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Exercising Time Geography in gender and disaster. Discourse through Women Headed Household experience during drought

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Time Geography is a boundary-oriented approach to understanding human activity in space and time. In this study, this concept is implemented to identify the daily activities of Women Headed Household (WHH) and their survival strategies in drought disasters and to understand their root causes through analysing capability, coupling, and authority constraints. This research starts to fill the gap in knowledge of the Time Geography in "Gender and Disaster". The combination of Time Geography's daily diary technique with in-depth interviews is used to understand the constraining and enabling conditions in local contexts. The results show that the socio-economic characteristics of WHH in Gunung Butak Hamlet, Java, Indonesia, tended to be homogeneous and formed a pattern of daily activity with low variation. Likewise, their strategy in dealing with drought. The three geographical constraints faced by WHH in this hamlet are interrelated and do not stand alone.

Key Words: ***time geography, gender and disaster, Women Headed Household (WHH), drought, vulnerabilities, survival strategy, Java, Indonesia***

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Introduction

Time Geography (TG) is a boundary-oriented approach to understanding human activity in space and time. This concept was coined by Hägerstrand and is an active and growing research domain after its initial conceptualisation in the 1960s. TG interacts with social sciences, including gender studies, and provides the possibility to visualize constraints, the dominance of activities, and individual mobility range by creating images of everyday struggles between activities, decision-making, obstacles and intervention policies from an individual perspective at the local level geography. The analysis of space and time conditions proved helpful in discussions about the distribution and access to resources which are closely related to power relations, which are the core of gender studies (Scholten et al., 2012).

This research aims to start to fill the gap in knowledge about the concept of TG, which has never been implemented in the context of "Gender and Disaster". Through this research, the concept of Geography of Time was implemented to explore the experiences of Women-Headed Household (WHH) or Female Headed Household (FHH) as per UNESCO in daily life and dealing with drought disasters. Analysis of spatiotemporal conditions in TG helps understand the sources of women's vulnerability through exploration of their daily activities as well as identifying three types of constraints that limit human activity in the concept of TG according to Hägerstrand, namely: capability constraints, coupling constraints and authority constraints. Specifically, this study aims to 1) identify WHH's daily activities and in the context of survival strategy in drought disasters using the concept of TG; and 2) understand the root causes of WHH's vulnerabilities in their daily life and adaptation to drought through analysis of capability, coupling and authority constraints. Gunung Butak hamlet, located in Tepus District, Java, Indonesia, was chosen as the research location because it experiences drought every year. At this time, the people in this hamlet mainly rely on rainwater and pipe water from the Local Government Water Company during the dry season to meet their daily water needs.

TG recognises that humans have fundamental spatial and temporal limitations as a boundary-oriented approach to understanding human activities in space and time. Humans can only physically be in one place at a time, and these activities occur in one place for a limited time (Miller, 2017). Therefore, human activities are limited to a certain extent. Hägerstrand (1989 in Miller, 2017; 1985 in Šveda & Madajová, 2012; 1970 in McQuoid & Dijst, 2012) defines three types of constraints, namely: capability constraints, coupling constraints and authority constraints.

Isaksson & Ellegârd (2015); Schwanen et al., (2008); Ritsema van Eck et al., (2005); Pred, (1977); and Lenntorp (1999) explain that ability constraints limit individual activity participation by demanding that most of the time be allocated to physiological needs (sleep, eating, and self-care) and by limiting the distance a person can travel within a specific time span. Coupling constraints limit travel and activity participation by identifying where, when and for how long individuals

must join others in space and time for production, consumption or transactions. Finally, authority constraints refer to the institutional and societal context, including laws, regulations, and norms, which imply that particular areas can only be accessed at certain times for distinctive people to carry out specific activities. This also means that the use of space is exclusive and has a limited capacity for use. These three constraints should be seen as interrelated rather than independent and complementary in practice.

In gender studies, TG provides a close, empathic, and micro-level intervention approach that makes the barriers and constraints resulting from space-time conditions visible and thus changeable (Scholten et al., 2012). TG also provides the possibility to visualize constraints, the predominance of activity and individual reach by creating pictures of everyday struggles between activities, decision making, barriers and intervention policies from individual perspectives and at local level geography, which is helpful in "Gender and Disaster" studies.

However, the concept of TG has never been specifically implemented in the context of "Gender and Disaster". TG in gender studies is generally used to analyse activities, division of space, and mobility of workers by highlighting the role of influencing gender relations. For example, Scholten et al. (2012) analysed the mobility of women workers in Sweden, while Stuyck et al. (2008) analysed the pattern of gender roles in two different industrial areas in Belgium. Kwan (2000) used the TG approach to study gender differences in space and time limitations and their impact on travel activity patterns for women and men in Columbus, Ohio (USA). Jensen (2014) focused on the analysis of space-time to examine the daily lives of underage female domestic workers in Dhaka, Bangladesh, while Estrada (2002) discussed the spatial-time arrangement of households carried out by female domestic workers in Tijuana, Mexico, to accommodate productive work within the home, and emphasised its consequences for gender roles and gender spatial relations.

Methodology

In this study, the identification of vulnerabilities and constraints of WHH in carrying out daily activities and dealing with drought is carried out using a TG diary. TG diaries can reveal capability, coupling and authority constraints that affect the lives of WHH. The unique phenomenon of an individual life is examined with four basic questions: what activities were carried out; when they were carried out, where the activities were carried out, and with whom the activities were carried out, but other questions can also be added (Ellegard, 1999; Kwan, 2000; Thulin & Vilhelmson, 2012; Jensen, 2014; King & Puppa, 2020).

This research was conducted in 2021. Based on information from the head of the Gunung Butak hamlet, there are 13 WHH, all of whom were participants of this research. The data collection method used a semi-open diary, which means the activity categories were defined before. This method was chosen because of the characteristics of the participants, who are all elderly with low literacy skills

and had difficulty constructing their memories sequentially, so it is not possible to fill in the diary independently.

Creating activity categories helped WHH in recalling their memories and setting priorities. For analysis purposes, predefined activity categories will produce a diary with the same level of detail for each activity. The activities that take the most time are considered the most important. In fact, the activity with the least amount of time can be the most important activity from an individual perspective. In this case, a time analysis perspective is formed.

Modification of the use of diaries due to the special characteristics of participants was previously carried out by Bartlett (2012) in his study of the lives of people with dementia. The limited ability of people with dementia to recall things prompted Bartlett to help document the participants' activities and feelings through interviews, photos, and voice recordings. Through the semi-open diary method, the researcher interacted directly with the participants to help them construct a picture of their daily activities. WHH's daily activities in Gunung Butak were identified by the HETUS (Harmonised European Time Use Surveys) Categorisation Scheme, which refers to the development of HETUS Categorization by Ellegârd (2018) from HETUS Guidelines published by the European Union and combined with three main activities categories.

However, many researchers argue that the use of diaries should not be the only major source of data. There are limitations in the use of diaries, such as recall or memory problems or information being varied and misleading. That is why the use of diaries should be complemented by other methods such as in-depth interviews and participant observation (Kaun, 2010; Alaszewski, 2011a; Alaszewski, 2011b). In-depth interviews were also conducted to collect more complete data on a defined set of topics such as socioeconomic characteristics of the family, description of the daily activities of WHH in terms of reproductive, productive, and social functions, as well as adaptive strategies for overcoming the drought problem. During the in-depth interview process, the seasonal calendar instrument was also used to reveal the cycle of cropping and harvests and the use of water influenced by the seasons. The seasonal calendar can also provide an overview of the income and expenses of WHH to obtain water in each season. Combining the diary method with in-depth interviews is the most appropriate research method to understand the constraining conditions and conditions that may occur in local and regional contexts (Fortuijn, 1999).

Mapping was carried out to determine the location of the distribution of objects that play an essential role in the daily activities of women heads of families, namely houses, fields, and lakes in Gunung Butak. Mapping was done using ArcMap 10.3 software. Spatial data, including the location of houses, fields, and lake were obtained by taking coordinate data using a mobile topographer application. Meanwhile, the travel route data were obtained by digitizing the road route according to the information obtained from participants. The geographical distribution of these objects was used as a basis for understanding the time budget for various daily activities, including travel time. The data related to the daily activities of the female heads of the household obtained were then constructed

into a graph of individual paths that are activity-oriented and display all activities sequentially.

Results and discussions

Condition of the research location and characteristics of the WHH

Gunung Butak is part of the Tepus sub-district, which experiences drought every year. Geographically, this hamlet is at an altitude of 261-296 meters above sea level. The long dry season and the structure of the karst hills that make it difficult to store water are the leading causes of drought in this hamlet (The Regional Disaster Management Agency of Gunungkidul Regency, 2019). There is one surface lake close by, Waliklar Lake, but it has experienced excessive sedimentation and eutrophication, so it has lost its function as a water source. Previously, when drought occurred, people had to buy water from tanks to meet their needs (Suryanti et al., 2010). Now, the people in this hamlet can rely on pipe water from the Local Government Water Company in addition to rainwater during the dry season to meet their daily water needs.There are 13 WHH in the Gunung Butak hamlet. All WHH in this hamlet are elderly, with no schooling (>60 years old) and graduated from elementary school (50-60 years old). There is only one WHH aged >60 years old who graduated from a Vocational High School. Almost all WHH in this hamlet depend on farming for their livelihood; only one is trading. One WHH no longer works as a farmer because she is old and sick, but she has a son living with her who continues to cultivate the fields. Half of the WHH live alone and have no dependents. Generally, they have been WHH for a long time because their husband died.

Table 1. Characteristics of Women Headed Household in Gunung Butak hamlet

Participant no.	Age	Education	Profession	Status of living with family
1	55	Unschooled	Farmer	Alone
2	76	Unschooled	Farmer	Alone, children live nearby
3	61	Elementary	Groceries seller	Alone
4	50	Elementary	Farmer	Alone, aunt lives nearby
5	68	Unschooled	Farmer	Alone
6	80	Unschooled	Farmer	With granddaughter in law and great-grandchild
7	50	Elementary	Farmer	With child and grandchild
8	70	Unschooled	Farmer	Alone
9	62	High School	Farmer, Producing cassava crackers	With children and mother
10	66	Unschooled	Farmer	Alone
11	65	Unschooled	Housewife	With child and grandchild
12	52	Elementary	Farmer	With child
13	62	Unschooled	Farmer	With a daughter in law and grandchild

Source: Primary data, 2021

Identifying WHH's daily activities and in the context of survival strategy in drought disaster using the concept of 'TG'

WHH's daily activities in Gunung Butak hamlet using The HETUS Categorization Scheme were combined with 3 main activity categories (Table 2). Furthermore, the time allocation for WHH in carrying out each activity was identified. Figure 1 shows that reproductive activities dominate WHH's daily activities: care for oneself, care for others, and household care.

In detail, the most dominant reproductive activities are caring for oneself, which includes eating, sleeping, and showering. This is understandable, considering that WHH sleep for 8-9 hours a day, and several of them claim that they still add an hour nap after working in the fields in the morning before leaving for the fields again in the afternoon.

Table 2. Activity categorization for WHH

Triple burden	Activity category	WHH's activity
Reproductive	Care for oneself	Eating, sleeping, showering
	Care for oneself	Taking care of family members
	Household care	House cleaning, washing clothes, cooking, shopping
Productive	Work	Farming, taking care of livestock, labouring in other people's fields, producing cassava-based products, trading
Public	Socializing	Meetings, social gatherings, community service
Other	Activity category	WHH's activity
Leisure	Reflection/recreation	Praying, watching TV
Travel	Transportation	Travelling from house to farm and back

Source: modification based on highest level activity categories in the TG activity categorization scheme by Ellegard (1999) and the HETUS Categorization Scheme

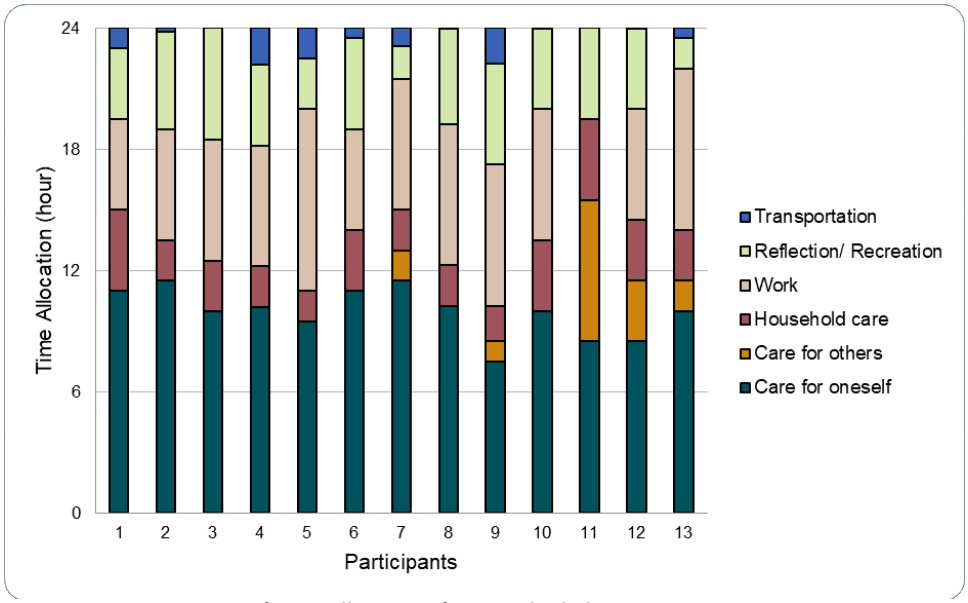

Figure 1. Construction of time allocation for WHH's daily activities

Pred (1977) and Lenntorp (1999) refer to this as an ability constraint that limits individual activity participation by demanding that most of the time be allocated to physiological needs (sleep, eating, and self-care) and by limiting the distance a person can travel within a certain time span. Meanwhile, Kwan (1999) calls it a time budget constraint, namely the limited time available to individuals after deducting important self-care activities (e.g. sleep) in a day. According to Kwan, a person has at least 15 hours per day after deducting self-care activities. In other words, those 15 hours become a limit for someone to do other activities. Meanwhile, the time allocation for household care is only around 1.5-4 hours/day and not all WHH have to allocate their time to care for others because they live alone. The second dominant use of time is work, namely working in the fields and one of the WHH selling in her stall. One of the WHH no longer works in the fields, so her productive time is replaced with reproductive time, namely care for others, her grandchildren.

Figure 2 shows that the WHH's paths in the hamlet are very narrow: from house to field or vice versa. In fact, there are other routine activities carried out by WHH, but not every day, namely selling crops or products to the market (precisely every Pon-name of a day in the Javanese calendar) and various community meetings/activities. These non-daily based activities are not discussed in either Figure 1 or Figure 2.

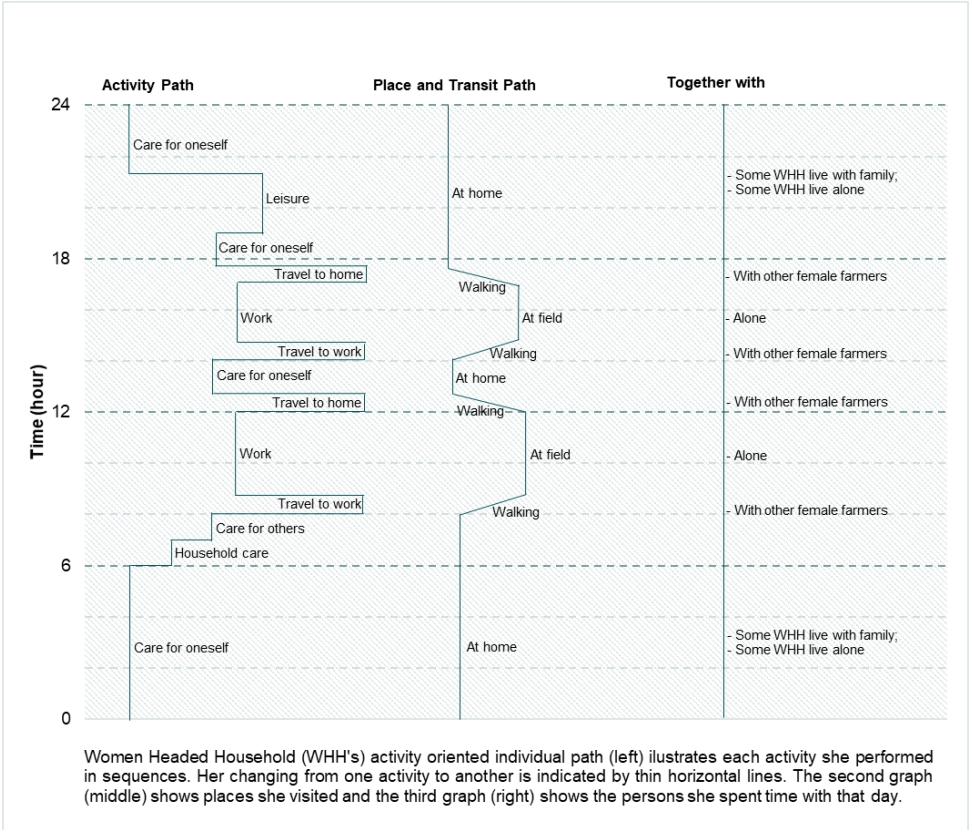

Figure 2. Average of WHH's individual paths

TG shows differences in the pattern of WHH's daily activities, although they are micro and appear to be less significant. Ellegard (1999) mentions that using a TG approach with a diary will show various variations. The more different the individual characteristics studied, the higher the variation in activity patterns produced. WHH in this hamlet tend to have the same characteristics (Table 1), namely the same culture, the same landscape of residence, occupations that are mostly in the agricultural sector, then the same level of economy and education: a middle to low level. Therefore, the pattern of WHH's daily activities tends to be the same (Figure 1).

Reproductive activities, namely cleaning the house, cooking, washing, and taking care of children, have a fixed nature, which tends to have a constant pattern and are carried out regularly every day. On the other hand, productive activities (out-home activities) are more dynamic in terms of time and place. Therefore, they are more likely to experience changes that allow a woman to have a wider movement of time and space (Kwan, 1999; Ranade, 2007; Ettema et al., 2007; Jensen, 2014). However, it is necessary to consider several things such as information and technology interventions, the difference in activity fixity level, and the involvement of other people to identify the space and time constraints based on the fixity nature of activities (Staeheli & Martin, 2000; Schwanen et al., 2008; Mehta & Sai, 2021).

WHH can be divided into two groups based on the travel time required for a round trip between their homes and fields. The first WHH group is WHH whose farm location is in the yard of the house, so it has a very short round trip time of about 2-3 minutes. The second WHH group is those whose farm is far from home. The round trip time from home to fields with a frequency of 2-3 times per day takes about 30-54 minutes (Figure 3).

In addition to the productive and reproductive activities, WHH also spend their time on leisure activities. Most WHH have 3-5 hours of leisure time allocated per day. The forms of leisure time for WHH in this village are praying (5 times per day) and watching TV (Table 2). However, there are two WHH (participants 5 and 13) with only have 1-2 hours of leisure time per day because they have to work longer in their fields, which is 8-9 hours per day.

Furthermore, related to the survival strategy carried out by WHH in this hamlet in dealing with the drought, the location of their residence in the karst area, threatened by drought every year, certainly presents challenges for WHH in meeting water needs. Drought and desertification have a significant impact on women. During periods of scarcity, women are burdened with spending more time managing food, water, fodder, and fuel, in addition to their usual household chores (Sahu, 2018). The work of fetching water in various parts of the world is largely the responsibility of women, especially those who lack piped water in their homes. This results in several hours spent on unpaid work. In Mozambique, prior to the drought, women often spend up to 2 hours per day collecting water for household consumption. The work of collecting water increases the burden on women, although men and boys also contribute (Das & Hatzfeldt, 2017). The

extended nature of the drought has meant women have had to spend more than 6 hours searching for and transporting water to their homes. As a result, younger girls and adolescents are being pulled from school to assist their parents or other family members with searching for and transporting water (Fischer, 2016).

However, women's unpaid work, such as collecting water, has decreased due to increased coverage of infrastructure such as water and sanitation (Das & Hatzfeldt, 2017). The same thing happened in Gunung Butak. About 40 years ago, this hamlet was very dependent on rainwater and the lake, so the residents had to take water from the lake to meet their water needs in the dry season. Then, the construction of road access made it easier for vehicles to enter this village so that the residents' water needs could be helped by supplying water from other areas using tanks. Starting in 2013, the Local Government Water Company has been actively operating in this hamlet. Since then, similar to other household heads, WHH do not need to spend time walking to the lake to collect water, and their daily water needs are met with rainwater which is collected in storage tanks and supplemented with pipe water in the dry season. The distance between settlements and Waliklar Lake is about 1 km or 1.5 hours' round trip (Figure 3).

In previous years, the inhabitants of this village had to go to the lake 2-3 times a day, so about 3-4.5 hours of their time were spent collecting water. However, currently, there are 3 WHH who really depend on the rainwater stored in the tanks to meet their daily water needs because they live alone, so the need for water is not much.

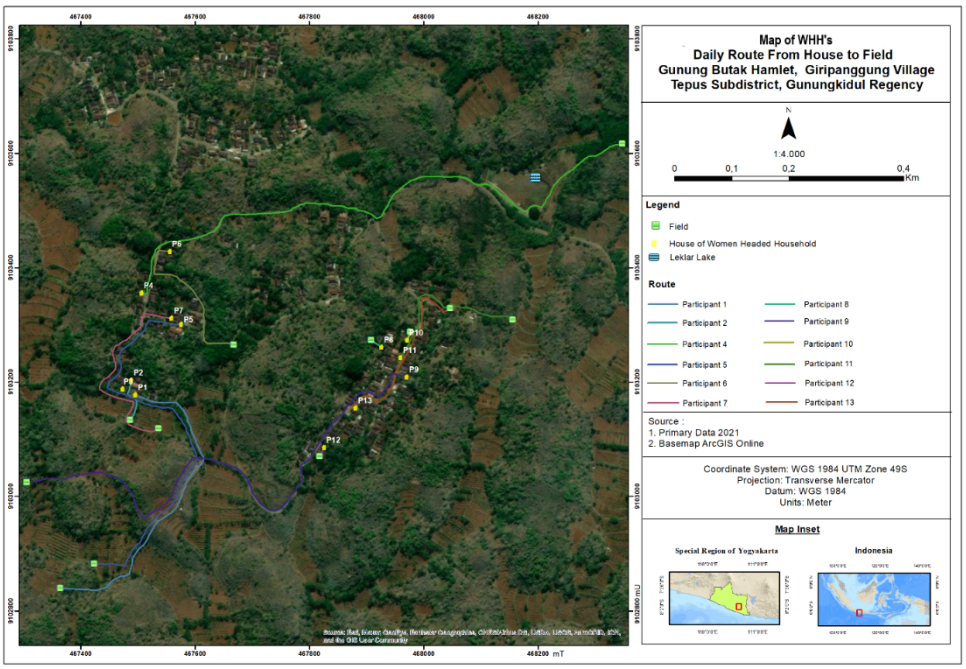

Figure 3. WHH's daily route from house to the fields

Currently, during the dry season, when the water supply in storage tanks is running low, WHH only need to get water from a neighbour who has a house connection pipe. This water-supplying activity does not consume their time because it can be done while WHH perform other activities. Therefore, WHH currently have two strategies to deal with drought. First, during the rainy season, WHH will fill the storage tanks. Second, during the dry season or when they almost run out of rainwater in the storage tanks, they will supply water from neighbouring houses that have a connection (HC) from the Local Government Water Company before the tank is empty because sometimes it takes 2 weeks to fill the tank. Meanwhile, 3 WHH's strategy that only relies on rainwater is to conserve water use.

Understanding the root causes of WHH's vulnerabilities in daily life and adaptation to drought through analysis of capability constraints, coupling constraints and authority constraints

The root causes of WHH's vulnerabilities in their daily life and adaptation to drought in this study were identified using the analysis of constraints in the TG concept, namely capability constraints, coupling constraints and authority constraints.

Like most people in Gunung Butak, almost all WHH in this hamlet work mainly as farmers and farm labourers. Working as farmers or farm labourers as the only source of livelihood is very risky. First, the lack of water resources precludes the possibility of irrigating rice fields. The only possible type of agriculture is rain-fed agriculture, which depends on rainwater. Second, agricultural land generally has a narrow and terraced area following the topography of Dusun Gunung Butak (Photo 1). The main agricultural commodities are limited to drought-resistance crops such as cassava, peanut, corn, and Gogo rice. Third, WHH have to walk through high topography, steep terrain with sharp stones and clay, and limited road infrastructure to work in the fields. Table 3 shows that three WHH spend between 1 - 2 hours a day walking to and from the fields. When it rains, access to the fields becomes more difficult because the clay becomes slippery, and there is a high risk of accidents.

Photo 1. WHH on their way to the field (left); Gunung Butak's agricultural fields with terraces (right)

Table 3. Estimated travel time between house and farm

Partici-pant no.	House-Farm Distance (km)	Round Trip Time (hour)	Round Trip time (min.)	Freq/ day	Travel Time (hour)	Productive Time (hour)	Travel + Productive Time (hour)	Repro-ductive Time (hour)	Leisure Time (hour)
1	0.59	0.50	30	2	0.99	4.5	5.49	15.0	3.50
2	0.10	0.08	5	2	0.17	5.5	5.67	13.5	4.83
3	0.00	0.00	0	0	0.00	6.0	6.00	12.5	5.50
4	1.07	0.90	54	2	1.80	6.0	7.80	12.2	4.00
5	0.86	0.72	43	2	1.44	9.0	10.44	11.0	2.50
6	0.28	0.24	14	2	0.47	5.0	5.47	14.0	4.50
7	0.35	0.29	18	3	0.88	6.5	7.38	15.0	1.60
8	0.02	0.02	1	2	0.03	7.0	7.03	12.25	4.72
9	1.04	0.87	52	2	1.75	7.0	8.75	10.25	5.00
10	0.01	0.01	1	3	0.03	6.5	6.53	13.5	3.97
11	0.33	0.28	17	0	0.00	0.0	0.00	19.5	4.50
12	0.02	0.02	1	2	0.03	5.5	5.53	14.5	3.97
13	0.28	0.24	14	2	0.47	8.0	8.47	14.0	1.53

Source: Calculation based on primary data, 2021

Even so, the elderly WHH who are physically weaker still have to go to the fields because no one can replace them for these productive activities. In addition to the difficult terrain, WHH also have to carry heavy loads such as farming equipment and crops, that are tied and carried on their backs. The demand for meeting their daily needs discourages WHH from being absent from their work in the fields. This phenomenon illustrates one of the constraints of WHH, namely their limited physical ability as elderly women who work as farmers on challenging land.

Another source of WHH's vulnerability is their *solitude* which is a form of de-coupling constraint. WHH who still have to support their families may be economically vulnerable. However, WHH who live alone are also very vulnerable psychologically. Elder people living alone are one of the most vulnerable groups in society (Mui, 1998; Xu et al., 2015; Singh & Misra, 2009). Compared to elderly people who live with a family member or spouse, elderly people who live alone usually have poorer health, lower self-esteem and life satisfaction, are more prone to depression, and are most likely to receive less support from their family and environment (Kim & Lee, 2015; Srivastava et al., 2021). Several WHH who live alone said that they often could not sleep at night because they are lonely and miss their husbands, children, or grandchildren. Loneliness and social immobilization are one form of response to pain and anxiety due to traumatic events that occur in a person's life, such as the death of a loved one (Rokach, 2001; Rokach et al., 2004). Loneliness also forces them to do everything on their own without the help of family members, including cultivating their fields. WHH who do not have enough money to pay farm labourers prefer to do everything themselves, so the productivity is not optimal. There is even one WHH who no longer grows rice because her younger brother, who used to help her, has died.

In public life, WHH participate in various community activities. Their position as the head of the family obliged them to participate in various community activities. The social activities of the community in Gunung Butak are quite

diverse. The activities that WHH participated in included community service/mutual assistance, PKK (Pemberdayaan Kesejahteraan Keluarga - Family Welfare and Empowerment), social gathering, savings and loan activities, and KWT (Kelompok Wanita Tani - Women Farmers Group). These community activities are routinely carried out. Participating in community social activities brings benefits to a WHH's life. WHH can socialize with the community through cooperation activities that can reduce their feeling of loneliness, especially for those who live alone. Here, community social activities are social capital forms that help WHH meet their needs. For example, through savings and loans activities, several WHH borrow money to meet their daily needs, help sick neighbours, or contribute to wedding celebrations. Through KWT, WHH can get seed loans in the planting period.

On the other hand, WHH's obligation to participate in community activities presents its own challenges. Women are considered to have higher constraints to carry out activities outside the home than men (Kwan, 1999). WHH's role in community service activities depends on the policy of each neighbourhood association. In one neighbourhood association, WHH's role in community service or activities is equated with the role of a male-headed household, such as helping to transport materials used for paving roads. However, in other neighbourhood associations, WHH are given lighter jobs than male-headed households, for example, sweeping roads and pulling grass. Local-level policies that are not supportive of women can be a source of vulnerability for WHH, which is a clear example of authority constraints sourced from capability constraints. Furthermore, several hamlet activities are conducted at night; WHH can not go out at night because of the lack of lighting and road infrastructure. This is also a coupling and also authority constraint for WHH to participate.

In conclusion, policies regarding programs/assistance/activities based on family heads in this hamlet can be a source of vulnerability that comes from authority constraints for WHH. On one side, in terms of obligations, WHH are required to participate in the same activities as male-headed households, even though WHH have different limitations from the male-headed households. However, there has been no special assistance or attention for WHH whose conditions are more vulnerable than male-headed households.

From an economic perspective, WHH in Gunung Butak have a low economic level. It shows a capability constraint in everyday life which amplifies during droughts. WHH's livelihood sources that depend on rain-fed agricultural activities are very vulnerable to climate change and will be hampered if the change in the rainy season and the dry season does not match their calculations. If the rainy season arrives late, WHH must postpone their planting activities. However, if the rainy season is short, it is likely that crops will fail due to a lack of water to irrigate the fields. If the WHH's main source of livelihood is disrupted, food security and other aspects of life will be disrupted. WHH's economic condition can also be seen from the physical condition of their houses, which are generally classified as semi-permanent; characterised by soil floored houses, plywood house walls, wooden house structures, and without ceilings. In addition, there are some

WHH who do not have permanent toilets yet. Furthermore, most of the WHH also have rainwater storage tanks that are not up to standard, so they are unable to maintain the quality of the water stored in them. They generally have open-type rainwater storage tanks where rainwater enters without a filtering process so that the stored water is very likely to be contaminated (Photo 2).

To increase their income, during the rainy season, some WHH take additional jobs as labourers in other people's fields. However, the need for labour is not always met and becomes one of the coupling constraints for WHH farmers. This is due to the simultaneous planting and harvesting seasons in this village, so fighting over farm labourers to work the fields might happen. WHH who work as farm labourers must adjust their schedule to the owner of the field they are working on. In this case, we can see that there is also an authority constraint where the owner of the field has the power to determine who will work, the field to be worked on, when and with whom the work will be carried out.

While WHH who work as labourers can sometimes work on several fields in a day, WHH who own large fields sometimes have to work on their fields with minimal assistance due to the lack of workers. During the dry season, the intensity of work in the fields generally decreases, so some WHH fill their activities by processing agricultural products such as making lempeng and geplek (cassava-based products) which are then sold outside the village.

The interaction between WHH and farm labourers also shows that an individual's space for activities is limited by the activities of other individuals and the access they have. Access depends on the place of residence, which determines the distance to the workplace, the role or occupation of the individual, as well as their resources, such as financial resources; the ability of WHH to pay farm labourers; or vice versa, namely human resources for WHH who use their strength and knowledge to work in a farm. Since the individual agendas of all parties need to be considered, confirming the feasibility of joint activities in space and time is a complex process (Neutens et al., 2007). However, despite its complexity, joint activity planning is essential to get a good insight into how, where, and with whom an activity will be successfully carried out and to avoid losses that may occur due to a couple of constraints.

Photo 2. WHH house (left); Rainwater storage tanks condition (right)

In general, WHH's dependents can be the sources of their vulnerability. In this hamlet, seven WHH live alone, while the other six WHH live with their families, including their children, grandchildren, and children's in-laws. If women who live alone face more de-coupling constraints, women who live with their families face more capacity constraints because their expenses are higher. WHH who live alone must carry out all activities themselves. They do not have free labour to help maintain the fields, repair damaged houses, and earn extra income. In addition, they must take care of themselves when they are sick and do not receive affection and love from their family members.

Finally, the location of Gunung Butak, which is isolated and has rugged terrain, results in poor access to main roads and public transportation (Photo 1). Therefore, the community's living environment tends to focus only on houses, fields, and (in the past) lakes, so their individual paths are relatively narrow.

The root causes of WHH vulnerability to drought are pretty much related to the location of their residence in the karst area. A drought that threatens every year presents its own challenges for WHH in meeting their water needs. In addition, there are several factors that increase their vulnerability to drought disasters. First, all WHH in this hamlet do not have water house connections. Currently, there are 12 House Connections (HCs) from the Local Government Water Company in this Hamlet, but none of WHH has her own house connection. In addition to the house's location, homeowners also have to pay a HC installation fee of around 500,000 rupiahs (about 35 USD). That amount of money is a lot for the WHH in this hamlet, which are classified as poor. This shows the capability constraint of the WHH in meeting water needs or in dealing with drought disasters. Houses that do not have HC have to supply water from houses that have HC at the cost of around 10,000 – 12,000 rupiahs/cubic meters. This cost does not include the cost of renting a water hose. The cost of renting a roll of water hose is around 5,000 rupiahs, which will cost more if the WHH's houses are far from the neighbouring houses that have HC. The furthest distance between the house of the WHH and the HC is 23 meters; meanwhile, the closest distance is 5 meters (Table 4).

The second capability constraint relates to damage in the storage tank or the gutter to the tank because WHH cannot repair those damages alone. The third source of WHH's vulnerability to drought is related to time. The time for supplying water from neighbouring houses that have HC sometimes takes longer than usual. Sometimes the water does not flow for about 2 weeks, not to mention the need to queue up with other neighbours who also supply water from the same HC. It shows a coupling constraint.

Conclusion

The TG concept helps us understand the very dynamic concepts of time and space. One of them is that time is highly structured by human activities which are strongly influenced by the characteristics of the space in which humans live.

Table 4. Estimated distance between WHH houses and the nearest house connection (HC)

Participant no.	HC code	House-HC Distance (Km)
1	HC 1	0.18
2	Not using HC	-
3	HC 1	0.16
	HC 2	0.18
4	HC 2	0.01
5	Not using HC	-
6	HC 3	0.01
	HC 4	0.005
7	HC 1	0.03
8	HC 5	0.07
9	HC 6	0.04
10	Not using HC	-
11	HC 5	0.04
12	HC 7	0.01
13	HC 8	0.02

Source: Calculation based on primary data, 2021

While the daily activities of the elderly in Gelderland, the Netherlands, are structured by mealtimes (Fortuijn, 1999), WHH activities in Gunung Butak are structured by activities around houses and fields. WHH's daily activity patterns in Gunung Butak tend to be the same, considering their similar characteristics. The same applies to their strategy in dealing with drought. In the context of gender and disaster, the WHH's experiences in daily life and when dealing with drought, it is clearly seen that the three constraints of TG are interrelated and do not stand alone.

Understanding how and why gender relations function, the pattern of time budgeting to carry out daily activities together with the constraints they face, as well as evolving spatial pathways, where women's spatial pathways are more complicated than men's, are the first step in addressing and resolving the issue of gender inequality (Stuyck et al., 2008). Through gender studies, it is shown that time-geography is not limited to studying trajectories or movements and that emotions are lost in this concept; however, TG deals with spaces dominated by the patriarchy or masculine spaces (Scholthen et al., 2012).

WHH who become farm labourers may work in more than one field daily. The more jobs are taken, the higher the income for the day. However, the individual has ability constraints because physically, she cannot be in two fields at once, and she cannot work in many fields simultaneously. Therefore, the most likely thing to do is to finish the one activity as quickly as possible, then move on to another. According to Ellegard (1999), this phenomenon builds a daily time perspective, which states that activities are prioritized over time, namely when a person is ready to continue doing activities if the previous activity has been completed. Through the TG approach, it can be seen that the choice of activities and their sequence set by an individual on one day will limit the range of other activities that may be carried out for the rest of the same day.

Lastly, based on WHH's experience in rural areas, the concept of TG can be developed to accommodate the concept of time according to the local wisdom of each region. Each country/region has a unique calendar, which does not follow the Gregorian calendar, and is the main calendar in some rural or remote areas. For example, local markets in some rural areas on Java Island only operate on certain days following the Javanese calendar called Pasaran days (there are five Pasaran days: Pon, Wage, Kliwon, Legi, and Pahing). Likewise, various community activities still follow the Javanese calendar: social gatherings every Pon, community service every Wage, and so on.

This paper adds to the discourse that the concept of TG is very likely to be developed in various fields, including in the context of gender and disasters. The concept of TG is beneficial in exploring daily human activities and adapting to the environment they live in, which sees a disaster risk that adds to the constraints in their livelihood. This paper also shows that the sequential reconstruction of daily activities also helps to develop the concept of time, where time in carrying out daily activities is structured by various *important* factors in human life, and also by the environment in which they live.

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