Essential Water Supply Resources through Payment for Environment Services Program in The Cidanau Watershed, Banten Province, Indonesia

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Abstract. Payment for Environmental Services (PES) is seen as an effort to preserve and used environmentally sustainable manner. The program is believed to bridge the two different interests, such as the people who inhabit in the upstream watershed in general are poor farmers with land holdings of less than one hectare with urban communities. The field data were processed using descriptive qualitative way. The results showed that the PES in Cidanau watershed started in 2003 and has entered into the second phase (the second 5 years), followed by 15 farmer groups to target land area of 520 hectares. Value of contracts was signed through a memorandum of agreement between the PT KTI acting as a buyer to a group of farmer-members (sellers) through Communication Forum of Cidanau Watershed (FKDC) as organizational managers IDR 4 billion until 2019. For farmer groups with an initial contract of five years was paid IDR 1.2 million per hectare per year and will increase to IDR 1.75 million per hectare per year for a second five-year contract. The program of PES in Cidanau Watershed relatively has been successful in maintaining the availability of Cidanau river flow which is used for domestic and industrial needs in Cilegon City.

1. Introduction
Rapid national development and increasing population pressures on natural resources have caused serious social and environmental problems in Indonesia that require concerted efforts to overcome and proper resource management [1]. Indonesia has benefited from inland waters – lake, rivers, wetlands, reservoirs – which provide supply water for everyday needs and livelihoods, foods from fishes, hydropower for electricity, and also for recreation. However, these functions have changed due to human activities affecting directly Inland water ecosystems and also through the modifications of land use of the catchment areas or watersheds of inland water ecosystems [2]. The greatest challenge for natural resource management is the sustainability and existence of ecological services for human life [3].

Forms of environmental management is widely practiced started Payments for Environmental Services (PES). PES is an environmental management model that involves two parties: the service provider (sellers) and those who take advantage of environmental services (buyers) with mutual agreements economically with voluntary principle there is no coercion or pressure. Payments for environmental services can be trusted to mediate between the interests of users of the existing natural
resources in the watershed upstream and maintainer community environment in the upstream watershed [4]. Fee or payment within the meaning of the word is the transfer in the form of money (cash) or goods in a barter economy in exchange for goods or service, usually in market conditions [5]. According to Wunder and Wertz Kanounnikoff (2009), “We define PES as voluntary, contingent transactions between at least one seller and one buyer over a well-defined ES, or a land use likely to secure that service” [6].

There are five simple criteria the payment for environmental services, namely (1) voluntarily and no compulsion, (2) there were no transactions at least, (3) the seller and, (4) the buyer, (5) to land an area which is used for environmental services. Limitation popular other PES: PES is a voluntary transaction for environmental services is clearly defined (or land use to ensure that service), purchased by at least one buyer environmental services of at least one environmental service provider, if and only if an environmental service provider meets the requirements in the agreement and ensure the provision of environmental services [7].

The Cidanau River Basin is one of the water sources for domestic needs and supplies water for more than 100 industries located in Cilegon. The holder of the water harvesting permit from Cidanau watershed is PT Krakatau Tirta Industri (KTI) issued by the Government of Serang Regency of Banten Province. According to Rahadian (2005), an environmental service reward model has been implemented in the Cidanau watershed, in the implementation of a Cidanau Watershed Communication Forum abbreviated FKDC based on the Governor of Banten Decision which consists of community, government, NGO, and private. This watershed management model is expected to be a win - win solution with the continuous supply of water resources.

2. Characteristics and Research Method
The Cidanau River Basin (DAS) is one of the watersheds in Banten Province and is an important watershed for Banten Province, especially for Cilegon City. In Cidanau watershed that flow the Cidanau river which become a source of raw water to be processed into clean water for the meet of water needs in the city of Cilegon. The Cidanau river basin is located at S: 06°07'18" - 06°18'00" and E: 105°40'00" - 106°04'00", encompassing two districts of Serang and Pandeglang districts in six sub-districts and 38 villages (Figure 1). The Cidanau River is the main river in the Cidanau watershed which holds 18 watershed sub-basins in an area of 20,120 hectares (catchment area). Cidanau River empties into the Sunda Strait [8].

![Image of Cidanau Watershed, Banten Province](image_url)
Cidanau river discharge has diverse characteristics and decreased discharge from year to year. Characteristics of the magnitude of this Cidanau discharge. Based on data cited from Rahadian (2005), shows the distribution of land use in Cidanau watershed consists of, (1) forest area of 2,814.41 ha, (2) swamp forest area 1,433.47 ha, (3) swamp or swamp lake 306,80 ha, (4) mixed garden area 8,174.88 ha, (5) wide rubber plantation 16,32 ha, (6) wide rice field 6,708,95 ha, (7) wide field 67,45 ha, and (8) Residential area of 386.89 ha [8].

The method used in this research is case study with the resulting data in the form of qualitative data. Intended use of this method is to create a description in a systematic, factual and accurate about the facts and properties as well as the relationship between symptoms investigated. The study was conducted in some stages. Such steps, that included a literature review, observation of research field, semi-structured key informant interviews with stakeholders the payment for environmental services (PES) program, and a focus group discussion with participating farmers in August 2016.

In this case the object or focus of research is the implementation of PES Program in Cidanau watersheds, Banten Province, especially related to the conservation of water resources. Subjects were used as key informants in this study were all parties involved, directly or indirectly, including the farming community who are members of a group of farmers in the Cidanau watershed upstream role as a provider of environmental services (sellers) are located in the district of Serang and Pandeglang, PT Krakatau Tirta Industri (PT KTI) as an environmental service users (buyers), and the Communication Forum of Cidanau Watershed (FKDC) as a facilitator and mediator PES program. To obtain field data, this study will use purposive sampling technique, which is a sampling technique or the technique of determining the informant as the source data with the specific purpose of the researchers themselves [9]. Due account informants, among others by direct involvement in the PES program and understanding on the implementation of PES in this research area.

3. Results and Discussion

3.1 Early Establishment of Payments for Environmental Services in Cidanau Watershed
Cidanau watershed management is handled by many sectors, both government and private and public companies. The implementation of the watershed management program still has not been disaggregated and well-coordinated. Each program is planned, implemented, and evaluated individually with unsatisfactory results. Even people who live and work in the watershed itself less to be fully involved from the planning, implementation, and evaluation of activities. Even if his role involved only limited help in planting trees for example. In other words, society as subject and object of less attention basin management wants and needs in life so it was less successful management activities.

Watershed management Cidanau essentially has based on the principles as follows: (1) the principle of the watershed as a whole ecosystem, (2) a single economic entity, and (3) the principle of balance between economy and ecology [8]. From the background and the fact above, shows that the Cidanau watershed management cannot be done partially separated by egoism and interests of the institution or body or both government and private institutions in solving the problems that exist in the Cidanau watershed increasingly complex. The need for a comprehensive approach and sit together to formulate an integrated watershed management involving various stakeholders, communities, companies, governments and non-governmental organizations (NGOs) concerned.

3.2 Institutional Business of Payments for Environmental Services
Follow-up of the various results of the agreement, there shall be established a Technical Team whose members consist of all stakeholders in integrated management of Cidanau watersheds. The team is preparing the draft which was then proposed to the Governor of Banten (Banten after the separation from West Java Province). One important concept proposed is the establishment of institutions to communicate the planning and implementation of integrated Cidanau watershed management. Further follow up with the Banten Governor issued Decree Number: 124.3/Kep.64-Huk/2002 dated May 24, 2002 on the Establishment of Communication Forum of Cidanau Watershed (FKDC). FKDC is
established as a forum to implement the results of the agreement containing the identification of problems and recommendations for the integrated management of watersheds Cidanau. In history FKDC undergone several changes and improvements. Changes and improvements include: through Banten Governor Decree No. 614/Kep.211-Huk/2006 on Organizational Structure Change Core Cidanau Watershed Communications Forum, which is further followed by the decision BAPEDAL To Banten province as Chairman FKDC No. 38 / SK-FKDC / VII / 2006 on the Vision, Mission, Organizational Structure, Job Description and Working mechanism FKDC. And operationally set forth in Decree of the Head BAPEDAL Banten province as Chairman FKDC No. 01/SK-FKDC/II/2007 on Technical Guidelines for the Management of Environmental Services Watershed (PES) Cidanau. This FKDC have a vision "Creating watershed preservation and improvement of people's lives". Of vision is further elaborated in the form of missions, namely: (1) preserving the realization of the ecological balance, social and economic development in the watershed Cidanau; (2) achievement of improvements in the quality and quantity of human resources Cidanau watershed; (3) preservation of the availability of raw water, both the quantity and adequate quality in a sustainable manner; (4) the maintenance of other types of environmental services, both in quality and quantity sufficient sustainable manner; (5) the establishment of integrated management based on the concept of one river, one plan, and one management in the Cidanau watershed. The purpose of this FKDC are: (1) increase the value of ecological, social and economic Cidanau watershed a balanced manner; (2) build community self-reliance in order to increase economic capacity, through the exploitation of natural environmentally friendly; (3) improve the quality and quantity of water resources and other natural resources in the Cidanau watershed; (4) build synergy and integrity of the integrated management based on the Master Plan and Strategic Plan for Cidanau Watershed Management. FKDC institutional nature are an independent and open to any institution involved in the management and utilization of Cidanau watershed, as long as these institutions understand and want to carry out the vision and mission of the institution.

FKDC as an independent agency that regulates the implementation of payment for environmental services in Cidanau watershed plays an important role and put a key position in the success of this program. FKDC in the implementation of PES plays a role, as follows: (1) Manage the proceeds from payments for environmental services beneficiaries (buyer) Cidanau watershed environmental services for the rehabilitation and conservation of the land in the Cidanau watershed through Cidanau watershed management institutions environmental services. (2) Encouraging the development of forest on land owned by the community with the mechanism of payment for environmental services. (3) To raise funds from potential beneficiaries of Cidanau watershed environmental services. (4) Encourage the government to make payments for environmental services in Cidanau watersheds. (5) Event FKDC in the implementation of environmental services. (6) Build a Cidanau watershed management authority agreement among stakeholders PES Cidanau. (7) Conducting negotiations with PT. Krakatau Tirta Industri (KTI) for payment for environmental services, the results of negotiations set forth in the text of understanding between FKDC and PT KTI. 8) Establish ad hoc team that handles payment management services to the Environmental Services agency business Cidanau formed. (9) Discuss the mechanism of payment for environmental services between the ad hoc team of forest peoples in the upstream Cidanau watershed.

3.3 Implementation Mechanism Payments for Environmental Services
Mechanisms PES implementation in Cidanau watershed includes several stages. These stages are:

a. Socialization program to potential participants with the principles of volunteerism and community participation approach farmers in the upstream Cidanau watershed. Prospective participants are members of farmer groups.

b. Identifying and cataloging the landowners along its land area. And then designated as the land included in the PES program to its limits that have been set.

c. The next step is a signatory to the contract agreement, which must be obeyed by both parties as well as the risk of sanctions. The contract also includes the amount of payments received by a
group of farmers for each hectare of land included. Each hectare of land shall be planted perennials (forest plants and fruits) of at least 500 trees with tree species that have been determined.

d. Payments for environmental services from PT KTI (buyers) to the group of farmers (sellers) are given directly, via submitted to FKDC settings that act as the manager of PES.

e. Payments for environmental services for the first period (first five years) to IDR 1.2 million per hectare per year. The second period (five second) and will further increase to IDR 1.75 million per hectare per year. The payment system in three stages, covering the first phase paid when signed of contracts by 30%, in the first six months after the verification in the field are paid by 30%, and the rest is paid by the end of the contract by 40% after a second verification.

f. The distribution of cash payments for environmental services for individual farmers in the level of farmers’ groups made by consensus or agreement all farmers facilitated by the group leader. This was done, given the ownership of each farmer extent (less than one hectare).

On July 10 to 12, 2014 along with NGO’s Rebhumi and ICRAF collaboration with FKDC conduct an open auction experimental environmental services. Before the auction held the prospective bidders training using the Participatory Landscape Appraisal (PaLA) approach, the farmer groups were elected as participants of the PES. This refers to the opinion of Ha, et al (2011) PaLA was designed as an option to combine multi-stakeholders knowledge and perspectives for the development of sustainable land use from plot to farm and community level, mainly to be used in the upland context. With an interdisciplinary and system approach in mind, the author brought both biophysical and socio-economic aspects into the method. The objectives of PaLA are: (i) To articulate and study farmers’ perception of the relationship between land use and landscape functioning; (ii) To understand farmers’ management options and actual choices made; (iii) To understand the flows of water, sediment, nutrients and organisms and internal filter functions that determine landscape functioning on the basis of the mosaic of land use practices and interactions between landscape units; (iv) To understand links between ‘goods and services’ outcomes of each land use decision made and to be made.

3.4 Benefits and Obstacles

More than ten years of PES program implementation in Cidanau watershed have a positive impact for all parties involved, either directly or indirectly. The benefits are felt by PT KTI as buyers at the moment is the supply of raw water sources are relatively stable in every season, so as to guarantee the sustainable production of clean water. Before the PES program implemented Cidanau river flow is very volatile, very abundant in the rainy season and vice versa debit fell sharply in the dry season (Table 1). Fluctuating flow rate conditions, it is often very difficult for the company, namely the difficulty of supply of raw water source in the dry season [10]. In the rainy season but the supply is abundant silt level in the raw water is very high, this causes the production costs in the water purification process will increase (Figure 2). Based on the results of interviews with technical director of PT. KTI, it can be concluded that (1) if the watershed environment is not given treatment for conservation, there will be a decrease of flow rate in the coming year; And (2) increasing current flow discharges is difficult to achieve, attempts to maintain flow discharge so as not to extreme fluctuations are seen as a skill.

### Table 1. Average Debit of Cidanau River 2007-2014 (liters/second)

| Years | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2005  | 14,628 | 9,362 | 6,284 | 5,259 | 8,525 | - | 4,051 | 3,668 | 5,593 | 4,793 | 5,911 | 13,210 |
| 2006  | 32,244 | 30,415 | 26,115 | 15,256 | 12,544 | 11,762 | 3,284 | 3,207 | 2,153 | 2,052 | 2,278 | 2,997 |
| 2007  | 3,204 | 21,025 | 16,583 | 10,033 | 6,935 | 5,594 | 3,242 | 2,138 | 1,460 | 1,507 | 1,303 | 7,365 |
| 2008  | 11,114 | 15,840 | 13,105 | 8,855 | 3,882 | 2,139 | 1,366 | 1,255 | 1,326 | 2,115 | 4,419 | 9,874 |
| 2009  | 13,683 | 19,895 | 3,920 | 5,152 | 5,064 | 5,353 | 3,064 | 1,536 | 1,796 | 2,628 | 14,156 | 5,425 |
| 2010  | 17,529 | 4,357 | nd | nd | 7,744 | 7,185 | 8,482 | 10,842 | 17,353 | 31,827 | 14,708 | 15,520 |
| 2011  | 14,827 | 22,382 | 25,141 | 19,364 | 10,749 | 3,614 | 2,949 | 1,501 | 1,620 | 3,110 | 3,406 | 7,284 |
| 2012  | 15,979 | 16,534 | 9,920 | 12,261 | 4,062 | 2,957 | nd | nd | nd | nd | nd | 2.495 |
| 2013  | 19,655 | 14,735 | 8,179 | 13,181 | 12,756 | 7,224 | 11,336 | 4,949 | 3,862 | 2,386 | 7,619 | 14,870 |
| 2014  | 14,090 | 11,186 | 8,666 | 10,324 | 5,766 | 5,503 | 8,536 | 4,605 | 2,226 | 1,946 | 5,997 | 13,058 |
| 2015  | 17,443 | 11,186 | 8,512 | 7,912 | 7,572 | 7,424 | 1,704 | 1,658 | 1,419 | 1,390 | 2,638 | 13,136 |

*nd = No Data, AWLR is damage*
For the farmers who inhabit the upper reaches of the Cidanau watershed after the PES program many benefits. In addition to obtaining cash paid on a regular basis, also benefit follow-up of replanting in their property, namely in the form of tree that are non-wood can be utilized. The requirement of Payment for Environmental Service (PES) in Cidanau Watershed is that the number of stand exist and grow well should not be less than 500 (five hundred) stands per hectare until the contract period expires (Khairiah, et.al, 2016).

The benefits for farmers from this PES program are direct and indirect benefits. The immediate profit is cash payment of IDR 1.2 million to IDR 1.75 million per hectare per year. Indirect benefits are obtained through the sale of plant products (fruits and others) and the availability of water sources for domestic needs.

4. Conclusions
In closing of this writing, there are some things that should be highlighted regarding payment for environmental services program, among others: PES Program is a new paradigm in the management of environmental resources that explores the sustainability of resource utilization without factor of the economic dimension is abandon in the form of incentives. These incentives received by providers or seller who have bothered to maintain and preserve the environmental resources of the parties who have benefited or service users (buyers) for a number of services it uses.

PES Program of Cidanau watershed located in Banten Province is the only source of water for communities downstream of the watershed, especially a source of raw water for the needs of about 120 industries in Cilegon area. Therefore, need to be maintained. Meanwhile, in the upstream watershed inhabited by mostly farming communities in exploiting the land are often incompatible with the principles of conservation, such as cultivation, agriculture incentives, and so on. Though this area is the catchment area and water infiltration (recharge area) which supplies water to Rawa Danau downstream. With this program is expected to bridge two interests and mutually benefit each other, so that the sustainable use of environmental resources can be maintained properly.

Implementation of the PES program in Cidanau watershed also expected to be a motivation for similar programs in other areas. When this program has been carried out widespread, expect apart objects and environmental services can be used on an ongoing basis, it can also lead to a mutually beneficial synergistic relationship between watershed communities downstream and upstream sections.
of society. Thus, it can be expected to help reduce poverty, or at least can rise up of income communities in upstream watershed.

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