Ligtas Agtas: a sustainable and disaster-ready resettlement area for the Agta Community in Sitio Pulang Lupa

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Abstract. Most indigenous peoples experience homelessness in the Philippines. This is the case for Mount Kalbo’s indigenous tribe, the Agta Community. They face the challenges of dealing with mass wasting disasters potentially devastating their houses and compromising the lives of their families. It is with high hopes that they will be resettled to Sitio Pulang Lupa to rebuild a community, in which this research aims to propose and develop. The proposed resettlement’s goal is to improve and sustain the Agtas’ living conditions in Sitio Pulang Lupa by addressing the unstable slopes and preparing the community to cope with mass wasting disasters. Sitio Pulang Lupa is analyzed compared to Mount Kalbo regarding its advantages of keeping the resettlement sustainable and safe from mass wasting. The resettlement merges the Agtas’ necessities to achieve the research’s objectives, which are improved living conditions, cultural representation, and disaster preparedness into one landscape development in Sitio Pulang Lupa. The resettlement comprises of spaces and facilities that reflect their cultural practices and their needs. Disaster management protocols were also formulated by mapping safe routes, and refuge landscapes to equip the Agtas with preparedness in case disaster occurs. To sustain the vision for the Agtas, soil conditions are firstly addressed by using contour planting. It was used as slope protection and to over-all enhance the environmental quality of the Agtas’ resettlement area. The resettlement as a whole shall be able to meet the research’s goal of proposing a landscape development that mitigates the mass wasting threats experienced by the Agtas, and improves their living conditions. Having said that, Agtas shall finally feel safe and secured in their own homes.

Keywords: Culture, Disaster Preparedness, Mass Wasting, Resettlement, Sustainability

1. Introduction

Quirino province comprises of 80 per cent highlands that make it mountainous.[1] Entailed with its rich topography are threats of mass wasting. Mass wasting, commonly known as landslides, is a life threatening occurrence where soil, rocks, or sand naturally moves downward according to gravity through falling, sliding, or rolling. [2]

In addition to this concern, Nagtipunan, Quirino was recently hit by a magnitude 4.8 earthquake at the evening of 14th of November 2019.[3] Although there are reportedly no damages caused, the sudden jolt of the ground in Quirino may lead to the fragility of its soil and cause disasters in the future. It is an enormous threat to the people and communities that reside in the province, most especially if not equipped with knowledge on how to act or prevent such disasters from happening.

Mount Kalbo’s Agta Community, one of the indigenous peoples in Quirino Province, faces these kinds of threats.[4] Indigenous peoples’ welfare is often neglected with government support, which hinders them from building a safe and sustainable community.
They hope to resettle in Sitio Pulang Lupa, where the soil is more stable, and be able to develop their community towards unity and resiliency, in which this research’s goal will focus.

1.1 Problem Setting
Having mentioned the situation of the Agtas, this research’s main goal is to address the problem by formulating a functional and secure landscape development design for the resettlement of Agta Community. The resettlement’s objective is to improve and sustain the Agtas’ living conditions by addressing the unstable slopes and preparing the community to cope with mass wasting disasters. It is achieved by characterizing the soil and topography conditions in the resettlement site and making use of landscape architectural elements and natural slope protection measures to address these. In designing the landscape development plan, the Agta culture was considered, and procedures to mitigate threats of mass wasting was provided. Accessible and functional refuge landscapes that serve as an evacuation area for the Agta Community in times of mass wasting disasters will be included in the development. Altogether, Agtas’ resettlement will be able to rebuild a community that is not only sustainable but enhances the environmental quality of the area as well.

2. Methodology
A research method design is formulated reflecting the processes conducted in this research. This research is divided into two phases as reflected in Figure 1. The first phase is the development of the resettlement for the Agta Community, and second is the transitioning to an evacuation model in case of disasters, especially mass wasting.

As the research established the problems and goals, a site selection was conducted to identify the site that best embodies the objectives of the research. A site visit and interviews were then accomplished to acquire perspective to the situation of the previous site. With this, a site within the Agtas’ ancestral domain was selected following criteria that

![Figure 1 Methods Used to Develop The Resettlement of The Agta Community](image-url)
The chosen resettlement site was then compared to the previous site to justify that the chosen site is suitable for the resettlement of the Agta Community. Agtas’ culture and lifestyle were also recognized in planning the development. With this, a design concept was developed that reflects the culture of the Agta Community. The development then transitions to the second phase where the development spaces shift into disaster-resilient spaces in case of disasters. Evacuation routes were mapped, and refuge landscapes or evacuation areas were determined. In the end, a landscape design will be proposed where it will secure the Agta Community from the risks of mass wasting disasters.

3. Findings

3.1 Geographic Information
The barangay where the Agta communities reside is the Barangay of Disimungal. Agta communities reside in different areas in Disimungal such as in Mount Kalbo, Masog Falls, Tili-tilan, Junuan Falls, and Sitio Pulang Lupa. Reflected in Figure 2 is the boundary of Disimungal where most land area is prone to moderate erosion due to the mountainous topography of Quirino.

Some areas experience slight to severe erosion, while there are also areas with no apparent erosion. These areas with no erosion are usually those along with the river bodies because of the slight slope going to the river. One main river body runs at the west side of the national road, and this is where most Agta communities fish for their livelihood. Generally, the Agta communities are only accessible through the national road.

3.2 Cultural Information
Documenting and analyzing the following cultural practices and beliefs of the community is significant to apply these to achieve cultural preservation in the resettlement.

1) The Agtas practice communal activities due to limited space inside their houses because they are accustomed to doing chores outside with their neighbours.
2) The public has the rights towards the whole land included in their ancestral domains.
3) Agtas plant crops for sustenance, raw materials, and medicinal purposes.
4) Their swidden farmland is their primary source of income, food, and medicine. Mostly Agtas plant beans, banana, ginger, cassava, ube, and sweet potato.

5) Agtas through history relocate from places to places where they have access to rivers. They fish as their alternative source of food and income if their crops are dull.

6) They practice animal farming. Currently, they own carabaos, wild boars, and chicken, which they also raise, sell, or eat.

7) They sell their products as one of their sources of income. They also make a living from handmade products. One particular culture they are skilful at is weaving crafts.

8) As part of their culture as hunters, seeing a broad vantage point from their homes assures them security since they can see their surroundings from their very own homes.

9) There is no definite pattern of housing layout. Agtas’ housing pattern is usually dictated by the slope in the site.

4. Analysis

4.1 Site Selection Analysis

The main drive behind this research is prompted by their safety concern in their homes because of mass wasting disasters. With this, it is necessary to select the most effective and safe site for the resettlement.[5] The selection shall analyze the following criteria:

1) Location - The location should have the necessities of the community for their everyday living. The land area should cater all needed infrastructures. It should allow a room for expansion to anticipate the growing population of the community.

2) Topography – The site that shall be selected shall not have brutal slopes that it will introduce mass wasting disasters.

3) Soil Characteristics and Condition - The soil should nurture vegetation. With this, the soil shall be stable and prevent possible mass wasting disasters.

4) Accessibility of Utility, Service Needs, and Transportation - The site should be accessible to modes of transportation, especially by emergency response vehicles.

5) Public Acceptance - The community should wholeheartedly accept and feel at home and secured at the site where they will be resettled.

The site selection was made among the different areas within the Agtas’ ancestral domain in Barangay Disimungal, where an Agta community exists. These are Masog Falls, Tili-tilan, Junuan Falls, and Sitio Pulang Lupa.

By conducting a series of site visits, analyses were conducted on the mentioned sites and, an evaluation shall determine the ideal resettlement site for the Agtas by rating each set criteria from 1 to 5 with a corresponding percentage equivalent. With this, the result of the evaluation of the sites is reflected on the table below.

| CRITERIA       | % | Masog Falls | Tili-tilan | Junuan Falls | Sitio Pulang Lupa |
|----------------|---|-------------|------------|--------------|-------------------|
| Location       | 25| 3           | 15         | 3            | 15                | 3                 | 15                | 5                  | 25                |
| Topography     | 20| 2           | 8          | 3            | 12                | 2                 | 8                 | 4                  | 16                |
| Soil           | 20| 4           | 16         | 2            | 8                 | 4                 | 16                | 4                  | 16                |
| Accessibility  | 15| 4           | 12         | 3            | 9                 | 2                 | 6                 | 5                  | 15                |
| Acceptance     | 20| 3           | 12         | 2            | 8                 | 3                 | 12                | 5                  | 20                |
| Total          | 100| 63          | 52         | 57           | 92                |
As seen on the table above, Sitio Pulang Lupa earned the highest rating as the Agtas’ resettlement area. Its location provides areas for their livelihood such as swidden farming and fishing. Moreover, the land area is possible for expansion. Sitio Pulang Lupa has a slope that ranges from 20 per cent to 40 per cent. It requires minimal earthmoving interventions for it to be buildable by infrastructures and houses. The area is not highly susceptible to landslide than the other sites with steep slopes ranging from 60 per cent. From the name itself, Sitio Pulang (red) Lupa, the site’s soil has a distinct characteristic making it red. It appears to be stable, buildable, and minimal soil erosion is experienced. Moreover, the area is accessible immediately through the national road. It has road paths inside the community beneficial for transport or emergency response vehicles. Most importantly, according to conducted interviews, Sitio Pulang Lupa is the chosen location for resettlement by the Agtas in Mount Kalbo. It is ideal because the location is resided by Agtas solely. They consider Sitio Pulang Lupa as the “core of the Agta community.”

4.2 Comparative Micro-Site Assessment
To analyze better the need for the Agta Community to resettle to Sitio Pulang Lupa from their previous area in Mount Kalbo, site inventory and analysis are provided to determine the difference between the two sites. These will provide information such as threats and weaknesses of the previous area that may be prevented and solved for the proposed resettlement area in Sitio Pulang Lupa.

As seen in Figure 3, most areas in Mount Kalbo is prone to soil erosion, and the direction of the erosion is towards their houses. Because the majority of the site in Mount Kalbo has 31 to 50 per cent slope, the area is highly susceptible to landslides. On the other hand, the proposed resettlement area, Sitio Pulang Lupa has few areas prone to severe soil erosion. Most areas have 0 to 30 percent slope, which makes it more ideal and less hazardous.

5. Synthesis
To combine the findings and analyses in one development, their weaving culture will be used to produce a design for the resettlement of the Agta Community. Habin, or weft in English, are lateral threads used in weaving inserted over-and-under the warp. It is responsible for keeping intact all the materials used in the process to produce a new product.

Like a Habin that ties together its materials to serve its purpose in weaving, the Agta Community also does most of their activities together as a community. Their culture of
working together, if channeled in this development, can enrich the people of Agta and strengthen them as a community.

![Image](image-url)

**Figure 5** Weaving used as the Design Concept

The general form for the whole development, as seen in Figure 5, reflects a representation of interlocking threads in weaving that follows the slope of the site. The pathways also reflect the form by having vertical and horizontal connections within site.

### 5.1 Site Development Plan

By consolidating the data gathered from the site analysis, interviews and focus group discussions with the Agta community, specific spaces that shall cater to the community’s needs were programmed in the site.

The spaces in Figure 6 reflect the resettlement plan of the Agta Community in Sitio Pulang Lupa. Housing is the primary concern of the Agtas. The Agta population in Mount Kalbo and Sitio Pulang Lupa combined comprises of 100 families. The usual house in the present Agta community in Mount Kalbo is smaller than a standard house and accommodates over three families in one roof. To address this inadequacy, the proposed housing provided 145 houses with 42 square meters to provide a 1:1 house to every family with enough space for outdoor activities as part of their culture. The resettlement also provides additional space for expansion, and these should have access to significant facilities in the community. Such spaces include a cultural area, where they can do their cultural activities and handmade activities such as weaving, and a wet and dry trade market. The development also fulfils the Agta community’s wish of a school that will encourage their children to continue their studies. Moreover, a livestock farm, and a health centre was proposed. To further enrich their culture, the community is also provided with communal facilities, such as outdoor communal laundry areas, gymnasium and open communal spaces. Lastly, to support their primary source of livelihood, their swidden farmland is preserved for the community. To address soil stability in the area, contour farming will be applied along with their houses to serve as their garden. Water for the whole community will be provided through a water tank that connects to every communal faucet for every five households. The water in the tank is driven from a spring at the top of the mountain where the site is located.
To address the slopes in Sitio Pulang Lupa, planting across the contour shall help mitigate soil erosion as seen in Figure 7. The contour planting shall follow a combination of strip-cropping and ditch and barrier system where strips of protective crops are alternated with row crops. Strips are placed with ditches in between that catches water. This heightens the effectivity of contour planting in decreasing water runoff speed.[6] Moreover, every home has access to the contour farm where they can plant edible plants or medicinal herbs. A list of suggested protective and row crops are listed in Table 2.
Table 2 Contour Planting Plant Examples

| Protective or Vegetative Crops | Scientific Name          | Common Name |
|--------------------------------|--------------------------|-------------|
| Brassica rapa subsp. chinensis | Pechay                   |             |
| Colocasia esculenta            | Gabi                     |             |
| Gliricidia sepium              | Madre de Cacao           |             |
| Ipomoea batatas                | Kamote                   |             |
| Leucaena leucocephala          | Ipil - ipil              |             |
| Saccharum officinarum          | Sugarcane                |             |
| Zingiber officinale            | Ginger                   |             |

| Row Crops                      | Scientific Name          | Common Name |
|--------------------------------|--------------------------|-------------|
| Chrysopogon zizanioides        | Vetiver Grass            |             |
| Fagopyrum esculentum           | Buckwheat                |             |
| Glycine max                    | Soybean                  |             |
| Lablab purpureus               | Abitsuelas               |             |
| Lactuca sativa                 | Lettuce                  |             |
| Pachyrhizus erosus             | Singkamas                |             |
| Phaseolus vulgaris             | Common Beans             |             |
| Psophocarpus tetragonolobus    | Winged Bean              |             |
| Vigna unguiculata              | Sitaw                    |             |
| Zea mays                       | Mais                     |             |

Plants reflected in Table 2 are also based on local plants and trees found in Sitio Pulang Lupa. Included also on the table are plants familiar to Agtas as plants for their food or medicine. Aside from these listed plants can serve as soil protection, Agtas can maximize the contour farm to practice their culture of planting.

5.2 Disaster Risk Reduction Management Plan – Transitioning and Simulation

To ensure the security of Agtas and promote their self-independence, a disaster management plan was also developed to prepare them from disasters in the future, especially mass wasting.

The spaces will transition into six stations for evacuation, as seen in Figure 8. The whole community will be divided into five clusters that will be provided with stations for the resident’s safety, namely handling, emergency, storage, hygienic, and receiving stations. Residents within their cluster will be heading to their designated assembly area where refuge landscapes are located as reflected in Figure 9 (legends A, B, C, D, and E) in case of evacuation.

Routes towards refuge landscapes are mapped as seen in Figure 9. In case the emergency intensifies, all residents should be gathered at the central camp, refuge landscape B, to ensure everyone’s safety. According to the Japan Institute for Fire Safety and Disaster Preparedness, the average speed of refugees during an evacuation is 1.1 meter per second.[7] This will measure the time to reach the refuge landscape from the farthest point of the connecting path walks. The routes are mapped in which no path will be overcrowded to lessen panic. Residents shall be educated by these evacuation protocols through training, seminars, and visual aids. It is assumed that with residents who are aware and equipped with the knowledge of their distance to the safe zone and how they shall respond to the emergency, they will be more alert and all individuals from different houses can reach the safe zone in time.
Figure 8 Transition Map of the Resettlement for Disaster Management

Figure 9 Simulation Map of the Resettlement for Disaster Management
### Table 3 Evacuation Routes Distance and Time

| Evacuation Route | Total Seconds | Length in Meters |
|------------------|---------------|------------------|
| Route A1         | 164 seconds   | 180 meters       |
| Route A2         | 160 seconds   | 175 meters       |
| Route A3         | 119 seconds   | 130 meters       |
| Route A4         | 110 seconds   | 120 meters       |
| Route A5         | 87 seconds    | 95 meters        |
| Route B1         | 228 seconds   | 250 meters       |
| Route B2         | 210 seconds   | 230 meters       |
| Route B3         | 210 seconds   | 230 meters       |
| Route B4         | 160 seconds   | 175 meters       |
| Route B5         | 173 seconds   | 190 meters       |
| Route B6         | 123 seconds   | 135 meters       |
| Route B7         | 110 seconds   | 120 meters       |
| Route B8         | 73 seconds    | 80 meters        |
| Route C1         | 196 seconds   | 215 meters       |
| Route C2         | 205 seconds   | 225 meters       |
| Route C3         | 150 seconds   | 165 meters       |
| Route C4         | 164 seconds   | 180 meters       |
| Route C5         | 119 seconds   | 130 meters       |
| Route C6         | 128 seconds   | 140 meters       |
| Route C7         | 91 seconds    | 100 meters       |
| Route C8         | 73 seconds    | 80 meters        |
| Route D1         | 128 seconds   | 140 meters       |
| Route D2         | 119 seconds   | 130 meters       |
| Route D3         | 78 seconds    | 85 meters        |
| Route D4         | 96 seconds    | 105 meters       |

As calculated in Table 3, the longest route distance to reach its designated refuge landscape is Route B1. Figure 9 shows that it is located at a high elevation of the site, and it measures 250 meters with 228 seconds to travel. Nevertheless, the most efficient way possible to reach the destination was determined through mapping a perpendicular route from the starting point to the refuge landscape. With this, an individual taking any route can reach the safe zone in an estimated time of no less than 5 minutes. Each safe zone or refuge landscape can hold more than the Agtas’ population in every cluster, which is necessary to provide every individual with space for their needs.

### Table 4 Carrying Capacity of Refuge Landscapes

| Evacuation Area | Area                | Carrying Capacity |
|-----------------|---------------------|-------------------|
| Refuge Landscape A | 5 100 square meters | 3 642 individuals |
| Refuge Landscape B (central camp) | 4 870 square meters | 3 478 individuals |
| Refuge Landscape C | 2 670 square meters | 1 907 individuals |
| Refuge Landscape D | 3 200 square meters | 2 285 individuals |
| Refuge Landscape E | 2 590 square meters | 1 850 individuals |

Table 4 shows the area and occupant capacity of each refuge landscape based on the Fire Code of the Philippines. A less concentrated capacity will be 1.4 square meters per person. It
shows that the area of the refuge landscapes will be enough to carry the whole population of 1,200 Agtas safely in case of disasters.

6. Conclusion
The Agta Community highly expects from their resettlement for the safety of their families and homes. By analyzing the soil and topography conditions in the sites selected, the research has arrived at Sitio Pulang Lupa as the optimal option. It can improve the living conditions of the whole community and create a well-prepared community from mass wasting disasters and a sustainable environment where they can grow their community.

The effect of a thorough and well-planned landscape development is evident in the results found in the methods used in this study. It is concluded that soil conditions contribute significantly in community development as a stable and nurtured ground creates a safe environment for the community. More importantly, landscape elements mostly take part in mitigating the effects of natural disasters such as mass wasting catastrophes. In addition to this, the impact of landscape architecture can channel the culture of the Agtas. The spaces proposed in the development is in line with their interests that they will be encouraged to stay permanently in this proposed resettlement and nurture their community.

Landscape architecture takes part in creating a safe and effective environment when disaster comes. By providing easily accessible and functional refuge landscapes, the Agtas are well-prepared and educated that their worry of safety and security they used to have from their previous settlement will no longer appear to mind.

With these landscape architectural interventions done, the Agtas will develop environmental and community sustainability that enriches future generations.

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