RESEARCH IMPACT OF DEVELOPMENT OF DAM KOTOPANJANG

Province of West Sumatra and the Province of Riau Indonesia

WALHI

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Jakarta
July 2004

INTRODUCTION

The Dam of Hydroelectric Power Plant of Koto Panjang (PLTA-KP) located in frontier of the province of West Sumatra and the province of Riau Daratan, Indonesia, is a big project generating a lot of problems. It is an example of development which is heedless of the society condition and elephant habitat. The Project supported with the debt fund from Japan through JBIC Project (*Japan Bank for International Corporation*) have harmed the people in 10 villages with inappropriate compensation and also damaged the habitat of Sumatra Elephant.

Friends of the Earth Indonesia (WALHI) as environmental organization and people advocacy in defending of natural resource sovereignty have conducted various activity to implement the organization mandate. One of activities for supporting people advocacy is a comprehensive research about the condition of environmental, natural resources and also societies. The research consists of four items that is Research of The Physical Condition of Koto Panjang Dam, Research of the Economic Assessment and Natural Resource Finance as a development impact of The Dam of Hydroelectric Power Plant of Koto Panjang (PLTA-KP), Study of Mitigation Action on Development Negative Impact of PLTA-KP concerning with the population of Sumatra Elephant and Analyses of the Social Impact and house hold of Development of PLTA-KP

The Research of the Physical Condition is taken to know the change of ecology landscape caused by development of PLTA-KP. We research it because the change of ecology landscape will have an effect to all of beings who live around in the Koto Panjang Dam. The Change of the ecology landscape has caused the loss of natural resource as the source of the society life.

The Research of the Economic Assessment and Natural Resource Finance is expected to be able to give the description of the economical effect of decreasing and also losing the economic value from changing the ecology landscape. The natural resource tries to be assessed economically to see the counted value.

The Study of Mitigation Action of Elephant is to see how far the action of evacuation of Sumatra Elephant such as those which is qualified. This study also explores how far the possibility of behavioral change of elephant and also negative influence from destructive action on elephant habitat.

The condition of Society as the victim of the development of PLTA-KP becomes a part of ultimate core and the key from all studies above. This Research is taken by doing analysis of the social impact. Particularly, this research purposes to get the analysis about how much the benefit

and loss takes from the pattern of resident evacuation and how far recovery of economic society does, How does the pattern of agriculture product change as consequence of changing the pattern of the natural resource ownership?, How big does the investment and economics policy applied by government influence in the effort of rehabilitating society economics?

The Big expectation of this research is that it can be the valuable information based on the strong data to explain that development without giving the people elementary rights and bothering environmental condition only produces the increasing poverty more and more and also environmental crushing.

Jakarta, 1st September 2005

Chalid Muhammad
Executive Director of WALHI

Summary Executive

The Assessment of Koto Panjang Landscape of step in the study territory technically was produced through the correlation activity or overlay thematic maps related to the scope between 0° 06' 45"- 0° 28' 15" North Latitude to 100° 34' 45"- 100° 56' 00" West Longitudinal within scope 221.619,7 Ha.

These data was received based on the method of computerization (the scope of the study territory), whereas in the JBIC report on the area of the flooded territory reached 124 km².The flooded region of the water generally is river terraces and the fertile territory for agriculture as well as the centre of the settlement of the inhabitants. The flooded territory spread beginning with around the Muara Takus Temple afterwards narrowed around the Alai lama Cape Village and widened again to the narrow river valleys after through the Muara Mahat. The region that remained was based on the interpretation of the image landsat TM the recorder on April 25, 2000 the width reached 11.718.92 Ha

Based on automatic – computerized analyses to count the length of water catchments area studied, identifies that the longest water catchments area is found at sub water catchment Mahat (421,548.87 m or 18.57 m/hectare) and sub water catchment Gulamo (419,244.12 m or 20.94 m/hectare). Some areas have longer water catchment, such as Tiup Gadang (176,071.9 m or 16.2 m/hectare), Takus (134,606.72 m or 18.29 m/hectare) and Parmanisan (120,610.97 m or 23.31 m/hectare). At those sub water catchment can be indicated that the sub water catchments are susceptible of erosion, beside that the dominant rock in these areas are sedimentary rocks, which consists of sandy rock, gravel, and mud.

Pattern of the land usage on the past before the dam project needed to be know to compare with the development of pattern of the land usage now. Based on the analysis of RePPProt map in 1987 and topography scale 1:50.000 in 1984, the land usage is classified into 7 classes include

Changing condition of land cover was happened in the study area along period of 1990 and 2000. Forest and dry field land covers decreased their vast respectively 24.725,87 Ha and 2.390,16 Ha. The decrease of land cover vast was happened by the reason of the development of rubber and oil palm estate concession, such as in sub water catchment Gulamo which is in the north of Muara Takus and in the north of Rantau Berangin. Other reason was the forest area reclamation for the preparation of the people removal from their old village to the new one such as from the village of Pongkai Baru which was in the north of Muara Takus, villages of Pulau Gadang and Koto Masjid to Koto Ranah. People removal from the villages of Lubuk Agung and Koto Masjid to Ranah Sungkai also caused a decrease of dry field land cover, which led the people also bring their work to the new place. The decrease of dry field land cover except as a

result of the people who moved their work in new place, was also reasoned by their dry field which flooded by dam PLTA-KP

One of impacts of the construction of the Koto Panjang dam was the removal of people from the old place to the new settlement. The relocation involved removal about 5.953 Households (4886 Households, JBIC) from 10-recorded villages. People expectation was that the new place was the same with their old place, but the program only made the people suffered. In the new location people did not found existence pattern on the culture and social dissolution. The process was done without cares to individual interest, the society and their social life. In simple word, there was human rights violation because no job, no education, no health care, no warranty to hold cultural identity, no warranty of safety and social continuity for the removal people. Sometime they were removed to the location with a very different environment of life for their culture.

The change of vegetation density in the period of 1990 – 2000, where in 1990 the density was 2.471,79 Ha (2,28%) and it increased become 46.634,53 Ha (43,08%) in 2000. It happened as the result of forest area reclamation for plantation and land clearing done by the government to prepare location for people whose land was flooded. In 2000, the wide density was highly increase as it was resulted by the growing of the cultivation plants such as oil palm and rubber, in other side caused of limitation of the people access and their interaction to the area they left was seldom done so there were natural growing of bushes and secondary forest happened. People also used the open area to cultivate gambier plant and areca nut. The spreading of the very high vegetation density in 1990 was in the back of hill and the other was in the North West. While in 2000 the spreading broad to the North West, part of them in north of the dam and grouping in the South East.

Natural Resources is the main source in Economy and Social development, but in this understanding most of the natural resources was sacrificed for short-term importance and the value. Farmers sacrificed their plantation field for mound, it means that the farmers didn't notice the field's value. If the government gave permission to sold sand to our neighbour countries than the island is threatened to vanish, it means that the government didn't value the island. Same as the government decree to give permission to open the forest or forest conversion for wide field plantation it means that the government didn't give value to the forest existence.

In the last era, Economy and Social development was done for short-term advantage and forget the continuity aspect. Same as the farmer who opened the forest for coffee field in protected forest or took wood illegally for their economy advantages, it caused economy goes to the wrong direction and decrease the national production for long-term and impact to high cost, and then rehabilitation became economy burdened.

Those problems aren't new. Sacrifices of the Natural resources for development importance not yet being the consideration of a project development. A case in reconstruction of

Hydroelectric Power Plant of Koto Panjang (PLTA-KP) by moving the villagers in 10 villages (4886 head of house hold) and the farming field, infrastructure, etc that was finance by the National Budget (APBN) and District Budget (APBD) up to now still arouse some cases. The sacrifice of the farming resources and settlement means need replacement natural resources as a consequence from losing their plantation field and settlement.

The policy about moving the villagers from reservoir to the new area aroused a new problem for the organizer of PLTA-KP, it means that new settlement directly limit the forest area as an erosion preventive. Sacrifices of the forest resources are burdened if the relocation didn't work as it planed to replace the economy and the lost income like potential before. The failure will also increase the depression of the left forest area, minimal new area needed for relocation is about 146,58 km2.

Sacrificed of the natural resources for the reconstruction of PLTA-KP is value from 2 sectors, they are farming and forest resources. The financial lost is about Rp 721,64 billions. Farming sector is about Rp 436,86 billions and forest Rp 284,78 billions. The calculation of the forest resources is classified into economy value directly and indirectly. Indirect detriment like lost a habitat area and the ecology value, the ecology value is about 224,96 billions. The financial lost of the detriment of natural resources is the same as electric production value for 15 years. The assumption of PLTA-KP production if one take an average per year is about 397,7 million kwh.

The one who sacrificed from moving the villagers are forest resources and shrub, with width is 146,58 km2 for new settlement and farming. More than 70% of the new settlement the area is in Catchments area. It means that movement and relocation indirectly had burdened PLTA-KP project with organizing the water catchments area's problem. It can be seen from the vegetation changing and the forest flaw, it will cause the discharge of water decreases and sedimentation increases which limit the PLTA-KP functions. If we make an assumption that the damage of catchments area will decrease the PLTA production as much as 10% so for 30 years production will loose Rp 15 billions. If the damage of the catchments area caused the decrease of the production 30% so for 30 years production will loose Rp 45 billions with assumption that the electric production per year is 397,69 million kWh.

Loosing in sacrificed of the forest area for new settlement with width is 146,58 km2 (14.658 Ha) can be calculated economically and ecologically. Economically the detriment of the forest vegetation changing into plantation field, and cultivation is Rp 511,3 billions. Ecology loose is Rp 886,40 billions (loose on forest as controller, hydrology, water sources, eruption controller, land, air cycle, and decrease the pollution). Total the detriment of opening the forest for settlement is Rp 1,4 quintillions.

The total detriment of natural resources from plantation field for PLTA-KP reconstruction is Rp 436,86 billions, forest resources without calculate the ecology value is Rp 59,82 billions and sacrificed of forest resources from wood production per year for settlement is Rp 511,3 without

calculate the ecology value. The total detriment without ecology is Rp 2,12 quintillions, this loos is more than the electric production for 35 years with assumption the average production /year is 397,7 million kWh.

Elephant of Sumatra (*Elephas maximus sumatranus*) is one of big mammals which has spread large in Sumatra areas[1]. Elephant moves from montane areas to coastal lowland forest along the summer and they hide around the hills in rainy season[2]. In Sumatra, the population of elephant is showed in eight provinces (Lampung, South Sumatra, Jambi, Bengkulu, Aceh, riau, West Sumatra, and North Sumatra) and also fragmented in at least 44 groups of population.Newest estimation by Tilson et al (1994) predicts that there were between 2800-4800 wild elephants from those previous groups.

The population of elephant has got a lot of pressures especially from human activities, those from cultivation or resident activity and also development of infrastructure resulted from damage and elimination habitat of elephant. It is possible based on the fact that there are only 17 of those 44 groups that exist on protected areas, and rest of them is on production areas.[3] In North Sumatra and West Sumatra, population of elephant is almost forced to move to another area by the pressures.[4] The same pressure is also happened on population of elephant in Riau. It is not equal when the missing habitat areas resulted from plantation, wood disaster, infrastructure of resident development, industrial, and mining is not continued by appropriate control for the population of Sumatran elephant preservation, such as providing and developing appropriate protected areas or other conservation improvement.

The importance of the effect of mitigation action on Sumatran elephant population in Koto Panjang area is already stated in the article of The Planning of Environment Management in Hydroelectricity Project that is published by Tokyo Electricity Power Service Co. Ltd and PT Yodya Karya for the State Electricity Enterprise (PLN) in 1998.

Considering the report, removing the population and relocating the habitat of Sumatran elephant are chosen in mitigation action in the development of Koto Panjang Hydroelectricity. The group of elephant will be pushed into new habitat in Giam Siak Kecil Animal Conservation, and if it is needed will be pushed into Bukit Rimba Baling-Baling Animal Conservation.

Is relocating the population as a mitigation action the first best option for the Sumatran elephant population preservation in Koto Panjang? There are two things which cause the option is doubtful as the best option and enough to secure the Sumatran population preservation.

Those facts show that Sumatran elephant relocation from Koto Panjang to Giam Siak Kecil Animal Conservation area is not conducted with adequate technical appropriateness. *The process conducted is lack of accountability so it causes doubt.* The process tends to

[1] IUCN. No Years. Indonesia : Sumatera. Status of Elephants in Sumatera
[2] Ibid
[3] Ibid
[4] Ibid

domestication not relocation with reintroduction to new wild life habitat. This assessment leads that the whole process of mitigation action of negative effect of Koto Panjang Hydroelectricity on Sumatran elephant population in the area is in 4th scenario of mitigation action. The action is not adequate and is not well conducted.

Relocation directly had caused forced – change to the agriculture system, from system relied on natural resource to be a capital dense system. Relocation facilitated by government for people who had been the victim of developing KP Hydroelectricity gave two alternative choices; those were UPP/Rubber system and PIR/Oil Palm system in a context of local transmigration. Each system controlled by government with the limitation of giving infrastructure and means, such as 2 hectares area for each system, species of rubber or oil palm plants, transmigration settlements, and a year guarantee of life. In earlier transition time of relocation brought serious problem to the society, before or after relocation. First problem was shown by the process of compensation price that valued too low and even many of them didn't get the compensation yet until now. After relocation, problem continued to facilities promised by government which were not available until now, such as ready – harvested rubber plantation, village's public facility (road and watery facility) and so on. Those accumulating problem was burdened to society as the victim (social cost) of KP Hydroelectricity development.

Simultaneously, the amount of social cost caused the wealthy declines and future hope disappears. This condition was far from society's hope and it was a fact that relocation done because it was forced. It's an example of social cost that should be paid by society as a result of development project but its benefits were not for them. The resistance of developing KP hydroelectricity continued to compensation refusal, but the government kept forcing relocation as an effect of KP hydroelectricity development. The cost should be paid was so high, such as vanishing of productive economic source, vanishing of livelihood diversity, vanishing other natural resources. Those were only visible lost, but there were other invisible lost, such as vanishing indigenous life.

The high social cost of KP hydroelectricity development also described the failure of implementing plan. Simultaneous relocation worsened people's economic, social and cultural conditions. There were not all of village followed such relocation system for some reasons and considerations. Pongkai village, for example, based on peoples' meeting headed by ethnic leader, relocation's places offered by government were not agreed, and so in a consequence they didn't receive two hectares area for rubber plantation and settlements. While Tanjung Pauh and Tanjung Balik village accepted UPP/Rubber system or PIR/Oil Palm system which required relocation area should be located in Rimbo Data, near reservoir not far from their previous village. Whereas the others accept government offers without any requirement that means relocation areas offered by government were accepted.

The failure to prepare substitution resources is second mistake after process of substituting economic resource and people's land was not appropriate to market prices. The second mistake was related to the failure of implementation of many things promised by government after relocation. The third failure concerned to government's inconsistency of building KP hydroelectricity and its supporting factors by using area which should be protected near Hydroelectricity reservoir to be relocation area. The longer time government prevents the failures higher social cost effect will be.

From the analyses of comparing people's wealthy level after relocation which was based on system applied, the trend of social cost level in social, economic, cultural, and ecological aspects showed raising tendency, up to there was economic rehabilitation and equal investment which benefited people. Rehabilitation systems that were carried by government did not work optimally as many people hope. It was shown by over than ten years rehabilitating economy there was no significant differences. However, the system applied in society had caused many problems, as followed: **1)** It was difficult for Tanjung Pauh, Tanjung Balik, Pongkai Istiqomah, etc to build economic base without government's support and help. **2)** Incomplete public facility significantly could lower people's wealth. **3)**. Unclear system of possessing natural resources in resettlement location outside previous area. **4)**. The potential conflict about the border of village area with traditional area between previous village and relocation village or within the same relocation village.

Significant change on people's agricultural system also needed much costs to contribute which was suffered by people as society's unready to cultivate the land using intensification system. Clearly, this change caused problems on attitude and behavior to operate land farm, species of plants usually used and capital shortage. It was possible that these problems empties into technical guidance and support which needs to be facilitated to solve the problem faced. Livelihood differsity lost, from 9 – 22 types to 2 – 5 types, with the tendency of decreasing. Economically, their income increased but its raising followed by life cost raising as result of change on agricultural system and consuming pattern. It also should be concerned that relocation societies was related to Indonesian macro economic and life condition, which means failure at many economic sectors simultaneously influenced people's economic improvement.

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CHAPTER I
THE PHYSICAL CONDITION OF KOTO PANJANG REGION

1. THE ASSESSMENT OF KOTO PANJANG LANDSCAPE

1.1. General Analysis of the Methodology

The series of step in the study territory technically was produced through the correlation activity or overlay thematic maps related to the scope between 0° 06' 45"- 0° 28' 15" North Latitude to 100° 34' 45"- 100° 56' 00" West Longitudinal within scope 221.619,7 Ha. The basic maps used as 'work maps' to analyze the physical constructions, like the slope, the height, as well as the determination of the landscape unit (relief) consisted of 'earth maps with scale 1 : 50.000 (the Bakosurtanal production) page 0816-11, 0816-12, 0816-13 and 0816-14 as well as the Image Landsat TM-7 Path/Row 127/060 recorded on April 26, 2000 a d n1990 (see the **Map 1. Landsat TM-7 FCC 542 Dam Koto Panjang and Surroundings**).

The work maps that was used for the determination analysis and area dividing physical types of the unit in this study were the contour, the height territory, the slope, the pattern, the density, the river basin and the density of the vegetation index as well as other to the territory of the study of the Koto Panjang's dam that width approximately 221.619,7 Ha. This study used analysis of DAS that directly connected with the width dam of 108.243,86 Ha (WALHI, 2004). In the feasibility report of the PLTA-KP research the width of DAS as big as 3.337 Km² (water catchments the area) and the territory remained 124 Km² (JBIC, 2002).

The study in connection with the aspect of form was based on the landscape-typed variable fact of relief. Whereas discussions that in connection with the aspect of the process, was based on process-typed variable fact. The discussion correlation from the two aspects was made use to analyze the determination of physical unit.

The scope limit of each physical unit region afterwards was put forward in thematic maps, as being named above. So that, only referred to thematic maps that were produced then was able easily to describe its appearance, without must do the correlation or overlay again these thematic maps.

1.2. Area Dividing and Production of the Maps Territory

The study of the morfodynamic aspect was linked with types of river current that supported with information concerning the level of surface denudation from the thematic maps respectively. Likewise with morfostructure covered geology structural variables and litologi to the thematic work maps respectively.

Parts of the study territory that was identified the process geomorphology from his formation, so as was 'territory type of the process from', afterwards was described through the thematic activity of the correlation of work maps, that is the maps of the pattern of the river current, the river basin, the density of the river, litologi, the structure and the level of denudation of geology.

1.3 The Qualitative Interpretation

The qualitative interpretation in the study of the determination physical appearance in this study territory covered the correlative activities as follows:

- Field observation was carried out towards several parts in the study territory and surrounding area.
- Distribution spatial interpretation, class interval territories the steepness of the slope were done overlay with the thematic maps of the contour, afterwards was adapted to results of field observation.
- Analysis of Landsat image was carried out in accordance with the scope of image study to keep monitoring and the evaluation of the Dam Region Koto Panjang in the West Sumatra border and Riau That could be carried out in three grouping stages, that is the Analysis of the fact be based on appearance of Landsat image 1990 and Landsat TM 2000 with interpretation image analysis about the cover and the use of the land, as well as counted his area. The interpretation and the image analysis about density of vegetation were based on the vegetation index and counted his area of the distribution. Be based on this matter above, then the theory base in its model design was the theory base about the cover, the use, the form and the vegetation index of the land. The analysis and the density of vegetation of the distribution of vegetation were based on the vegetation index from the Landsat image 1990 and Landsat TM 2000.
- The Technique to find the density of maximal vegetation and not to overlap could be done in the image that has been processed based on the vegetation component (vegetation index).The interpretation of the vegetation index was carried out by means of reduced, increased, and compared the digital value of each different spectral channel. One of the methods was carried out for this study made use of the comparison of several

channels was based on the normal difference of the vegetation index (normalization), that was acknowledged as NDVI (Normalization Difference Vegetation index).The approach was used by the formula of the channel comparison as follows:

$$NDVI = \frac{\text{Channel Image II} - \text{Channel Image I}}{\text{Channel Image II} + \text{Channel Image I}}$$

The area calculation paid attention to two factors, that is the measurement pixel and the spatial resolution its image.

The calculation of the area could be counted in each kind of the land covering interpretation, the use of the land, the form of the land, zonasi vegetation.

Delineation of each classification was counted based on the number of pixel and the spatial value of the resolution image (see the **Map 2. Normalization Difference Vegetation Index (NDVI) in Year 1990 Dam Koto Panjang and Surroundings, Map 3. Normalization Difference Vegetation Index (NDVI) in Year 2000 Dam Kotopanjang and Surroundings).**

The data processing stage and the analysis for the potential prediction of forest each zonasi was done as follows:

- Make the value of vegetation index used the normal value formula of vegetation (NDVI) from Pseudo Display image that was corrected. It means that this stage was carried out after doing all the corrections of the image (radiometric and geometric).
- Find the density of vegetation using virtual data set to make zonasi vegetation especially forest vegetation.
- Count the area of each zonasi forest vegetation used calculate statistic.

1.4. Quantitative Interpretation

The spatial Pattern of the distribution from construction elements, hills and valley, produced physical types of the form, as rippling, bumpy or wavy.

Manifestation Patterns on earth surface that wavy could be distinguished according to "level of steepness" from the side or the route or the field the adjacent surface of the earth, as well as according to the high difference between the mountains peak/the hill and the point of valley foundation.

In connection with this matter, then the quantitative interpretation in this study covered the activities:

- Steepness level of the slope showed the repetition manifestation elements of the construction hills and valley, so as in this interpretation earth surface part pointed out the impression of wavy

- Height Territory showed the repetition manifestation elements of the construction hills and the valley. The classifications of height difference referred to the table of classification of relief that was put forward by Desaunettes (1979:6)
- The digitize Process, was done to inputting the spatial data, this process could be carried out through the table digitizer or through scanning with scanner.
- Editing was done to remove the mistake, changed and refined feature from the data that has in input. The mistake that was carried out by humankind (human error) was something that appropriate, so SIG software provided the process editing from each object that experienced this mistake
- Co-ordinate Transformation, especially for the spatial data, must be done by rectification of the maps projection system, so as the maps that was produced will be in accordance with the national standard.
- Topology Development was a process of obtaining information that was linked with the scope aspect of an object.
- Data tagging, this process was the development of the code as the marking from each object in SIG. Coding in this stage was needed so that the spatial data and the tabular data could have one connector (key) for the link process the tabular data (link database).The link process of database, was done for the merging of attribute data from each object with the related spatial data inside.
- Maps join was the merging from each maps that has digitized separately became a unity.
- Clipping or cut off the spatial digital data became a spatial data that included a certain territory.
- Finally was quality control, the process of the inspection whether output from the beforehand process has filled the standard.

1. 5. Tools and Materials

The data and materials that were used in this study were the remote sensing data, the supporting spatial data and the tabular data about Koto Panjang region's dam.

The remote sensing data that was used in this study was: for the study territory of Koto Panjang's dam included in the Image of Landsat-TM with Path/Row 127/060 recorded in April 2000 and 1990.

The image data Landsat used in this study was given priority to the data that the coverage of the cloud was very little of so as the study territory could be maximally analyzed. The supporting spatial data that used in this study was:

- Height territory maps
- Geology maps
- Land category maps

- Land purpose maps
- Land system maps
- Slope maps
- Accessibility / network maps
- River access maps
- Administration maps
- Public layout planning maps

Further data tabular that was used in this study was:

- Rainfall data
- Amdal data of Koto Panjang's dam
- Distribution area of the community's efforts data
- Primary Data took from the results of survey
- Interview data (questioner)

The material and equipment that was used covered: hardware and software for the processing and the analysis of the remote sensing data, and the geographical analysis of the information system:

- Computer for processing, analyze, and writing the report.
- ERDAS Software, ER-MAPSPER, Arc/Info, Arc/View; Microsoft Office.
- CD-ROOM for the storage of the remote sensing data; Diskette to save the temporary results of vector data and raster data.
- Scanning, for the conversion of the supporting data to digital form.
- Color Printer, to print the results of classification and reports.
- Materials needed to printer: ink, papers, and equipment.
- GPS and the Compass were needed in the survey of the location.

2. THE DAM'S LANDSCAPE' CONDITION OF THE STUDY TERRITORY

2.1. Physiographic of the Study Territory

The study territory was located in the West Sumatra border and the Province of Riau, covered 10 villages that was moved for the development of PLTA-KP. The location of the study, based on the geographical co-ordinate scope was located between 0° 06' 45" – 0° 28' 15" North Latitude to 100° 34' 45"- 100° 56' 00" West Longitudinal that the width as big as 221.619,73 Ha (WALHI, 2004).

These data was received based on the method of computerization (the scope of the study territory), whereas in the JBIC report on the area of the flooded territory reached 124

km².The flooded region of the water generally is river terraces and the fertile territory for agriculture as well as the centre of the settlement of the inhabitants. The flooded territory spread beginning with around the Muara Takus Temple afterwards narrowed around the Alai lama Cape Village and widened again to the narrow river valleys after through the Muara Mahat. The region that remained was based on the interpretation of the image Landsat TM the recorder on April 25, 2000 the width reached 11.718.92 Ha (WALHI, 2004).

Based on the distribution of physiographic Van Bemmelen (1970), the study territory includes the zone of front line physiographic with rock mass that was covered. The geographical scope began from Umbilin, next east the Singkarak Lake that split to the side of outside (wedges out) between the mountainous Rank of Lisun – Kuantan – Lalo and the Schiefer Line.

South-east side of the wedge from the front line zone disappeared because was closed by Tertiary sediments from Basin East Sumatra (the East-Sumatran basin) (Van Bemmelen, 1970).The movements took the form of the fault rose and the fault descended formed the region surface of the earth Koto Panjang like Hill, Plain, Valley and River Terrace. Like Suligi Mountain (600 m above the sea level), Percaminan Hill (350 m above the sea level), Payung Sari Hill (550 m above the sea level), Ebony Mountain (600 m above the sea level), the Girl's Hill (1330 m above the sea level), the Itam Stone Hill (1380 m above the sea level), Sialang hills (1155 m above the sea level), Long hills (560 m above the sea level), hills of Dew Wood (550 m above the sea level) and Bungkuk Mountain (450 m above the sea level). On the Other side, the vertical movement was accompanied with the tropical condition for the climate that resulted in the surface of the region Koto Panjang experienced processes of the weathering and the erosion took place with the strong intensity, so as to be formed river valleys, the river terrace and the flood plain (Verstappen, 1973).

The block mountain ranges on the north side from Umbilin, as the mountainous Rank of Suligi – Lipat Kain and Lisun – Kuantan – Lalo was classed by the Van Bemmelen as the Physiographic zone II from Sumatran Island.

The region Koto Panjang was located in the east flank of Line's mountains that was formed because of the geanticlinal arch incident in the period of Plio-Plistosen. The formation of Block's mountain took place at geological period the Tertiary time, afterwards formed the grip for volcanoes that were formed in the Quarter time. Volcanic materials as results of the eruption covered the pre-volcanic surface of the earth that lays in south the Sumatran Island.

Simultaneously with the shaping process, took place also a sedimentation process and folding process following to geosynclines that lies in the east side of Sumatra Island (Verstappen, 1973).

Region surface of earth Koto Panjang was as the results of interaction between structural factors and climatologists that took place continually. The impact of the important earth crust movements that has taken place for the geological period in recent times and that takes place

now, was matched by the strength and fast rate of the degradation processes and aggradations that was caused by tropical climate humid in the region of Koto Panjang. The structural factor was determined by facts that the region Koto Panjang formed a part of hills, Plateau as well as system of mountains, plain, river embankment, river terrace, the alluvial valley and the swamp that stretched the west direction sea – south-east. These facts caused the region Koto Panjang had the form that lie alongside longitudinal, with sides or steep mountains of hills.

Beside the endogen process (the inside style), the exogenous process (the outside style) also played the important role in the development of the earth surface landscape in the Region Koto Panjang, especially the chemical process of the weathering that took place strong and fast was caused by the abundance and the height concentration of various chemical compounds of acid such as carbonic acid, humic acid, etc that most protracted during was carried by the water. Especially in the earth surface parts that were under the cover of forest vegetation, the level of air humidity, eventually accelerate the chemical process of the change in the composition of rock or sped up the alteration process of rock (Verstappen, 1973).

The fast-rated rock alteration and the process of land formation, was matched by the process of erosion that was marked by the tight of the river current, that once more was caused by the height of the rainfall. The fast rate of the degradation also caused the height of concentration for the content of the gravel, silt, sandstone and was as fast as that also happened to the development of terrace, river embankment and plain. Therefore the rotten material continued to leave or leave gravel, sand or content of clay and mud particles.

2.2. Litologi

The study territory (Koto Panjang and surrounding area) was formed by the process of the Sedimentation that was compiled over materials:

1) The sediment rock that was shaped from the Paleozoic period to Quarter. Characteristic of the rock was compiled on the igneous rock (metamorphic) and grey wacke, the gravel, sand, the conglomerate, and tuff (coal sediment and lignite).
2) The plutonic rock, characteristically the granite rock that was shaped in the Paleozoic period. On part of this rock fracture contained tin and diamond, and assumed contained uranium.
3) The piroclastics rock, that was shaped in the Quarter period (Neogene) and was compiled on tuff volcanic breccia rock, andesit, and basalt.

The geological condition in PLTA KP (location of the Dam) included in the superficial formation that was compiled in the Mesozoic period.

The superficial formation consisted of sand sediment and gravel that came from tuff rock, afterwards formed bedrock, sediment of the river terrace, river sediment, material talus and the upper layer of the land (top soil).

At the north side of the study territory spread long hills and steeply above metamorphic rocks, afterwards this rock experienced the erosion materially that dominant took the form of quartz and the sandstone.

At the north side, especially far north side lays a sediment side hills and the other side exist in sub water catchment Tiup Gadang. Whereas between Tandum and Kotoranah side along to south spread out evenly a sediment plain over the bumpy to curvy territory. This plain borders a side hills lay on asymmetries sediment rock. Evidences that still can be seen are plateau and part of mountain system i.e. in sub water catchment Arau, Gulamo, and Mahat. This area create asymmetries side hills sediment and had a wide slit. The materials of slit was washed away into the river, the materials contain of quartz, sand, mud, and conglomerate. In the big strip river or meander with a wide dike is a alluvium area. Today the condition is flooded because the water flow is stop around Rantau Berangin for the shake of PLTA-KP project. (see **Map 4. Land System Dam Koto Panjang and Surroundings and Map 5. Land Use Dam Koto Panjang and Surroundings).**

2.3. Climate and Rainfall

Extreme rainfall disparity determines earth surface, it takes such a relatively long period (geological scale). Rain falls on plain areas and in that way, it creates river/stream. Any stream indicates plain friction and results in scrapes, and material erosion as well. This situation is called denudation or erosion. Erosion processes are streams, trenches and deep slopes. They determine the structure of earth surface.

River stream system and river stream structure in Koto Panjang are determined by climate elements such as rainfall and season. Sumatra is identical with high density of rainfall whose distribution is flat upon the year. However, there are no clear limits between rainy season and dry season. Rain distribution upon the west side of Barisan hill is dense enough; on the other hand, it is lower on the east of the hill. According to Oldeman classification, climate of Koto Panjang is type C. it gives the area with continuous rainy period for 5 to 6 months and 3 to 4 dry months. In rainy period, rate of rainfall is higher than 200 mm/month, whereas dry period is identical with rate of rainfall below 100 mm/month.

The climate of Koto Panjang and surrounds are rainy tropical whose lowest rate of rainfall is 3.250 mm/year and it goes to 4.000 mm/year. The first highest rate falls in April-May and the second one is in October-November, the lowest one occurs in February and the second one in June. In April and October, rain falls on the whole day, it reaches 200 mm/month. Therefore, in Oldeman classification, the areas are classified in type C 1.

The higher the place, the higher the rainfall rate. Hydroelectricity of Koto Panjang is surrounded by hills and mountains: Suligi Mountain (600 m above the sea level), Percaminan Hill (350 m above the sea level), Payung Sari Hill (550 m above the sea level) Kayu Arang Mountain

(600m above the sea level), Gadis Hill (1330 m above the sea level), Bukit Batu Itam Hill (1380 m above the sea level), Sialang Hill (1155 m above the sea level), Panjang Hill (560 m above the sea level), Kayu Embun Hill (550 m above the sea level), and Bungkuk Hill (450 m above the sea level), therefore rainfall rate in those areas is higher the lower areas. Moreover, slope structures that challenge and catch the air makes it higher.

The north side of the observed areas are called "thermal equator". It means that there is air movement from the higher density to the lower one. Temperature of the areas moves the air to the higher place i.e. the areas. As a result, the temperature decreases, the movement of the air passes thermal equator in ocean, therefore, it catches moistures. Temperature decrease and moisture falls as rain. It is called "convection rain." Finally, maximum rainfall occurs on May and October.

2.4. Hydrology

Relief of an area is observed through its river condition. River condition consists of length, crossing and length wise planes, stream patterns, stream density, type and structure of sedimentation. Thus, river is an important part to form landscape (Pujiharto, 1980)

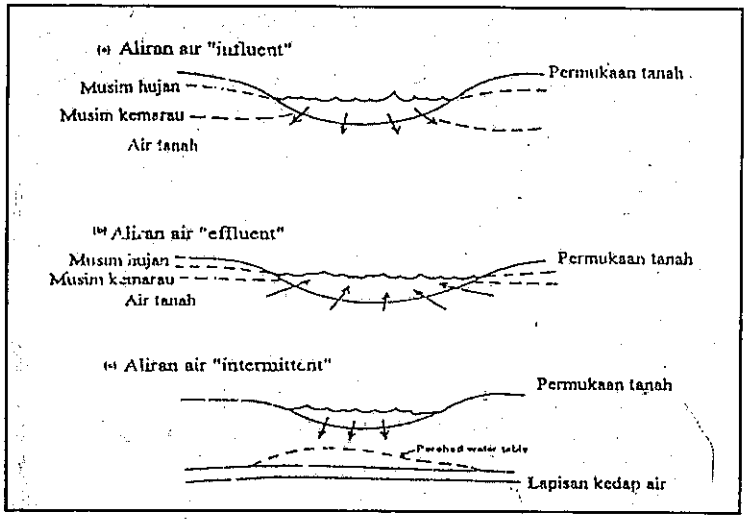
Next, there are three important river activities. Those are erosion, transportation and sedimentation. Erosion is any activities of scraping landscape by stream. It forms gullies or hills which take thousand years. During the years, river is deepened, widened and lengthened. Transportation means moving scraped materials. Sedimentation is a process of material gathering as a result of erosion and transportation in lower places (Sampurno, 1976).

Furthermore, flood often strikes Riau. The area consists of swamps, flood areas, and hilly areas. There are many rivers: Rokan, Siak, Kampar, and Inderagiri rivers. The upper courses of Kampar Kanan river are located in Amas Mountain (2,271m above the sea level), Hijau Mountain (2,274m above the sea level I). It lies upon a mountainous zone which is bent by a fracture (the fracture lies on north west and south east). It lies upon orogeny of depression. It joins Batang Mahat and Batang Kampar Kanan rivers and called Kampar water catchment. The new river lies to the east and crosses wide up land. In addition, Kampar water catchment width is 21,530 km2, it includes Kampar Kanan and Kampar Kiri (JBIC, 2002).

Continuous and regular scraping, transportation, and sedimentation processes in Kampar water catchment changes landscape becomes plain. The process is called geological turbine or turbine.

Small rivers in upper courses form dense dendritically stream types whose gradients are steep. In mountainous areas, their stream types are parallel and meander. In hills and plain areas, they are meander. The river crosses dike location (see **Map 6. Water Catchment Area Dam Koto Panjang and Surroundings**).

It is not easy to classify Koto Panjang in water catchment due to unpredictable stream gradient occurrences to stimulate waterfall. In geology, stream types include: influent, effluent, and intermittent (**Picture 1. Geological classification on river stream pattern**). Influent is stream provides ground water. It occurs during the whole year. Therefore, it is also called annual stream or perennial stream. Generally, cut stream or intermittent is found after hard rain occurs. It is perched water table. Moreover, those three types are found on the observed areas. But, the most dominant is stream which appears from ground water stream (effluent). Combinations of the streams are as follows:



Picture 1. Geological classification on river stream pattern (Asdak, 1995:20)

Effluent is found on main rivers, and rivers on upper courses which reach big rivers such as Batang Kampar Kanan and Batang Mahat rivers. In the project of constructing hydroelectricity of Koto Panjang dike, the two rivers are the main source of electricity. Furthermore, there are small rivers of 37 sub water catchments (see **Map 6. Water Catchment Area Dam Koto Panjang and Surroundings**) as follows:

1) Rivers come from north west: 3 sub water catchments, including: Tiup Gadang, Takus, and Kinawaitaras rivers.
2) Rivers come from north: 10 sub water catchment, including Mantasan, Kototengah, Lubukagung, Limbago, Mangai, Sigamai, Angsa, Pukatan rivers, etc; rivers whose streams are classified in short stream.
3) Rivers come from west and south: 24 sub water catchments (see water catchment map). Their characteristics are varied.

However, there are three other sub water catchments whose estuary is not the dike, but Batang Kampar Kanan and Batang Mahat rivers. Since this description concerns with rivers directly influencing the dike, they are not discussed here.

2.4.1. Stream pattern

River is significant factor to develop earth's surface as it conducts three major activities: scraping, transportation and sedimentation. The activities results on aggradations, and degradations. Furthermore, aggradations are sedimentations, whereas degradations are formed by erosions.

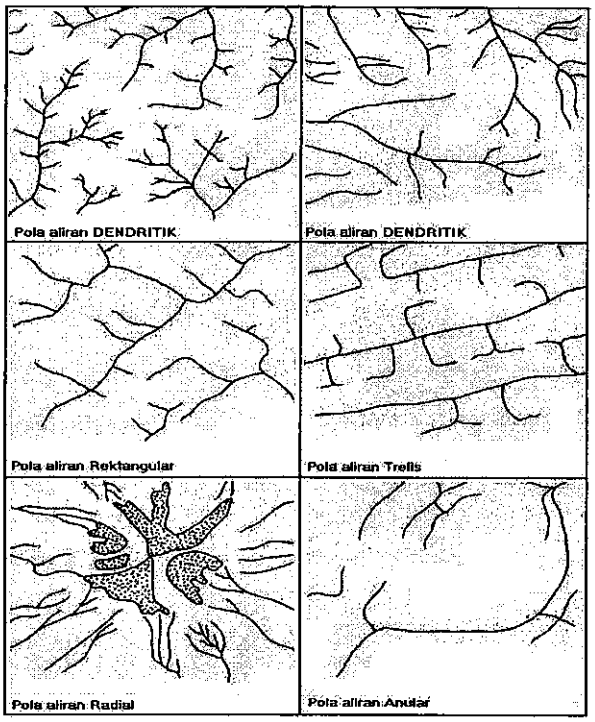
Stream patterns are determined by constructional activities, i.e., volcanic, crinkles, fracture, fault, or orogenies. Rock structures also determine them (Sampurno, 1976).

Stream patterns are closely related with geological structures. Hence stream patterns are indicators of area's geological structures. Rivers' characteristics developments in hydroelectricity of Koto Panjang are geomorphic. Their periods change and vary from age, mature and green. Reliefs of sub water catchments Pubala, Koto Tengah, Badin Angin, Lubuk Agung, Angsa, Rambutan, etc, are high and sheer. Furthermore, the characteristics determine the ability to scrape stream:

1) Hilly areas with sheer landscape over tufa sediment in 7 sub water catchments: Badinangin, Biliktanjung, Kiawai, Mahat, Permanisan, Pubala, and Takus of 2,822.37 Ha in width or 2.61 % of sub water catchment's total width. They consist of sandy stones, muddy stones, granite, and tufa; they contain salt. Landscape of sub water catchment Mahat is wider than other sub water catchment, it is 1,342.67 Ha or 1.24% of total observed sub water catchment's width.
2) Hilly areas lay upon sheer metamorphous stones (coagulated stones). The stones include: quartz, sandy, shale, schist, and phylist spread over 14 sub water catchments of Arau, Batu Basurat, Binawang, Bual, Buyuh, Gulamo, Marang, Patut, Pukatan Saluran, Sigamai, Silantung, Singgam and Tiupgadang. Their width is 9,526.73 ha or 8.81% of the total sub water catchments width.
3) Hilly areas upon basalt volcanic layer whose slope is sheer. They reach 3 sub water catchments: Binawang, Tangko and Tiugadang. The reach is 210.25 Ha or 0.19% of sub water catchments' total width. However, sub water catchment Tangko's width is the major part of the width. It is 202.49 Ha or 0.18% of total width. Volcanic basalt stone characteristics develops this area are basalt, andesit, granite, and diorite.
4) Hilly areas whose back extends upon irregular sediment structures and divided by rivers. Distribution off landscape on the observed areas dominates the total width of sub water catchments, except for 8 sub water catchments: Kulang, Manggung, Patut, Pubala, Pulai, Saluran, and Singkalikur. The other 29 sub water catchments are 33,482.05 Ha or 30.

93% of total sub water catchments' width. Stone characteristics develop it are conglomerate, sandy, muddy and shale. Widest distribution is on sub water catchment Gulamo which reaches almost a half of the area of 10,078.68 Ha or 9.31%, followed by sub water catchment Mahat of 6,414.05 Ha or 5.93 % of total width.

5) Linier hill system which is developed by sediment and extends with sheer slopes. The landscape is found on 9 sub water catchments: Gosong, Gulamo, Kulang, Mahat, Manggung, Manggilang, Singgam, Sipanai and Tasam. Their width is 6,862. 69 Ha or 6.34 % of sub water catchments' width. The characteristics of the stones are: sandy, muddy, and shale. The widest sub water catchments is Mahat of 2,923.38 hectares or 2.7 % of total width, and sub water catcment.97 Ha or 2.34%.
6) Questa or kuesta develops an area that is similar to dome. Its slope is fair and developed by sandy stones. Hilly small landscapes are found on 4 sub water catchments i.e. Batubasurat, Gulamo, Limbago, aand Lubukagung. The characteristic of the sandy sediment are conglomerate, sandy, muddy and shale.



Picture 2. River Stream Pattern (Lobeck, 1939).

2.4.2. River stream aspect

Some aspects discussed in this article are the length of river stream, Water Catchments Area, pattern of river stream and the density of river stream. To count the river stream density index is used Linsley's (1949) formula, that is:

$$D = \frac{I}{A}$$

D = River Stream Density Index

I and A = the sum of length and area of WCA (m and Ha)

The density index of River stream shows how many watercourses are in a water catchment. Horton (1945 in Patton, 1990: 53) stated that river stream density is a functional widening process of infiltration capacity and land resistance to erosion. Drainage area of a river is an area where precipitation flows. The characteristic of water catchment can be described both qualitatively and quantitatively. Horton (1932 as quoted by Patton, 1990: 51) said some factors affect river's characteristic, such as:

1) Morphometry of river's network; it is a quantitative form of morphology characteristic of a river's network, which includes river density index, grade of river branching, and the declivity of water catchment.
2) Land characteristic; land characteristic of water catchment relates with its capacity of infiltration.
3) Lithology condition; rock characteristic influences to erosion process. Permeable rocks have higher capacity of infiltration so it makes flood less possible than an area that its rock is impermeable.
4) Vegetation condition; vegetation condition affects erosion process, infiltration, and surface resistance.
5) Meteorology and climate condition; climate affects rainfall rate.

If a river has a high-density index, it means that the distance of water flow is shorter, then it could be concluded that a river with high density has greater possibility of flood disaster as an effect of the higher surface run off than infiltration to be underground flow. The highest density index of river network is 6.53 m/ha, which is found at sub water catchment Tangko, this area is also drained by Kampar Kanan's stream and recently most of the area are drowned by PLTA – KP reservoir. The lowest density index is found at sub water catchment Koto Tengah, it is 30.53 m/Ha. This stream passes rocks with high permeability and strong resistance, so less deposit carried away. Averagely river's network density studied is 18.85 m/Ha, it means surface run off, which is not infiltrated to land, is quiet high. It is caused by land resistance in this area cannot retain water contents, so it becomes surface run off, which sweeps materials away (erosion process) or underground flow into river.

Based on automatic – computerized analyses to count the length of water catchments area studied, identifies that the longest water catchments area is found at sub water catchment Mahat (421,548.87 m or 18.57 m/hectare) and sub water catchment Gulamo (419,244.12 m or 20.94 m/hectare). Some areas have longer water catchment, such as Tiup Gadang (176,071.9 m

or 16.2 m/hectare), Takus (134,606.72 m or 18.29 m/hectare) and Parmanisan (120,610.97 m or 23.31 m/hectare). At those sub water catchment can be indicated that the sub water catchments are susceptible of erosion, beside that the dominant rock in these areas are sedimentary rocks, which consists of sandy rock, gravel, and mud (see **Table I.1. The amount of sub water catchment Koto Panjang Reservoir** and **Map 6. Water Catchment Area Dam Koto Panjang and Surroundings**).

Table I.1. The amount of sub water catchment Koto Panjang Reservoir

No	Sub water catchment	Area of water catchment (Hectare)	Length of River (m)	The density (m/hectare)	Rivers Pattern
1.	Takus	7,3659.38	134,606.72	18.29	Semi dendritik
2.	Tiup Gadang	10,866.57	176,071.90	16.20	Parallel of rough texture
3.	Kinawaitaras	2,679.21	56,483.19	21.08	Semi dendritik
4.	Bandin Angin	1,282.71	37,297.11	29.07	Semi dendritik
5.	Pubala	255.84	9,361.31	36.58	Semi dendritik
6.	Bilik Tanjung	504.29	9,046.75	17.93	Parallel
7.	Permanisan	5,173.56	120,610.97	23.31	Dendritik
8.	Tangko	3,372.10	22,033.84	6.53	Meander
9.	Mantasan	9,112.24	21,00.45	23.53	Semi dendritik
10.	Binawang	2,501.20	27,105.45	10.84	Meander
11.	Koto Tengah	764.13	23,328.30	30.53	Semi Parallel
12.	Lubuk Tengah	689.53	17,985.71	26.08	Semi Parallel
13.	Batu Basurat	1,960.95	26,111.70	13.32	Semi Parallel
14.	Limbago	528.14	12,838.73	24.31	Sentripetal
15.	Pukatan	949.22	18,831.19	19.84	Semi dendritik
16.	Mangai	1,478.87	33,178.67	22.43	Semi dendritik
17.	Sigamai	1,371.64	24,936.98	18.18	Semi dendritik
18.	Bual/Batu Angk.	1,364.45	23,099.02	16.93	Semi Parallel
19.	Angsa	215.09	6,075.14	28.24	Parallel
20.	Arau	4,962.62	97,692.92	19.68	Trellis with middle texture
21.	Buyuh	2,387.61	54,971.07	23.02	Complex
22.	Patut	2,068.42	39,959.24	19.32	Trellis with rough texture
23.	Saluran	1,137.34	21,984.09	19.33	Trellis with rough texture
24.	Silantung	742.75	16,197.75	21.81	Parallel
25.	Marang	1,747.72	35,399.97	20.25	Pinate
26.	Singgam	1,532.30	24,772.83	16.17	Parallel
27.	Rambutan	271.06	7,081.21	26.12	Semi Parallel
28.	Singkalikur	266.75	6,150.01	23.05	Parallel
29.	Kulang	677.04	9,513.61	14.05	Sentripetal
30.	Pulai	170.50	4,248.48	24.91	Parallel
31.	Manggung	1,334.31	23,098.72	17.31	Semi dendritik
32.	Sipanai	1,038.29	17,430.76	16.79	Rectangular
33.	Gosong	1,548.71	23,526.84	14,80	Parallel
34.	Gulamo	20,024.80	419,244.12	20.94	Dendritik

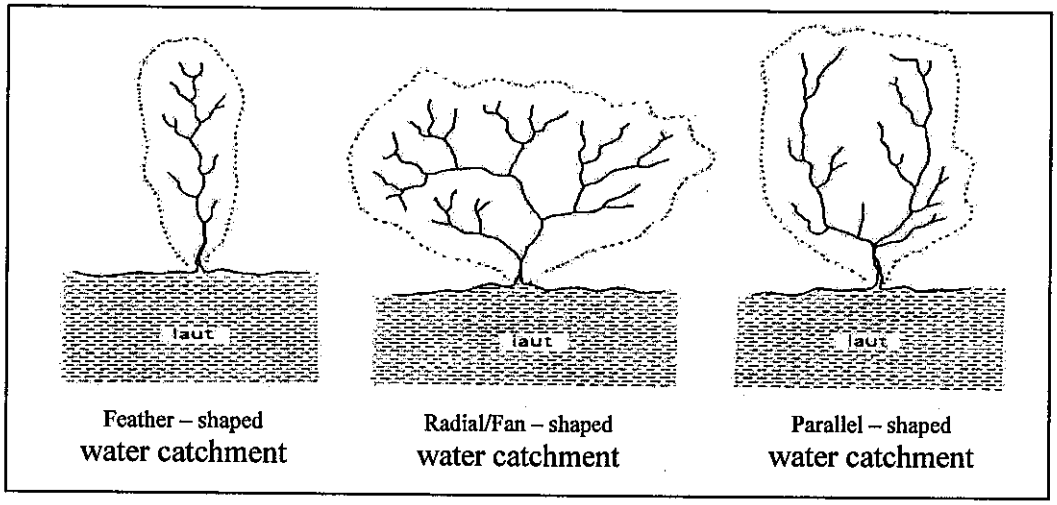
35.	Tasam	1,056.37	12,488.03	11.82	Parallel
36.	Mahat	22,700.14	421,548.87	18.57	Complex
37.	Manggilang	307.03	4,843.99	15.77	Semi dendritik
Total		**108,243.86**	**2,040,155.48**	**18.85**	

Source: Calculated from WALHI's data, 2004

Geographically the studied area is 221,619,73 hectare, and it is divided into 37 sub water catchment which each of it is 108,243,86 hectare (WALHI, 2004). If in each sub water catchment, the density is 18.85%. Mostly the land consists of sandy sediment, gravel, and mud. It also has high rainfall rate, which will make high erosion process too. Part of materials are carried by the stream and other enter to PLTA – KP reservoir.

Generally, there are four types of water catchments area, such as:

1) Feather – shape water catchment: this kind of water catchment has a low flood debit because the difference of arrival time of flood at river's branches to main river.
2) Radial – shape water catchment: its shape looks like a fan or a circle. Generally, this water catchment has high flood debit at confluent area.
3) Parallel – shape water catchment: this water catchment has two types of river stream that unite at confluent area in each downstream.
4) Complex – shape water catchment; it is a combination of some sub water catchment.



Picture 3. Types of water catchments area
(Sosrodarsono, S and Takeda, 1983;169)

2.5. The Place Altitude

Altitude factor is intended to differ the shape of earth's surface after influenced by water activity (rainfall, surface run off, and river stream) that changes the structure of earth's surface. The altitude affects weather condition, moreover in tropical area, then the weather will affect climate and corrosion process also shape of earth's surface. Altitude in this study is divided into 5

classes (**Map 7. Region of Elevation Dam Koto Panjang and Surroundings**), they are: the altitude of 0 - 100 m above the sea level, the altitude of 100 - 250 m above the sea level, the altitude of 250 - 500 m above the sea level, the altitude of 500 - 750 m above the sea level, the altitude of more than 750 m above the sea level

2.5.1. The Altitude of 0 – 100 m above the sea level

The studied area is about 21,220.95 hectare or 19.45% of total of sub water catchment. It is classified again based on sub water catchment division. The table shows that at altitude of 0 – 100 m are distributed at sub water catchment Tiup Gadang (2.53%) and sub water catchment Tangko (2.4%). In sub water catchment Tiup Gadang, it is located at northwest beside ridge directs to Tandun. While, in sub water catchment Tangko, it is located closely to southern area of Tiup Gadang. Most area of both sub water catchments are drowned by PLTA – KP reservoir. Wide area with 0 – 100 m height also find at sub water catchment Gulamo (2.16%) and locates at the middle area and southwestern area of sub water catchment Takus (1.82), very close to Tiup Gadang. Topography of this location shows many types of small hill and sedimentary land, and the peak is circle above ultra alkali rocks.

The altitude of 0 – 100 m are mostly found at sub water catchment Mantasan, Koto Tengah, Lubuk Agung, Batu Basurat and Limbago. It is clearly seen from topographical vision, which shows river dike form or flat riverbank.

2.5.2. The altitude of 100 – 250 m above the sea level

The area studied at this altitude is 70,152.98 hectares or 64.32% of total area. This height dominates at sub water catchment Gulamo and Mahat, averagely 13.46%, and these are separated by sedimentary ridge directs to southwest – southeast. Usually this altitude is spread out at theentire area of sub water catchment, by forming small hills and deep river's valley. At southeast area, this height is influenced by long crease topography, so its shape is a steeply ridge above metamorphic rocks. In a smaller area, such as sub – water catchment Pulai, this altitude also dominates (0.15%) and usually at upper course of river.

2.5.3. The altitude of 250 – 500 m above the sea level

The distribution of this altitude forms various fields and the dominating shape is steeply hill with sheer valleys. In sub water catchment Mahat, this height distribution is dominating, they are 6,573.61 hectares or 6.03% and the summit is on Bukit Lincir (450 m asl). At some places, such as sub water catchment Gulamo, Mahat, Sipanai, Marang, Manggung, Gosong, and Permanisan, this height forms steeply slope. The area of this height can be classified as follow:

1) At sub water catchment Takus, Tangko, Kinawai, Pubala, Bilik Tanjung, Mantasan, Binawang, Koto Tengah, Batu Basuat, Lubuk Agung, Limbago, Pukatan, and Nangilan, there are not this altitude anymore.
2) At sub water catchment Badinagin, Mangai, Arau, Bual, Sigamai, Angsa, Buyuh, Patut, Saluran, Silantung, Singgam, Rambutan, Singkalikur, and Pulai, the average height of these places are under 500 meters. Totally the height area located in those sub WCA is 3,026.87 hectares or 2.77% of entire area.

2.5.4. The Altitude of 500 – 750 m above the sea level

The 500 – 750 m asl height is only found in sub water catchment Permanisan, Gulamo, Kulang, Sipanai, Gosong, Manggung, Tasam and Mahat. The area is about 1,161.3 hectares or 1.48% of entire area studied. The area's appearances are narrow riverbank with steeply cliff pattern, and at certain place such as sub water catchment Mahat, the pattern has big incision and it is in irregular form (see **Map 7. Region of Elevation Dam Koto Panjang and Surroundings** and **Table I.1. The amount of sub water catchment Koto Panjang Reservoir**).

2.5.5. The Altitude of more than 750 m above the sea level

The altitude at this height is only found at sub water catchment Mahat, it is 193.65 hectares or 0.18% of entire area studied. The summit is on Sarang Layang – Layang Mountain (868 m asl), which is categorized as sedimentary ridge with wide incision.

2.6. The Slope's Declivity

The field declivity or slope becomes a measurement of proper activity, which affects the sustainability of human bussiness. The slope is a measurement of a physical unit, especially on width element, distribution, and the declivity pattern of earth's surface. Declivity can be associated based on the aspect of pattern and distribution. The slope with various class and stretching pattern can be associated with the form of folded area. Various slope and the pattern forms concentric circle can be associated with mountainous land or volcanoes. While, monotonous slope and it is widely distributed can be associated with plainland or flat. If the pattern is stretch and includes steeply declivity (>40%), it is associated as slope form, while low level declivity (0%) is a form of floodplain or seashore.

The declivity of land is an important parameter in a water catchments area. Rising relief and steeply slope causes times needed to collect the water is shorter. Beside that it effects to flood, land's declivity affects to erosion process too. The more steeply a slope of water catchment, will increase surface run off than infiltration capasity. It causes higher possibility of erosion. Usually in this case, the first river order is located at steeply slope and the next order is on flatter slope.

In Koto Panjang study, the declivity of slope used consists of seven classes (see slope map), those are: the declivity level 0 - 2%, the declivity level 2 - 8%, the declivity level 8 - 15%, the declivity level 15 - 25%, the declivity level 25 - 30%, the declivity level 30 - 40%, the declivity level of more than 40%.

2.6.1. The Declivity level 0 – 2%

Distribution of declivity level 0 – 2% in area studied is 15,125.4 hectares or 13.87%. Class of this slope based on the form appears and is associated that the field is wavy land. Based on the water catchment distribution, the widest area is found at sub WCA Tiup Gawang (2.43%), Takus (2.09%), Tangko (1.46%), Mahat (1.25%), Gulamo (1.15%), and Binawang (1.09%). The shapes of wavy land are floodplain, riverbank, and sedimentary land, which make small groups. The declivity level 0 – 2% has a limited area and distributed on groups form that are restricted by hills or wavy land. As seen at the map, that area of declivity level 0 – 2% is used to settlements and are located around riverside.

2.6.2. The Declivity level 2 – 8%

This area is distributed at 35,800.01 hectares or 23.82 % of entire area. Slope with declivity level 2 – 8% can be associated that the appearance of its geographical type shows wavy surface to small hills. The wide distribution is found at sub water catchment Gulamo (5.45%). This area at 1990 was seen as lowland forest. However at 2000, has been changed into rubber and oil palm plantation, also dry field rice and open land. Most of sub water catchment Mahat area, 5.22% of the entire, has changed into dry field land. It also happens to other sub water catchments. Slope with declivity level 2 – 8% is already replaced by big scale of dry field and plantation area.

2.6.3. The Declivity level 8 – 15%

The area of this slope is 23,435.77 hectares or 21.49% of entire. It is associated as landscape that shows steepl wavy land up to hilly. Averagely slope area in each sub water catchment is 244.87 hectares or 0.22%, except in sub WCA Gulamo (5.79%), Tiup Gadang (1.57%), Permanisan (1.77%) and Mahat (4.95%). These areas are also already used maximally, by opening the rest of lowland forest in this slope for farmland or plantation. Nevertheless, on a wide landscape, it is seen plantation or open land shown by regular pattern (see the map of cover land at 2000).

2.6.4. The Declivity level 15 – 25%

The similar appearance of landscape in every sub water catchment is shown by scope and pattern of slope distribution. Except in sub water catchment Gulamo (3.65%), Arau (1.19%),

and Mahat (4.17%), declivity distribution occurs in hill's feet and locates wide area. Some major rivers direct to reservoir, their upper courses come from these slope, such as sub water catchment at the middle and sub water catchment, which enters Mahat's tributary. Physical condition of the surface has been eroded and deposited at basin area located on hill's foot. Materials washed away by river's stream such are sand and mud, part of it forms river's base and the other forms riverdike or riverbank.

Limited sub water catchments' area such as Permanisan, Pubala, Mantasan, Koto Tengah, Lubuk Agung, Limbago, Pukatan, Angsa, Silantung, Rambutan, Singkalikur, Kulang, Pulai, and Manggilang, have stream with high erode power. It caused by the short stream and its land characteristic is very axis, wide fluctuation of temperature that causes corrosion process, and steeply slope that makes materials erosion and drifting happen.

2.6.5. The Declivity level 25 – 30%

The area with declivity level 25 – 30% means that the location is very steep and shows high declivity and fast acceleration of river stream. In studied area, there are 37 sub water catchments as analyses unit with various characteristic, which shows various physical condition in its area. One of the variables is slope's declivity, which is closely related to the level of declivity, and limiting factor which can be drawn, and acceleration of water stream crossing the area. The feature of declivity level 25 – 30% can be associated with steeply slope and hilly area. In studied area scopes 5,110.60 hectares or 4.68% and divide into 3 classes, those are:

1) The distribution of declivity level 25 – 30% with average scope 0.04% locates in sub water catchments: Tangko, Mangai, Bual, Sigamai, Angsa, Silantung, Singgam, Rambutan, Singkalikur, Kulang, Pulai, Gosong, Marang and Manggilang. Generally, the scope of those sub water catchments is narrow and has short river stream, while the distribution locates in northern, southeastern, and southern of PLTA – KP reservoir.
2) The distribution of declivity level 25 – 30% with average scope 0.13% locates in sub water catchments Permanisan, Tiup Gadang, Buyuh, Patut, Saluran, Sipanai, Manggung and Tasam. Almost in every sub water catchment shows very high steep level and deep valleys, except sub water catchment Tiup Gadang.
3) The distribution of declivity level 25 – 30% with average scope 0.91% locates at sub water catchments Gulamo, Arau, and Mahat. In sub water catchment Arau, formed slopes is influenced by fold structure or corroded fault, whereas Gulamo shows small hills with steeply slope separated by river valley. In sub water catchment Mahat, slope of hills and mountain has irregular shape and spread out to many directions.

2.6.6. The Declivity level 30 – 40%

The area, which its declivity is 30 – 40%, is an area that is difficult to be used. As seen on the map of covering land at 2000, it shows mosaics of forest vegetation but its surrounding has been carried on plantation or others. This location associated as steeply ridege or mountain with its feet direct to river valley, as clearly seen at sub water catchment Gulamo, Arau, and Mahat. The appearance of slope's direction of sub water catchment Mahat is very complex, but Arau directs to northeast – southwest, while Gulamo's direction is northwest – southeast. The directions are determined by geological process, and then it influences stream pattern in each sub water catchment.

Already identified that scope of declivity level 30 – 40% located in area studied is 6,927.45 hectares or 6.35%. The distribution of the slope is almost equal in every sub water catchment, except sub water catchment Takus, Kinawai, Pubala, Biliktanjung, Koto Tengah and Lubuk Agung. Generally, declivity level 30 – 40% dominates southern area of PLTA – KP reservoir, and the rest is found northern, which is dominated by sub water catchment Tiup Gadang.

2.6.7. The Declivity level of more than 40%

The slope of this declivity can be associated with steeply sloping or cliff that is impossible to be carried on. Usually there is landslide or rockslide. The recorded scope is 5,414.41 hectares or 4.96%. The widest is in sub WCA Mahat, it is 2,486.45 hectares or 2.28% and then sub WCA Gulamo (599.02 hectares or 0.55%). This declivity level can be found at sub WCAs around Kampar Kanan stream and northern of PLTA – KP reservoir (see **Map 6. Water Catchment Area Dam Koto Panjang and Surroundings**).

3. THE CLASSIFICATION OF STUDIED LANDSCAPE AREA

Improving process of genesis is influenced by geological and geomorphological process that happen from past until now (Van Zuidam, 1979). Origin is a beginning process of forming a certain shape of earth surface. Some elements contented in genesis aspect and origin process are geological condition, stratigraphy, and kind of rock by considering water catchment area aspects, and rainfall rate. Geological pattern concerns with the structure of rock in the earth. Startigraphy is description of past creation process. Kind of rock is related to characteristic and origin of creating a shape. water catchment area reflects changing process of earth surface because all of time river always erodes, transporting and settling the sediment by its water, which is affected by rainfall rate.

The current slope and earth surface studied consists of non – resistant raw sedimentation and has regular pattern, easily eroded, and there is increasing unequally open - cut area because of the amount of river or water stream, and hilly area with cone summit. Those hills have steeply slope and have a transition process, from big riverbank, highland then be steeply summit similar to its geological structure.

Considering those elements, final shape of earth surface discussed consists of (see **Map 4. Land System Dam Koto Panjang and Surroundings**):

Table I.2. The Classification of tudied landscape (PLTA-KP)

No.	Kind of Landscape	Area (Hectare)	Percentage (%)
1	Plateau and Mountainous system	41.934,20	18,9
2	Hills	91.121,30	41,03
3	Land	78.018,28	35,13
4	River dike	3.168,68	1,43
5	Swamps	193,96	0,09
6	Alluvial Valley	3.250,09	1,46
7	Riverbank	4.372,78	1,97
Total		**222.059,29**	**100,00**

Source: Result of data analyses (WALHI, 2004)

Steeply slope as an upper course of rivers make the stream similar with waterfall, when it crosses land, the rivers form wider and flatter river body, which can be used by people to search fish. It can be seen in batang Mahat, batang Kampar Kanan and some rivers are included in III order. Rainfall rate influences regime of non – resistant land, so rivers erode some materials such as sand, gravel, and mud. Then, the materials are settled on alluvial land along river base or in a basin.

The process of sedimentation process is still on going until now, it is shown by the using of sedimentation material by people around Muara Takus stream.

3.1. Characteristic of Landscape

3.1.1. Plateau and mountainous system

This landscape characteristic occurs because elevation process that form plateau, then upper part of it is affected by erasure and erosion process, which settle in the land. The eroded part forms steeply slope. This study classifies plateau and mountainous based on rocks pile it. Back hill formed from solid metamorphic stone and it is orientated very steep find in 17 sub water catchments, it is about 7,534.265% hectares or 6.96% of total area (see **Table I.2. The Classification of tudied landscape (PLTA-KP)**), which dominates by quartz and sandy rocks. While characteristic of ridge consists of sedimentary rock with irregular shape already widely eroded, find in 13 sub water catchments for about 13,869.11 or 12.81% of total sub water

catchment. Conglomerate rock, sandy rock, gravel, and mud dominate the characteristic. It is also indicated that this area contents salty minerals.

The distribution of plateau landscape and mountainous system with both characteristics of rock pile is found in 8 sub water catchments, they are Arau, Gosong, Gulamo, Kulang, Mahat, Marang, Sipinai, and Tasam. It means these sub water catchments, its rock course, can not deposit water, and it causes erasure and erosion processes.

3.1.2. Hills

Hills landscape in area studied reaches 91,121.30 hectares or 41.03% of total area. Based on the distribution, it can be classified into characteristic of rock pile and its form, so it will be identified as 6 units hills landscape, they are:

1) Hills with its back shows steeply landscape on tufa sedimentary rock, are found at 7 sub water catchments, such as Badinangin, Biliktanjung, Kiawai, Mahat, Permanisan, Pubala, and Takus, for about 2,822.37 hectares or 2.61% of total area. These area cosists of sandy rock, muddy rock, granite, tufa and also salty mineral. In sub WCA Mahat, this landscape are wider than the others, it is 1,342.67 hectares or 1.24% of total area studied.
2) Hills with long ridge on very steeply metamorphic rock. Metamorphic rock that pile it are quartz, sandy rock, shale, schist and phylits. It locates at 14 sub water catchments, such as sub water catchment Arau, Batubasurat, Binawang, Bual, Buyuh, Gulamo, Marang, Patut, Pukatan, Saluran, Sigamai, Silantung, Singgam and Tiupgadang. The identified scopes are 9,526.73 hectares or 8,81 % of total area.
3) Hills formed on volcanic – basalt rock with very steeply back. This type of hills is found at 3 sub water catchments, Binawang, Tangko and Tiupgadang. Its distribution locates on 210.25 hectares or 0.19% of total area, except on sub water catchment Tangko, it places on 202,49 Hectares or 0,18 %. The characteristic of volcanic – basaltic rocks formed this area are basalt, andesite, granite, and diorite.
4) Hills with its ridge locates on sedimentary rock, irregular shape, and separated by river valley. This type of landscape locates on wide area and is found at every area, except at 8 sub water catchments, Kulang, Manggung, Patut, Pubala, Pulai, Saluran, and Singkalikur. While at the rest sub water catchments, it locates on 33,482.05 hectares or 30,93 % of total area. The rock form characteristics consist of conglomerates rock, sandy stone, muddy stone, and shale. The location is on sub water catchment Gulamo and places almost half of this area, it is 10,078.68 or 9.31 %, then is followed by sub water catchment Mahat (6,414.59 hectares or 5.93 %) of total sub water catchment.
5) Hills landscape with linier and long ridge pattern with steeply slope. This landscape is distributed at 9 sub water catchments (Gosong, Gulamo, Kulang, Mahat, Manggung,

Manggilang, singgam, Sipanai, and Tasam) for about 6,862.69 hectares or 6.34 % of total area. Characteristics of forming rock are sandy stone, muddy stone, and shale. The widest area is sub WCA Mahat (2,923.38 hectares or 2.7%) and sub water catchment Gulamo (2,534.97 hectares or 2.34%).

6) Kuesta which shapes as dome with slope direction is in middle declivity and cosists of sandy rock. Kuesta landscape only can be found at 4 sub water catchments, Batubasurat, Gulamo, Limbago and Lubukagung. This characteristic consists of conlometrates, sandy rock, mud and shale.

3.1.3. Peneplain

It caused by denudation or dilution rock process which is able to change earth surface to be peneplain. Denudation consists of erosion process and then washes materials away and deposits at other place. Materials washed away are from mountainous, hills, and slopes. This landscape is stretched on 78,081.28 hectares or 35.13 % and classified based on its forming processes:

1) Peneplain area with small hills formed on mixed – metamorphic stone which spread out at 4 sub water catchments, they are Buyuh, Patut, Saluran, and Sigamai. Wkhile mixed – metamorphic consists of phillite, shale, quartz, sandy rock, alluvium, and river sediment. The scope of four sub water catchments are only 481.57 hectares or 0.44%. It means land area is very limited.
2) Peneplain area with small hills placed on metamorphic rock, which consits of shale, sandy rock, alluvium, and river sediment. This area is also limited, only for about 281.38 hectares or 0.26%, and is located on 4 sub water catchments (Gosong, Gulamo, Marang dan Singgam). Only sub water catchment Singgam has average wide area, it is 182.345 hectares or 0.17% of total sub water catchment.
3) Peneplain area place on top of hill or mountain which has circle shape and formed on ultra basalt rock. This area contents granite rock, tufa, sandy rock, mud, alluvium, and river sediment, also indicated it has salty minerals. It is distributed on 12 sub water catchments (Badinangin, Biliktanjung, kinawai, Kototengah, Lubukagung, Mahat, Mantasan, Manggilang, Permanisan, Takus, Tangko dan Tiupgadang) for about 6,856.77 hectares or 6.33 %. The widest distribution is on sub water catchment Tiupgadang (2,953.12 hectares or 2.73 %) and sub water catchment Mahat (1,559.25 hectares or 1.44%). The rest is less than 0,6 %.
4) Peneplain area with small hills consists of tufa sedimentary rock (granite, tufa, sandy rock and mud), and indicated salty mineral. It places on 12,265.48 hectares or 11.33% area, and divided into 9 sub water catchments (Bandinangin, Kinawai, Kototengah, Mahat, Mantasan, Pubala, Takus, Tangko and Tiupgadang). The scopes of more than 1000

hectares are found at sub water catchment Takus (5,259.57 hectares or 4,86 %), Tiupgadang (3,126.3 hectares or 2.9 %), Kinawai (2,112.75 hectares or 1.95 %) dan Mahat (1.111,89 hectares or 1.03 %).

5) Peneplain area with wavy landscape and formed from sedimentary rock (shale, conglomerates, sandy rock, mud, and contents salty minerals). Wavy lands at any level are found at 16 sub water catchments (Arau, batubasurat, Binawang, Bual, Buyuh, Gosong, Gulamo, Kototengah, Limbago, Lubukagung, Mahat, Mangai, Pukatan, Sigamai, Singgam dan Tangko). The scope is for about 5,209.58 hectares or 4.81%, and the widest distribution only locates on sub water catchment Gulamo, about 1,786.52 hectares or 1.65%.

3.1.4. Riverdike

It caused by fluviatic process, it is surface run off or river stream with alluvium material. The shape produced is dispositat shape such as wide embankment around meander stream of Kampar and Mahat. These embankment locates on 15 sub water catchments (Badinangin, Batubasurat, Biliktanjung, Binawang, Gulamo, Kinawai, Kototengah, Limbago, Lubukagung, Mantasan, Pubala, Takus, Tangko dan Tiupgadang) about 2,772.65 hectares or 2.56 % of sub water catchment area. Averagely each sub water catchment has embankment no more than 185 hectares or 0,17 %.

3.1.5. Alluvial valley

Alluvial valley produced by fluviatic processes, those are run off or river stream with alluvium and collovium material (river sedimentation) which locates on uphill. It is a small base of valley. Kolovium is a dispositional aas a result of erosion on upper part, then settles on hill's slope and valley. The distribution locates on sub water catchment Gosong, Gulamo, Mahat, Manggilang, Singgam dan Tangko, about 1,647.62 hectares or 1.52 % of entire sub water catchment area.

3.1.6 River terrace

River Terrace is an alluvial plain, oxbow lake, and flood plain. The study area differentiated into panoramic view and the spread, identified into 2 kinds of river terrace:

1) River terrace contains alluvium and the view is wavy, it placed in 11 water catchments area, i.e. Badinangin, Batubasurat, Binawang, Gulamo, Kinawai, Kototengah, Mantasan, Pubala, Takus, Tangko, and Tiupgadang. The width is 3.465,62 Ha or 3,2 % from the total width of sub water catchment area. 1.722,41 Ha or 1,6% is in sub Water catchment Tangko and 1.094,86 ha or 1,01% is in sub water catchment Binawang.
2) Narrow river terraces that was created by alluvium and colluvium material in the small

valley are placed in 5 sub water catchments area, i.e. Gosong, Kulang, Mahat, Singgam, and Singkalikur. From the those 5 sub water catchments only 358,78 Ha or 0,33% that are spread and create small groups in valley and hills.

4. PATTERN OF LAND USAGE

Investigation of land usage is focused on physic factors which are the most influential factors, i.e. (1) height; (2) margin; (3) river net. Usage of the land will be discussed to know the pattern of the land usage today remained the patterns were combination of history, physic, social culture, and economy factors (Sandy 1995: 124). Can be revealed that the description of the physic environment of the nature which was the chosen place for people to do their activities in the past (PLTA-KP area) because human habit to live random to choose the place (Mundardjito 1995).

Pattern of the land usage reflect the level and people orientation of life in that area. Actually, pattern of land usage was a description of space rather than as human effort, total and level of the technology.

Sandy (1973) develop a model of the development of land usage in Indonesia as an effect of human spread. Then, the study area systematically was described as follows:

1) The first area that is used by human without outside influence was a plain land, but free from nature attack or wild animals (flood, landslide, wild animal, plant disease).
2) The next development was in uppercourse not in lowercourse, i.e. had a plantation or unirrigated agricultural field with traditional plant or dry field.
3) When they had the increasing of interaction intensity, i.e. the influence of outside with the PLTA-Kp dam project so the removal society had decline life in social, economy, and cultural aspects.
4) If there is no effort to stop the decline in the new area and the population increases or changing profession it will cause massive poverty.

Table I.3: Kind and width of land usage at study area (sub water catchment) PLTA-KP

No.	Land usage	Width (ha)	Percentage (%)
1	Settlement (Village)	1.600,50	1,48
2	Rice field	2.434,11	2,25
3	Unirrigated field	29.645,64	27,44
4	Thicket	28.786,02	26,65
5	Plantation	2981,22	2,76
6	Coarse grass	4.372,80	4,05
7	Forest	38.200,02	35,36
Total		**108020,27**	**100,00**

Source: RePPProt data processing result, 1987 and topography 1984 (WALHI,2004)

Pattern of the land usage on the past before the dam project needed to be know to compare with the development of pattern of the land usage now. Based on the analysis of RePPProt map in 1987 and topography scale 1:50.000 in 1984, the land usage is classified into 7 classes include (see **Map 5. Land Use Dam Koto Panjang and Surroundings, Map 9. Land Cover in Year 1990 Dam Koto Panjang and Surroundings, Map 10. Land Cover in Year 2000 Dam Koto Panjang and Surroundings** and **Table I.3: Kind and width of land usage at study area (sub water catchment) PLTA-KP**):

4.1. Classification of Land Usage In Study Area

The spread and wide of land usage in this area was classified based on the sub water catchment area. The aim is to see the configuration relation between the water flow and pattern of the land usage. The relationship can be use to decide wisely the pattern of the land usage by consider the preserve environment and continually organize.

Below is the analysis of land usage at sub water catchment is in PLTA-KP dam, combination 1984 and 1987:

4.1.1. Settlement (village)

Settlement in the village is an artificial culture that has a specific characteristic in each location. If we see the map of land usage publish by RePPProt 1987, the spread settlement identified was not only a cover settlement to the sub water catchment unit but also relocation settlement by the PLTA-KP dam project. People orientations to choose the location near water flow (batang Kampar and batang Mahat) and also near the street net can be seen from some aspects, those are:

1) Social aspect, usually people in Koto Panjang decided to design their settlement gather each other to have close relation and can live cooperation.
2) Economy aspect, It is not far and difficult for Koto Panjang people to find area for work, i.e. platation, rice field, fishing,etc. They can distribute the agriculture produce easily, even through land and river way.
3) Overhead facilitate in social-economy aspect, generally at that time people could interact easily with another society, that was the reason why people choose to live near the street, mosque or other pray place, village meeting hall, school, stall, market, etc.

Generally in area study the people orientations are social life and safety to construct a settlement. Next development social-economy knowledge is important to do wide interaction. Before the flood can be seen on the map there were settlement spread in south, i.e. Tanjungbalit, Tanjungpauh, and Muaramahat villages. Those three villages established group with special distance along the Mahat street/river, also with the west area or in batang Kampar Kanan (tanjungalai, Batubersurat, Kototengah, Pongkai, Pulaugadang, Muaratakus, and Bungsu mount).

Means that the village location wasn't randomly to placed but society has their own criteria and some support borders to be used, i.e plain land to start their work, near the water, and save from flood.

Base on the area study which is include 37 sub water catchments area the settlement area wasn't evenly wide and the location. Based on the width of the settlement it was identification about 1600,5 Ha or 1,48% from the total width of sub water catchment. There are 18 sub water catchments (Badinangin, Batubasurat, Biliktanjung, Bual, Kinawai, Kototengah, Lubukagung, Mahat, Mangai, Mantasan, Manggilang, Permanisan, Pubala, Sigamai, Sipanai, Takus, Tangko, Tasam, and Tiupgadang). The widest is in sub water catchment Badinangin (173.4 Ha or 0.16%) then sub water catchment Tangko (156.27 Ha or 0.14%). It was identification also the limited sub water catchment Tiupgadang about 2.85 Ha).

4.1.2. Rice field

Society who live near the river know how to control and use the river, so the plants don't depends on the rain season. Gradually the rice field in the plain area get the simple irrigation also the productivity is maximum in a season on length. At the first, the rice field is cistern now, some had been irrigated and also with some field that used for plantation now becomes mixture plantation (kinds of fruits, tuber groups, and vegetables).

Space process for farming settlement beneficial if we see from the culture aspects seems that the rice field system is dominated in settlement area. On the first time the distribution had history background, culture, and ecology and the use of technology also. From the length of investigation process there was trail and error when use the land. Can be conclude that the match physic environment for the rice field area is valeey and land with flood periodic rain in a season. Furthermore, the development of farming technology which is used by the people in Koto Panjang area had capability to irrigate the rice field using a simple irrigation, those are sub water catchment Batubesurat, Binawang, Kototengah, Limbago, Mahat, Mantasan, Marang, Tangko, and Tiupgadang. From those 13 sub water catchments the width is 1.359,14 Ha. This is because of the limitation of smooth land.

On the map of land usage 1987 data, can be seen that the spread of rice field only in some villages, such as in Lubukagung, Batubesurat, Kototua, Pongkai until Kotointan. Those villages are very influenced by the periodic flood on the rain season; the farming system is organized by the society once in a season. Space aspect in Koto Panjang reflect providing flood. But, traditional plantation which oriented for trade wasn't organized well, plant treatment and rejuvenation. Rice field in second layer after settlement from land usage, it can be seen from the spread of rice field near the settlement area. Beside distance factor, also because the physic factor where smooth land is limited to be irrigated. Based on the map data interpretation the width of irrigation farming field is about 615,504 Ha in 5 villages.

Beside use the land as rice field also dry field, it can be seen from the spread of mosaic land work. In this part it is difficult to differentiate the cultivation with land cover, besides there are small groups of rice field to be work on special time. The cultivation area is still exist and is going to be change especially in slope and had the clearing new area to the hills. Rice field mosaic and cultivation are in 7 sub water catchments area, they are Batubesurat, Bual, Gulamo, Limbago, Mangai, Pukatan, and Sigamai. The width is 1.074,97 Ha or 0,99% from the total width of sub water catchment area.

4.1.3. Unirrigated agriculture field (ladang)

The characteristic of unirrigated field is there is a mosaic land work that spread with re-grows vegetations from some level and types. It is difficult to differentiate strictly between cultivation and new area that growing to be forest. The forest growing is thicket or bushes which are growing after have had the work. Physically it is difficult to differentiate unirrigated field with plantation (kebun) but if we see the type of plants we can make the border. Plantation around the settlements are vary but if it is far from the settlements the plant is rubber. Seems the location to be open and use for farming is limit, then high place becomes the target to be unirrigate field (rice field dependent on rain) andthen plant traditional plantations. At this level, condition of Koto Panjang to be work on is limited, even from the distance, fertility, and capability factors.

Generally, cultivation by burn the forest is related with rite and society life in Koto Panjang or others city where it was the appropriate way in that area. After falls and burn the forest they will use the land to planting the main plant like dry field rice. The management in this area appropriate with the ecology condition and didn't change the humus structure and water content. The land becomes unfertile after the first well harvest, the next harvest will decline moreover the cost is incomparable with the result.

Because the living cost get higher, some people tried to organized the land energetically and intensively. It had change the land usage, such as the plantation becomes dry field, even the mixture plantation and unirrigated field is still exist but the people keep falls the trees in higher location. In that area they will use the area as cultivation and it had in sub water catchment Mahat with width is 938.53 Ha. Where the plantation width is 29.645,64 Ha or 27,44% from the total sub water catchment area.

In general, West Sumatra applied and boards the cultivation system with permanent system, if the water content is fulfill to irrigate the available smooth land. If we see the map of land usage (RePPProt) on 1987, in some sub water catchments area (Angsa, Arau, Batubesurat, Binawang, Bual, Kototengah, Limbago, Lubukagung, Mangai, Mantasan, Takus, and Tiupgadang) could not be found the plantation but the plantation system is develop in sub Water Catchment area Mahat (12.450,02 Ha or 11,52%) and start to apply plantation system in hills. Also with sub water catchment area in Gulamo (3.090,79 Ha or 2,86%).

4.1.4. Thicket

Thicket is part of extensive farming system where the land is left for long time to recover the fertility. After that they will open the land again and use dry field rice once or twice of harvest, after that they will use traditional plantation like rubber, Gambier, or fruits. In some sub water catchments area like Angsa, Arau, Bual, and Mangai thicket is dominant in this area with width is 1.796,76 Ha or 1,66%. Means that in others area even thicket is left but we still could see the traditional plantation but in sub water catchment area there is no traditional plantation. Physically, the area shown a big slit with quite deep river slot, and the land surface layer is gravel now and washed when the rain comes. It is not amazed the fertility is getting thin and only thicket and bushes left and could growing.

In another sub water catchment area even there is thicket but inside we can see traditional plantation especially rubber, fruits, gambier, or areca nut. In sub water catchment area Takus, thicket spread widely (5.202,38 Ha or 70,96% from the total wide of that water catchment area), the formed of thicket was an effect of clearing land forest became rubber estate and oil palm andthen preparing location for local transmigrate. Almost all study area the land condition is serious, both the fertility and the humus washed by the flowing water. Not surprising if in hills only thicket can growing. The width is 28.786,02 Ha or 26,65% this value difference 1% with plantation. The spread of thicket divided into thicket, bushes, savanna, and north plantation, in south cultivation is dominant.

4.1.5. Plantation

The total width in area study is 2.981,22 Ha or 2,76% in North West. In 1987, in this area was planned to open a big plantation by develop the rubber estate and nowadays oil palm develop also. Identified that the plantation area in sub water catchment area in Takus is 2.029,76 Ha (1,88%) and Tiupgadang (951,45 Ha or 0,88%). This plantation area split in part of upperstream of Takus river and Tiupgandang at wavy area and hilly region. In the south of Tiupgadang there are signs of forest vegetation and bushes until the back of mountain.

4.1.6. Coarse grass

Coarse grass is wide spread in sub water catchment Mahat (2.391,79 Ha or 2,21%) and spread around densely settlements. It shows that land organized intensively without recover the fertility made the land unfertile and only coarse grass can live. Another caused is because the limit of land for plantation and cultivation, it made the fallow shorten. Means, land that should not use for 8 years to recover the fertile was shorten to be used again as plantation land.

The coarse grass also can be seen in Tabing and Tanjung villages, where coarse grass grouping in hill 686 Ha widths. In area study, usually the coarse grass are in densely settlement.

4.1.7. Forest

Forest in area study was categorized into 2 kinds, low land forest is around 1.000-2.000 m above the sea level and lower land with high less than 1.000 m above the sea level. Land forest in area study is sign by creeping plant, big battress root and tree with high tree trunk and smooth tree bark. Even there are some destroys in traditional villages, wild animal, forest, farmer, and bushes but those things still cannot stop the dam project. The dam had separates Koto Panjang area or a barrier for elephants, tapir, tiger, and other species. Fauna habitat is getting narrow, in other side they have to compete with people to have some food. Always elephants destroy the plantation of a people or a company. But the most dangerous threat is from forest plunder and fauna's hunter. Elephant population only some left, now only 2 elephants swarm about and can be seen. Tapir and tiger is threaten with extinction also because pressure from the hunter and forest plunder.

Based on 1987 data, the forest spread are at the back of mountain until foot of sloop which group into 2 parts, those are:

1) In north the cover land spread in Rantau Berangin until Tandun. This land cover laid on asymmetry sediment stone, the shape is lay along South east – north west. In the middle of this area especially in Koto Ranah the forest had clearing land and enclave of rubber and dry field. The uncover land group with sediment stones in wavy view. Meanwhile most of the land cover in sub water catchment Tiupgadang was clearing for rubber and oil palm plantations, the rest of the forest in that area is 2.740,37 Ha (1987 data). (WALHI,2004)
2) In south, the forest is widely group in sub water catchment Gulamo (13.563,64 Ha or 12,56%) and sub water catchment Permanisan (2.886,82 Ha or 2,67%) this land cover laid in hills and sediment stone. In south further, sub water catchment Mahat the land cover is quite wide (5.048,78 Ha or 4,67%) but the spread is in small group and there is no wide connected. In south point to east angel, the land cover laid in freeze stone which covered the hills until the back of mountain, the land cover width is 7.202,45 Ha or 6,67% (WALHI,2004).

The forest usage of some people and the society reaction to the land in water catchment Koto Panjang dam had change the vegetation, now it could not be said as forest area. The clear fact as the changing is in sub water catchment Gulamo, the land cover was being falls and burnt to make plantation. At the beginning only barren land can be seen because there is no rain for some weeks. In area study, when dry season takes long time and the rain season get harder this caused erosion andthen made new trench for new river. Meanwhile the erosion materials was washed away by the water which flow in the trench and settle in dam.

Spatial data on 1987 shows the land covered by forest vegetation was generally spread

in hills and mountain area, like in sub water catchment Arau, Gulamao, Tiupgadang, patut, Permanisan, and Saluran. Assumed that the width of land cover which include in area study is only 38.200,02 Ha or only 35,36%.

4.2. Land Cover Change in 1990 – 2000

Based on the Landsat TM-7 image analysis in 1990 and 2000 at the image of April recording there were 5 classes of land covers in area study (see **Map 9. Land Cover in Year 1990 Dam Koto Panjang and Surroundings** and **Map 10. Land Cover in Year 2000 Dam Koto Panjang and Surroundings**):

Table I.4. Land cover's vast change in 1990 – 2000

No	Land Cover	1990's Vast (Ha)	2000's Vast (Ha)	Change (Ha)
1	Waters	1.145,96	11.717,62	10.572,06
2	Forest	67.963,29	43.237,42	(-) 24.725,87
3	Garden	28.889,37	39.628,43	10.739,06
4	Open Land	4.051,95	9.857,28	(-) 5.806,33
5	Dry Field	5.975,47	3.585,31	(-) 2.390,16
	Total	**108.026,06**	**108.026,06**	

Sources: Result of Landsat TM image in 1990/2000, Path/Row 127/060 (WALHI, 2004)

Based on the table, there were found that changing condition of land cover was happened in the study area along period of 1990 and 2000. The table shows that forest and dry field land covers decreased their vast respectively 24.725,87 Ha and 2.390,16 Ha. The decrease of land cover vast was happened by the reason of the development of rubber and oil palm estate concession, such as in sub water catchment Gulamo which is in the north of Muara Takus and in the north of Rantau Berangin. Other reason was the forest area reclamation for the preparation of the people removal from their old village to the new one such as from the village of Pongkai Baru which was in the north of Muara Takus, villages of Pulau Gadang and Koto Masjid to Koto Ranah. People removal from the villages of Lubuk Agung and Koto Masjid to Ranah Sungkai also caused a decrease of dry field land cover, which led the people also bring their work to the new place. The decrease of dry field land cover except as a result of the people who moved their work in new place, was also reasoned by their dry field which flooded by dam PLTA-KP (see **Table I.4. Land cover's vast change in 1990 – 2000**).

The forest reclamation has prepared for the dry fields showed a trend which lead toward the hills and mountain ranges, so it was only visible like mosaics or groups of dry field. The real condition showed that they were difficult to be differentiated as the plants generally cultivated were the traditional plants, and that the people also has parceled the land signed with kinds of traditional plants as the land guard. This land guard plant was a sign that the land has belonged to someone so the other people cannot open the forest except the owner permitted them.

The other assumption was that the local people who were removed to the new location could not follow the agriculture pattern applied like the Javanese transmigrant. For the local people this agriculture pattern did not give any advantage so they sold and left their house and field and used the money for forest reclamation at the old village. These trends happened in the village of Pongkai Baru where the local transmigrant sold their allocated house and land to the Javanese transmigrated.

Decreasing of the vast of the bushes happened as the people developed the land which covered by bushes before for big plantation and for their advantage. It seem that the local removal might be related with the border factor where the access of the society which they usually used by overland but must crossed the dam so then they chose to stay in the location near their plantation or dry field. Based on the analysis of the remote sensing, the vast of the plantation/dry field land cover increased where in 1990 had 26,74% and became 36,68% in 2000. As a note: the intended dry field/plantation was generalized from land covers of big plantation, traditional plantation, dry field etc.

The open land's vast also increased. This condition was clearly caused by the forest reclamation by big plantation company, which was clearly visible from the usage pattern and orderly formed. The spreading areas of big plantation were in sub water catchment Takus, Gulamo and Tiupgadang. Began from 1987 the open areas was clearly visible orderly formed, in 1990 based on the remote sensing analysis recorded that the vast was 4.051,95 Ha (3,75%) and it increased in 2000 became 9.857,28 Ha (9,12%).

The intended waters were rivers, the lake, and the dam or the swamp, but in the study area there were only found river and dam. In Koto Panjang, before 1990 the vast of the waters land cover was only 1.145,96 Ha (1,06%) and it increased became 11.717,62 Ha (10,85%) in 2000 (see **Map 9. Land Cover in Year 1990 Dam Koto Panjang and Surroundings** and **Map 10. Land Cover in Year 2000 Dam Koto Panjang and Surroundings**). Waters formed the dam of PLTA-KP by stopping the stream of Kampar Kanan. The flowed territory began from the village of Muara Takus to the area arround the Rantau Berangin and around the dam.

4.3. Removal of the People's Settlement

One of impacts of the construction of the Koto Panjang dam was the removal of people from the old place to the new settlement. The relocation involved removal about 4.953 Households (4.886 Households, JBIC) from 10-recorded villages. People expectation was that the new place was the same with their old place, but the program only made the people suffered. In the new location people did not found existence pattern on the culture and social dissolution. The process was done without cares to individual interest, the society and their social life. In simple word, there was human rights violation because no job, no education, no health care, no

warranty to hold cultural identity, no warranty of safety and social continuity for the removal people. Sometime they were removed to the location with a very different environment of life for their culture.

Table I.5. The Number of families and removal's year

No	Village	HH	Relocation	Year
1	Tanung Balit	421	SP II Rimbo Dalam, 50 Koto/UPP Karet, Kec. Pangkalan	1st Stage: 07/93 (401 Household) 2nd Stage: 08/94 (49 Household)
2	Tanjung Pauh	350	SP II Rimbo Datar, Kec. Pangkalan	July/August 1993
3	Muara Mahat	477	PIR Sawit Bangkinan Blok X/G	October 1994
4	Tanjung Alai	313	Ranah Koto Talago, XIII Koto Kmp	October 1994
5	Batu Basurat Pasar	700	UPP Karet/Selatan Batu Basurat	
	BB Koto Tengah	337	UPP Karet/Ranah Sungkai, Kampar	January 1995
	BB Lubuk Agung	220	UPP Karet/Ranah sungkai, Kampar	July 1995
6	Koto Tuo	599	SP II Selatan Muara Takus	March 1994
7	Pongkai Istiqomah			
	Pongkai Baru	200	SP II Selatan Siberuang, Kampar	
	Mayang Pongkai	259	PIR Trans Sawit, Sungai Pagar	February 1996
8	Pulau Gadang	592	UPP Karet/ Koto Renah Sei Silam	August 1992
9	Muara Takus	244	Selatan Muara Takus, Kec. XII	January 1994
10	Gunung Busu	241	SP I Selatan Siberuang	
	TOTAL	**4953**		

Source: Composed from the report of Special Assistance for Project Sustainability (SAPS) May, 2002

The construction of the Koto Panjang dam accepted many pressures but it continued by removing 24.765 people to improper settlement location in which its ground was not suitable for compartment agricultural system. Too many improper compensation and manipulation happened on the process of the finishing. The process of the people removal was done in some stages, i.e. began in 1992 to 1996 (see **Table I.5. The Number of families and removal's year**). There were some promises on the process of the removal, but only few of them were fulfilled. People got 2 Ha lands, which was not a flat and a 0.25 Ha of house with the yard, in the location of isolated slope hills or in back of the mountain. The location was not proper for agriculture and a difficult place for cultivation, as it was a dry land and no water.

Generally the placement of settlement of the new location was in the water border area or in the slope of the hills as it was happened in Pongkai Baru. The location of the slope of hills was the border of sub water catchment Takus and sub Kinawai, and also Tanjung Balit and Tanjung Pauh which was in the slope of the sub water catchment Gulamo. Others villages in Ranah Sungkai such as Tanjung Alai, Lubuk Agung, Pulau Gadang and Koto Masjid were dry land and they were covered by bushes that must be cleaned first before they were cultivated.

All the numbers of the decrease cultivation land in Koto Panjang for the project of the dam was 10.572,16 Ha. Numbers of the people who must be removed as the impact of the project of the Koto Panjang dam indicated the productivity of the flooded land. Based on the natural resource economic analysis it was found that from the numbers of the lose cultivation lands, Koto Panjang was a prosperous land. It was a dry and wet land in the banks of the Kamparkanan and Batang Mahat rivers was very fertile, while people with their own pattern was able to get wealthy result and the benefit from the lands. Not only cultivation plants such as rice, areca nut, coconut, and fruits but also trade plants such as gambier, vegetables and fishes extensively found in water areas. Food productivity level in Koto Panjang was high as their agriculture wss supported by the land and the climate. The flooding of 11.717,62 Ha (124 Km2 JBIC) land caused big financial suffer and for the removal people.

4.4. Index of the Vegetation Density

Result of vegetation index classification in Koto Panjang area and its surrounding as it was showed at the NDVI map in 1990 and NDVI 2000. On the NDVI 1999 the process of Landsat image interpretation was done by automatic computerized generalization. On the Landsat image in 1990 were found 5 classifications but they were not detail because only available 3 bands on the Landsat image 1990. There was better facility with 7 bands on the Landsat image 2000 to analyze many themes. It was called Landsat TM-7. It could show clearer result and there were 6 classifications of vegetation densities. From the classes generated they could be mentioned such as the very high vegetation index, high vegetation index, medium vegetation index, low vegetation index, and very low vegetation index and no land cover vegetation. The explanations for each of them are:

1) Very high vegetation index value included hills primary forest, low level ground secondary forest and plantation
2) High vegetation index value included the forest, secondary forest, low level ground and plantation.
3) Medium vegetation index value included the irrigated field and vegetated field, plantation and bushes.
4) Low vegetation index value included dry field rice, new plantation, ex-logging land, bushes and low vegetation.
5) Very low vegetation index value were areas such as ex-burnt flat land and ex-dry field area, ex-land clearing area. This value also applied to the empty land or weeds, nipa palm, and the grasses.
6) River, lake, swamp, and no vegetation open land could be involved in zero vegetation index value. If there was effect of water biota then the vegetation index value was more than zero.

Table I.6. Normal Differences Vegetation Index (NDVI)

No	Index	Extensive (Ha)	Percentage (%)	Index	Extensive (Ha)	Percentage (%)
1	0	19.683,76	18,18	0	14.641,47	13,52
2	0,15	31.205,96	28,83	0,1	8.569,33	7,92
3	0.25	35.272,24	32,58	0,2	14.035,18	12,96
4	0.36	19.615,93	18,12	0,24	24.369,17	22,51
5	0.59	2.471,79	2,28	0,27	28.232,97	26,08
6	-	-	-	0,3	18.401,56	17,00
Total		**108.249,68**	**100**	-	**108.249,68**	**100**

Source: Processing Result from Landsat image 1990 and Landsat TM-7, 2000. WALHI, 2004

The change of vegetation density in the period of 1990 – 2000, where in 1990 the density was 2.471,79 Ha (2,28%) and it increased become 46.634,53 Ha (43,08%) in 2000. It happened as the result of forest area reclamation for plantation and land clearing done by the government to prepare location for people whose land was flooded. In 2000, the wide density was highly increase as it was resulted by the growing of the cultivation plants such as oil palm and rubber, in other side caused of limitation of the people access and their interaction to the area they left was seldom done so there were natural growing of bushes and secondary forest happened. People also used the open area to cultivate gambier plant and areca nut. The spreading of the very high vegetation density in 1990 was in the back of hill and the other was in the North West. While in 2000 the spreading broad to the North West, part of them in north of the dam and grouping in the South East.

The highly density vegetation change from 1990 to 2000 could be proved by comparing open area (no vegetation cover) on those periods. In 1990 the open area was 19.683,76 Ha (18,18%), then in 2000 the open were decrease became 14.641 Ha (13,52%).

The other change was at the high vegetation index value in 1990 in which 19.615,93 Ha (18,12%) became 24.369,17 Ha (22,51%) in 2000. While the medium vegetation index value in 1990 was 35.272,24 Ha (32,58%) and decreased become 14.035,18 Ha (12,98%) in 2000. At the very low vegetation index value in 1990 was 31.205,96 Ha (28,83%) then highly decreased in 2000 became 8.569,33 Ha or 7,92% of the vast of the sub water catchment.

If it was summarized in general, density vegetation index value between the period of 1990 to 2000 found that the vegetation increased or the area surround the Koto Panjang dam that the growing of the plants were good naturally or intentionally in the form of oil palm and rubber estate.

Density vegetation value difference between 1990 to 2000 was also effect by the source of the Landsat image data. The facility of Landsat image of 1990 which is only 3 bands is effected the performance and the process of identification image analyzed. On the TM-7 Landsat image there are 7 bands so the process of the analysis can be combinated and more detail in the

classification of the image in the Koto Panjang area. As the comparison can be found at the explanation of the change of the wide lan cover wide cause the source of the data used is the same. Further as it was saw in the map of the land cover in the year of 2000 except happened the lose of the plantation and settlement, the followed impact by Koto Panjang dam is also happened the lose of the forest land cover of 24.725,87 Ha (WALHI, 2004).

CHAPTER II
THE ASSESSMENT OF ECONOMICAL AND FINANCIAL OF NATURAL RESOURCES AS AN EFFECT OF THE DEVELOPMENT OF PLTA KOTO PANJANG

1. INTRODUCTION

1.1 Background

The reconstruction of Hydroelectric Power Plant of Koto Panjang (PLTA-KP) was planned on 1979, indicated by some project arrangements that related with technical and economy properness study and also project impact through social and cultural life. Project preparation was begin on 1983, and the technical and economy properness study was done by JICA (Japan International Corporation Agency) and the detail design project on 1987/1989 which was done by TEPSCO (Tokyo Electric Power Service Co.Ltd) and Yaduya Karya. Andalas University and Riau University also involved in designing the Analysis of Environment Impact (ANDAL) and planning of the Environment organising/ Planning of the Environment Monitoring (RKL/RPL) on 1984. The process of doing the body was begin on 1993 and done 0n March 1996.

The capacity of PLTA-KP was planned to use 114 MW (38 MW x 3 turbine). To reach the electrical power it needed a dam with 58 m high, 257,5 m long with CONCERETE GRAVITY TYPE. PLTA-Kp was planned will have the capacity 1.457 million/m3 and it could catch 1.040 million/m3 capacity and the width flood reach 124 km2. The width of the water catchment area reaches 3.337 km2, which include West Sumatra and Riau Province (JBIC, May 2002) (see **Table II.1. Technical Data of PLTA Koto Panjang**).

Beside yield the electrical power sources, PLTA-KP also aimed as the flood controller, irrigation, tourism objects, and fishes breeding. Even though, the water catchment area gives wide impact to the economic, social, cultural to the society around the project. The wide compensation was to the changing of the area functions like forest, river, farming field, settlement, become reservoir and followed by the other changing.

Reservoir area includes 8 villages in sub-district of XIII Koto Kampar, Kampar regency, Riau province and 2 villages in sub-district of Koto Baru, Regency of 50 cities, West Sumatra. From 10 villages noticed that 4.886 head of the household have has been lost their villages,

farming field. Some of the households didn't get the compensation from PLTA-KP reconstruction because some of the intangible value, it means that some of the resources were marker failure. The tangible value wasn't part of the PLTA-KP cost.

Table II.1. Technical Data of PLTA Koto Panjang

Capacity Installed		**Penyadap Building**	
Power energy installed	: 114 MW (3x38MW)	Type	: Preassure
Energy per year	: 542 GW Hour	Elevation	: 64,0 M
Maximum Debit	: 348 M3/second	Gate type	: Roller Gate
High fall effective	: 38,1 M		
Dam type	: Concrete dam	**Spilway constuction**	
High	: 58,0 M	Type	: Overflow
Free Board	: 2,5 M	Flood	: 8,000 M3/second
Long part of the dam	: 257,5 M	Gate type	: Roller Gate
Wide dam	: 5,0 M		
High blow up dam	: 87,5 M	**Pipe centre**	
Long blow up dam	: 71,0 M	Type	: Surface
		Long	: 86,9 M
Power Plant Building		Total	: 3 Unit
Type	: On the surface	Diameter	: 5,0 M
Long	: 80,3 M		
Wide	: 35,6 M	**Transmission Network**	
High	: 44,0 M	Type	: 150 KV
Turbine	: Vertical Pivot Kaplan	Long	: 170 Km (3 phase system)
Generator	: 3 phase, Ac synchoronous generator	Tower total	: 213 unit
Capacity	: 45 MVA x 3 Unit	**Main Pylon**	
Voltase/ Frekwency	: 11 KV/ 50 HZ	Location	: Pekanbaru
		Type	: 3 phase out door
Connected Trestle		Capacity	: 18/30 MVA x 2 Unit
Location	: On the left dam	Voltage	: 150/20 KV
Tipe	: 3 phase		
Capacity	: 10 MVA x 1 unit	**Street Relocation**	
Voltage	: 150/ 20 KV	National Street	: 39,25 Km
		Province street	: 22,15 Km
Dam			
Gross dam capacity	: 1,545 million M3	**Bridge relocation**	
Netto capacity	: 1,040 million M3	Kampar Kanan	: 293 M
Water highest elevation	: 85 M	Gulamo	: 288 M
Lower elevation	: 73,5 M		
Width surface	: 124 Km2		
Flow area	: 3,337 Km2		

Often, cost that supported by society missed from the consideration and planning of a reconstruction. Looses arouse by the dam project have wide impact to the economy and wild animals in the forest. For examples the forest area that function as area for the elephants maximus, Ptingris sumatreinsis, Helarectos Malayanus, Tapirus indicus. National Budget (APBN) and loan from JBIC had financed the reconstruction project of PLTA-KP. The loan was Indonesian government loan. On the Phase I the cash flow was 12,500 million yen and phase II was 17,525 million yen with repayment period 30 years and 10 years grand period, the interest of the phase I is 2,5% p.a. and phase II 2,6% p.a. (JIBC, May 2002). Means that loan and ist

intererest will be due in 2007 (installment payment and its interest). The basic question is will PLTA-KP produce as the planning? So that the investment could return the loan and the interest without burdening the government, as a note that on 2000 PLTA-KP was deficit on operational Rp 24,6 million (JBIC, May 2002).

Table II.2. Total the resettlement house holds

No	Village name	Total KK	Citizen in 2000	Relocation Pattern	Information
1.	Tanjung Pauh	421	1450	UPP Rubber	646
2.	Tanjung Balit	313	1789	UPP Rubber	862
3.	Pulau Gadang	333	2584	UPP Rubber	666
4.	Koto Mesjid	259		UPP Rubber	518
5.	Ranah Sungkai	337	5777	UPP Rubber	674
6.	Lubuk Agung	220		UPP Rubber	440
7.	Batu Basurat	522		UPP Rubber	1044
8.	Binamang	178		UPP Rubber	356
9.	Pongkai Baru	72	1080	UPP Rubber	400
10.	Mayang Pongkai	259	1903	PIR Sawit	518
11.	Pongkai Istiqomah	128		UPP Rubber	-
12.	Tanjung Alai	313	1341	UPP Rubber	626
13.	Muara Takus	244	855	UPP Rubber	488
14.	Koto Tuo	599	2329	UPP Rubber	1198
15.	Muara Mahat Baru	447	1964	PIR Sawit	894
16.	Gunung Bungsu	241	1039	UPP Rubber	482

Source : JBIC report, Special assistance for project sustainability (SAPS) May, 2002

Someday the citizen movement and settlement in catchment area will make new problem that related with the controlling water in catchment area. Majority of the new villages were marked become the negative investment against the PLTA-KP construction. The location should have been a forest and protected area and support the ecology functions as controlling water that enter the dam.

Another problem that also related with the capability of dam in PLTA-KP to inflow the water, if the water level is more than 85 m above the sea-level, it would have sink the historical Muara Takus temple and Pangkalan Kota Baru Village (86,3 m above the sea-level). To reach the effective storage capacity the water level should be 100 m above the sea level. It means that dam function as flood controller doesn't work as expected.

1.2. Research Objective

1) To know the descriptive of the loss value in Natural resources (Ecology function) which was caised by the reconstruction of the dam for PLTA-KP.
2) To know the descriptive of the loss economic value and financial which supported by the society around PLTA-KP project.

1.3. Methodology

The study using the descriptive analysis to measure the economy loss because the construction of PLTA-KP which caused the loss of the natural resources and the forest ecology function. The estimation technique using combination of some techniques that appropriate for the field condition. Such as 1) relocation cost approach to know the cost needed to move the settlement and economy activity of the society 2) and replacement cost approach to count the cost needed to replace the ecology counting and use another relevant calculation to get better result. The second approach is used prudently to preventdooouble counting and use other counting system which is relevan ti case in field to get better result.

1.4. Data and Sources of Data

The primary data was taken from field observation and interviewing some sources who are relevant. Such as Taratak NGO, BPRK-DKP, WALHI West Sumatra and Riau, and also WWF Riau, and some athers who are related with PLTA-KP project. The secondary data was taken from SAPS report JBIC team, the research result of Andalas University and Riau University, BPS Riau, and BPS 50 cities, WALHI intern report and some other relevant reports.

2. THE DEVELOPMENT OF PLTA KOTO PANJANG, AN OPPORTUNITY COST

2.1. The Economic and Ecology Detriment as The Impact of The Development of PLTA-Koto Panjang

The development of dam in Koto Panjang is not only functioned as electric power station (3 x 38 MW) but also as flood control, irrigation, tourism development, and fishery. The project spent 30.025 billion Yen (Rp.1.6 quintillions). The loan fund was spent for: 1). The development of the construction of PLTA Koto Panjang. 2). The construction of the transmission circuitry, 3). The development of sub-station (dame site), and 4). Consultant service expense (JBIC, may 2002). Substantially, the development of PLTA-KP is an inefficient project, which spent a very big amount of fund as direct cost or indirect cost. The direct costs were not well thought-out so that it resulted complicated problems, which spent bigger cost than the project itself. The decrease of

prosperity, the destruction of economic, the ruin of social and culture of the society, was not calculated as the real cost of the project.[1]

The development of PLTA-KP victimizing land resources, forest, and other resources, results changes and brings big impacts to the society and the environment. The impacts are either positive or negative toward the economy, social and culture of the society. The positive implication is financial benefit got by the society because of the existence of the project. Positive implication toward the society is usually called *social benefit*. The negative implications are loss of natural resources which are the bequeath of the next generations, loss of field of works, loss of resources for the fulfillment of daily life needs, and loss of easiness of the nature. Negative implication is usually called *social cost* (Sukirno Sadono, 1978). The difference between the benefit (social benefit) and the loss (social cost) in a development of a project is called *net social benefit* or *national benefit.*

Direct cost is the cost used up to achieve the main goal of the project, while indirect cost is the cost resulted by the impact of the development of the project, for example: conflict cost, relocation cost, housing compensation cost, development of new settlement cost, and farmland and plantation compensation cost. However, most of the losses, for example: the loss of the beauty of the village, the loss of the ecological functions of forest, the loss of historical values, and the loss of local values, is difficult to calculate (intangible cost). The existence of the PLTA-KP project, from the beginning (project planning) until producing (1997), has brought problematical impacts toward the society. Economic and socially, it did not bring any positive impact toward the society who becomes the sufferers of the development of the project.

In a matter of economy, the losses the society suffered, like the loss of farmland and plantation, is fact of being forced. It means that if there were not the project, the society would not lose the resources they had. From the economic of natural resources point of view, the losses of natural resources means the loss of benefit of long-range in their life. These losses are use-making value of the natural resources, quasi option value, benefit of existence value, and benefit of bequeath value. One of the losses is the loss of rubber estate, which had produced economic net income Rp. 80,000 per day. (The production was 20 kg per day, and the price of rubber in April 2004 was Rp. 4000 per kg). If a farmer worked 20 days in a month, it means that amount loss of a month is Rp. 1,600,000. Their loss for 30 years would be Rp. 576,000,000 per hectare. This amount is what the farmer should have got during the 30 years.

Ecologically, the loss the society suffers is the ecological function of forest, which brought benefit for the economy, for example: the availableness of water for agriculture, microclimate control, erosion prevention, and etcetera. The suffering became more serious when the availableness of clean water decreased (the case happened in Tanjung Pauh Village) so that the

[1] Quasi benefit is benefit that gets from one project and accepted by one certain group, but there's other people group that suffer by its project existency, the quasi benefit is often not noticed in project making.

society had to allocate an extra expense for getting clean water. The loss of farmland is that because the previous farmland could be cultivated just by relying on the natural fertility. On the contrary, the new farmland needs an extra effort to cultivate. The land required fertility rehabilitation that spends an expensive cost. As the result, the production cost of cultivating the new farmland is higher than the previous farmland. Even, for poor farmers, the land becomes useless because they do not have enough money to cultivate it. Another benefit of forest that now could not be exploited is the product of forest, for example: timber. This condition was getting worse because the way of life changes totally. Some poor do not have enough ability to adapt the changes, for example to move from extensification pattern of agriculture into intensification pattern.

2.2. The Economic and Financial Benefit/Loss of Household As The Impacts of The Development of PLTA Koto Panjang

Financially, the society received compensation for their property (house, farmland, plantation, etcetera) because of the development of PLTA-KP. The compensation received by the society is Rp. 30 for a meter^2 of farmland and Rp. 500 for a meter^2 of field. It means that for one hectare of farmland and one hectare of field the farmer got Rp. 300,000 and Rp. 5,000,000 respectively. Meanwhile, Rp. 300 compensates productive land per meter^2. It means that the farmer got Rp. 3,000,000 for one hectare of productive land. Compensation was also received for their plantation, for example rubber. The compensation for one rubber tree is Rp 2,500 while the compensation for one coconut tree is Rp. 2,600. It means that the compensation for 300 rubber trees on a hectare land is Rp. 750,000. The amount of the compensation was decided based on the price of the seed. It means that the decision neglected the value of the plantation and the time of cultivation. In this case, the society's opportunity for having the product of agriculture in the future has been cut off by the compensation given unfairly.

The average compensation received by a household (if one household has one hectare of field, one hectare of rubber estate, and one hectare of unproductive land) case in Muara Mahat is Rp. 9,050,000. Another benefit got by the household is new settlement with 2 hectares of prime rubber estate and 0.80 hectare of crops planted, transmigration standard type house and the yard. Besides, every household also gets life insurance for the first one-year and the cost of prime rubber estate cultivation. The amount of the aids for cultivating prime rubber estate until the estate give product was Rp. 502,500 (2000) and Rp. 397,500 (2001). Up to now (2004) the rubber estate, which has been 3 years old (2000), has not given product yet. It is estimated that the rubber will give product in the next 1-2 years. The government gave some alternatives to rebuild the economic life through animal husbandry and fishery.

All of the facts above are the financial benefit received by the society that becomes the victims of PLTA-KP project. The average financial benefit or the compensation received by every

household is Rp. 9,000,000. Based on the result of the survey (WALHI, 2004), the financial benefit or the compensation received by the society is spent mostly for consumptive things. Some bought motorcycle, electronic (television and radio). Some others used the money to reconstruct their houses or to fulfill their daily needs. Only a little of the society used the money for productive business.

Table II.3. Relocation and rubber tree supplied by the Government

No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.	Tanjung Pauh	UPP Rubber	646	8 %	2-6	
2.	Tanjung Balit	UPP Rubber	862	0%	2-6	
3.	Pulau Gadang	UPP Rubber	666	80%	0.5-6	
4.	Koto Mesjid	UPP Rubber	518	90%	0.5-6	
5.	Ranah Sungkai	UPP Rubber	674	90%	2-5	
6.	Lubuk Agung	UPP Rubber	440	95%	3-6	
7.	Batu Besurat	UPP Rubber	1044	50%	10	Boat way
8.	Binamang	UPP Rubber	356	75%	8-10	
9.	Pongkai Baru	UPP Rubber	400	95%	1-3	
10.	Mayang Pongkai	PIR Sawit	518	-	0.5-3	
11.	Pongkai Istiqomah	UPP Rubber	-	-	-	Not supplied by the gov.
12.	Tanjung Alai	UPP Rubber	626	90%	2-7	
13.	Muara Takus	UPP Rubber	488	50%	3	
14.	Koto Tuo	UPP Rubber	1198	95%	1-7	
15.	Muara Mahat Baru	PIR Sawit	894	-	0.5-3	
16.	Gunung Bungsu	UPP Rubber	482	85%	3-8	
	Total		9812			

Source: Report from Special assistence for project sustainability (SAPS) May, 2002

Loosing the resources on which the society depended their life, the society got serious problem. It needs a quick handling to create alternatives of activities for the society. The government had ever promised to give a rubber estate that is ready for producing but it never comes true. Besides, the land given by the government still needs fertility rehabilitation. Because the society does not have any alternatives of productive activities, and because the society does mostly consumptive activities, the level of the society's prosperity decreases generally. Other cause is that the society is not ready yet to change their agriculture method. Besides, the society becomes dependent on aids or subsidy from the government.

Generally, the nominal of the income increases. However, the society, in fact, is not satisfied with the relocation. The investment and economic method implemented has not worked well. It does not bring optimal recovery for the condition of the economyof the society. The society still considered themselves as suffered victims. The way the society spent the compensation received does not bring positive effects for the effort of economic recovery. It is because of the lack of socialization to the society about the consumption method.

The loss resulted by the PLTA-KP project becomes more serious and complicated. The government fails to prepare important facilities for recovering the economy condition in the new

location. The government fails to create ready-cultivated farmland, especially about the fertility and the plantation. In the previous location, there were so many field of works and resources on which the society depended their life. On the contrary, in the new location the field of works and the resources are very restricted. It is because the society is not ready to change the way they live.

The rice field depends mostly on water. It is related closely with forest. As the result, only certain field could be cultivated as rice field. For the farmers, rice field plays a very important role in their life. In short, they need rice field to compensate theirs, which have been used for the project of PLTA-KP.

Table II.4. Main livelihood after Relocation in 2002

No.	Village Name	Main Livelihood	Sideline
1.	Tanjung Pauh	Gambier	Fishing
2.	Tanjung Balit	Gambier	Fishing
3.	Pulau Gadang	Freshwater Fishery	Hired Farmer
4.	Koto Mesjid	Freshwater Fishery	Hired Farmer
5.	Ranah Sungkai	Rubber	Hired Farmer, food plantation.
6.	Lubuk Agung	Rubber	Hired Farmer, crops.
7.	Batu Bersurat	Rubber	Hired Farmer
8.	Binamang	Fisherman	Hired Farmer
9.	Pongkai Baru	Rubber	Plantation, labor
10.	Mayang Pongkai	Sawit	Food Plantation , cattle, hired plantation
11.	Pongkai Istiqomah	Fisherman	Rubber tree
12.	Tanjung Alai	Fisherman	Carpentry
13.	Muara Takus	Fisherman	-
14.	Koto Tuo	Fisherman	
15.	Muara Mahat Baru	Sawit	Rear chicken, Hired farmer
16.	Gunung Bungsu	Gambir	Fishing, Food plantation

Source : JBIC report, Special assistance for project sustainability (SAPS) May, 2002

2.3. Forest Resources

The development of the PLTA-KP project does not only victimize the agriculture resources, but also forest resources. Forest as natural resources plays important role, especially as the hydrologic cycle balancer, microclimate and land fertility controller. The government did not consider the relocation as the compensation. The condition of the new land compensated is far from worthiness for agriculture. The function of forest as the hydrologic cycle balancer is one important thing should be considered. The evidence is the destruction of the forest resources resulted by illegal logging that makes the production cost of agriculture become more expensive. The production cost of agriculture was cheaper because it was supported by the good condition of ecology.

The bad management of forest seems to be the cause of the flood in Riau Daratan Province. The method of investment implemented by the government is also the beginning of the

destruction natural resources because it does not consider the natural resources exploitation for the future. A project usually becomes a problem to another project. As the result, the negative impacts are accumulated as public cost that is difficult to rehabilitate. The cost is very expensive. This would not have happened if the government had had a clear concept of management for the natural resources. The concrete example of unclear concept of the management is licensing the logging concession (HPH) and monoculture agriculture concession without doing any deep analysis toward the economic and environment aspects. Because of this, the irrigation channel was clogged up and the water did not flow.

The effort of rehabilitation of forest should not only be programmed continuously, but also be implemented by considering the economic benefit for the society. This must be liable. The serious problem for the developer of PLTA is the fact that there is a rotation of putting out of the electricity current that is, actually, a warning concerning the problem of water catchments area. In some locations, a little part is still a protected forest and conservation forest that the condition is in serious problem. It is caused by the erosion in the surroundings of water catchments, which reaches 2 cm per year (RTRWK-Kampar). If the vegetation of the forest changes into non-forest, the next 10-years the sedimentation would reach 20 cm. It means the management of PLTA-KP will get problems that are more complicated in the future.

Another function of forest is as the habitat of wild animals. This is one important thing should be considered because wild animals is component that must be conserved. If the population of wild animals (elephant, tiger, tapir, gibbon) gets extermination, it will result another costs, for example: rehabilitation of wild animals, preparing new habitat, and economic loss because of the destruction of farmland. Economic problem is not only a matter of farmland, but also a matter of government budget (opportunity cost).

3. THE ECONOMIC AND FINANCIAL VALUE OF THE LOSS OF NATURAL RESOURCES LOSS RESULTED BY THE DEVELOPMENT OF PLTA KOTO PANJANG PROJECT

3.1. The Method of Evaluation of The Economic and Financial of Natural Resources

The evaluation of the economic and financial of natural resources loss as the impact of the development of PLTA Koto Panjang project, is aimed to find out the direct cost. It is related to the permanent changes of the nature, which has been submerged. The area submerged is 124 km^2, Including two Kabupaten administratif region 50 cities, west Sumatera province (3,400 hectar) and Kampar, Riau daratan province (9.000 hectare) which was protected forest, and,

according to the customary law, the land is belonging to the society. The changes, of course, bring loss economic and ecologically for the society and the environment. The loss is divided into two, namely: tangible value and intangible value resulted by the failure of the market (market failure). The direct cost spent for the project is an opportunity cost. It includes the prosperity recovery because the PLTA Koto Panjang project has closed other opportunities of developing other projects.

The choice of developing PLTA Koto Panjang directly results impact of economic, social and culture. However, the choice becomes so expensive because it has to relocate villages with all the infrastructures, namely: farmland, forest, and other natural resources. The infrastructures play important roles in the society life because the society, from one generation to the next generation, depends their life on them. The easiness of nature (ecological service), the existence value, and the bequeath value are also disappeared because the functions of the nature has been changed into reservoir. Related to the natural resources disappeared because of the development of the PLTA Koto Panjang project, the methods of evaluation of the economic and financial used are relocation cost based and replacement cost based.

The evaluation of the natural resources is not aimed to decide the proper amount of compensation should be received by the society, but to describe the benefits and losses resulted by the disappeared natural resources. In the previous discussion, the form of benefits and losses resulted have been already illustrated. The loss the society suffers is also the part of indirect costs of the development of the PLTA Koto Panjang project and vice versa if the project brings positive impacts into the development of the society economic and financially.

Indonesian government often neglects the economic value of the natural resources. Natural resources are not considered as the important or crucial to manage in developing a project. Natural resources are only considered in term of commercial value, which merely bases the consideration on the price. In fact, farmland is a restricted natural resource; so victimizing farmland should mean compensating the farmland by opening new farmland. Furthermore, it also means other land will change its function. Changing the function of farmland, rice field, plantation, settlement, infrastructures, and forest resources to be a reservoir is not only a matter of loosing land for agriculture, but also a matter of isolation impact of the area or settlement near the reservoir.

3.2. Economic Value of Plantation (rubber, coconut, oil palm, and fruits)

3.2.1. Economic value of rubber

Rubber estate becomes prime commodity of this area. Besides, the commodity also plays important role for the society economic life by providing alternatives of work fields for the villagers. There are two kinds of rubber planted by the society, namely: prime rubber that the age

is shorter (28 years) and local rubber that the age is longer (more or less 78 years) and immune to plant disease. The advantages of prime rubber are the production capacity. Besides, the prime rubber could give product continuously during a year. This kind of rubber, in a year, could produce latex more or less 1,500 – 2,000 kg per hectare, while the local rubber could only produce latex 400-600 kg (KIT/P2TP, 1999). However, most of the society in Koto Panjang prefers to plant the local of rubber because this kind of rubber is immune to plant diseases. The local rubber could produce latex after 8-9 years age. The productive period depends on the season of the year.

Tapping the rubber depends on the weather. In the rainy weather the tapping could not be done. The average of effective tapping per year is 160. **Table II.5 The Economic value of plantations (rubber, coconut, oil palm, fruits)** shows the calculation of the economic value of rubber estate of 30 years of effective production. It is 50 % lower than the previous economic value. Totally, the product of latex per year is Rp. 5,283,600. To find out the net of today value (NPV), the annual product is multiplied by the productive period using the 10% discount. From this calculation, it is found out that the today value is Rp. 224.8 billions.

Table II.5 The Economic value of plantations (rubber, coconut, oil palm, fruits)

Components	Net Value/Year (Rp/Ha)	Net Value/Year (Net Value x area)	Total NPV of 30 years, (10% discount)
Rubber	1,200,000	5283.6 millions	224.8 billions
Coconut	2,400,000	4848.0 millions	44.6 billions
Oil Palm	5,316,000	159.5 millions	2.0 billions
Fruits	3,000,000	5757.0 millions	54.3 billions

Prices

- The area of the rubber estate based on the level of main income is 4,403 Ha., the average price is Rp. 2,000 per kg.
- The area of the coconuts is 2,020 Ha, and the price is Rp. 500- 1200 per piece.
- The area of oil palm is more or less 30 Ha, and the price is Rp 350 per kg.
- The area of fruits is 1 ha and the value is Rp 3 millions. It is assumed that there is no intensive cultivation.

Source: JBIC 2002; RTRWK Kampar Regency, 2000; Kampar in Numbers, 2002.

3.2.2. The Economic value of coconuts plantation

Coconut is plantation used for the fulfillment of daily needs. Besides, coconut is also a kind of old-aged plantation that does not need special treatment. The productive period of a coconut tree is 2-3 times per year. During a productive period, a coconut tree could produce 7-19 coconuts. It means that a coconut tree could produce more or less 48 coconuts (minimally estimated) per year. The price per coconut is Rp 500-1,500. In this analysis, the price taken is the lowest price. The value of the production of a coconut tree per year is Rp. 24,000. **Table II.5 The Economic value of plantations (rubber, coconut, oil palm, fruits)** shows that the value of

coconut production per year is Rp 2.4 millions per hectare. Using the estimation that the area is 2,020 hectares, based on the data of income (JBIC, May 2002), the production of coconut per year is Rp 4.848 millions. The today net value (NPV) of coconut, with 10% discount and 30 years of productive period, is Rp. 44.6 billions.

3.2.3. The Economic value of oil palm plantation

Oil palm plantation has a high economic value. The seed of the oil palm could reach Rp 9.000-15,000 per seed. In Kampar Regency, there are 64 plantations of oil palm scattered in six sub-districts. The area is about 77,269 hectares, which the 84.5 % is in Tapung, Sub-District XIII Koto Kampar, West Bangkinang, and Bangkinang Sub-Didtrict. The area is functioned as the water catchments area. The oil palm plantations that are cultivated by the society is just a little. It is estimated only 30 hectares scattered in the villages that become the victims of the project of PLTA Koto Panjang. The price of oil palm per kg is Rp, 350-450. Oil palm plantation could produce 3-4 times per year. One period harvest in one hectare can reach Rp.145 TBS. The value of one production is estimated Rp 5,3 millions per hectares. By the 28-30 years of production period, the total of net loss is Rp 2 billions.

3.3.4. The Economic value of fruits

Fruit plantation is the dominant plantation planted surroundings house. It is still rare that the society cultivates fruits as plantation like rubber, coconut, or oil palm. The fruits cultivated are rambutan, durian, avocado, jackfrui, and etcetera. Most of the fruits produces one time in a year. The price of one durian is Rp. 2,000 until 7,500. One durian tree could produce 50 until 120 durians. One rambutan tree could produce 100 until 150 kg, and the price is Rp. 1,500 until 4,000 per kg. In one trunk can produce 150-200kg, depen on trunk's big size. It is estimated that the area planted with fruits is 1,919 hectares. The total of commercial value of fruits production is Rp. 3,000,000 per year. Using the estimation of the wideness of the area based on the livelihood, it can be found out that the total loss in a year is Rp. 5,757 millions. It means that the total loss for the 30 years production, with 10% discount, is Rp. 54.3 billions.

3.3. The Economic Value of Young Plantation Agriculture

Young plantations cultivated by the society are plantation that has high economic value, for example: chili, corn, peanut, sweet potato, and cassava. For some of the society, cultivating young plantations is their main activity. Related to the relocation because of the development of the PLTA Koto Panjang project, the society lost their farmland to plants young plantations.

Table II.6. The Economic value of young plantation agriculture

Komponen	Nilai Value per Hektar	Net Value Per Year Nilai Value / tahun	NPV 30 years 10 % discount
Corn	1.65	1.0 billions	9.5 billions
Cassava/Sweet Potatoes	1.50	0.2 billions	1.7 billions
Peanuts	2.00	0.1 billions	1.2 billions

Assumption
- Corn is 0.5% from the total number of the farmers (the price is Rp 1100 per kg)
- Cassava and sweet potatoes is 10 % from the total number of the farmers. The price is Rp.1, 500 and Rp. 2,000.
- It is assumed that every farmer cultivates 0.25 Hectares for young plantation.
- The prices are based on the data from Kampar in Numbers, 2002

The Source of The Data: Compiled from various sources.

Table II.6. The Economic value of young plantation agriculture shows that the young plantations cultivated are corn, cassava, sweet potatoes, chili, and peanuts. The production capacity of the plantations per year could reach Rp. 1.3 billions. It the productive period is 30 years, with 10% discount, the NPV value would be Rp 1.2 billions. The production of cassava and sweet potatoes itself has reached Rp. 1.7 billions during the 30 years. The net value of corn that could be cultivated together with other plantations. The corn that cultivated by the people in a lot of land which aare possible and usually can be done ones in a year by combinet to other plant as based on data at **Table II.6. The Economic value of young plantation agriculture** is Rp 1.006 billions. If the cultivation is done for 30 years, with the level of discount 10 %, the loss would be Rp. 9.5 billions.

3.4. The Economic Value of Rice Field Agriculture

To fulfill the need of rice in Kampar Regency, the society cultivates rice field. From the 10 villages, which have become reservoir, more than 520 farmers or 11 % of the number of the farmers depended their income on the rice field. The rice field scattered in Gunung Bungsu Village, Koto Tuo Village (41 farmers), Muara Takus Village (19 farmers), and Tanjung Balik Village (26 farmers). The average of the wideness of the rice field of a farmer is 0.30 hectares or 1,3% or 3720 Ha. The system of rice field agriculture depends on the irrigation. Reicefield agricultural very devend on irrigation system, most irrigation system that exist in half technical irrigation system and rain water irrigation system.

The rice field cultivation using traditional and natural irrigation could produce 5 until 7 tons paddy per hectare. The production per year, the price is Rp 900 per kg, is Rp. 4.5 millions. It means that the rice field agriculture sector in one year could produce income Rp. 4.1 billions. If it is cultivated for 30 years, and the production is one time per year, the loss value suffered would be Rp 38.2 billions.

Table III.7. The Economic value of rice

Comparison	Net Value Per Year (Rp/Ha, Million)	Net Value Per Year (Net Value x Area)	NPV (discount 0%)
Rice (cultivated in un-irrigated field)	4.03	30.6 billions	60.5 billions
Rice (cultivated in irrigated field)	4.50	4.1 billions	38.2 billions

Assumption:
- The area used to plant unirrigated field rice per year is 15% of total previous village area.
- The area used to plant unirrigated field rice per year is 15% of total previous village area.

Source: calculated from JBIC's data May 2002

The farming of unirrigated field rice or dry field rice is conducted by a farmer, which does not have wet field. Then to fulfill their needs of rice, farmers expand their energy on planting dry field rice minimally 1 hectare to fulfill the needs for a month or for selling purposes. The areas used to plant dry field rice are about 1, 954 Ha or more less 15 percent of total puddle area. Then the dry field rice productions per year are Rp 30, 6 billions with NPV reaches Rp 60, 5 billions with 10% degree of discount.

Based on **Table III.7. The Economic value of rice** it is shown that field production, by assuming the field were operated to produce 1 – 2 times per year, with productions per harvest time are Rp 4, 050 millions. If this value multiplied with total operated field rice, then field production values are Rp 4, 1 billions. When those field produce for 30 years and carry out to get recent NPV, it becomes Rp 38, 2 billions with 10% degree of incentive.

3.5. Economic Value of Land Fishery

The calculation of income from fishery affairs is divided into two operations form; those are fishery catching and fishery cultivation. To measure the income from this sector is used two forms of calculations; those are income acquisition, which is based on the model of family's business, whether it is primary income or secondary income. Data of JBIC at May 2002 told that the total people's income, which earn their livelihood from catching fish, and is affected by project of PLTA-KP is 14% of all families (4, 886 families (HH)). Those are who carry out catching fish as secondary income, but the 2% of it makes the activity as their primary livelihood. Some villages that their major inhabitants are operating catching fish, are Pongkai Istiqomah Village, Muara Mahat Baru Village, Koto Tuo Village, Tanjung Pauh Village, and Tanjung Balik Village. However, after there were relocations, some villages turned their livelihood, such as Binamang Village, Koto Mesjid Village, and Batu Bersurat Vilage. These villages increase their income sourced from catching fish. **Table II.8. Economic value of fishery in millions rupiah** shows the data:

Table II.8. Economic value of fishery in millions rupiah

Components	Net Point Value per Year	Net Point Value for Per Year	NPV 30 years 10% degree of discount
Fishery	0. 51	6. 12	57. 7
Assumptions: • Result of catching in a day/HH is about 3 kg • The average of catching fish is 17 days/month			

Source: Data are calculated from many sources in 2004

Catching fish is not done everyday. It is very depending on condition of river stream and price of fishes at market. It activity is done when there is a spare time after harvest, to spend free time after collecting sap or cultivating their land. From a survey (WALHI, April 2002), the activity could be a daily business, while they do another activity in their garden or field; they also set a net or fishhook.

Effective time to catch fishes in a month is about 17 days. It could be more but to analysis purpose 17 days is used because from interviews with Pongkai Istiqomah inhabitants, the reality is various, could be so high or none. The average value is 3 kg/day, then in a month inhabitants' incomes are Rp 510, 000 or Rp 6, 12 /year. If it income is accumulated for 30 years catching, so the NPV is Rp 57 millions with 10% degree of discount. This scenario is only a minimally calculation. Usually, this catching is for their owns consumption.

Interview findings said that fishes are difficult to find and prices are not good, after the reservoir was built. Before development, many fishes are easy to find and have good price. Some fishes which hard to find or it could be disappear are garing fish (*labiobarbus sp*), baung fish (*macrones nemorus*), sunggai fish, barau fish (*hampala macrolepidota*), and some high streamer, such as gual fish (*lucima stigerum*). Some fishes which difficult to get are mali fish, toman fish, gurami fish, sepat fish, etc. The methods to catch do not change also tools used, such as fishhook, net, and dragnet. The value of loosing these species is still unknown because it needs more research to do.

3.6. Total Loss Value of Agriculture Resources as an Effect of the Development of PLTA Koto Panjang

Some people's sources of live that lost are farming, rubber plantation, coconut plantation, fruits plant, green plants, and so on. The biggest value to be sacrificed are rubber plantation resources, it reaches Rp 224. 8 billions with 10% degree of discount. The other sacrificed resources are dry or wet field rice, those are Rp 98. 7 billions with 10% degree of discount for 30 years operation. In detail, it could be seen in table 3.6.

Table II.9. Recapitulation of the loss value of agriculture resources as an effect of PLTA Koto Panjang

Commodity	Net Present Value Per Year (Rp/Year)	Total NPV for 30 years Production (10% Degree of discount)
Rubber Plantation	5. 3 billions	224. 8 billions
Oil Palm Plants	0. 16 billions	2. 0 billions
Coconut Plants	4. 85 billions	44. 6 billions
Fruits Plants	5. 76 billions	54. 3 billions
Green Plants	1. 3 billions	12. 4 billions
Dry/wet Field Rice	34. 7 billions	98. 7 billions
Fishery	0. 006 billions	0. 06 billions
Total		**436. 86 billions**

Source: Data calculated from table before

Total of sacrificed agriculture resource value reaches Rp 436. 86 billions for 30 years production and 10% degree of discount. It means that this value is a value of area production for 30 years if all products were harvested. A big loss of this potential means sacrifice big income from agriculture resources. To calculate economical value of agriculture used the lowest estimation to give logical picture of simple system of farming. The calculation "does not" include selling point agriculture area per hectare.

3.7. Economic Value of Forest Resource

PLTA-KP development also has sacrificed animal's homage, such as Elephant (*Elephans maximus*), Sumateran Tiger (*Pantera Tigris sumatrensis*), Tapir (*Tapirus indicus*), and Honey Bear (*Helerctos malaynus*) and so on. The development of PLTA-KP also drowned many crops and growths that have economic value or do not. Majority people around forest are farmers, which are directly or not related with forest resource. Even some of them make use of forest resource as their primary earnings to support live. For examples, the people who take lumber, NTFP, and forest animal. The lost of forest means the lost of their economic source for them.

The rating of people dependency towards forest products very relies on how big an income from forest itself. However, to some people, loosing a forest is not only closing their earning of livelihood but also seem as a threat to source of live they have. Farming area's need of water is necessary because during this recent time farmers rely on subsidy from existence of forest. Loosing forest also will increase plant disease and disturb the freedom of farmer to work on their land because destructed by animals (wild boar, deer, and elephant).

Forest is one of natural resource that plays a great role to support economic sustainability and prevent the sustainability of development's product itself. Direct use values is using forest function which has marketable economics value, where indirect use values are the advantage of forest as water controller, micro climate and preventing erosion and so on.

3.7.1. The Economic value of wood and non-wood

At 1999 forest area in Kampar Regency are estimated 609. 725 hectare or 56 percent of all Kampar's area (Kampar's RTRWK, 2002). However, the existence as an effect of forest conversion to be agriculture land, settlement, and plantation is threatened beside that, the growing of illegal loggings at protected forest or conservation forest. Forest resources become victim of many side's instant interest of economic. The assessment done toward forest tends to put on economics point of view. Then, it is forgetting to treat forest as a resource, which needs to be prevented as its function has an important role to sustainable long time development. Forest's sacrifice does not become a precisely thoughts yet as one of costs that should be taken by government or entrepreneurs, which have chosen to sacrifice forest in development program.

Damages towards forest area are not only caused by investors but also Government's Policy Product. As an example is the development of PLTA-KP. It does not only change the function of forest area entirely, but also policy of relocating villages and its habitants to where should be a protected area. Minimally it needs new area for rubber plantations are 4, 800 hectare and for green plants and settlements are 4, 500 hectare. This pressure does not stop yet, villages and inhabitants, which move to forest limit, they will directly use forest product either its wood or non – wood. Simultaneously, the relocation would shorten primary project's period, which is built with large sacrifice of material or non – material.

Table II.10. Economical value of wood forest and NTFP in millions rupiah

Lumber	25. 0	2, 571. 00	24, 234. 0
Firewood	2. 4	343. 20	3, 235. 0
Deer/Small antelope	-	7. 50	71. 00
NTFP	21. 6	2, 224. 80	20, 972. 0

Assumptions:

- Each of HH is assumed to gather 2 cubic/week, price/cubic is Rp 650, 000 and splendid cost 40% of selling price (8 x 650, 000 – 60% of selling price, Rp 2, 080, 000)
- Firewood gathering/day is assumed 20 bundles; price is 500/bundle (20 x 500 = Rp 10000) x 20 working days/month.
- Need of meat (Deer/Small antelope) is assumed 10 deer/year Rp 750, 000/deer
- Rattan gathering is assumed Rattan/HH/month, 200pcs., its price is Rp 9000/pcs
- So income/month Rp 1, 800, 000. This is only from a commodity of forest.

Source: Data are calculated from village monographic and JBIC's survey May 2002

This policy only focuses on solving instant problem and ignores long-term effect which will arise for the sacrifice of natural resources. This is only an accumulation of dissatisfaction towards PLTA-KP project that would threaten optimization of production process as an excess of mismanaging in technically or non – technically side. The problem becomes more complicated related to relocation and application of society's economic rehabilitation policy. The sacrifices are

reflected from forests' natural resources, which are counted basing on societies' primary income of wood and non – wood product.

Forests' area that sacrificed for PLTA-KP project's interests are 1). The Puddle area is 124 km^2, 2). Resettlement area, 3). The increasing of forest exploitation as an effect of relocation, 4). The opening of rubber plantation, oil palm, and green plants also the plan of new land expansion for plantation to attract some investors to invest their capital in Kampar Regency. People's economical losses are not only how large the drowned area, but also isolation towards people's plantation area, which would decrease economic values itself.

Table II.10. described loosing forest will loose people's economic potential resource from forest. Direct economic interest from forest is using the woods. Based on people's earnings which affected by PLTA-KP development are 4, 886 HH, 7. 1% of them work at forestry sector to take woods and other products, or about 143 HH from 349 HH work to this sector. From the data 143 HH work as firewood collectors to sell and 206 HH are lumber collectors. The calculation of total income for families who work at forest is shown at **Table II.10.** above.

Income per HH from gathering wood reaches Rp 24. 4 millions a year and from gathering rattan and large rattan reaches Rp 21. 6 million and from firewood are Rp 2. 4 millions. If the result in a year is multiplied by all of HH who work in forestry sector, then income values if the whole income per year multiply by hoaushold number aho work in forestry sector then income velue from building wood reach Rp.2.3 billion and NTFP reach Rp.22.2 bilion of lumber are Rp 343. 2 millions. To know loss value of NTFP and it is assumed 30 years operation of each NTFP, and then the values are Rp 48. 44. The losses are only from livelihood earning only, actually the other losses are bigger because functional changes are not affected societies' economic access only but also loosing animals' habitat, and another ecological advantages. Another loss from societies' meat needs is Rp 71 millions with assuming deer and small antelope catching of each villager is one per year.

3.7.2. The Lost of economic value of forest animal (elephant)

Forest conversion for developmental interest, settlement investment, and agricultural area have threaten animal's habitat. Riau Province's elephant population (*Elephus maximus*) are about 800, and 22% of the number are out of habitat (Riau Pos, March 2000) at the breeding place or center of exercise for elephant (PLG). The numbers of wild elephant are 627 and they are spread out in some locations at Riau's forest (see **Table II.11. Elephant population in Riau**) . Elephant disturbance becomes higher along with increasing forest's damages as an effect of illegal logging activity and forest opening for big plantation and settlements. At 2002, there was raging elephant in Biran Vilage, Kampar Sub – district that caused farming land and one unit of elementary school destructed, and 2 people injured (Riau Pos, March 2000). Furious elephant case continued to destroy residence's garden, field, and 12 houses in Baloi Village. In Kritindang,

there were 50-hectare field destroyed, and in Limau Manis 30 rubber plantations and oil palms were destructed (Media Riau, July 2000).

Table II.11. Elephant population in Riau

The spread of the elephant in Riau in 1985
According to Raleigh A. Blouch and Kuppin Simbolon 1985 They had identified 11 pouch of the elephants population in Riau,the total amount of the elephants ware 1,067-1,617. This amount was the highest at that time.

Elephant in Riau in 2000
Based on the data of BKSDA Riau, on July 2000, there were 16 pouch of the elephant population in Riau. The totals of the elephants on those pouches were 709.

Elephant in Riau in 2003
Based on the taken data from WWF, BKSDA Riau, Elephant training centre in Minas and others sources it was said that population of the elephant in those pouches were decrease significantly, on the 15 pouches left there were 353-431.

It was predicted agricultural land destroyed by furious elephant in 42 locations since 1982 – 1999 are rubber plantation 10 – 20%, oil palm 30%, and HTI 10% (Riaupos, April 2000). The high numbers of destruction have pushed people and certain side to hunt and kill elephants.

The hunting and killing elephant at 2000 happened in Tembilhan and Indragiri Hilir, Riau Province. However inside the incident, it surely caused by the damaging of its habitat or functional changing fro exploitation and forest conversion. WWF's data showed populations of elephant at 1985 are 1, 700 and spread out to 11 locations, and at 2000, the population decreases to 800. Threat of elephant extinction is coming because according to UNDP/FAO report elephant's adult time are about 10 12 years, and possibility to improve its population needs 30 – 50 years. (Riau Pos, April 2000).

Table II.12. Cost spending to relocate elephant as an effect of PLTA-KP development

Cost Component	Estimation Recovered Value in billions Rp	Note
Monitoring and Protection cost*	3, 303. 53	Destructed agriculture land and settlement caused by furious elephant are not counted yet *Totally Rp 10. 67 billions*
Catchments cost**	864. 00	
Maintenance cost***	6, 328. 00	
Transportation cost****	175. 00	

Note:
* Primary Report of Sub KSDA and PLN (1995) and Fund which is managed by NGO based on JBIC's report (2000)
** Catchments cost per elephant is Rp 24 millions, estimation cost of Sub KSDA Riau (Riau Pos, 2002)
*** Based on personal communication with WWF (estimation cost)
**** The other cost calculated from many sources and relevant data

Assumptions:
- Value is converted according to recent rate of exchange in 2003 and inflation level
- Maintenance cost of per elephant is Rp 24 millions and assumed 80% are protected
- It is assumed from 50% of the number are caught and protected for 10 years (1993 – 2003)

Source: Calculated from many sources

Assessing the value of an elephant is difficult because it is not one of market's good, different with other animals. To assess economic value of elephant should be directed on the loosing habitat and relocation cost acquisition and assuming that elephant is important to be protected. Elephant as a key species for analytical point of habitat's economical value, then for each elephant needs 400hectare of forest area. Loosing their habitat means there should be many cots spent to many possible scenario of relocating the animals. Surely, the cost would come from government's or NGO's development budget. In addition, some costs which are carried by people for the destruction to their land and settlement caused by furious elephant and also frightened costs.

The disadvantage caused by loosing habitat is not only finished on relocation scenario of elephant to PLG or new habitat, which clearly will arise new using of forest resources for loosing its real habitat. However, it will disturb ecosystem stability, and an ecosystem with new species, elephant, needs a large habitat. For example, the relocation of 36 elephants as an effect of PLTA-KP development need new habitat about 144 km^2, this is equal with sacrificed area and it is assumed that all of them release at new habitat.

According to **Table II.12.** the loosing of animals needs new habitat. It is clearly that animal's extinction has been an important issue for people's economic interest. Basing on the cost spent to protect elephant the calculation is:

Before filling PLTA-KP reservoir at 1997, 36 Sumateran Elephants was caught, but there were still some elephant around the reservoir (inhabitant's information). Elephant that looses its habitat caused by the project destroy people's plantation around the puddle. For the widen of settlement and the opening of new big Monoculture Plantation have caused elephant loosing its habitat trend was uncontrollable., then elephants made small and separated colonies.

At **Table II.12.** the costs should be spent to relocate elephants caused by the development of PLTA-KP as a preparation and catchments cost (monitoring cost) are more than Rp 3 billions. Total cost of protection and monitoring, catchments cost and breeding for 36 elephants spend more than Rp 10. 67 billions. This catchments and relocation costs does not include destruction costs on agriculture land and settlement caused by furious elephant yet. To breed and protect elephants with assumption of 80% of those elephants are protected and breaded, for 30 years NPV are Rp 6. 33 billions with 10% degree of discount for 28 elephants. It

also thought that the number is steady and exclude the possibility of elephant, which is dead, or birth.

Table II.13. Report of moving the Elephant from PLTA-KP to KM Gian Siak Kecil

No	Time and sex	Location of catching	Date of let the free
1	29 April 1992, male	Gulamo River	30 April 1992
2	9 may 1992, female and male	Batu Besurat Village	11 may 1992
3	23 may 1992 male	Lubuk Agung Village	26 may 1992
4	17 July 1992, female	Kabun Village	20 juli 1992
5	18 July 1992, male	Kabun Village	21 july 1992
6	20 July 1992, male and female	Kabun Village	23 juli 1992
7	11 August 1992, female	Kabun Village	15 August 1992
8	15 August 1992, female	Kabun Village	18 August 1992
9	20 August 1992, 2 female	Kabun Village	24 agustus 1992
10	27 August 1992, female	Kabun Village	31 August 1992
11	20 Sept. 1992, 2 female	Kabun Village	24 Octpt 1992
12	21 Oct 1992, male	Tanjung Alai Village	22 Oct 992
13	3 dec 1992, female	Telangkah Village	5 Dec 1992
14	6 Dec 1992, female	Telangkah Village	7 Dec 1992
15	9 Dec 1992, male	Telangkah Village	10 Dec 1992
16	11 Dec 1992, female	Telangkah Village	12 Dec 1992
17	14 Dec 1992, female	Telangkah Village	
18	17 Dec 1992, male	Telangkah Village	19 Dec 1992
19	27 Dec 1992, female	Gadang island Village	28 Dec 1992
20	12 April 1993, male and female	Kabun Village	14 April 1993
21	14 april 1993, 2 female	Kabun Village	17 April 1993
22	28 may 1993, 3 female	Kabun Village	30 may 1993

Source : Final report of catching and free the wild elephant by PLN and KSDA Riau
(Report of moving the Elephant from PLTA-KP to KM Gian Siak Kecil Catch and free the wild elephants from PLTA kotopanjang to SM. Giam Siak kecil was begin from 30 April 1992 up to 30 may 1993)

Table II.14. Catching the elephants on the step II let them free

No	Time and sex	Catching area	Date of let free
1	9 feb 1995, female	Pulau Gadang baru Village	16 feb 1995
2	20 feb 1995, female	Pulau Gadang Lama Village	23 feb 1995
3	16 march 1995, male	Pulau Gadang Lama Village	20 march 1995
4	23 dec 1995, male	Pulau Gadang Lama Village	26 dec 1995
5	28 dec 1995, male	Pulau Gadang Lama Village	30 dec 1995

Source: Final report of catching and freedom the wild elephants by PLN and KSDA Riau

3.7.3. Functional Economic Value of Forest Ecology

Economic value of Forest ecology is a value, which not considered yet in taking the development policy. Therefore, forest conversion policy only focused on forest commercial value. When flood or erosion becomes a problem, the thinking of how important is to protect forest as a water systematic controller and to protect forest existences be a significant need to minimize the

lost caused by. However, forest economic commercial value defeats ecological value itself, although illegal logging activity and simultaneous forest cutting down makes ecological problem related with the damage of ecosystem as an effect of loosing forest area.

Forest ecological function is realized as undivided part in an effort of increasing agricultural production. Although government tries to control flood and irrigation system by building a reservoir (DAM), forest still takes an important role to protect the function of both projects for long-term era. Many development cases are wasted in Kampar Regency, such as 23 unit of irrigation which are intended to watery field land as 9, 917 hectare now are broken and 80% of its do not function because of the damages of water catchments area (DAS) and the changing of forest covering vegetation becomes non forest. Beside ecological function, forest is also important to supply food source for many animals and as a certain habitat for some creature, which are only live in forest and will extinct along with forest extinction.

If this ecological function is calculated in detail, so the loss of loosing forest will be higher. Forest ecological loss is counted using the comparison between the results of world tropical ecosystem function and economic losses study caused by forest burn to estimate the sacrificed forest ecological value. Therefore 0 value becomes Rp 6, 415, 000/ha. These values include forest value as *climate regulation, disturbance regulation, water regulation, erosion control, nutrient cycling, raw material,* and the other function which might be too many to be explained.

Based on drowned area and sacrificed forest area, the area is about 30% and forest area estimated is 3, 720 hectares. Basing those areas and the estimation of forest ecological values in developing PLTA-KP are Rp 224. 96 billions.

3.7.4. Economic Value of Sacrificed Forest Resources in Development of PLTA-KP

According to **Table II.15.** the sacrificed economical forest value in the development of PLTA-KP is Rp 59. 82 billions and the recent forest economic value consummated by people is Rp 224. 96 billions. This value is only small part, which is counted according to the intensity of forest product's exploitation, in term of NTFP (rattan/large rattan, lumber, and firewood) exploitation. The other economical values of forest products are not counted yet. Wood exploitation values are about Rp 24. 23 billions, by excluding the variety of wood.

The loosing habitat only calculated from elephant's habitat, but tiger's, tapir's, and bear's habitat are not counted. Actually using black market prices could do the calculation. The price of a tiger reaches 24 millions; this prediction gives a disadvantage calculation in habitat conservation. Forest economic value, if included the sacrificed ecological function, ability to control flood and to serve raw material of biological resources, could be Rp 61. 97 billions from 3, 720 hectare of forest area (see **Table II.15.**).

Tabel II.15. The loosing of economic value forest resource an effect of PLTA-P development

Wood	2,57 milyar	24,23 milyar
NTFP	2,91 milyar	24,21 milyar
Meat	0.07 milyar	0.71milyar
Elephant's of habitat	-	10,67 milyar
Ekologis value	23 milyar	224,96 milyar
Total	-	284,78 milyar

Data resources : tabulation data from village monoghrapy and forestry (Dephut 1997)

4. Threat toward Ecology Function of Sustainable Natural Resources of PLTA Koto Panjang

4.1. Forest Interrelatedness and Water Resources

PLTA koto Panjang development is a project that efforts to make use of optimal water resources. It's believed that water resources is very related to forest existency as rresources that could put in order hidrologic function naturally. Forest can reduce soil surface erosion, prevent landslide and the root of trees in the forest is very effective to keep the water. Means, PLTA Koto Panjang development is not only construct the dam itself but also rehabilitate function and keep water catchment area well to give optimal protection to the beneath area. Ruin forest in water catchment area will become serious threat for PLTA Koto Panjang that will disturb inflow reservoir stabilization.

Pionneer cut down forest area activity and illegal logging for temporary economic purpose gave negative impact to PLTA Koto Panjang project. Means, threat toward project effective period which is planned for 50 years because water supply that become main input for PLTA Koto Panjang is being disturbing. This threat happened because reservoir area become shallow resulted by sedimentation that occured. Sedimentation level is estimated 150% per year (RTRWK 2000). In 35 years operation will occur 1 meter dam shallowness.

Related to its, erosion controlling in upstream area which is half located in Kabupaten 50 kota (kecamatan Pangkalan Koto Baru, kecamatan Kapur IX snd kecamatan Suliki Gunung Mas) needs agricultural and forest rehabilitation , land conservation by reforestation which is urgent to be done. Occured expirience at dry season in 2002, PLTA Koto Panjang must take extinguishing turns resulted by water inflow which is not support PLTA Koto Panjang to produce elctricity normally. So that , PLTA Koto Panjang is forced to take extinguishing turns to prevent total extinguishing, if all installed turbines are being function then water outflow will be bigger automatically, then in some days the reservoir can not turn the turbine (Riaumandiri, February 2002) Dam capability to serve water decrease because ruin of forest ecology function resulted by

decreasing water catchment area quality that not planned well, if the environmental condition is getting worse so the dam capacity will not optimal toward project effective period that planned for 50 years (RTRWK Kampar 2002).

4.2. Lost value Caused by Water Catchment Area Ruin

Forest ruin value ecologically could be seen by decreasing electricity production from PLTA Koto Panjang, forest function as water supply controlling to turn the turbine is reducing. PLTA Koto Panjang case is clear, forest ruin caused by intentionally or unintentionally, caused by lack of knowledge that how important to manage water catchment area is. Of course, water catchment area management can not be done by one institution, but it's must be done integrationally and cross by sector. Usage land and arrangement area as guidance to manage region can give positive direction for projrct continuing unless occur lost for the project.

4.2.1. Flood victims resettlemant villages location

10 (Ten) villages which is sunk by PLTA Koto Panjang development, more than 705 removed and relocated in water catchment area, that area should become dam protection area. One of removed flood village is Koto Tuo village and Siberuang village with 4466 household who moved to the village which is located in Bukit Bungkuk natural asylum forest region. Widening land that needed to form new settlement and rubber plantation with UPP rubber pattern minimum 8932 hectare or around 67% of Bukit Bungkuk natural asylum forest region.

Table II.16. Pattern and Relocation of Resettlement the Villagers as an Impact of Dam PLTA-KP construction

No	Village name	Name of new village	Resettlement location	Information
1	Tanjung Pauh	Tanjung Pauh	Rimbo Data/UPP Rubber tree	Village area
2	Tanjung Balit	Tanjung Balit		
3	Pulau Gadang	Pulau Gadang Koto Mesjid	Koto Ranah/UPP Rubber tree	XIII Koto Kampar
4	Batu Basurat	Ranah Sungkai Lubuk Agung	Ranah Sungkai/UPP Rubber tree	
		Batu Basurat Binamang	Souther Batu Bersurat/UPP Rubber tree	
5	Ponngkai	1. Pongkai Baru	Southern Siberuang/UPP Rubber tree	
		2. Mayang Pongkai	PIR/Sawit Sungai Pagar	Kampar Kiri
		3. Pongkai Istiqomah	Free/	Village area
6	Tanjung Alai	Tanjung Alai	Ranah Koto Talago	XIII Koto Kampar
7	Muara takus	Muara Takus	Sourthern Muara Takus	
8	Koto Tuo	Koto Tuo		
9	Muara Mahat	Muara Mahat Baru	PIR Sawait Bangkinang Blok X/G	Tapung
10	Gunung Bungsu	Gunung Bungsu	Southrn Siberuang	XIII Koto Kampar

Source : Arrange based on the report of Special assistance for project sustainability (SAPS) May, 2002

Pongkai Istiqomah village with free settlement pattern and relocation that they had done voluntarily but location that they had chosen is location which should become green belt area, same as Tanjung balik village and Tanjung Pauh village. It is estimated that widening land which used by PLTA project for removing and settlement is 14% of protection forest and conservation forest widening which regulate water inflow to PLTA Koto panjang. Protection forest and conservation forest widening which function as water catchment area is around 47029,22 hectare. But this protection forest and natural asylum forest condition is already changed in vegetasion covering appearance which is caused by illegal logging and cut down forest.

Private plantation widening reach 20% from total water catchment area widening that 74719 hectare contain rubber plantation and sawit coconut. The remain land is resettlement area and new settlement location and also previous settlement area in around PLTA Koto Panjang. Only a little area remain the function as forest region. Ruin and cultivation land usage without knowledge will keep continue the problem in around reservoir area.

Some type ruin and usage land in water catchment area assuming will reduce water support 20-30% from maximum water inflow possibility. Reducing water rate of flow also assuming to some planning toward reducing electricity supply to develop Kabupaten Kampar. In **Table II.17.**, it can be seen some planning to reduce electricity supply which is resulted by water supply disturbing.

Table II.17. Value of electricity production lost resulted by water catchment area ruin

Actual (98-01)	397,69	Rp. 1,50 thousand billion
Planning 1 decreasing 10 %	357,92	Rp. 1,35 thousand billion
Planning 2 decreasing 30%	278,38	Rp. 1,05 thousand billion
Assuption: 1) Price Rp.460 per kwh, average production cost Rp 61 per kwh 2) Average actual production based on data (JBIC May 2002) 3) Electricity production financial value, counted for 30 years production		

Data resources : tabulation data, JBIC report May 2002

In **Table II.17.**, PLTA Koto Panjang electricity production averaggge is 397,7 million per year. If it produces for 30 years, so production value 1.50 thousands billion with discount 10%. Water catchment area which is function to protect and supply water to PLTA Koto Panjang get more ruin resulted by settlement and extention privete plantation land, taking forest product without preservation and cut down for the new land for development and economic purpose. Because of that, forest function as water controlling influences water rate of flow is also influenced by high level surface erosion which occur in water catchment area that become shallow of dam around 2 cm per year (RTRWK). Assumption for this condition, water supply to dam will decrease so the dam does not produce optimally.

Decreasing product caused by water catchment area ruin, net present value become Rp.1.35 thousand billion in 10% discount. Means, decreasing income occur from production around 10% with value NPV Rp.0.15 thousand trillion. Second planning, assumed that decresing product 30% so the value Rp1.05 thousands billion with 10 % discount for 30 years production. Electricity lost value which is caused by forest resources ruin around dam and upstream area is Rp0.45 thousand biliion lost for 30 years production.

4.2.2. Economic and ecology value lost caused by resettlement in water catchment area

If forest resources lost caused by development resettlement region as substitute settlement land which is usage by PLTA Koto Panjang count, forest land widening which is conserved 14.658 hectare resettlement area. Each household got 3 hectare, the detail is 1 hectare for resettlement and garden, 2 hectare for rubber plantation. Forest that victimize for resettlement and rubber plantation is counted as in table II.10. Upright wood lost value and paintation diversity. This counting is different to table 3.8 counting, which lost is counted ecologically, because forest function changed totally. Forest covering in water catchment area case is forest function change into resettlement and garden. The forest lost upright trees and ruin of ecology.

Upright wood lost caused by pionneer cut down forest for resettlement and agricultural minimum 3 hectare per household. Based on upright wood value toward secondary forest condition and mix wood harvest system, lost value for 30 years operation is Rp54.23 billion with 10 % discount. If the production value used to present value so the lost for upright wood become Rp511.3 billion.

Table II.18. Forest resources economic lost value as impact for forest pionneering cut down for settlement in PLTA Koto Panjang water catchment area

Item	Net value (Rupiah per hectare)	Total NPV at 10 years of operation (Rupiah per hectare)
Wood	54,23 billion	511,3 billion
Value	94,03 billion	886,40 billion
Total	-	**1.4 thousand billion**

Assumption:
- Wood value is counted based on 14658 hectare new resettlement widening, upright wood secondary forest Rp. 3 - 3,7 million per hectare (Forest Ministry, 1998)
- Forest ecology function value Rp. 6.415.000 (Forest Ministry, 1998)

Resources : Tabulation data from village monography & WALHI's survey data, 2004.

Forest lost as ecology function, as hidrolic function, water saving, erosion controlling, soil former, soil fertilizer, and waste asunder. Average value lost 1 hectare is Rp6.4 million per year.

Forest value lost for resettlement is Rp886.4 billion with 10 % discount. Total lost become Rp1.4 thousand billion for 30 years.

4.3. Dam Effectivity to Control Flood in Downstream area

One of PLTA Koto Panjang dam development purpose is to control flood in downstream area like in Palalawan Kabupaten riau province is kabupaten that expirience directimpact of the flood. Half kecamatan in Kampar kabupaten include kampar Kanan water catchment area (DAS). High flood intensity caused trillion lost avery year, like agricultural area ruin including the product itself, economic line broken off so that economic activity become disturbing. Flood cycle that occur in these days is very different to the flood that occur in 1990-ies. Citizenry who lived at the edge of river got drunken fishes, took building wood and fire wood that flow by the river during flood in 1990-ies. Flood is not something new for people who lived in the edge of river kampar kanan river untul Palalawan kabupaten area.

Flood that occur in some last years looks like uncontrol. And the lost that caused of it is very huge, and sometimes the victim is human being. Rootcause of the flood that occur in Riau province is more than half (mostly) forest ruin, along these times forest hafunctin as controlling water management.

PLTA Koto Panjang dam development give a hope to the people to manage and control the flood, but it does not come true because the dam is not function effectively to solve the flood that occur in Kampar kanan water catchment area (DAS). After the dam exist, flood that occur also can not be controlled and caused economic lost by fish breeding dissolved, agricultural dissolved, and housing dissoved. Koto panjang dan become dilemma, because dam can not use effectively to keep the water in rainy season. Because the dam only tolerant toward certain limitation water rate of flow.

High maximun water that can be hold out by dam is only 85m dpl. If the dam keep the water until 100 m dpl, some villages and Muara Takus Termple will be sunk because temple location is in 86 m dpl. This is the choice for PLTA Koto Panjang dan management, let some villages and temple being sunk or release the water and let some downstream get flood as consequency. Besides, dam only possible to keep the water normally to preventmore huge lost, but the dam management choice is hold some villages and sacrifice other life's needs and economics. Even this is hard, but minimum lost solution must be found out.

Reservoir development plannings are for fish breeding and tourism. Those are other purposes that need to be follow up wisely and concrete, because it needs good management to prevent lost, as case sample in Keramba terapung fish breeding in danau Maninjau in 1999. That case could has happened again, and water quality will become main focus for society economic interest. Tourism development planning needs investment, and development itself can not stand by it self alone.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The estimation of natural resources is one way to give consideration on planned a project that is related with the function of the natural resources. Based on the analysis and calculation of the natural resources there are huge and variety sacrifices had been done because of the PLTA-KP construction. Some sacrifices are farmers, forest, and settlement. The reconstruction of PLTA-KP had been lost the potential in economy including the forest. The project, clearly, must take the responsible on the sacrifices. A reconstruction project will not be economic again if the sacrifices cost more than the financial advantages.

The calculation of the natural resources value will face some problems especially when it have marked failure, so the estimation is really determined by the creativity of an approach to give the logic of loss descriptive from the impact of the reconstruction of PLTA-KP. Cost for the direct impact is part of the cost project., even though in realisation cost never been calculated as cost project. If the cost involved, it means that the project is inappropriate economically.

The calculation of compensation value and natural resources loss value is different calculation. The calculation on economy loss for natural resources that was sacrificed wasn't in proportion with the old of the project value. These losses could be lost their income, advantages on enjoying the ecology subsidy, beauty and the value of the existence of natural resources. Disadvantages could be the value of water needed where society before could took it easily because it was available on nature. The condition was change, in the new area these values are scarce and they have to spend some money to have it. The doer of the project forgets the value of fertility of the land. In the last village, the cultivated land gave them freedom to made effort, because the land was still fertile and it had wide areas as moving farming pattern. While in new village there is no beneficial for the villagers and it needs high cost to recover fertilises of the land. Society take all the responsibility of the cost by not using the land and leave it. Another cost was decrease of the land value because of the distance from settlement.

Another sacrificed of the resources was the forest, both high economy value and unvalued. The valuable is separated into 2 parts they are economy value in directly and indirectly. Examples of direct economy value are wood produce and NTFP produce. Habitat of fauna will suffer from the loosing and changing functions of the forest, and it will cost with high price because of the changing animal. Not only the government but also society have to take the responsibility of this effect, infection of the elephants will attack the farming and plantation land. Finally, this attack will be a big problem for the continuity of elephants itself as a protected animal.

The loosing of elephant value is a consequence for the government and society. With assumption if the elephant's habitat is not being disturbed and they have enough space to live so

the government and the society didn't have to spend much money and they can use the land for their living. There are so many sacrifices on making a project and it cost becomes so expansive but it always denied.

5.2. Recommendations

1) PLTA-KP construction had sacrificed the economy value of natural resources more than the project advantage financially. The loosing of this project will higher if the production of the factor decrease, like water inflow from protected area, and didn't do any preventive thing optimally. So what people worried about will be proven that is the high eruption will make sedimentation to the dam.
2) Management the water catchment area is a must to give guarantee for the PLTA-KP needs, work as it planned, but in realisation the condition of the water catcmen area is broken and don't have any pattern to manage the natural resources related with catchmen area. It is need some support activities as follows:
   a. Government plan to open the opportunity for the investors to invest in plantation in Kampar should re-planned and accommodated water catchmen area of PLTA-KP's management.
   b. Government plan to give alternative on water catcmen area management by industry plant is dilemma because the plant will be fell again. Agroforestry system maybe betters rather than industry plant.
   c. Both new and old settlements which in catchmen area should get full attention to decrease the negative impact through the dam and conservation farmers' activities. And increase the income for economy productive to press the society interaction with forest.
   d. To give positive effect by the exist of the dam it would be better if there are alternative economy activities and develop another sector like tourism, develop the water management for economy need in lower area.
   e. Because of the broken water catchment area and dam a lot of the farming field dry, effect of the changing of river and subDAS debit of water. It is need a new irrigation to replace the old one and can't function anymore.
3) Reconstruction of the PLTA-Kp loos the natural resources not only society who loose their settlement but also the elephants. To decrease the loosing it is need protection and determining specific area for elephant' concession and far from entrepreneur and society who want to exploit the forest.
4) The operational of PLTA-KP should give positive contribution for the increasing and development of society economy. Natural resources' sacrificed in develop a project not yet a cost of a reconstruction project, it caused the compensation for resources always

low. Then, the disappointed makes new board disadvantage and impact to the reconstruction itself.

5) Effort to recover the society economy because of the PLTA-KP construction is a must, but it needs wise solution related with the problem that society faced because of the changing of the farming and management pattern now and in the future. Owner pattern in field and administrative isn't clear yet and it also makes problem.
6) Recovery the society economy by investment should based on the root problem and the process. Those ways are the solutions in village level before or after applied the investment by the government.

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CHAPTER III
MITIGATION ACTION STUDY ON NEGATIVE IMPACT OF PLTA CONSTRUCTION IN KOTO PANJANG WITH POPULATION OF ELEPHANT IN SUMATRA[1]

1. INTRODUCTION

1.1. Background

Elephant of Sumatra (*Elephas maximus sumatranus*) is one of big mammals which has spread large in Sumatra areas[2]. Elephant moves from montane areas to coastal lowland forest along the summer and they hide around the hills in rainy season[3]. In Sumatra, the population of elephant is showed in eight provinces (Lampung, South Sumatra, Jambi, Bengkulu, Aceh, riau, West Sumatra, and North Sumatra) and also fragmented in at least 44 groups of population.Newest estimation by Tilson et al (1994) predicts that there were between 2800-4800 wild elephants from those previous groups.

The population of elephant has got a lot of pressures especially from human activities, those from cultivation or resident activity and also development of infrastructure resulted from damage and elimination habitat of elephant. It is possible based on the fact that there are only 17 of those 44 groups that exist on protected areas, and rest of them is on production areas.[4] In North Sumatra and West Sumatra, population of elephant is almost forced to move to another areas by the pressures.[5] The same pressure is also happened on population of elephant in Riau. It is not equal when the missing habitat areas resulted from plantation, wood disaster, infrastructure of resident development, industrial, and mining is not continued by appropriate control for the population of Sumatran elephant preservation, such as providing and developing appropriate protected areas or other conservation improvement.

The development of PLTA at Kota Panjang is one of the activities that have been judged as a factor affecting population of elephant preservation either in Riau or Sumatra. The PLTA is made in areas functioning as the main habitat of Sumatran elephant in Riau with higher

[1] By: Biodiversity Conversation Indonesia
[2] IUCN. Tanpa tahun. Indonesia : Sumatera. Status of Elephants in Sumatera
[3] Ibid
[4] Ibid
[5] Ibid

conservation priority. Without appropriate control, the PLTA activity will increase the habitat loss, make habitat and population fragmentation, and increase potential conflict between elephant and people which will threat living population of Sumatra elephant directly or not at the end.

1.2. Aim

Research by Biodiversity Conversation Indonesia is aimed at reviewing on previous activities (mitigation action) conducted by the government or related parties in order to guarantee the preservation of elephant population in Sumatra on Kota Panjang related to the development of PLTA Kota Panjang.

2. METHODOLOGY

2.1 Method of Study

This study was started on May 2005 through several literal analyses. Then, continued by surveying field to get information and additional data related to the newest condition of habitat on Koto Panjang and Giam Siak Kecil wildlife reserve, and also survey condition of PLG Minas. Our team also made some interviews with the people on Koto Panjang and people around Giam Siak Kecil wildlife reserve, interview related parties such as WWF Riau, the leader of PLG Minas and Forest Service in Riau. The surveys held on August 5-14, 2005.

Furthermore, the data and information from literary and survey used to analyze activities that was done by the government and related parties in order to guarantee population preservation of Sumatran elephant at Koto Panjang related to the development of PLTA at Koto Panjang.

2.2. Analysis Framework

2.2.1. Population of Sumatran elephant in Riau

Riau is an important province for population of Sumatran elephant. It is estimated that there are at least 35-40% of those population live at Riau, and others areas are from Lampung, South Sumatra, Bengkulu and Jambi (40-50% of population) and Aceh. At least there are 1100-1700 elephants lived wildly in those provinces.

In Riau, the population spread at eleven giant groups includes population group at Torgamba, Tanjung Medan, Middle North Riau, Koto Panjang, Lipat Kain, Langgam, Middle South Riau, South Riau, Buatan, Siak Kecil, dan Rokan Hilir (Blouch and Simbolon, 1995).

Moreover, Blouch and Simbolon (1985) said, these groups is fraction from giant group population of elephant in Riau. They are formed as a result of habitat damage. Those groups have various population sizes, mostly are small population (less than 50 and 50-100 elephants) and the biggest population is on the border between Jambi/South Riau (at least 300-400 elephants). Among the 11 groups, the highest conservation group comes from Middle South Riau, Koto Panjang, and South Riau.[6]

Mostly they live either at outside protected areas or conservation. Blouch and Simbolon's study (1985) show that the population of sumatran elephant only live at Giam Siak Kecil Wildlife Reserve areas (50,000 hectares) and Bukit Rimbang Bukit Baling Wildlife Reserve areas (136,000 hectares). Data from Forest Service in Riau (2002) also supported the study that said there was not all protected areas can be used for habitat of elephants.

2.2.2 Threat

Population of elephant in Sumatra face bigger and bigger pressures from human activities. IUCN identified 5 main threats, as follows:

1) Forest conversion result from development of resident, cutting, expansion of cultivation and plantation, forest fire and land fire.
2) Development of plantation, especially on oil palm plantation.
3) The improvement of transmigration resident
4) Commercial cutting activities
5) Shifting cultivation

Those activities are able to make negative impacts to Sumatran elephant's preservation. The expansion of forest conversion may result in damage and habitat fragmentation. Limited habitat made elephants been trapped in habitat areas which limited support so that the population sensitive to extinction threatening (Terborgh as said in IUCN, no year). Without considering those elephant existences, Plantation and resident improvement may increase the conflict between people and elephant.

The same threat also happen in Riau. Blouch and Simbolon (1985) said that beside transmigration and plantation, the habitat of elephant in Riau is also "threat" by the development of infrastructure for industrial oil manufacture, either from ways or pipeline. Those pressures even been worse because of two factors, as follows:

1) Riau topographic circumstances which is relatively flat caused the elephant haven't got appropriate area to shelter around the hills in order to hind the pressures.
2) The limited amount of protected areas and conversion, and not all of them are suitable for habitat of elephant.

[6] IUCN. Op.Cit

Table III.1. Kind of threats to population of Sumatran elephant in Riau

Groups	Total Elephants	Main Threat
Torgamba	100-200	Forest conversion
Tanjung Medan	< 50	Transmigration, Habitat loss
Middle North Riau	200-300	Transmigration, Habitat loss
Koto Panjang	50-100	Dam construction
Lipat Kain	50-100	-
Langgam	< 50	Group Fragmentation
Middle South Riau	< 100	Transmigration
South Riau	300-400	Plantation
Buatan	<20	Group Fragmentation
Siak Kecil	100-200	Resident
Rokan Hilir	50-100	Transmigration

Source: IUCN, no year
Explanation: *= Blouch and Simbolon calculation (1985)

2.2.3. Impact of PLTA Koto Panjang

Koto Panjang areas is one of the habitat of Sumatran elephant which have the highest conservation value in Riau, after middle South Riau and equal to South Riau (IUCN, no year). The population in-group is 50-100 individual. Ahmad (1985) and Effendi (1987) mapped three explore areas of Sumatran elephant at Koto Panjang, as follows:

1) Kampar I track: cross over Tanjung-Muara Takus - Koto Tuo-Pongkai - Batu Bersurat - tanjung Alai and then back to Tanjung. This track is passed over 24 elephants
2) Kampar II track: cross over Malelo Mountain - Muara Takus- Batu Bersurat - Koto Ranah – Kebun – Tandun - North PIR Kalianta and then back to Malelo Mountain. This track is at least passed over 27 individuals.
3) Track XIII Koto Kampar –Tandun - Rokan: cross over Pendalian – Siberuang - Malelo Mountain - Muara Takus - Batu Bersurat - Koto Ranah – Kebun – Tandun - Ujung Batu and back to Pendalian. This track is passed over 25-50 individuals.

The construction of PLTA Koto Panjang will cause flooded area for about 75-85 m above sea, including subdistrict XIII Koto Kampar (wide 36.07 km2) and Pangkalan Baru (wide 27.93 km2). This dam has flooded the south side areas of Tanjung, Muara Takus, Pongkai, Pulau Gadang Lama, Tanjung Alai Lama, Muara Mahat, Ranah Sungkai, Lubuk Agung, Sungai Silam Tanjung Batik, and Tanjung Pauh (WWF, 2002; PT Kodya Kary, 1988). Seeing those flooded areas, it predicted that the dam would cut the sumtran elephant's track at Koto Panjang, either Kampar I track, Kampar II or track XIII Koto Kampar, at Tanjung, Muara Takus and Pongkai.

There are negative impacts as a result from cutting track, as follows:

- Habitat reduction and fragmentation, elephant cutting track may cause their habitat reduce and fragment into " habitat islands" that has only little supported power through the population.

- Population fragmentation, the cutting track may also cause settled giant groups divided into more small groups (pocketed heard). Elephant with small group is more sensitive to extinction.
- Increasing conflict with people, reduced and fragmented habitat force them to leave their traditional track and then start to enter cultivation areas or people residents to find the feed. This will make the potential increasing conflict between elephant and people.
- Population decrease, those three factors in a long term will make the survival ability of those elephants decrease drastically so that they will decrease their population significantly. In a short term, conflict between people by the increasing of poaching will create descent population significantly.

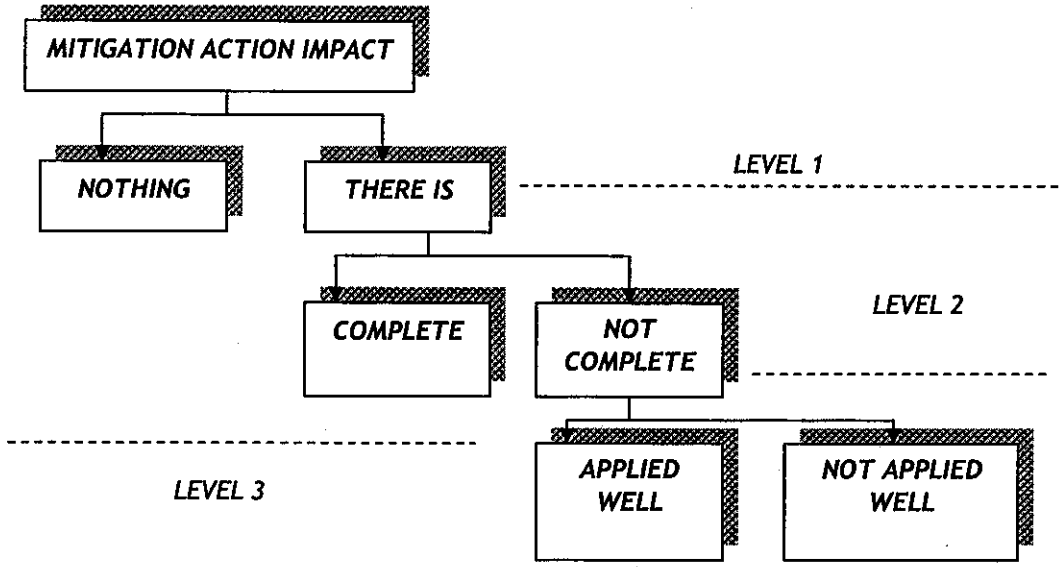
2.2.4 The Level of review on mitigation action

The negative effects can be avoided or reduced the intensity if the development of Koto Panjang Hydroelectricity includes comprehensive preventive action and handling the negative effects on elephant population (*mitigation action*). This research will conduct the review on mitigation action in three levels, that is:

1) Existence, includes there is mitigation action or not
2) Sufficiency, includes the sufficiency from the choice of mitigation action, such as is the action chosen the first best or not.
3) Technical appropriateness, includes have the choice conducted well technically and get the best result or not

The last conclusion will be concluded based on the review on three levels of mitigation plan applied in the development of Koto Panjang Hydroelectricity. Picture 1 shows the plot. From that plot there will be some possibilities, those are:

1) **Scenario 1** : There is mitigation action, the action completes and applied well – **the best condition**
2) **Scenario 2** : there is mitigation action, the action completes but it is not applied well
3) **Scenario 3** : there is mitigation action, the action does not complete but it is applied well
4) **Scenario 4** : There is mitigation action, the action does not complete and is not applied well
5) **Scenario 5** : There is no mitigation action – **the worst condition**



Picture 1. Analysis Plot

3. Discussion

3.1. Existence

The importance of the effect of mitigation action on Sumatran elephant population in Koto Panjang area is already stated in the article of The Planning of Environment Management in Hidroelectricity Project that is published by Tokyo Electricity Power Service Co. Ltd and PT Yodya Karya for the State Electricity Enterprise (PLN) in 1998. The action includes:

> "*...remove the elephant, tigers, from the area of dam before flooding process. The plan of removing is arranged by the Directorate of Forest Protection and Natural Conservation, Forestry Department, whereas the removing is conducted under the guidance of sub-bureau of Riau Natural Resources which is coordinated by the Bureau of Population and Environment of Riau Province. Besides that, it also involves Kampar Regency Government and the people. The cost is addressed to APBN (Local Development Budget)..Sub Bureau of Riau Natural Resources, already starts this effort by preparing back up forest area around Duri that is Sebanga as elephant habitat or forest of Giam Siak kecil Animal Conservation (160.000 Ha). In this condition, the forest can accommodate 400 elephants. Besides this forest, there is also forest area in Rimba Baling-Baling Hill Animal Conservation (136.000 Ha) which can accommodate 315 elephants. Theses two forest area are chosen for relocating elephant habitat because its capability to be animal conservation, those are broad enough, environment and topography are good and the status of forest area*"[7].

[7] Tokyo Electric Power Service Co.Ltd dan PT Yodya Karya. Rencana Pengelolaan Lingkungan (RKL) Proyek PLTA Kotopanjang. Maret 1988, halaman III-9 - III-10

Considering the report, removing the population and relocating the habitat of Sumatran elephant are chosen in mitigation action in the development of Koto Panjang Hidroelectricity. The group of elephant will be pushed into new habitat in Giam Siak Kecil Animal Conservation, and if it is needed will be pushed into Bukit Rimba Baling-Baling Animal Conservation.

This mitigation plan is strengthen with some decision letters as guidance. Within the reference WWF (2002), the guidance includes:

1) Decision Letter from General Director of Forest Protection and Natural Conservation no. 385/VI/PA – 5? 1992 27th February 1992 about the activity of Elephant Removal in Koto Panjang Hydroelectricity
2) Decision Letter from General Director Forest Protection and Natural Conservation no. 386/VI/PA – 5?1992 27th February 1992 about the activity of Elephant Removal in Koto Panjang Hydroelectricity
3) The Letter of MOU between PLN PIKITIRING West Sumatera – Riau with Sub Bureau KSDA Riau, Forestry Office of Riau Province no. 001/Ks.PJ/070/1992/M 4th Januari 1992
4) The Letter of MOU between PLN PIKITIRING West Sumatera – Riau with Sub Bureau KASDA Riau, Forestry Office of Riau Province no. 052.PJ/071/1994/M-3 3rd March 1994
   This mitigation action is strengthening by:
5) The Letter of MOU between PLN PIKITIRING West Sumatera – Riau with Sub Bureau KSDA Riau, Forestry Office of West Sumatra Province no 007/PJ/008/1997/M HT.120/0226 – 1870/97k 26th February 1997 about Operational Base Camp/Camp of Wild Animal Saving because the Project of Koto Panjang Hydroelectricity regency 50 cities West Sumatra Province
6) The Letter of Duty the Head of Sub Bureau KSDA West Sumatra no. KP.440/0228 – 1879A/97k 28th February 1997

The plan of mitigation and technical standard of mitigation action are integral anticipation of the environmental effect Koto Panjang Hydroelectricity **to avoid the worst scenario (5th scenario) in Koto Panjang.**

3.2. The Sufficiency

Is relocating the population as a mitigation action the first best option for the Sumatran elephant population preservation in Koto Panjang? There are two things which cause the option is doubtful as the best option and enough to secure the Sumatran population preservation, those are:

First, There is alternative choice of mitigation action which is more safety for Sumatran elephant population in Koto Panjang. IUCN/SSC Asian Elephant Specialist Group in their review on the action for Sumatran elephant conservation recommends the development of elephant

reserves around basin area as the first best option for the elephant population conservation in Koto Panjang after flooding process. IUCN declares that:

> *'...the second area concerns the planned Koto Panjang hydroelectric scheme, which would create a 124 km^2 reservoir. This would form the basis for'an ideal reserve for the 50-100 elephants found there. The new reserve should be created along the Riau/west Sumatra border on the west, covering about 700 km2 of good elephant habitat'.*[8]

This recommendation strengthen the idea from Oliver (1978) and Blouch and Simbolon (1985). Blouch and Simbolon clearly stated that:

> *"If it is decided to develop the hydroelectric project, consideration should be given to the possibility of creating a wildlife reserve bounded by the roads to Ujung Batu and Payakumbuh in the northeast and south, the plantations south of Ujung Batu in the north, and the Sumatra Barat border on the west. This would cover about 70,000 ha, most of which is good elephant habitat consisting of shrubby secondary growth interspersed with forested hills. Besides providing an area for elephants and other wildlife including tiger and tapir, the reserve would protect much of the watershed upon which the success of the hydroelectric project depends.."*[9]

IUCN, BLOUCH and Simbolon, and also Oliver never recommended the relocation of elephant population as the first best option in mitigation action to save the elephant in Koto Panjang. There is basic difference between relocation choice and the development of animal conservation in Koto Panjang. The development of animal conservation is internalization from externalities which arises as the effect of the project. Relocation, in other side, is the effort to remove externality to other place.

Some ideas as the becakground to not recommend the relocation are:

- The limited place for relocation. Table 1 show that every elephant habitat in Riau, except Lipat Kain, also facing the increasing pressure. The introduction of new group in large size will make the supporting ability of that habitat, which usually supports little groups, will be exceeded.
- The new places provided, are not match for elephant habitat
- The relocation process needs very carefully handling, not only when it is applied but also after the relocation or it will cause the high mortality for the elephant.

It's only, *the development elephant reservation around Koto Panjang Hidroelectricity is not the strategic choice and the first prority for Indonesian Government or Riau government.* The report from Forest Service of Riau Province (2002) shows that the project is focused on : wild elephant translocation, the development of elephant training center, and also the making of supoorting zoneor border in plantation area and transmigration area.

Second, *the choice of Animal reservation area Giam Siak Kecil as elephant population relocation area in Koto Panjang is not ideal choice.* IUCN reports that the area, same with Middle

[8] IUCN. Op.Cit
[9] Interview dengan Kepala PLG Minas dan staff Dinas Kehutanan Riau.

– North of Riau and Middle – south of Riau, needs better handling to reduce elephant and human conflict. The pressure from the widening of settlement area around becomes biggest threat for Siak Kecil. The other factor causes Siak Kecil area threatened is because this area is less priority comparing to habitat in Koto Panjang. From 11 dispersion area of elephant population in Riau, Siak Kecil area only in 6th position same with Rokan Hilir, with total number 33 than Koto Panjang which has 42 (IUCN, no year). *Field assesment* and *interview* conducted also shows that Siak Kecil area which is dominated peat moss swamp is doubted as a comfortable place for elephant habitat. This area is purposed to be wild life animal conservation in general and it is not purposed specifically to be sumateran elephant conservation.

Those two factors cause mitigation action which is only rely on animal reservation relocation Giam Siak Kecil *is not the first best option and it is not enough* to guarantee the conservation of elephant population in Koto Panjang. *This causes the failure of 1st and 2nd scenario so that the possibility comes to 3rd and 4th scenario.*

3.3. Technical Appropriateness

Have the choice to relocate elephant as mitigation action already conducted well? There are some doubts on technical appropriateness on the relocation. Those are:

- *The number of elephant relocated is not from the entire population in Koto Panjang.* Although, according to Effendi (1987) elephant population in Koto Panjang has decreased from 50 – 100 to 27 – 50. The official number recorded is under 50. The compilation from WWF (2002) shows the official data from government is 31 on relocation phase 1 (1992) and the cost is Rp. 299.988.000,00, and in phase 2 (1994 – 1995) and the cost is Rp. 49.885.000,00.
- *The actual number relocated is less than reported.* WWF investigation (2002) finds that there are elephant from other place included in the total number reported in Koto Panjang. The interview conducted by BCI also strengthen the possibility of manipulation of total number reported.
- *The high death rate when relocation or after that.* Although the number reported is only 1, WWF investigation and interview by BCI shows the high death rate. It is about 3 – 5.
- *Not all of elephant relocated from Koto Panjang is really reintroduced to Giam Siak Kecil Animal Conservation* . WWF's investigation (2002) also shows that majority elephant relocated is domesticated in PLG Sebanga and they are never relocated to Siam Kecil. The interview by BCI shows that elephant caught in Koto Panjang is removed to PLG Sebanga without information that the elephants are released again or not to Giam Siak Kecil Animal Conservation . The fact shows that there 13 elephant are caught and brought to PLG Minas.

- *There is not design and implementation monitoring after relocation action conducted.*
- Those facts show that Sumatran elephant relocation from Koto Panjang to Giam Siak Kecil Animal Conservation area is not conducted with adequate technical appropriateness. *The process conducted is lack of accountability so it causes doubt.* The process tends to domestication not relocation with reintroduction to new wild life habitat. This assessment leads that the whole process of mitigation action of negative effect of Koto Panjang Hydroelectricity on Sumatran elephant population in the area is in 4th scenario of mitigation action. The action is not adequate and is not well conducted.

4. SUMMARY

From the interview about mitigation action conducted relate to the development Koto Panjang Hydroelectricity shows that the scenario done is the 4th, that is: there is mitigation process, the action is not adequate and not well conducted. *The condition is the second worst from five possibilities. In this condition, it is very doubtful that in negative effect caused by the development of Koto Panjang Hydroelectricity on Sumatran elephant population in the area can be reduced or avoided.* Based on the consideration, this discussion concludes that *the development of Koto Panjang Hydroelectricity will reduce Sumatran elephant population in Riau for long term.*

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CHAPTER IV
THE ASSESSMENT OF SOCIAL AND ECONOMICAL HEAD HOUSE AS AN EFFECT OF THE DEVELOPMENT OF PLTA KOTO PANJANG

1. INTRODUCTION

1.1. Background

Ling journey of PLTA-KP construction planned is started by Project Finding (1979) and project detail design 87/89 by TEPSCO (Tokyo Electric Power Service Co. Ltd) and Yaduya Karya. The design was designed by 2 education institutions, Andalas University and Riau University where they did the analysis of environment impact (ANDAL) and Environment Organizing Planned/ Environment Monitoring planned (RKL/RPU). Physically the project started on 1991 and was officially on 1997. Hoped that PLTA-KP would be able to fulfill the over demanded of electric in West Sumatra – Riau. The demand was 500MW on 2002.

PLTA-KP construction used Kampar Kanan water with width flood was 12.400 Ha. The width flood area in 8 villages will under water the sub district XIII Koto Kampar, Regency Kampar, Riau Province and 2 villages in Koto Baru, 50 cities regency, And west Sumatra province. PLTA project using big money but the people sacrificed big also where they had to sacrificed their settlement, infrastructure, and their living.

For the need of the construction, government should relocated 10 villages which going to under water. Government prepared two patterns of relocation: customary pattern UPP/rubber, PIR pattern oil palm and self-supporting pattern. Self-supporting wasn't prepared by the people, but this pattern arouse because there was an inappropriate in people's need. The realization of the pattern by government wasn't appropriate with the fact. People made protest and claim the government about unpaid compensation or just half paid, also claim about house facility, and village facility in general which was inappropriate, the rubber estate promised had not planted yet (KORAN TEMPO, 8 Oct 2002). Government had released the money as much as US $ 17 billion as an economy compensation on 1988 (BELA, 2nd edition, June 2002).

Relocation is a big deal in economy development, so it is nature if the government scheduled all aspects which related with people's life, who became the victim on PLTA-KP project, to rehabilitate the economy, social, and culture. Means that actually the decision to make

PLTA-KP will give advantages compare with the cost for relocation and the nature sources sacrificed. But it would be a big question when people protest become higher then it identified that their sacrificed incomparable with the project advantages.

The higher protest should become the attention of the related side of the project to reanalyze the relocation and recover the economy. The lateness of the problem will make the economy and social problem worst. It is proper that economy and social recover find a new form and analyses comprehension. To find a new form is a must to recover the economy and society life and also to relocate the purpose had planned straight. To relocate the society life and economy is a challenge of course it is not a piece of cake. Related with the problem pattern used, this pattern is also related with productivity of farming pattern and nature source, organizing pasca/post relocation. This investigation will also compare the pattern with the society life before relocation.

1.2. Research Objectives

The research will focus on the relocation pattern applied and some problems arouse in economy social life of the people in new location, some of the objectives will be survey are:

1) To know the benefit and disadvantage of relocation pattern applied by the government and to see how the recover economy held in society.
2) To see the changing in farming produced pattern as an affect of the changing in owner the nature sources.
3) To know the investment and economy applied by the government to rehabilitate the society economy.

1.3. Research Methodology

Related with the research objectives therefore this research will use descriptive analysis to see the progress of economy recover in society and to compare the relocate pattern applied by the society. This research will also compare the economy progress on each village from different pattern and the economy/investment focus done by the government to built new economy.

1.3.1 Research location

The research will be held in some chosen villages and representative the different on relocation pattern such as Pongkai Baru Village, Pongkai Istiqomah Village, Tanjung Pauh Village, and Balung Village. Hope that those three villages will give specific description about some patterns applied in relocation as an effect of PLTA-KP dam. A monograph filling data in 15 relocation (fifteen) villages will be use to get the general description of the whole village.

1.3.2 Data and sources

Data used is premier data which get from direct interview, hope that it will give the description of the problem. The supporting data will get from discussion with NGO who involved directly with the society.

The secunder data is got from formal report from WALHI West Sumatra, WALHI Riau, NGO Taratak, and KBH Bukittinggi who active to support the people aspiration from relocation case in Koto Panjang. Another data was from BPS and BAPPEDA Kampar district, 50 cities district.

1.3.3 Data gathering technique

Premier data was got from direct observation from Social Economy Team of PLTA-KP for 20 Ha to the chosen villages based on the pattern applied. Gathering data technique is done using sampling method, each village had 30 respondents and the respondent is randomly chosen. To see the village whole description so we held the monograph filling questionnaire to each village, hope that the filling questionnaire do directly.

Secondary data which related with PLTA-KP was got from NGO Taratak and KBH Bukittinggi, and another support documents from WALHI Wast Sumatra, WALHI Riau. Supporting documents like special area planned, Riauin Account, Kampar in account, West Sumatra in account and another supporting data was got from BPS, Forestry Department, WWF Riau.

2. RELOCATION FORM/PATTERN APPLIED AND THE IMPLICATION TOWARD PEOPLE RECOVER ECONOMY

2.1. Relocation Form/Pattern Applied

Relocation pattern applied by the government through Andalas University facility and Riau University is separated into two patterns by giving alternative offering, where the terms definite by the government through Andalas University and Riau University as follows: *1).* Usual relocation/ UPP rubber, *2).* PIR oil palm relocation, 30 Free relocation (choose by their own because of undecided terms). The third alternative appears just because disagreement for the prepared location so the people choose their own land (see **Table IV.1.**). From the table can be seen that 14,5% from the total of head of household choose PIR oil palm pattern. And 3,9 % choose free pattern because disagree with the prepared land by the government. The high

choose for usual pattern/UPP rubber is because people consider that the this term better than others.

In Tanjung Balik and Tanjung Pauh society choose this pattern but with one condition that the area is still around Rimbo Datar. The term is accepted by government even the area is water catchment area or green belt area. Pongkai Istiqomah village offered the same condition but was refused by the government. UPP/rubber pattern is interesting because the sacrificed land for PLTA-KP is rubber estate area, means that the people had experienced or with other word the community was used to organized the area.

The relocation process had been growing, from 10 villages becomes 15 villages based on the government consideration on capacity of relocation objectives. Pongkai village was 3 villages, they are Pongkai Baru village, Mayang Pongkai village, and Pongkai Istiqomah village those three villages choose different pattern. Pongkai Baru with 200 head of household (HH) choose UPP/rubber pattern (usual pattern), Mayang Pongkai village with 166 head of household choose PIR oil palm and Pongkai Istiqomah village choose 190 head of household choose free pattern. From those three pattern chosen Pongkai Istiqomah didn't get house and plantation area as a compensation of their land sacrificed.

Table IV.1. Relocation pattern chosen based on the destination village

No	Village Name	Total HH	New Location	Relocation Pattern
1	Muara Mahat	447	Muara Mahat Baru	PIR/ oil palm
2	Pulau Gadang	333	Pulau Gadang	UPP/rubber
3	Tanjung Alai	313	Tanjung Alai	UPP/ rubber
4	Batu Basurat	552	Batu Bersurat	UPP/ rubber
5	Binamang Batu Basurat Pasar Batu Basurat Seberang	178 700 557	Sungkai Selatan Batu Basurat Ranah Sungkai	UPP/ rubber
6	Pongkai	259 200	Trans Sungai Pagar Selatan Seberuang/SP II	PIR/ oil palm UPP/ rubber
			Pongkai Istiqomah	Free
7	Koto Tuo	599	Selatan Muara Takus SP II	UPP/ rubber
8	Muara Takus	244	Selatan Muara Takus SPI	UPP/ rubber
9	Gunung Bungsu	244	Selatan Seberuang SP I	UPP/ rubber
10	Desa Tanjung Balit	421	Rimbo Datar SP I	UPP/ rubber
11	Desa Tanjung Pauh	312	Rimbo Datar SP II	UPP /rubber
	Total	**4886**		

Data source : WALHI, 2004.

2.1.1. Free relocation system (Pongkai Istiqomah)

Relocation process of Pongkai Istiqomah was more based on ethnic leaders' consideration. They had some reasons, such as:

1) Their authority of previous area and resources was prevented not to be given to other people.
2) The consideration of location which was predicted as strategic area to develop tourism around reservoir
3) Based on their economic perspective and majority livelihood types before (WALHI's survey, May 2004).

In perspective of traditional area, they did not loose their area because they still stayed around previous village and they had traditional authority to control and operate their resources.

Following to traditional figure's considerations people accepted gradual relocation system and were helped by their families. New relocated area is an area of settlement and dry field rice area which little family already stayed in before. Although at that time, this process of relocation was not permitted by government, it did not make people stop their trial to ask that their new settlement should be admitted as a village. Their effort succeeded after six years fighting. At 2000 their place admitted as a village, as a part of Koto Kampar XII Sub – district.

This admission means they also deserved to accept economic development and improvement as a part of compensation to people's affected by reservoir development. To improve their economic life, people needed a support to replace their primary livelihood, for example rubber plantation, and also other economic support, such as capital aid for fishery activity to change catching – fishermen to be operating – fishermen (WALHI's survey May 2004).

2.1.2. Usual relocation system/UPP Rubber (Tanjung Pauh)

Tanjung Pauh's residences chose UPP/Rubber system of relocation, this choice based on some considerations:

1) Relocation area was inside their traditional area
2) Their previous major livelihoods were rubber plantation and peasant of rubber plantation.
3) The place was near to mainly road connecting Sumatera and Riau.

In the agreement of this system, the government would provide facilities and infrastructures for new settlement, a unit of house, two hectares of rubber plantations, and a square of yard. Actually, this policy is such a controversial decision since the land used should be water catchment area, as well Pongkai Istiqomah's location.

Before, there was agreement that relocation costs were burdened by government, but in its implementation showed different fact. Rubber lands which were expected to replace people's primary livelihoods before, only a few of it gave benefit. It was caused by not all of two hectares of promised land had rubber plants on it as agreed before (JBIC's reported only 30 % of promised area planted). Although, government helped people by life cost aid for certain month, it did not work much because there was no guarantee of life after the aid stopped. In fact, the aid had made new behavior of people, depending to government in fulfilling their life needs. While farm

land substituted for dry crop (palawija) could not be operated yet because the area needed large capital to cultivate as it was resulted from flatted land so its fertile had been covered.

The pressure of life needs forced people to seek another livelihood beside agricultural sector, such as building laborer, sand and gravel laborer, and trading. Beside that, some people changed their position to be wood laborer as wood lifter, wood drainer, and chainsaw operator. As a result, it increased illegal logging and wood cutting. The raising escalation of woods exploitation in protected forest and conservation area around reservoir automatically inflicted a significant loss to KP Hydroelectricity, which used Reservoir Debit Water to run production processes. It means the raising escalation would lower KP hydroelectricity's production.

2.1.3. PIR Oil Palm relocation system (Balung)

This system was chosen by 14.5% of total families stayed in Balung and Mayang Village. Economically this system gave significant guarantee to people's livelihood, but it also caused big lost relate to economic dependency as oil palm system was monocultures pattern. Directly, this system put people on monoculture oil palm farmer and its made people only focus on operating major plants. Oil palm production process from planting, producing, transporting, and industrial process was a chain of production process that made people as a part of it, without understand to forest and to benefit they would get. Generally, oil palm commodity is a commodity which have fluctuated price and depends to investor and production cost. It means the profit get from oil palm is not so much when TBS price raises and it is not so little when TBS price downs because it is unseparatable part in oil palm plantation management.

Table IV.2. Problems Happened in Balung Village After DAM Kotopanjang Construction

Problems	Past	Now
Transportation	• Before 1983 used horses as transportation to pick their product (goods), while the people walk. • 1983 used truck to pick their goods and the people also. ✓ 1 person: Rp1000.00 ✓ Goods: rubber and gambier Rp 75/kg	• Now, to cross the river they use pantoon from PPK help in 1999 and just function in 2001 (Rp 135 million). The charges are: ✓ 1 person : Rp 1000.00 ✓ Motorcycle : Rp 3000.00 - Rp 5000.00 ✓ Car : Rp 20,000.00 ✓ Filling car : Rp 35,000.00/cubic • The crossing workers are from Balung and Tanjung Balik people. ✓ Fee for them is Rp 100/kg ✓ If small thing is Rp 1000/unit ✓ Motorcycle transportation : Rp Rp 10,000.00
Education	• There is only elementary school (SD) and only in Mahat Lama and Rangkiang, etc.	• There is SD, MTS (2000). • Because of the high cost for transportation children who continue their study should live in boarding house outside the village.

Market	• Acces to the market only by walked. • Balung people went to Pangkalan market every Saturday (weekly market)	• Market place still the same as before but they have to spent big money far transportation. And it effect to the cost for food in village. It becomes ¼ higher from the market price.

Some problems faced by people with this relocation system were untransparency on cutting price process, and loan installment, also direct cutting such as, transportation expenses and fertilizer's price, besides other cutting. This component rose when TBS sale price also rose and the escalation was not appropriated to their installment, which should be appropriated to the assessment of bank's interest declared at loan start. Agriculture process with capital dense and depended to market price had put people on a position which unable them to truly understand plantation's mechanism of production process. The people were used to accept net profit after directly subtracted for expenses and costs by main company. Other factors doubting people is future time after their plantation productivity finishes and process of rehabilitating land which needs large cost, and also status of land ownership for long term era.

2.2. The Application and the Process of Compensation are Inappropriate with the Relocation System.

In the process of compensation for wealth and sources of living which are the victims of Hydroelectricity's development, the government in the early process promises to give a better live after the relocation. The government explains in details about the profits that will be received. This process aims to encourage the societies to have the relocation with the guarantee that there are the improvement and development of future economy for the victims of Hydroelectricity. The promises from the government are the compensation for the houses based on the houses' specifications, the replacement of the farmlands, the rice-fields, and the other potential efforts. However, the societies realize that the relocation is the never-ending problem because the early indication shows that the process of the compensation doesn't work well. Moreover, there are no primary means of livelihood that once the government has promised. For the consequences, the government gives the cost of living but there are no clear time limits of the improvement of the societies' economy sources that lost.

Actually, the cost of living is given to guarantee the societies' live until they have the crops from the primary plants, but the primary plants themselves are not given to the societies. In contrast, the cost of living is given by the government only for one-two years (Mai's survey, WALHI, 2004). This condition causes the difficulties for the societies in the process of economy development and the process of creating a new beginning. Therefore, in these three years when the program of giving the cost of living is stopped, the societies have more difficult live.

In the process of the compensation, the societies are not explained how to manage the money in order to support the economy development after the relocation. It means that the societies are free to use the money as what they wish to. In fact, it is the government's responsibility to make the societies understand how to manage and spend the money in order to accelerate the societies' prosperity. From the WALHI's survey, it is obvious that the societies never get the explanation about how to manage the money. Besides that, the compensation is given in 6-12 months before the removal and it means that the money is already gone before the relocation itself is done.

The giving of compensation is each village has different problem and the systems chosen by the societies do not depend on the amount of the compensation money. For example, in *Pongkai Istiqomah* village, the compensation is given only 55,6% from the total amount but the houses' replacement are 100% done. For the rubber plants, it is only 42,2%; the coconut trees only 22,2% given; and for the fruits only 21,9% (JBIC, Mey 2002).

The same process can be seen also in *Tanjung Pauh* village which also has the disappointment with the process of compensation. The compensation for the farmland is only given 44% from the total amount, and for the housing, it is only 82,7% given from the total amount. Moreover, the compensation for rubber plants, coconuts, and fruits are given only 59% from the total amount. It shows that the process of compensation does not end yet. The process of compensation in other villages is not very different from the one in *Tanjung Pauh* village.

3. THE CHANGES OF THE SYSTEMS OF AGRICULTURE AND LIVELIHOOD AS THE RESULTS OF THE RELOCATION

3.1. The Changes of Agricultural System – Economy and Investment

Before the relocation, the agricultural system depends on the width of the land and the natural fertility to increase the crops. The efforts in increasing the crops depend on the width of the land and the rotation system applied as well. Some of the systems are not beneficial economically, but they help in supporting the economy life of the societies. These traditional agricultural systems are done by one generation to another. However, the land is already impacted by the relocation.

The development of hydroelectricity changes the societies' agricultural system where they depend on the various livelihoods in the village. Based on the survey done by WALHI 2004, there are 12-20 sources of economy life become the victims, for examples, the agricultural plants (rice, corn, cassava, etc), the fish hunting, the breeding, the hunting, and so on. These kinds of

livelihoods are restricted after the relocation, for examples, the societies are no longer can plant rice in the rice-field, hunt for fish, especially for those who are far from their previous village.

PIR's system of oil palm is the system which focuses on one type of oil palms because of the limited land, workers, and funds. The societies who choose this system will have a monoculture livelihood, such as in *Balung* village. However, *Pongkai Istiqomah* village does not change much but still the attempts also cause the uncertainty for the primary livelihood that lost.

According to the societies, the relocation is the new problem that can be passed, because the relocation directly changes the ways of planting, the ways of processing the farmland, the commodity, and the working tradition. Obviously, these changes demand the new knowledge and skills. Moreover, the relocation also integrates the societies into the market's influence. These changes also bring the changes in the productivity of the land and the changes of the traditional knowledge about how to manage the land in order to increase the crops. Obviously, bigger framing inputs are needed to do the changes compare to the previous one they have.

These systems' changes together with the development of hydroelectricity cause the disappearing of the ability to fulfill the daily needs through the various types of living source. Before the relocation, the means of livelihood use the system which plants many kinds of plants and forests as the alternative means of livelihood.

3.2. The system of the Management of Natural Resources

The relocation system determines the system of the ownership of the lands and the natural resources. In examining the system, the comparison is made between *PIR*'s system of oil palm and the ordinary system of UPP/rubber, and also the free system such as one in the *Pongkai Istiqomah* village. These three systems obviously show the various implication of the system of the natural resources' ownership. The system chosen by the societies in *Pongkai Istiqomah* village doesn't differ much from the old system because they do the relocation in their own village's area and village's custom. In contrast, *Pongkai Baru* village choose the ordinary system/UPP Rubber and they also determine the management of the restricted natural resources which is in another village's area. In one interview with the important person in the village where the relocation is, *Tabing*'s area, it is obvious that they just join in the land. If they want to expand the land, of course it will cause a conflict with the owner of the land, in this case the *Tabing*'s societies.

The system applied by the societies of UPP/Rubber is similar with the *PIR*'s system concerning with the width of the land. However, in the *PIR*'s system of oil palm, it depends on the parent-firm. It means that the system is interconnected to the agreement with the firm about the land's management. This *PIR*'s system is the system which is expanded by the firm to give the

advantage to the societies around the plantation area. However, the management's cost is from Bank and it is given by the firm with the guarantee of the land's certificate.

The system of *UPP*/rubber in *Tanjung Pauh* village does not differ much only that they are still in their own custom area and it means that they have their won income from the other resources such as the traditional plants. And they also have the possibility to expand the area because the previous area is only used as a reserve area. Some of the societies still have the traditional plants, such as rubber, gambier, and fruits.

3.2.1. Accessibility of the relocation and the old village

From various types of systems that are offered to the societies, some of them choose to have a self-supporting removal or the free system which still considers the old area of the village where they plant. The choosing of the area which is near the village is one of the considerations in choosing the location. Another consideration is that the commodity they have and the commodity itself is the economy for the societies.

3.2.2. The Influence of kinship in the management of the natural resources

The kinship system is the determining system in the management of the natural resources and the farmland which is done from one generation to another. The societies which have the unrestricted land will have the changes related to the management of the restricted land. The societies' ability in adaptation for the new natural resources will influence the success of creating the new working fields. The basic problem is concerning with the habits and the limited knowledge.

4. THE COMPARISON OF SOCIAL AND CULTURAL CHANGES BEFORE AND AFTER THE RELOCATION

The chosen system has the differences in the ownership of the natural resources and it changes the agricultural system. This change is followed by the changes of social and cultural aspects of the societies. One of the changes is the disappearing of the custom area which causes the traditional rules about the process of planting disappear as well. The changes also cause the kinship to be wide-apart.

The following will compare the social condition before and after the relocation in *Pongkai Baru* village. This village uses the ordinary system of *UPP*/rubber and is about 50 km from the previous village. While, *Tanjung Pauh* village also uses the same system but the relocation area

is still around the administrative area of the village. *Pongkai Istiqomah* village chooses the free system which does not use both of the systems offered by the government (*UPP/*rubber or *PIR* oil palm).

4.1. Pongkai Baru village

Pongkai Baru (New Pongkai) village was one of the three villages from Pongkai Lama (Old Pongkai) village. The other two were Pongkai Istiqomah village and Mayang Pongkai village. The area of Pongkai Baru village itself was 5,50 km^2 and the village was in XIII Koto Kampar district. It was 30 km from the capital the district.

4.1.1. The Society's condition before the relocation

The villagers of Pongkai Baru were farmers planting rubber and gambier along the bank of Kampar river. The relocation was done in 1996, and it had been socialized to the society since 1996. A meeting held by the society in the mosque of Pongkai Lama was the first step of the relocation process. The government, at that time, socialized their program of building new better resettlement. The government promised the villagers that they would develop better public facilities and housing.

The villagers' way of living in the previous village was naturally supported by the good familiarity and the customs, which grew harmonically with the social development of the society. The villagers did not find difficulties to finance and to fulfill their daily needs because there were some alternatives of income sources. There were many natural resources which were available to be exploited. Besides, the ideal distance between the houses and the market, between the houses and the source of water, were indispensable.

The villagers' level of prosperity in the previous village, in fact, is still higher than it is in the new resettlement. In the previous village, the agricultural commercial enterprises, and other food crops commodity initiated since a long ago, were strongly supported by the traditional resources. As the result, they could give important contribution for the development of the society in some aspects generally. In other words, the sacrifice of the society because of the relocation is a fact being forced.

Rationally, the sacrifice value of the society is completely higher than value of the hope to have a better life in the new resettlement. The society had no other choice; they had to follow the relocation program because of the development of hydroelectricity. In term of economic, social, and culture, the effects inflicted a loss upon the villagers. In the previous village, the villagers had rice field, rubber estate, coconuts, and river resources. All of these, traditionally, had fulfilled the villagers' daily needs. Besides, the alternatives of income sources were available.

4.1.2. The Economic condition after the relocation

In the new resettlement, fifty percent of the villagers of Pongkai Baru had become low-paid employees. Besides, they also exploited forest resources as their income source. The government had not realized the program of building new rubber estate in the new resettlement until 1996. The rubber estate, in fact, was build in 2000. Different from other villagers of other villages, the villagers of Pongkai Baru could not exploit river resources as fisherman. As employees, they get wages to finance their daily needs while waiting for the rubber estate production. Their wage per day was Rp. 9,000 – Rp. 15,000. This data was based on survey conducted by WALHI, May 2004.

The hard condition and the unavailability of alternatives of income source had resulted financial problem. Because of the financial problem, some villagers sold their house and the rubber estate. The reasons why they did this were as follow:

1) They found difficulties in getting income sources that could support their life.
2) Because of familiarity reason, they wanted to move to Pongkai Istiqomah where their family lived
3) They wanted to live in city.

The villagers sold their house and the rubber estate through the person who were important figures in the society. The value of all they had was Rp. 9,000,000 until Rp. 15,000,000. The thirty percent of the buyers that became the new villagers of Pongkai Baru village were refugees from Aceh.

The economic reason is sensible because the government program to build rubber estate in the new resettlement was just realized in 2000. It means that the production period would be in 2005 or 2006. The number of rubber tree got by each farmer was 200-250. This number would not be able to support the farmers' life significantly in the future because the farmers had to face more problems that were more complicated. This condition made the villagers had to find other alternatives of income sources that could support their life. Most villagers, then, gathered wood in the forest even though it could not guarantee their life would be better.

4.2. Tanjung Pauh Village

Tanjung Pauh village was one of the victims of the development of Koto Panjang Hydroelectricity in West Sumatra Province, 50 Koto Regency, Pangkalan District. Tanjung Pauh villagers were dependent on Batang Mahat, which is the creek of Kampar River. They were farmers of rubber. Their economic condition was save because their rubber production and the river resources could fulfill their daily needs.

4.2.1. The Process of Tanjung Pauh relocation

The government began the first relocation of Tanjung Pauh society on July 1993. The society was relocated to SP II in Rimbo Datar, Pangkalan District. There were 312 families or 1152 people relocated using transmigration system. On August 1994, the second relocation was done. There were 38 families or 387 people relocated. A meeting in a mosque in 1990 began the process of the relocation. At the meeting, the government promised the villagers of Tanjung Pauh to give the villagers compensation. The compensation would be a permanent house and a rubber estate that would be ready to produce for every family.

4.2.2. The Condition after the relocation

After the relocation, the society of Tanjung Pauh got the compensation, namely: fund of living for 18 months, a two hectares rubber estate which was ready to produce, a field for food crops, the compensation of their houses, and the compensation of their field and the plantation. However, the process of giving the compensation was not realized as the government, who was in charge, had programmed it. Only a little of the rubber trees could grow healthily.

Besides, the expensive cost of life in the new resettlement resulted by the unavailability of water sources in dry season had brought the society into complicated problems. More than sixty five percent of villagers had to buy water to fulfill their needs unless they had to reduce their productive time for working because they had to take water from long distanced area. This condition gave big impact into the economic condition of the society. Because of this difficult condition, some of the farmers decided to be traders, and most of them chose to gather wood in the forest to support their life.

4.3. Pongkai Istiqomah Village

Pongkai Istiqomah village was located in 4 km distance from the capital of Koto Kampar XIII District. Pongkai Istiqomah had one elementary school and two mosques. Pongkai Istiqomah bordered directly on Koto Tuo village, Binamang village, and Batu Basurat village. The changes of the social and economic condition were interesting to be observed because the relocation system was different from those of other villages.

4.3.1. The Condition before the relocation

Before the relocation, the way of life of the Pongkai Istiqomah villagers was not completely different from the villagers of Pongkai Baru. The villagers were farmers of rubber, farmers of food crops, and river fisherman. The government's program of relocation because of the development of KP Hydroelectricity had been heard by the society of Pongkai Istiqomah since

1991. There was an agreement between the government and the society. The agreement was that relocation program would be done after observing the condition of the new resettlement. However, the villagers were not satisfied with the condition of the new resettlement and the compensation the government promised. Because of these, some families initiated to relocate themselves to the new location they choose. The villagers consulted the new location they had chosen by themselves to the chief of the tribe. They themselves financed the relocation cost.

The villagers used the compensation cost they had to finance the relocation to the new location they chose. However, they found difficulties in the new location because the main land on which they depend their life was not available. It was difficult for them to have livelihoods like they used to have in the previous location. The way of life of villagers who lived in up-land become different from those who lived in lower-land. The primary needs, for example rice and coconut, that previously were easy to have from their own land, became difficult to get. They had to buy them whenever they needed.

4.3.2. The Condition after the relocation

Generally, the society of Pongkai Istiqomah after the relocation had made the lake located near their new resettlement as their income sources. They decided to become lake fisherman. Besides, they also cultivated their rubber estate that they got through agro-forestry program. Another aids after the village was definitively admitted could be seen from the economic development of the society exploiting the potentials of the village.

5. THE COMPARISON OF THE LEVEL OF THE SOCIETY'S PROSPERITY BEFORE AND AFTER THE RELOCATION

5.1. General Description

To compare the level of the society's prosperity before and after the relocation, some components were used as the means of measurements in order to get an appropriate comparison. The data of survey conducted by WALHI (2004) and of other researchers shows that the prosperity level of the society in general tended to rise. However, it is suggested that the prosperity of the society still needed to be improved by rehabilitating the public facilities and means for primary needs, for example: drinking water, and by rehabilitating the plantation that did not grow well (JBIC, May 2002). From the result of the analysis in the previous chapter, the comparison was restricted in certain villages as the samples. The villages taken as samples were

Pongkai Istiqomah, Tanjung Pauh, and Pongkai Baru. The process and the system of the relocation of the three villages were different.

The relocation process of Pongkai Istiqomah village was done in several steps. To finance the relocation, each family used the compensation cost of the house and the field. Answering the questions of the survey, most of the villagers from the villages taken as the samples stated that the compensation they received for their houses and fields were not appropriate. They said so because the compensation cost given were not enough to build new house. To build new house, most villagers used all compensation they received of their house, plantation, land and field. This was what happened to the villagers of Pongkai Istiqomah.

The villagers of Pongkai Baru village, previously they had been the same village as Pongkai Istiqomah, chose rubber as the commodity that would be cultivated in the new resettlement. The commodity chosen was as the compensation of their rubber estate and field, which had been victimized for the development of Koto Panjang Hydroelectricity. The relocation system was transmigration. It means that each villager got a restricted land to be cultivated, and it, then, means that they lost the area regarded as the community land. Intensification was a compulsory in order to increase the productivity of the agriculture, and in order to improve the level of the prosperity of the society.

When the survey was conducted (May, 2004) about 35 – 45 percent of the villagers worked in oil palm plantation located in the next village. They worked as daily-paid employees. This kind of job was both for women and men. However, there was different tariff for women and men. The tariff for a woman employee was Rp. 9.000,00 until Rp. 11.000,00 per day, while the tariff for a man employee was Rp. 15.000,00 until Rp. 17.000,00. They took this job because there was no other choice for them in order to fulfill their daily needs. The rubber estate provided by the government had not produced yet because it was just planted in 2000. It means that the rubber estate was build late. The lateness was about 3 – 4 years after the relocation. Because of this difficult condition, some villagers took a straight-risky way; they sold their land and the rubber estate. More than thirty percent of the families of Pongkai Baru migrated to Pongkai Istiqomah or to cities in order to get new income sources.

The society of Tanjung Pauh Village followed the relocation program of the government. However, the villagers insisted the government about the new location. They were willing to be relocated if the new resettlement was in Rimbo Data. Rimbo Data was a location which was not far from Tanjung Pauh. They had two hectares land for rubber estate. They also had land that had been planted with gambier. However, the gambier plantation did not last for long because the economic value of gambier was not high. As the result, most of gambier plantation were neglected.

5.2. The Comparison of The Income of The Society

Generally, the level of the prosperity of the society could be observed by comparing the income and the expenses of each family. Nominally, the income of the society had been higher than it was in the previous village.. However, the life cost was also getting higher and higher. From the income source and the nominal of the income point of view, there was significant difference between the period before the relocation and the period after the relocation. Before the relocation, there were many kinds of income sources which were available for the society and on which they could depend their life. Furthermore, the life cost was relatively low or cheap.

The availability of various income sources and the strong natural support had made their life easy. They had invested many things that could support their life in the future. There were already rice fields that could be cultivated every year by the support of natural watering. Their own vegetables commodity had been able to fulfill their daily needs. Even, they also could sell some of the vegetables they produced to add their income. The production of coconut and fruit were also overwhelming. Of course, they brought good impact to their income. The need of fish or other protein was also easily fulfilled because they could easily catch fish along the river. Even, some villagers had chosen fisherman as their main livelihood. The program of agricultural extensification for the traditional plantations, for example: local rubber and dry-field rice, which was conducted using rotation system, had become cash income sources that could support their daily life. However, because of the relocation, all of the easiness the society had in the previous location had been gone. They were only replaced by a hope of having new better life in the new resettlement after the relocation.

The hope of having new better life could only be achieved if the relocation, which was programmed by the government, had been implemented using such a way in which it was in accordance with intensification program. The hope of having new better life in the new resettlement could also be achieved if in the new resettlement there were income sources available for the society. Besides, the new resettlement should enable the villagers to make diversifications of their livelihood. After the relocation, in fact, there was not two hectares of rubber estate promised by the government. Another public and primary facilities, for example: clean water supply for daily needs, was not provided appropriately. The field provided for planting food crops could not be cultivated because the land was completely infertile and unproductive. In short, all easiness and natural income source the society had in the previous location were not yet compensated by all facilities provided by the government.

These unbalanced had resulted lower level of prosperity of the society in general. Most villagers stated that they would prefer to live in the previous location than to live in the new resettlement. Although, the income was getting higher nominally, the life cost was also more expensive. The change of the income sources, which refers to the easiness of getting money,

was resulted by the monoculture supported by the government. The lateness of providing the primary income sources in the new resettlement had been the society's loss in term of real life. The unavailability of primary life sources, the expensive life cost, the long distance between the resettlement and the agricultural land, the long distance between the water source and the resettlement, the long distance to the market, had become social variable costs that the society had to suffer until all their needs and the unbalanced compensation were fulfilled appropriately. It means that the longer the government could provide the primary life source, the higher and the heavier the social cost the society had to suffer. However, some villagers had been successful in term of economic in fact. They were successful by having new kind of livelihood in the new resettlement. This fact should also be regarded as the impact of the relocation programmed by the government.

The components of social cost the society suffered were as follow:

1) The compensation cost was not yet enough by only providing land and housing.
2) Some of the government's program were not realized, for example: rubber estate.
3) The government's guarantee that the society would have better life in the new resettlement was not fulfilled,
4) The facilities for the primary needs in the new resettlement were not provided appropriately.

Based on the result of the survey conducted by WALHI 2004, forty-seven percent of the income of the society came from service business. The average income of the society of Tanjung Pauh was Rp. 10,800,000 per year. It means that they got Rp. 770,000 per month. This amount was used to finance their family which consisted of 4-5 people.

Table IV.3. Comparison of people's income before and after the relocation (Mahat Baru village case)

No	Before relocation	After relocation	Activity before relocation	Intensity	Activity after relocation	Name
1	7.480.000	9.600.000	Woods, stone, fish/rubber oil palm	decrease		Hadirin
2	1.560.000	7.200.000	Woods, fish	Stabil	Oil palm	Ismon
3	1.080.000	18.000.000	Fish, rubber	Increase	Oil palm	Abh Razak
4	9.000.000	12.000.000	Farming	Stabil	Farming	Agus Salim
5	4.800.000	12.000.000	Rubber	Increase	Oil palm	Pria Edi
6		15.600.000			Farming, laborer	Nasir Siregar
7	3.800.000			decrease	Farming	Sodikit
8	6.000.000	4.000.000	Rubber	decrease	Oil palm	Nur
Total	33.720.000	78.400.000				

Data source : Survey WALHI 2004

Table IV.4. Avarage Income before and after the relocation of Tanjung Pauh, subdistrict Pangkalan 50 Koto

No.	Relocation		Changes	Kings of living before
	Before	After		
1	3.600.000	12.000.000	Increase	wood
2	9.125.000	12.000.000	Stabil	farming
3	-	10.800.000	-	farming
4	12.000.000	10.000.000	Decrease	Laborer, fsrming
5	7.200.000	19.000.000	Increase	Civil servant
6	13.800.000	8.400.000	Decrease	farming
7	6.720.000	14.400.000	Increase	Teacher
Avar age	8.740.833	8.841.666		

Data source : Survey WALHI 2004

Table IV.5. Percentage the income before and after the relocation in Balung village XIII Koto Kampar sub district Kampar in 2004

Name	Before relocation	Percentage	After Relocation	Percentage	difference
Hadirin	7.480.000	32%	9.600.000	78%	2.400.000
Ismon	1.560.000	-692%	7.200.000	22%	-10.800.000
Abh Razak	1.080.000	556%	18.000.000	6%	6.000.000
Agus Salim	9.000.000	33%	12.000.000	75%	3.000.000
Pria Edi	4.800.000	-75%	12.000.000	0.4	-3.600.000
Nasir Siregar			15.600.000		
Sodikit	3.800.000				
Nur	6.000.000	-33%	4.000.000		-2.000.000
	1992		2002		
	2270		8500		27%

Data source : Survey WALHI 2004

The description of the society's income in the new resettlement shows that the average income of the society, which was taken from the 30 villagers as the samples, were only Rp. 9,000,000 per year. It means that they got more or less Rp. 800,000 per month. This amount included already all incomes they got. Most families had two people who produced income. The amount had also included the additional income they got from their family who lived in cities. The amount was not enough to meet the daily needs. This condition was not completely different from the condition of other villages.

5.3. The Comparison of The Level of The Society's Prosperity Before and After The Relocation

The decrease of the level of the society's prosperity as the impact of the relocation programmed by the government had become social cost of the project of the development of KP Hydroelctricity. The society did not deserve to suffer the social cost. It should be an important lesson because the cost was too expensive and would become more expensive if the government did not handle the problem quickly. The society was still waiting for the realization of what had been programmed by the project implementer. The society was waiting for the improvement of the livelihood availability, for example: rubber estate which was ready to produce, land which was fertile to plant food crops, rice field. The society also insisted economic aids until their main livelihood programmed came into productive phase.

The average income of the society of Tanjung Pauh village was Rp. 770,000.. This amount was already bigger than their income in the previous location. However, the condition in the new resettlement was completely different from the previous location. The condition would be far better if this amount of income was for living in the previous location. Because in the new resettlement they had to buy all of their daily needs, they became poorer and poorer. This condition became worse because the general economic condition was also getting worse. It could be seen by the index price of primary needs that had been raised.

In the previous village, the primary needs, for example: rice, could be fulfilled by their own production both from the rice field and from dry field. To be able to fulfill their own need of rice, they needed at least one hectare of rice field. From one-hectare rice field the rice production could fulfill their need until the next production. The need of vegetables and side dishes could easily be fulfilled without spending any money because they could get vegetables from their own land and they could get fish from the river. Some kinds of old plantation, for example: coconut, was also enough for their own consumption. They could also get additional income by selling coconut. The main livelihood of the most society was cultivating rubber estate. The average production of the rubber estate per day was 19 – 24 kg. It was equal with Rp. 76,000 (based on the price of rubber on May 2004). The effective production phase of the rubber estate was 20 days per month. It means that the income the society could get from their rubber estate was Rp. 1,500,000 per month. Another potential income source were available. They could plant certain plantation in their yard, they could gather wood from the forest, and they could catch fish in the river.

The high sacrifice the society had to pay should be paid back with appropriate compensation. The appropriate compensation the society deserved to receive was a new resettlement that has the same value as the previous one. Various kinds of livelihood should be available in the new resettlement as they were in the previous one. The rubber estate that had

become the main livelihood of the society in the previous village should be available in the new resettlement.

From the description of the economic condition in the new resettlement, it is clear that the society had a feeling of being poor because the high life cost was not compensated by the availability of income sources in the new resettlement. The social cost the society had to suffer had become higher and higher because there was no improvement in the economic condition of the society. The inappropriateness of the public facilities and the unavailability of income sources had given a negative contribution to the bad exploitation process of the natural resources and environment. The urgent need of having cash money had resulted dependency of the society on brokers. The villagers never considered the bad impact of felling of trees. They fell of trees in the water catchments area in order to get quick cash money. It means that the relocation that had decreased the level of economic condition of the society had also given negative contribution to the goal of the development of the project. The level of erosion that was high had resulted the decrease of the capacity of the water catchments area. It, in the end, made the cost of the project of the development of Koto Panjang Hydroelectricity became higher and higher. It also means that the ability of the project to produce an optimum benefit was decreased. In contrast, the loss the society had to suffer become higher and higher. It could be predicted that hydroelectricity as the company would not be able to finance all costs of the development.

6. THE GOVERNMENT'S POLICY PATTERNS FOR THE IMPROVEMENT OF THE SOCIETY'S PROSPERITY AS THE VICTIMS OF THE DEVELOPMENT OF THE DIKE

6.1. The Form of Economic Activities and Investment Implemented by the Government.

The policy pattern for the improvement of the economic condition of the society could be divided into two forms, namely: several forms of economic aids and investment. Generally, the form of the aids were as follow:

1) Providing the seeds of rubber plantation
2) Fishery improvement
3) Agricultural input
4) Cultivating cost

However, in order to be successful, the investment could not be implemented separately. It means that one activity should support another activity in order to achieve the goals of the investment optimally.

Most of the investment conducted by the government had not given a clear result yet. Some activities implemented looked like reproducing the same problem in the short period. A successful investment, principally, should have shown indications of real gradual improvement. The problem and the loss the society suffered at that time and the next period were the result of the investment. The patterns of the economic aids which were implemented, for example: providing fund for life cost, directly could be seen as ineffective and unclear program. It was already clear that without fund for life cost the society could still struggle for their living.

The economic improvement for the society as the victims of the development of Koto Panjang Hydroelectricity was a compulsory in order to bring the society back in to the good economic condition they had. The economic improvement could not be separated from the government effort in implementing the compensation cost of the relocation program. Building the good economic condition the society had ever had was a big challenge. It was the basic problem should be solved first. The investment model, which was implemented in the effort of improving the economic condition of the society, had to be considered and measured in term of function and advantage for the society and other parties. The government, in their effort of improving the economic condition of the society, preferred to focus on the creativity in developing the enterprises which cultivated the resources left in the new resettlement, or it was adapted with the availability of the resources in the new resettlement. Meanwhile, the government also implemented the economic aids program, for example: the program of cheap rice, the fund for life cost, and other consumptive activities.

6.2. The Distribution of The Cost and The Advantages of The Implementation of The Investment or Economic Aids Pattern of The Government

The distribution of the advantages of the implementation of the investment or economic aids pattern varied. By understanding the distribution of the advantages of the investment in the effort of improving the economic condition of the society, and by understanding the value of the advantages, would got a clear understanding of the value added the society got in various sectors of economic. However, the clear understanding of how much a farmer, a trader, the project implementer, and the local government got the advantages were not clear. The interesting thing could be exemplified by the program of the development of the rubber estate which had been failed. The distribution of the advantages for the society did not reach the target. What happened was the contrary of what was expected. The advantages could only be accessed by businesses

or organizations involved in the program of relocation and realization of the compensation. The businesses and organizations involved in the program of relocation and realization of the compensation did not do their duties responsibly. As the result, the society who had been relocated had to suffer the cost of the relocation. Similar thing happened in the investment program in order to provide the facility of clean water supply for every village. The program was also failed. The failure, of course, had become another cost the society had to suffer. The society did not have to suffer the cost if the program was implemented appropriately.

The model of relocation programmed by the government was different from one village to another. Of course, the advantages got by one society were different from another society. The advantage of oil palm plantation, of course, was different from the advantage that the society got from rubber estate. In the oil palm plantation which was programmed using Perkebunan Inti Rakyat (PIR) or The Primary Plantation of the Society, the villagers were bound by a contract with businesses. The contract was for the production and the enterprise analysis involving banks for the financial. By signing the contract the society, indirectly, had suffered the loan facilitated by the businesses. Oil palm plantation pattern was really integrated with the industry cultivating the product and other supporting facilities because all of them would influence the value of the advantages that would be received by the businesses and the income the society would get. Meanwhile the UPP patern/rubber was not bound integrally with the business because the model of the cultivation and the marketing were decided by the society.

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

PLTA-KP location is in Kampar Kanan river near Bangkinang, riau Province, West Sumatra in the middle. The use land is protected forest area and the width is 12.400 ha include Riau district about 9000 ha and 50 cities about 3.400 Ha. The PLTA-KP construction started on 1993 and had finished on 1996. and start the process of water flood trial in 28 February 1997 and on 1994, people was relocate to new area with promise to give compensation for that.

Before PLTA-KP construction built Koto Panjang district Riau Province, the condition of the Batang Mahat river which had 10 villages placed near West Sumatra province and Riau is a farming area and forest. The characteristic of Koto Panjang people is depending on forest produce and farming. People leaving from their ability to plant rice, rubber, oil lamp, rattan, collect rattan, eaglewood, leaves roof, zallacca, orange, petai, rambai, lanseh tree, gambier, durian, and some fishing. When PLTA-KP built, their living is broken also.

For the importance of PLTA-KP construction government relocate the people from 10 villages become 15 villages with three patterns of relocations. Each pattern had ways to recover the economy of the PTLA-KP victims, but it wasn't held as planned. Means that the lost of social cost becomes higher because the there was no activity to support the rehabilitation of economy and social recovery.

The main livings in society were: farming (rice field, dry field), fishing, vegetables plantation, rubber estate, coconut, and fruits. People use the natural sources around the village also such as substein and NTFP, fishing, etc. The invaluable advantages in that society were traditional culture, social value, relationship between society and traditional ceremonial which life in society. The effect of the construction started from the beginning until watering the dam area. Some of their treasures like house and social facility was drawn without get compensation are:

- Destroyed the social economy because they lost their property and home when they had to move to new location. There were 3637 head of house hold was relocated, where 2832 are farmers. The houses building were 2619 or 77.74% where included permanent building and semi building, include infrastructure and social facility (school, office, and public facility).
- Four villages (Koto Panjang, Pasar Usang, Lakuk Gadang, Lubuk Nago) in sub district of Pangkalan Koto Baru will be sufferer because of annual flood. Those four villages usually had been flood before the dam project and after the project the flood becomes higher and takes a long time. On the contrary, in dry season they will suffer because of the dry land.
- The loss of 15,795.5 Ha farming land, industry/ plant trade protect plantation, and others plant which had economy value wasn't get money compensation.

7.2. Recommendations

The long time of rehabilitation effected the people, they sufferer. It needs stretch rehabilitation and integrated for each activity for economy recovery.

- The most important to do is to rehabilitate the main plant rather than give economy incentive using another form.
- Economy potential needs to be developed to support the people's need for living such as make rice field or irrigation.
- Applied each pattern is sensitive to increase the conflict in owning the land especially the relocation area outside traditional area or PIR pattern.
- For better development each village needs facility as a bridge for hope and needs of the people by planned and implemented program or rehabilitation economy and social.
- Solve the land and plant compensation as soon as possible to give the people's rights, this is one way to disappear the dependent thing.

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