack of support and social and productive integration of the indian in the external reserve.

- Finally, the work demonstrated the facility using images in a digital form, by the automatic process, in the elaboration of studies and diagnosis

in the ambiental area, applied specially in indians areas.

As recomendations, this work proposes:

TEECHNOLOGY

The use of sensors of resolution more thin, as HRV SPOT for a better identification and forestal typology separation, and Landsat TM5 for the actual land use.

INDIAN AREA

Amplification of the works to all indian areas in the state, and control the actions by a systematic monitorament.

Viability of studies that allow evaluation the costs of degradation of environmental in the indians conditions of life.

Elaboration of gerencial plans to the land application since the data generated by the work.

- Stimulate alternative use for the reserves of high ambiental level, and concentrate efforts in the use with investments and technology in areas with potential.

6. ACKNOWLEDGEMENTS

The authors would like to thank Mr. Ivo Flavinha for the drawings; to the FUNAI, for the disponibility and effort demonstrated in the providing informations, and to the others friends of ITCF, that in many forms, contributed for the viability of this work.

7. BIBLIOGRAPHY

DIRETORIA DO SERVIÇO GEOGRÁFICO DO EXÉRCITO-D.S.G., 1965. Carta Topográfica do Brasil. Escala 1:100.000 e 1:50.000. Folhas Mangueirinha, Clevelândia, Ilha do Mel, Congoinhas, Guapirama e Pitanga. Rio de Janeiro, Brasil. Mapas.

DISPERATI, A.A., 1981. The Mapping fo Stands of Parana Pine (*Araucaria angustifolia*, Bert) O. Ktze) in the Forest of South Paraná State (Brazil) using computer - Aided Analysis of Landsat MSS data. Tese de Doutorado. Bedford College, London, 250p.

EMPRESA BRASILEIRA PESQ. AGROPEC. S.N.L.C.S., 1984. Levnatamento de Reconhecimento dos Solos do Estado do Paraña. Curitiba, Brazil. 900p.

HELLER, R.C. 1975. Evaluation of ERTS-1 data for forest and sangeland surveys. U.S.D.A. Forest Service Research Pojer PSW:39-42.

HERNANDEZ, Filho P.; Faria. K., 1990. Avaliaçao de Áreas Indígenas utilizando-se de Dados TM/Landsat. In: VI Simp. Bras. Sens. Remoto. Manaus. Brazil, vol 1, p.p. 028-033.

ITO ISAIA, E.M.M.; Isaia, T.; GARICLIO, M.A.; VERSLYPE, C., 1990. Avaliação do estoque lenheiro do R.N. Estratificação da vegetação nativa lenhosa através de composições coloridas do Sensor TM Landsat. In: VI Simp. Bras. Sens. Remoto. Manaus, Brazil. vol. 1, pp.028-033.

LANGE JR., F.L.P.; MAXIMIANO, G.A., 1991. Utilização de Imagens SPOT para fins de estratificação florestal na Represa Indígena de Mangueirinha-Paraná. In: Simp. Nacional de Sens. Remoto aplicado ao planejamento municipal - INPE. Serra Negra, São Paulo.

MAACK, R., 1981. Geografia Física do Estado do Paraná. Rio de Janeiro/Curitiba, Brazil, 445p.

MINERAIS DO PARANÁ S.A. - MINEROPAR, 1989. Mapa Geológico do Paraná. escala 1:650.000. Curitiba, Brazil.

PONZONI, F.J.; INONE, M.T., 1990. Reflectância Especial de folhas "ex situ": Uma abordagem metodológica. IN: VI Simpósio Bras. Sens. Remoto. Manaus, Brazil. vol. 1, pp. 015-023.