Water fire suppression system to protect a valuable Herbarium Collection – is this folly or the future for herbaria?

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Introduction

The Western Australian Herbarium (PERTH) is uniquely positioned as it is located within a world biodiversity hotspot. PERTH services the vast State of Western Australia, which covers 2.5 million km2 and has a tropical climate to the north, a winter-wet south and arid desert interior. Western Australia has over 11,000 native vascular plants with up to 200 new taxa documented yearly. The Collection at PERTH currently houses over 730,000 specimens with an average of 20,000 specimens added annually.

In 2012 PERTH completed its move to a modern purpose-built facility. In an unusual step amongst modern herbaria, a water-based fire suppression system was installed to protect the Collection. The justification behind this decision, the novel approaches PERTH has taken to protect specimens from water damage in the event of fire, and other benefits gained from this approach are discussed.

Choosing a water-based fire suppression system to protect the specimen collection

Early in the planning stages of the new building PERTH made the decision to use fixed shelving (Figure 1) rather than compactor units to house the Collection (see '**Why choose fixed shelving?**'). Fixed shelving occupies up to twice the area of compactor units for the same number of shelves. Taking into account future expansion for an estimated 1.2 million specimens in 20 years time, a large area was required to house the specimens (i.e. four main vaults) and to be protected in case of fire. The three main issues PERTH addressed to help determine whether a gas- or water-based fire suppression system should be implemented are outlined in Table 1.

The 'PERTH Box' – a novel approach to protect specimens from water incursion

Ultimately PERTH required a box design that was able to protect specimens from water incursion in the event of the water fire system activating. To achieve this, PERTH developed the world's first shower-proof, front-loading storage box (Figure 2). Many herbaria use a box system to store specimens and some are shower-proof – but none have this unique combination. The lid flips up providing easy and unimpeded access to the specimens; when closed the interference lock and water runoff design features ensure water is unlikely to enter the box.

The box is effectively the shelf, as it is supported on a racking system that was specially designed for the box. The racking is light-weight but strong and supports the box on both the sides and back. Most of the shelf is hidden from view leaving a neat and tidy appearance (Figure 2).

Although PERTH implemented a water fire suppression system in the large Collection vaults for the reasons outlined, gas fire suppression is used in the smaller areas occupied by the loans room and the type collection. This is due to the exceptionally important nature of these specimens and the potential concern external institutions may express if PERTH used a water fire suppression system to protect their loaned specimens.

Conclusion

Although the implementation of water fire suppression on its own may seem unusual, it was the catalyst for innovative design and novel approaches toward protecting the Collection. A great deal of thought went into the design of the building focusing on the planning and development of modern approaches to Collections Management, which may in the future prove to be world's best practice. The PERTH box is at the core of these changes.

Figure 1. Fixed shelving units.

Why choose fixed shelving?

- Compactor units contribute to specimen damage when rows knock together (based on PERTH's previous experience).
- Specimens are easier and quicker to access – PERTH has more than 2000 visitors a year.
- The space beneath compactor units is difficult to reach and can harbour plant material, which attracts pests.
- Fixed shelving allows flexibility as they can be vertically extended if required.

Benefits of the box

- Protect specimens against destructive pests (see '**Integrated Pest Management Plan (IPM) at PERTH**').
- Provides protection to the contents from water and pests whilst the specimens are not in the vault.
- Protects the contents within a box from condensation, which can occur when removed from a freezer.
- The use of vertical space is maximised as each box can be filled to capacity and the racking is designed to leave minimal space between boxes, thus more specimens can be stored per vertical metre than other herbarium shelving systems.

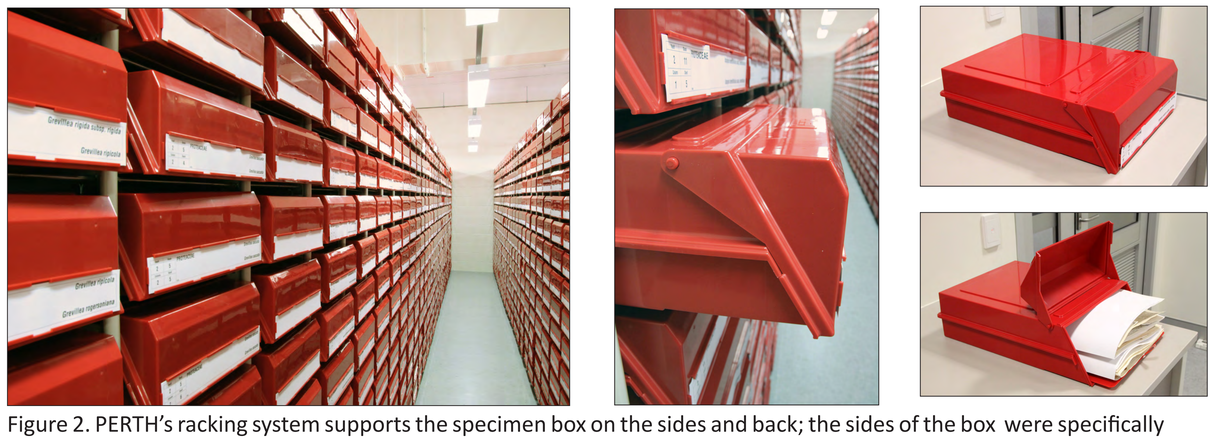

Figure 2. PERTH's racking system supports the specimen box on the sides and back; the sides of the box were specifically designed to promote water runoff; PERTH's unique shower-proof, front-loading storage box.

Table 1. Comparison between gas- and water-based fire suppression systems

	Gas	Water
Cost	**Fire suppression requires an entire vault to be filled with gas to douse a fire. The volume of gas required is expensive to store and maintain.**	**Modern fire detection and suppression systems target the fire, dousing just a small area of a vault. The volume of water required is relatively inexpensive to store.**
Occupational Health and Safety	**Inert gas fire suppression is recognised as safe for humans; however, in a large vault environment such as at PERTH it wasn't clear that some categories of users (such as older volunteers) would be able to evacuate in a timely manner without harm.**	**Not dangerous to humans.**
Pest Management	**Ongoing incursion of pests and dust through exit portholes, which are a requirement to allow large volumes of air to be displaced in the event of a fire.**	**No issue.**

Integrated Pest Management Plan (IPM) at PERTH

The shower- and pest-proof nature of the boxes, in conjunction with climate control (16°C and <50% humidity) in the vaults, are integral to a successful IPM at PERTH. The uniquely designed interference lock will prevent a pest entering a box or if present, will ensure the pest will be contained within one box. This will inhibit the spread during an outbreak. The low temperature of the vaults will also prevent insect pests from breeding, or the development of beetle larvae.

Specimens can be removed from the vault in a PERTH box and stored in non-climate-controlled areas of the herbarium for short periods with the knowledge that the specimens are safe from water in the event of fire and from pest ingress.

An integral part of PERTH's IPM are large climate-controlled short term storage rooms. Specimens removed from the vaults for study are placed in this area daily or weekly when not actively being studied. In the case where a pest does manage to target a specimen, its development or capacity to breed is greatly reduced in this environment.