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Land Archives Crisis After the Flood Disaster in Aceh Tamiang Regency

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ABSTRACT

Background: The flood disaster in Aceh Province in late 2025 severely affected Land Office operations, with the Aceh Tamiang Regency Land Office hit hardest, floodwaters submerged the archives building for several days, damaging all vital records, including land books, measurement letters, and warkah (documents).
Purpose: The study analyzes the impact of the disaster on land archives, the evacuation process, and the restoration of these records as well as draws policy lessons for mitigating future land archive risks.
Methods: Qualitative methods were used, including observation, interviews, document study, and analysis of official reports on post-disaster archive management, covering the period from December 2025 to March 6, 2026.
Findings: Damage to the vital records disrupted land services and required complex, time-consuming recovery efforts.
Originality/Value: The case underscores the importance of building a disaster mitigation-based land archive protection and preservation system through media transfer and/or digitization of archives, improved archive storage standards, and strengthened post-disaster archive management capacity.

Keywords: Land archives; Archives restoration; Archives management

1. INTRODUCTION

Indonesia is a country with a high level of disaster vulnerability due to its geographical location at the confluence of the world's tectonic plates and its tropical climate with high rainfall (Erlina et al., 2024; Suwanda Risky et al., 2023). Various types of disasters, such as earthquakes, floods, landslides, and tsunamis, frequently occur in various regions and have a broad impact on people's lives and government administration. Recently, flooding has become one of the most frequent disasters, with increasing intensity and coverage,

particularly in lowland areas and downstream areas of river basins (Augia et al., 2024). The impact of flooding not only causes physical and economic losses but also disrupts the continuity of public services and government administration, leading to challenges in recovery efforts and exacerbating vulnerabilities in affected communities.

One sector that has received relatively limited attention in disaster management is land administration. Nevertheless, land administration systems play a fundamental role in ensuring legal certainty over land rights and supporting post-disaster recovery. The land registration process generates a range of official documents that constitute vital land records. These include the Land Book (*Buku Tanah*), which contains the legal and physical data of a registered land parcel for which rights have been established (Government Regulation of the Republic of Indonesia No. 24 of 1997); the Survey Letter (*Surat Ukur*), which records the physical characteristics of a land parcel in the form of maps and descriptive information (Government Regulation of the Republic of Indonesia No. 24 of 1997); and the Land Registration Deed (*Warkah*) which serves as documentary evidence of the physical and legal status of a land parcel and forms the basis for land registration (Government Regulation of the Republic of Indonesia No. 3 of 1997). These records are maintained as vital archives by the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (*Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional, ATR/BPN*) and function as the primary legal reference for land administration, public land services, and the resolution of land disputes. Consequently, the damage, deterioration, or loss of these archives can result in significant administrative, legal, and socio-economic consequences for both the government and affected communities (Arasyid & Putra, 2024; Simanjorang, 2024).

The vulnerability of land archives becomes particularly evident when natural disasters affect regional administrative centers. Many land offices in Indonesia continue to rely on the physical storage of land records and lack adequate disaster-resilient infrastructure and archival protection systems. As a result, these vital records remain highly susceptible to damage or loss, potentially disrupting land administration services and compromising legal certainty over land rights (Suhendi et al., 2020). During floods, archives stored on the ground floors of land office buildings are often among the first assets to be affected. This vulnerability highlights that disaster risks threaten not only physical infrastructure but also the continuity and resilience of the land administration system.

The major flooding that occurred in Aceh Province, Indonesia, in late November 2025 is a clear example of the impact of disasters on land administration. Flooding affected at least twelve land offices in Aceh Province, causing varying degrees of damage. However, the Aceh Tamiang Regency Land Office was the most severely affected area due to its location in the lowlands and downstream of the Tamiang River Basin (Putra, 2024; Suprayogi et al., 2024). The floodwaters, which lasted for several days, submerged office buildings and archives to a depth of approximately two meters, damaging all vital archives at the Aceh Tamiang Regency Land Office due to water and mud inundation.

Damage to these archives directly disrupted the delivery of land administration services. As the primary basis for these services, the records became inaccessible due to water damage and required immediate evacuation and restoration. Moreover, restoration did not guarantee that all archives could be fully recovered or returned to operational use, potentially resulting in prolonged service disruptions. This service disruption demonstrates that natural disasters can have a cascading and massive impact on public services, particularly in sectors that rely on physical archives as their primary data source (Jalinur & Rahmi, 2022). This

situation also demonstrates that post-disaster land administration recovery requires considerable time, cost, and resources.

The aforementioned arguments suggest that there are relatively few studies on disasters and their impact on the management and rescue of land archives. Disaster studies naturally focus more on aspects of victim rescue, infrastructure recovery, and economic impact. The author explores some of these studies, including Martino (2024) study, which is intriguing because it discusses the integration of disaster risk management with vital archive protection systems to ensure the availability and accessibility of important public documents after a disaster. Martino emphasized the importance of institutional preparedness and archive protection policies as part of public administration resilience. Meanwhile, Jalinur & Rahmi (2022), Nalole & Azizah (2024), and Sumrahyadi (2012) focused on the importance of preparedness systems and operational standards for archive rescue to minimize the loss of vital information for the state. Reza et al. (2022) offered a post-disaster archive management model, specifically in the area of archive management, to ensure the protection of citizens' rights after a disaster. The use of technology was one focus of the study by Unger et al. (2019). Unger highlighted the use of the Land Administration Domain Model (LADM) to support land data recovery in disaster-prone areas. This study demonstrated that digital land data standards facilitate post-disaster land administration reconstruction, particularly by improving the efficiency and accuracy of data management in the aftermath of disasters. Learning from the Korean experience, a study by Park et al. (2019) demonstrated the integration of land administration systems with disaster management in South Korea to maintain land data sustainability during disasters. In their study, Park demonstrated that a robust land administration system helps accelerate post-disaster recovery by ensuring timely access to accurate land records, which is crucial for effective recovery efforts and planning.

Although various studies have addressed the impact of disasters on physical infrastructure and archives, studies specifically examining the impact of disasters on land records and their implications for the sustainability of land administration services are still relatively limited in Indonesia. The protection of vital records, particularly land records within the framework of sustainable land services, has received little academic attention. Nevertheless, damage to records can have long-term administrative and legal consequences, including the potential for increased land conflicts due to difficulties in proving rights (Latifaturrohmah & Junarto, 2023; Mabapa & Ngoepe, 2025; Maisa et al., 2024; Mochtar, 2024).

Based on these conditions, there is a research gap regarding how natural disasters affect the land administration system, how vital records are handled post-disaster, and what policy lessons can be learned to strengthen risk mitigation for land records in the future. In this context, this study aims to analyze the impact of disasters on land records at the Aceh Tamiang Regency Land Office, examine the process of handling and restoring records post-disaster, and formulate policies to strengthen risk mitigation for land records in Indonesia. This study's insights will provide significant policy guidance for other disaster-prone developing countries, such as the Philippines, Nepal, Haiti, and others, which need to strengthen the resilience of their land administration systems against natural disasters (Unger et al., 2019; Yonson & Noy, 2020).

2. METHODS

This study employed a qualitative approach using a case study method to gain an in-depth understanding of the phenomenon of post-disaster land archive damage and archive management at a specific site, namely the Aceh Tamiang Regency Land Office. This approach was consistent with Creswell's view that qualitative research is intended to explore and understand the meanings that individuals or groups ascribe to social or humanitarian issues through data collection in natural settings and inductive data analysis (Chu, PH. and Chang, 2017; Creswell & Creswell, 2018). The case study method was selected because the research focused on a specific event, namely the catastrophic flash floods that struck the region in late 2025, particularly in Aceh, North Sumatra, and West Sumatra. Examining this event within its real-world and complex context enabled an in-depth analysis of the dynamics of post-disaster land archive damage and recovery (Yin, 2018).

The research data was obtained through direct field observations and semi-structured interviews as well as discussions with key informants, including the head of the Aceh Tamiang District Land Office, the head of the Aceh Tamiang District Rights Determination and Registration Section, and the archives manager of the Aceh Tamiang District Land Office. The author also had intensive discussions with the Post-Flood Disaster Assessment, Restoration, and Archives Destruction Team at the Aceh Tamiang District Land Office (which included representatives from the Ministry of ATR/BPN, representatives from the Aceh BPN Regional Office, and the Aceh Tamiang Land Office; the head of ANRI; the director of archive rescue; and archivists from ANRI who went directly to the field to provide assistance). The interviews and discussions were conducted from mid-December 2025 to March 2026, and all participants provided informed consent prior to the interview, and their identities were kept confidential to ensure confidentiality.

The author then utilized qualitative content analysis (or thematic analysis) of the post-flood archive management report from the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) and documentation of the archive's condition. The author's observations and utilization of various document sources were intended to obtain a comprehensive overview of the disaster's impact on land archives, the archive evacuation and restoration process, and the operational conditions of the Tamiang Regency Land Office following the flood disaster. A documentation approach was chosen because most information regarding the incident and the handling process is administratively documented in official reports from relevant agencies.

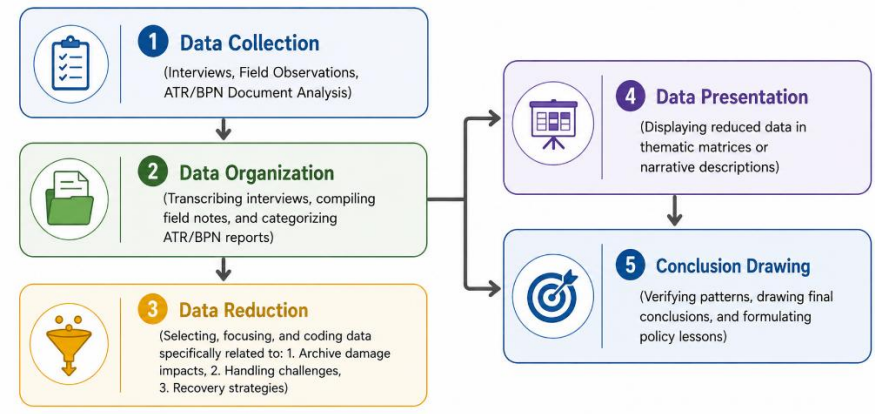


Figure 1. Data Analysis

Data analysis was conducted using a descriptive qualitative approach, with the stages of data organization, data reduction, data presentation, and conclusion drawing, as recommended in the qualitative analysis approach (Kalpokaite & Radivojevic, 2019; Walliman, 2018). The analysis process was conducted in stages to identify patterns of archive damage impacts, challenges in handling, and implemented recovery strategies. The systematic step-by-step procedure of this qualitative data analysis is illustrated in Figure 1. Through this approach, the research is expected to provide a comprehensive understanding of the post-disaster archive management process while generating policy lessons for strengthening land archive risk mitigation in the future.

3. RESULTS AND DISCUSSION

Chronology of Disasters and Their Impact

Natural disasters, including floods, landslides, and earthquakes, occurred in several areas of Aceh Province between November 24 and 28, 2025. According to data, heavy rainfall in Sumatra caused several rivers to overflow in various areas. The impact of these disasters was not only felt by the community but also disrupted the operations of various government agencies, including land offices in several districts/cities in Aceh, North Sumatra, and West Sumatra. According to official reports, at least twelve Land Office work units in Aceh Province were directly impacted, with varying degrees of damage, ranging from operational disruptions to damage to office facilities and archives. The Aceh Tamiang Regency Land Office suffered the most severe archive damage compared to other offices, as seen in Table 1 (Kementerian ATR/BPN, 2026).

Aceh Tamiang Regency was the most severely impacted area due to its geographical location in the lowlands and downstream of the Tamiang River Basin (DAS), making it highly vulnerable to flooding from upstream areas. This condition causes waterlogging to persist longer than in other areas (BPS, 2025). The Aceh Tamiang Regency Land Office, including the archives building within the office complex, was inundated with floodwaters, reaching approximately two meters for four days. All office facilities and infrastructure, including the archives storage room, were left wet and contaminated with mud (Kementerian ATR/BPN, 2026).

Table 1. Matrix of Flood Disaster Impact Scale for the Land Office

Priorities	Land Office	Damage Rate	Impact of the Archive	Operational Status	Priority Actions
PRIORITY I (CRITICAL)	Aceh Tamiang Regency	Very heavy	Vital archive submerged in mud, massively damaged	Disabled service	Mass archive restoration, archive storage space relocation, emergency service restoration
PRIORITY II (HIGH)	Langsa City	Medium	Partially wet archive	Service interrupted	Archive restoration & archive storage space repair
	Aceh Singkil Regency	Medium	Partially submerged archive	Service interrupted	Cleaning & drying of archives
	Pidie Regency	Medium	Affected equipment & archives	Service interrupted	Archive storage space recovery
	Bireuen	Medium	Archives	Service	Office operational

Priorities	Land Office	Damage Rate	Impact of the Archive	Operational Status	Priority Actions
	Regency		partially affected	interrupted	stability
PRIORITY III (MEDIUM)	North Aceh Regency	Lightweight	Relatively secure archives	Operations disrupted	Service & network recovery
	Simeulue Regency	Building damage due to earthquake	Relatively secure archives	Limited operations	Building structure repair
PRIORITY IV (ISOLATED ACCESS)	Central Aceh	Disconnected access	Relatively secure archives	Service stopped	Access & operational restoration
	Bener Meriah	Disconnected access	Relatively secure archives	Service stopped	Access restoration
	Gayo Lues	Disconnected access	Relatively secure archives	Service stopped	Access restoration
	Southeast Aceh	Disconnected access	Relatively secure archives	Service stopped	Access restoration
PRIORITY V (OPERATIONAL IMPACT)	Other land offices in Aceh	Electrical/network outages	Secure archive	Unstable service	Normalization of services

(Sources: (Kementerian ATR/BPN, 2026)

After the floodwaters began to recede, the office could not be immediately restored because mud still inundated the room to a depth of approximately 60–80 cm, and electricity and communication lines were cut off. This hampered the initial review and evacuation of archives, as the room was still unsafe to enter, and some archives were still submerged in mud on storage shelves, especially the lower levels. During a field inspection in mid-December 2025, all archives in the archives building were found to be wet due to floodwaters. Some archives had been submerged for more than three weeks, increasing the risk of permanent damage due to mold growth and decay (Kementerian ATR/BPN, 2026).

The archives affected by the flood were dynamic archives, namely those still used in carrying out the duties and functions of the Aceh Tamiang Regency Land Office (Banuwati, 2025; Hapsari & Suharso, 2021; Kowey & Poserattu, 2024; Susanti & Puspasari, 2020). The dynamic archives consist of (1) active archives, archives that are still frequently used in carrying out daily tasks and functions, for example, land acquisition archives whose process has not yet been completed; (2) inactive archives, archives that are rarely used in carrying out daily tasks and functions, for example, financial archives for past fiscal years; and (3) vital archives, archives that have critical value and are the lifeblood of the land office, which are used as evidence of activities so that they have serious impacts if damaged or lost, for example, certificates, land books, and measurement letters (Fauzi, 2025; Kowey & Poserattu, 2024; Soraya et al., 2023; Susanti & Puspasari, 2020).

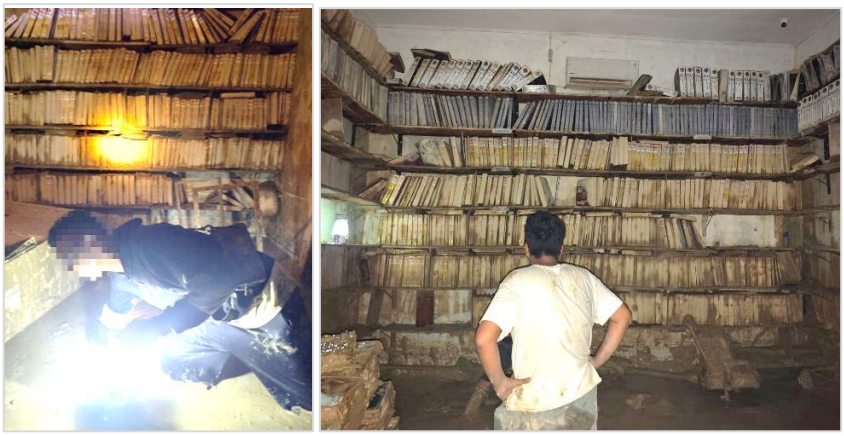


Figure 2. The Land Archive Storage Room of the Aceh Tamiang Regency Land Office after the flood disaster, showing the submerged conditions and the initial evacuation process: (Left) overview of the damaged shelves, and (Right) emergency assessment by staff inside the flooded room
(Source: Bureau of General Affairs and Procurement Services, Ministry of ATR/BPN (Left, 12-18-2025). Aceh Province BPN Regional Office (Right, 01-15-2026))

The impact of the flood not only damaged physical infrastructure but also disrupted the operation of land services for the public. Vital records, including land certificates (*Dak Ukur*), measurement certificates (*Surat Ukur*), and land records (*Warkah*), which form the basis of administrative services, could not be immediately accessed, resulting in delays in various land services. This situation demonstrates that natural disasters can have a knock-on effect on the land administration system, particularly when vital records, the foundation of public services, are damaged on a large scale (Kementerian ATR/BPN, 2026).



Figure 3. Tamiang Regency Land Office Archives Removed from Storage Room in Muddy Conditions
(Source: Aceh Province BPN Regional Office, 01-15-2026)

Condition of Affected Archives

Post-disaster identification results indicate that all vital archives at the Aceh Tamiang Regency Land Office were damaged by being submerged in floodwater and mud for several days. The affected archives included land books, measurement letters, and land registration documents, which are the primary documents proving land rights. The most severe damage

occurred to archives stored on the bottom shelves, as these storage locations were directly exposed to floodwaters that reached a depth of approximately two meters. Furthermore, the prolonged inundation caused the archives not only to become wet but also to become covered in mud, undergoing an initial weathering process before evacuation could be carried out.

These conditions indicate that the damage to the archives was not solely caused by contact with water but also by a combination of other factors such as the duration of the inundation, the mud content, and the interruption of electricity and ventilation, which led to a drastic increase in humidity. Humid environments accelerate mold growth (Rahman & Arfa, 2021) and cause paper to stick together, ink to fade, and paper structure to weaken. If not addressed promptly, this condition has the potential to lead to permanent loss of information in documents. Therefore, the initial post-disaster stage is the most critical period in determining whether archives can still be saved or have suffered total damage.

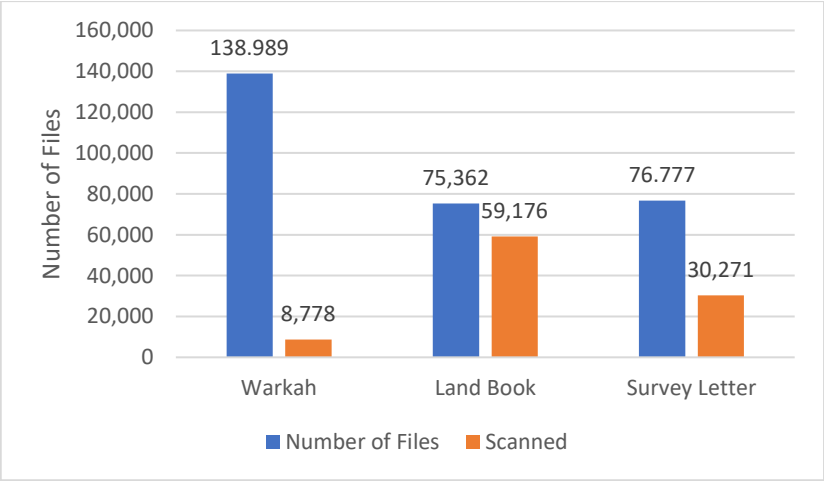


Figure 4. Number of Land Archives (Types of Archives) Affected by the Aceh Tamiang Flood (Source: Processed data from the Kementerian ATR/BPN, 2026)

Chart 1 shows that certificates are the most impacted archive group, nearly twice as much as other types of archives. Data shows that of the 138,989 certificates, only 8,778 have been scanned, or 6.31%, so electronic certificates as data backup are not yet available. Certificates are generally stored on lower storage shelves, making them more susceptible to flooding. This makes certificates the most vulnerable archive group to physical damage and information loss. If the physical archive is damaged and cannot be restored, there is no backup data available. Certificates are instruments that can explain why a land object can be certified in the name of the rights holder.

Table 2. The Impact of Post-Flood Land Archives

Archive Type	Number of Affected
Warkah	138.989
Land Book	75.362
Other Land Surveys/Books	76.777
Total	291.128

(Sources: Kementerian ATR/BPN, 2026)

Thus, the total number of affected archives reached 291,128 documents, representing the largest scale of damage to land records in recent years. In addition to the number of documents, the identification also revealed that the affected documents (*warkah*) covered approximately 804 linear meters, equivalent to 67 cubic meters.

The data presented in Graph 1 shows that documents (*warkah*) were the most affected archive group compared to other types of archives. This is understandable because documents (*warkah*) are generally stored in very large quantities as supporting records for the entire land registration process, requiring extensive storage space, and are often placed on lower shelves. This condition makes documents (*warkah*) the most vulnerable archive group in the event of a flood. In other words, the archive storage structure currently in use has not fully considered disaster risks, resulting in the largest volume of archives being the most affected.

In addition to the number of damaged documents, the identification also revealed the extent of archive damage based on their physical condition. Some archives suffered moderate and severe damage, potentially losing 804 linear meters, equivalent to 67 cubic meters, of archival information. This condition significantly impacts the difficulty of archive recovery. Archives that are only exposed to water can still be salvaged through a shorter process, eliminating the need to remove the adhering mud. Meanwhile, archives exposed to mud require a much more time-consuming, labour-intensive, and costly process: cleaning them from dirt, mold, and other sources of damage through manual washing; sterilization to prevent mold growth; drying; breaking down the archives into individual sheets; filing and wrapping them in paper casings; placing the archives in archive boxes; labelling; and creating an archive list.

Technically, mud is the primary damaging factor because soil particles penetrate the pores of the paper, causing pages to stick together and making it difficult to separate without tearing the documents. Furthermore, the microorganisms in mud accelerate document decay if not promptly addressed. This explains why some archives require longer restoration times than archives only exposed to water (Kuswati & Zulaikha, 2020). This situation also demonstrates that the speed of post-disaster archive evacuation is a crucial factor in determining the success of archive rescue.

From an archive governance perspective, this damage data demonstrates that the still-dominantly physical storage of archives without a digital backup system significantly increases the risk of data loss during a disaster. The damage to hundreds of thousands of archives is not only a technical issue in archival restoration but also has the potential to cause long-term administrative and legal consequences if the data cannot be fully recovered. Based on Graph 1, of 75,362 Land Books, only 59,176 have been scanned, or approximately 78.52%. Of 76,777 Land Measurement Letters, only 30,271 have been scanned, or approximately 39.43%. And the smallest percentage is for land records, where out of 138,989 records, only 8,778 have been scanned, or approximately 6.32% (Kementerian ATR/BPN, 2025). Thus, it shows that the damage to land records cannot be viewed solely as an administrative loss but also as a threat to the sustainability of land services and the legal certainty of community land rights. The scale of the damage also indicates the need for a change in approach to land records management, particularly through strengthening disaster risk mitigation, improving archive storage standards, and accelerating media transfer and/or digitization of land records nationally.

Disruption of Land Office Operations

In addition to causing physical damage to buildings and archives, the flooding that hit Aceh Tamiang Regency also disrupted overall office operations. High water levels caused power outages, disrupted communication networks, and temporarily made road access to the office impassable. This situation prevented office activities from proceeding as intended, while some employees were directly affected by the disaster and had to evacuate to temporary shelters. This situation demonstrates that disasters not only damage physical facilities but also paralyze public service functions for a relatively long period of time (Kementerian ATR/BPN, 2026).

These operational disruptions directly impacted land services to the public. Official reports indicate that land services were disrupted due to unstable networks and power outages in various affected areas. Even at several other land offices in Aceh that were not directly affected by the floods, services were still disrupted due to network and power outages, thus hampering land administration services at the regional level. This situation indicates that land services are still highly dependent on electricity infrastructure and communication networks, so disruptions to both directly impact public services (Kementerian ATR/BPN, 2026).

At the Aceh Tamiang Regency Land Office, specifically, the flooding caused a complete shutdown of land services to the public. This is reflected in an official letter from the head of the office on January 5, 2026, requesting assistance from the local government to clean the office building so that services could resume. The request indicated that by early January 2026, the office had not fully recovered, and services were unable to operate normally because the building and office environment still required post-flood cleaning. In other words, restoring office operations would take more than a month from the time the flood occurred in late November 2025 (Kementerian ATR/BPN, 2026).

Recovery efforts were then carried out in stages through building cleaning, relocation of archives to temporary rescue locations outside Aceh Tamiang, and implementation of archive restoration that began in January 2026 and will continue until June 2026. This activity is supported by a joint team from the center (Kementerian ATR/BPN, 2026) and the National Archives of the Republic of Indonesia (ANRI) as well as additional personnel from the National Land Institute (STPN). Although the archive restoration process has been underway, land services cannot immediately return to normal because access to the archives that form the basis of services is still in the recovery stage. This condition shows that operational disruptions to land offices due to disasters do not only occur during the emergency phase but can have medium-term impacts until the process of restoring infrastructure and vital archives is completely completed (Kementerian ATR/BPN, 2026).

Archives Evacuation and Restoration Process

a) Evacuation and Temporary Storage of Archives Following the Flood

After the floodwaters began to recede and access to the Aceh Tamiang District Land Office became accessible, the initial stage of archives management involved evacuating the archives from the previously flooded storage building. This process could not be carried out immediately after the flood because the room was still filled with mud and the floor was slippery and unsafe for staff. Furthermore, some archives were still wet and covered in mud, requiring careful handling to prevent further damage to the documents during their removal.

Therefore, the evacuation was carried out in stages once the building's conditions allowed entry.



Figure 5. Illustrates the evacuation of archives from the Tamiang Regency Land Office (Source: Aceh Province BPN Regional Office, 01-15-2026)

Evacuating archives was a significant undertaking, as the affected archives numbered hundreds of thousands of documents in varying physical conditions. Many of the mud-soaked archives stuck together and became heavy due to water absorption, requiring additional labor and considerable time. Furthermore, the transfer of archives must consider the risk of further damage if documents are moved in excessively wet conditions without adequate protection. Therefore, archives were moved selectively, prioritizing those that could still be salvaged (Suliyati, 2017).

According to the post-disaster response report, the successfully evacuated archives were then moved out of the affected area to a safer, temporary storage location. The first archives to be rescued were the Land Books and Measurement Letters, which were then evacuated to Langsa Regency. Langsa Regency was designated as a temporary evacuation site because the distance is not too far and the road is accessible by four-wheeled vehicles. Due to inadequate space, the Land Books and Measurement Letters were then moved to Kampung Mulia, Banda Aceh, for restoration. The *Warkah* archives were the last archives to be rescued, as they were stored at the bottom of the archive shelves and were submerged in the mud for a considerable period. *Warkah* was then evacuated to Langkat Regency, North Sumatra Province. The relocation outside of Aceh Tamiang was necessary because the local environmental conditions were not yet fully stable and the available storage facilities were not adequate to protect the archives from further damage. The use of a temporary storage location outside the affected area was crucial to ensure the archives could be quickly stabilized before entering further restoration.

This temporary storage location served as a transit point for the archives prior to the cleaning, drying, and restoration processes. During this stage, the relocated archives were separated based on their level of damage to determine the next step in their handling. Archives exposed only to water were handled through a drying process, while archives covered in mud required further cleaning before drying. This process aimed to prevent further damage from humidity and mold growth (Rahman & Arfa, 2021; Susilowati & Nashiroh, 2022).

The evacuation and transfer of archives to a temporary storage location outside the disaster area demonstrated that post-disaster archive management requires cross-regional coordination and adequate logistical support. Without prompt evacuation, archives remaining in a humid environment could potentially suffer permanent damage within a short time. Thus, the evacuation and temporary storage phase is a crucial phase in the post-disaster land records rescue process.

The experience of evacuating archives from Aceh Tamiang to Langkat demonstrates that the readiness of alternative storage locations is a crucial factor in land records risk management. Going forward, the existence of backup storage facilities in safer areas should be part of the national mitigation strategy so that vital state records can be quickly relocated in the event of a disaster without waiting for a prolonged emergency situation in the affected area.

b) Archive Restoration

Following the evacuation of the *Warkah* archives from Aceh Tamiang to a temporary storage location in Langkat Regency, North Sumatra, the next phase, the primary focus of which is the implementation of archive restoration. Archive restoration is the act of physically repairing archives or documents that have suffered damage, deterioration, or decay. The goal is to restore their physical condition as closely as possible to their original state and ensure that the information contained therein remains legible and usable (Feather, 1993; Harvey, 2008). The restoration of the Kantah Tamiang Regency archives was carried out to save archives that were still recoverable after being damaged by water and mud. This process was crucial because most of the archives were wet and dirty and had sheets stuck together due to mud and high humidity during and after the flood.

Based on the condition of the archives as previously described, cleaning and handling of the archives were necessary to remove dirt, prevent mold growth, and repair damaged archives. The equipment required for this activity includes the following:

a. Tools used to clean archives of dirt: running water, a soft brush, a spatula, and/or tweezers;
b. Tools used to prevent mold growth: 70% alcohol or thymol;
c. Tools used in the archive drying process: non-woven paper, fans, portable heaters, drying racks, and/or trays;
d. Tools used to repair damaged archives: film-retaining film and/or Japanese tissue;
e. Tools used to re-store archives: casing paper, macramé rope, archive boxes, labels, and/or markers; and
f. Personal protective equipment (PPE): gloves, boots, masks, and/or aprons.



Figure 6. The condition of the Kantah *Warkah* archive of Aceh Tamiang Regency which was moved to a shophouse in Langkat Regency, North Sumatra.
(Source: Bureau of General Affairs and Procurement Services, Ministry of ATR/BPN, 01-05-2026)

The restoration work was carried out by a joint team consisting of officers from the Land Office, central technical staff, archivists experienced in post-disaster archive rescue, and students from the National Land Institute (STPN). According to daily restoration activity reports, the work involved several main stages: sorting archives based on the level of damage, washing muddy archives, untangling stuck documents, drying them, reassembling them into protective casings, and repackaging them into storage boxes. These stages were carried out systematically to minimize the risk of further damage during the restoration process.

The archive washing process required the most care, as the documents were fragile due to prolonged immersion in water. The washed archives were then dried using natural drying methods or simple equipment available at the temporary storage location. Once the documents were dry, they were separated into bundles, reassembled, and then placed back into protective archive cases before being placed in new storage boxes. This process was relatively time-consuming, as each bundle of archives had to be individually inspected to ensure the information contained within was still readable and reusable. Based on restoration progress data, as of the reporting period of March 6, 2026, approximately 391 archive boxes, equivalent to approximately 78.2 linear meters of archives, had been restored by the entire team (11.22% of the total archives requiring restoration). Meanwhile, approximately 3,500.5 archive boxes, equivalent to approximately 700.1 linear meters of archives, remained unrestored. This data indicates that the volume of archives still requiring treatment is significantly greater than the volume of archives successfully restored in the initial stages of restoration activities. The following is a summary of archive restoration progress based on activity reports:

Table 3. Post-Disaster Archive Restoration Progress in Aceh Tamiang

Categories Archives	Quantity (Box)	Meter Linear
Archives completed restoration	391	78,2 m
Archives have not been restored	3.500,5	700,1 m
Total archives affected	4.020	±804 m

(Source: (Kementerian ATR/BPN, 2026)

The data shows that the initial restoration completion rate was relatively low compared to the total volume of affected archives. This phenomenon is due to the varying degrees of damage to the archives. Archives exposed only to water were restored relatively quickly, while those covered in mud required a much longer washing and page separation process. Furthermore, limited restoration personnel and drying facilities also impacted the speed of the archive restoration process.

The activity report also noted various obstacles encountered during the restoration process, including the discovery of archives that had dried out but were still attached, requiring manual separation; limited space for drying archives; and the need to prioritize which archives should be saved first. Therefore, the restoration team implemented a phased approach, prioritizing archives that were still in a condition that could be restored quickly to prevent permanent damage.



Figure 7. The process of cleaning the *warkah* using clean water flows with the intensity of small water flow so that the archive is not damaged
(Source: Bureau of General Affairs and Procurement Services, Ministry of ATR/BPN, 01-17-2026)

Overall, the post-disaster archival restoration process in Aceh Tamiang demonstrates that restoring vital land records is a complex and time-consuming undertaking. The damage, spanning hundreds of linear meters of documents, underscores the untimely completion of post-disaster management. This situation also serves as an important lesson that risk mitigation efforts, including digitizing archives and improving disaster-resistant archive storage standards, are urgently needed to reduce the risk of similar archive damage in the future.



Figure 8. The *warkah* that has been cleaned is separated then placed on a drying rack, then put in an archive box
(Source: Bureau of General Affairs and Procurement Services, Ministry of ATR/BPN, 01-16-2026)

c) Obstacles to Archives Handling and Their Impact

Based on the archive restoration progress report documented in the activity work report sheet, obstacles to archive handling are not only technical but also involve operational and managerial aspects during the restoration process. Field data indicates that the main problem at the restoration site arose when the dried archives were still stuck together due to hardened mud between the documents. This condition caused the document separation process to be very slow, as each sheet had to be manually separated to avoid tearing the archives. Furthermore, it was found that several archives that had undergone the washing and drying stages still required further processing before they could be stored again, as their physical condition was not yet stable. Documents that were stuck together or slightly damaged still required additional handling to maintain readability. This situation demonstrates that archive restoration does not stop at the drying stage but requires further processes that require more time and effort.

Field data also indicated that limited workspace and drying facilities prevented the restoration process from being carried out simultaneously on all affected archives. Archives that had been washed had to wait for their turn to dry, resulting in a backlog of work. This situation caused the restoration process to proceed slower than needed in the field, especially considering the hundreds of linear meters of affected archives. Activity records also indicate that limited restoration personnel slowed down the archive handling process. The number of available personnel was not commensurate with the volume of archives that needed to be restored. Consequently, the restoration team had to prioritize which archives to handle first, especially those that were still in a condition that could be restored quickly to prevent permanent damage.

To overcome this obstacle, the Restoration Team implemented a phased approach, prioritizing archives to be restored first. Archives that had been washed but were still attached were manually separated before being reassembled. This strategy aimed to ensure that archives with a high chance of recovery could be immediately rescued before further damage became severe. In addition to prioritizing, the team also reorganized the restoration workflow to make the washing, drying, and arrangement of archives more efficient. Archives that were in stable condition were immediately placed back into protective cases and repackaged to reduce the risk of further damage. This approach helped expedite the stabilization of some archives, despite the still-significant number of affected archives (Attachment to Regulation of the Minister of ATR/KBPN Bo.2/2026).

Overall, the obstacles encountered demonstrate that the post-disaster archive restoration process depends not only on document recovery techniques but also on work management, facility availability, and human resource capacity. Without prior mitigation planning, post-disaster archive management becomes a lengthy process that requires significant costs and effort. Therefore, the experience of Aceh Tamiang provides an important lesson: mitigating risks to land archives needs to be prepared before a disaster occurs, not only after the archives have been damaged.

Table 4. Mapping Obstacles, Constraints, and Solutions for Post-Disaster Archive Management

Obstacles/Obstacles/Problems	Impact on the Field	Solution/Action
Archives that have dried are still sticking to each other	The restoration process is slow and risks damaging documents	Manual separation of archives before reorganization
The washing archive is not in stable condition	Archives cannot be saved immediately	Re-handling before packing
Limited drying space and means	Archive waiting for the drying queue	Restoration workflow reset
The volume of the archive is very large	Restoration lasted a long time	Pre-prioritizing restored archives
Limited restoration expert/skilled	The recovery process is slow	Task division and handling priorities

(Sources: (Kementerian ATR/BPN, 2026)

Based on the constraint mapping in Table 4, it is clear that most obstacles to archive restoration are not solely caused by physical document damage but also by limitations in preparedness systems and supporting infrastructure for post-disaster archive management (Jalinur & Rahmi, 2022; Sumrahyadi, 2012). Problems such as stuck-together archives, limited drying space, and a lack of restoration personnel indicate that the scale of archive damage far exceeds available handling capacity at the regional level (Panagiotis & Loukas, 2022). This means that the primary issue is not simply how to restore damaged archives, but how to develop a mitigation system capable of reducing the burden of restoration when a disaster occurs. Without a shift from a reactive to a preventive approach, every disaster has the potential to cause large-scale archive damage, which invariably requires a lengthy and expensive restoration process.

Lessons Learned and Policy Recommendations

Based on the constraint analysis and experience of post-disaster archive management in Aceh Tamiang, a strengthened national policy for land archive protection is needed, focusing not only on post-disaster archive recovery but also on mitigation efforts before a disaster occurs. This experience demonstrates that the readiness of alternative storage facilities, the availability of restoration personnel, and an archive backup system are crucial factors in reducing the risk of land data loss, which directly impacts public services and legal certainty over land rights.

Furthermore, the need to accelerate the digitization of land archives is becoming increasingly urgent. Reliance on physical archives significantly increases the risk of data loss during a disaster. Digitization, coupled with a data storage system in different locations, will enable land data to remain accessible even if physical documents are damaged. Therefore, the Aceh Tamiang experience should serve as momentum for the formulation of a more systematic national policy for mitigating land-archive risks that is integrated with the national

disaster management system. Based on the research findings, several policy recommendations that can be considered include:

a. Accelerating media transfer and/or digitization of land archives, particularly vital records such as land books, measurement letters, and *Warkah*;
b. Building or adapting disaster-resistant archive buildings, especially in disaster-prone areas;
c. Dispersed storage of archive backups (in different regions) as a regional risk mitigation measure;
d. Developing standard operating procedures (SOPs) for post-disaster archive evacuation and rescue that can be applied uniformly across all work units; 4.
e. Strengthening the competency of archivists and archive managers, including training in post-disaster archive handling; and

Integrating the protection of vital archives into regional and national disaster management systems so that archives become part of the protected objects in every disaster contingency plan.

4. CONCLUSION

The Aceh Tamiang floods demonstrate that damage to land records not only results in the loss of administrative documents but also exposes the vulnerability of Indonesia's land administration system, which still relies on physical records. Large-scale damage to records disrupts land services, increases the risk of land disputes, and weakens the legal certainty of land rights for affected communities. These research findings indicate that post-disaster records management is still dominated by a reactive approach through the restoration of damaged records, while preventative efforts to reduce the risk of damage before a disaster occurs have not been prioritized. This situation indicates that the problems faced are not solely related to the capacity for archive restoration but also to the suboptimal risk mitigation system for land records within the national land administration system.

Furthermore, this research confirms that land records constitute legal infrastructure that plays a strategic role in ensuring land rights security and therefore needs to be positioned as a key component of disaster risk management policies. Strengthening archive protection through digitization, media transfer, backup storage, and the integration of disaster mitigation into land records management are urgent steps to increase the resilience of state administration amidst the increasing disaster risk due to climate change. In addition to providing empirical contributions regarding the impact of disasters on land administration, this study also opens up opportunities for further research on the relationship between archive damage, land conflicts, legal certainty of land rights, and the effectiveness of disaster-resilient land archive management models.

AUTHORS' CONTRIBUTIONS

Diah Retno Wulan: Writing oiginal draft preparation. Ideas; formulation or evolution of overarching research goals and aims. **M. Nazir Salim:** Writing oiginal draft preparation. Ideas; formulation or evolution of overarching research goals and aims.

CONFLICT OF INTERESTS

We state that there are no known conflicts of interest linked with this publication, and that there has been no significant financial assistance for this work that could have influenced its outcome.

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