



National
Trust

Climate Change Adaptation Guidance – Collections and Interiors

Photographs

Climate change vulnerability: high

Photographs – introduction

A single photograph captures a moment in time. When you view a photograph, you see what the photographer saw through their camera lens: a direct visual link to the past.

Original historic photographs are found at nearly all National Trust properties. Conservatively estimated at over 550,000, photographs are held not only in houses but also at gardens, countryside, coastline and industrial buildings. Photographs are most familiar to us as prints, which are often displayed in frames on flat surfaces or hung on walls. Yet many more photographs – especially photographic negatives, moving film and albums – are in storage. Sometimes these are held in archive rooms, but often they are present in offices (particularly at non-mansion sites) or in showroom furniture and shelving.

Traditionally, photographs were created by the action of light or other radiation on a surface made light-sensitive by chemicals. They encompass many different combinations of materials, typically made up of light-sensitive particles (often silver) in an emulsion layer, coated on a base or support. Additional layers can include photographers' adjustments, such as retouching, hand-colouring or toning, and original components such as mounts, frames and albums. Each of these elements adds complexity to the make-up of photographs and their conservation.

Photographs were widely used and handled in the past, and they are still highly valued today as sources of historical information and for engaging visitors. However, they may already have been weakened by past handling, and many will have undergone detrimental chemical change.

Most deterioration is caused by a combination of internal weaknesses inherent to the particular photographic process or type, as well as external factors such as light, relative humidity, temperature and pollutants.

Climate change may exacerbate the deterioration of photographs through increased light, higher temperatures and wider fluctuations of relative humidity. Potentially, there is also a greater risk of catastrophic damage from sudden or gradual water ingress into buildings. This guidance chapter considers the impact of climate change on photographs and proposes adaptive measures to help protect them for the future.



Image credit: This daguerreotype of the Blythway family from Dyrham Park, South Gloucestershire, is contained in its original frame. The silvered copper plate is tarnishing – caused by a combination of internal and external factors. The rate of chemical change increases with warmer temperatures and higher relative humidity (© National Trust Images/ Clive James & Rod Stowell).



Image credit: Framed photographs on the writing table at Polesden Lacey contribute to understanding the place and its people, but control of exposure to light and UV is essential for their preservation (© National Trust Images/John Hammond).

Photographs – why do they matter?

The wide variety of different photographic processes found in National Trust collections reflects the history of photography. Rare examples, uncommon in domestic collections, can be numerous. Unlike museum collections, historic house photographs often remain in the places where they were first created or collected. This association with place and other parts of the collection can increase their significance.

Photographs are amongst the most sensitive and vulnerable of all collection objects. Extremely reactive to their environment due to the light-sensitive chemicals used in their manufacture, the combinations of different image particles, binders (emulsions) and base materials add to their complexity. The inherent nature of some photographic types puts them at even higher risk. Albums often have acidic wood-pulp pages that may become discoloured, embrittled or warped and affect the attached prints. Deterioration of cellulose nitrate and cellulose acetate film is auto-catalytic – hastening their own destruction through harmful gases emitted as they degrade. These materials are challenging to care for, even in good environmental conditions. Climate change adaptations are important to mitigate the impact of extreme conditions which will increase the rate of deterioration and may bring about the untimely destruction of the most vulnerable photographs.

But why do the originals matter? The information held in an original photograph cannot be captured entirely in a digital or facsimile version. The layers of a photograph, its components and assembly all provide invaluable information, and even a very high-resolution digital image cannot replicate this. Albums of prints compiled and often taken by their owners are collections in their own right. The choice and arrangement of images can be revealing. Moreover, glass or film negatives never produced as prints may contain a wealth of previously unknown images.

Photographs are far greater than the sum of their component parts. Careful study can bring understanding of a place and the interests of the people who lived there. These revelations may echo or contrast with our concerns today and can be used to connect with visitors.

Should we digitise our original photographs?

Digitisation enables access to photography collections, for management and research purposes and to enable broad public engagement. It should **not** normally be considered a replacement for originals. Nevertheless, high-quality digitisation can be helpful in cases where the originals are too vulnerable or delicate to show; for example, ciné film, negatives or multiple album pages. Digital materials also enable the creative use of images to encourage engagement with collections.

If digitisation is undertaken, you should consider copyright and put a digital asset preservation policy in place to ensure that storage, maintenance and future retrieval are addressed. Although you should avoid using digital assets as a sole means of preservation, they do provide a 'back up' of images in the event of loss of the originals.



Image credit: Photograph albums can be revealing. Nanny Lucy Hitchman at Erddig, Wrexham was given photographs of the Yorke children she looked after for her album. Although albums can provide protection to prints from environmental factors such as light, prints are often more vulnerable at the outer edges of pages, as can be seen here by their greater discolouration (photo by Lux & Livre).

Agents of deterioration, impacts and options

Agent of deterioration/hazard	Impacts	Options
Water Sudden or gradual ingress from high-intensity rainfall or flooding.	Water can stain images, warp supports and destroy emulsion layers leading to partial or total loss; presence of water leads to increased relative humidity.	Regular building monitoring and maintenance and adaptation of building fabric and rainwater goods where necessary (see guidance chapters on Historic Building Fabric and Rainwater Goods). Avoid storage in vulnerable spaces. Protect stored photographs in robust, conservation-grade boxes. Avoid storage in areas known to flood or in basement levels of buildings.
Relative humidity (RH) Higher RH from prolonged wet weather or water ingress; greater RH fluctuations due to heavier rainfall combined with periods of drought.	Adverse chemical change in the emulsion layer of photographs; mould; fluctuations increase strain on composite items as materials expand and contract at different rates; album pages may warp. Too little moisture can cause emulsions and paper to crack.	Monitor environmental conditions to identify trends in RH levels in display and storage areas. Investigate and address sources of moisture/building defects. Move items to a more controlled environment. Control RH in stores using humidistats attached to a dehumidifier rather than radiators; consult a climate and environment advisor about the sustainability of options.
Temperature Temperatures more likely to exceed the acceptable range for conservation of photographs.	The higher the temperature, the more rapid the rate of chemical change, hastening oxidation/reduction reaction particularly for silver images, many colour photographs and early film. Heat increases the adverse reaction of photographs to external pollutants from their immediate surroundings – that is, containers/enclosures and the wider environment. The risk of combustion of cellulose nitrate negatives also increases in heat.	Increased monitoring of display and storage conditions (together with RH). Avoid heat such as direct sun on displayed photographs and storage in hot spaces such as attics and south facing rooms. Change location of collections stores, to move items to a cooler, more controlled environment. Specialised external storage might be used for catalogued cellulose nitrate film.
Light and ultraviolet (UV) Light and UV levels are likely to increase. ¹	Fading – especially silver images and colour dyes; loss of intended contrast between dark and shade in images; irreversible changes, detrimental to the enjoyment and understanding of a photograph; paper weakens and embrittles. High levels of UV in daylight cause the most damage.	Careful selection of areas where original photos are displayed, controlling light, UV and length of display. Ensure darkness for stored photographs and for displayed items when a room or property is closed. Microfading testing can help identify the most vulnerable processes, aiding decision-making for display. Control light levels indoors using UV filters, awnings, shutters, blinds, curtains or sun curtains. Provide alternative, better light-controlled location or use a digital or facsimile version to show the images of photographs vulnerable to light deterioration.

¹ According to [the Met Office's 2021 'State of the UK Climate' report](#), winters in the decade 2012–21 were 13 per cent sunnier than between 1961 and 1990, and springs 15 per cent sunnier. It is reasonable to assume future conditions will include greater average levels of direct sun in most UK locations.

Agents of deterioration, impacts and options

Agent of deterioration/hazard	Impacts	Options
<p>Chemical agents There may be an increase in pollutants, including sulphur dioxide, nitrogen oxide and ozone resulting from opening windows and doors in hotter weather.</p>	<p>Gaseous and pollutant particulates from outside can cause fading, soiling and staining of photographs, especially when combined with warmer temperatures and higher RH.</p>	<p>Keep windows closed at peak travel hours, especially in urban or industrial areas where pollution is high (though this would need to be balanced with regulation of temperature and RH). Display significant or sensitive items in controlled environments, such as conservation-grade showcases. Ensure frames are fit for purpose, correctly sealed, and with no broken glazing. Provide conservation-grade boxes and enclosures which have passed the Photographic Activity Test (PAT) for storage.</p>
<p>Biological agents Increase of insect pests and mould presence from higher RH and temperature levels; that is, warmer, wetter weather.</p>	<p>Increased presence of thrips/thunderbugs (<i>Thysanoptera</i>) trapped in framed photographs kept near open doors or windows; this is visually distracting and soils the paper. Increase of insect pests which graze away paper supports of photographic prints or album pages. Increased mould on prints, glass plates and film, especially those with gelatine emulsions, leaving stains and loss to the emulsion layer.</p>	<p>Avoid display of framed photographs near windows or doors which are opened regularly. Increase monitoring and control of display and storage areas, and address the source of any outbreak. Maintain an Integrated Pest Management programme. Occasional inspection inside albums, especially if environmental conditions change or if they are regularly at the higher end of recommended acceptable levels. If ongoing or regular periods of high RH occur, check the building for problems and address any issues. Increase ventilation and introduce dehumidification where practical and climate conscious.</p>

The issues with early film

Photographic film dates from the 1880s to the present day. It can be monochrome or colour, showing 'positive' or 'negative' images. It is found in many formats including sheet and roll film, X-ray film and ciné film. There are broadly three main groups: cellulose nitrate, cellulose acetate and polyester. Polyester is considered to be stable, but **cellulose nitrate** – also known as 'nitrate', 'nitrate-based', 'nitro-cellulose based' or 'celluloid' – has a highly flammable film base and presents a **serious fire risk**. **Cellulose acetate**, introduced as 'safety film' in 1923, is not very flammable but is affected by 'vinegar syndrome' – characterised by the smell of vinegar as the acidic base degrades. Conditions of warm temperature, inadequate ventilation and high relative humidity rapidly hasten deterioration. There is a risk of spontaneous combustion of nitrate film at high temperature (recorded as low as 38°C) if acidic gases – built up as the film degrades – cannot escape. This is more likely for a significant mass of deteriorating off-gassing material; for example, multiple rolls of nitrate ciné film.



Image credit: Two cellulose acetate sheet film negatives with 'vinegar syndrome'. The film base has become sticky and separated from the emulsion layer in 'channels'. Vinegar odour, discolouration or distortion of the film base are signs of active deterioration. Deteriorated nitrate film can appear like acetate film. A photographic materials conservator can help you identify what film you have, explain the risks which are increased by climate change, and make recommendations for mitigation (photo by Alex Koukos).

Photographs – options and thresholds

Adaptation options for collections are likely to relate to building fabric and the conditions in which photographs are displayed and stored. Chapters of this guidance which deal with building fabric, including [Rainwater Goods](#), may be useful to you. Many photographs are paper-based, so the [Paper and Books](#) chapter is also relevant.

Get to know your collection – conservator-led collection surveys can identify different photographic processes and their (often dispersed) locations. Environmental standards can then be tailored to meet specific needs, rather than imposing blanket conditions for a whole collection. Identify early film as some types may present increased fire risk to a property when conditions are exacerbated by climate change.

Increase environmental monitoring – monitor store or display areas when new or ongoing deterioration is noted. This can help identify whether climate change may be a contributing factor.

Improved environmental control – provide cooler, drier conditions needed for the preservation of photographs. If feasible, control RH with humidistats: dehumidification rather than temperature control is best. Seek advice on energy efficient options. Creating a ‘store within a store’ may be possible, but sometimes a compromise is needed: photographs may be difficult to separate from other collection objects due to space or other restrictions.

Better storage – use of robust, conservation-grade storage materials intended for each photographic type and format is beneficial in combatting impact from climate change. This provides protection from dust and pollutants, a buffer against environmental fluctuations, and some immediate protection against sudden water ingress. Use PAT materials (storage materials which have passed the Photographic Activity Test) which are acid and pollutant-free. These can help mitigate against photographs’ adverse reactions to external pollutants increased by higher RH and temperature levels. Avoid storage in areas at risk of water ingress, damp and/or heat.

Provide alternatives for display – where original photographs are vulnerable; for example, to heat, light or damp. This could mean choosing alternative locations, using display cases which offer better control and protection, replacing sensitive materials with good quality copies or reducing the length of exposure to damaging factors; that is, limiting the amount of time on display through rotation, providing darkness if closed to visitors, etc.



Photographs – thresholds and tipping points

At what point might you diverge from your current maintenance/ management strategy? What are the events/impacts that may trigger this change of approach (action/philosophy)?

- Environmental monitoring logs change in RH (rise/fall or greater fluctuation) and/or temperature (a general trend upwards is of concern).
- Condition monitoring notes change in other agents of deterioration; for example, an increase in the amount of light.
- Signs of damage caused by pests or mould seen during routine or conservator inspection; ‘silver-mirroring’ (silvery appearance to dark image areas of photographs); yellowing or other colour shifts, fading or staining of images; warping/cockling of paper supports or album pages; tarnishing of photographs on metal supports (for example, daguerreotypes); chemical, musty or other odour emitting from storage areas where photographs are kept; yellowing, stickiness, embrittlement, delamination of layers or odour affecting early film.

Regular inspection by house and collections teams is invaluable in noticing change. Raise concerns with the conservator to help identify and address the problem.

Photographs – worked pathway example

This section explores how you might move between different adaptation options to safeguard photographs from the impacts of climate change.

Consult curators before undertaking any adaptive measures because it is important to understand the significance of the photographs in your care. Avoid decision-making in isolation as there may be unintended consequences from actions taken. Working as a team is key to understanding the implications of different adaptation options.

By first identifying the photographic materials, their location and significance in your collection, you can choose solutions tailored to meet their needs and which are appropriate for your property. A specialist conservator can carry out an overview survey to broadly identify the photographic processes present in your collection, the issues and potential risks. They can guide you to the best adaptation options and provide training for staff and volunteers to help put in place measures such as improved storage.

The following adaptive pathway¹ sketches out adaptation options for a typical property collection of original photographs containing different processes, some displayed, but most held in storage in less-than-ideal conditions. As weather patterns change, higher RH and temperature, and wider RH fluctuations, will cause a greater rate of deterioration, especially to the most reactive materials. The pathway assumes that any sources of water ingress have already been addressed through maintenance or adaptation of the building fabric.

Specialised storage such as cold store

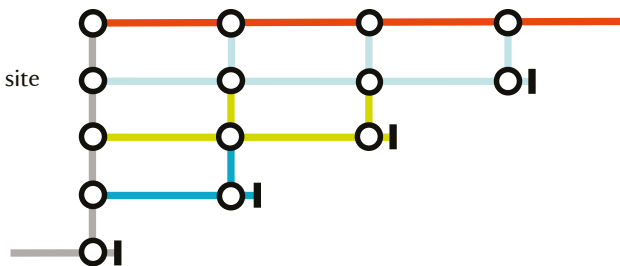
RH and temperature-controlled photo archive within a store on site

Provide PAT storage enclosures and boxes

Seek alternatives to vulnerable originals on display

Increased condition monitoring

Time/frequency and intensity of wet weather



The 10th agent of deterioration: disassociation

If photographs are not catalogued, their value and meaning are at risk if they become separated from any containers which give information, such as dates and subject matter.

Separation of photographs from marked enclosures or boxes might occur in certain catastrophic circumstances – such as sudden flooding where there is a need to dry out components.

Disassociation is also a risk through well-meaning actions, such as adapting storage to respond to climate change. Keeping inventories up to date is key – and vital before deciding to move any part of the collection elsewhere.

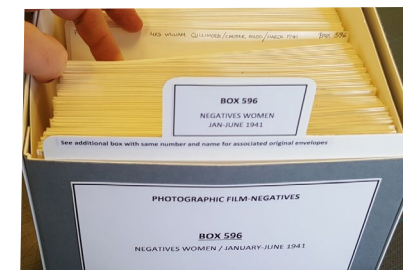


Image credit: Carefully labelled to avoid disassociation, Hardman's negatives are placed in PAT storage enclosures and boxes in cold storage (photo by Alex Koukos).

Specialised cold storage from an external provider means collection items leaving the site (as well as an on-going storage cost and higher carbon footprint). To avoid unnecessary disassociation, consider off-site storage only for the most vulnerable photographs (that is, cellulose nitrate, which is flammable, and cellulose acetate films, which are very reactive to their environment). Discuss with stakeholders, including the conservator and curator, and explore other options first. Whilst small-scale cold storage for prepared and specially packaged film is possible in frost-free freezers, it is not a long-term solution, requiring a monitoring regime to identify freezer failure/compromised packaging, and a back-up freezer option.

¹ Dynamic Adaptive Policy Pathways approach ([Haasnoot, Kwakkel, Walker & Ter Maat, 2013](#)).

Case studies, signposting and references

Here are some examples of where collections teams have identified impacts that may be related to climate change, showing what measures can be put in place to safeguard photographs.

Water ingress can be devastating to photographic materials. Heavy and prolonged rainfall in Wiltshire in January 2024 caused widespread flooding across the landscape, including **Avebury Manor**. Water flooded into the archaeological archive, soaking the modern archive photographs stored at low level but not reaching the historic photographs kept more safely on higher shelving and drawers. Future mitigation against flood risk includes re-locating the whole archive to a safer space in the manor, at a higher level. It is important to remember that photographs not considered to be part of the historic collection may also contain significant information.

At **The Argory, County Armagh**, over the Christmas/New Year period in 2010/11, water from an overhead burst pipe poured through two floors, affecting several hundred historic photographs (and their protective boxes and enclosures) kept in the archive store. Modern conservation-grade boxes containing historic prints and albums withstood the direct impact of water ingress. Although the boxes were water-damaged and needed replacing, the photographs (soon removed by staff to avoid them becoming wet) survived without damage. Simple storage techniques such as this can help to protect photographs from the increased risk of water ingress related to extreme rainfall.

High and fluctuating relative humidity and warm temperatures, exacerbated by climate change, can be hard to manage in some spaces. The photographic archive at **Arlington Court, Devon**, has been stored in a secure office, handy for research access. However, with condition checking revealing mould presence and fading/discolouration attributed to chemical deterioration (rather than exposure to light), a new store is currently being prepared where environmental control can be better managed. This will operate using dehumidifiers rather than environmental heating.



Signposting & additional guidance

National Trust staff should consult relevant sections of the *Manual of Housekeeping*. These resources can be shared with other organisations on request.

The Institute of Conservation offers guidance on collections care including photographic materials: [Caring for your treasures \(icon.org.uk\)](https://www.icon.org.uk)

The [Image Permanence Institute](https://www.imagepermanenceinstitute.org/) has a range of useful resources relating to the preservation and identification of photographic materials.

The [Bizot Green Protocol](https://www.bizotgreenprotocol.org/) (2023 Refresh) encourages museums to adopt environmentally sustainable approaches to long-term collections care with evidence, tools and case studies.



Image credit: Top, modern colour prints drying after being rewashed after flooding at Avebury Manor (photo by Anna Barnes); bottom left, flood-damaged conservation boxes at The Argory, previously containing albums and prints (photo by Anita Bools); bottom right, an album of historic photographs at Arlington Court; mould growth and foxing are greater where the album page has warped, allowing greater exposure to environmental conditions, including high and fluctuating RH (photo by Anita Bools).