

## **Strengthening libraries emergency preparedness and response**

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### **A Practical Wind Tunnel Method to Protect Water-Damaged Documents**

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#### **Abstract:**

The documentary heritage that is systematically deposited in archival repositories may be accidentally damaged due to human error. The National Library of Sri Lanka (NLSL) had a renovation of its central air conditioning system in 2018, and suddenly water leakage occurred from its duct's line to the newspaper collection deposited on the ground floor. The leakage had occurred from the night to the morning for 8 hours when the incident was detected by the maintenance team of NLSL. Fortunately, the newspapers were deposited on shelves, enclosing them in archival boxes.

The six newspaper boxes kept on the ground temporarily were more badly damaged than the three boxes deposited on the bottom of the shelves. The archival boxes served as a buffer to minimise the damage to the newspaper bundles. The newspaper bundles were classified according to their damage level: high, medium, and low. Drying documents within 72 hours to inhibit mold growth on the newspaper is the main strategy used by conservators to preserve wet documents. The natural air drying was impossible due to the continuous rain that fell during that period, which saturated the environment with moisture. During that time, the southwest monsoon rains were boosted. Even though natural air drying is preferred, the technical refining version of freeze drying or vacuum freeze drying is recommended as a conservation treatment for water-salvaged documents a newly designed air-drying tunnel was used due to a lack of technical instruments and because it was impossible to carry out the natural air-drying process in bad weather conditions.

The water-damaged newspaper bundles (each bundle contains 15 newspapers) were placed on an archival board, which was placed on the ground underneath a wooden bench (2 W x 2 H x 7 L feet). The four newspaper bundles were kept underneath the bench, with three inches between them. Then, a wooden bench was covered by a 1 mm-thick black polyethylene sheet so that a tunnel could be opened from both ends. A 100-watt tungsten bulb was fixed 11/2 feet away from one opening. A table fan was fixed next to it. The newspaper bundles did not get direct light because black polythene was the outer layer of the tunnel. The archival board (4 mm) was laid on each newspaper bundle, and a 2 kg wooden brick was placed on it. The dry air generated as a result of the heat emitted from the

tungsten bulb and blown by the table fan completely dried the most damaged newspaper bundles after 10 hours of operation. The medium-damaged newspaper took 7 hours, and the rest took 5 hours to dry completely. The newspaper bundles were flattened to avoid wrinkling under the weight placed on them.

This artificial air-drying tunnel can be used in small libraries and archives whenever necessary instruments or natural air drying are not practical. Over-dehydration damages the documents; therefore, careful monitoring is essential when operating the system.

**Keywords:** water salvaged documents, wind tunnel method, drying wet documents.

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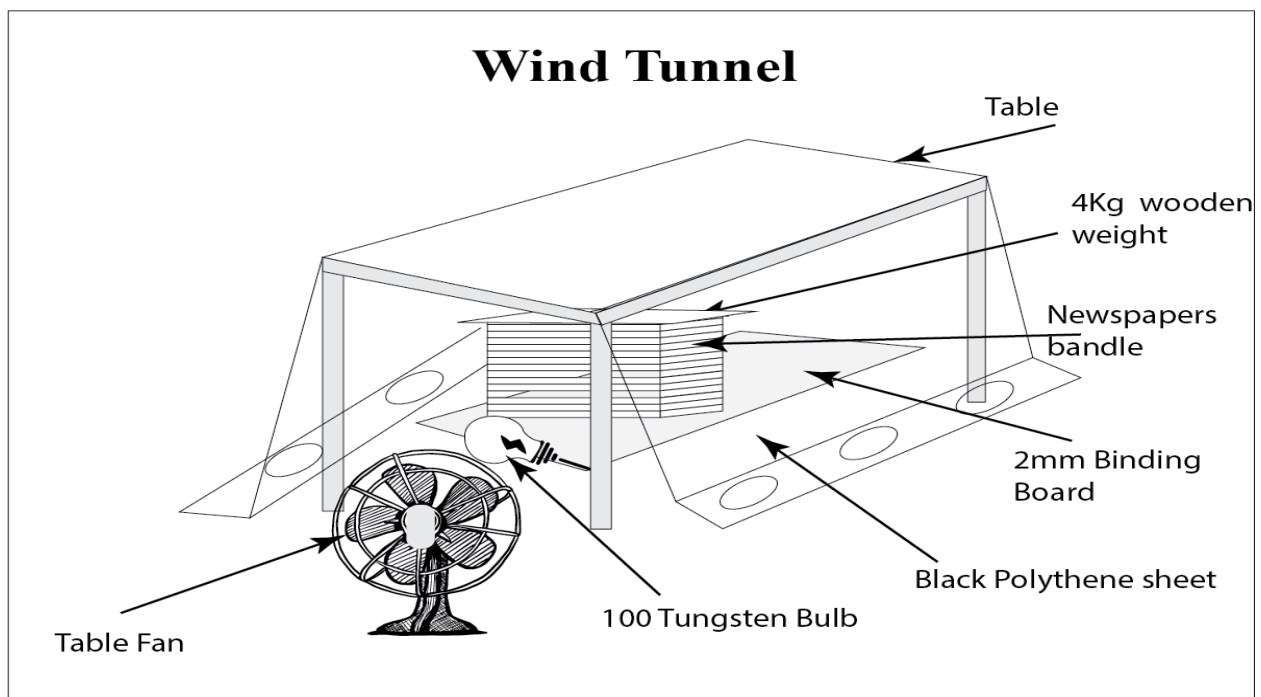
## Introduction

Sri Lanka is an Island located in the Indian Ocean. The Island gets rain throughout the year due to seasonal moons and winds that occur across the island. From the topography, the central part of the country is highland, and the surroundings are lowland. During the rainy season, the lowlands are flooded, and earth slides occur in the highlands. The highlands get more than 5000 mm of precipitate annually, and the lowlands get 2500 mm–5000 mm of precipitate annually. The Bay of Bengal is a large but relatively shallow embayment of the northeastern Indian Ocean, occupying an area of about 839,000 square miles (2,173,000 square kilometres). It is bordered by Sri Lanka and India to the west. The climate of the Bay of Bengal is dominated by the monsoons. The wind pressure created cyclones annually when it stimulated monsoon winds. Sri Lanka has a rich documentary heritage that dates back to the 3<sup>rd</sup> Century B.C. The ancient writing medium of palm leaf manuscripts is a precious material deposited in many temple libraries and special libraries across the country. Most of them are considered archaeological artefacts according to the antiquity ordinance in Sri Lanka. The papers were introduced to Sri Lanka in the 18<sup>th</sup> Century A.D., and the library materials produced are still well preserved in many libraries. Modern library materials, both analogue and digital, are also part of the library collections of many libraries. In this current situation, very precious library materials stored in libraries across Sri Lanka are prone to damage by water disasters on any occasion during the year.

The librarian pays full attention to protecting the collection from water disasters. Libraries are normally constructed on high land in the village or city. The school libraries in the coastal part of the country and the lowlands are encouraged to be located on the first floor of the storied school buildings. The National Library organises workshops annually to make the library community aware of the protection of salvage documents. The tsunami hit the southern coast of the Island in 2004. It was the biggest disaster ever to happen in the country, with many libraries destroyed and thousands of civilians killed. In this context, the documentary heritage of the country is prone to disasters related to water. The absence of relevant modern technologies at the main heritage institutions, such as the National Archives, National Museums, and National Library, to restore the water-damaged documents makes the situation worse. Documents can be damaged not only by natural disasters but also by man-made disasters. The documentary heritage that is systematically deposited in archival repositories may be accidentally damaged due to human error. The National Library of Sri Lanka (NLSL) had a renovation of its central air conditioning system in 2018, and suddenly water leakage occurred from its duct line to the newspaper collection deposited on the ground

floor. The leakage had occurred from the night to the morning for 8 hours when the incident was detected by the maintenance team of NLSL. Fortunately, the newspapers were deposited on shelves, enclosed in archival boxes. As the country has a tropical climate, winds and sunshades can be used to dry the salvage documents. But it takes much time for the process, and many librarians adopt this traditional wind and sunshade method to dry-slavage documents. Drying the wet documents in a high-efficacy way is a problem for libraries in the absence of modern document drying technologies. An experimental set-up was designed to speed up and increase the efficacy of the natural drying process of wet documents as a solution for librarians.

The water-damaged newspaper bundles (each bundle contains 15 newspapers) were placed on an archival board, which was placed on the ground underneath a wooden bench (2 W x 2 H x 7 L feet). The four newspaper bundles were kept underneath the bench, with three inches between them. Then, a wooden bench was covered by a 1 mm-thick black polyethylene sheet. So that a tunnel could be opened from both ends. A 100-watt tungsten bulb was fixed 11/2 feet away from one opening. A table fan was fixed next to it. The newspaper bundles did not get direct light because black polythene was the outer layer of the tunnel. The archival board (4 mm) was laid on each newspaper bundle, and a 4 kg wooden brick was placed on it. The dry air generated as a result of the heat emitted from the tungsten bulb and blown by the table fan completely dried the most damaged newspaper bundles after 10 hours of operation. The medium-damaged newspaper took 7 hours, and the rest took 5 hours to dry completely. The newspaper bundles were flattened to avoid wrinkling under the weight placed on them (Figure 1).



**Figure 1 Experimental setup – Wind Tunnel**

## **Results and Discussion**

This method has several advantages over the traditional convention method. The documents can be dried within three days, even in a rainy or wet environment. The convention method may take more than three days before the mould germinates on the paper surface of the document that was wet for more than 72 hours or three days. The slight heat generated by the hundred-watt tungsten bulb dried the air blowing from the table fan fixed in front of the wet collection. The dry blowing air increases the drying process of documents. The sun-shade drying process, or traditional method of drying, does not dry the document at a constant level. The level of sun rays, the cloud dispersion in the sky, and wind speed govern the drying rate of the document. The drying process can't be controlled by ourselves. Careful monitoring is essential for this conventional method. The new method introduced by this study could solve several drawbacks of the conventional method. With this method, the air flow can be controlled by regulating the speed of the table fan, and the air drying process can be controlled by the type of bulb. The wet documents can be dried in three days by controlling air speed and changing the bulb types. Unlike the conventional method, the removal of moisture vapour from the document is constant in this method. That could avoid wrinkling the document when it is drying. The 4kg weight on the document creates a constant force on the ground. It helps to flatten the documents without additional force and avoid deforming or wrinkling them when drying. This wind tunnel method is cheaper than the conventional method, as a number of blotting papers are to be removed and placed from time to time when drying the documents. This method reduces the labour force and labour costs. In many cases, in Sri Lanka, during the rainy season, salvage documents can't be dried using the traditional method until the outside environment settles into a normal rainy environment. Even though the rain settles on occasion, some cloudy and moist conditions remain for several days. On such an occasion, the documents can't be dried. This new wind tunnel method is very useful on such occasions, as the instruments can be set up indoors in any condition, even in rainy situations. To get maximum benefit, the binding board (2 mm) layer on the ground where documents are placed is placed every three days. If the binding board remains wet for more than three days, mould prone to germinating on its surface may affect the documents to be dried. Not only paper materials but any type of library material can be dried using this method. The material close to the table fan is drying faster than the others, so the drying set of documents can be removed and replaced with new set-out documents, and the other end of the instrumental set-up can be used while running the drying process. Over-dehydration damages the documents; therefore, careful monitoring may be useful for operating the system. The freeze drying process is the technical sound method available in the world for the treat water salvage documents. The libraries in developing countries, small libraries and private collection owners might useful this method in an emergency situation to restore their precious documents.

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