

## Farmer Community Facing Drought Disasters in Mount Merapi Slope, Indonesia: is Social Engineering Possible?

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**ABSTRACT:** This article studies the response of the residents of Sruni Village to disaster drought with social impact engineering theory of global warming. Experienced by 3,591 people in the central cattle farming village of Boyolali Regency, the drought have caused a clean water crisis, increased living costs (for purchasing clean water for families, livestock and agriculture), the threat of crop failure and limited food and drink for livestock (even people were forced to sell livestock). Then, social engineering is performed to face this drought. The findings show that social engineering is carried out through preparation stages, approaches to partners, program socialization, community-based RT/RW organizing, implementation of various trainings, program implementation, community mentoring such as monitoring and consultation, participation in various competitions, expansion of external partners, evaluation of achievements and sustainable action plans within Proklim framework. The driving force behind social engineering is Agni Mandiri Forest Farmers Group (Kelompok Tani Hutan/KTH) accompanied by Lestari Mandiri (NGO in Boyolali) and supported by Pertamina, Adi Sumarmo Airport, Muhammadiyah University of Surakarta and Muhammadiyah University of Karanganyar, Government of Regency Boyolali and of Sruni Village. Engineering social is built in a social constructivist-adaptive way in accordance with internal dynamics and external opportunities. A qualitative-descriptive research method is used to describe how social engineering was carried out by residents. Non-participatory observations are conducted five times throughout the social engineering process. Informants are identified based on their role as drivers of social engineering. The results of the analysis based on observation data, informal interviews, secondary data documentation (offline) in 2022, assignment data from two groups of students in 2023, and secondary data (online) in 2026 are processed inductively into research findings.

**KEYWORDS:** Disaster drought, Constructivist-adaptive, Participation community, Proklim, Social Engineering

### I. INTRODUCTION

"Global warming is defined as a rise in Earth's average temperature. As the Earth gets warmer, disasters such as droughts, hurricanes, and floods are becoming increasingly common" (Hasan, 2024, 73). Masin (2008) states, "Global warming is a gradual increase in Earth's average atmospheric temperature attributed to the greenhouse effect, which is induced by higher levels of methane, carbon dioxide, chlorofluorocarbons, and other contaminants" (in Hasan, 2024, 73). The increase in the earth's temperature affects global warming, including the drought disaster in Sruni Village, Regency Boyolali, Province of Central Java, Indonesia (Antaranews.com, June 12, 2019). In relation to the disaster, contemporary sociology agrees that: (1) disasters are social phenomena; (2) the perspective of external agents should be avoided; (3) social disruptions that arise as part of the impact of the disaster should be the main focus; (4) the concept of disaster itself is a social construction; and (5) the focus of disaster research should be directed at developing effective responses for social organizations (Maarif, 2015). In Sruni Village, residents organized themselves to respond to the drought they were experiencing.

Empirically, the western part of Musuk District, which is located at an altitude of 700 meters above sea level on the eastern slope of Mount Merapi, including Sruni Village, tends to have the potential for a shortage of adequate water availability. During the dry season, approximately forty thousand residents in seven villages in the district experience water shortages. They must compete with their livestock for bathing and washing water. Some residents even resort to bathing once a day to meet their livestock's water needs (Detik.com, 2001). This drought is still ongoing. Tragically, the Boyolali Regency Regional Disaster Management Agency (BPBD) estimates that the drought will last for five to seven months, starting in May 2026. (Solopos.espos.id, April 26, 2026). Sruni Village is home to 3,591 people. It is a cattle farming center with a thousands cattles. The impacts of the drought include a clean water crisis, rising living costs (purchasing clean water for families, livestock, and farming), the threat of crop failure, and limited



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### A. Drought and Its Impacts

Drought in the village was conveyed by the driver Agni Mandiri Forest Farmers Group (KTH) in a radio interview, namely Mr. Setiyo. He said that one of the problems faced by residents of the village is drought. He mentioned two things, "... *related lack of water sources, drought... every year...*" (Setiyo, Radio Interview, 2023). Observations in 2023 also showed the same condition. This is reinforced by the news in various media over several years.

**Table I. Drought News in Sruni Village Subdistrict Musuk Regency Boyolali (2015-2026)**

| Media Name           | News                     | News Excerpt                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Solo Post            | Monday, July 27, 2015    | Jiyarto, 54, a resident of Ngambong Hamlet, Sruni Village, Musuk District, said the price of clean water in Sruni is still Rp 100,000 per tank. However, the price has increased from the initial price during the dry season, which was only Rp 85,000 per tank. Sruni Village residents who buy water store it in reservoirs in each house. Each household's water reservoir is quite large, on average, able to hold more than two tanks of water. |
| UCANews Indonesia    | September 6, 2017        | One source of fire energy is burning wood. However, excessive use of firewood can lead to water depletion, as there are no natural components to "capture" and retain water, especially rainwater.                                                                                                                                                                                                                                                    |
| Between Central Java | Wednesday, June 18, 2018 | Sarjono (36), a resident of RT 07 RW 05 Magersari, Sruni Village, said that his house is quite far from the Nggares River water source, which only has a small amount of water, so to meet his water needs he has to buy tanker water at a price of IDR 130,000.                                                                                                                                                                                      |
| Detik.com            | July 3, 2023             | "The current price of water here is Rp. 140 thousand per tank. It has gone up, last year it was Rp. 130 thousand per tank (8,000 liter capacity)," said Yanto, a resident of Mlambong, Sruni, Musuk.                                                                                                                                                                                                                                                  |
| Radar Solo, Jawa Pos | October 18, 2023         | Setiyo, a farmer from Sruni Hamlet/Village, Musuk District, Boyolali Regency, said the impact of the drought has been felt since last June. "This September, there's been a phenomenon of livestock eating livestock. This has never happened before. So what can we do? We have to buy feed, we have to buy water, everything..." he explained on Tuesday (10/17/2023).                                                                              |
| KataJateng.com       | June 5, 2026             | Water storage facilities such as reservoirs and dams play a crucial role in disaster mitigation. The reservoir in Sruni Village, Muk District, for example, still held enough water to meet the needs of local residents several weeks ago.                                                                                                                                                                                                           |

**Source: Data quoted from various online media (2015-2026)**

Why did the drought occur? This is what residents and their colleagues are talking about. This village, located at the peak of Mount Merapi's eastern flank in Musuk District, Sruni, borders directly on an active volcano. This experience has caused damage to the forest that serves as a barrier between the villages at the summit and the eastern flank of this "necked" volcano. The mountain experienced a major eruption on October 27, 2010, which volcanologists say was similar in magnitude to the eruption of 1870. Just as with normal temperatures, the higher a mountain approaches an eruption, the higher the ground temperature on its slopes will be. This is also the case in Sruni Village.

The impact of rising land temperatures is a decrease in land humidity. Water sources are needed to maintain this humidity. During an eruption, forests on the upper slopes affected by the pyroclastic flow burn, reducing forest area. The foliage also helps reduce land humidity. The exposed foliage allows direct sunlight to hit the land surface, increasing land temperatures. Rising ground temperatures cause surface groundwater to evaporate and seep into the soil pores, thus reducing groundwater reserves. In fact, these

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groundwater reserves flow downward, forming springs in certain locations. As a result, the limited number of springs is dwindling. The shrinking water resources are outweighed by the population growth of over 3,000 people, with a large number of cattle. The livestock population in Sruni Village is 14,336 cattles, including 13,100 dairy cattles and 1,236 beef cattles (Nurtanti, Irawati, Ficky, December 2024; 236). The village's enormous water needs mean they cannot adequately meet their water needs due to dwindling water resources. Based on previous research (Priyana and Safriningsih, 2025; 86), water availability in this village is sufficient through purchasing water (from tanker trucks), collecting rainwater in reservoirs, and taking river water. Of these, river water is the village's primary water source, located in the upper forest. As the forest area shrinks, soil moisture also decreases, resulting in a decrease in groundwater reserves flowing through the river, making it unable to meet the needs of the entire population.

Due to climate change and global warming, seasonal rainfall is also erratic, making it difficult for residents to anticipate the droughts that plague their villages. Prolonged droughts lead to periodic droughts. The remaining springs become increasingly dry, leading to a decline in asset values. To meet their daily food needs, residents need firewood for cooking. To save money, as the agricultural sector doesn't always provide a certain profit, residents cut down twigs, branches, and even certain trees for firewood. This causes a decrease in land cover, allowing direct sunlight to penetrate the soil. Ground surface temperatures also increase, causing groundwater near the surface to evaporate throughout the day. Limited water reserves are increasingly dwindling. Martinus Sutomo, SJ, Deputy Director of KARINA KAS, who assists 10 villages on the slopes of Mount Merapi, emphasized this: *"When trees in the forest are not cut down, it will help maintain water availability, so that when the dry season arrives, water will not be lost as before. This would be better supported by other environmental sustainability programs, such as the creation of biopores and reforestation"* (UCANews Indonesia, September 6, 2017).

**Figure 2. Illustration of Inhabitant Queue to Get Clean Water**



Source: (ANTARA IMAGE/Okky Lukmansyah)

The drought negatively impacts residents. *First*, they are forced to purchase water to store in clean water reservoirs (PAH), increasing expenses. *Second*, harvests are not always successful because residents with limited means cannot afford to irrigate their plantations, resulting in plants drying out and yielding suboptimal yields or even dying. *Third*, they must save on various family expenses because the funds allocated for water purchases are sufficient to cover routine expenses. *Fourth*, if they don't have enough money to buy water, they are forced to sell their cattle to reduce the burden of buying water. Cows require more water than the clean water needed by families. *Fifth*, for residents who are forced to sell their cattle, the only source of standard organic fertilizer from animal waste (called *kohe*) is no longer available. They have to use plant humus or buy cheap, factory-made inorganic fertilizers. This means they still have to spend money on fertilizers from manufacturers that are known to make the soil damp in the long run, blocking the soil pores, preventing worms and microorganisms from breathing and eventually dying, thus losing its fertility. Exposure to hot sunlight will increase as the number of plants above the surface decreases because the soil becomes less fertile. If left alone, uncultivated plants will die or only produce minimal yields. *Sixth*, if they can't survive, they will sell their land and buildings and move to the city to work in the informal sector or industry (factory labor). If the selling price of their assets isn't enough to buy a house in the city, they will rent a room or house to survive. They will become the "urban poor."

Regarding animal waste (*kohe*), its negative impacts will also be felt by nature. In this regard, other research results state: *"The ammonia (NH<sub>3</sub>) and hydrogen (H<sub>2</sub>) content in cow dung, which causes an unpleasant odor in the air, research shows that cow dung is one of the causes of environmental pollution. In addition to CH<sub>4</sub> and NH<sub>3</sub> found in manure, livestock manure also produces N<sub>2</sub>O gas, which can increase the effect on house windows"* (Huda and Wikanta, 2018). Therefore, the twelve people often chatted at Mr. Setiyo's house to discuss things, although their main concern was the problem of the smell of pollution in the air and

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pollution on the ground surface.

The impact is felt not only by residents but also by the local government. One of the routine impacts that the local government must face is the need to distribute clean water to drought-affected villages, including Sruni Village. To that end, they also support the program by creating plastic water containers for residents using the aerial water drop system, which is collected not only by the PAH family but also in the water containers. If a deep spring can be drilled, it will be allocated in the regional budget for Village Development Assistance in collaboration with the local village government. Sruni Village also has a similar Village Development Assistance facility located near the village hall, but it is insufficient to meet the clean water needs of all residents, particularly for livestock and agriculture.

This was the main topic of discussion for Mr. Setiyo and his friends, who served as informants, when interviewed by a radio broadcaster from Jakarta (Setiyo, Radio Interview, 2023). They discussed a typical day at their home during the evening, located west of the village hall. They discussed what they could do to benefit the environment, namely: limited water resources, drought, and poorly managed livestock waste. The cattle farming business itself has an impact on the environment, one of which is pollution from cow dung. Each cow can produce 8-10 kg of feces per day, or 2.6-3.6 tons per year (Huda and Wikanta, 2018). If not managed properly, this cow waste can become an environmental problem. This, along with a number of other issues, has become a topic of discussion among Sruni residents.

### **B. Establishment of Agni Mandiri Forest Farmers Group (KTH) and Its Efforts**

In addition to the various negative impacts mentioned above, discussions on environmental issues also yielded a positive outcome. They agreed to establish a Forest Farmers Group (Kelompok Tani Hutan or KTH) called Agni Mandiri. This was established in 2014 by a Village Government Decree. Two years later (2016), they successfully established the Agni Mandiri KTH officially through a notarial deed, allowing them to legally partner with various external government agencies requiring such legality. They then formed these partnerships with various external parties to address environmental issues, particularly drought.

In the radio interview above, Mr. Setiyo and his friends expressed their hope, *"As ordinary citizens, how can we benefit society?"* (Setiyo, Radio Interview, 2023). This is what led them to meet frequently over the years to find "solutions" to various environmental problems. This process culminated in 2014 when they successfully established the Agni Mandiri Community Forest Management Unit (KTH Agni Mandiri) and its legal framework, which took two years to manage. However, this new institution would be useless if they did not find activities that could be implemented to solve the problems. Indeed, historically, the issue of drought as a disaster threat has not been the sole focus of their discussions. This issue is integrally connected to various other issues, as outlined above. Therefore, the solutions sought are attempts to address the systemic problems they face, but in ways that are affordable and accessible to them.

But is that the solution? This is what they are trying to find with the biogas program's entry point. However, according to their knowledge, this biogas installation is expensive, reportedly reaching over 30 million rupiah, which is not only burdensome but also beyond the reach of local residents. Regarding this, Deputy Director KARINA KAS stated:

*"The biogas program has actually been in this area for quite some time, but it hasn't been well developed, and many residents are reluctant to use it because the process of producing biogas requires a significant investment of around 30 million rupiah. Furthermore, residents who want to build biogas must have at least four cows, a large area of land, and sufficient water. Furthermore, residents who use biogas generally just accept it. They have never been involved in biogas production, so they don't understand how it works and how to maintain it"* (Soetomo, UCANews Indonesia, July 27, 2023).

So, an idea will remain just an idea if it can't be realized. Therefore, people seek opportunities to make it a reality.

### **C. Social Engineering against Disaster Drought and Its Achievements**

This issue was clarified through extensive outreach. Coincidentally, the village had a reforestation program underway, facilitated by KARINA KAS. Mr. Setiyo's explanation echoed Soetomo's account of KARINA KAS's activities in the Sruni area, which is part of the Musuk sub-district. Soetomo wrote:

*"Following the 2010 Merapi eruption, KARINAKAS provided assistance to farmers in seven sub-districts within the Merapi region. While providing assistance, KARINAKAS noted that several areas on the eastern slopes of Merapi, particularly eight villages in the Musuk and Selo sub-districts of Boyolali Regency, frequently experienced drought. This drought occurs almost every year. According to residents, many water sources in the Musuk and Selo sub-districts had disappeared from time to time"* (UCANews Indonesia, July 27, 2023).

As an introduction to his involvement in this reforestation program, Mr. Setiyo stated that he received a 2.5 million rupiah loan from KARINA KAS and the Lesman Association to build a low-cost biogas installation. KARINA KAS provided assistance in the installation's construction, thereby transferring technical knowledge and skills to the local community. What happened was a blessing from a challenge from friends that night: they would follow suit with the cheap but expensive biogas production process once there were examples of success. Therefore, Mr. Setiyo, who became the "victim", was forced to initiate discussions and agreements to realize the results of that night. Finally, with the help of a second institution, he successfully installed his own biogas

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installation, using only one of his cows to power his stove and lights. In the field, the installation can certainly power the stove and lights, but with limitations. While the stove's flame can be blue, it doesn't have the same stability as an LPG stove. Lighting is also limited; not all lamps are powered by biogas, but still use electricity.

However, what really helps residents is managing livestock waste, reducing monthly electricity costs, and obtaining biosludge for organic fertilizer for plants in their yards or gardens. This provides them with economic benefits. According to Soetomo (UCANews Indonesia, July 27, 2023), residents can save money by cutting costs and thus saving: *"In practice, after residents start using biogas, they can save between 100,000 and 600,000 rupiah per month."*

**Figure 3. Asriyah Shows the Flame of the Biogas Stove**



Source: ANTARA/Aris Wasita, Tuesday (31/10/2023)

The successful biogas installation at Mr. Setiyo's house influenced eleven of his friends. As previously discussed, they joined in on similar installations based on their families' financial capabilities. Those with around 3.5 million rupiah in funds will be assisted through collaborative efforts to install similar systems at their homes. Mr. Setiyo and the residents who previously participated in the biogas installation construction, accompanied by KARINA KAS and the Lesman Association, will also participate in the installation construction, along with the prospective installation owner. This will increase the number of residents with the skills and technical knowledge needed to build a biogas installation and the various equipment requirements to be purchased and provided. What about those who don't have sufficient funds? Mr. Setiyo explained that they do this through a social fundraising method for biogas. Each fundraising session is used to prepare for the construction of a biogas installation. Once sufficient funds are collected, they hold a lottery. Those whose names are drawn will receive a biogas installation. Thus, up to twelve people will have affordable biogas installations, as reported in the interview (Setiyo, Sruni Village, February 2023).

In a radio interview, Mr. Setiyo stated that since then, the number of residents wanting their own biogas installations has increased. He said that about 50 people have lined up to install their own. The procurement method for these installations follows the aforementioned method: independent funding and community-based funding (called *arisan*). The production process is carried out in an agreed-upon manner. In the radio interview, Mr. Setiyo stated that, *"80% of families in the local village use biogas"* (Setiyo, Radio Interview, 2023). He further stated that each household has livestock for biogas needs. Good livestock are either owned by the individual or even *gadhuhan*. *Gadhuhan* livestock is livestock owned by other that is cared for on the principle of profit sharing after the livestock has its own offspring (called *pedhet*). If the livestock is *gadhuhan*, then it is agreed that it will be used for a rearing program, then be sold before the Eid al-Adha celebration. The profits from the sale will be divided according to a certain agreement, for example, 70% for the caretaker (called *penggadhuhan*) and 30% for the cattle owner. Whatever the method, the most important thing is that every household wishing to build a biogas installation must have cow dung that can be processed into biogas energy. According to Mr. Setiyo, he only has one cow and built a 4 m<sup>3</sup> manure storage tank to support the biogas installation at his home (Setiyo, Radio Interview, 2023).

Can biogas address the threat of drought? Soetomo explains this quite clearly: *"Long-term use of firewood will damage environmental sustainability, which in turn will increase the threat of drought, landslides, floods, and so on. Therefore, alternative energy is needed to replace firewood, which in this case is biogas"* (UCANews Indonesia, July 27, 2023). Previously, residents cut down trees for firewood, which negatively impacted land cover reduction, so that drought did not decrease but instead increased. There are four reasons why biogas is an option for drought relief. Soetomo explains these reasons as follows:

*"First, nearly a third of Boyolali's population are cattle breeders, raising approximately 88,533 dairy cattle and 98,248"*

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beef cattle. This offers significant potential as a raw material for biogas. Second, biogas is environmentally friendly because it reduces the use of firewood, thus preventing tree felling. The community also benefits from processing cow dung, which in turn reduces CH<sub>4</sub> emissions and produces organic fertilizer. Third, biogas production is very easy, simple to operate, and safe. Fourth, it's inexpensive and efficient, requiring minimal investment. Building a single biogas unit costs around Rp 2.5 million to Rp 4 million, but in the long run, they'll save money by eliminating the need to purchase firewood or LPG for cooking" (UCANews Indonesia, July 27, 2023).

This is what led to the village being nominated as an independent energy village in a competition. Pertamina even partnered with the village to become a recipient of Pertamina's CSR program. After a lengthy process, the judges finally declared the village an Independent Energy Village. The program then expanded from biogas to other programs to address the drought. In addition to biogas, four other programs were discussed and agreed upon for joint implementation in stages. These four programs are: 1) biopore construction and water absorption, 2) planting perennial plants, 3) establishing a waste bank, and 4) participating in the Climate Village Program called Proklam. (Setiyo, Radio Interview, 2023)

The construction of biopore wells and water absorption wells is carried out through mutual cooperation. Anyone with available land and in need will be prioritized for assistance. This primarily applies to the construction of water absorption wells, which are made of standard concrete and perforated covers. The concrete is prepared by residents who request it. Once all necessary materials are in place and a work schedule is agreed upon, they will work together to assist residents in constructing the infiltration wells. If residents have other needs that prevent them from applying for assistance, this is also understandable, as the nature of mutual cooperation is voluntary. However, for biopore creation, because the equipment is readily available and the process is easy, it is generally done independently. Biopore creation simply involves using a sharp iron rod that is rotated downwards to create a hole in the desired soil. Various leaves and organic waste are usually placed into this hole so that over time it can become humus. The same applies to water infiltration. If they want the humus formation process to be faster, they can add EM 4 purchased from the store or liquid organic fertilizer (POC) that they usually make. For information, based on the author's introduction and observations since 2018, Mr. Setiyo is affiliated with the Independent Sustainable Association (Lesman) Boyolali which is a member of the Indonesian Organic Alliance (AOI) based in Bogor, so the production of various organic fertilizers is already commonly done by him with Mas Eko, Mas Mulyono, and Mas Wangsit, who are also AOI activists.

Then the resilient tree planting program was carried out by the residents of Sruni Village together with KARINA KAS. Since 2010, after the Merapi eruption, a resilient tree planting program has been carried out on the slopes of Merapi by environmental activists, the Environmental Agency and NGO activists. Mr. Setiyo stated, "*Damaged forests, including community forests in Musuk, need to be saved,*" so that residents along with various concerned parties planted the land with various resilient tree seedlings that are suitable for local endemic vegetation so that they can adapt and survive (Setiyo, Radio Interview, 2023).

They also have a Waste Bank Program specifically designed to accommodate inorganic waste that could potentially pollute the soil when buried or pollute the air when burned in dumpsters (as was the practice of the previous residents). In addition to education, this program also aims to provide financial support to the Agni Mandiri Community Group (KTH Agni Mandiri) in organizing activities independently. Therefore, the financial support of each family is limited and they have certain inorganic waste, so this problem is addressed with this program. Various village social activities, such as helping the sick, deceased family members, and other urgent needs that need to be addressed, are supported by community funds derived from the sale of this inorganic waste. This inorganic waste typically consists of paper, cardboard, hardwood (bottle caps), plastic bottles, glass bottles, used cans, and other packaging for various family necessities purchased from roadside stalls or shops. They organize their own open waste bank management every Sunday. Generally, mothers do this work because they are more meticulous, patient, and diligent in weighing, recording, sorting, and storing (until buyers arrive). Fathers help transport this inorganic waste to the storage warehouse while seeking buyers for organic waste from Boyolali.

In addition to the biogas program that made Sruni become an Energy Independent Village, Proklam also brought proud achievements. As a community activist, Mr. Setiyo explained this as follows. Because these good practices are beneficial, many villagers want to join. This process produces more biogas, biopores, and water absorption carried out by Sruni Village residents. This process then led the village to participate in the Proklam Competition in 2016 (the same year that KTH Agni Mandiri obtained institutional legality through a notary deed). As a result, the village received an award as a Main Proklam Village. For information, there are several award categories in this competition, namely Beginner, Main, and Established/Sustainable. This achievement has made the villagers proud, leading them to become even more enthusiastic about organizing their village to address the impacts of climate change resulting from global warming. They have integrated several of the aforementioned programs with integrated organic farming and processed products based on integrated organic farming.

Using management principles, the planning aspect is reflected in local activists and Agni Mandiri Forest Farmers Group mapping out multi-stage action plans that leveraged the village's vast cattle population (3,107 cattles). They planned low-cost biogas installations, biopore/water absorption wells, planting resilient endemic trees, establishing a waste bank, and building small agricultural reservoirs. Organizing principle involved KTH Agni Mandiri establishing legal recognition to partner with external

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institutions. At the community level, resources were organized down to the neighborhood (*Rukun Tetangga and Rukun Warga/RT and RW*), Farmer Groups, and Women's Farmer Groups (*Kelompok Wanita Tani/KWT*). Financial resources were pooled through community (*arisan*) to finance individual household biogas units, while inorganic waste was gathered through a waste bank program operated by local women to fund emergency village social needs.

The leading principle is reflected in Mr. Setiyo's role alongside KTH Agni Mandiri, supported by village leaders and facilitators. The leadership, based on human resource management, was conducted through persuasion rather than rigid, top-down enforcement. It involved participatory training, regular meetings, motivating the residents, and voluntary participation (called *gotongroyong*). Lastly, the controlling is seen in routine joint field monitoring, evaluations, and consultations to address operational issues. Achievements were systematically measured through participation in formal frameworks like the Climate Village Program (*Program Kampung Iklim* or Proklam), where Sruni Village earned top national awards (Main and Sustainable Proklam Village). This feedback loop helped leaders to track the overall performance indicators, including reduced land temperatures, financial savings on LPG and electricity, lower livestock waste emissions, and the expansion of household biogas adoption.

The paragraphs above can be related with the visits, interviews, and observations to this village. From these, several notes can be conveyed as follows (Eko and Setiyo, Sruni Village, March 2023).

First, the integrated organic farming program gained momentum with the biogas, biopore, and water absorption programs, as mentioned above. In fact, in 2018, there was a discussion between Mr. Setiyo and Mr. Wangsit (the then Director of AOI) to establish an organic pilot village. According to AOI's monitoring, this did not yet exist (in terms of village coverage). Therefore, when Proklam was launched as a community achievement in addressing the drought disaster (which is included in one of Proklam's objectives), this aligned with the wishes of Mr. Setiyo and his colleagues (the Lesman Association, which is a member of AOI, and even the Director of AOI, Mas Mulyono, who had led the Lesman Association). Thus, there was a synergy of interests that became the driving force for Sruni residents in implementing this integrated organic farming program.

Second, biogas waste, namely liquid and solid bioslurry, is an excellent raw material for organic farming fertilizer. Typically, a fermentation process is carried out to create bioslurry containing fertilizer bacteria, which act as a catalyst for enriching the soil where plants grow. Thus, the zero-waste principle applied to native livestock manure remains unaddressed, as Pas Setiyo narrated in the radio interview above. The livestock manure issue is resolved with this program.

Third, what is the impact on farmers? They achieve better harvests at lower operating costs because they produce their own organic fertilizer and pesticide components, while the processing is carried out cooperatively, primarily through Women's Farmers Groups (KWT). This creates a synergy between biogas and organic farming. Consequently, production costs are lower, resulting in greater profits for farmers when their products are sold.

Fourth, integrated organic farming can reduce methane emissions and expand land area. Much of the land is covered by vegetable and horticultural crops, allowing sunlight that would normally reach the soil to be absorbed by the leaves for photosynthesis. The impact of this material is that the soil temperature does not increase due to the presence of organic cover crops. Drought can be mitigated by increasing soil temperature and moisture thanks to the presence of leafy cover crops, organic fertilizers that loosen the soil, and the activity of microorganisms that open the soil pores, allowing the soil to breathe because it is no longer waterlogged.

**Figure 4. Residents of Sruru Village Picking Roses in the Field**



**Source: Suara Merdeka Solo/Joko Murdowo**

Fifth, the brand's harvests produce processed products that are sold online. These products include various processed chips made from tubers, dried fruit, and rose oil (used as an air freshener during the COVID-19 pandemic). Residents often meet together to

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process the products, photograph, upload, and take orders. A side effect is increased financial income.

Sixth, a small reservoir program funded by the fund helps them build water reservoirs on their farms/plantations so they can still irrigate their crops during the dry season. Water is collected during the rainy season, subscribed to by the Village Water Supply Agency (*Perusahaan Air Minum Desa* or PAMDes) and supplied by water tanker trucks. Purchasing water is made possible by financial support through savings on energy, fertilizer, and pesticides, as well as increased income from organic farming.

Seventh, due to media coverage, they are known as an independent energy village, an organic farming village, and a Proklam Village, resulting in a large number of visitors. The visitors' arrival aims to generate additional revenue for the community fund and encourages them to offer CSR programs to provide financial support for further program work, including this integrated organic farming initiative. University researchers, along with students in attendance, also provide partnership support in implementing this joint program, funded by external partners.

In addition to the notes above, Mr. Setiyo stated that, thanks to the various programs and achievements mentioned above, this village successfully received an award as a Sustainable Proklam Village in 2021. The mass media also reported this (JPPN.com, October 22, 2021): *"From Central Java, two villages also received the Proklam Lestari award: Sruni Village in Musuk District, Boyolali Regency, and Sambak Village in Kajoran District, Magelang Regency. These two villages received the "highest" awards, Widi said when contacted by phone"*.

How was the achievement achieved? This social engineering project was actually designed by Mr. Setiyo and his colleagues, the Independent Sustainable Association (Lesman), Boyolali. Based on discussions with Mr. Setiyo and Mr. Eko, as well as documents provided by Mr. Eko, this social engineering project aimed to mobilize the residents of Aini Village to prepare for drought by leveraging the momentum of the Climate Village Program (Proklam) competition. To summarize, the steps are as follows:

1. Preparation. The idea that originated from AOI, Organic Village, which did not exist before, Sruni Village has the potentials by considering the driving figures, NGO support, the potential for organic plantations, cattle farming (organic fertilizer), good relations with the village government (regulatory support). What happened in 2016, namely the ratification of the Agni Mandiri KTH with the Decree of the Sruni Village Government is part of this effort, namely gaining legal support, so that when the community moves in this direction, they also invite other residents and receive regulatory support. This is not considered an illegal community because it has the approval of the village government. Village driving figures will also be easier to invite because the village head supports it. The Agni Mandiri Community is a forum for community mobilization. As Mr. Setiyo explained, he and his colleagues had to ask permission (or *kula nuwun*) when inviting the Hamlet Head and his residents to participate in joint activities to address environmental issues in the village. Likewise, when they entered the neighborhood units called RT and RW, Farmer Groups (*Kelompok Petani*), and Women's Farmer Groups (KWT), they needed official recognition to facilitate outreach, align perceptions, prepare programs, organize training, provide mentoring, and carry out various documentation for the Proklam race's needs and establish external partnerships, or receive visits from outside.
2. Lobbying internal (government village and figures community) and external partners. The Village Government Decree above demonstrates the village government's support. Mr. Setiyo explained that the village head at the time was his relative, making lobbying easier. Because Javanese culture generally tends to be patriarchal and hierarchical, the village head agreed to approach these figures easily, as they respected the village head's support. Externally, KARINA KAS and the Lesman Association have been active in this village since the post-2010 Merapi eruption, making it easy to be invited to collaborate because the villagers have an institutional "umbrella", namely Agni Mandiri. This collaboration became a foothold for residents in interacting with potential external partners, which was then mediated by the Lesman Association and parties who came after the village received an award as an Energy Independent Village with a biogas program initiated together with KARINA KAS. Pertamina then provided CSR, as did PT Angkasa Pura Adi Sumarmo Airport, Muhammadiyah University of Surakarta, Muhammadiyah University of Karanganyar, the Surakarta Boyolali Regency Environmental Agency (DLH), the Boyolali Regency Regional Disaster Management Agency (BPBD), and various other parties who came as guests, including international institutions mediated by the Lesman Association.
3. Program socialization. As mentioned above, prior to the program's implementation, Agni Mandiri, with the assistance of the Lesman Association, held a program outreach event inviting various village community representatives. These included representatives from the village government, hamlet heads, neighborhood units (RT and RW) heads, heads or managers of farmer groups and farmer-oriented women's groups (KWT), youth representatives (or *Karang Taruna*), and village and hamlet leaders. They explained what they would be doing together in preparation for the Proklam competition, as well as addressing environmental issues, particularly the threat of drought and shrinking water sources. Regarding this, Mr. Setiyo stated that the biggest challenge was *"changing the mindset of the residents"* (Setiyo, Radio Interview, 2023). Awareness is crucial. This requires extra effort for the program to run smoothly. Social engineering, through building a persuasive and argumentative "common ground," is key to the success of this commitment. If agreement and commitment are not achieved, the program plan will not be implemented and could

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be considered a failure. Facilitators from Lesman play a role in this, in addition to Mr. Setiyo and the support of the village government.

Once the audience has a shared understanding, they are invited to design future action channels programmatically, following the timeline and various equipment required for program implementation. As a forum for community members, Agni Mandiri will discuss what residents can prepare. Meanwhile, the Lesman Association will also provide various resources at its disposal.

4. Organizing community. The various communities above are then organized into various training activity schedules as a basis before they implement the program. One of the main programs is integrated organic farming. Meanwhile, biogas, biopores, water absorption, and other programs have been implemented. This can be replicated by residents, groups, and communities who want it. Collecting data on residents' aspirations is crucial to determine what needs to be done. Community organizing (including RT, RW, Farmer Groups, KWT, and Karang Taruna) is carried out after the aspiration data is recorded. The driving team, consisting of core management from Agni Mandiri and Lesman, will organize all participants and their aspirations into a planned activity schedule in agreement with the Sruni residents. Community organizing not only means organizing human resources (HR) but also various other necessary resources, such as meeting places, catering, secretarial and documentation equipment, land for field training, and so on.

5. Implementation of training. Various training sessions are conducted based on the aforementioned agreement. These sessions utilize existing community meetings and schedules (e.g., regular meetings every 35 days/week), unless otherwise agreed. These sessions involve experienced facilitators from Lesman, who invite relevant and experienced trainers. The Lesman network plays a crucial role in this regard. These sessions are conducted over several months, in stages, tailored to the residents' available time, and utilize existing community meeting schedules. Training on various post-harvest processed products is based on the success of previous organic plantings or on leveraging the potential of the local community, which has a variety of tuber-based snacks and rose-flavored drinks that can be made without waiting for the harvest of vegetables and other horticultural crops grown in Sruni Village. Both have readily available ingredients.

6. Implementation of the program. Because of training takes a long time, the program is implemented simultaneously. So, groups that have completed the training and are deemed to have understood are then invited to participate in the program. Regarding integrated organic farming, they are invited to apply organic fertilizer production using standard liquid and solid bio-slurry ingredients. They are also invited to practice planting pest and insect repellent plants in demonstration plots (called *demplots*), namely various attractively colored or pungent flowers that repel insects. Plant seeds are prepared by Lesman with the support of partner institutions to ease the burden on residents. Organic pesticides are made from various locally available plants, such as herbs. Thus, the program and training are implemented simultaneously, taking into account field readiness.

7. Mentoring: Monitoring and consultation. Throughout the implementation of good and sustainable organic farming, the support team regularly conducts joint monitoring in the field. Local stakeholders are invited to share their opinions, challenges, and ideas for achieving the desired harvest. Consultations are conducted both in the field and outside of informal meetings.

8. Evaluation and follow-up planning: Program improvement, intensification, and expansion. Every activity undertaken is always followed by an evaluation. This evaluation involves participant training and program implementation, in addition to internal evaluations by Agni Mandiri and Lesman activists. Evaluations help design future sustainable actions: what should be maintained (because it's already working) and what needs to be improved (because there are still shortcomings or weaknesses).

9. Participation in Proklm Competitions. For participating in Proklm Competition, residents were invited to participate in preparing various documents and documentation activities, in addition to filling out the provided forms. Lesman helped clarify the focus of the preparation targets in accordance with the provisions of the Proklm Competition Guidelines obtained. Agni Mandiri prepared residents along with evidence of the supporting flagship programs that had been achieved to convince the jury team who might present various achievements that had been achieved. In a radio interview, Mr. Setiyo stated that "*The Main Award to Lestari is thanks to the use of biogas, biopores, infiltration wells, waste banks, integrated organic farming, planting perennial plants, processed products based on organic farming.*" (Setiyo, Radio Interview, 2023) These various efforts were carried out in the training and program implementation because they were the "poles" supporting the "success" of the competition. All of these are integrated elements to address the threat of drought that hit this village.

10. Expansion partners. As seen in the description above, the villagers carry out the activities mentioned above with the support of various external partners. Historically, the partnership, which started out small, has grown into a larger one. Initially, the partnership consisted of only 12 people, who were the main driving force behind Agni Mandiri. They then expanded by approaching and gaining support from the village government. They then collaborated with KARINA KAS and Lesman. After that, they partnered with district-level services, PT Angkasa Pura Adi Sumarmo Airport, Pertamina, renowned universities, AOI, and later an international institution that even visited Sruni Village, namely the KTH Agni Mandiri Secretariat.

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11. Evaluation achievements. Together with Lesman, Mr. Setiyo, representing Agni Mandiri, conducted a joint evaluation by asking external partners to critically write their stories so that an external perspective could hopefully help them "reflect" on their achievements thus far. In informal conversations, as witnessed firsthand in 2023, they also evaluated their experiences and achievements. This included the impact of the village head election on Agni Mandiri's cohesion, as it attracted affiliated support from different village head candidates. This means that Agni Mandiri wanted to reflect on their journey in championing causes that benefit the community. Various media publications and writings by academics and activists can also be used as a "mirror" to evaluate the achievements of their efforts in utilizing biogas programs, climate programs, integrated organic farming, perennial planting, product processing, biopores and water absorption, as well as waste banks and reservoir construction in agricultural areas as an integral part in addressing the drought that hit their area.

With these various stages of social engineering, what have they achieved? According to our records, they have achieved the following:

1. Reducing direct sunlight exposure to the land, thus controlling temperatures.
2. Awards from various institutions/agencies.
3. Opportunities to save money on electricity and LPG gas thanks to the biogas installation.
4. Savings on electricity and LPG conversion costs for livestock drinking water.
5. Opportunities for side jobs from organic farming.
6. Serving as a reference site for research and demonstrations related to drought mitigation.
7. Several institutions have entrusted the implementation of CSR programs in these villages.
8. Animal waste containing methane gas has been successfully converted into biogas, and waste has been converted into organic fertilizer, thus preventing damage to the already damaged ozone layer and contributing to global warming and climate change.

With the social engineering and achievements above, what can be reflected in the process of Sruni residents in facing the drought disaster above? In the radio interview above, Mr. Setiyo stated, "... it is said to be good, yes..." (without a tone) (Setiyo, Radio Interview, 2023). However, he expressed his gratitude for the achievements of the residents of Sruni Village together so far. He thanked his friends, members of the KTH Agni Mandiri who had worked together to encourage residents to move together to face the drought, the Sustainable Independent Association (Lesman), KARINA KAS, the Boyolali Regency Environmental Service (DLH), in addition to those who cannot be mentioned one by one. However, he still hopes that in the near future, *"60% of the village population will use biogas"* (Setiyo, Radio Interview, 2023). New biogas users number 232 families, or 18.5% of the 1,250 families in Sruni Village (Tribun Jateng.com, August 18, 2023). Biogas has great potential to be used as a renewable energy source. With a high methane (CH<sub>4</sub>) content and a fairly high calorific value (4,800–6,700 kcal/m<sup>3</sup>), methane gas combustion is more environmentally friendly because there is only one carbon in each chain, which makes it more environmentally friendly (Huda and Wikanta, 2018).

Although Sruni is known as an Energy Independent Village, not all residents are using biogas to contribute to collective drought relief efforts. They still use firewood, meaning they are still pruning tree branches and twigs, have not yet practiced integrated organic farming, and have not continued various activities within the Proklim framework that were previously carried out jointly. This is why Mr. Setiyo, as the initiator and driving force behind the local government, remains "doubtful" about whether this social engineering initiative has truly been substantially successful.

Ultimately, it is understood that global warming is indeed insurmountable; its root causes lie at the local level. Local movements, such as the social engineering initiative in Sruni Village, demonstrate that the only way to mitigate the greatest potential risks at the local level is through the use of nature. This demonstrates how vulnerable humans are when nature is damaged. Vandana Shiva's critique of patriarchal capitalism, which has caused global environmental damage, remains relevant. "Mother Earth" and "Father Space" suffer because the greedy and hedonistic nature of "children" exploits the earth, which is the "mother" of their lives. This is the unfinished journey of humans as "spiritual beings possessing human experience" (Tielhard de Chardin), who continue to rise to improve themselves.

### D. Sociological Reflection

By using a sociological perspective, and a little philosophy about the subject (read: citizen) Sruni as the subject), this will convey the following reflection.

First, sociologically, the statement that *"disaster issues are related to society, both its vulnerability and capacity"* (Dodon, 2013, in Ernawati, 2023) is relevant to the findings above. Disaster issues, in terms of drought and dwindling water sources, were indeed discussed by the founders of KTH Agni Mandiri, as explained above. For years they have strived to improve their abilities (to become Übermensch, in Nietzsche's term) by overcoming their own weaknesses. The twelve driving forces are important, and especially Mr. Setiyo because the first thing to do is build a biogas installation without a supply of knowledge and skills of adequate technical support. He does not fall into "nihilism" (borrowing Nietzsche's term), to call the self "empty," because there is no point

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in challenging life and society. To borrow Heidegger's term, in the passing of "time," he is always in the process of "becoming" (*being*) better so that it is meaningful to fellow humans and the natural environment closest to him.

Second, what about the phrase *"Increasing disaster insight as knowledge and attitudes can be done through disaster education, as well as as a basis for someone to try or act on safety activities when a disaster occurs"* (Dodon, 2013, in Ernawati, 2023)? Social engineering characterized by socialization, training and implementation of field programs, as well as monitoring, evaluation and follow-up planning above, is a method to improve various knowledge and attitudes, in addition to education about disasters (disaster education), in facing disaster drought. According to an academic (Drabek, 1986, in Ernawati 2023) who stated that *"the sociology of disaster includes planning, warning, emergency evacuation, reconstruction, perception, and adaptation,"* the explanation above is not related to the concepts of "emergency evacuation" and "reconstruction" because the disasters faced are different. If they were facing a Mount Merapi eruption, this second term would certainly be relevant. All other terms are consistent with what happened in Sruni Village in the social engineering process for dealing with the drought disaster mentioned above. However, the phrase that *"disaster sociology generally includes preparedness, response, recovery, and mitigation... community perspectives and responses must be included within the organizational framework"* is in fact generally relevant to what the Sruni residents are doing, except for the concept of "recovery." To some extent, planting trees in damaged forest areas can be aligned in meaning with this concept of "recovery."

Third, the statement that social engineering is characterized by *"non-repressiveness and demonstrates legitimate social management and is a hallmark of a rational society... guided by self-motivated goals,"* (Murphy, 1981, 10, in Ernawati, 2023). This is very relevant. All of the above efforts certainly shape the work of a rational society with legitimate social management because it was agreed upon when socialization was initially carried out. They have various goals that crystallized in "chat night" by the twelfth pioneer (self-motivated goals).

Fourth, in general, in the context of the statement that social engineering considers *"self-reflection," "self-motivated projection and monitoring of social desires,"* and *"self-management,"* I believe this is also true economically. Group desires then become collective desires when they become programs at the village level.

Fifth, the assertion that social engineering involves the co-creation of interests between stakeholders (*stakeholder co-creation*) is thus distinct from positivistic, rigid, and top-down "*social planning*" (Murphy, 1981; 10, in Ernawati 2023) seems to align with the efforts of the Sruni residents. However, the process of Agni Mandiri's ideas, with Lesman's assistance in socializing with residents, feels "*top-down*" because it originates from village "*elite*" activists who have been "*exposed*" to various knowledge thanks to their social circles with a number of external institutions, especially Lesman. Nevertheless, discussions of interests between stakeholders are indeed carried out during this ongoing social engineering process. The principle of co-creation is carried out together both among Agni Mandiri activists and with residents (of course) with varying levels of knowledge and capacity.

Sixth, what are the pioneers' ideas? Can these ideas be accepted by the residents? Brushwood's (2012) statement seems to be relevant to this issue. The village government's attention, sincerity, commitment, effort, and support for Agni Mandiri activists demonstrate that they fulfill three key components of influencing the audience: "*likability*," "*reciprocity*," and "*authority*." They are well-liked because they are committed to helping residents. They also interact well and benefit residents (reciprocity), so residents also appreciate them by providing support. Agni Mandiri's agreement with the Sruni Village Government Decree gives them the "*authority*" to carry out social "*engineering*" "*for the common good*" of the residents. They have succeeded in achieving the residents' common interests ("*finding common ground*"), to borrow Hamdan's (2026) term.

Seventh, related to the contemporary sociological view of disasters, namely: (1) *disasters are social phenomena*; (2) *the perspective of external agents must be avoided*; (3) *social disruptions that arise as part of the impact of disasters must be the main focus*; (4) *the concept of disaster itself is a social construction*; and (5) *the focus of disaster research must be directed at developing effective responses from social organizations* (Maarif, 2015), it will be conveyed as follows. In authenticity, the residents of Sruni Village were able to organize themselves to respond to the drought they experienced. This perspective on the drought disaster was the result of "*chats*" together at Mr. Setiyo's house repeatedly day and night. Thus, this is not an external perspective, but rather, it is the result of internal social construction (*socially constructed*). They discussed this because they had felt the impact of various environmental problems, including drought and shrinking water sources, so that it is in line with the statement above, namely "*the impact of the disaster is the main focus*." How they responded to the impact of the drought disaster by carrying out social engineering is what is being studied, as a statement that the focus of disaster studies is the development of effective responses from social organizations to overcome the differences in impacts. This study has not examined the "*effective responses*" of social organizations in facing drought disasters.

## IV. CONCLUSION

Social engineering in response to the drought disaster in Sruni Village was built in a socially constructivist-adaptive manner in accordance with internal dynamics and external opportunities. Engineering was carried out through preparation stages, approaching partners, program socialization, organizing community-based RT/RW, conducting various trainings, program

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implementation, community mentoring (monitoring and consultation), participation in various competitions, expanding external partners, evaluation of achievements and sustainable action plans within the Proklim framework. Thus, social engineering that considers "*self-reflection*," "*projection and monitoring of self-motivated social desires*," "*self-management*" is truly necessary to be adaptive according to the contextual needs of the local population.

The driving force behind the social engineering is the Agni Mandiri Forest Farmers Group (KTH), with the assistance of the Independent Sustainable Association (an NGO in Boyolali), supported by companies, universities, and the local government. The relationship between local actors and NGOs across various programs transforms ordinary farmers into social activists with broad perspectives. The transmission of social knowledge and skills makes social engineering possible in this village. However, without external financial support from companies, local governments, universities, and even donor agencies behind the supporting NGOs, this social engineering would not have been sustainable.

The root causes of global drought, namely *global warming*, cannot be addressed solely through local efforts, such as social engineering at the village level. This is Vandana Shiva's ecofeminist critique. This critique is appropriate for analyzing the causes of global warming, although it also argues that no one can address it because the power relations at the political-economic level are beyond critique. Capitalism is too powerful to be confronted academically, as it exists at the global political-economic level.

Based on the experiences of the Sruni residents, multi-stakeholder collaboration that relies on community empowerment is superior to positivistic, rigid, and top-down social "*planning*." Therefore, the government needs to collaborate with civil society elements in social engineering efforts to address disasters.

This study is not expected to yield optimal results. As anthropologists do, conducting "*field studies*" would yield more detailed data and a deeper understanding, as they relate to the meaning of the community as subject actors in the field over a relatively long period (2010-2026). A "*microscopic*" perspective (Geertz) and "*reflective ethnography*" would support ethnographic research in gaining a deeper understanding of this study.

### ACKNOWLEDGMENT

This article was compiled as a blessing from the collaborative efforts of KTH Agni Mandiri, especially Mas Setiyo, and Perkumpulan Lestari Mandiri, especially Mas Eko. Thank you for the permission and access to the data provided, which made this "random" article possible, even though it is only in its early stages.

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