

## **CLIMATE CHANGE PERCEPTION AMONG STAKEHOLDERS AND CLIMATE CHANGE ADAPTATION DESCRIPTION BASED ON LOCAL WISDOM IN GUNUNGKIDUL, INDONESIA**

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### **Abstract**

Adaptation is a process of adjustment with the climate change by reducing its risk level to human. Meanwhile, the stakeholder can be defined as people who have an interest in climate change, either the policy maker or the population. This research is aimed at identifying the current climate change's situation in Gunungkidul, Indonesia; assessing stakeholder perception regarding climate change, and capturing climate change adaptation in local level. The research was conducted qualitatively through FGD and workshop to take account of perception among stakeholders. Climate change's situation in Gunungkidul was identified by the extremely fluctuating precipitation level in the last 10 years. On the basis of respondent's testimony, we come to know that season can no longer be predicted by their local wisdom calendar. The majority of them defined climate change as changing of season from dry to rainy season and vice versa. There were several forms of adaptation strategy taken by diverse people in Gunungkidul, considering their occupation. A farmer chose the crop that survives in dry condition (need less of water). On the other hand, an entrepreneur adapted to climate change by creating an everlasting business that remained unaffected by seasonality or climate change. Meanwhile, a breeder acclimated themselves by preserving fodder like silage for their livestock. Lastly, government employees stated that they were left untouched by climate change. From this research, we come to a point that Gunungkidul is experiencing climate change's impact in many sectors. Despite the fact that Gunungkidul citizens have a relatively low level of understanding about climate change, it can be seen that they have an adaptation strategy to climate change based on their local wisdom. Thus, in order to strengthen their adaptation capacity, we definitely require the support from the policy maker and local authority.

*Keywords: stakeholder; climate change; adaptation; Gunungkidul*

### **Abstrak**

Adaptasi terhadap perubahan iklim adalah suatu proses penyesuaian terhadap berubahnya iklim dengan mengurangi tingkat resiko terhadap manusia. Stakeholder didefinisikan sebagai orang yang memiliki kepentingan terhadap perubahan iklim baik pembuat kebijakan maupun masyarakat. Tujuan penelitian ini adalah mengidentifikasi situasi terkini perubahan iklim di Kabupaten Gunungkidul, Indonesia; mengamati persepsi perubahan iklim diantara pihak-pihak berkepentingan tersebut dan untuk mengamati adaptasi perubahan iklim

di tingkat local. Penelitian ini dilakukan melalui 2 tahap, yaitu FGD dan workshop. Situasi perubahan iklim terkini di Kabupaten Gunungkidul dalam penelitian ini diamati dari fluktuasi curah hujan dalam 10 tahun terakhir. Berdasarkan testimony responden, dapat disimpulkan bahwa musim di Gunungkidul tidak lagi dapat diprediksi dengan menggunakan "pranotomongso" yang semula penduduk gunakan. Sebagian besar responden mendefinisikan perubahan iklim sebagai peralihan musim dari musim kemarau ke penghujan dan sebaliknya. Terdapat beberapa bentuk adaptasi terhadap perubahan iklim yang diidentifikasi di lokasi berdasarkan pekerjaan responden. Petani melakukannya dengan memilih tanaman yang dapat bertahan hidup saat musim kemarau, sedangkan wiraswasta memilih beralih pekerjaan yang tidak terdampak perubahan iklim. Sedangkan peternak melakukan adaptasi dengan mengawetkan pakan ternak yang akan digunakan saat musim kemarau. Terakhir PNS menyatakan tidak terimbas dengan perubahan iklim. Berdasarkan penelitian ini diketahui bahwa Gunungkidul terdampak perubahan iklim dalam berbagai sector kehidupan. Responden memiliki pemahaman yang rendah tentang perubahan iklim itu sendiri, namun demikian, masyarakat memiliki strategi adaptasi berdasarkan kearifan lokal setempat. Sehingga dalam rangka memperkuat kapasitas adaptasi tersebut dukungan dari pembuat kebijakan dan pemerintah setempat mutlak diperlukan.

*Kata kunci: pemangku kepentingan; perubahan iklim; adaptasi; Gunungkidul*

## **1. Introduction**

Climate change has become a global issues in the world (Environmental Protection Agency 2013). Climate change has greatly affected not only the developed country but also the developing country. Terminologically, climate change is a process of climate anomaly occurring in the long period of time and in a large geographic scale. It takes place when there is a manifestation of the increasing of CO<sub>2</sub> concentration in the atmosphere which triggers the greenhouse effect.

Globally, climate change is influencing human being in many sectors, not to mention Yogyakarta Special Region of Indonesia and Gunungkidul district of Yogyakarta in particular. This District is considered as one of the vulnerable regions to suffer from climate change due to its geographic and demographic condition. Most of Gunungkidul landscape consist of dry land and seasonal paddy field with, coastal system in the southern area. Given the landscapes, the inhabitants mostly work in non-formal occupations such as farming and fishing which are inevitably inescapable from and vulnerable to the climate change impact.

Meanwhile, a stakeholder is anyone with an interest in a particular decision, who can act as individuals or as representatives of a larger group (Gardner et al. 2009). Regarding the climate change, every country may have different stakeholder involved in overcoming the problem depending on

the degree of the vulnerability. There is a population group which has a high degree of vulnerability, such as the low income people, the elderly, and the children (McCoy and Watts 2014). Many countries have piloted adaptation or mitigation in order to reduce and protect the negative impact of the climate change. For example, in Sweden, people adapted to climate change from its various impacts; let's say Sweden will become warmer and wetter, thus people are seeking ways to adapt themselves to the occurring situation by all means. They also take into account the possibility of dramatic change in the Baltic Sea environment (Commission on Climate and Vulnerability Sweden 2007).

From the aforementioned examples, there is a need to highlight the need of climate change assessment with the aim of formulating adaptation in the context of strengthening the community capacity. This study is pivotal for Gunungkidul district in particular or other regions which have similar vulnerabilities to climate change in the context of generating the policy regarding climate change. Based on the previous research, it is revealed that teenagers in Gunungkidul district have low comprehension level about climate change (Sulistiyawati, 2014). The previous research has unveiled that the majority of high school students in Gunungkidul understood about the emerging climate change; however they didn't know what they should do to reduce the impact. Thus, the current research

aims to map the current situation of climate change in Gunungkidul district in order to identify vulnerable groups. It is also designated to capture the climate change perception among stakeholders and describe their adaptation based on the local wisdom of Gunungkidul, Indonesia.

## 2. Methodology

This research is conducted in Gunungkidul District in the framework of collaboration with District Disaster Management Agency (BPBD of Gunungkidul District) in two phases. The first phase was Focus Group Discussion (FGD) among the delegation of district work unit (SKPD), while the second phase was conducted in a sub-district level of Paliyan. Paliyan was chosen based on the result of phase one. Afterwards, the result of FGD and workshop was transcribed in order to render the conclusion.

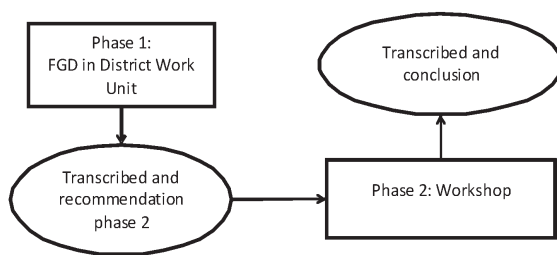


Figure 1. The schematic research step

## 3. Result and Discussion

### 3.1 Results

#### a. Respondents

Participant of Focus Group Discussion (FGD) in phase one consisted of the delegation from the several District Work Unit, which was identified as a stakeholder in Gunungkidul regarding climate change.

Table 1. Respondents of Phase one

No.	Institution	Code
1.	Gunungkidul Health Office	R1
2.	Gunungkidul Office of Environmental Impact Management	R2
3.	Gunungkidul People Representative Council	R3
4.	Gunungkidul Office of Communications	R4
5.	Indonesian National Police (Gunungkidul District)	R5
6.	Gunungkidul Office of Public Works	R6
7.	Gunungkidul Office of Agriculture	R7
8.	Gunungkidul District Disaster Management Agencies	R8

A second phase was conducted in Paliyan sub-district which was chosen based on the FGD in Phase one. It involved people from 4 categories based on their occupation, which were civil servants, farmers, breeders and merchants. Each group consisted of 20 people.

Table 1. Respondents of Phase two

No.	Respondents Group	Code
1.	Indonesian National Police (Paliyan Sub-District, Indonesian Army (Paliyan Sub-District), Civil Servants in Paliyan, Employer at State-Owned Enterprises	P1
2.	Farmer	P2
3.	Breeder	P3
4.	Merchants	P4

#### b. Rainfall Anomaly

We tried to investigate the changing of the climate in Gunungkidul by rainfall approach for the last 10 years from year 2001-2010. Figure 1 illustrates that within 10 years the rainfall in Gunungkidul fluctuated with the tendency of high intensity.

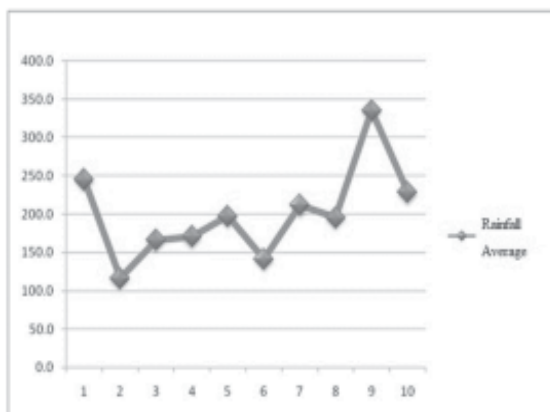


Figure 2. Rainfall in Gunungkidul District

### c. FGD and Workshop

According to community's knowledge, climate change can be rendered from the chaotic season and seasonal change. They feel the emergence of climate change from the difficulties of predicting the planting time by using the local wisdom.

*"Usually there is a local wisdom of counting which is known as rodong (gadung). The occurrence of (Dilung) blooming flowers indicated the dawn of season one" (P2);*

*"When the sun is at oblique position to the north, we can say that the dry season has come, but if the sun is in the south there will be rainy season" (P4);*

When people were asked about the indication of climate change, they answered that it can be derived from their own local wisdom based on the inconsistency of the nature sign.

*"there was seasonal change from rainy season to dry or vice versa" (P2);*

*"if the temperature was very hot, there will be dry season" (P4);*

*"extreme temperature happened. Rain was rare. The season is extremely changing" (P1);*

*"I understand climate change as the changing of temperature between hot and cold, between rain and dry" (P3).*

Gunungkidul people have their own local wisdom which provides benefits for protecting the local capacity in facing climate change. The local

wisdom is saving harvest yield in certain place known as "Lumbung". The harvest yield will be consumed when they are facing food scarcity, mainly in the dry season when it is not possible to produce rice. Second, they also preserve animal food (grass) as a food reserve for the dry season. Third, they invest their money in the form of livestock. This livestock will be sold in the dry season for purchasing water or food. Last, they manage their field mainly on how to choose the crops in the dry season; they chose a plantation with minimum water requirement.

The local authority of Gunungkidul has been implementing a policy in order to anticipate the impact of climate change, especially for handling the drought situation. Drought in Gunungkidul, like the previous experience, has an impact on the decrease of agricultural products. The decline of harvest yield is feared to harm the food security of the population. The local authority has built several dams known as "Embung". It was built as an irrigation source for agriculture sector and for tourism purposes. By this program, they obtain two benefits, 1) the supply of water for agricultural sector remain stable and 2) they receive income from the tourism sector. Both of them will increase the resilience of the community against climate change impact.

### 3.2 Discussions

Climate change is truly at stake with convincing evidences in many sectors as supported by several researches. Intergovernmental Panel on Climate Change (IPCC) reported that the surface temperature of the earth was increasing, especially in the north latitude (Intergovernmental Panel on Climate Change 2007). The IPCC also stated that the sea level has increased with the average of 1.8 mm per year since 1961. However, the climate change evidence in local level is very limited, not to mention in Indonesia. Therefore, it is important to extract the climate change perception in local point of view in order to acquire the information for further purposes.

Climate change in Gunungkidul is shown by the rainfall pattern during the last 10 years. During the period, there were 2 years with significant level of rainfall rate difference, low intensity of rainfall (average 110/month) in 2002 and high intensity of rainfall in 2009 (average 340 mm/year). Presumably this anomaly occurred owing to the El Nino. Since the escalating rainfall rate in 2009, the rainfall rate

decreased significantly thereafter in 2010. This extremely fluctuated rainfall rate makes Gunungkidul people assume that the climate has changed. However, they recognize climate change merely based on the changing local season. For example, they consider climate change as an extremely hot temperature of air and significant decrease of rainfall from year to year. What can be highlighted from their testimony is that their local wisdom regarding seasonal calendar can no longer be applied in their daily lives this time. This local wisdom dealing with seasonal pattern includes prediction of the occurrence of dry and rainy season, which was used to guide the planting time of farmers. Unfortunately, currently this local wisdom was no longer accurate to predict the plantation time owing to the seasonal change. These confirm the previous research mentioning that climate change will alter the season pattern and trigger difficulty in predicting the season including rainfall (Feng, Porporato, and Rodriguez-Iturbe 2013).

Adaptation to climate change's impact is a comprehensive process that involves the whole stakeholder, not only the policy maker but also the community member as a whole. This process needs an understanding of individual, household and community vulnerability. By this understanding, adaptation strategies can be formulated and applied properly. The other important component of adaptation process is an evaluation of efficacy of the adaptation option, knowledge and learning (CARE Indonesia 2009). Delegation from Gunungkidul's SKPD mentioned that the important stakeholder on climate change adaptation in Gunungkidul is SKPD itself and the district head in the capacity of using and determining the budget principally in critical situation such as in disaster.

Based on FGD result, it is revealed that the vulnerable sectors to climate change in Gunungkidul among others are agriculture, health, and fisheries. This finding is not much different with the research in Central Asia (Regional Environmental Centre for Central Asia, 2013) which identified that the majority of developed countries is facing climate change problem regarding the availability of water and agriculture. Meanwhile, the primary problem on the south part coastal areas of Gunungkidul is temporary flood. Temporary flood happened because of the

rising sea surface, which unfortunately inundated some part of the coastal area located in the basin.

Besides, food insecurity is also identified as a threat caused by climate change impact, despite the fact that it only took place in few parts of Gunungkidul. In other words, there was supposed to be enough stock of main food (rice) in Gunungkidul, but due to the occurrence of climate change there were many un-successful paddy harvest because of the lengthened drought in some parts of Gunungkidul. The local authorities pointed the finger at accessibility as the primary stumbling block of food distribution in the area with drought or temporary flood such as the poor access of road to the certain location.

Paliyan is a sub-district in South of Gunungkidul located at 0-300 meters altitude. This area is unique because it consists of limestone which triggers soil infertility and water scarcity in this area. No wonder, the main source of irrigation of the farming land is rain, without which farmers cannot perform the farming activities. During the dry season, Paliyan almost always suffers from clean water for daily consumption and for agriculture due the lack of water spring and irrigation channel. The only waterway from the local authority (PDAM) cannot suffice the need of the entire community. Consequently, they decide to purchase clean water from the outside of Paliyan to meet regular water necessity. As has been noted, this has left Paliyan to be one of the most vulnerable sub districts mainly to drought.

Despite the condition, community resilience at Paliyan sub-district adapts to the situation by applying some forms of local wisdom. They tried to survive from food and water shortage by having valuable properties that can be sold in a tough situation. The people also have a capital base from their neighborhood. They are accustomed to helping each other, a shared culture commonly known as "Gotong Royong" and solidarity that will be useful in case of a disaster or harsh situation. The research reveals that farmers derive their knowledge to face climate change from the previous generation. They can survive with the potential resources they own namely the natural agriculture fertilizer from their livestock. Also they organize farming by intercropping system which enables them to conduct

both farming and breeding at the same time. The system benefits them very well as the cattle can be other main source for their livelihood besides the harvest.

To overcome the harsh situation, it is prominent that Gunungkidul government and inhabitants have anticipated the drought by taking some measures indicating their resilience. Building the dam on top of the hill in order to irrigate the farm land situated in the lowland is one thing. Another thing is the attempt of the community to keep the harvest as their stock for the dry season. Third is the breeder's effort to anticipate the lack of food for their livestock by preserving grass. Last but not least, is looking for other occupations, such as turning from breeding into food selling business and so on.

#### **4. Conclusion**

The current escalating situation of climate change in Gunungkidul is apparently indicated by the rainfall rate from 2001-2010 which fluctuated extremely. People in Gunungkidul felt the signs of climate change very well, such as the increasing temperature but, they fail to define it as climate change as they refer to the situation merely as seasonal change, not as climate change. Gunungkidul is a truly vulnerable district to climate change, but the community has the capacity to protect themselves against climate change's negative impact. In addition, Gunungkidul authority has made proactive efforts in order to increase the resilience of Gunungkidul inhabitants. It is highly recommended that other researchers perform further inquiry on community resilience towards climate change.

#### **5. Acknowledgement**

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