Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 6 (2023)

Sustainable Tourism Model on National Park Enclave Area (Case Study: Ranu Pani, Lumajang Regency)

Yuli Harisma Wati [1*], Marjono [2], Rita Parmawati [3,4,5]

[1] *Master Program of Environmental Management, Brawijaya University, Malang, Indonesia*

[2] *Department of Mathematics, Faculty of Mathematics and Natural Science, Brawijaya University, Malang, Indonesia*

[3] *Postgraduate Program, Brawijaya University, Malang, Indonesia*
[4] *Agriculture Socioeconomics, Faculty of Agriculture, Brawijaya University, Malang, Indonesia*
[5] *Study Program of Agribusiness (Off-Main Campus), Brawijaya University, Kediri, Indonesia,*

Abstract:- The Lumajang Regency Government is eager to develop the tourism destination of Ranu Pani, located in the enclave of Bromo Tengger Semeru National Park (TNBTS), into a sustainable tourism destination. The objective of this research is to develop a sustainable tourism model in Ranu Pani, Lumajang Regency, by considering the balance between the actual conditions and the capacity of Environmental Carrying Capacity (DDTL). The method used refers to the calculation of DDTL by Cifuentes (1992) and the analysis of model development and scenarios using a dynamic system approach on two components: tourism carrying capacity and tourist dynamics. This allows for the adjustment of the relationship between variables and predictions of conditions over time. The results show that the DDTL values of Ranu Pani are PCC (9,941), RCC (1,228), and ECC (1,228). According to the model simulation, the carrying capacity of tourism in Ranu Pani will remain constant until 2030. However, changes in marketing variables will significantly impact the number of tourist visits in the tourist dynamics component. By combining these two components, the model predicts that by 2024, assuming an increase in tourist visits, the number of tourists will exceed the carrying capacity of Ranu Pani tourism. To prevent and maintain the stability of tourism activities and preserve the environment in Ranu Pani, a developed scenario is to limit the number of tourists to 50% per day in Ranu Pani.

Keywords*: Environmental Carrying Capacity, Dinamic System, Sustainable Tourism.*

JEL Classification: *Q01; Z32*

1. Introduction

Indonesia, one of the largest archipelagic countries in the world, has a sub-tropical climate and a variety of unique landscapes in each region. This presents a great opportunity to optimize the tourism sector, which is expected to have a multiplier effect on economic components such as employment and welfare, as well as environmental components (Ernawati, 2019; Slamet et al., 2019; Prohansah & Eprilianto, 2022; Carito et al., 2023). Indonesia's diverse ethnic groups give rise to a variety of unique cultures, which are complemented by the country's high biodiversity, making it an attractive destination for both local and foreign tourists. According to data from BPS (2023a), the number of foreign tourist visits between January and September 2023 increased by 143.41% compared to the same period in 2022. In 2022, domestic tourist arrivals in East Java increased by 134.61% compared to 2019 (BPS, 2023b).

Bromo Tengger Semeru National Park (TNBTS) is one of the top tourist destinations in East Java Province. It covers an area of 502,763 km2 and is geographically located in four regions: Pasuruan Regency, Malang Regency, Lumajang Regency, and Probolinggo Regency (Akbar & Pangestuti, 2017). The highland landscape of

the National Park has become a major attraction for tourists, and the unique culture adds to the value of experiencing it. The primary attraction in TNBTS is Mount Bromo, renowned for its stunning sunrise views. However, there are several other potential destinations that could be optimized to become tourist attractions and increase opportunities for regional income diversification. One such destination is Ranu Pani, located in Ranu Pani Village, Senduro District, Lumajang Regency. This destination is situated in the enclave area of Bromo Tengger Semeru National Park (TNBTS). The majority of the community is comprised of the Tengger tribe, who work as farmers. Due to this, the Lumajang Regency Government has targeted this location for tourism development (Prawijaya, 2014; Lumajang Regency Tourism and Culture Office, 2019; Adawiyah & Susilo, 2020). Ranu Pani is known for having a volcanic lake formed by the volcanic activity of Mt. Semeru. However, like other tourist destinations, the problem of unsustainable management, dominant negative impacts, inadequate marketing facilities, unsupportive human resources are some of the remaining problems to be solved.

Researchers conducted a study on Ranu Pani as an enclave area of TNBTS due to potential planning and development issues that may arise in the future. This presents a challenge for the government and academics to develop effective, efficient, and optimal development and implementation strategies. Additionally, the process of planning tourism development must adhere to the principles of sustainable development to ensure positive impacts and minimize negative ones in both the present and future (Parmawati et al., 2022). This study focusses on creating a sustainable tourism development model in the Ranu Pani area of Lumajang Regency by considering the balance between current conditions and the capacity of Environmental Carrying Capacity. Thus, the formulation of tourism development policy in Ranu Pani should prioritize sustainability.

2. Research Method

The study site is Ranu Pani, Lumajang Regency, East Java, which is one of the enclaves of Bromo Tengger Semeru National Park (TNBTS) and has high potential for tourism development. Ranu Pani is situated at an altitude of 2,100 meters above sea level and covers an area of 35.79 km2. Some of the common tourist activities in the area are trekking, picnicking, and camping. The Ranu Pani area has been identified as a potential tourist destination in Lumajang Regency. This has been achieved through collaboration between the National Park management, the Tourism Awareness Group (Pokdarwis), and the Village-Owned Enterprises (BUMDes).

The research collects data through field observations and interviews with key stakeholders of tourism management or Tourism Awareness Community Group (Pokdarwis). The analysis will be divided into two parts: (1) Analysis of Environmental Carrying Capacity of Ranu Pani and (2) Formulation of Tourism Development Model in Ranu Pani Area based on carrying capacity.

The Ranu Pani Environmental Carrying Capacity analysis involves three main components namely Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC) and Effective Carrying Capacity (ECC), the calculation of each component can be seen in Table 1.

Table 1. Environmental Carrying Capacity Formula

Physical Carrying Capacity (PCC)	Real Carrying Capacity (RCC)	Effective Carrying Capacity (ECC)
$PCC = A \times \frac{v}{a} \times Rf$	$RCC = PCC - Cf_1 - Cf_2 - \cdots Cf_n$	$ECC = RCC \times MC$
$Rf = \frac{open\ duration\ of\ torism\ destinations}{avegrage\ tourist\ visit\ duration}$	$Cf_n = \frac{M_1}{M_t} \times 100\%$	$MC = \frac{Rn}{Rt} \times 100\%$
Notes:	Notes:	Notes:
A : Area for Tourism Activities	C_f : Correction Factor	MC : Management Capacity
$\frac{v}{a}$: Area for specific activities	M_1 : Limiter for Varibel Size	Rn : Number of Actual Staff
Rf : Rotation Factor	M_t : Total size of variabel	Rt :Number of Needed Staff

The dynamic system model developed will include an environmental sub-model that explains two main components: (1) the Tourism carrying capacity Sub Model and (2) the Tourist Dynamics Sub Model. The model

for sustainable tourism management in Lumajang Regency will be analyzed using Powersim Studio 10, with the following stages of modeling analysis:

1. Creation of Causal Loop Diagram, which will illustrate the positive - negative relationship of each variable that will be used in the study.
2. Stock and Flow Diagram, describing the relationship of each variable.
3. Model Simulation, describing the simulation of the relationship between variables with certain time constraints.
4. Model validation and verification involves testing the model with existing conditions and assumptions that shape the structural dynamics model.
5. Scenario development is used to simulate the results of an intervention or treatment carried out on certain variables. The research scenario involves controlling the number of tourists based on an analysis of carrying capacity and tourism capacity.

The created scenarios can serve as a basis for recommendation policy development of Lumajang Regency Government to optimize Ranu Pani, which is part of the Bromo Tengger Semeru National Park Enclave. It is important to prepare appropriate strategies for this purpose.

3. Result And Discussion

Ranu Pani, Lumajang Regency

Ranu Pani is located within the Bromo Tengger Semeru National Park with geographical location of 8°0'46.7" N 112°56'48.0" E. As stated by Fath (2013), Ranu Pani is located at an altitude of 2,100 meters above sea level (MDPL) and could have an estimated temperature until -4 °C. Located at the slope area of Mount Semeru provides Ranu Pani with an amazing scenery, landscape, and fertile soil suitable for farming. On the economic side, the main source of income for Ranu Pani community is agriculture, and some people also work as porters for a climbers that want to hike on Mount Semeru. Ranu Pani is classified as an enclave village and has an estimated tourist area of 35.79 km2. Tourists typically hike and camp around the attraction to enjoy the panoramic view of the volcanic lake. As per tourism information, Ranu Pane is open for 24 hours a day. After the management is handle by Lumajang Regency Government and Pokdarwis, there is an entrance fee to Ranu Pane that range from IDR 19,000 on weekdays and IDR 24,000 on holidays. The entrace fee is then used as a one of the source for Ranu Pani infrastructure development and give more jobs opening to Ranu Pani surrounding community.

Environmental Carrying Capacity (DDTL)

The concept of Carrying Capacity is a fundamental aspect in the planning process of development and tourism activities. In Ranu Pane, several variable values were observed to calculate carrying capacity (refer to Table 2).

Table 2. Variable Value for Environmental Carrying Capacity

Sub-Variable	Ranu Pani
Tourist activity Area (m2)	35.790.000
Tourist activities (m2)	Trekkking (16 m2) Camping (90 m2)
Operational duration (hours)	168 hours
Average tourist duration (hours)	60 hours
Rotation Factor	2,8

Source: Observation, 2023

The DDTL value of Ranu Pani was calculated using the formula in Table 1 and the variable values in Table 2. The results are presented in the following table 3.

Table 3. Environmental Carrying Capacity Ranu Pani

Physical Carrying Capacity (PCC)	Real Carrying Capacity (RCC)	Effective Carrying Capacity (ECC)
9.941	1.228	1.228

Source: Analysis, 2023

Dynamic Model of Sustainable Tourism in Ranu Pani

A dynamic model is a tool that aids in policymaking and decision-making. With the use of a dynamic system model, the interaction between variables in a system can be analyzed in depth. The structure of the developed dynamic model creates a picture of the interaction between elements in the system. The capacity of a dynamical system model to replicate the temporal evolution of model variables enables it to make a more substantial contribution to the actual and relevant analysis of existing conditions. In this study, the dynamic system model will examine (1) Tourism Carrying Capacity and (2) Tourist Dynamics.

Sub-Model 1: Tourism Carrying Capacity

Tourism carrying capacity is the maximum number of tourists that the ecosystem at a tourist site can accommodate, considering physical, environmental, and management aspects of the location. Figure 1 shows the Stock Flow Diagram of the tourism carrying capacity submodel, where the main variables are the components of Environmental Carrying Capacity (DDTL), namely Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC), and Effective Carrying Capacity (ECC).

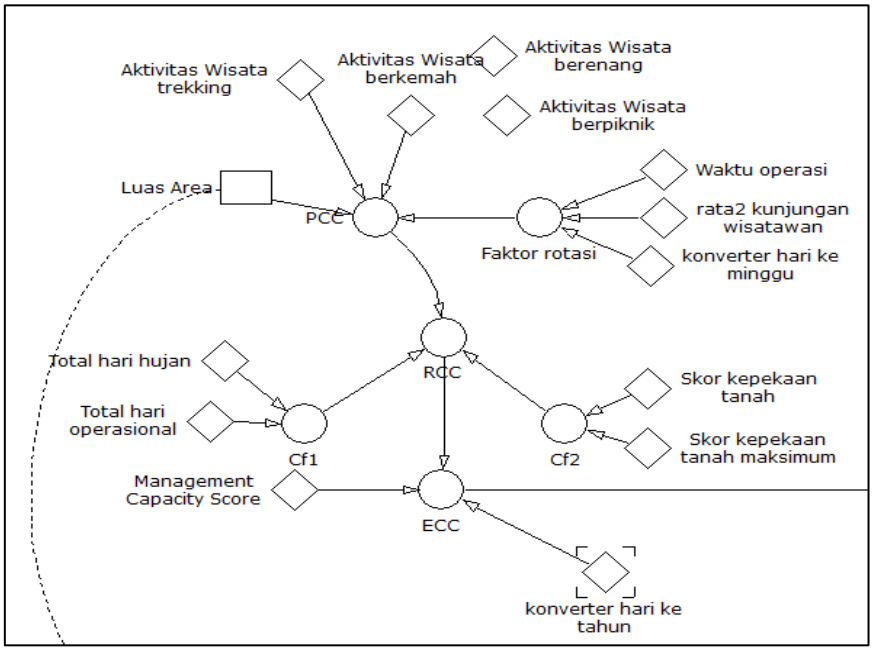

Figure 1. Stock Flow Diagram Submodel Carrying Capacity Tourism

When examining the submodel, it is evident that the three types of carrying capacity have an impact in the following order: Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC), and Effective Carrying Capacity (ECC). The factors that influence Physical Carrying Capacity (PCC) include the size of the tourist attraction, tourist activities, and rotation factors related to the length of stay of tourists in tourist attractions. The Real Carrying Capacity (RCC) is influenced by the Physical Carrying Capacity (PCC) value and correction factors (Cfn), specifically rainfall and soil sensitivity. On the other hand, the Effective Carrying Capacity (ECC)

is affected by the Real Carrying Capacity (RCC) value and Management Capacity Score. These variables are interdependent, and changes in one variable can have a significant impact on the entire system.

Data from 2023 shows that the tourism area in Ranu Pani is 35,790,000 m2, with trekking and camping being the main tourist activities. The average length of stay of tourists in Ranu Pani, based on observations and interviews with key stakeholders, is 60 hours. It indicates and resulting that the Environmental Carrying Capacity in Ranu Pani components is PCC (9,941), RCC (1,228), and ECC (1,228). Changes in the value of the tourist attraction submodel are strongly influenced by land area. If the land area is large, the level of environmental carrying capacity will also be greater. However, if the land area of Ranu Pani decreases, it will affect the carrying capacity of existing tourism.

Table 4. Environmental Carrying Capacity Ranu Pani

TAHUN	PCC (person/days)	RCC (person/days)	ECC (person/year)
2018	9.941,67	1.228,95	448.568,00
2019	9.941,67	1.228,95	448.568,00
2020	9.941,67	1.228,95	448.568,00
2021	9.941,67	1.228,95	448.568,00
2022	9.941,67	1.228,95	448.568,00
2023	9.941,67	1.228,95	448.568,00
2024	9.941,67	1.228,95	448.568,00
2025	9.941,67	1.228,95	448.568,00
2026	9.941,67	1.228,95	448.568,00
2027	9.941,67	1.228,95	448.568,00
2028	9.941,67	1.228,95	448.568,00
2029	9.941,67	1.228,95	448.568,00
2030	9.941,67	1.228,95	448.568,00

Source: Analysis, 2023

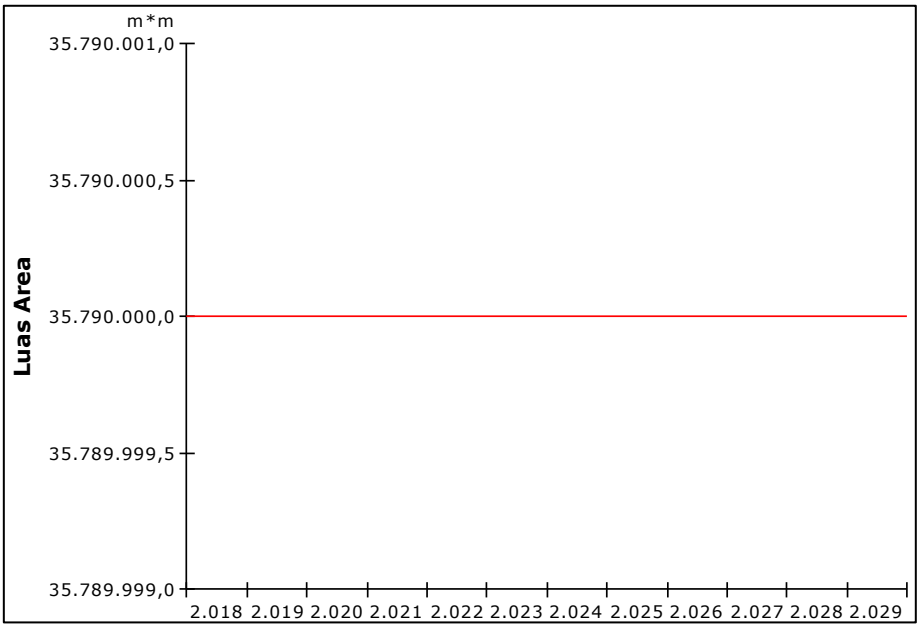

Figure 2. Correlation model simulation (Area and Time)

Based on several observations and literature studies, Ranu Pani village has a sloping topography with a slope of up to 29% (Suharto et al., 2023). Data from BPS (2021) shows that of the total area in Ranu Pani area, 91% is categorized as other land management status, which can refer to land used for agriculture, plantation, forest, or residential. Meanwhile, only about 9% is categorized as dry land, where it is used as a medium for growing crops with limited water conditions. The vast land owned by Ranu Pani is expected to accommodate various tourism activities that will be carried out by tourists, even in line with this, the Lumajang Regency Government is actively conducting reforestation activities on land in the Ranu Pani area. It is hoped that the ecosystem, which has been gradually degraded by community activities, can be stabilized and support life in Ranu Pani. When referring to Figure 2, with the condition of Ranu Pani area that is constant or does not experience a significant decline from year to year. Followed by the role of Lumajang Regency government in the process of restoring Ranu Pani ecosystem due to human activities. Then, in 2030, it can be assumed that the carrying capacity in Ranu Pani is fixed or stagnant.

Sub-Model 2: Tourist Dynamics

This submodel represents the potential number of tourist visits to tourist sites. The variables used to analyze the dynamics of tourist numbers include promotion through word of mouth (WOM) and promotion by local governments, both digitally and non-digitally. The language used is clear, objective, and value-neutral, with a formal register and precise word choice. The presence of a predetermined tourist carrying capacity value impacts the reduction in the number of daily visitors who can access the tourist attraction. Below is the Stock Flow Diagram of the Tourist Dynamics submodel.

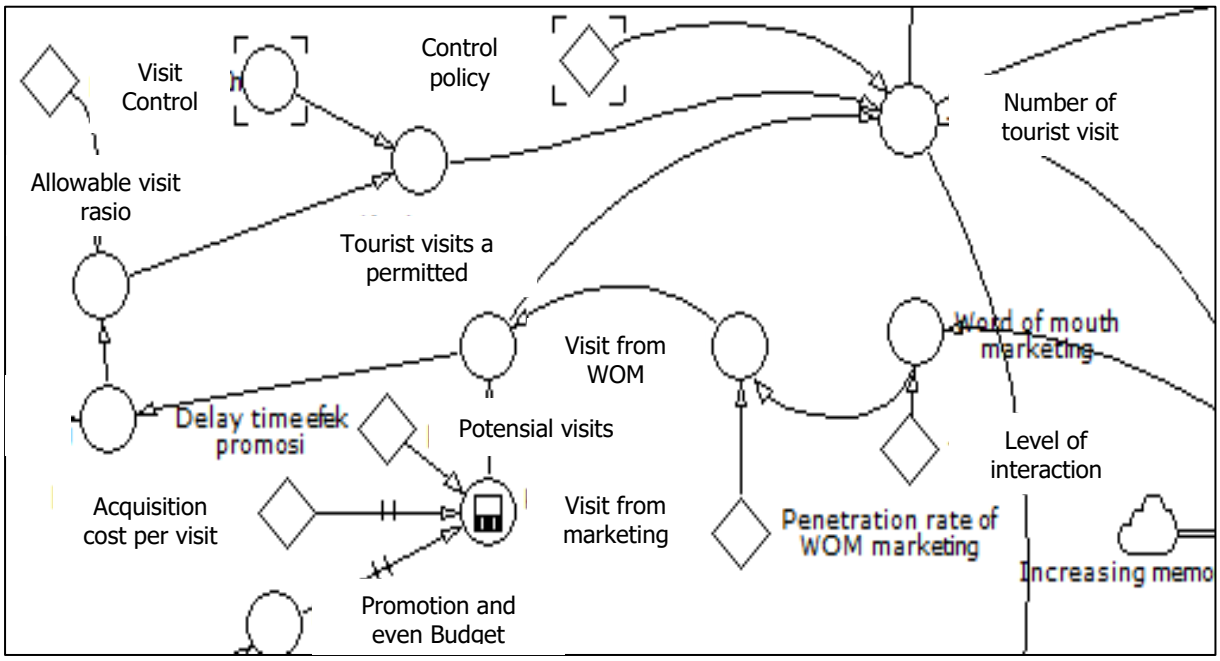

Figure 3. Stock Flow Diagram Submodel Dinamika Wisatawan

To understand tourist dynamics, it is important to analyze historical data on tourist visits. The Lumajang Regency Tourism Office has recorded the number of tourist visits from 2018 to 2021. In 2018, there were 364,306 visits, while in 2021 there were 4,940. Additionally, a promotional structure has been developed to assess the potential for future tourist visits. It is important to note that the effects of promotion may not be immediately felt and may require time to take effect. The study assumes an acquisition cost of 0.15 million per person per visit. Additionally, it assumes that satisfied tourists who have visited Ranupani will promote the location to an average of 20 people per year through word-of-mouth, without any budget for promotion. Based on these data, the simulation results for tourist dynamics are as follows in Table 5.

Table 5. Submodel of Tourist dynamics

Year	Total Tourist	Word of Mouth Marketing	Visitor from Marketing
2018	350.000,00	30.000.000,00	200.000,00
2019	226.555,23	23.007.686,34	111.516,80
2020	80.847,00	15.900.765,47	1.343,17
2021	53,044,43	10.608.396,01	2,45
2022	66,631,45	7.224.083,74	30.511,03
2023	128.279,84	5.878.011,27	98.889,78
2024	251.339,11	6.420.314,31	219.237,54
2025	455.354,90	9.452.949,07	408.088,15
2026	619.365,30	14.531.792,71	546.706,33
2027	697.936,22	19.264.018,64	601.616,12
2028	774.108,37	23.328.299,95	657.466,50
2029	852.895,37	27.005.960,22	717.865,57
2030	935.972,89	30.507.039,70	783.437,70

Source: Analysis, 2023

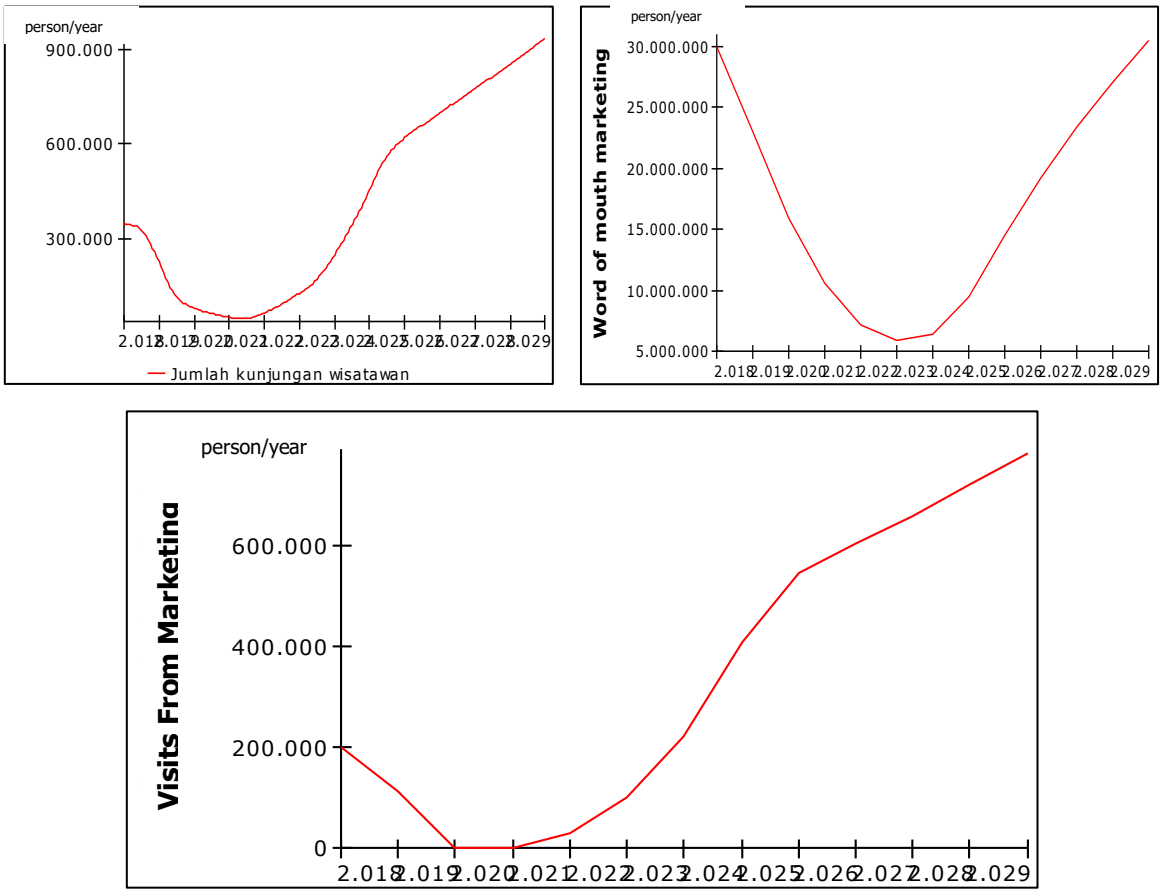

Figure 4. Simulation of the (a) number of tourist visits, (b) number of tourist visits because of WOM and (c) number of tourist visits because of promotions

Based on the sub-model simulations conducted, it is evident that the patterns between graphs a-c are similar. Graph 4a shows that the number of tourist visits in 2018 exceeded 300,000 tourists/year, but experienced a decline in 2019-2022, likely due to the COVID-19 pandemic. However, the trend then increases until it is predicted that the number of tourist visits will exceed 900,000 tourists/year by 2030. Graph 4b shows the potential for Word of Mouth (WOM) since before 2018, with 30,000,000 tourists per year attending due to this variable. However, there was a significant decline in 2019-2021 due to Indonesia's recovery from the pandemic and the ecosystem restoration process in the Bromo Tengger Semeru National Park (TNBTS). It is predicted that this component will continue to increase until it reaches over 30,000,000 tourists per year. Figure 4c shows a slow increasing trend in the marketing component implementation. In 2022, there will be optimization of digital devices and strengthening of various tourism stakeholders around the Bromo Tengger Semeru National Park (TNBTS), which is expected to increase the number of visitors to over 700,000 per year due to appropriate marketing. These three components have an equal relationship. If there is a decrease in the variables of WOM and tourism promotion, then the number of tourists will also decrease. Conversely, if WOM and promotion increase, then the number of tourist visits will also increase.

Tourism development model scenario based on tourism carrying capacity

Based on each sub-model developed, it is possible to determine the condition of tourism carrying capacity for the number of tourists in the future. Figure 5 displays a model scenario developed from the two previous sub-model components.

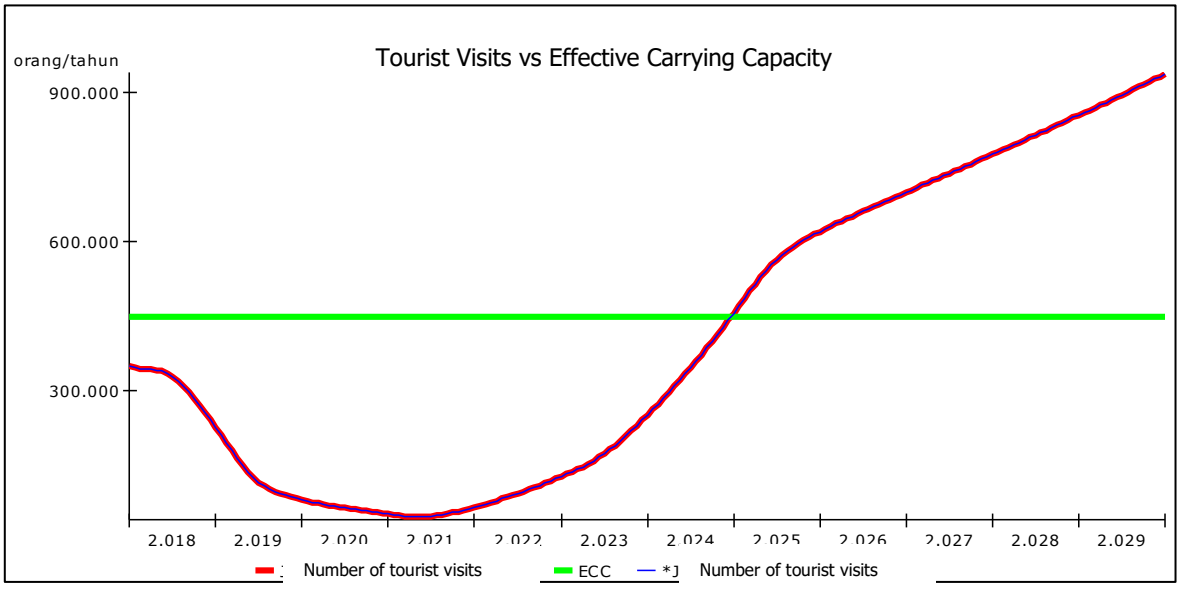

Figure 5. Comparison bertween variable (a) total tourist (b) Environmental Carrying Capacity for Ranu Pani

According to the graph, tourist capacity will be exceeded in late 2024 due to the lack of visitor control and efforts to limit the tourist arrival. To determine effective policies for developing tourism based on carrying capacity, several simulations were conducted with different scenarios.

Scenario 1: Limiting the number of tourists based on the analysis of tourist carrying capacity and tourist dynamics.

The tourism development model involves providing feedback on the effective capacity (ECC) value and implementing controls to limit the number of tourists. Specifically, the model attempts to reduce the number of daily visitors by 50% of the historical daily average through a visitor control policy. The simulation results are presented below.

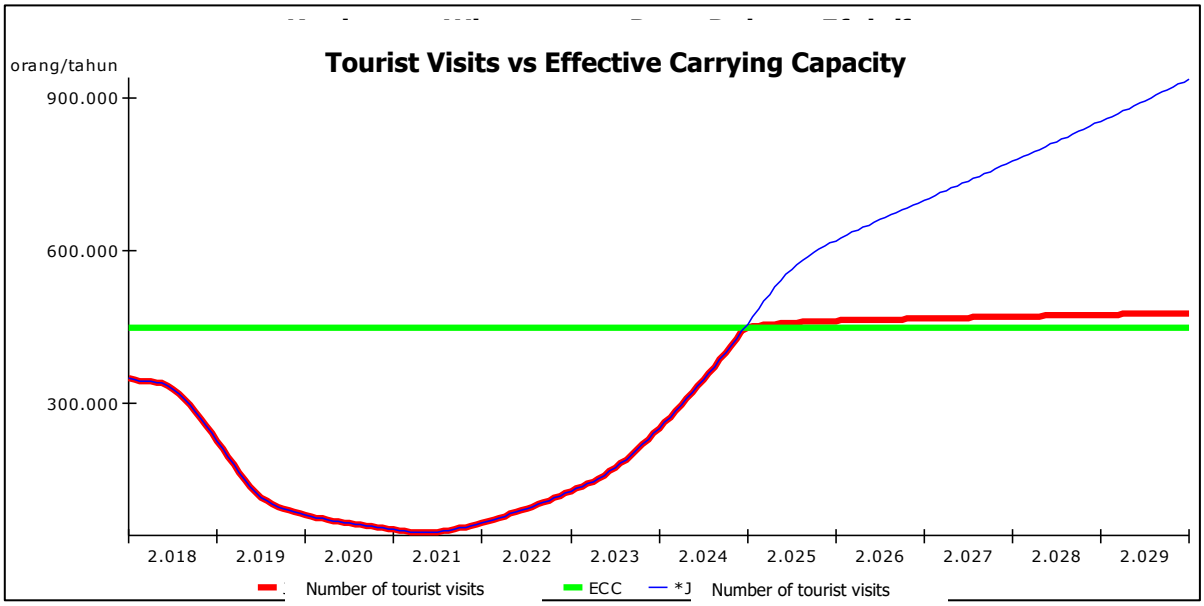

Figure 6. Scenario Model

According to Figure 6, an increase in the number of tourists is expected to reach Ranu Pani's Environmental Carrying Capacity threshold by 2024. Without concrete and effective measures, this could lead to environmental degradation. It is important to consider that the Environmental Carrying Capacity prediction from Ranu Pani has a constant value, while the tourist component is dynamic and tends to increase annually. This research proposes limiting the number of tourist visits to 50% of the total tourist capacity or Real Carrying Capacity (RCC). Referring to the graph, it is possible to exceed Ranu Pani's environmental carrying capacity even with the limitation reaching 50%. Therefore, pentahelix cooperation is necessary in the planning and management process of tourist destinations in Ranu Pani. This will ensure better maintenance, support environmental and human harmony, and promote sustainability.

As Ranu Pani is a strategic and potential tourist location, a surge of tourists during holiday times is highly likely to occur. The Lumajang Regency government predicts a potential increase in tourists during holidays, but is concerned about a potential decrease in tourist comfort. To address this, the government is currently implementing policies such as limiting camping activities to 500 people per day and restricting non-camping tourists to 1000 people per day. In addition, On The Spot (OTS) has provided entrance tickets with close monitoring from the community. The aim is to control tourist visits more efficiently and in accordance with the Environmental Carrying Capacity of Ranu Pani.

4. Research Implication

The research conducted on the measurement of Environmental Carrying Capacity (DDTL) in Ranu Pani, one of the Bromo Tengger Semeru National Park (TNBTS) Enclave areas, combined with the development of a dynamic system model, has implications for policies related to the sustainability of tourist sites. The study observed two components: (1) Tourism Support Capacity and (2) Tourist Dynamics. The Lumajang Regency Government cannot accomplish this task independently and requires support from relevant stakeholders, such as tourism awareness community group (pokdarwis), farmers, and tourists who plan to visit.

The measurement results for Environmental Carrying Capacity (DDTL) indicate that Ranu Pani has a relatively high value. The modeling results suggest that this value will remain constant despite various tourism activities in the area. According to Manning's (2002) research, measuring the Environmental Carrying Capacity (DDTL), particularly in National Parks and protected areas, assists managers and governments in formulating indicators and standards for the quality of natural and cultural resources, as well as improving the tourist experience. By calculating the DDTL and creating a dynamic system mode, the Lumajang Regency Government can monitor

and predict future conditions. This will enable the government to make more standardized and sustainable policies based on the condition of Ranu Pani from year to year.

A high score on the Environmental Carrying Capacity scale does not necessarily indicate that a tourism destination is sustainable. There is area many other factors that can also influence sustainability, such as tourist arrival, community activities, disaster, and others dependent variables. Therefore, this research also analyzes on potential additional components, including tourist dynamics. It can be said that Environmental Carrying Capacity as part of the 'supply side', and then this component (tourist dynamics) can be seen as representing the 'demand side' of a tourism destination. Tourist dynamic shows the number of tourist arrivals and the reasons why these tourists choose to visit the destination, especially Ranu Pani. Based on Peraturan Daerah Kabupaten Lumajang Number 5 Year 2018 about Masterplan on Tourism Development in Lumajang Regency 2018 – 2033, Ranu Pani is considered as Strategic Tourism Area. So, Lumajang Regency willing to boost the tourist arrival to increase tourism sector revenue and indirectly increase wellbeing in surrounding community. Ranu Pani is a nature tourism destination that is easily accessible to tourists. This is showed by the increasing number of tourists who visit during the high season, which tends to grow (excluding during COVID-19). According to the existing model, it is estimated that by 2030, the number of tourists could reach 900,000 per year or 2,500 per day. The Lumajang Regency government is investing heavily in infrastructure development to support tourism activities in Ranu Pani. The aim is to enhance tourism and boost economic growth at the local level. The Lumajang Regency government is investing heavily in infrastructure development to support tourism activities in Ranu Pani. The goal is to strengthen the tourist attraction and increase economic growth at the local level. The hope is that the tourist destination being developed will become a tourist icon of Lumajang Regency (KSDAE, 2019). The policies implemented by the Lumajang Regency government to anticipate an increase in tourist numbers are appropriate when compared to the existing system dynamics model.

The dynamic model that developed does not only indivdually calculate the two components, but also combines them so that the comparison between the two components can be known and can also formulate appropriate strategies in accordance with the policy direction of the Lumajang Regency Government. The combination of the two components showed that Ranu Pani's high Environmental Carrying Capacity value may not accommodate the projected number of tourists arrival until 2030. So, researcher developed a scenario strategy for limiting the number of tourists up to 50% per day. This strategy is in line with the recommendations of Baloch et al. (2023) and Kiswantoro et al. (2022). When there is a high level of environmental quality, it can stimulate tourist arrivals, leading to excessive tourism and irresponsible behavior in the area. The researcher's scenario confirms Butler's (1991) statement that limiting the number of tourists before the environment is overloaded supports environmental sustainability. According to the model calculation, the number of tourist visits is estimated to have reached 128,279.84 per year in 2023 and increased by approximately 40% to 251,339.11 per year in 2024. The Lumajang Regency Government can implement a limit on tourist arrival starting from 2023-2024 or during the current year, This can also be combined with improved tourism management and the development of appropriate supporting infrastructure. Primarily in making boundaries - boundaries of areas that are allowed to conduct tourism and agricultural activities and make restrictions on protected areas and special interest tourism. Socialization to the community is also very important to do along with the implementation of this policy, so that in the future there will be no conflicts due to the management of Ranu Pani. The goal is to promote Ranu Pani while also imposing restrictions to achieve a balance between Environmental Carrying Capacity and the number of tourists. This will have a positive impact on making Ranu Pani a sustainable tourist destination.

5. Conclusion And Suggestion

Dynamic model simulations created using Environmental Carrying Capacity variables can improve the focus of development planning based on predicted future conditions. Based on the model simulation results, the Environmental Carrying Capacity value at Ranu Pani remains constant, indicating a visit limit of 1,228 tourists per day according to the Real Carrying Capacity (RCC) value. The tourist dynamics component reveals that the marketing variable significantly influences the system. A decline in marketing will result in a decrease in the number of tourists visiting. Although the Environmental Carrying Capacity allows for many visitors to Ranu

Pani, specifically 1,228 tourists per day, the combined scenario of tourism carrying capacity and tourist dynamics predicts that the number of visitors in 2024 will exceed this limit. It is hoped that the Lumajang Regency Government, together with the surrounding community, will limit the number of visitors to approximately 50% per day, or 614 tourists per day. The aim is to maintain the ecosystem in Ranu Pani and ensure its sustainability in the future.

References

[1] Adawiyah, R., & Susilo, H. 2020. Pengembangan Ekowisata untuk Meningkatkan Keberdayaan Masyarakat Desa Ranupani Taman Nasional Bromo Tengger Semeru.rnal Mahsiswa Pendidikan Luar Sekolah. 9(2): 138 – 147.
[2] Akbar, A.T., & Pangestuti, E. 2017. Peran Kuliner dalam Meningkatkan Citra Destinasi Pariwisata Taman Nasional Bromo Tengger Semeru. Jurnal Administrasi Bisnis. 50(1): 153 – 159.
[3] Badan Pusat Statistik (BPS). 2021. Kecamatan Senduro dalam Angka. Kabupaten Lumajang: Badan Pusat Statistik.
[4] Badan Pusat Statistik (BPS). 2023a. Perkembangan Pariwisata September 2023. Berita Resmi Statistik No. 73/11/Th. XXVI, 1 November 2023.
[5] Badan Pusat Statistik (BPS). 2023b. Pemulihan Pariwisata Domestik Indonesia 2022. Berita Resmi Statistik No. 33/05/Th. XXVI, 2 Mei 2023.
[6] Baloch, Q.B., Shah, S.N., Iqbal, N., Sheeraz, M., Asadullah, M., Mahar, S., Khan, A.U. 2023. Impact of tourism development upon environmental sustainability: a suggested framework for sustainable ecotourism. Environ Sci Pollut Res 30, 5917–5930.
[7] Butler, R.W. 1991. Tourism, Environment, and Sustainable Development. Environmental Conservtaion, 18,3, 201 – 209.
[8] Carito, D.W., Setyobakti, M.H., Sulistyan, R.B., Muttaqien, F. 2023. Optimization of Tourism Potential in An Effort to Empower Tourism-Conscious Communities. TGO Journal of Community Development. 1(1)
[9] Dinas Pariwisata dan Kebudayaan Kabupaten Lumajang. 2019. Optimalisasi Ranu Pane dan Ranu Regulo tahun 2020. Retrived https://disparbud.lumajangkab.go.id/berita/detail/aWk%3D
[10] Direktorat Jendral Konservasi Sumber Daya Alam dan Ekosistem (KSDAE). 2019. Pengembangan Destinasi Wisata Ranu Pani Mendapatk Dukungan pemerintah Daerah Kabupaten Luamajang. Retrieved https://ksdae.menlhk.go.id/berita/5345/pengembangan-destinasi-wisata-ranu-pani-mendapat-dukungan-pemerintah-daerah-kab-lumajang.html.
[11] Ernawati, D.P. 2019. Development of the Tourism Industry as the Motor of Economic Growth in Indonesia. International Journal of Science and Society. 1(4)
[12] Kiswantoro, A., Rohman, H., Susanto, D.R., Saputro, L.E., Rohman, N. 2022. Sustainable Eco-Tourism Development Strategy as Tourism Alternative During COVID-19 Pandemic in Posong Tourism Area. International Journal of Tourism, 1, 1, 1 – 17.
[13] Manning, R.E. 2002. How Much is Too Much? Carrying Capacity of National Parks and Protected Areas. Monitoring and Management of Visitor Flows in Recreational and Protected Area.
[14] Parmawati, R., Hardyansah, R., Pangestuti, E., Hakim, L. 2022. Ekowisata: Determinan Pariwisata Berkelanjutan untuk Mendorong Perekonomian Masyarkat. Malang: UB Press.
[15] Prawijaya, T.I. 2014. Faktor Sosial Budaya Masyarakat Petani Memengaruhi Tidak Diterapkannya Sistem Terasering (Sengkedan) dalam Pertanian (Studi Kasus Sistem Pertanian Terasering di Desa Ranu Pani Kecamatan Senduro Kabupaten Lumajang). Swara Bhumi. 2(1)
[16] Prohansah, S.D., & Eprilianto, D.F. 2022. Upaya Optimalisasi Pariwisata dalam Meningkatkan Pendapatan Asli Daerah Kabupaten Magetan Menggunakan Prinsip Dasar Manajemen. Jurnal Ilmu Administrasi Negara. 10(4).
[17] Slamet, A., Raharjo, M., Samudro, B.R. 2019. Optimization of Tourism as a Development of Region and Local Economy of Sub-District Selo. International Journal of Economics, Business, and Management. 3(8).