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Indonesia Disaster Knowledge Update - April 2023

Research Publication about Disaster in Priority Tourism Destinations in Indonesia

Introduction

This **IDKU** is a part of the **preliminary process** to **develop guidelines for resilience tourism** with the **Ministry of Tourism and the Creative Economy of the Republic of Indonesia**. The findings of this IDKU offer an overview of the current state of **disaster risk management (DRM) research** and distribution across each **Super-priority Tourism Destination (*Destinasi Superprioritas Pariwisata* or DSP and Priority Tourism Destinations (*Destinasi Prioritas Pariwisata* or DPP)** location, highlight knowledge gaps, and provide suggestions for further research. The Government of Indonesia categorized several leading national tourist destinations as DSP and DPP, in addition to Tourism Destinations (DTW) across the country. To further improve tourism, especially at DSPs' and DPPs' resiliency, the Ministry of Tourism and Creative Economy of Indonesia published a ministerial regulation 10/2019, which states and emphasizes the pivotal roles of establishing a resilient tourism ecosystem through Tourism Crisis Management. There are twelve DSP-DPP studied in this IDKU, including **Lombok-Mandalika, Bromo-Tengger-Semeru, Labuan Bajo-Flores, Borobudur-Prambanan, Danau Toba, Likupang-Minahasa Utara, Bangka Belitung, Raja Ampat, Wakatobi, Kepulauan Seribu, and Morotai**.

Status	Site
Super Priority Destination (DSP)	Borobudur-Prambanan
	Danau Toba
	Labuan Bajo-Flores
	Likupang-Minahasa Utara
	Lombok-Mandalika
Priority Destination (DPP)	Bromo-Tengger-Semeru
	Wakatobi
	Morotai
	Bangka Belitung
	Raja Ampat
	Tanjung Lesung
	Kepulauan Seribu

Source: Sisparnas & Strategic Plan of Kemenparekraf (2020-2024)

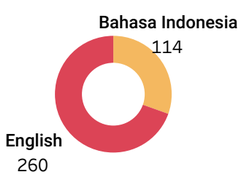
Indonesia faces various threats from natural and non-natural hazards, which might disrupt tourism activities and national economic stability. Several disasters have impacted Indonesia's economic growth in the last two decades. Earthquake and tsunami in Aceh in 2004, the volcanic eruption of Merapi and Bromo in 2010, Agung's 2017 volcanic eruption, Lombok's earthquake in 2018, Sunda Strait's tsunami in 2018, and the COVID-19 pandemic in 2020 have given a wake-up call for Indonesian governments to improve its disaster management. Although it became one of the main sectors impacted by disasters, Indonesia's tourism has not yet established a robust approach to address the issue. Hence, there is a crucial need to ensure the establishment of Indonesia safe tourism to achieve **resilience and sustainable tourism** in Indonesia.

In this IDKU, we used four main phases of the disaster management phase as a framework. **Prevention and Mitigation** consist of activities related to identifying potential disasters and risks and minimizing disaster risk through several activities such as public education, risk assessment, disaster risk reduction policy, etc. **Preparedness** consists of activities related to taking action ahead of time to be ready for an emergency. The existence of a contingency plan, availability of EWS, and community capacity also support the preparedness stage. The **Response** phase consists of activities to protect people and property in the wake of an emergency, disaster, or crisis, while the **Recovery** phase consists of activities to build-back better after a disaster to return operations back to normal.

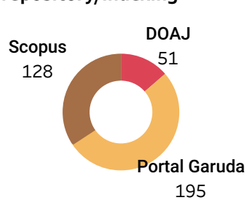
Research Articles Statistics

375 Publications | 230 Publishers | 364 Authors

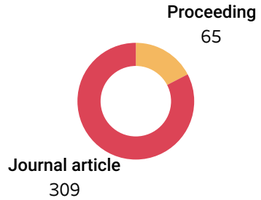
Publications by language



Publications by repository/indexing



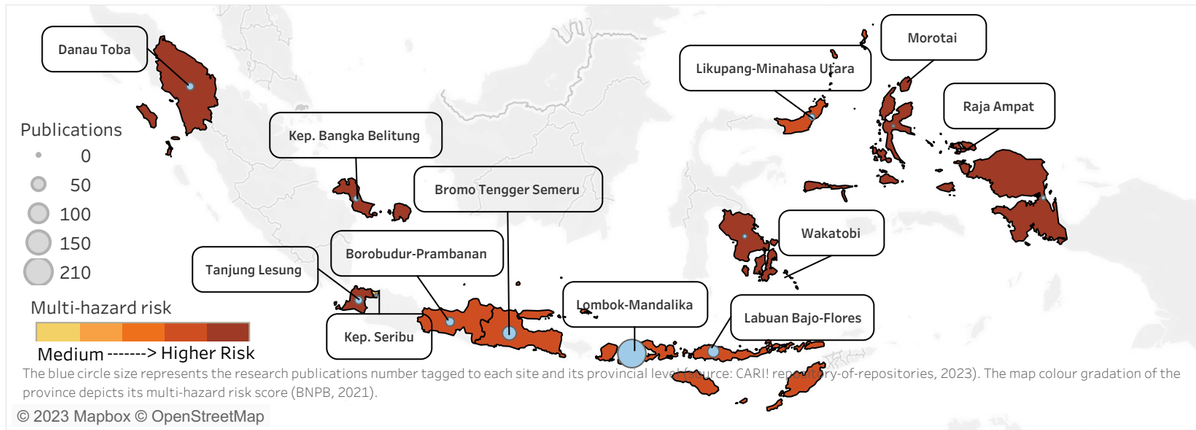
Publications by type



We examined research publications related to disasters in national priority tourism destination locations in Indonesia. The scientific articles were obtained from CARI! Knowledge Engine sourced from Scopus, DOAJ, and Portal Garuda repositories. All journal articles and proceedings were included in this analysis. Also, only articles written in English and Bahasa Indonesia were included. In total, we selected **375 publications** from 230 journal publishers to be reviewed in the subsequent analysis.

The Lombok-Mandalika is the most studied one, but only limited research is found on other locations

Research article distribution map in the DSP and DPP locations



The blue circle size represents the research publications number tagged to each site and its provincial level (source: CARI! repository-of-repositories, 2023). The map colour gradation of the province depicts its multi-hazard risk score (BNPB, 2021).

DSP & DPP wordcloud

The map and wordcloud show that the **Lombok-Mandalika** tourist destination is the most studied location, with **208 publications**. This condition is inseparable from the recent **Lombok earthquake in 2018**, which prompted researchers to study the earthquake. A similar pattern also happens in the **Tanjung Lesung** tourist destination, with **16 publications** related to the **2018 Sunda Strait Tsunami**. As one of the popular destinations, **Labuan Bajo has 35 publications**. While tourist destinations in the region of Java, such as **Bromo-Tengger-Semeru**, have **50 publications**, and **Borobudur-Prambanan** with **20 publications**. However, research in other priority tourist destination sites still **needs to be improved**, particularly in eastern Indonesia, namely **Raja Ampat, Wakatobi**, and **Morotai**. Overall, priority tourist destinations are located in administrations with medium-high multi-hazard risk class thus, it might be a concern to develop these sites by considering the aspect ..

Universitas Mataram is recognized as the most productive institution since Lombok-Mandalika become the main research lo..

Main author affiliation wordcloud

Based on the main author's affiliation, **Universitas Mataram** contributes as the most productive university with **45 research publications**. This shows that the recent earthquake that hit Lombok in 2018 prompted the university to study it comprehensively. Followed by Major & Java-based institutions like **Universitas Brawijaya** and **Universitas Gadjah Mada**, with **20 & 16 publications**, respectively. Other prominent universities with a significant number of articles are **Institut Teknologi Bandung, Institut Teknologi Sepuluh November, Universitas Sam Ratulangi Manado**, and **Universitas Muhammadiyah Mataram**. Overall, there are **147 different affiliations dominated by Indonesian institutions**, as well as several foreign affiliations that exist in this review corpus.

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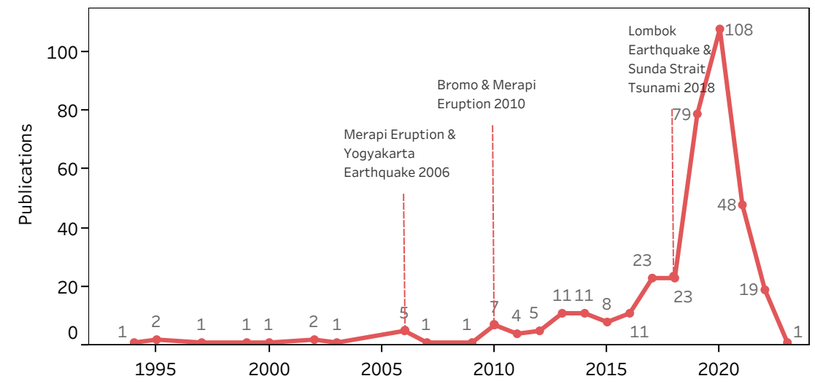
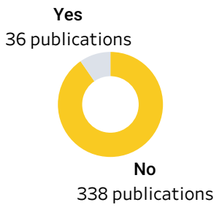
Research Growth & Descriptive Analysis

Only a limited number of research on disaster-tourism topics, despite the growing number of disaster res..

Research publication trend by year in the DSP and DPP locations



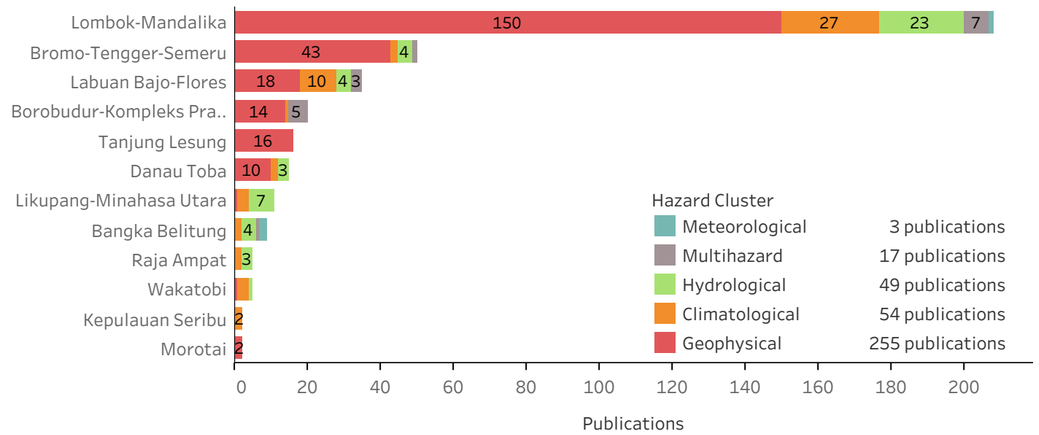
Proportion of publications related to 'Disaster' and 'Tourism'



The growth of disaster research in priority tourist destination locations continues to increase. **Substantial growth of publications was observed after 2018.**In 2019 and 2020, there were 79 and 110 research publications, respectively. This growth is inseparable from the 2018 Lombok Earthquake and the 2018 Sunda Strait Tsunami. However, there are only a small number of publications that examine both disaster and tourism topics. In the last two years, research in these locations has decreased, and attention to the topic of disaster and tourism needs to be increased in the future.

Geophysical hazard is the most researched topic

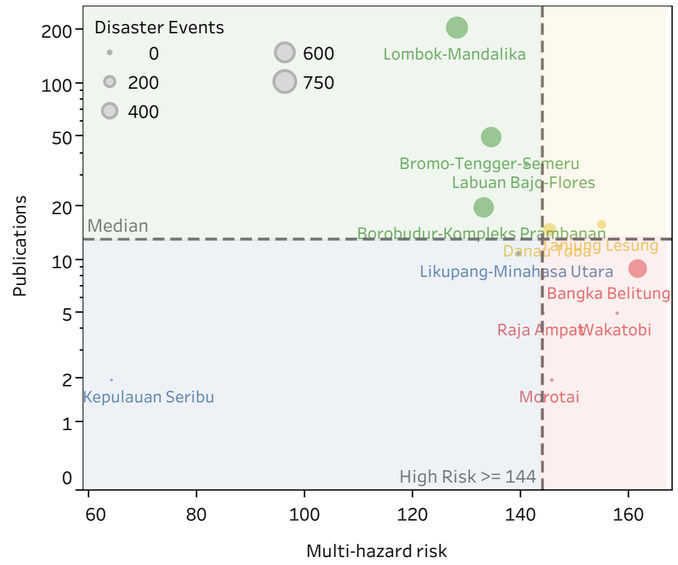
Distribution of publication by hazard cluster in the DSP and DPP locations



The distribution of research publications in tourism destinations tends to **focus** on the topic of **geophysical hazards**, such as earthquakes, tsunamis, and volcanic eruptions. The Lombok-Mandalika tourism destination has been studied the most in terms of geophysical hazards, especially earthquakes, as this was encouraged after the 2018 Lombok earthquake. Followed by climatological hazards, drought, and forest and land fires. The figure shows that tourist destinations in Nusa Tenggara have research information related to climatological hazards. Meanwhile, the distribution of other hazard clusters, which are **quite well-studied**, is **hydrological hazards** related to floods, landslides, abrasion, and storm surges. However, there is only **limited** research information related to **meteorological hazards**. Lastly, there are studies that examine multi-hazards risk in the area, which means it includes several types of hazards.

More published research is found in administrative areas with more disaster events regardless of their risk level

Quadrant plot of number of publications vs multi-hazard risk score



Category
- Less publications, higher risk
- More publications, higher risk
- Less publications, lower risk
- More publications, lower risk

We divided tourist destination sites into four groups based on the median number of publications and the multi-hazard risk score with a high-risk category limit (risk score >= 144) into a quadrant plot. The plot shows four categories, namely more publications & higher risk (yellow), more publications & lower risk (green), fewer publications & higher risk (red), and fewer publications & lower risk (blue). Additionally, we used disaster event data based on administrative areas that bind to tourist destination sites (the circle size).

Tourism destination sites located in administrative areas with higher disaster events led to more research publications on the sites. **Four** tourist destination sites are categorized as **green**, consisting of three DSP **Labuan Bajo, Borobudur, and Mandalika**, and one DPP, **Bromo-Tengger-Semeru**. There are **two** tourist destination sites categorized as **yellow** (**Tanjung Lesung** and **Danau Toba**) and **blue** (**Kepulauan Seribu** and **Likupang – Minahasa Utara**), respectively. However, **four** tourist destination sites are categorized as **red**, namely **Bangka Belitung, Morotai, Raja Ampat,** and **Wakatobi**. Meaning these four sites have high-risk areas and insufficient disaster knowledge.

Top Research Articles

Top publications related to disaster in general

10,000 Years of explosive eruptions of Merapi Volcano, Central Java: Archaeological and modern implications
Newhall C.G. | Journal of Volcanology and Geothermal Research |
Published on January 1, 2000 | Cited by 114 article(s)

Numerical simulation of the 1992 Flores tsunami: Interpretation of tsunami phenomena in northeastern Flores Island and damage at Babi Island
Imamura F. | Pure and Applied Geophysics PAGEOPH |
Published on September 1, 1995 | Cited by 55 article(s)

Damage to coastal villages due to the 1992 Flores Island earthquake tsunami
Tsuji Y. | Pure and Applied Geophysics PAGEOPH |
Published on September 1, 1995 | Cited by 45 article(s)

Top publications related to disaster & tourism

An analysis of tsunami inundation in mandalika tourism area (stage i) central lombok, west nusa tenggara
Setiawan A. | International Journal of Civil Engineering and Technology |
Published on July 1, 2018 | Cited by 6 article(s)

Reducing the risk of potential hazard in tourist activities of Mount Bromo
Meilani R. | IOP Conference Series: Earth and Environmental Science |
Published on May 16, 2018 | Cited by 2 article(s)

Impact of tsunami Sunda Strait to coastal tourism in Tanjung Lesung Special Economic Zone Pandeglang Regency Banten Province
Mulyawati L.S. | IOP Conference Series: Earth and Environmental Science |
Published on December 3, 2019 | Cited by 1 article(s)

The list above is each of the **top three publications** on disasters in general and disasters related to tourism topics in the DSP & DPP locations, ranked by citation number recorded in Scopus. When we compared the number of citations between the top three, **top publications specifically addressing DRM and tourism** still receive **little attention** from readers. **Disaster-related publications** generally attract **more interest** when viewed from the number of citations. The **main topic** of the **top publications**, in general, discusses more **historical disasters**, while the **topic of disaster and tourism** studies more about **potential hazards & mitigation** a..

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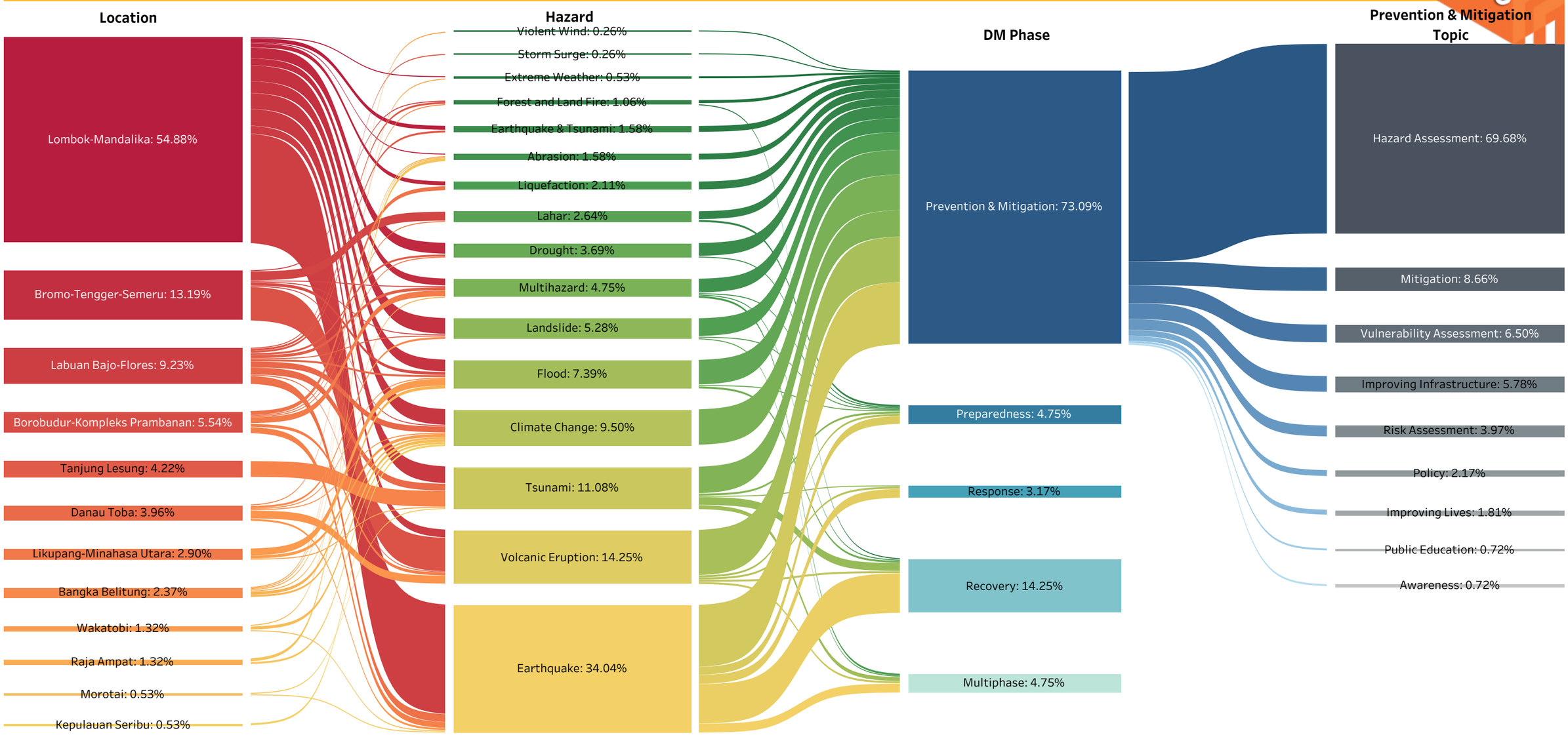
Sankey Diagram of Publications: Research Location to Hazard Type to Disaster Risk Management Phase to Prevention & Mitigation Topic



The Sankey diagram is proportionally visualizing the number of publications. The larger size of the box and the wider lines indicate a greater number of publications accounted for them. The diagram illustrates the distribution of research articles and their relations across studied locations, hazard types, disaster management phases, and prevention & mitigation topics.

This diagram is developed to determine the co-analysis relationship among the research location, the hazard type, the disaster management phase, and the prevention & mitigation topic investigated in each research article. There are **54.88% or 208 articles** of all research conducted in the **Lombok-Mandalika** area, followed by the **Bromo-Tengger-Semeru** area with **13.19% or 50 articles**, and the **Labuan Bajo** area with **9.23% or 35 articles**. **Many studies** discuss **geophysical hazards** such as earthquakes which account for **34%** of the total publications, which are mainly contributed by **Lombok-Mandalika**. In general, the potential hazards & historical disaster at tourist sites will lead their research distribution based on the type of hazard, such as **Bromo-Tengger-Semeru, Danau Toba,** and **Borobudur-Prambanan** which are associated with **volcanic hazards & historical volcanic eruption disasters**. Meanwhile, other tourist destinations make a small contribution to research with their respective hazard characteristics of each destination.

Most types of **hazard research** are related to **prevention and mitigation**, namely **73.09% (277 articles)** of the total publications. This is inseparable from disaster research which **generally** takes the topic of **hazard assessment** as seen in the flow from the prevention & mitigation phase. There are **14.25% (54 articles)** of the total publications discuss the **disaster recovery** phase. The flow depicts that the recovery phase is **largely** contributed by the **earthquake hazard**. This is related to the Lombok earthquake disaster in 2018, which prompted researchers to study the earthquake in the post-disaster recovery phase. In summary, the findings revealed a considerable gap in research on the **location of the tourism destination**, the **type of hazard**, the **disaster management phase**, and the topic of the **prevention & mitigation** phase. Therefore, there is a need for encouragement for broader research in disaster & tourism, particularly by considering the distribution of tourist locations, types of hazards, and disaster management phases.

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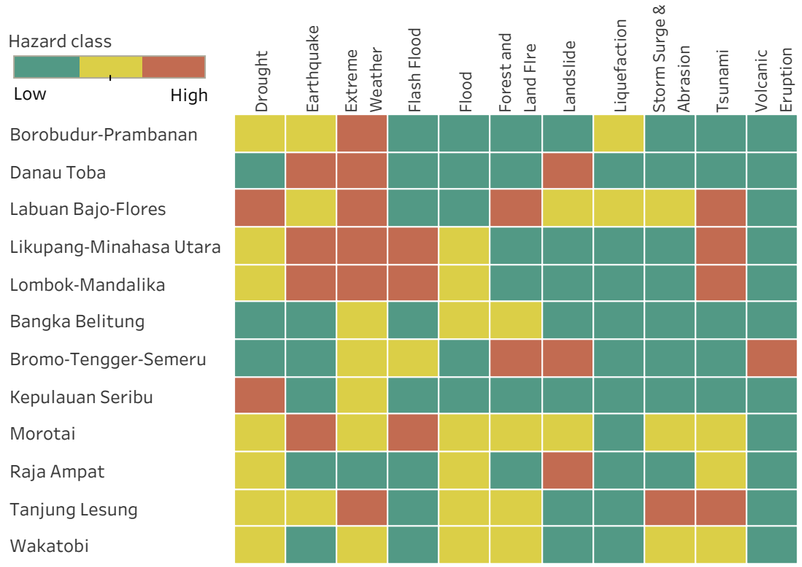
Descriptive Analysis of Research Publications on Super Priority Destinations: Borobudur, Danau Toba, and Labuan Bajo

Hazard profile in the DSP and DPP locations

Heatmap of the DSP & DPP locations based on InaRISK hazard category

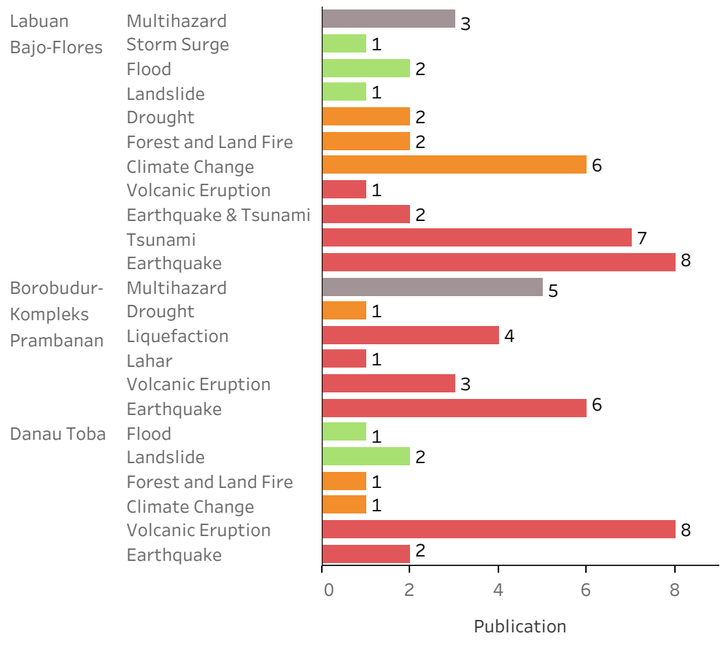


This **heatmap** shows the hazard index value sourced from **BNPB Inarisk Natural Hazard Index**. The hazard index is assessed qualitatively by looking at the location points of the DSP & DPP with their respective hazard Index.

The **Borobudur DSP** has a **moderate** category for **earthquake, drought**, and **liquefaction** and a **high** category for **extreme weather**. However, the **Borobudur & Prambanan** complex is also **prone** to **volcanic ash** from the Merapi eruption despite the **volcanic hazard index** value being categorized as **low**. The **Danau Toba DSP** has a **high** category for **earthquakes, extreme weather**, and **landslides**. While the **Labuan Bajo DSP** has a **high** category for **drought, extreme weather, forest-land fire**, and **tsunami**, as well as a **medium** category for **earthquake, landslide, liquefaction**, and **abrasion**.

Geophysical hazard is the main topic of research in the three DSP

Distribution of publication by hazard category in the three DSP locations

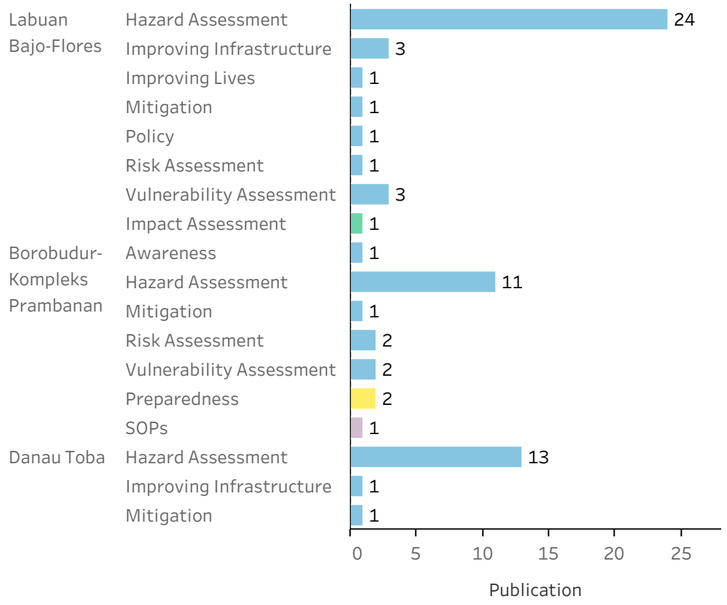


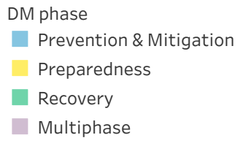
The distribution of **research publications in the three DSP locations** tends to cluster on the topic of **geophysical hazards**, such as earthquakes, tsunamis, and volcanic eruptions. In general, **the potential hazards at tourist sites will lead their research distribution based on the type of hazard**, such as D**anau Toba** and **Borobudur-Prambanan**, which are associated with **volcanic hazards & historical volcanic eruption** disasters.

Moreover, **Labuan Bajo**, located in a coastal area prone to earthquakes and tsunamis, also encourages some research on **earthquake & tsunami hazards**. The issue of **climate change** has also become a concern for researchers in **Labuan Bajo**. Meanwhile, **other** types of **hazards** tend to have **smaller numbers** when compared to geophysical clusters. Thus, there is a need to **encourage more research** on other types of hazards, especially non-geophysical, such as **climatological**, **meteorolo..**

Hazard assessment in the prevention and mitigation phase is the most studied topic

Distribution of publication by disaster management topics in the three DSP locations





The bar graph shows that **most of the research** in the **three DSP** locations discusses the **prevention & mitigation** phase of disaster management. In more detail, **many studies** specifically **examine** the topic of **hazard assessment** at the three DSP locations. There is also research that addresses other aspects of the prevention & mitigation phase, such as vulnerability & risk assessment, infrastructure, awareness, livelihoods, mitigation, and policy.

Meanwhile, the other disaster management phases are **minimally researched**, such as the **preparedness, recovery**, and **multiphase phases**. In addition, **no research** was found that discussed the **response phase** specifically. The findings show that there are **gaps within one phase of disaster management** itself and also **between phases of disaster management**. Therefore, there is a need to **encourage more research** by considering **other aspects of disaster management** to support a more comprehensive research landscape.

Summary - Disaster Risk and Knowledge Landscape on Super Priority Destinations: Borobudur, Danau Toba,..

Borobudur: **Fourteen publications** have focused on **geophysical hazards**, while only **one** and **five** publications have investigated **climatology** and **multi-hazards**, respectively. Specifically, **six publications** looked into **earthquake hazards**, **four** examined **liquefaction**, **three** focused on **volcanic eruption**s, and **one** studied **lahar**. In line with the distribution, **earthquake** and **liquefaction risks** are classified as **moderate**. In contrast, **climatological hazards**, which only **one publication** addressed, pose a **high risk** to the sites based on InaRISK. As for **volcanic hazards**, although they only have a **low hazard-risk** level, **three publications** have discussed **ancient eruption** events and categorized them in the **prevention and mitigation** phase, emphasizing **hazard assessment**. These publications explored the eruption impact, which destroyed and covered the temple sites and influenced the morphology around the sites.

Danau Toba: When looking at the distribution of publications on Danau Toba, **most** of them discuss **volcanic eruptions**. Publications related to this volcanic eruption mainly discuss the **impact** caused by the **historical eruption** of Mount Toba. In addition, the **second most publications** discuss **earthquakes** and **landslides**. In line with the hazard index, **earthquake,** and **landslide** studies are the hazards that have a **high hazard inde**x. **Earthquake-related publications** discuss **potential** and **vulnerability** based on fault activity in the **Sumatran Fault Zone**. **Thirteen publications** discuss **hazard assessment** with the disaster management phase as **prevention and mitigation** topics. Very few publications discuss **preparedness, recovery**, and **multiphase** in this region.

Labuan Bajo: Labuan Bajo, located in the coastal area, has a high tsunami hazard index and a **moderate** hazard for **earthquakes** based on the InaRISK. Moreover, as a characteristic of the islands in East Nusa Tenggara, Labuan Bajo is **prone to drough**t. At total of 35 publications discuss **disasters** in Labuan Bajo, the **majority** of which discuss geophysical hazards, especially **earthquakes,** and **tsunamis**. In connection with the earthquake and tsunami, some publications discuss the **historical disasters** of **earthquakes** and **tsunamis** that have occurred on **Flores Island**. As a dry region, **some** publications discuss **climate change, forest-land fires**, and **drough**t, with **six**, **two**, and **two** publications, respectively. However, **34 out of 35** publications discuss disasters in the **prevention and mitigation** phases, and only **one** discusses the **recovery phase**.

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