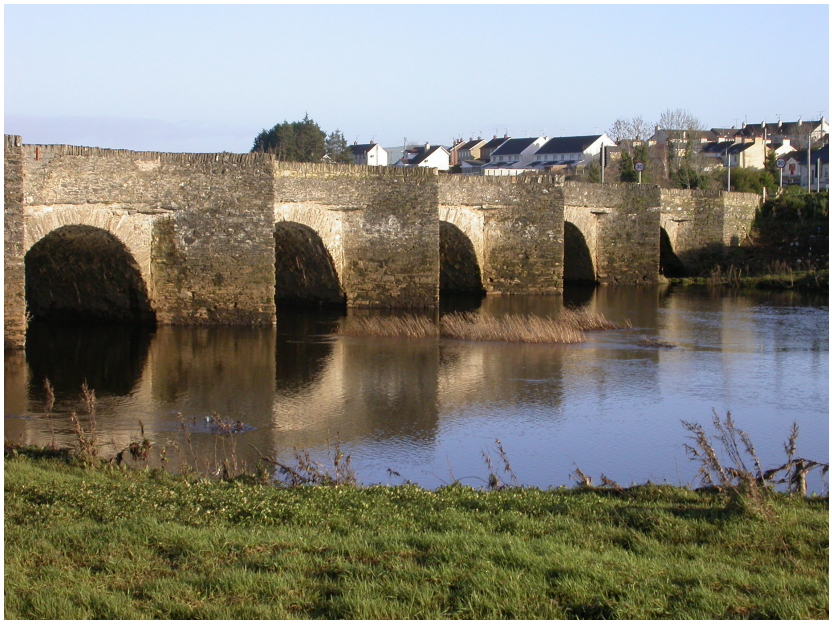
GAIA ASSOCIATES

The Management of Old Stone Bridges:

Best Practice for the Conservation of Flora and Fauna



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An Chomhairle Oidhreachta

The Heritage Council

An Roinn Comhshaoil, Oidhreachta agus Rialtais Áitiúil
Department of the Environment, Heritage and Local Government

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1. INTRODUCTION

Donegal County Council has in its care 1,491 bridges. While it is not known at the moment how many of these could be described as old stone bridges, the number is certainly large. There are 17 bridges on the Record of Protected Structures for County Donegal, distributed over five of the six Electoral Areas. They are:

Glenties Electoral Area:
Hornhead
Doochary

Inishowen Electoral Area:
Malin

Milford Electoral Area:
Barrack
Railway
Rashedoge
The Bridge (Ramelton)

Stranorlar Electoral Area:
Clady (see cover photo)
Killygordon
Liscooly
Castlefinn
Ballybofey

Donegal Electoral Area:
Pedestrian Bridge (Bridgetown)
Assaroe
Laghey
Eske
Sminver

This short list includes some of the larger bridges in the county, crossing the lower reaches of the biggest rivers, and often with multiple arches. But many of the smaller single arch bridges are of similar quality or antiquity, and all that were built with stone have some real or potential value for the conservation of wildlife.

There are three principal areas of concern
(i) Flora
(ii) Birds
(iii) Bats

2. FLORA

If soil exists on the top of bridge parapets or in crevices on the vertical faces, its condition is usually well-drained, base-rich, thin and sandy. Such soils provide a demanding environment for plants, but that has an advantage. It usually means that most of the commoner plants will not grow there, and the rarer, more specialised species have a better chance to thrive. Many species will grow on walls if sufficient soil has built up, but the following selection concentrates on those species which have a significant proportion of their total populations growing on old stone walls or bridges.

2.1. Lichens

A sizeable percentage of Ireland's 1,000 species live on bare rock.

2.2. Bryophytes (mosses and liverworts)

Large numbers of Bryophytes also grow on bare rock.

2.3. Ferns

There are relatively few ferns in Ireland. Some are genuine wall specialists, and others will occasionally grow there if sufficient soil has built up in crevices. The main wall specialists are:

Black Spleenwort
Common Polypody
Hart's-tongue
Intermediate Polypody
Maidenhair Spleenwort
Rustyback
Southern Polypody
Wall Rue

2.4. Flowering Plants

As flowering plants need soil for both roots and nutrition, the number that specialise in wall or bridge habitats is proportionally small.

Annual Meadow-grass
Biting Stonecrop
Early Hair-grass
English Stonecrop
Fairy Flax
Herb Robert
Ivy
Ivy-leaved Toadflax
Navelwort
Ox-eye Daisy
Red Valerian
Reflexed Stonecrop
Ribwort Plantain
Rock Stonecrop

Silver Hair-grass
Wall Speedwell
Wall Whitlow-grass
Wallflower
White Stonecrop

Bridges are often the only source of exposed rock over a wide area, so their importance for both lichens and bryophytes is very great. In areas where the bedrock and soils are acidic, the only alkaline rocks may be those imported from elsewhere for bridge or wall construction. That, together with the use of lime-based mortars, can result in these sites being the only place for miles around where calcicole (lime-loving) plants can get a toe-hold.

In County Donegal, natural conditions for a calcicole flora are mainly confined to the area around Donegal Bay, and some of the sand dunes, where sand with a high proportion of broken sea-shell fragments occurs.

Other sources of variation include aspect, and the amount of moisture falling onto, or retained on, wall surfaces. For example, cushion-forming mosses (which maintain their own micro-climate within the cushions) prefer north-facing surfaces, whereas the pleurocarpous (tending to flatter) mosses prefer the south. Crustaceous lichens and cushion-forming mosses tend to be the pioneer plants in dry situations, while algae start colonization on damp walls.

Plate 4: Ivy-leaved Toadflax among Ivy leaves

3. FAUNA

3.1. Birds

There are only a small number of species that use stone bridges for nesting, but one of these is almost totally dependent on them.

The Dipper is the only aquatic songbird and lives along fast-flowing streams. In the natural state it would have built its domed nest in river banks or among tree stumps, but has long since become very dependent on bridges. Its nest is usually built on the ledge which separates the vertical piers from the roof of the arches, preferably where a missing stone or other crevice gives it some additional purchase. Such sites are very limited, and the frequency of old bridges in any case is not much greater than the size of a typical Dipper territory, so sites are traditional and are used year after year.

The Grey Wagtail is also confined to the same sort of streams as the Dipper, but is not as dependent on bridges as the Dipper. It will build its nest in Ivy or other dense vegetation. Wrens will do likewise, but in addition they can often roost in crevices under arches normally occupied by bats (see below).

Plate 5: Dipper

Plate 6: Ledge and hole created for Dipper's nest

3.2. Bats

All Bat species are protected under the Wildlife Act and the EU Habitats Directive, and it is an offence to kill them or interfere with their breeding or hibernating roosts. They have a vital role in maintaining the balance of nature by consuming millions of aerial insects. If their presence is causing serious problems, help should be sought from the National Parks and Wildlife Service.

Bats use bridges mainly in summer, but can be found there at all times of the year. The main species involved is Daubenton's Bat, but Long-eared, Natterer's, Whiskered and Pipistrelle have also been found. Daubenton's is sometimes called the Water Bat, after its habit of feeding low over the surface of streams and lakes, hunting for insects on the surface.

Bats roost and rear their young in crevices under the arches (Smiddy 1991). A survey in County Cork of 366 bridges found that 51 of them (14%) contained roosting bats. A further 40 bridges (11%) had evidence of having been used recently, and 95 bridges (26%) were considered suitable but with no evidence of recent occupation. 180 bridges (49%) were considered unsuitable. The number of bats per roost site is rarely more than three, but there can be several roost sites under one bridge.

In winter, hibernating bats generally require: (i) Darkness, (ii) Humidity above 90%, (iii) Steady temperature between freezing and 10°C, (iv) Freedom from potential predators, and (v) Crevices to hide in. These conditions can be met under some bridges, although there is still much doubt about where the majority of Donegal bats spend the winter.

4. MANAGEMENT

4.1. Walls

These should be treated in the same way as any stone wall of similar construction. Generally they would have been constructed with lime-mortar, and this should be used in repair work. Cement is not normally colonised by plants, and walls re-pointed or capped with cement usually remain sterile. It must be stressed that there is no structural advantage or saving in maintenance by using cement, as wall flora (apart from Ivy and other woody plants) is benign and self-limiting through lack of soil. And, although this report is being written by an ecologist rather than an engineer, it is my understanding that cement being impermeable, will retain damp, and will destabilise the structure through frost-action. It is also liable to cracking. None of this is the case with lime-mortar. There are many other compelling reasons from a building or architectural point of view why lime is preferable to cement in maintaining old stonework, and these should be considered before any decision to use cement is made.

Lime-mortar can be prepared from the ingredients, but is also commercially available in a variety of prescriptions to suit each situation (see Appendix 1).

Where structural work needs to be done, as is inevitable from time to time, care should be taken to avoid clearing away any more of the existing flora than is necessary. A residual pool of plants representing the full variety present is needed as a source for re-colonising the parts of the bridge which have been restored. This might be achievable by doing only one wall at a time, allowing some years to elapse before doing the other side. A better way would be to seek advice from a botanist or ecologist in advance. This should minimise any inconvenience as it would enable the most important plants or communities to be prioritised.

Lichens and bryophytes can be induced to colonise rock by coating it with an organic medium. The obvious method of spraying it with slurry is not recommended, as slurry contains seeds of many agricultural grasses and weeds, which should not be encouraged. A sterile medium, like sour milk can be used. This will mostly wash off after the first shower, but enough will adhere in crevices or on the rougher surfaces to give plants like lichen some initial advantage.

4.2. Arches

Birds

Dipper nests are easily located, and should be protected from casual or incidental damage during maintenance works.

When no nest is found, a suitable ledge should be provided – assuming the river is suitable. All that is required is the space created by the removal of one or two stones above the high water line, and a flat base.

Bats

The biggest threat to bats comes when reinforcement work is done on the underside of the arches. Bats can be entombed, and their roosting sites eliminated.

The first thing that has to be done is to identify any existing or potential bat roosts. These will be crevices that give bats access behind brick or plaster work, or missing bricks.

If cement is to be sprayed, occupied crevices will have to be protected with a temporary cover. The best way to protect unoccupied crevices is to plug them with a material like polystyrene, which can be removed after the spraying has been done, but before the cement dries.

Bat crevices can be created by removal of a stone, and rubble or old mortar removed from behind the adjacent stone. The removal of a stone will probably not on its own give bats the sort of protected space they need. Another way to do this is with the use of a "Bat Brick". These are brick-sized objects approximately 200mm x 100mm x 70mm. They have a series of slits of the correct size for Daubenton's, Natterer's, Long-eared and Whiskered Bats to hide in. They are of a registered design and are only produced by The Norfolk Bat Group (see Appendix 1).

Plate 7: The Norfolk Bat Brick

Bats will not use bridges if the surrounding environment is unsuitable. Many species use trees not only for hunting among, but also as routeways. An occupied bridge will almost always have mature trees nearby. These should be maintained, and if possible, they should be planted if they are not already present.

Plate 8: Diverse flora on parapet, contrasting with sterile cement replacement

Plate 9: Same wall as in Plate 8, showing rapidly colonising mosses and lichens on a new surface of lime mortar.

Plate 10: Highly diverse flora of specialised lichens, mosses, grasses and small perennials. This is on an old lime mortar surface.

Note: These three photographs were all taken in mid-winter on a single stretch of less than five metres of bridge parapet.

5. PROTOCOL

(i) A list of all stone bridges should be compiled.

(ii) A schedule of repairs required should be maintained.

(iii) In the spring of each year, bridges to be repaired in the following year should be surveyed to establish what is their wildlife conservation status, and what particular conservation measures are required. This work needs to be done in the summer months.

(iv) People involved from both engineering and conservation should meet in person on the site to ensure that everything that is possible will be done.

6. SUMMARY AND CONCLUSIONS

- The Protocol above should be followed to ensure that the wildlife value of no stone bridge is damaged by default.
- The bridge should be surveyed in advance of repairing to establish what flora and fauna is already present.
- Principle measures normally required include:
  - ♦ Using Lime Mortar for stone laying and re-pointing.
  - ♦ Spraying rock surfaces with a sterile organic medium like sour milk, to give lichens and mosses a head start.
  - ♦ Protecting any potentially useful crevices under arches during cement spraying operations.
  - ♦ Installing one or more Bat Bricks under larger bridges, or where there is any evidence of over-wintering.

REFERENCES

McAney K. (1992). *Bats and Bridges: a report on the importance of bridges to bats* (Galway: The Office of Public Works).

Smiddy P., (1991). "Bats and Bridges," *Irish Naturalists' Journal*, Vol. 23, No. 10, pp. 425-426.

The Heritage Council & Local Authority Heritage Officers (n.d.). *Conserving Bats/Caomhnú an Sciatháin Leathair* (Kilkenny: The Heritage Council).

APPENDIX 1: CONTACTS

The Norfolk Bat Group,
The Barn Cottage,
Wheelers Lane,
Seething,
Norwich,
Norfolk. NR15 1EJ
Telephone: (01508) 550 784
Fax: (01508) 550 850
Website: www.norfolk-bat-group.org.uk/norf.html

For information on Lime Mortar, the Building Limes Forum is one of the more comprehensive sources, but most of the following Irish lime manufacturers will also supply information.

Narrow Water Lime Service,
Warrenpoint,
Co. Down.
Telephone: (048) 4175 3073

Traditional Lime Company,
Tullow,
Co. Carlow.
Telephone: (050) 351 750

All Purpose Stone Ltd.,
Townspark,
Daingean,
Co.Offaly.
Telephone: (057) 935 3090 / 935 3408
Fax: (057) 935 3212
Email: info@allpurposestoneltd.com

Lochplace Lime Company,
Innishannon,
Co. Cork.
Telephone: (021) 776 677

Stoneware Studios,
Pillmore,
Youghal,
Co. Cork.
Telephone: (024) 90117

APPENDIX 2: SPECIES MENTIONED IN THE TEXT

English Name	*Scientific Name*
Ferns	
Black Spleenwort	Asplenium adiantum-nigrum
Common Polypody	Polypodium vulgare
Hart's-tongue	Phyllitis scolopendrium
Intermediate Polypody	Polypodium interjectum
Maidenhair Spleenwort	Asplenium trichomanes
Rustyback	Ceterach officinarum
Southern Polypody	Polypodium australe
Wall Rue	Asplenium ruta-muraria
Flowering Plants	
Annual Meadow-grass	Poa annua
Biting Stonecrop	Sedum acre
Early Hair-grass	Aira praecox
English Stonecrop	Sedum anglicum
Fairy Flax	Linum catharticum
Herb Robert	Geranium robertianum
Ivy	Hedera helix
Ivy-leaved Toadflax	Cymbalaria muralis
Navelwort	Umbilicus rupestris
Ox-eye Daisy	Leucanthemum vulgare
Red Valerian	Centranthus ruber
Reflexed Stonecrop	Sedum rupestre
Ribwort Plantain	Plantago lanceolota
Rock Stonecrop	Sedum forsterianum
Silver Hair-grass	Aira caryophyllea
Wall Speedwell	Veronica arvensis
Wall Whitlow-grass	Draba muralis
Wallflower	Erysimum cheiri
White Stonecrop	Sedum album
Birds	
Dipper	Cinclus cinclus
Grey Wagtail	Motacilla cinerea
Wren	Troglodytes troglodytes
Bats	
Daubenton's Bat	Mysotis daubentoni
Natterer's Bat	Mysotis nattereri
Pipistrelle	Pipistrellus pipistrellus
Long-eared Bat	Plecotus auritus
Whiskered Bat	Myotis mystacinius