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Management of land use in heritage tourism: Case study Mount Fuji (Japan) and Mount Merapi (Indonesia)

Gestión del uso del suelo en el turismo patrimonial: estudio de caso Monte Fuji (Japón) y Monte Merapi (Indonesia)

Seno Budhi Ajar*

Universitas Sebelas Maret, Indonesia
Yamaguchi University, Japan

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Abstract

The conservation of heritage landscapes seeks to maintain the authenticity of objects or landscapes, while tourism modifies the land in the opposite direction. Policy reform is required to integrate conservation and tourism principles. This study aimed to identify the impact of land-use changes in heritage tourism sites on land-use change patterns. This research was conducted by comparing countries with high population growth rates, represented by Indonesia, and countries with low population growth rates, represented by Japan. Spatial and comparative methods are used in this study. This study concludes that land use management in Merapi and Fuji has so far been directed towards conserving lands with a zoning system. However, the Indonesian government manages Merapi with a separate land-use system, where each zone is managed by a different institution. Meanwhile, the Japanese government manages the land use of Mount Fuji with an integrated national park system, where land use is managed by one institution consisting of the government and the community. This study also found that tourism development policies are more

*Corresponding author.
E-mail address: senobudhiajar@staff.uns.ac.id (S. B. Ajar).
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influential than environmental protection policies in heritage tourism. However, criticism from effective and powerful stakeholders such as UNESCO can compel governments to reform their management policies. Finally, this study clarifies that population growth is not the main factor for land degradation, especially forest loss, but tourism policies accelerate the rate of forest loss.

JEL Code: Q15, Q24, Q56
Keywords: heritage; tourism; policy; land use management; government; UNESCO

Resumen

La conservación de los paisajes patrimoniales busca mantener la autenticidad de los objetos o paisajes, mientras que el turismo modifica el territorio en sentido contrario. Se requiere una reforma de políticas para integrar los principios de conservación y turismo. Este estudio tuvo como objetivo identificar el impacto de los cambios en el uso de la tierra en sitios de turismo patrimonial sobre los patrones de cambio de uso de la tierra. Esta investigación se realizó comparando países con altas tasas de crecimiento poblacional, representados por Indonesia, y países con bajas tasas de crecimiento poblacional, representados por Japón. En este estudio se utilizan métodos espaciales y comparativos. Este estudio concluye que la gestión del uso de la tierra en Merapi y Fuji hasta ahora se ha dirigido hacia la conservación de tierras con un sistema de zonificación. Sin embargo, el gobierno de Indonesia administra Merapi con un sistema de uso de la tierra separado, donde cada zona es administrada por una institución diferente. Mientras tanto, el gobierno japonés gestiona el uso de la tierra del Monte Fuji con un sistema integrado de parques nacionales, donde el uso de la tierra es gestionado por una institución formada por el gobierno y la comunidad. Este estudio también encontró que las políticas de desarrollo turístico tienen más influencia que las políticas de protección ambiental en el turismo patrimonial. Sin embargo, las críticas de partes interesadas eficaces y poderosas como la UNESCO pueden obligar a los gobiernos a reformar sus políticas de gestión. Finalmente, este estudio aclara que el crecimiento demográfico no es el factor principal de la degradación de la tierra, especialmente la pérdida de bosques, pero las políticas turísticas aceleran el ritmo de pérdida de bosques.

Código JEL: Q15, Q24, Q56
Palabras clave: patrimonio; turismo; política; gestión del uso de la tierra; gobierno; UNESCO

Introduction

Land use change is considered an illustration of the relationship between ecosystem functions and economic value (Pătru-Stupariu et al., 2020). Economic value is the main point of land use change, especially during the Anthropocene. As one of the last habitats of the wilderness, mountains are also affected by human activity. Many mountainous areas experience environmental degradation in the form of the loss of primary forests due to land use by humans (Mugagga et al., 2012; Said et al., 2021). The use of forestland for human use is closely related to increasing population growth (Ochoa-Gaona & González-Espinosa, 2000). However, limited land and resources make people expand mountain forest areas for

agriculture (Yusri et al., 2012), mining (Rodríguez-Eraso et al., 2013), and even settlements (Andini, 2018). According to Black (1990) and Blaikie & Brookfield (2015), the perspective of regional political ecology states that population is one of the variables that can affect resource degradation. One of them is the transformation of forests into human land, so land capacity systems are needed to maintain population pressure. One way to reduce land degradation and conversion is to protect the land. Protected areas in the form of national parks and world natural heritage sites are often used to protect sites from land conversion or degradation (La Mela Veca et al., 2016). This status has been successful in countries that do not have high population growth, such as Canada and Italy. The country's world natural heritage status protects the Canadian Rocky Mountains and Mount Etna from the conversion of wild to human land (Rhemtulla et al., 2002).

Countries experiencing high population growth have also succeeded in implementing the World Natural Heritage status and national parks to minimize the rate of forest loss, such as Mount Kinabalu in Malaysia (Miuse & Kamlun, 2019; Rhemtulla et al., 2002). Contrary to the perspective of regional political ecology, population growth is an intermediate factor in land degradation, and the ultimate factor may be the damage or mismanagement of land policies. Nigeria is one of the countries that can develop forestland in protected forests despite population growth pressures. In this country, armed and mining conflicts force people to build settlements and agriculture, and exploit forests on Mount Nimba Liberia as part of the world's natural heritage (Enaruvbe et al., 2019; Granier & Martinez, 2011). Tourism is a significant way to contribute and provide a positive externality to the country's economy because it helps develop foreign exchange, new infrastructure, human capital, and jobs in GDP (Rasool et al., 2021). Tourism contributes to the industry in terms of labor, capital, and land. Land is a natural resource, such as beaches, mountains, and forests, while labor and capital are human products, including buildings and equipment, respectively. In addition, the service sector uses natural and cultural resources as products that tend to be traded in the market. Tourism supports the transportation, accommodation, and standard entertainment industries and fills cheap holiday packages.

However, developments originating in the service sector always need to consider the norms and cultures of the countries visited (Che & Holden, 2002). Tourism can cause mishandling of land management (Sunlu, 2003), fragmentation, vegetation degeneration, and coastal erosion (Wang et al., 2021). Previous research has examined the history of land-use change in mountainous areas with world natural heritage status (Miuse & Kamlun, 2019; Rhemtulla et al., 2002). This paper will contribute to examining land use transformation in mountain areas that have cultural world heritage status or have Outstanding Universal Value (OUV) in the region. Therefore, this paper seeks to fill the gap and compare between Mount Merapi (Indonesia) and Mount Fuji (Japan) which have the status of national parks and world cultural heritage. However, in Mount Fuji, Japan, OUV of world cultural heritage sites are one

entity management while in Mount Merapi, Indonesia, the OUV of world cultural heritage sites is separated at the foot of the eastern mountain (Klaten) and the western mountain (Magelang). Previous research has also linked demographics to land use change (Andini, 2018; Yusri et al., 2012) and related demographic factors to the physical and abiotic environment in land use change (Ochoa-Gaona & González-Espinosa, 2000; Rodríguez-Eraso et al., 2013), even linking land use change with population trends and forest harvesting policies (La Mela Veca et al., 2016), and the impact of armed conflict (Enaruvbe et al., 2019). Meanwhile, this study examines the relationship between changes in land use and land use management policies and population growth rates as a result of land use policies for protected areas and tourism on Mount Merapi and Mount Fuji.

This study had three important findings. First, land use in the Mount Fuji area in Japan is regulated by an institution that involves central and regional governments as well as the community. In contrast, the distribution of zones for land use management on Mount Merapi is based on the province, area, and function of land. Second, the evaluation of UNESCO heritage sites can change land use management policies in Indonesia and Japan. Third, the tourism sector will accelerate deforestation eight-fold, even though the rate of population growth is reduced. Thus, there are three phases of land-use management in heritage tourism: the pre-tourism phase, the tourism expansion phase, and conservation tourism.

Material and method

Mount Fuji is located in Yamanashi and Shizuoka Prefectures. In this mountain, UNESCO World Heritage area located at 35°13l′ 29.976″ N — 35°34′ 24,491″ N and 138° 31′ 51.37″E — 138° 56′ 8.82″ E because it has about 70,329.8 hectares consisting heritage property and buffer zone of 20,702.1 and 49,626.7 hectares respectively (UNESCO, 2012). Meanwhile, Mount Merapi is located in 4 districts, including Sleman, Boyolali, Magelang, and Klaten Regency. In this mountain, the districts are situated at 7° 8′ 16,389″ S— 7° 50′ 3,727l″ E and 11° 2l 35,776″ N — 110° 51′ 34,314″ N because it has an area of 355,556,33 hectares. Multispectral imagery for making Landsat land use maps of Mount Fuji and Mount Merapi can be seen in Table 1:

Table 1
Image primary data

Mountain	Year	Satellite	Spatial resolution	Band Formation	Spectral Band used and Spectral Range
Fuji	October 1981	Landsat 2	80 m	765 (Atmosphere Penetration to clarify vegetation cover from cloud thickness)	• Band 5 Visible red (0.6 to 0.7 µm) • Band 6 Near-Infrared (0.7 to 0.8 µm) • Band 7 Near-Infrared (0.8 to 1.1 µm)
	November 1991	Landsat 5	30 m	321 (Natural Color to identify land use features)	• Band 1 Visible (0.45 - 0.52 µm) • Band 2 Visible (0.52 - 0.60 µm) • Band 3 Visible (0.63 - 0.69 µm)
	August 2001	Landsat 7	30m		
	December 2011 December 2021	Landsat 8	30m	432 (Natural Color to identify land use features)	• Band 2 Blue (0.450 - 0.51 µm) • Band 3 Green (0.53 - 0.59 µm) • Band 4 Red (0.64 - 0.67 µm)
Merapi	September 1972	Landsat 1	80 m	654 (Vegetation Analysis to identify vegetation)	• Band 4 Visible green (0.5 to 0.6 µm) • Band 5 Visible red (0.6 to 0.7 µm) • Band 6 Near-Infrared (0.7 to 0.8 µm)
	August 1990	Landsat 5	30 cm	321 (Natural Color to identify land use features)	• Band 1 Visible (0.45 - 0.52 µm) • Band 2 Visible (0.52 - 0.60 µm) • Band 3 Visible (0.63 - 0.69 µm)
	December 2001	Landsat 7	30m		
	December 2011 December 2021	Landsat 8	30m	432 (Natural Color to identify land use features)	• Band 2 Blue (0.450 - 0.51 µm) • Band 3 Green (0.53 - 0.59 µm) • Band 4 Red (0.64 - 0.67 µm)

Source: created by the authors

The image is processed using ENVI software with the supervised classification method. This Landsat is divided into four types: forest, cropland, health, and built-up.

Table 2 shows the number of observation samples from Google Earth and street maps.

Table 2
Number of the observation sample

Sample in Mount Fuji	Sample in Mount Merapi
Forest = 54 Regions	Forest = 50 Regions
Cropland/orchard = 44 Regions	Cropland/orchard = 79 Regions
Heath = 24 Regions	Heath = 39 Regions
Built-up = 28 Regions	Built-up = 60 Regions

Source: created by the authors

The classification results are exported in a shape file which tends to be reprocessed in ArcGIS software to analyze land use and land-use changes. The data is in the form of unit area of land use patterns from each year sampled. The confusion matrix is a tabulation of each failure's calculation on every form of land cover from the classification process result. It is used to see the relationship between known reference data (validity) with the result according to the classification procedure (Story & Congalton, 1986).

1. Using the confusion matrix to calculate the correction data. The confusion matrix calculation can be seen in table 3 below:

Table 3
Confusion Matrix

Class Reference		Data Interpretation A	B	C	Number of Sample	User's Accuracy
Data Reference	A	X_{11}	X_{12}	X_{13}	X_{+1}	$X_{11.}$ X_{+1}
	B	$X2_1$	$X2_2$	$X2_3$	X_{+2}	X_{22} X_{+2}
	C	$X3_1$	$X3_2$	$X3_3$	X_{+3}	X_{33} X_{+3}
Total Sample		X_{1+}	X_{2+}	X_{2+}	N	
Producer's Accuracy		$X_{11.}$ X_{1+}	$X_{22.}$ X_{2+}	$X_{33.}$ X_{3+}		X_{ii}
User's Accuracy				$\frac{x_{11}}{x_{+1}}\ x\ 100\%$		
Producer's Accuracy				$\frac{x_{11}}{x_{1+}}\ x\ 100\%$		
Overall Accuracy				$\left(\frac{(\sum_{i=1}^{r} x_{ii})}{N}\right) x\ 100\%$		
Kappa Accuracy				$\left[\frac{N\sum_{i}^{r} x_{ii} - \sum_{i=1}^{r} x_{i+}x_{+i}}{N^2 \sum_{i=1}^{r} x_{i+}x_{+i}}\right]$		

Source: created by the authors

Function description:

N = Number of samples

Xi+ = Number of samples in the i-th row

X+i = Number of samples in the i-th column

Xii = Diagonal value of row contingency matrix of row-i and column-i

2. Determining the periodization of landscape management by comparing the land area of each land use unit from each year's data.
3. Analyzing the pattern of land use change using overlay and buffer techniques.
4. Observing the management form by comparing the results of land change patterns with land management policies.
5. Seeing the influence of population on land use patterns by comparing population growth with changes in the composition of land use units.

a) To analyze the rate of population growth using the formula Geometric growth rates (Statistic-Division, 2015).

$$r = \left(\frac{Xn}{Xo}\right)^{\frac{1}{n}} - 1 \quad (1)$$

r : Population Growth Rate

X_n : Year-end population

X_0 : start year population

N : the gap between the end year and the beginning year

b) To analyze the rate of land use change using the formula (Puyravaud, 2003).

$$c)\quad r = \left(\frac{1}{T2-T1}\right) x \left(\frac{A2-A1}{A1}\right) \quad (2)$$

r : Land use Change Rate

T2 : Year-end population

T1 : start year population

A2 : Land cover at T2

A1 : Land Cover at T1

Accuracy analysis

Overall accuracy is a whole classification score that shows the result of the image validity level. The score is obtained by comparing the total pixel amount, which is classified correctly with the number of pixel references (Story & Congalton, 1986). While, producer's accuracy is a score that shows the pixel references percentage from every kind of land cover classified correctly. Thus, the higher the percentage score, the higher the image quality in showing the land cover object (Story & Congalton, 1986). A user's accuracy is a score that shows a pixel's proportion probability from a classified image. It represents the category of land use in the field. Thus, the greater the probability score, the smaller the error in the land use classification (Story & Congalton, 1986). Kappa accuracy is a score that shows suitability between the classified images and references the image, calculated based on the confusion matrix. The higher the kappa coefficient score, the better the classification result (Hudson & Ramm, 1987).

The accuracy analysis consist of confussion matrix (see Table 4(a)) and user accuracy and procedural accuracy (see Table 4(b)).

Table 4(a)
Confusion Matrix

Fuji Classification		Satellite Image Digitize					Number Sample
		Built-Up	Crop line	Forest	Heath	Water Body	
	Built-Up	24	2	2	-	-	28
Ground	Crop line	4	38	2	-	-	44
check	Forest	2	2	50	-	-	54
(Street map)	Heath	-	4	3	17	-	24
	Water Body	-	-	1	-	5	6
Number sample		30	46	58	17	5	156
Merapi Classification		Satellite Image Digitize					Number Sample
		Built-Up	Crop line	Forest	Heath	Water Body	
	Built-Up	58	2	-	-	-	60
Ground	Crop line	3	65	6	5	-	79
check	Forest		5	45		-	50
(Street map)	Heath	2	2	3	32	-	39
	Water Body	-	-	1	-	7	8
Number Sample		63	74	55	37	7	236

Source: created by the authors

Table 4(b)
User Accuracy and Procedural Accuracy

Merapi User Accuracy (Digitize)	Percentage (%)	Merapi Procedural Accuracy (Street map)	Percentage (%)
Built-Up	96.6666667	Built-Up	92.0634921
Crop line	82.278481	Crop line	87.8378378
Forest	90	Forest	81.8181818
Heath	82.0512821	Heath	86.4864865
Water Body	87.5	Water Body	100
Fuji User Accuracy (Digitize)	Percentage (%)	Fuji Procedural Accuracy (Street map)	Percentage (%)
Built-Up	85.71428571	Built-Up	80
Crop line	86.36363636	Crop line	82.60869565
Forest	92.59259259	Forest	86.20689655
Heath	70.83333333	Heath	100
Water Body	83.33333333	Water Body	100

Source: created by the authors

Based on image testing, the lowest percentage of User accuracy is 70.83%. The highest value is 100% of the image data test above; the level of accuracy of satellite image analysis above 70% is categorized as an acceptable result (Luthfina et al., 2019). Likewise, the overall accuracy value in Fuji is 85.89% and in Merapi is 87.71%, where a minimum of 85% is considered satisfactory for land use classification (Baig et al., 2022). The Kappa accuracy value for Merapi is 0.84, and for Fuji is 0.81, so it belongs to the substantial class where the lowest value is 80% (Rwanga & Ndambuki, 2017).

Land use management in heritage landscape

The current land use management of Mount Fuji unites the World Cultural Heritage with the national park into one entity since 1998. Before that, Mount Fuji went through 3 land-use management policy changes. Mount Fuji shifts from a spiritual realm to an emblem of national pride, which drawn in the Meiji rules that make the mountain as a hiking trails, shrines, and pilgrim huts (Longbottom & DeCaroli, 2015). Figure 1 below shows a picture of the Fuji San tourist zone in the Edo period.

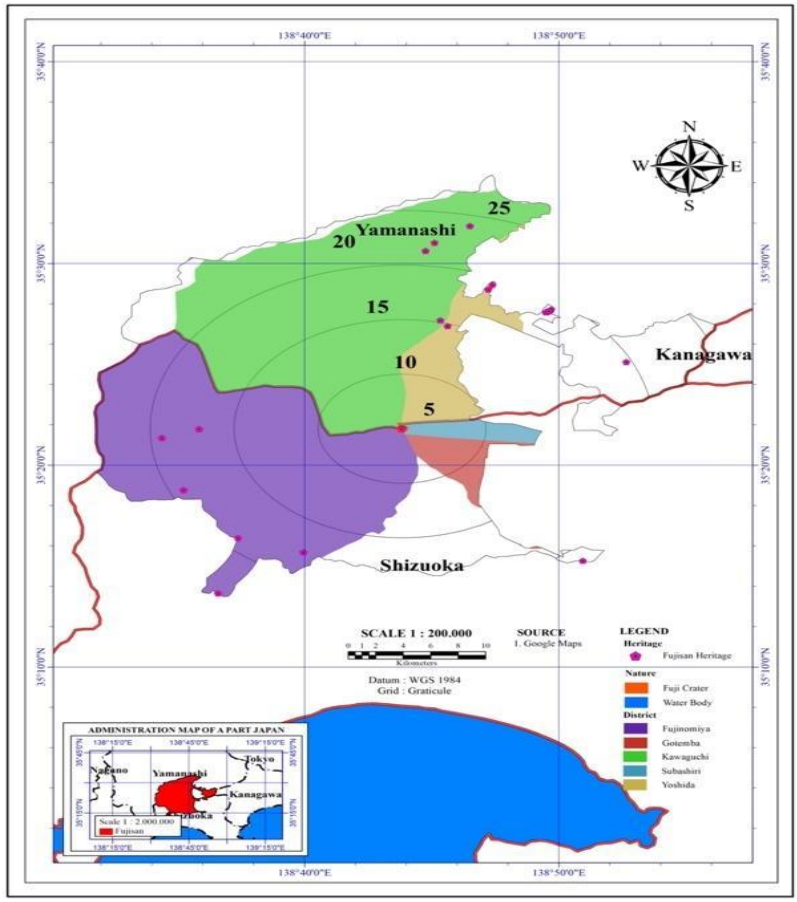

Figure 1. Fuji San tourism zone at Edo Period

Since 1850, Mount Fuji has been developed into international tourism; the development of infrastructure and facilities began to run the construction of railways that began in 1889, electric trains in 1929, and the development of second home tourism programs in 1930, which made international tourist destinations such as skating centers and many amusement parks. In 1935 the Japanese government established a National park on Mount Fuji, but the management focused more on tourism; it was seen that private companies still operated transportation systems and tourism services in the national park area, while the park management experienced management limitations due to private property rights (Delmas & Argueyrolles, 2021). Land use management at this time was managed separately between the Shizuoka Prefecture and Yamanashi Prefecture, as seen from the development of facilities in the northern and eastern regions (Yamanashi Prefecture was more developed than the southern and western regions

(Shizuoka Prefecture)) (Kureha et al., 2015). The picture of the Fuji San tourist zone before the Fuji Charter can be seen in figure 2 and after the Fuji Charter in figure 3.

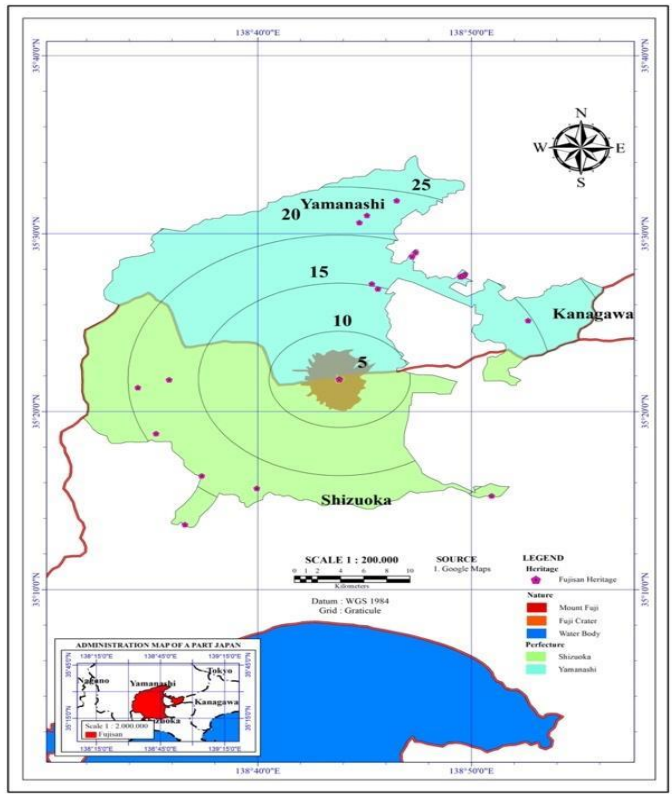

Figure 2. Fuji San Zone before Fuji Charter

The "Fuji Charter" in 1998 marked the renewal of Mount Fuji's land use management. This period saw Mount Fuji being managed as an entity by unifying everything related to Mount Fuji into one institution, including land use management. The commission issued a protection law on core and buffer zones, focusing on three laws: cultural property protection, national park, and forest management. These three laws will be the basis of conservation instrumentation contained in spatial planning laws, local ordinances, and land use management policies of local governments. The control of planning for forest towns and national parks is vested in the Fujisan world cultural heritage council. Still, the planning regulations remain with the relevant ministries and local governments (Fujisan World Cultural Heritage Council, 2017).

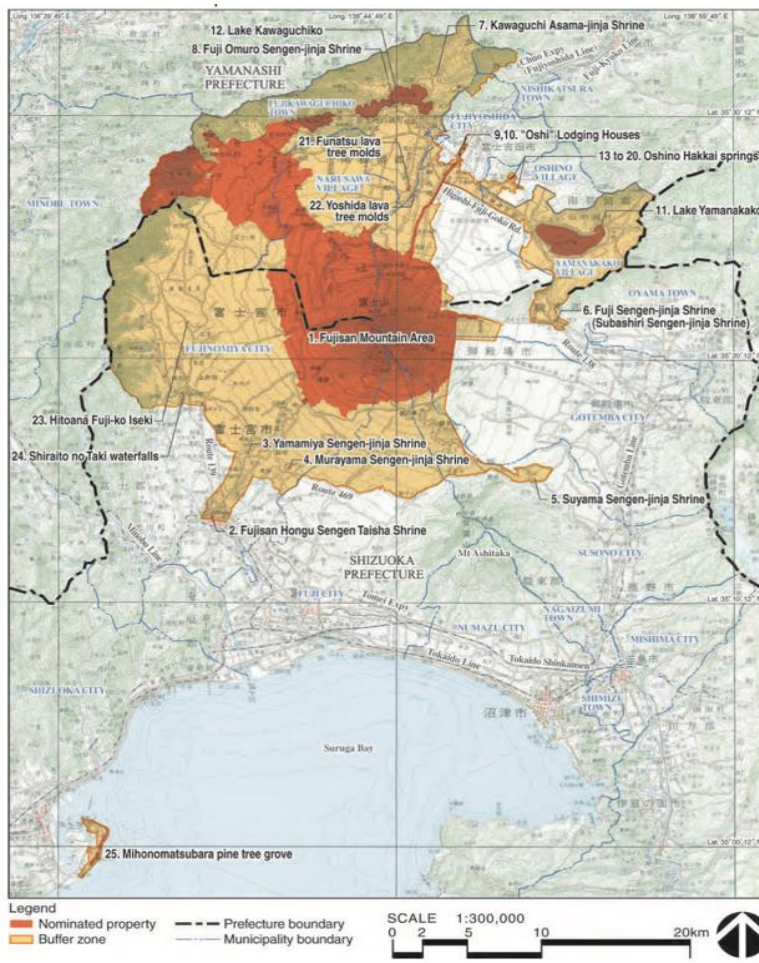

Figure 3. Fuji San Zone after Fuji Charter (UNESCO, 2013)

Unlike Mount Fuji, the land use management of Mount Merapi is still carried out separately based on district boundaries, northern region (Boyolali Regency), southern region (Sleman Regency), eastern region (Klaten Regency), and western region (Magelang Regency). However, Indonesia is experiencing both centralized and decentralized land use management. Indonesia had a centralized government system until 2001, so the central government carried out land use management based on administration. However, in 2001, the decentralization system gave local governments the authority, among others, to make urban/rural plans following national regulations. The land use management of Mount Merapi is divided into four regions. The North region is Boyolali Regency Government; the South

is Sleman Regency Government; the West is Magelang Regency Government; and the East is Klaten Regency Government.

Nevertheless, in 2003, or 12 years after being inscribed, UNESCO gave a report related to activities that threaten the sustainability of the landscape of the Borobudur Temple and Prambanan Temples in the form of the construction of high-rise buildings and the uncontrolled development of vendors and local communities, both settlements and economic activities. Through the Ministry of Forestry, the Government of Indonesia issued Decree No.134/Menhut-II/2004, creating the Mount Merapi National Park on the summit of Mount Merapi, which covers all four districts. The Ministry of Forestry is responsible for land use on Merapi Peak. In 2012, Prambanan Temples and Borobudur Temples were considered harmful for land conversion where land changes occurred sporadically, which could potentially threaten the harmony of the site's landscape (Asia-Pacific World Heritage Centre, 2003a, 2003b, 2012a, 2012b), so Indonesia issued a policy through presidential decree number 58 of 2014, which limits urban development, conversion of agricultural land, forests, and other activities that damage sites and their landscapes in the Borobudur and Prambanan temple complexes. This policy allows the Ministry of Education and Culture of the Republic of Indonesia through the Borobudur and Prambanan Conservation Center to manage land use in Magelang Regency and Klaten Regency. Management land use in Mount Merapi right now divides the area into four zones (see figure 4).

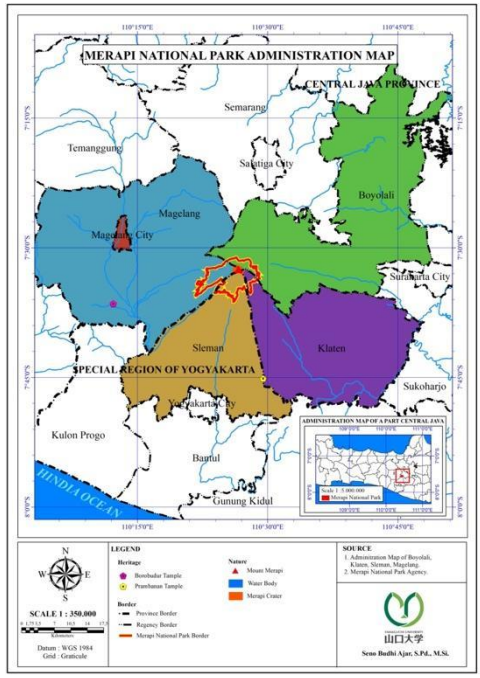

Figure 4. the division of the Merapi management area

1. The natural conservation zone is located in the top spot of Mount Merapi, which the Indonesian Ministry of Environment and Forestry manages.
2. Western and eastern Mount Merapi were heritage landscape protection zones. The pattern of their agricultural landscape protects Magelang (East) and Klaten (west).
3. The northern area as a support city zone and a toll road connecting the north with the southern makes Boyolali (north) an entrance from Jakarta, Semarang, and Surabaya. Also, an International Seaport and Airport make this region significantly develop industrial sectors. In 2018-2019 these sectors increased from 97 to 114 (Dinas Perdagangan dan Perindustrian Kabupaten Boyolali, 2022).
4. The core of tourism development is in the southern zone. The Sleman (south) and Yogyakarta cities are facilities and infrastructure tourism centers where accommodation and accessibility are developed. Moreover, Sleman and Boyolali experienced rapid land change, controlled by the Klaten and Magelang regency.

Transformation of land use management and land use patterns

Land use policy changed in Mount Merapi from 1972-2021 occurred four times, while the land change policy in Mount Fuji from 1981-2021 changed twice. These policy differences in land use management have an impact on land transformation. Merapi transformed from agricultural development to tourism development, but Fuji shifted from tourism development to conservation tourism development. The following figure 5 is Merapi's land use from 1921 until 2021.

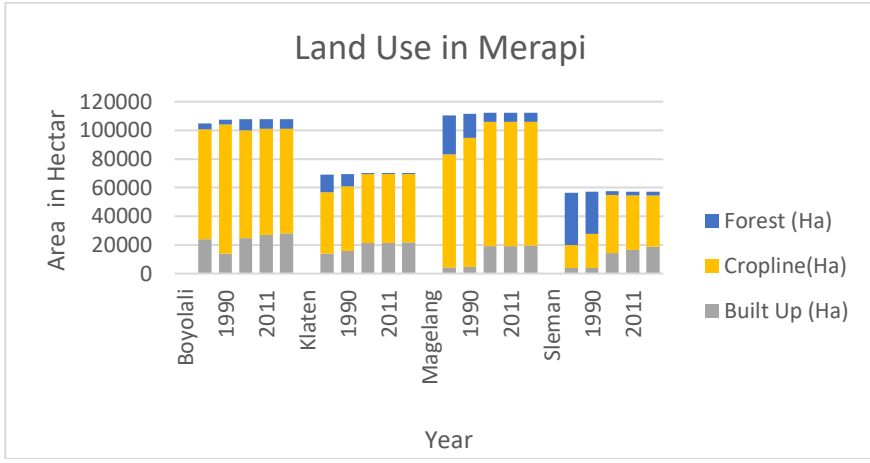

Figure 5. Merapi Land Use 1972-2021

The transformation of Mount Merapi started with the development of agriculture, especially rice paddies, by the central government in 1970, in which the story of rice farming was centered in the northern region (Boyolali) so in 1972 the north region (Boyolali) had less forest area than other regions, especially the southern region (Sleman), which was used as a protected area. Forest conservation areas still dominate the southern region (Sleman), while other sites are already dominated by agriculture.

The Indonesian government began to develop the conservation of Borobudur Temple (west of Merapi) and Prambanan Temple (southeast of Merapi) as archaeological heritage tourism. Preservation of the temples began in 1973 and 1980, and the Taman Wisata Candi.Ltd (a company owned by the Indonesian government) was established to manage the tourism of the two temples. Conservation and structuring of this tourism paid off when in 1991, Borobudur and Prambanan Temple became part of the world's cultural heritage by UNESCO. The land use pattern of Mount Merapi in 1991 shows that tourism development has not had a significant impact on forest loss because the area of agricultural land in the

four districts increased by 5-49%. The map of Merapi land use in 1972 and 1990 can be seen in figure 6 below:

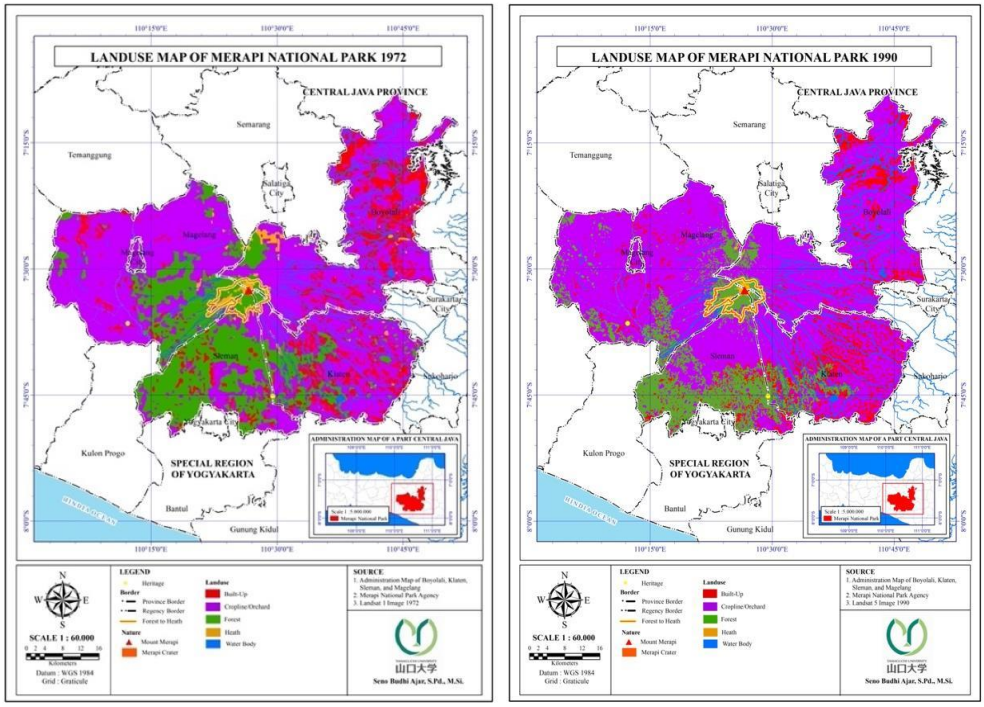

Figure 6. Map of Merapi Land Use 1972 and 1990

The National Government has developed Mount Merapi, especially the eastern (Klaten), southern (Sleman) and western (Magelang) parts, as an International Tourism Center with a central point of gravity in the city of Yogyakarta (south of Sleman) after Prambanan Temple and Borobudur Temple has achieved UNESCO World Cultural Heritage status. The development of this tourism center increased the number of Visitors significantly; for Borobudur Temple alone in the 1972-1979 period, the number of visits was 200,000-750,000 in the 80s, and the average stay ranged from 1,000,000 - 1,500,000 people. In the 90s, there was a massive increase in visitors of 1,750,000 - 2,750,000 people, but this development also impacted land use patterns. The forest was only concentrated in the peak area in 2001 because the three regions (Klaten, Sleman, and Magelang) lost forest by 61-91% and built up increased by about 320% in 1991-2001. Boyolali lost 17% of agricultural land, but forest and built-up areas increased by almost 90%. The land use in Merapi zone is pictured in figure 7 below:

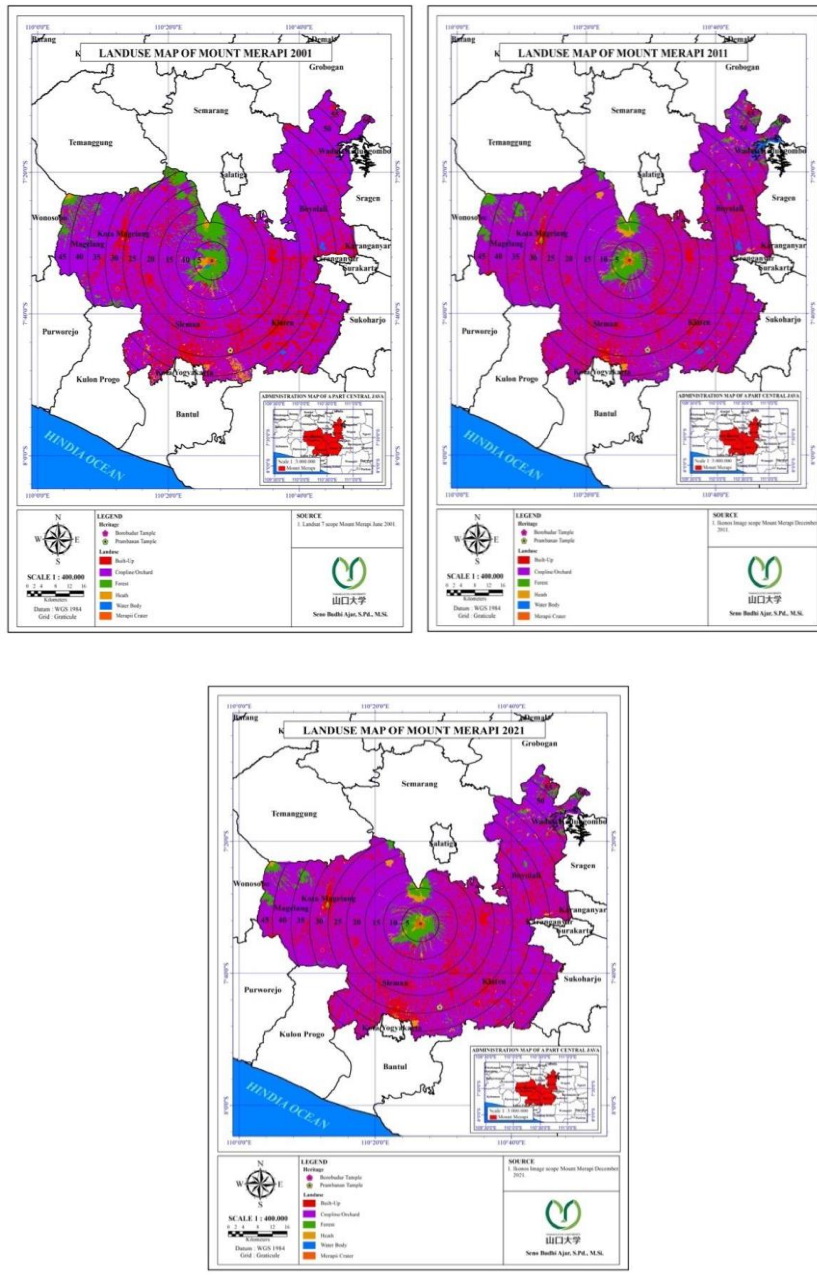

Figure 7. Map of Merapi Land Use 2001, 2011, and 2021

Tourism development with a separated zoning system began to be implemented in 2004 as a response to the UNESCO report related to activities that threatened the sustainability of the Borobudur

Temple and Prambanan Temple landscapes in the form of the construction of high-rise buildings and uncontrolled development of traders and local communities (Asia-Pacific World Heritage Centre, 2012a, 2012b). The first zone is the national park zone implemented in 2004 in the area of 0-10 km from the summit, and the second zone is the heritage zone, namely Borobudur Temple and Prambanan Temple. Mount Merapi National Park maintains the area 0-5 km from the summit with the dominance of forests. Moreover, the Borobudur and Prambanan Temple heritage zones maintain the agricultural landscape in Magelang Regency and Klaten Regency in Sleman and Boyolali regencies significantly change but was slightly affected in Klaten and Magelang over the past 20 years (figure 8). Sleman and Boyolali changed to 14.214.87 hectares and 17.511.6 hectares, while Magelang and Klaten changed to 2.130.62 hectares and 789.69 hectares Magelang and Klaten. Sleman and Boyolali regencies of about 7,841.08 and 10,203.14 hectares vary from agriculture to built-up land by 13.64% and 10.05%, respectively. The results showed that more than 10% of these two regencies have the same pattern of change because they are satellite cities, including Yogyakarta and Surakarta. These two regencies are affected by urban expansion, including toll roads and flyovers, as well as Adi Sumarmo and Sucipto airports. The new infrastructure helped to increase the pattern of land-use change from agriculture to built-up land, specifically in Yogyakarta city. It is supported by the masterplan document that Yogyakarta is integrated tourism because it is occupied by 90% of the people visiting the Borobudur and Prambanan temples (Bappenas, 2020). The following figure 8 below is the pattern of Merapi land use.

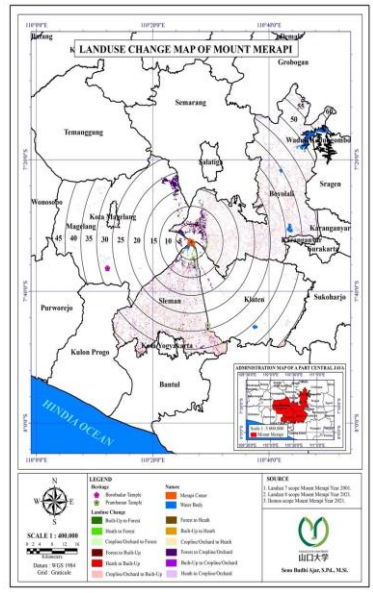

Figure 8. Merapi Land Use Change Pattern 2001 to 2021

The transformation of Mt. Fuji land use management started with Tourism development with a separated zoning system because Mount Fuji has been designated as a national park since 1936, but land use management is a separated zone; this is because land management depends on land ownership, where there is private and state-own land. Nationally owned land is under the administration of the Japanese Ministry of Environment and the Shizuoka-Yamanashi government. In contrast, shrines, mountain lodge associations and private companies mostly own privately owned land. It is a limitation for the Japanese Ministry of the Environment in managing land use in Fuji-San National Park because it has to adjust private property rights and coordinate development. During 1981-2001, the Yamanashi region of Mount Fuji lost more forest and gained more built-up land than the Shizuoka region, which can be seen in figure 9.

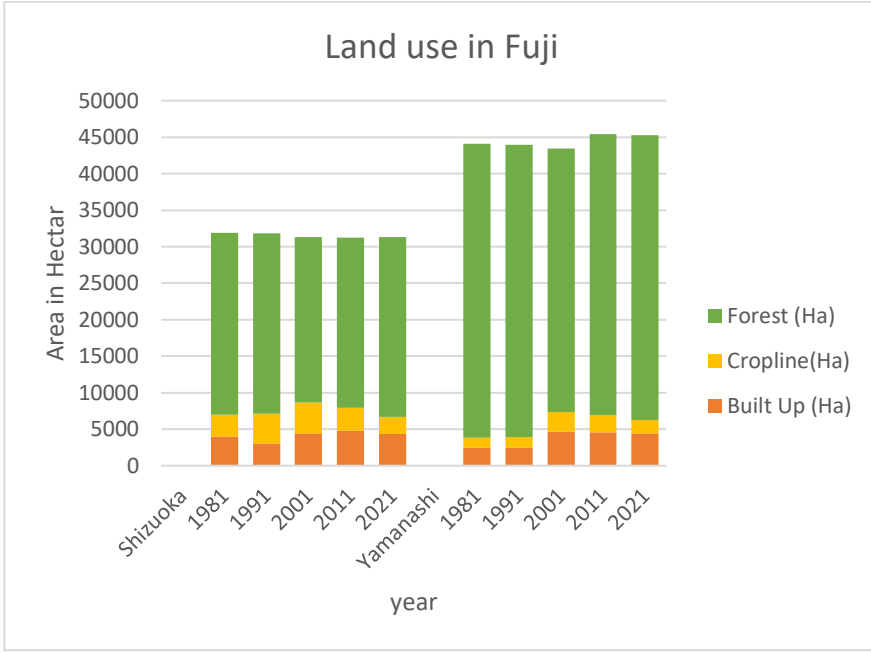

Figure 9. Fuji Land Use 1981-2021

After UNESCO concluded that Mount Fuji was worthy of World Heritage listing in 1995, Mount Fuji's land use management used conservation tourism (Earhart, 2015). Mount Fuji is managed as an ecosystem unit divided into two zones. The first is forest conservation, and the other focuses on tourism activities and is governed by the central government, local government, community representatives and private entrepreneurs, as stated in the 1998 Fuji Charter. This management caused an increase in forest area by 8.3%, while agricultural and built-up areas decreased by 40.2% and 2.1%, respectively.

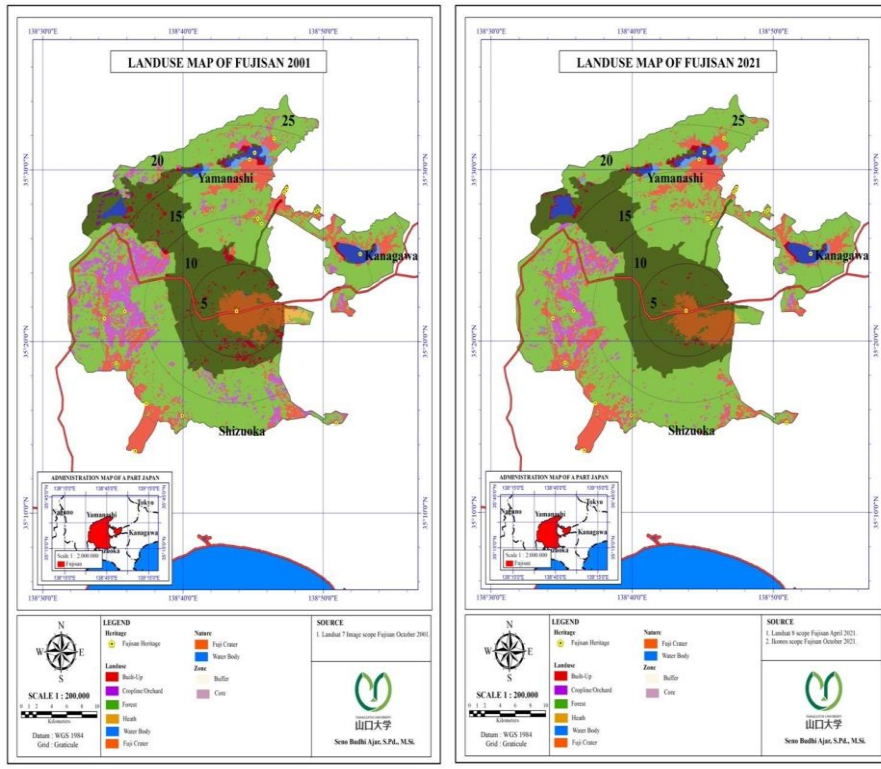

Figure 10. Map of Merapi Land Use 2001 and 2021

Figure 10 above showed all areas ranging from 0-25 km were dominated by forest land use before and after designation in 2001 and 2021. Meanwhile, in 2001, the pattern of built-up agriculture was distributed in each region, including Yamanashi and Shizuoka Prefecture. Figure 10 shows many lands used for built-up and agriculture in 0-25 km. In 2021, the land use pattern of Mount Fuji was dominated by forest and heath, but there are differences in the built-up and agricultural processes. Meanwhile, in 2001, this pattern was distributed in each region, while it was concentrated in areas 10-20 km around the Fujisan Architectural and Lake Cultural Heritage in 2021. The land use pattern was devoted to the forest, agricultural, and built-up processes in the west, north, and south of Fuji peak. In the eastern and western foothills, agricultural land use in Mount Fuji experienced a significant decrease. In the lowlands, there is vegetable cultivation, while there is rice and dairy farming in the middle lands. From 1970 to 2010, the production of green tea, vegetables, and fruits increased due to agriculture. The pattern of Fuji land use from 2001 to 2021 is seen in figure 11.

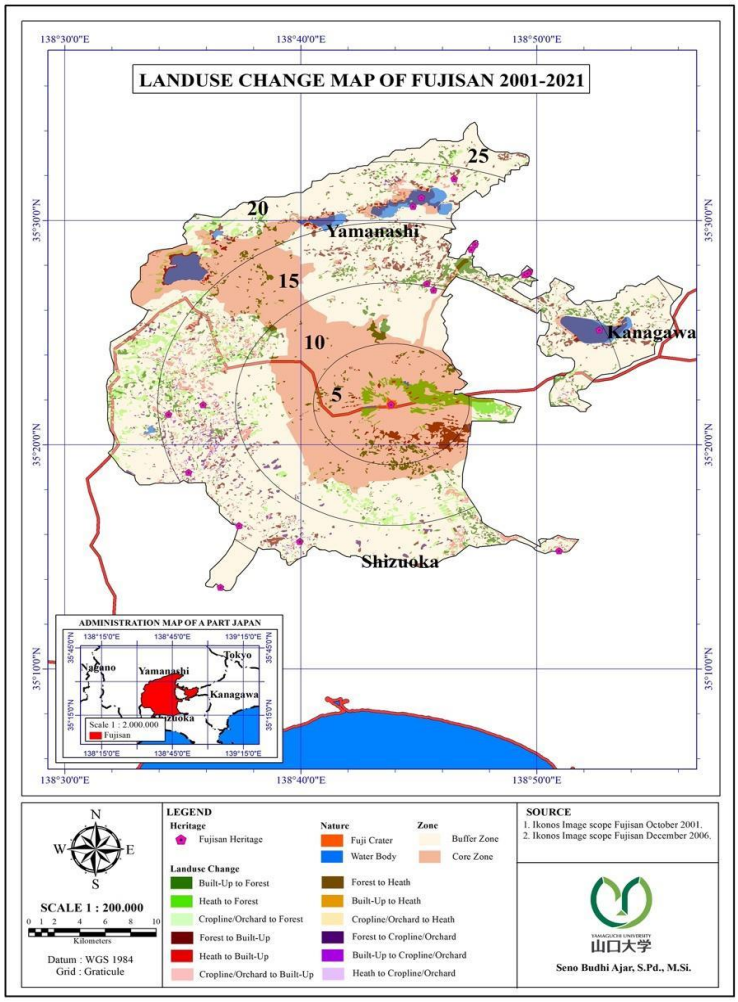

Figure 11. Fuji Land Use Change Pattern 2001 to 2021

Relationship between land use change rate and tourism and population growth rate

Mount Merapi and Mount Fuji, as heritage tourism, have experienced changes in land management policies. Mount Merapi experienced three transformations of land management policies, 1972-1991 was a transformation from agricultural development to tourism planning; 1991-2001 was the development of an integrated tourism center; 2001-2021 the development of conservation tourism with separated management, while Mount Fuji since 1981 experienced two transformations of land management policies, first developed as conservation tourism with a separated management system in 1981-2001, then changed

to Unity management in 2001-2021. Land management policies will affect land use change. Hence, the use of heritage tourism land is changing and divided into three stages. The following are data on the rate of change in land use and the population growth rates of Indonesia and Japan, which can be seen in Table 5.

Table 5
The Rate of Land Use Change and The Population Growth Rate

Country	Region	Period	The Rate of Change Built Up	Cropline	Forest	Population
Indonesia	Boyolali (Northern Merapi)	1972-1991	-2.12%	0.87%	-0.55%	1.03%
		1991-2001	8.98%	-1.73%	8.82%	0.59%
		2001-2021	0.04%	-0.01%	0.00%	0.67%
	Klaten (Eastern Merapi)	1972-1991	0.80%	0.26%	-1.61%	0.87%
		1991-2001	3.40%	0.64%	-8.94%	0.66%
		2001-2021	0.10%	-0.05%	0.03%	0.01%
	Magelang (Western Merapi)	1972-1991	0.56%	0.73%	-1.99%	1.02%
		1991-2001	32.01%	-0.38%	-6.13%	0.80%
		2001-2021	0.08%	-0.02%	-0.11%	0.82%
	Sleman (Southern Merapi)	1972-1991	0.12%	2.55%	-1.05%	1.42%
		1991-2001	32.08%	6.12%	-9.14%	1.00%
		2001-2021	0.11%	-0.08%	-0.11%	1.39%
Japan	Shizuoka (Southern Fuji)	1981-2001	0.56%	2.00%	-0.45%	0.65%
		2001-2021	-0.06%	-2.30%	-0.46%	-0.09%
	Yamanashi (Northern Fuji)	1981-2001	4.54%	4.68%	-0.52%	0.51%
		2001-2021	-0.22%	-1.56%	-0.39%	-0.24%

Source: created by the authors

Land management starts from the pre-tourism period. This period has a high population growth rate (0.87-1.42%). In this period, two patterns of land use change will be formed because there are areas developed as tourism and there are also areas that are not tourism priorities. The first pattern is an agricultural change to tourism, where the pattern of change is not only developing towards agriculture but starting to develop towards built-up land. This pattern is seen in Magelang, Sleman and Klaten, which shows that the rate of forest loss is relatively high (1.05-1.91%). It tends to be influenced by the

development of the agricultural sector rather than the tourism sector because the growth rate of agricultural land (0.26-2.55%) is higher than the development rate of built-up areas (0.12-0.80%).

While, the second pattern is an agricultural pattern where land use change is still focused on agricultural land use, so forest loss or settlement relocation will occur to support agricultural activities. This pattern can be seen in Boyolali Regency, which has a forest loss rate of 0.55%, a built-up land loss rate of 2.12%, and an agricultural land increase rate of 0.87%.

The more heritage tourism sites are known, the more visitors; this will make heritage tourism sites enter the tourism expansion phase. This phase accommodates tourists who come. The rate of forest loss will be eight times faster than in the previous step, even though the population growth rate is lower (0.59-1%) than in the last step. In this phase, there are also three patterns.

1. The first pattern is forest loss and transformation to farmland and built-up land in Sleman and Klaten.
2. The second pattern is the forest and agricultural land loss pattern that transforms into built-up land in Magelang.
3. The third pattern is the agricultural land loss that transforms into the forest and built-up land in Boyolali. Although not part of the tourism center, Boyolali is affected by developing tourism-supporting infrastructure, such as roads and terminals connecting with other regions.

Heritage sites as tourism will experience environmental degradation and stagnation; therefore, conservation must be carried out to protect heritage sites, namely the conservation phase. This phase will be divided into two patterns based on its management.

1. The first pattern is land use management with a separate management system between national parks and heritage tourism. In this pattern, the population growth rate is still positive.
2. The second pattern is land use management with an integrated National Park and heritage tourism system. This system helps to increase the forest area and limit the development of tourism and agriculture, but this pattern occurs in areas with no population pressure.

Conclusions

This paper concludes that heritage tourism development can be a significant factor in changing land use patterns. This site will continue to be in this state unless there is an evaluation from an influential stakeholder. This paper explains the Indonesian government that started to reform land use management in Mount Merapi by making regulations on development restrictions in the heritage zone and National Park after an unfavorable evaluation from UNESCO, as well as Japan that started to reform the management of Mount Fuji National Park to an integrated management between the government and the community when it wanted to try again to apply for world cultural heritage after being rejected for world

natural heritage by UNESCO. Establishing a commission of the central government, local governments, the private sector and the community to make integrated policies made the forest area grow positively in the core and buffer zones. The relationship of a social actor in land use management in Fuji as integrated management is centered in a world heritage commission (Fujisan world heritage council), such as: (1) The central government, as a supervisor and observer, extends its power with regional representatives to become members of the joint commission with prefecture and city regional authorities; (2) Coordination between regional leaders and central representatives becomes a forum to discuss reports on the preservation and management of landscapes and heritages properties; and (3) The officer responsible for monitoring heritage landscapes, planning reforestation activities, and preserving landscapes and heritage properties is collaborating with central representatives, local government, residents, and related organizations.

Social actor relations in land use management in Merapi as separated management are limited by administrative boundaries and forest functions. Local governments and local communities influence land use planning, where the government does spatial planning by capturing the aspirations of residents. The conservation center will become a barrier to changes in land use if one of its functions is to preserve heritage landscapes. This landscape preservation process will maintain the current land use from urbanization. Forest conservation to become a national park is one of the political forces of the central government in imposing conservation and protection activities because the designation of a national park in a forest places management rights in the hands of the central government.

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