



Payment for Environmental Services in Indonesia: Mutually Beneficial Watershed Environmental Management Model

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ABSTRACT

Payment for Environmental Services (PES) is an effort and commitment of the world community in tackling the symptoms of global warming and damage to the ozone layer that will affect global climate change. Using field research methods, research data is collected through in-depth interviews with stakeholders in environmental services return programs in this research area. Research data is analyzed and described qualitatively for further conclusions. The concept developed upstream and downstream watershed relationships through the PES mechanism is based on the principle of voluntary agreement and awareness of maintaining the watershed ecosystem. The experience of implementing the PES Program in the Cidanau Watershed of Banten Province of Indonesia, managed by an independent institution. The PES program, in addition to its role as an environmental conservation program in the Cidanau watershed, also has socio-economical benefits for the community, environmental service (ES) users, and providers.

INTRODUCTION

Land water flows naturally through the mechanism of the hydrological cycle (Easton 2015). As a result of forest destruction in the upstream watershed, rainwater will damage the soil and cause erosion, more runoff water than water enters the earth, and landslides occur in steep slope areas (Wasis et al. 2020). The impact of erosion is that in addition to causing a decrease in soil fertility, rainwater also carries soil particles along with surface runoff, which causes the water quality to become cloudy and poor.

Watersheds are producers of environmental services, namely: (1) carbon sequestration and storage; (2) biodiversity protection; (3) watershed protection; and (4) landscape beauty (Mayrand & Paquin 2004, Pagiola et al. 2005, Wunder 2006, Tacconi et al. 2012, Shrestha et al. 2021). The implementation of the PES program, especially water services, has been carried out to improve water quality through watershed improvements (Redondo-Brenes & Welsh 2006, Pissarra et al. 2021). To maintain the watershed environment has the value of sustainable environmental services, it is necessary to have ideal conditions for the forest environment that are well maintained and not damaged. The upstream watershed with rural characteristics is inhabited by farming communities

who live from agriculture and forest products. Meanwhile, in the downstream watershed, there are people with urban characteristics who use environmental services, especially water services to meet domestic and industrial needs. For the watershed environment to be well buffered, it is necessary to have a synergistic involvement between the two parties, namely the upstream watershed community to maintain and preserve the watershed environment that produces environmental services and the urban community in the downstream watershed utilizes environmental services. One of the efforts to achieve this goal is through the PES program.

PES is an environmental management model that involves at least two parties with mutually beneficial economic agreements with the voluntary principle that there is no coercion or pressure. This pattern contributes to the preservation and carrying capacity of the environment (Sommerville et al. 2009, Pirard 2012, Smith et al. 2013, Martin-Ortega & Waylen 2018, Aguilar-Gómez et al. 2020). PES is believed to be able to bridge the interests of natural resource users in the downstream watershed and environmental conservation communities in the upstream watershed (Wunder 2006). Even in the last decade, PES has spread widely throughout the world (Liu & Kontoleon 2018, Martin-Ortega & Waylen 2018, Rossi et al. 2021), in line with the increasing global

population and consumption of natural resources and increasing agricultural productivity, but on the other hand environmental degradation is also increasing.

Damage to the watershed environment is caused by the overexploitation of environmental resources, and poor farming families are accused of causing its damage. This group of poor farmers can be involved in the PES program and is expected to reduce poverty, especially by making payments to poor natural resource managers in the upstream watershed (Pagiola et al. 2005). The incentives for PES to overcome poverty are expected for environmental conservation through the PES program, and involving all stakeholders as participants by capturing local needs and interests (Ola et al. 2019).

The emergence of PES is motivated by concerns from experts, observers, and environmental researchers over global forest conditions. Mayrand & Paquin (2004), noted that since 1961 some tropical countries have lost more than 500 million hectares of forest, and consumption of forest products has increased by more than 50% worldwide. Such conditions have led to the loss of environmental services that are essential to life, economic development, and the health of the earth's population. These environmental services (ES) are generally unknown, poorly understood, or not accepted by policymakers, private companies, or local communities. As a result, these environmental services are rarely considered by the market, due to a lack of information or consumer awareness, or the absence of appropriate economic incentives that will influence the behavior of land users towards sustainable practice or conservation. The PES scheme attempts to remedy these market failures by internalizing benefits, thereby creating lost incentives for the provision of environmental services. The first step in this perspective is to define what environmental services are and what services can be internalized into market transactions.

The characteristics of the PES program are (1) voluntary transactions, (2) between environmental service users and environmental service providers, (3) expressed in the form of cooperation bonds for natural resource management, and (4) to produce agreed environmental services (Wunder & Wertz-Kanounnikoff 2009, Wunder 2015). In Indonesia, there are at least six locations (ICRAF 2013) namely: (1) Bungo in Jambi Province; (2) Singkarak in West Sumatra Province; (3) Sumberjaya in Lampung Province; (4) Cidanau in Banten Province; (5) Lembang in West Java Province; and (6) Kuningan in West Java Province.

Cidanau watershed has an important role as the main water supplier for the City of Cilegon located in the downstream part of the Cidanau watershed. Cilegon is an industrial city with more than 100 industries. These industries are dependent on the water supply of the Cidanau River for

their operational activities. Water needs for the community and industry will continue without knowing the seasons. On the other hand, water supply tends to decrease due to environmental damage due to erosion, floods, and landslides during the rainy season and drought during the dry season.

Environmental problems in the Cidanau watershed are mostly caused by human activities. Poverty is accused of causing environmental damage in this area. Almost all of the population inhabiting the upstream area of the river are small farmers with narrow agricultural land ownership, low income, and highly dependent on natural resource extraction. Along with the rapid rate of population growth which is always followed by efforts to meet the needs of human life, in the 1990s in the Cidanau watershed there has been a massive land conversion, natural forests are converted into dry agricultural land and swamp forests are converted into rice fields.

The research aimed to analyze the implementation of the PES program in Cidanau Watershed, Banten Province, Indonesia. The program is designed for the management of watershed natural resources that are mutually beneficial between people living in downstream watersheds as users of environmental services (Mayrand & Paquin 2004, Lipper & Neves 2011), especially water for industrial and domestic needs with farmers in upstream watersheds as environmental maintainers and environmental service providers.

MATERIALS AND METHODS

The research sites are located at 06°07'18"-06°18'00" SL and 105°40'00"-106°04'00" EL. Cidanau watershed has an area of about 22,628.66 hectares, administratively located in Serang Regency and Pandeglang Regency, Banten Province, Indonesia which includes six sub-districts and 38 villages in the two districts (Sunaedi et al. 2019b). Cidanau watershed is a basin shaped like a bowl, the water source comes from the catchment area of several mountains (Mount Karang, Mount Haseupan, and Mount Pulosari) and empties into the Sunda Strait west of Java Island (Fig. 1).

This study uses a field research method (Bailey 2017), with data collection through focus group discussions (Nyumba et al. 2018), depth interviews, field observations, and documentation studies. Focus Group Discussion (FGD) is a data collection technique in which a researcher gathers a group of individuals to discuss a particular topic. FGD is a technique that aims to collect data based on the personal experiences, beliefs, perceptions, and attitudes of the participants through moderated interactions. FGDs are widely used in conservation research. FGD is a data collection technique that is often used as a qualitative approach to gain an in-depth understanding of social issues. This method aims to obtain data from a deliberately selected group of individuals, not from a statistically

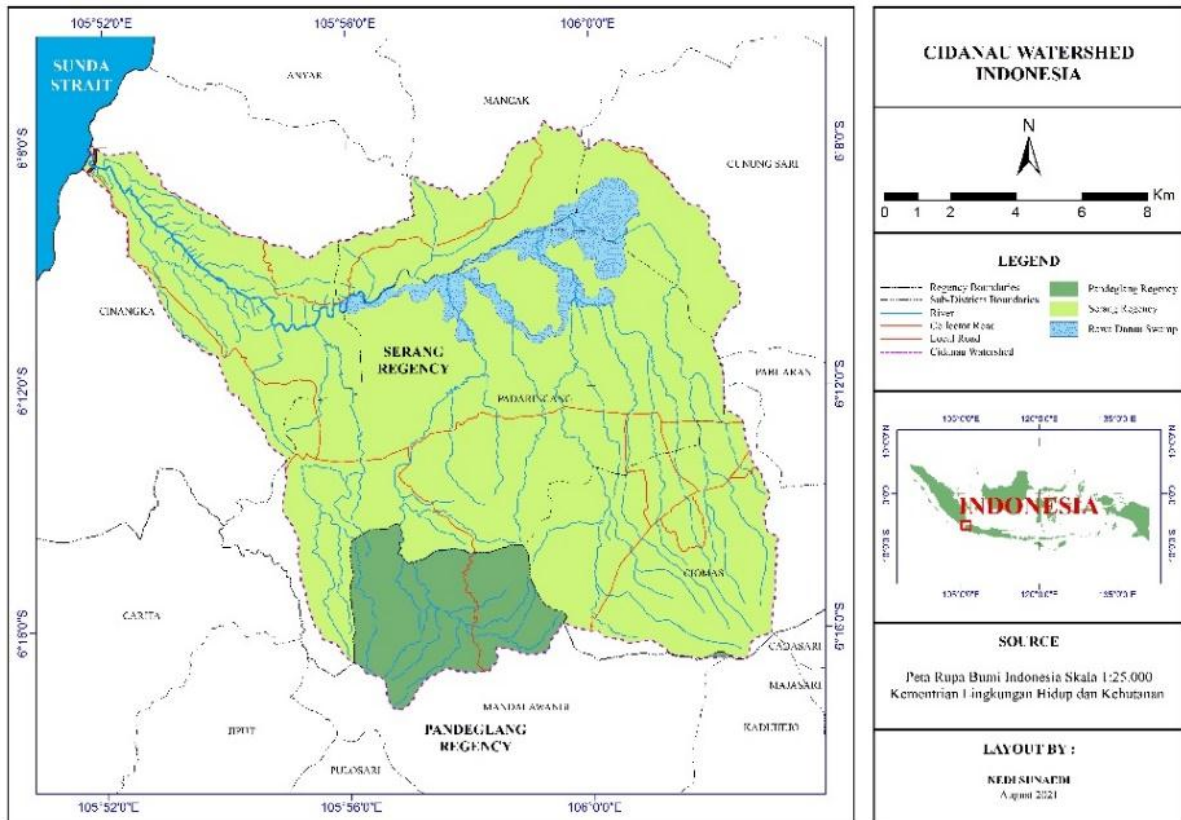


Fig. 1: Research site map.

representative sample of the wider population. Sources of data come from several informants consisting of; (1) a forest farmer group (FFG) as an ES provider, (2) KTI as an ES user, (3) the Cidanau Watershed Communication Forum (FKDC) which acts as a liaison in the PES program, and (4) the provincial government as the policy maker.

The main informants in this study were all parties involved directly or indirectly, including the people of the upstream watershed acting as providers of ES in Serang and Pandeglang, KTI, and other parties (local governments and NGOs) who act as facilitators and mediators of the PES program. Informants or sources from the selected farming community are the Chairman of FFG Karya Muda II Cinemas District of Serang Regency and the Chairman of FFG Maju Bersama in Padarincang District of Serang Regency. The considerations concerned are very understanding of the implementation of environmental service return programs at the level of environmental care providers or environmental service providers to provide in-depth information about environmental services. An informant from KTI is a Production Director who understands the IJL program because of its involvement from socialization, and negotiation to program

realization. Furthermore, informants from PES managers who are members of FKDC are the Secretary-General and an environmental activist from the Non-Governmental Organization (NGO) Rekonvasi Bumi.

This research was intensively carried out in 2019 - 2020 before the Covid-19 pandemic occurred. The data obtained are mostly qualitative and processed using an in-depth analysis of the focus under study, namely the PES program in the Cidanau watershed, Banten Province, Indonesia. Qualitative data processing techniques in this study consisted of data collection, data reduction, data presentation, and conclusion.

The data analysis technique used in this study is closely related to the research method used, namely the descriptive-qualitative method. Research data were analyzed qualitatively and equipped with tables or the like to facilitate understanding of research data. The data analysis technique used is the Miles and Huberman Model (Milies et al. 2020). Activities in qualitative data analysis are carried out inter-actively and continue to completion.

The steps of data analysis include (1) Data Reduction, which is quite a lot of data obtained in the field, then select-

ing, summarizing, and focusing on the important things, looking for themes and patterns. Thus the data that has been reduced will provide clearer answers and make it easier for researchers to conclude further data, and look for them if necessary; (2) Data Display, namely data presented in the form of brief descriptions, charts, relationships between categories, flowcharts, and the like. This step aims to make it easier to understand what happened, and plan further work based on what has been understood; (3) Conclusion Drawing/Verification, the data that has been analyzed is taken as preliminary conclusions that are temporary. This conclusion will change if there is no strong evidence to support the next stage of data inference. If the conclusions at the initial stage are supported by valid and consistent evidence when the research returns to the field, then the conclusions put forward are credible (Milies et al. 2020).

RESULTS AND DISCUSSION

Physical Environment Condition of Cidanau Watershed

The landforms consist of hills and wavy, and alluvial plains. Units of hill shape with moderate to high reliefs located to the North, East, and South form a horseshoe-like shape with a slope between ramps too steep. This hill unit is directly adjacent to the unit of form in the form of an intermountain depression with a slope of ramps to flat. In this form, The Rawa Danau (Swamp Lake) is located and drains the Cidanau

River as its main river. The Cidanau River drains water from the Rawa Danau and empties into the Sunda Strait.

The climatic conditions generally belong to a wet tropical climate with rainfall of more than 3000 millimeters per year. The wet season occurs from October to April and the dry season from May to September.

Table 1 and Fig. 2 showed that the average rainfall was relatively balanced with the average discharge. But, in certain years (2008, 2010, 2013, and 2017), the annual average of discharge is higher than the average rainfall. It was caused by the increasing discharge of some water sources from the wellsprings around the area.

Surface water conditions are characterized by the presence of rivers and their tributaries, swamps, and lakes. In the Cidanau watershed, there is the Cidanau River is the main river with 18 tributaries (sub-watershed). Rawa Danau is surface water in the form of swamps marked by typical swamp vegetation with an area of about 2,500 ha. The groundwater conditions in this area are classified into high, medium, and low groundwater potential. In some places, there are springs with the relatively high discharge with a flow rate between 100 m³/s to 300 m³/s with the main use being to meet domestic needs.

Land use in the Cidanau watershed is dominated by mixed plantations, paddy, and forest land (Table 2). The land use before the PES program was in the form of agricultural land with an open land-intensive system, such as dry land

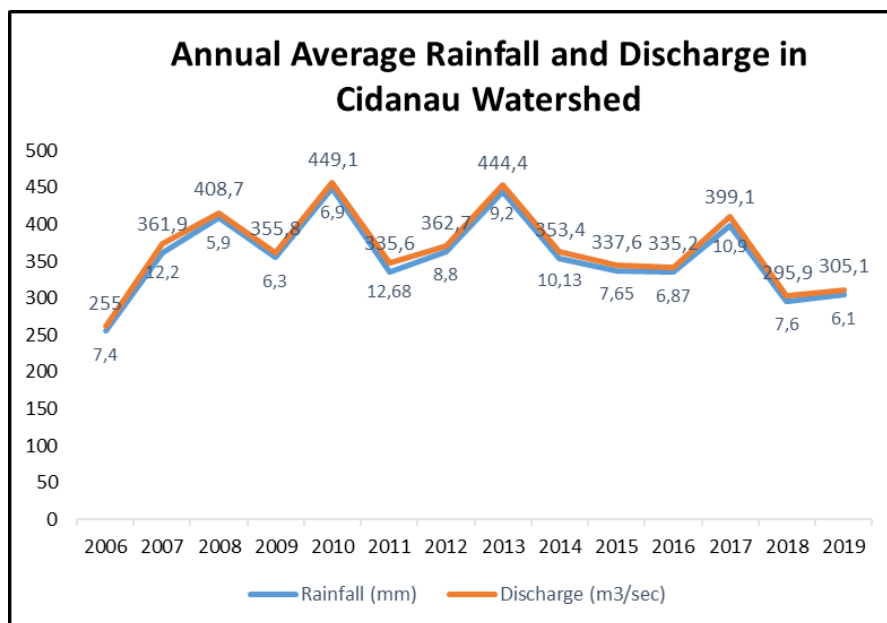


Fig. 2: Annual average rainfall and discharge at the Cidanau Watershed.

Table 1: Annual Average Rainfall and Discharge at the Cidanau Watershed (2006-2019).

Annual Average	Years													
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall (mm)	255	361,9	408,7	355,8	449,1	335,6	362,7	444,4	353,4	337,6	335,2	399,1	295,9	305,1
Discharge (m ³ /sec)	7,4	12,2	5,9	6,3	6,9	12,68	8,8	9,2	10,13	7,654	6,870	10,9	7,6	6,1

Source: Data from KTI Cilegon 2020.

rice and other seasonal secondary crops. The PES program has changed land use into a mixed plantation that resembles forest structures with the dominance of forest trees, fruits, and other commodities.

The inhabitants of the Cidanau watershed are 153,167 inhabitants. Most of them live as farmers with land ownership relatively narrow between 0.25-1.0 hectares. The composition of inhabitants' employment is very diverse, such as the agricultural sector with 53.03%, the manufacturing sector with 21.94%, the rest of it comes from trade, hotel, and tourism services. The level of education in the Cidanau watershed is low. Most people graduated from primary education because the educational facilities in each village are elementary schools and not sufficient. Higher schools only exist in the sub-district capital.

PES Mechanism in Cidanau Watershed

At least four parties are involved in the implementation of PES in the Cidanau watershed: (1) KTI as ES user, (2) farmers living in upstream watersheds as ES provider, (3) FKDC which serves as a liaison of all watershed management interests, and (4) Local Governments (provinces and districts) as policymakers (Sunaedi et al. 2018). The concept is based on the principle of voluntary agreement between inhabitants of upstream and downstream. This Memorandum of Understanding was signed by the Governor of Banten who

acted as Chairman of the Regional Council of the Cidanau Watershed Communication Forum and by the President Director of KTI Cilegon (Sunaedi et al. 2018). To realize the memorandum of understanding, a month later on November 1, 2004, PES Agreement was signed between FKDC and KTI (Sunaedi et al. 2019a). The Agreement agreed, such as (1) environmental services are services produced by an ecosystem whose benefits both ecologically and economically, (2) environmental service products are the flow of substances, which are influenced by the type of land use and production system; and (3) PES is the payment of services produced by an ecosystem, which benefits ecologically and economically.

The basis of the environmental services payment agreement is a text of understanding based on the principle of voluntary agreement in maintaining the environment of the Cidanau watershed and on the benefits of the environment. Amaruzaman et al. (2017) state that the farming group must maintain at least 500 trees/ha and if the trees under contract are cut down during the contract period, the farmers should replace them. Any member who violates the agreement, all members will receive sanctions, and possibly contract termination.

The scope of the agreement includes (1) FKDC agreed to receive payments from KTI for the utilize ES from the Cidanau watershed, (2) FKDC agreed to carry out community forest development in the Cidanau watershed, the cost

Table 2: Land Use at Cidanau Watershed.

No.	Land Use	Area [ha]	Percentage [%]
1.	Forest	2814.41	12.44
2.	Swamp forest	1433.47	6.34
3.	Swamp lake	306.80	1.36
4.	Mixed plantation	8174.88	36.14
5.	Plantation	16.32	0.07
6.	Dry land agriculture	67.45	0.30
7.	Settlement	386.95	1.71
8.	Paddy field	6708.95	29.66
9.	Others	2710.77	11.98
	Total	22620.00	100.00

originally come from KTI funds, (3) KTI agreed to pay ES in the form of water usage, and (4) The payment from KTI based on the willingness.

Based on the results of an in-depth study with regard to various considerations, FFG Karya Muda II from Citaman Village and FFG Maju Bersama from Cibojong Village was selected as PES participants. Both villages were selected because these areas are critical in the Cidanau watershed and the socio-economic conditions are suitable. The land requirement for participation in the PES program is 25 hectares for one plot of a group of forest farmers. Land ownership in research areas is relatively low and generally less than one hectare. As an illustration, to reach an area of 25 hectares, it was collected as many as 43 farmers in Karya Muda 2.

In 2008, FKDC signed new contracts with FFG Alam Lestari from Cikumbueun Village, Mandalawangi District, Pandeglang Regency, and FFG Agung Lestari in Gunungsari District, Serang Regency for a 5-year contract period until 2013. Yet in 2009, FFG Agung Lestari failed and broke the contract for various reasons. In 2010, FKDC signed new contracts with FFG Karya Muda 3 in Citaman Village and FFG Karya Muda 2 also extend the contract as a result of renegotiation for the success as participants in the PES program. In 2014, the PES implementation in the Cidanau watershed entered its third period (Fig. 3). The main objective of this program, apart from protecting the watershed environment, is also to improve the standard of living of the people in the upstream watershed. The expected impact of the increase in the community's economic standard is the reduction in the community's habit of cutting trees on their land or in forest areas when they need cash.

Based on the field conditions, shows that the PES program is considered successful in improving the welfare of

forest farmers, so the program has motivated other forest farmers to join this PES program. Due to the limited funds available, the forest farmer groups that will join, are selected based on the priority targets and the readiness of the forest farmer groups to join. The determination of new members for the PES program is determined by the selection of proposals. In the preparation of proposals that are included in the selection of contracts for compensation for environmental services, applying the Participatory Landscape Analysis (PaLA) method that has been developed by ICRAF to identify environmental problems that exist in land or landscapes in a watershed area, and map existing local wisdom to solve these problems. The preparation of proposals and their selection was carried out in a workshop organized by FKDC.

Ha et al. (2011) stated that the background for the development of PaLA by ICRAF was based on the fact that the phenomenon of global population growth, migration between regions, and increasing community welfare had put pressure on the conversion of forest land into agricultural, residential and industrial land. PaLA was designed as an option to combine knowledge and multi-stakeholder perspectives for sustainable land use development from a plot of land towards sustainable agriculture and sustaining people's lives. PaLA is applied primarily to communities in the upstream watershed. Specifically, the goals of PaLA are: (1) to articulate and study farmers' perceptions of the relationship between land use and landscape function, (2) to understand farmers' choices in agricultural land management, (3) to understand the flow of water, sediment, nutrients, and organisms and internal filter functions that determine the function of the landscape based on the diversity of land use practices and interactions between landscape units, and (4) to understand the relationship between the goods and services of each land use decision made.

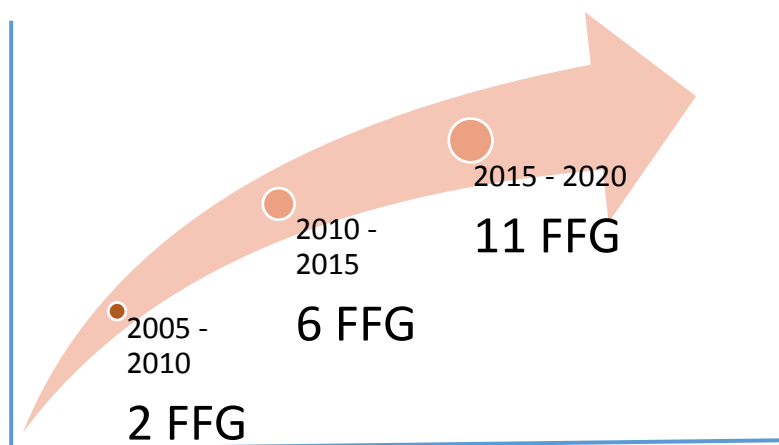


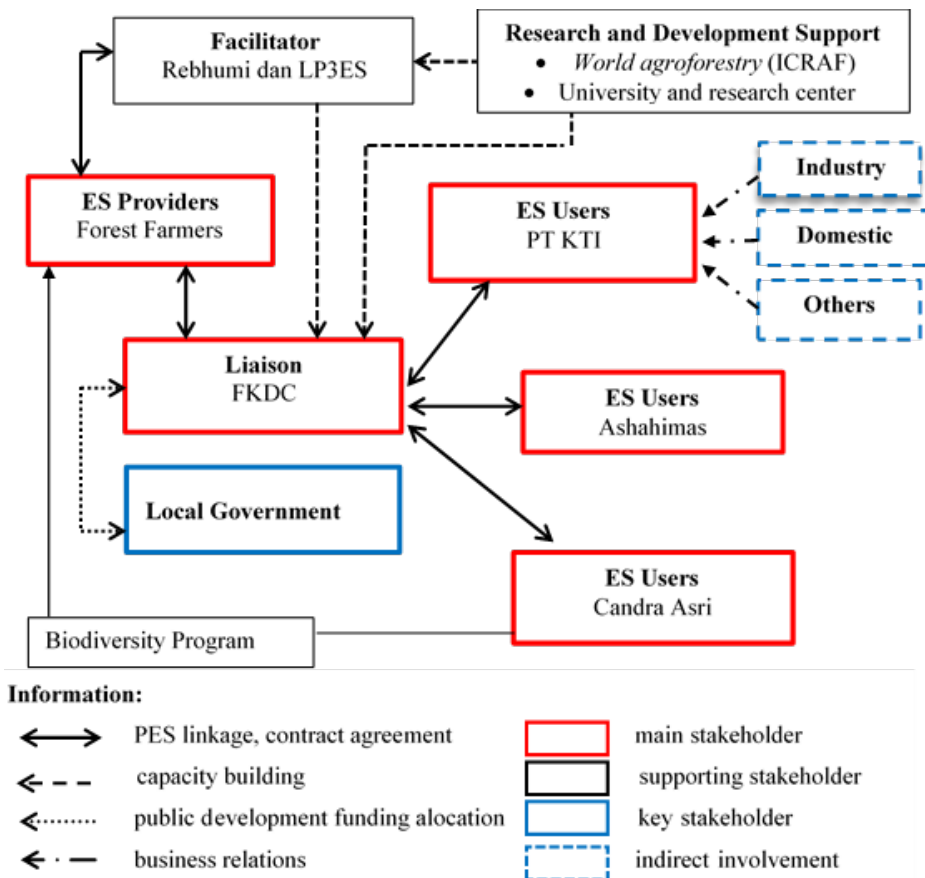
Fig. 3: Development of FFG as a participant in the PES program.

The implementation of the PES Program in the Cidanau Watershed includes several stages: (1) preparation of program plans and strategies, (2) identification of service providers and users of environmental services, (3) Socialization and activities at the FKDC level, at environmental service users, at service provider's environment, and (4) implementation of PES program. The implementation of the PES program begins with unifying the perception that all stakeholders need to understand the PES concept in the management of the Cidanau watershed. The unification of these various interests is contained in the vision and mission of FKDC, namely to build a balance of social and economic ecology in the utilization of natural resources in the Cidanau watershed to support sustainable development based on the concepts of one river, one planning, and one management. Its missions are (1) to preserve the natural resources of the Cidanau watershed; (2) to improve the welfare of the community in the Cidanau watershed area; (3) to maintain the sustainability of the water system to support sustainable development, (4)

foster an advanced investment climate and have the ability to compete.

The water environment service return scheme was also initiated and encouraged by FKDC which has also been a process dynamic since 2003 until now. In its development, many parties are concerned and contribute to the environmental services process in Cidanau, such as ICRAF which supports FKDC since 2007 and in 2014 awarded an environmental services contract to the group for applicative research. The concept of downstream-upstream payments was through the PES program, schematically shown in Fig. 4.

The PES management model in the Cidanau watershed (Fig. 4) is a model adapted from Leimona et al. (2010) which has been developing for a decade, namely by increasing users of ES. Initially from 2005 to 2010, the ES user who participated as a fund provider was PT KTI. In 2020, there were two additional ES users, namely Ashahimas and Candra Asri who donated funds to FKDC directly. One thing that



Source: adaptation from Leimona et al. 2010

Fig. 4: PES management model in Cidanau watershed.

attracted Candra Asri, apart from donating funds to FKDC, he also developed a biodiversity program in one of FFG's in the Cidanau watershed.

Positive Impacts of the PES Program

In an activity or program, it is expected that there will be a positive impact under mutually agreed goals. Likewise, the PES program must have a good impact on all parties. In accordance with the main objectives of building and developing PES programs that have been agreed upon and contained in the FKDC, are (1) increasing the value of ecological, social, and economic benefits in a balanced watershed, (2) building community self-reliance to increase economic capacity, through the exploitation of natural resources that environmentally friendly, (3) improve the quality and quantity of water resources and other natural resources in the Cidanau watershed, and (4) build the synergy and integrity of integrated management based on the master plan and strategic plan for the management of the Cidanau watershed. In designing, building, and developing the PES program, it is necessary to refer to the above objectives, especially with regard to the fourth goal, namely to build synergy and integrity that affects all parties involved in it (Leimona et al. 2010).

Environmental services beneficiaries: KTI as an ES user, through this PES program, expects financial benefits in the form of raw water supply to be processed into clean water. In line with industrial growth in Cilegon City, which continues to increase, it is necessary to increase the water supply as well. Water is needed in industry as a component in the production process (such as cooling, as a mixture, etc.), and also serves as a supporter to meet the domestic needs of the employees. After the PES program, the average annual discharge of the river remained relatively constant in the range of 6 m³/second to 12 m³/second. The number and average river discharge are influenced by the amount of rainfall that occurs and land cover by vegetation in the upstream watershed. Land cover with dense vegetation provides an opportunity for rainwater to seep.

Environmental services provider: The PES program aims to increase the value of ecological, and socio-economic benefits of watersheds in a balanced manner, and build community empowerment to increase environmentally friendly economic capabilities. The PES program must be able to lift economic capabilities and improve the welfare of poor farming families.

The PES program has a positive impact on forest farmers (Sunaedi et al. 2019a), including (1) an increase in income, the most significant increase in income is not from PES but from the sale of fruits and spices from hetero plants cultures that have a high selling value, such as durian (*Durio zibethinus*), melinjo (*Gnetum gnemon*), cloves (*Syzygium*

aromaticum), and so on; (2) increasing family welfare, increasing the family's economic capacity has encouraged families to repair their homes and buy goods for family needs such as motor vehicles, electronics, and so on; (3) new job opportunities, this occurs at harvest time which provides opportunities for the emergence of traders of fruits and other commodities as well as the emergence of home industries for processing crops; and (4) the ability to send their children to school for farmer families participating in the PES program.

In the context of improving the watershed environment, the PES program must have the courage to change the order of farmers' activities for the better. Gorgens et al. (2021) used two approaches to PES implementation: (1) compensation for land that is discontinued from production, targeting low agricultural capacity, and (2) payment for low-capacity land already covered by natural vegetation. Facts showed that land is "sacrificed" for watershed conservation has increased productivity. Monoculture farming is more susceptible to crop failure compared to multicultural farming models which provide the possibility of choosing commodities that have high economic value without leaving the aspect of environmental preservation (Manhães et al. 2018).

PES Program and poverty alleviation: Landowners provide a variety of environmental services, from air services to biodiversity and carbon sequestration (Landell-Mills & Porras 2002, Pagiola et al. 2005). However, they often do not benefit from environmental conservation efforts, so forest farmers are tempted to convert their land to intensify agriculture that is less environmentally friendly. Initially, the PES Program was not a poverty alleviation program; rather it aims to address environmental issues and sustainable natural resource management. To achieve this goal, poverty cannot be used as a Criterion for Participation. However, the perception that areas with very high poverty rates are spatially correlated with areas that provide environmental services raises the expectation that PES programs can contribute to poverty reduction (Pagiola et al. 2010).

The PES program has the potential to reduce the poverty of farming communities that inhabit upstream watersheds. Some of the reasons that the PES program can improve welfare include: (1) the cash flow of funds received by the community participating in the PES program or a broad sense creates opportunities for land owners to convert natural capital into financial flows, (2) PES can provide opportunities for additional income other than land products to local communities, and (3) help reduce community vulnerability through the diversity of income sources (Tangisujit & Barnwal 2009).

Obtaining direct funds in the form of cash from agricultural land that is included in the PES program. The range of income earned varies from around a few hundred thousand

rupiahs to less than 1 million rupiahs which are paid twice a year. This is due to relatively narrow land ownership, which is less than 1 ha. Generally used to meet daily needs, more to pay for monthly electricity. According to several farmer sources, the amount of money obtained is not sufficient for their daily needs. However, greater income is obtained from the harvest of fruit and vegetable crops.

Currently, the income of group members is increasing because fruit and vegetable crops have started to produce. Durian (*Durio zibethinus*) is a superior fruit with a high selling price. In addition, dry cloves are extraordinary commodities that have advantages compared to other commodities, namely that they can be stored for a relatively long time and serve as savings for farmers. When the price of cloves is low, farmers store the cloves first and when the price is high they will sell them. To meet their daily needs, farmers rely on vegetable crops, such as petai (*Parkia speciosa*), jengkol (*Archidendron pauciflorum*), and melinjo (*Gnetum gnemon*). The melinjo plant can be used for fruit crackers and the leaves are processed into vegetables. The advantage of the melinjo plant is that it can be harvested almost every day. Thus, the existence of the PES program has increased community incomes in the upstream watershed (Sunaedi et al. 2018). Recently, many types of intercropping plants that have high economic value have been cultivated, namely the porang plant (*Amorphophallus muelleri*). Porang is a type of tuber plant that can live under the shade of a tree, so it does not interfere with the structure and composition of existing plants. The results of this study confirm findings written by other researchers who state that non-economic factors, such as trust and participation in designing schemes, have an important role in determining decisions made by land owners about whether to participate in PES schemes sustainably or not (Matheus et al. 2014, Khanal & Devkota 2020).

CONCLUSIONS

The implementation of the PES program is inseparable from the participation of all parties who consciously and voluntarily realize the common ideal of integrated watershed management so that the environmental services it produces can be enjoyed sustainably. The concept developed upstream and downstream watershed relationship through the PES mechanism is based on the principle of voluntary agreement and awareness of maintaining the Cidanau watershed ecosystem. The parties involved are (1) KTI who act as users who can enjoy directly and benefit from environmental services, (2) environmental maintenance communities living in upstream watersheds and acting as providers, (3) local governments and technical institutions/bodies that act as policymakers, and (4) FKDC which acts as liaisons among the three.

The PES program in the Cidanau watershed has been running well and has benefited all parties such as (1) guaranteed raw water supply for urban communities as ES users to meet industrial and domestic needs, (2) increased socio-economic welfare for forest farming communities as ES providers, (3) the realization of government programs in preserving the watershed environment, and (4) increasing the carrying capacity of the watershed environment towards a sustainable green economy.

Experience in implementing an environmental services program in the Cidanau watershed managed by FKDC is the best practice to build environmental services. FKDC implements the program with the entire process of developing PES with the principle of integrated management through one river, one plan, and one management approach.

This field research is qualitative it takes a long time to discover new things. Researchers experienced several difficulties, such as determining competent sources and qualitative research data that must be analyzed in depth based on comprehensive and up-to-date references. These conditions provide opportunities for quantitative research with other variables.

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