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Conservation Objectives Series

East Burren Complex SAC 001926

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
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Local Government and Heritage

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

001926	East Burren Complex SAC
1065	Marsh Fritillary *Euphydryas aurinia*
1303	Lesser Horseshoe Bat *Rhinolophus hipposideros*
1355	Otter *Lutra lutra*
3140	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
3180	Turloughs*
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
4060	Alpine and Boreal heaths
5130	*Juniperus communis* formations on heaths or calcareous grasslands
6130	Calaminarian grasslands of the Violetalia calaminariae
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
7210	Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae*
7220	Petrifying springs with tufa formation (Cratoneurion)*
7230	Alkaline fens
8240	Limestone pavements*
8310	Caves not open to the public
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*

Please note that this SAC overlaps with Corofin Wetlands SPA (004220) and is adjacent to Moneen Mountain SAC (000054) and Termon Lough SAC (001321). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping and adjacent sites as appropriate.

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1972
Title :	A preliminary report on Areas of Scientific Interest in County Clare
Author :	Goodwillie, R.N.
Series :	Unpublished report
Year :	1981
Title :	A survey of the wetlands of the Fergus catchment and adjoining areas
Author :	Curtis, T.G.F.; McGough, H.N.
Series :	Unpublished report
Year :	1984
Title :	The vegetation of Irish lakes
Author :	Heuff, H.
Series :	Unpublished report to NPWS
Year :	1992
Title :	Turloughs over 10ha - Vegetation survey and evaluation
Author :	Goodwillie, R.N.
Series :	Unpublished report to NPWS
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manuals, No. 23
Year :	2006
Title :	Bat mitigation guidelines for Ireland
Author :	Kelleher, C.; Marnell, F.
Series :	Irish Wildlife Manuals, No. 25
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2007
Title :	Grasslands monitoring project 2006
Author :	Dwyer, R.; Crowley, W.; Wilson, F.
Series :	Unpublished report to NPWS
Year :	2008
Title :	Database of Irish Lepidoptera. 1 - Macrohabitats, microsites and traits of Noctuidae and butterflies
Author :	Bond, K.G.M.; Gittings, T.
Series :	Irish Wildlife Manuals, No. 35
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished report to NPWS

Year :	2009
Title :	Irish Red List No. 1 - Water beetles
Author :	Foster, G.N.; Nelson, B.H.; O Connor, Á.
Series :	Ireland Red List series, NPWS
Year :	2009
Title :	Ireland Red List No. 2: Non-marine molluscs
Author :	Byrne, A.; Moorkens, E.A.; Anderson, R.; Killeen, I.J.; Regan, E.C.
Series :	Ireland Red List series, NPWS
Year :	2009
Title :	Bryophytes and metallophyte vegetation on metalliferous mine-waste in Ireland
Author :	Holyoak, D.T.
Series :	Unpublished report to NPWS
Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manuals, No. 46
Year :	2010
Title :	Ireland Red List No. 4: Butterflies
Author :	Regan, E.C.; Nelson, B.; Aldwell, B.; Bertrand, C.; Bond, K.; Harding, J.; Nash, D.; Nixon, D.; Wilson, C.J.
Series :	Ireland Red List series, NPWS
Year :	2012
Title :	The conservation status of juniper formations in Ireland
Author :	Cooper, F.; Stone, R.E.; McEvoy, P.; Wilkins, T.; Reid, N.
Series :	Irish Wildlife Manuals, No. 63
Year :	2012
Title :	Ireland Red List No. 8: Bryophytes
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	Ireland Red List series, NPWS
Year :	2013
Title :	Conservation status assessment for petrifying springs
Author :	Lyons, M.D.; Kelly, D.L.
Series :	Unpublished report to NPWS
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manuals, No. 76
Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manuals, No. 78
Year :	2013
Title :	National survey of limestone pavement and associated habitats in Ireland
Author :	Wilson, S.; Fernandez, F.
Series :	Irish Wildlife Manuals, No. 73

Year :	2013
Title :	A survey of the benthic macrophytes of three hard-water lakes: Lough Bunny, Lough Carra and Lough Owel
Author :	Roden, C.; Murphy, P.
Series :	Irish Wildlife Manuals, No. 70
Year :	2013
Title :	Results of a monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manuals, No. 71
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2013
Title :	Baseline web surveys and habitat assessments for the Marsh Fritillary *Euphydryas aurinia* in Moneen Mountain SAC and East Burren Complex SAC
Author :	Ravenscroft, N.; Bourn, N.; O'Hanrahan, B.
Series :	Unpublished report to NPWS
Year :	2015
Title :	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
Author :	O Connor, Á.
Series :	Unpublished document by NPWS
Year :	2015
Title :	Turlough hydrology, ecology and conservation (Part 1)
Author :	Waldren, S. (ed.)
Series :	Unpublished report to NPWS
Year :	2015
Title :	Turlough hydrology, ecology and conservation (Part 2)
Author :	Waldren, S. (ed.)
Series :	Unpublished report to NPWS
Year :	2015
Title :	Summary of findings from the survey of potential turloughs 2015
Author :	O'Neill, F.H.; Martin, J.R.
Series :	Unpublished report to NPWS
Year :	2016
Title :	Ireland Red List No. 9: Macro-moths (Lepidoptera)
Author :	Allen, D.; O'Donnell, M.; Nelson, B.; Tyner, A.; Bond, K.G.M.; Bryant, T.; Crory, A.; Mellon, C.; O'Boyle, J.; O'Donnell, E.; Rolston, T.; Sheppard, R.; Strickland, P.; Fitzpatrick, U.; Regan, E.
Series :	Ireland Red List series, NPWS
Year :	2016
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Author :	Lyons, M.D.; Kelly, D.L.
Series :	Irish Wildlife Manuals, No. 94
Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS

Year :	2017
Title :	Conservation objectives supporting document: Turloughs* and Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation
Author :	O Connor, Á.
Series :	Conservation objectives supporting document
Year :	2018
Title :	Conservation objectives supporting document – lesser horseshoe bat (*Rhinolophus hipposideros*)
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2018
Title :	The Irish Juniper Monitoring Survey 2017
Author :	O'Neill, F.H.; Martin, J.R.
Series :	Irish Wildlife Manuals, No. 101
Year :	2018
Title :	The Irish Juniper Monitoring Survey 2017 - Appendices
Author :	O'Neill, F.H.; Martin, J.R.
Series :	Irish Wildlife Manuals, No. 101
Year :	2018
Title :	The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats
Author :	Martin, J.R.; O'Neill, F.H.; Daly, O.H.
Series :	Irish Wildlife Manuals, No. 102
Year :	2019
Title :	Results of a survey to monitor the EU Annex I habitat Calaminarian grassland, 2018
Author :	Hodd, R.L.; Hodgetts, N.G.
Series :	Irish Wildlife Manuals, No. 105
Year :	2019
Title :	Results of a survey to monitor the EU Annex I habitat Calaminarian grassland, 2018 - Appendices
Author :	Hodd, R.L.; Hodgetts, N.G.
Series :	Irish Wildlife Manuals, No. 105
Year :	2019
Title :	The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2019
Title :	Checklists Protected and Threatened Species in Ireland 2019
Author :	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
Series :	Irish Wildlife Manuals, No. 116
Year :	2020
Title :	Marl Lake (Habitat 3140) Survey and Assessment Methods Manual
Author :	Roden, C.; Murphy, P.; Ryan, J.; Doddy, P.
Series :	Irish Wildlife Manuals, No. 125
Year :	2020
Title :	Benthic vegetation in Irish marl lakes: monitoring habitat 3140 condition 2011 to 2018
Author :	Roden, C.; Murphy, P.; Ryan, J.
Series :	Irish Wildlife Manuals, No. 124

Year :	2020
Title :	Benthic vegetation in Irish marl lakes: monitoring habitat 3140 condition 2011 to 2018. Appendix III, Site Reports
Author :	Roden, C.; Murphy, P.; Ryan, J.
Series :	Irish Wildlife Manuals, No. 124
Year :	2020
Title :	Important Invertebrate Area Surveys: Ballyogan and Slieve Carran, Co. Clare
Author :	Mantell, A.; Anderson, R.
Series :	Irish Wildlife Manuals, No. 127
Year :	2021
Title :	Checklists Protected and Threatened Species in Ireland. Version 2.1. 3 December 2021
Author :	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
Series :	Irish Wildlife Manuals, No. 116
Year :	in prep.
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Author :	Kelleghan, D.B.; Fogarty, M.; Welchman, S.; Cummins, T.; Curran, T.P.
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Year :	1934
Title :	The Botanist in Ireland
Author :	Praeger, R.L.
Series :	Hodges, Figgis and Co., Dublin
Year :	1962
Title :	Noteworthy plants of the Burren: a catalogue raisonné
Author :	Webb, D.A.
Series :	Proceedings of the Royal Irish Academy, 62B(9): 117-134
Year :	1965
Title :	Notes on the Hemiptera, Coleoptera, Diptera and other invertebrates of the Burren, Co. Clare and Inishmore, Aran Islands
Author :	Lansbury, I.
Series :	Proceedings of the Royal Irish Academy, 64B: 89-115
Year :	1967
Title :	Weevils (Coleoptera: Curculionoidea) and other insects collected in north west Clare, with special reference to the Burren region
Author :	Morris, M.G.
Series :	Proceedings of the Royal Irish Academy, 65B: 349-371

Year :	1967
Title :	The Lepidoptera of the Burren, Co. Clare, W. Ireland
Author :	Bradley, J.D.; Pelham-Clinton, E.C.
Series :	Entomologist's Gazette, 18: 115-153
Year :	1974
Title :	Auchenorhyncha (Hemiptera) of the Burren, with special reference to species-associations of the grasslands
Author :	Morris, M.G.
Series :	Proceedings of the Royal Irish Academy, 74B: 7-30
Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1982
Title :	Eutrophication of waters. Monitoring assessment and control
Author :	OECD
Series :	OECD, Paris
Year :	1983
Title :	Flora of Connemara and the Burren
Author :	Webb, D.A.; Scannell, M.J.P.
Series :	Royal Dublin Society, Dublin and Cambridge University Press, Cambridge
Year :	1985
Title :	The status and ecology of *Limosella aquatica* L. in Clare (H9) and south-east Galway (H15)
Author :	Curtis, T.G.F.; Ryan, J.B.; McGough, H.N.
Series :	Irish Naturalists' Journal, 21(9): 406-407
Year :	1986
Title :	A study of the geology, hydrology and geomorphology of turloughs
Author :	Coxon, C.
Series :	Unpublished Ph.D. Thesis, Trinity College Dublin
Year :	1991
Title :	The spatial organization of otters (*Lutra lutra*) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	1991
Title :	The Burren. A Companion to the Wild Flowers of an Irish Limestone Wilderness
Author :	Nelson, E.C.; Walsh, W.
Series :	Boethius Press, Aberystwth
Year :	1992
Title :	A review of the scarce and threatened Coleoptera of Great Britain. Part 1. UK. Nature Conservation: 3
Author :	Hyman, P.S.; Parsons, M.S.
Series :	Joint Nature Conservation Committee, Peterborough, UK
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Series :	Botanical Society of Britain and Ireland, London

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Series :	The Collins Press, Cork
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Author :	Speight, M.C.D.
Series :	Entomologist's Record and Journal of Variation, 111: 139-141
Year :	2000
Title :	Appendix 2. Notes on the status and ecology of *Ditrichum cornubicum*
Author :	Holyoak, D.T.; Clements, R.; Coleman, M.R.J.; MacPherson, K.S.
Series :	English Nature Research Reports, No. 328: 40-50
Year :	2000
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Author :	Scannell, M.J.P.; Jebb, M.H.P.
Series :	Glasra, 4: 7-45
Year :	2001
Title :	Heavy metal concentrations in the soil substrates associated with rare bryophytes at former metalliferous mining sites in East Cornwell
Author :	Walsh, L.
Series :	Unpublished B.Sc. Thesis, University of Hertfordshire
Year :	2001
Title :	A report on the vegetation and algal plankton of base rich nutrient poor lakes in Clare and Mayo
Author :	Roden, C.M.
Series :	Unpublished report submitted to Heritage Council
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Author :	Asher, J.; Warren, M.; Fox, R.; Harding, P.; Jeffcoate, G.; Jeffcoate, S.
Series :	Oxford University Press, Oxford
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Author :	Peterken, G.
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Author :	Bradish, S.; O Connor, Á.; Reed, T.
Series :	Irish Naturalists' Journal, 27: 83-84

Year :	2003
Title :	Ecology of watercourses characterised by Ranunculion fluitantis and Callitricho-Batrachion vegetation
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Series :	Unpublished Ph.D. Thesis, National University of Ireland, Galway
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Title :	Further records of carabid beetles from turloughs
Author :	Regan, E.C.
Series :	Irish Naturalists' Journal, 28(2): 59–61
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Title :	Charophytes collected in Counties Clare (H9) and South-east Galway (H15) in 2003
Author :	Langangen, A.
Series :	Irish Naturalists' Journal, 28(4): 151–158
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Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2006
Title :	A reference-based typology and ecological assessment system for Irish lakes. Preliminary investigations. Final report. Project 2000-FS-1-M1 Ecological assessment of lakes pilot study to establish monitoring methodologies EU (WFD)
Author :	Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
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Author :	Mitchell-Jones, A.J.; Bihari, Z.; Masing, M.; Rodrigues, L.
Series :	EUROBATS Publication Series No. 2
Year :	2008
Title :	The lesser horseshoe bat conservation handbook
Author :	Schofield, H.W.
Series :	The Vincent Wildlife Trust
Year :	2008
Title :	Water Quality in Ireland 2004-2006
Author :	Clabby, K.J.; Bradley, C.; Craig, M.; Daly, D.; Lucey, J.; McGarrigle, M.; O'Boyle, S.; Tierney, D.; Bowman, J.
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Author :	Knight, T.; Jones, G.
Series :	Endangered Species Research, 8: 79-86
Year :	2009
Title :	Vegetation analysis of upland Burren grasslands of conservation interest
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Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 109B(1): 11-33
Year :	2009
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Title :	Review and revision of empirical critical loads and dose-response relationships. Proceedings of an expert workshop, Noordwijkerhout, 23-25 June 2010
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Series :	RIVM report 680359002, Coordination Centre for Effects, National Institute for Public Health and the Environment (RIVM)
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Author :	Naughton, O.
Series :	Unpublished Ph.D. Thesis, Trinity College Dublin
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Author :	Nelson, B.; Hughes, M.; Bond, K.
Series :	Entomologist's Gazette, 62: 213-233
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Title :	Rare and threatened bryophytes of Ireland
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	National Museums Northern Ireland

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Author :	Naughton, O.; Johnston, P.M.; Gill, L.W.
Series :	Journal of Hydrology, 470-471: 82-97
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Series :	Hydrobiologia, 692: 29-40
Year :	2013
Title :	Management strategies for the protection of high status water bodies
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Series :	Strive Report Series No. 99. EPA, Wexford
Year :	2013
Title :	Interpretation manual of European Union habitats- Eur 28
Author :	European Commission- DG Environment
Series :	European Commission
Year :	2014
Title :	Orchid Ireland Survey 2014
Author :	Curtis, T.; Wilson, F.
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Year :	2015
Title :	Water Quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
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Author :	Lyons, M.D.
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Author :	Mainstone, C.; Hall, R.; Diack, I.
Series :	Natural England Research Reports Number 064
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Author :	Perrin, P.
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Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 116B: 191-204

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Title :	Water Quality in Ireland 2010-2015
Author :	Fanning, A.; Craig, M.; Webster, P.; Bradley, C.; Tierney, D.; Wilkes, R.; Mannix, A.; Treacy, P.; Kelly, F.; Geoghegan, R.; Kent, T.; Mageean, M.
Series :	Environmental Protection Agency, Wexford
Year :	2018
Title :	Irish Vegetation Classification: Technical Progress Report No. 4
Author :	Perrin, P.
Series :	Report submitted to National Biodiversity Data Centre
Year :	2018
Title :	The hydrogeology of the Gort Lowlands
Author :	Naughton, O.; McCormack, T.; Drew, D.; Gill, L.; Johnston, P.; Morrissey, P.; Regan, S.
Series :	Irish Journal of Earth Sciences, 36: 25-44
Year :	2018
Title :	The distribution and ecology of *Gnophos dumetata* Treitschke, 1827 (Lepidoptera: Geometridae) in the Burren of western Ireland
Author :	Woodrow, W.; Nelson, B.; Allen, D.; Glanville, E.; Hughes, M.; Mclaughlin, V.; Mellon, C.; Waring, P.
Series :	Entomologist's Gazette, 69: 1-14
Year :	2019
Title :	Water Quality in Ireland 2013-2018
Author :	O'Boyle, S.; Trodd, W.; Bradley, C.; Tierney, D.; Wilkes, R.; Ní Longphuirt, S.; Smith, J.; Stephens, A.; Barry, J.; Maher, P.; McGinn, R.; Mockler, E.; Deakin, J.; Craig, M.; Gurrie, M.
Series :	Environmental Protection Agency, Wexford
Year :	2019
Title :	A review of *Ochthebius nilssoni* Hebauer (Coleoptera: Hydraenidae) in western Ireland including a first report from Lough Carra
Author :	Nelson, B.; O Connor, Á.; Foster, G.N.; Doddy, P.; Roden, C.
Series :	Irish Naturalists' Journal, 36(2): 117–122
Year :	2019
Title :	Cyanobacterial communities in limestone lakes and pools in Ireland: Effects of nutrient enrichment on community structure, and implications for conservation of marl lakes
Author :	Doddy, P.
Series :	Unpublished Ph.D. thesis, Galway-Mayo Institute of Technology
Year :	2019
Title :	Atlas of Britain & Ireland's Larger Moths
Author :	Randle, Z.; Evans-Hill, L.J.; Parsons, M.S.; Tyner, A.; Bourn, N.A.D.; Davis, T.; Dennis, E.B.; O'Donnell, M.; Prescott, T.; Tordoff, G.M.; Fox, R.
Series :	Pisces Publications, NatureBureau Ltd., Newbury
Year :	2020
Title :	Atlas of Water Beetles of Britain and Ireland – smaller families of Polyphaga
Author :	Foster, G.N.; Bilton, D.T.; Hammond, M.; Nelson, B.H.
Series :	Field Studies Council

Spatial data sources

Year :	2008
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	WaterPolygons feature class clipped to the SAC boundary. Expert opinion used to identify Annex I habitat and to resolve any issues arising
Used For :	3140 (map 3)
Year :	2018
Title :	Irish Juniper Monitoring Survey 2017. Version 1
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	5130 (map 4)
Year :	2015
Title :	Internal NPWS files
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	5130 (map 4)
Year :	2018
Title :	Survey to monitor the EU Annex I habitat Calaminarian grassland
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6130 (map 5)
Year :	2018
Title :	Grasslands Monitoring Survey 2015-2017
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6510 (map 5)
Year :	2016
Title :	Point file associated with Lyons (2015)
GIS Operations :	Dataset created from spatial references; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	7220 (map 6)
Year :	2013
Title :	National Survey of Limestone Pavement and Associated Habitats in Ireland distribution data
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	8240 (map 7)
Year :	2013
Title :	Internal NPWS data
GIS Operations :	Habitat polygon created from spatial references supplied by NPWS expert. Expert opinion used as necessary to resolve any issues arising
Used For :	91E0 (map 8)
Year :	2021
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1065 (map 9)
Year :	2021
Title :	NPWS lesser horseshoe bat database
GIS Operations :	Roosts identified, clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	8310, 1303 (map 10)

Year :	2012
Title :	Forest Inventory and Planning System, (FIPS)
GIS Operations :	Dataset clipped to 2.5km buffer centred on roost location
Used For :	1303 (map 10)

3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

To restore the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	East Burren Complex SAC contains many marl lakes and ponds, some occurring within turloughs, and is one of the most important SACs for habitat 3140 in Ireland. Most of the marl lakes surveyed were in good conservation condition; however, 3 (Cullaun, George, Muckanagh) were borderline good/poor (absence of deep-water vegetation zone, lower euphotic depth, higher colour) (Roden and Murphy, 2013; Roden et al., 2020). The objective of restore is precautionary. The surface area of the lake is the simplest measure of extent and should be stable or increasing. It may be possible to estimate the area of the vegetation communities/zones that typify the habitat. See map 3. Further information on all attributes is given in Roden et al. (2020) and O Connor (2015). See also Pentecost (2009) and Roden et al. (2020) for an overview of marl lakes in Britain and Ireland. Habitat 3140 was in bad, deteriorating conservation status in Ireland in the 3 reporting periods 2006-2018 (NPWS, 2007, 2013, 2019)
Habitat distribution	Occurrence	No decline, subject to natural processes	Habitat 3140 is widespread, of high ecological quality and has not been fully mapped in the SAC. Some marl lakes and ponds, such as Lough Gealain and Cooloorta, are within turloughs. Habitat 3140 was surveyed at Lough Bunny in 2011 (Roden and Murphy, 2013) and Ballyeighter Loughs 1 and 2, Bunny, Cooloorta, Cullaun, George and Muckanagh in 2012 and/or 2018 (Roden et al., 2020). An indicative distribution of the habitat in the SAC was mapped for NPWS (2013, 2019). Other sources of data on lake vegetation in the SAC include Heuff (1984), Roden (2001), Pybus et al. (2003), Langangen (2005) and the EPA for the lakes monitored under the Water Framework Directive. There is a long history of botanical recording in the Burren and many useful data sources exist (e.g. Praeger, 1934; Webb, 1962; Curtis and McGough, 1981; Webb and Scannell, 1983; Nelson and Walsh, 1991; Goodwillie et al., 1997 in Southern Water Global and Jennings O'Donovan and Partners, 1997; Nelson, 1999; Scannell and Jebb, 2000)
Vegetation composition: typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	Most surveyed lakes and ponds with habitat 3140 in the SAC have diverse charophyte communities and well-developed cyanophyte crusts (Roden and Murphy, 2013; Doddy, 2019; Roden et al., 2020). The SAC is also the centre of global distribution for the water beetle *Ochthebius nilssoni* that is found on cyanophyte crust (O'Callaghan et al., 2009; Nelson et al., 2019; Foster et al., 2020). Data on typical species in the SAC are available from a wide range of published and online sources, as well as Roden and Murphy (2013), Doddy (2019), Roden et al. (2020). For lists of 3140 typical species (cyanobacteria, algae, higher plants and water beetles), see the habitat 3140 Article 17 assessments (NPWS, 2013, 2019) and O Connor (2015). Roden et al. (2020) list species present in marl lakes in good condition, as well as other widespread and local/rare species

Vegetation composition: characteristic zonation	Occurrence	Restore characteristic charophyte and crust zones	All lakes surveyed had ≥4 characteristic zones; however, Cullaun, George and Muckanagh lacked the deep-water charophyte zones found elsewhere in the SAC, including in nearby Ballyeighter 2, likely as a result of reduced euphotic depth due to high water colour (Roden et al., 2020). Precautionarily, it is here assumed the deep-zone should be naturally present and the objective is restore. The characteristic zonation of 3140 in marl lakes described in Roden and Murphy (2013) was updated by Roden et al. (2020). Marl lakes in good condition have ≥4 characteristic vegetation zones, typically a cyanophyte crust zone with occasional *Chara virgata var. annulata*, a *C. curta* zone, a *C. rudis* zone, a *C. virgata* zone and, in some lakes, a *C. denudata* or *Nitella flexilis* zone. Roden et al. (2020) also provide methods for assessing the condition of the cyanophyte crust (3 metrics) and a novel indicator (C&K score) of good structure and functions
Vegetation distribution: maximum depth	Metres	Restore maximum depth of vegetation (euphotic depth), subject to natural processes	See Roden and Murphy (2013) and Roden et al. (2020) for data on maximum depth of vegetation in lakes in the SAC. Cooloorta has vegetation on the flat lake bottom at more than 9m depth, depending on water level; Cullaun, George and Muckanagh, by contrast, had euphotic depths of 5-6.5m in 2012 and/or 2018, indicating poor condition (Roden et al., 2020). Unusually low water levels in 2018 may have contributed to the lower euphotic depths measured; however, higher water colour appeared to be the limiting factor in Cullaun, George and Muckanagh where deep-water charophyte species were absent (Roden et al., 2020). The target for maximum depth of vegetation colonisation (euphotic depth) in marl lakes is >7m (Roden et al., 2020). Euphotic depth is considered to be a key measure of the structure and functions of marl lake vegetation and has been found to exceed 10m in some Irish marl lakes (Roden et al., 2020)
Hydrological regime: water level fluctuations	Metres	Maintain appropriate hydrological regime necessary to support the habitat	Groundwater flow dominates the karst landscape of the Burren. Delineation of groundwater divides/zones of contribution is required, and could explain differences in water colour between Ballyeighter Loughs and Muckanagh-George-Cullaun. Fluctuations in lake water level can be amplified by activities such as abstraction and drainage. In undisturbed marl lakes, fluctuations follow predictable seasonal trends and relationships exist with the vegetation zones (Roden et al., 2020). In summer, more than 90% of the crust zone should be covered and water level should never be lower than the top of the *Chara curta* zone; in winter, all zones should be submerged (Roden et al., 2020). Groundwater normally exerts a strong influence on the hydrology of marl lakes. Increased water level fluctuations can increase wave action, up-root vegetation, increase turbidity, alter the substratum and lead to nutrient release from sediment
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	See Roden and Murphy (2013) and Roden et al. (2020) for information on substratum types in the lakes in the SAC. In general, marl lakes are dominated by limestone bedrock, calcareous silt and sand, and loose stones (Roden et al., 2020). Deposited peat may indicate excessive sediment inputs and sediment can accumulate phosphorus and release it into the water column (Roden et al., 2020). Further research into acceptable sediment phosphorus concentrations and other aspects of substratum quality in marl lakes would be beneficial

pH and Alkalinity	pH units, mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	Data on alkalinity are available from the EPA (Environmental Protection Agency) for monitored lakes, and alkalinity is over 150mg/l or even 200mg/l in many marl lakes in the SAC. See also Roden et al. (2020) and Free et al. (2006). The lower alkalinity boundary for the habitat may lie between 80mg/l and 100mg/l; however, alkalinity is far higher in most Irish marl lakes, exceeding 200mg/l in some cases (Roden et al., 2020). Acidification is not considered a threat to habitat 3140, but eutrophication can lead to at least temporary increases in pH to toxic levels (>9/9.5 pH units). Maximum pH should be <9.0 pH units, in line with the surface water standards (The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019). Further study of the sediment pH, alkalinity and cation concentration may assist in understanding of nutrient cycling
Nutrients	mg/l P; mg/l N	Restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	The EPA reported high total phosphorus (TP) status in Loughs Bunny, Cullaun and Muckanagh 2007-15, with average concentrations ranging 0.005-0.008mg/l, while Atedaun and Inchiquin varied between good and moderate TP status and 0.015-0.51mg/l. Average TP has also been >10mg/l in some years in Lough Bunny (Roden and Murphy, 2013). See also Roden et al. (2020), Clabby et al. (2008), Free et al. (2006) and others. Roden et al. (2020) found that most marl lakes in good condition have TP ≤0.01mg/l and this is the target for good condition, although vegetation attributes determine the overall conservation condition (Roden et al., 2020). ≤0.01mg/l TP is equivalent to oligotrophic (OECD, 1982) and WFD high status (The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019). WFD high status targets for total ammonia (annual average ≤0.04mg/l N and annual 95th percentile ≤0.09mg/l N) may also be appropriate. See also Free et al. (2016)
Water colour	mg/l PtCo	Restore appropriate water colour to support the habitat	See Roden et al. (2020) and Free et al. (2006) for data on water colour in the SAC. Colour was relatively high at Muckanagh, George and Cullaun, and likely responsible for the reduced euphotic depth and absence of deep-water charophytes (Roden et al., 2020). Investigation is needed of drained peat and other potential sources of dissolved organic matter in the catchments of these lakes. Roden et al. (2020) found that water colour (dissolved light-absorbing compounds) is negatively correlated with euphotic depth, charophyte species richness and cover, and positively correlated with vascular plant cover in marl lakes. Roden et al. (2020) set good condition at <15mg/l PtCo; however, the most important Irish marl lakes have very clear waters with colour of <5mg/l PtCo. Roden et al. (2020) also set a TP×Colour Index with a target of <0.1 for good. Increased colour decreases light penetration and reduces the area of macrophyte habitat, particularly at the lower euphotic depths

Dissolved organic carbon (DOC)	mg/l	Maintain/restore appropriate organic carbon levels to support the habitat	Dissolved organic carbon (DOC) in the water column is linked to water colour. It can provide a substrate (food source) for heterotrophic organisms, which can impact directly (e.g. shading) and indirectly (e.g. nutrient release) on the characteristic lake communities. Damage and degradation of peatland, e.g. through afforestation or turf-cutting, leading to decomposition of peat is likely to be the predominant source of dissolved and particulate organic carbon in Ireland. Drainage of fen and other peat, for turf or scraw cutting, afforestation or agricultural improvement, may be responsible for the higher water colour in Muckanagh, George and Cullaun
Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate unit	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Transparency	Metres	Maintain/restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Secchi transparency data for lakes in the SAC can be found in Roden et al. (2020), Clabby et al. (2008) and Free et al. (2006). Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. Roden et al. (2020) advised it is preferable to measure euphotic depth directly by observation, but noted that a decreasing trend in Secchi depth indicates declining water quality. Transparency can be affected by phytoplankton blooms, water colour and turbidity. Secchi depth in marl lakes in good condition is generally >6m. The OECD fixed boundary system set transparency targets for oligotrophic lakes of ≥6m annual mean Secchi disk depth and ≥3m annual minimum Secchi disk depth
Attached algal biomass	Algal cover	Maintain trace/absent attached algal biomass (<5% cover)	Nutrient enrichment can favour epiphytic and epipelic algae that can out-compete the submerged vegetation. Roden et al. (2020) noted that occasional blooms of filamentous algae occur in marl lakes in the absence of excess nutrients, especially species of the orders Zygnematales or Oedogoniales, but that drifting masses of *Cladophora* species may indicate a decline in water quality. In general, the cover abundance of attached algae in marl lakes (3140) should be trace/absent (<5% cover)
Fringing habitat: area and condition	Hectares	Maintain/restore the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3140	The marl lakes and ponds in this SAC are fringed by a range of high conservation value habitats and vegetation communities, including alkaline and *Cladium* fen, orchid-rich grassland, limestone pavement, dry heath, reedbeds, freshwater marsh, wet and dry woodland, etc., in which a wide range of protected, red-listed and rare species occur. The fringing habitats along lake shorelines intergrade with and support the structure and functions of the lake habitat. Equally, fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves. See also Mainstone et al. (2016) and the other conservation objectives in this volume

3180 Turloughs*

To restore the favourable conservation condition of Turloughs* in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	East Burren Complex SAC contains a well-studied complex of Irish turloughs (Coxon, 1986; Goodwillie, 1992; Goodwillie et al., 1997 in Southern Water Global and Jennings O'Donovan and Partners, 1997; Regan, 2005; Naughton, 2011; O'Neill and Martin, 2015; Waldren, 2015). The more well-known turloughs in the SAC include Carran, Knockaunroe, Lough Mannagh, Castle Lough, Lough Aleenaun, Turloughmore, Tulla and Roo (NPWS internal files) and Lough Gealain (Waldren, 2015). Goodwillie (1992) studied six of the turloughs within the SAC; two were categorised as being of international ecological importance, two of national importance and two were of local importance. Five of the turloughs in the SAC were studied by Waldren (2015), with three assessed to be in favourable (good) condition and two in unfavourable-bad condition. See O Connor (2017) for information on all attributes and targets
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for habitat area above
Hydrological regime	Various	Maintain appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Hydrological regime is sub-divided into more detailed attributes (groundwater contribution, flood duration, frequency, area and depth, and permanently flooded/wet areas) and targets in O Connor (2017). The hydrology of East Burren Complex SAC has been well-studied (Coxon, 1986; Goodwillie, 1992; Naughton, 2011; Naughton et al., 2012, 2018; Waldren, 2015). Flooding regime across the turloughs within East Burren Complex SAC varies, with some, such as Knockaunroe, Roo West and Lough Gealain, recorded as having one major flooding event per annum, while others are characterised by many flooding events throughout the year, such as Lough Aleenaun and Turloughmore (Waldren, 2015). Waldren (2015) assessed the hydrological regime at all five turloughs that were studied within the East Burren Complex SAC as good
Soil type	Hectares	Maintain variety, area and extent of soil types necessary to support turlough vegetation and other biota	There is a diversity of soil types within East Burren Complex SAC. Peat soils are common within certain turloughs. For example, at Lough Aleenaun and Carran turlough, fen peat is the dominant soil type, and at Knockaunroe and Lough Mannagh, peat-marl is dominant (Goodwillie, 1992; Kimberley et al., 2012; Waldren, 2015). Other common soil types recorded within turloughs in the SAC include alluvial marl, which is the dominant soil type at Roo West and common at Lough Gealain, and shallow, poorly drained mineral soils, which are the dominant soil type at Turloughmore (Waldren, 2015). For further information on soil type in East Burren Complex SAC, see Goodwillie (1992) and Waldren (2015)

Soil nutrient status: nitrogen and phosphorus	N and P concentration in soil	Maintain nutrient status appropriate to soil types and vegetation communities	Waldren (2015) recorded the nutrient status of the soils within five turloughs from East Burren Complex SAC and the results were quite variable. Mean total nitrogen (TN) within the soils at Knockaunroe, Lough Aleenaun, Lough Gealain and Roo West turloughs was high (12,077mg/kg to 24,233mg/kg TN) and at Turloughmore, the value was low (8,233mg/kg TN) compared to the median value for the 22 turloughs studied by Waldren (2015). Mean total phosphorus (TP) at Knockaunroe, Lough Aleenaun and Turloughmore was high (915mg/kg to 1,594mg/kg TP) and at Lough Gealain and Roo West was low (578mg/kg to 716mg/kg TP) compared to the median value for the 22 turloughs studied by Waldren (2015)
Physical structure: bare ground	Presence	Maintain sufficient wet bare ground, as appropriate	See O Connor (2017) for information on all attributes and targets
Chemical processes: calcium carbonate deposition and concentration	Calcium carbonate deposition rate/soil concentration	Maintain appropriate calcium carbonate deposition rate and concentration in soil	Waldren (2015) recorded the status of the soils within five turloughs within East Burren Complex SAC. The soils for Knockaunroe, had a low calcium carbonate content of 5.2% and the soils for the other four turloughs, Lough Aleenaun, Lough Gealain, Roo West and Turloughmore, had a high calcium carbonate content of 15.8% to 37.7%
Water quality	Various	Restore appropriate water quality to support the natural structure and functioning of the habitat	Water quality is sub-divided into more detailed attributes (nutrients, colour, phytoplankton and epiphyton biomass) and targets in O Connor (2017). See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. Waldren (2015) studied the hydrochemistry of five turloughs from East Burren Complex SAC. The trophic status of the turloughs within the SAC varied, with some, such as Lough Gealain, naturally highly oligotrophic, and others, such as Lough Aleenanun and Turloughmore, naturally oligotrophic. The water quality at Lough Aleenaun, with 30.7µg/l TP and extensive algal mats, needs to be restored. Turloughs in the SAC should, typically, be naturally highly oligotrophic and require a target of ≤10µg/l TP to reach favourable condition. Chlorophyll *a* should have annual mean <2.5µg/l and annual maximum ≤8µg/l. There should be trace/absent epiphyton as algal mats (<2% cover)
Active peat formation	Flood duration	Maintain active peat formation	Peat soils are relatively common within the turlough habitat in this SAC. At Lough Aleenaun, fen peat is the dominant soil type (64.9% of the area), and at Knockaunroe peat-marl is dominant (74.6% of the area) (Waldren, 2015). Peat soils are also common in the Carran and Lough Mannagh turloughs within East Burren Complex SAC (Goodwillie, 1992)
Vegetation composition: area of vegetation communities	Hectares	Restore area of sensitive and high conservation value vegetation communities/units	The vegetation within the turloughs in the SAC is diverse. Common communities within the five turloughs studied by Waldren (2015) include *Eleocharis palustris-Ranunculus flammula* and *Lolium* grassland. Goodwillie (1992) recorded a wet *Carex nigra* community (6B) as relatively common, and an extensive tall sedge community (7B) with *Carex rostrata* at Carran turlough. Vegetation communities of high conservation value recorded by Waldren (2015) included the *Filipendula ulmaria-Potentilla erecta-Viola* sp. community, the *Molinia caerulea-Carex panicea* community and a Flooded pavement community. Of note are the open water communities recorded at Lough Gealain with *Phragmites australis* and *Cladium mariscus* (Waldren, 2015) and the charophyte communities recorded at Lough Gealain and Carran. See Goodwillie (1992), Regan (2005) and Waldren (2015) for further information on vegetation communities in the SAC

Vegetation composition: vegetation zonation	Distribution	Maintain vegetation zonation/mosaic characteristic of the turlough	Within the five turloughs studied by Waldren (2015) in East Burren Complex SAC, the upper vegetation zone commonly included Flooded pavement, Limestone grassland and *Lolium* grassland communities. Moving down into these five turloughs, the *Eleocharis palustris-Ranunculus flammula* community was common and at the lowest levels within some of the turloughs, reedbeds and open water communities were recorded (Waldren, 2015). According to Goodwillie (1992), there were extensive tall sedge communities towards the base of some of the turloughs within the SAC, such as Carran turlough. The base of many turloughs in the SAC is marl lake/pond with habitat 3140 (see the conservation objective in this volume). See Goodwillie (1992), Regan (2005) and Waldren (2015) for further information on vegetation communities in East Burren Complex SAC
Vegetation structure: sward height	Centimetres	Maintain sward heights appropriate to the vegetation unit, and a variety of sward heights across the turlough	The vegetation structure within the turlough habitat in East Burren Complex SAC is generally good. However, Waldren (2015) reported that Turloughmore is heavily grazed by sheep and cattle, and there is evidence of agricultural improvement (improved grassland, woodland and scrub clearance) at the site. See Goodwillie (1992), Regan (2005) and Waldren (2015) for further information on vegetation communities in East Burren Complex SAC
Typical species	Presence	Maintain typical species within the turlough	Typical species is sub-divided into more detailed attributes and targets in O Connor (2017). Notable vascular plant species recorded in the SAC include *Potentilla fruticosa* and *Viola persicifolia* (Waldren, 2015), listed respectively as Vulnerable (VU) and Near Threatened (NT) in Wyse Jackson et al. (2016), *Limosella aquatica* (NPWS internal files), *Teucrium scordium* (M. Wyse Jackson, pers. comm.), and *Filipendula vulgaris, Frangula alnus* and *Rorippa islandica* (Waldren, 2015). The rare *Chara aculeolata* and *Nitella tenuissima* have been recorded from Carran turlough and Lough Gealain. Notable moss species recorded include *Drepanocladus sendtneri* (NT), *Pseudocalliergon lycopodioides* and *P. trifarium*, both VU in Lockhart et al. (2012). Bradish et al. (2002) and Regan (2005) recorded notable beetle species listed in Foster et al. (2009) and Hyman and Parsons (1992)
Fringing habitats: area	Hectares	Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations	East Burren Complex SAC is of high conservation importance for its mosaic of Annex I and other habitats, particularly the transitions and gradations between habitats, e.g. between turloughs, limestone pavement, limestone grassland, scrub and woodland. See the other conservation objectives in this volume
Vegetation structure: turlough woodland	Species diversity and woodland structure	Maintain appropriate turlough woodland diversity and structure	The turloughs within East Burren Complex SAC are fringed by scrub and woodland communities. Goodwillie (1992) reported that the scrub communities at some of the turloughs within the SAC, such as Carran turlough, included *Frangula alnus, Rhamnus cathartica* and *Potentilla fruticosa*

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	Selection of East Burren Complex SAC for the habitat was based on limited data. Groundwater flow dominates the SAC and the only major over-ground river is a portion of the Fergus between Lough Inchiquin and Bealickania Bridge (downstream of Lough Atedaun). These stretches were drained from 1959 to 1963 as part of the Fergus Drainage Scheme. Curtis and McGough (1981) stated that the Fergus had 'well-developed aquatic flora and an interesting marginal flora'. Further survey of the River Fergus is required to determine whether a high conservation value sub-type of the habitat occurs. High conservation value sub-types may be present elsewhere within the SAC, such as in intermittent streams and lake in-flows, and may be associated with petrifying springs
Habitat distribution	Occurrence	No decline, subject to natural processes	As noted above, the distribution of the habitat in East Burren Complex SAC is not well known. Further study of Irish rivers is needed to interpret the broad description of habitat 3260 which covers from upland bryophyte/macroalgal dominated to lowland depositing rivers with pondweeds and starworts (European Commission, 2013)
Hydrological regime: river flow	Metres per second	Maintain/restore appropriate hydrological regimes	The stretches of the River Fergus within the SAC were subject to drainage, between 1959 and 1963 (inclusive). The river is meandering and generally slow-flowing in the SAC, with naturally broad-floodplains, and may have hydrological and ecological similarities to turloughs in the region. The hydrological regime of other streams or rivers in the SAC may be less altered, although drainage of lake inflows/outflows is common. All rivers and streams in the SAC are dominated by base-rich groundwater input. A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003)
Hydrological regime: groundwater discharge	Metres per second	Maintain appropriate hydrological regime	Hydrological regimes in the SAC are dominated by calcareous groundwater. It is essential that the appropriate groundwater contributions necessary for the natural functioning of the habitat are maintained and that there is no significant disturbance of the catchments' groundwater regimes
Substratum composition: particle size range	Millimetres	Maintain appropriate substratum particle size range, quantity and quality, subject to natural processes	Fine particles may dominate the River Fergus in the SAC. Although many high conservation value sub-types are dominated by coarse substrata and bedrock, certain sub-types, notably those associated with lake inflows/outflows, peatlands and groundwater inputs, are dominated by fine substrata. The size and distribution of particles is largely determined by the river flow and geology. The chemical composition (particularly minerals and nutrients) of the substratum is also important. The quality of finer sediment particles is a notable driver of rooted plant communities

Water quality	Various	Maintain/restore appropriate water quality to support the natural structure and functioning of the habitat	In 2019, the two River Fergus stations between Loughs Inchiquin and Atedaun had Q3-4 (moderate status/unsatisfactory). The specific water quality targets may vary among sub-types. The rivers within the SAC are likely to be naturally base-rich but nutrient-poor, and likely to require Water Framework Directive high status in terms of nutrient and oxygenation standards. See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019, Environmental Protection Agency (EPA) river water quality reports (e.g. McGarrigle et al., 2010; Bradley et al., 2015; Fanning et al., 2017; O'Boyle et al., 2019) and Ní Chatháin et al. (2013)
Typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	Typical species have not been fully defined but may include higher plants, bryophytes, algae and invertebrates. Marginal species of conservation interest recorded along the Fergus include *Limosella aquatica* and *Eleocharis acicularis* (Curtis et al., 1985; Curtis and McGough, 1981). Species of interest known to occur elsewhere in the River Fergus include *Potamogeton* x *nerviger*, which has its only site in Britain or Ireland upstream of Lough Inchiquin just outside of the SAC (Preston, 1995), and *Sium latifolium*, as well as historical bryophyte records for *Cinclidotus riparius* and *Fontinalis antipyretica* var. *cymbifolia* (Lockhart et al., 2012)
Floodplain connectivity: area	Hectares	Maintain/restore the area of active floodplain at and upstream of the habitat	The stretches of the River Fergus in the SAC have naturally large floodplains. River connectivity with the floodplain is important for the functioning of habitat 3260. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High conservation value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003; Mainstone et al., 2016)
Riparian habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the habitat and its sub-types	Riparian habitats are integral to the structure and functioning of rivers, even where not part of a floodplain. Fringing habitats contribute to the aquatic food web, provide habitat for life-stages of fish, birds and aquatic invertebrates, assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling. Shade may suppress algal growth and moderating temperatures. Equally, fringing habitats are dependent on rivers, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016)

4060 Alpine and Boreal heaths

To maintain the favourable conservation condition of Alpine and Boreal heaths in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Alpine and Boreal heaths occur in close association with other Annex I habitats throughout East Burren Complex SAC: Limestone pavements* (8240), *Juniperus communis* formations on heaths or calcareous grasslands (5130) and Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) (6210). These Annex I habitats cannot easily be mapped or considered separately. Conservation objectives for all these habitats should be used in conjunction with each other as appropriate. The habitat was recorded in two (of four) sub-sites surveyed in detail in the SAC by Wilson and Fernandez (2013) as part of the National Survey of Limestone Pavement and Associated Habitats (NSLP): Abbey East (site code NSLP04) and Slievecarran (NSLP09). This survey should be consulted for further details
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for habitat area above. Both mountain avens (*Dryas octopetala*) dominated heath and bearberry (*Arctostaphylos uva-ursi*) dominated heath occur throughout the SAC from higher ground, such as at Slievecarran and Mullagh More, down to sea level, such as along the western shores of Lough Bunny (NPWS internal files)
Vegetation composition: positive indicator species	Number at a representative number of monitoring stops	At least seven positive indicator species present	Attribute and target based on Wilson and Fernandez (2013), where the list of positive indicator species, as identified by Wilson and Fernandez (2013), is presented. Positive indicator species recorded by Wilson and Fernandez (2013) in the habitat in the SAC include ling (*Calluna vulgaris*), bell heather (*Erica cinerea*), mountain avens (*Dryas octopetala*), slender St. John's-wort (*Hypericum pulchrum*), harebell (*Campanula rotundifolia*), hoary rock-rose (*Helianthemum oelandicum*), common bird's-foot-trefoil (*Lotus corniculatus*), tormentil (*Potentilla erecta*), wild thyme (*Thymus polytrichus*) and the bryophytes *Breutelia chrysocoma, Ctenidium molluscum, Dicranum scoparium, Hylocomium splendens* and *Pseudoscleropodium purum*. Bearberry (*Arctostaphylos uva-ursi*) has also been recorded in the habitat in the SAC, including at the lowland location at Lough Bunny (NPWS internal files)
Vegetation composition: negative indicator species	Percentage cover at a representative number of monitoring stops	Negative indicator species collectively not more than 1% cover	Attribute and target based on Wilson and Fernandez (2013), where the list of negative indicator species, as identified by Wilson and Fernandez (2013), is presented. Wilson and Fernandez (2013) recorded the negative indicator species cock's-foot (*Dactylis glomerata*) in the habitat in the SAC, but at less than 1% cover
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Non-native species not more than 1% cover	Attribute and target based on Wilson and Fernandez (2013)
Vegetation composition: native trees and shrubs	Percentage cover at a representative number of monitoring stops	Cover of native trees and shrubs (except juniper (*Juniperus communis*) not more than 25% cover	Attribute and target based on Wilson and Fernandez (2013)
Physical structure: disturbance	Percentage cover at a representative number of monitoring stops	Less than 10% disturbed bare ground (excluding rocks/stones)	Attribute and target based on Wilson and Fernandez (2013)

Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015, species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021) and other rare or localised species, as well as archaeological and geological features, which often support distinctive species. During the NSLP survey, the Near Threatened hoary rock-rose (*Helianthemum oelandicum*) (Wyse Jackson et al., 2016) was recorded in the habitat in the SAC (Wilson and Fernandez, 2013). The Vulnerable pyramidal bugle (*Ajuga pyramidalis*) (Wyse Jackson et al., 2016) has also been recorded in the habitat (NPWS internal files)

5130 Juniperus communis formations on heaths or calcareous grasslands

To maintain the favourable conservation condition of *Juniperus communis* formations on heaths or calcareous grasslands in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	*Juniperus communis* formations on heaths or calcareous grasslands occur in close association with other Annex I habitats within East Burren Complex SAC, particularly Alpine and Boreal heath (habitat code 4060), Limestone pavements* (8240) and Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (6210). As part of the Irish Juniper Monitoring Survey (O'Neill and Martin, 2018), the habitat was surveyed and mapped at two sub-sites: Rinecaha (site code CE21) - two formations present with an area of 0.35ha; Cappacasheen (GY08) - one formation of 501.46ha. Cooper et al. (2012) recorded juniper vegetation at a number of sub-sites in the SAC (sites CE03, CE08, CE09, CE11, CE13, CE28, CE31 and CE32), but not all are classified as juniper formations (see below). Sub-sites CE09, CE13, CE31 and CE32 were resurveyed by NPWS staff in 2015 (NPWS internal files), with an area of 527.4ha. Note that further unsurveyed areas may be present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 4 for location of areas surveyed	Distribution is based on O'Neill and Martin (2018) and NPWS internal files. Map 4 shows the locations of the juniper (*Juniperus communis*) formations at Rinecaha (CE21) and Cappacasheen (GY08), surveyed by O'Neill and Martin (2018), and at Lough Bunny (CE09), Corcomroe (CE13), Lough Cullan (CE31) and Poulataggle 1 (CE32), surveyed by NPWS staff in 2015 (NPWS internal files). It is important to note that further unsurveyed areas may be present within the SAC
Juniper formation size	Number and proximity of juniper plants	At least 50 juniper plants present with each plant separated by no more than 20m	Attribute and target based on O'Neill and Martin (2018). A juniper formation is defined by O'Neill and Martin (2018) as any cluster of ≥50 juniper plants where no plant is more than 20m from another. In practice, this means that juniper plants should achieve a minimum density of 25 plants per hectare to qualify as a formation. O'Neill and Martin (2018) estimated that the population at the Rinecaha sub-site (CE21) falls within an interval class of 50-100 plants (two formations of c.50 plants each) and the population at the Cappacasheen sub-site (GY08) exceeded 100,000 plants
Vegetation structure: female fruiting plants	Percentage in a representative number of 5m x 5m monitoring stops or in an *ad hoc* count of 50 plants	Fruiting females comprise at least 10% of juniper plants rooted in plot in at least 50% of stops or in an *ad hoc* count of 50 plants	Attribute and target based on Cooper et al. (2012) and O'Neill and Martin (2018). It was estimated that 29% of juniper plants were fruiting at the Rinecaha sub-site (CE21) and 45% were fruiting at the Cappacasheen sub-site (GY08) when surveyed by O'Neill and Martin (2018)
Vegetation structure: seedling recruitment	Presence in a representative number of 5m x 5m monitoring stops	At least one seedling recorded in at least one monitoring stop	Attribute and target based on O'Neill and Martin (2018). Juniper seedlings are defined as plants less than 15cm high that are still flexible and single-stemmed, or with only two branches at most
Vegetation structure: live juniper	Percentage in a representative number of 5m x 5m monitoring stops or across the site as a whole	At least 90% of juniper plants rooted in plot alive in at least 75% of stops or across the site as a whole	Attribute and target based on Cooper et al. (2012) and O'Neill and Martin (2018). No dead plants were recorded at the Rinecaha sub-site (CE21) and less than 1% dead plants were recorded at the Cappacasheen sub-site (GY08) by O'Neill and Martin (2018)

Vegetation composition: negative indicator species	Percentage in a representative number of 5m x 5m monitoring stops	Total cover of negative indicator species to be less than 10% in at least 50% of stops	Attribute and target based on O'Neill and Martin (2018) where the list of negative indicator species is also presented
Physical structure: germination niches	Percentage in a representative number of 5m x 5m monitoring stops	At least 5% bare soil and/or at least 5% bare rock in at least 25% of stops	Attribute and target based on O'Neill and Martin (2018). Bare soil is important as a germination micro-site and bare rock can also contribute, particularly at the soil-rock interface and in limestone pavement grikes
Formation structure: browning/die-back of plants	Percentage of juniper cover in a representative number of 5m x 5m monitoring stops	Browning or dead juniper branches (excluding fully dead plants) comprise no more than 20% of total juniper cover in plot in at least 75% of stops	Attribute and target based on O'Neill and Martin (2018)
Formation structure: evidence of browsing and bark stripping	Occurrence across a representative number of 5m x 5m monitoring stops	No browsing of juniper shoot tips, and trunk bark stripping evident in no more than 10% of juniper shrubs in at least 75% of stops	Attribute and target based on O'Neill and Martin (2018). This attribute concerns bark stripping by animals, due to herbivory or trampling. Bark stripping or damage from abrasion by rock is not included here. It should be noted, however, that distinguishing between the two may be difficult
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). The Vulnerable shrubby cinquefoil (*Potentilla fruticosa*) (Wyse Jackson et al., 2016) was recorded at the Rinecaha sub-site (CE21) and the Near Threatened spring gentian (*Gentiana verna*) (Wyse Jackson et al., 2016) was recorded at the Cappacasheen sub-site (GY08) by O'Neill and Martin (2018). The Vulnerable moth *Eupithecia intricata* feeds on juniper and occurs in the Burren as a distinct subspecies *hibernica* (Allen et al., 2016; Randle et al., 2019)

6130 Calaminarian grasslands of the Violetalia calaminariae

To restore the favourable conservation condition of Calaminarian grasslands of the Violetalia calaminariae in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	No decline, subject to natural processes	Calaminarian grasslands of the Violetalia calaminariae in East Burren Complex SAC was surveyed in detail by Hodd and Hodgetts (2019) at a former lead and zinc mine at the sub-site Sheshodonnell East, where the area of the habitat is estimated to be 0.009ha. The total area of mine spoil was estimated as 0.03ha (Hodd and Hodgetts, 2019). The site had previously been surveyed by Holyoak (2009). Hodd and Hodgetts (2019) noted little change since the site was surveyed by Holyoak (2009), but noted that the site has become somewhat more vegetated, especially with spring sandwort (*Minuartia verna*), and the overall extent of Calaminarian grassland had probably declined very slightly, but not significantly
Distribution	Location	No decline, subject to natural processes. See map 5 for the point location of the surveyed sub-site at Sheshodonnell East	Distribution based on Hodd and Hodgetts (2019). Calaminarian grassland at Sheshodonnell East in East Burren Complex SAC is documented to occur on a low spoil heap in a wide flat area of limestone pavement at an abandoned former lead and zinc mine (Holyoak, 2009; Hodd and Hodgetts, 2019)
Soil toxicity: heavy metal content	µg/g dry weight soil	Maintain high levels of the heavy metals lead, zinc and copper in soil	Mine spoil with similar vegetation from Cornwall had available copper of 151–3,220µg/g dry weight (Holyoak et al., 2000; Walsh, 2001). As soil toxicity derived from mining operations begins to leach out over time, its influence lessens, allowing previously inhibited plants to recolonise spoil at the expense of Calaminarian grassland habitat. In some cases, scraping back of vegetation and topsoil to create new habitat would be beneficial (Hodd and Hodgetts, 2019)
Vegetation composition: positive indicator species	Number	At least one positive indicator species present in the habitat	Attribute and target based on Hodd and Hodgetts (2019), where the list of positive indicator species is presented. Positive indicator species recorded in the habitat in the SAC by Hodd and Hodgetts (2019) include spring sandwort (*Minuartia verna*) and the bryophytes *Bryum* cf. *pallens, Cephaloziella stellulifera* and *Weissia controversa* var. *densifolia*. *Cephaloziella stellulifera* is classified as Near Threatened in Ireland (Lockhart et al., 2012). Other species recorded include common mouse-ear (*Cerastium fontanum*), red fescue (*Festuca rubra*), ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), devil's-bit scabious (*Succisa pratensis*) and the bryophytes *Bryum capillare, B. dichotomum, Dichodontium pellucidum, Dicranella varia, Hylocomium splendens* and *Schistidium crassipilum* (Hodd and Hodgetts, 2019)
Vegetation structure: scrub encroachment	Percentage	No more than 20% of the habitat should be affected by scrub encroachment	Attribute and target based on Hodd and Hodgetts (2019). Hodd and Hodgetts (2019) recorded 0% scrub encroachment at Sheshodonnell East

Physical structure: Percentage negative human impact	No more than 20% of the habitat should be impacted negatively by human activities	Attribute and target based on Hodd and Hodgetts (2019). Negative human impacts include dumping of waste, activities related to grazing, removal and excavation of spoil, pollution from agricultural and urban sources, trampling by tourists and walkers, and damage by scrambler bikes and off-road vehicles; sites on non-protected land are also vulnerable to damage or loss through reclamation, building work or conversion to productive agricultural land. At Sheshodonnell East, Hodd and Hodgetts (2019) noted that 80% of the habitat was impacted negatively by intensive cattle grazing leading to nutrient enrichment from dung and causing poaching, particularly in wetter parts of the habitat

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)

To restore the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The habitat occurs in close association with other Annex I habitats in the SAC, and these cannot easily be considered separately. The conservation objectives should be used in conjunction with each other as appropriate. Areas of 6210 have been mapped by 5 surveys: Grasslands Monitoring Project (GMP; Dwyer et al., 2007); Irish Semi-natural Grasslands Survey (ISGS; O'Neill et al., 2013); National Survey of Limestone Pavement (NSLP; Wilson and Fernandez, 2013); Orchid Ireland (Curtis and Wilson, 2014); Grasslands Monitoring Survey (GMS; Martin et al., 2018). GMP visited 5 areas, some visited by later surveys. ISGS surveyed 7 sites with 6210 (ISGS codes 1616, 1649, 1653, 1654, 1675, 1676, 2271), 3 of which the GMS re-surveyed. All Orchid Ireland sites were covered by ISGS. NSLP mapped the habitat at 10 plots in 4 study sites (NSLP02, 04, 09, 17). Notwithstanding the above, further unsurveyed areas are likely to be present within the SAC, and as such the total area of the habitat is unknown
Habitat distribution	Occurrence	No decline, subject to natural processes	Knowledge of the distribution is based on the five surveys listed above, which show the habitat to occur widely across the SAC, except for the south-east where wetlands dominate. However, knowledge of the distribution is known to be incomplete, i.e. further areas of the habitat are likely to occur within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least two 'high quality' positive indicator species present in stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality indicators, are also presented. These documents should be consulted for further details. See also Dwyer et al. (2007), Wilson and Fernandez (2013) and Curtis and Wilson (2014) for lists of species recorded in the habitat in the SAC. Of particular note, the Near Threatened orchids autumn lady's-tresses (*Spiranthes spiralis*), fly orchid (*Ophrys insectifera*) and frog orchid (*Coeloglossum viride*) (Wyse Jackson et al., 2016) have been recorded in the habitat in the SAC (Dwyer et al., 2007; O'Neill et al., 2013; Curtis and Wilson, 2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover of an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the list of negative indicator species is also presented
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Wilson and Fernandez (2013) list red valerian (*Centranthus ruber*) and cotoneaster (*Cotoneaster* sp.) as non-native species particularly associated with this habitat and limestone pavement, and both are known to occur and be spreading in parts of the Burren

Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species (except certain listed species) and bracken (*Pteridium aquilinum*) not more than 5%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Woody species that can occur above 5% cover are juniper (*Juniperus communis*), burnet rose (*Rosa spinosissima*), mountain avens (*Dryas octopetala*) and hoary rock-rose (*Helianthemum oelandicum*). However, cover of these species above 25% may indicate transition to another Annex I habitat such as Alpine and Boreal heaths (4060) or *Juniperus communis* formations (5130). Lack of management and/or insufficient grazing levels has resulted in the spread of scrub, bracken and heath species into areas of 6210 in places in this SAC, resulting in a loss of area. Scrub removal in parts of the sub-site Gortlecka (ISGS/GMS site code 1654) has led to an overall increase in the area of the habitat from the ISGS survey to the GMS (Martin et al., 2018). It is important to note that mature scrub is a valuable habitat, and only young encroaching scrub is suitable for removal and control
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Broadleaf herb component of vegetation between 30% and 40% may be allowed to pass on expert judgement (Martin et al., 2018). Rank purple moor-grass (*Molinia caerulea*) has developed in some areas that were formerly recorded as 6210 habitat by the ISGS (O'Neill et al., 2013) in the Keelhilla sub-site (ISGS/GMS site code 1616). This was reported to be due to a lack of grazing or mowing, and an increased cover of purple moor-grass was also recorded in some monitoring stops (Martin et al., 2018). High cover of any grass can impact on the broadleaf herb:grass ratio. It is understood that recent grazing increases have knocked back *Molinia* cover (NPWS internal files)
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 30% of sward between 5cm and 40cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare soil	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m²	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)

To restore the favourable conservation condition of Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The entire area of lowland hay meadows in East Burren Complex SAC is currently unknown. As part of the Irish Semi-natural Grasslands Survey (ISGS; O'Neill et al., 2013), the habitat was surveyed within the sub-site Glencolumbkille South (ISGS site code 1696). This sub-site was monitored during the Grassland Monitoring Survey (GMS; Martin et al., 2018) and c.8.6ha was mapped. See map 5. It is important to note that further unsurveyed areas are likely to be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution based on Martin et al. (2018). See map 5. It is important to note that further unsurveyed areas are likely to be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stop	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least one 'high quality' species present in stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality species, are also presented. These documents should be consulted for further details. Positive indicator species recorded in the habitat in the Glencolumbkille South sub-site during the ISGS (O'Neill et al., 2013) include red clover (*Trifolium pratense*), selfheal (*Prunella vulgaris*), autumn hawkbit (*Scorzoneroides autumnalis*), rough hawkbit (*Leontodon hispidus*), smooth hawksbeard (*Crepis capillaris*), ribwort plantain (*Plantago lanceolata*), yellow oat-grass (*Trisetum flavescens*) and common knapweed (*Centaurea nigra*), as well as the high quality indicator species oxeye daisy (*Leucanthemum vulgare*) and common spotted-orchid (*Dactylorhiza fuchsii*)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the list of negative indicator species is also presented. High cover of the negative indicator species perennial rye-grass (*Lolium perenne*) was recorded in one monitoring stop in the Glencolumbkille South sub-site by the GMS, although agricultural intensification is not evident in the sub-site (Martin et al., 2018)
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species and bracken (*Pteridium aquilinum*) not more than 5%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). A marginal failure result (35-39%) in the percentage broadleaf herb component may be allowed to pass on expert judgement (Martin et al., 2018)
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 50% of sward between 10cm and 50cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 5% bare soil	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or other disturbance less than 20m²	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

7210 Calcareous fens with Cladium mariscus and species of the Caricion davallianae*

To maintain the favourable conservation condition of Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae* in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae has not been mapped in detail for East Burren Complex SAC and thus the total current area of the priority qualifying habitat in the SAC is unknown. *Cladium* fens are frequent in the southern and eastern parts of the SAC, where hard water marl lakes (habitat code 3140) and Turloughs* (3180) also occur. Areas where extensive examples of the habitat have been recorded include around Lough Bunny, Lough Cullaun, Ballyeighter Loughs (particularly in the upper part of the system), Lough George, Muckanagh Lough, continuously around Lough Oona, around the various small lakes at Kilmacduagh marshes, Templebannagh Lough, Lough Briskeen, Lough Sheeaun, Attyslany Lough, Rockforest Lough and scattered around Skaghard/Travaun Loughs (NPWS internal files)
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for habitat area above
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Relevant nutrients and their natural ranges are yet to be defined for fen habitats. However, nitrogen deposition is noted as being relevant to this habitat in O'Neill et al. (in prep.). See also Kelleghan et al. (in prep.). Increased nutrients can lead to changes in plant and invertebrate species through competition and subsequent structural changes to micro-habitats. These nutrients favour growth of grasses rather than forbs and mosses and leads to a higher and denser sward
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	In order for peat to form, water levels need to be slightly below or above the soil surface for c.90% of the time
Ecosystem function: hydrology - groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients; water supply	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). Fen groundwater levels are controlled by regional groundwater levels in the contributing catchment area (which sustain the hydraulic gradients of the fen groundwater table). Regional abstraction of groundwater may affect fen groundwater levels
Ecosystem function: hydrology - surface water flow	Drain density and form	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	Drainage, either within or surrounding the fen habitat, can result in the drawdown of the fen groundwater table. The depth, geometry and density of drainage (hydromorphology) will indicate the scale and impact on fen hydrology. Drainage can result in loss of characteristic species and transition to drier habitats
Ecosystem function: water quality	Various	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus, with the latter tending to be the limiting nutrient under natural conditions. Water supply should also be relatively calcium-rich
Vegetation composition: cover of *Cladium mariscus*	Percentage cover at a representative number monitoring stops	Cover of *Cladium mariscus* at least 25%	Attribute and target based on O'Neill et al. (in prep.)

Vegetation composition: typical vascular plants	Percentage cover at a representative number monitoring stops	Maintain adequate cover of typical vascular plant species	For lists of typical vascular plant species, including high quality indicators, see O'Neill et al. (in prep.). Typical species occurring along with great fen-sedge (*Cladium mariscus*) in the habitat in the SAC includes black bog-rush (*Schoenus nigricans*) (NPWS internal files). See also Goodwillie (1972)
Vegetation composition: native negative indicator species	Percentage cover at a representative number of monitoring stops	Cover of native negative indicator species at insignificant levels	Negative indicators include species not characteristic of the habitat and species indicative of undesirable activities such as overgrazing, undergrazing, nutrient enrichment, agricultural improvement or impacts on hydrology. Native negative indicators may include *Anthoxanthum odoratum, Epilobium hirsutum, Holcus lanatus, Juncus effusus, Phragmites australis, Ranunculus repens* and *Typha latifolia*. See O'Neill et al. (in prep.)
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species less than 1%	Attribute and target based on O'Neill et al. (in prep.). Non-native species can be invasive and have deleterious effects on native vegetation. A low target is set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on O'Neill et al. (in prep.). Scrub and trees will tend to invade if fen conditions become drier
Vegetation composition: algal cover	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of algae less than 2%	Attribute and target based on O'Neill et al. (in prep.). Algal cover is indicative of nutrient enrichment from multiple sources (McBride et al., 2011)
Vegetation structure: vegetation height	Percentage cover at a representative number of monitoring stops	At least 10% of live shoots more than 1m high	Attribute and target based on O'Neill et al. (in prep.)
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground not more than 10%	Attribute and target based on O'Neill et al. (in prep.). While grazing may be appropriate in this habitat, excessive areas of disturbed bare ground may develop due to unsuitable grazing regimes. Disturbance can include hoof marks, wallows, human footprints, vehicle and machinery tracks. Excessive disturbance can result in loss of characteristic species
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Attribute and target based on O'Neill et al. (in prep.)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019; 2021)
Transitional areas between fen and adjacent habitats	Hectares; distribution	Maintain/restore adequate transitional areas to support/protect the *Cladium* fen habitat and the services it provides	In many cases, fens transition to other wetland habitats. It is important that the transitional areas between *Cladium* fen and other habitats are maintained in as natural condition as possible in order to protect the functioning of the fen. The *Cladium* fen habitat occurs in association with the Annex I habitat Alkaline fens (7230) and other swamp vegetation in the SAC. See the conservation objective for habitat 7230 in this volume

7220 Petrifying springs with tufa formation (Cratoneurion)*

To maintain the favourable conservation condition of Petrifying springs with tufa formation (Cratoneurion)* in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Square metres	Area stable or increasing, subject to natural processes	Within East Burren Complex SAC, Lyons (2015) recorded a total of 680m² (0.068ha) of Petrifying springs with tufa formation (Cratoneurion)* habitat within seven sub-sites: 30m² at Doomore (site code PS053); 350m² at Keelhilla Nature Reserve fen (PS054a); 100m² at Keelhilla Nature Reserve waterfall (PS054b); 50m² at Seven Streams of Teeskagh (PS095a); 50m² at Teeskagh (PS095b); 50m² at Rinnamona Lough Stream Head (PS103) and 50m² at Rinnamona Lough Fen (PS104). The total of 680m² is the minimum estimated area of the habitat in the SAC. This is a dynamic habitat and one which is likely to be significantly impacted by any reduction in water supply. Tufa sites may also decrease naturally due to natural blockages of upwelling springs. See Lyons (2015) and Lyons and Kelly (2016) for further details. It is important to note that further unsurveyed locations of the habitat are likely to be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 6 for point locations of sub-sites surveyed by Lyons (2015)	See map 6 for the habitat distribution (point locations) in East Burren Complex SAC based on Lyons (2015). It is important to note that further unsurveyed areas may be present within the SAC
Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources (Lyons and Kelly, 2013). In karst areas, water tends to flow away rapidly over bare rock surfaces, even on fairly flat ground (Lyons and Kelly, 2013). Water flow should not be altered anthropogenically. See Lyons and Kelly (2016) for further details
Physical structure: tufa formations	Seepage rate to the spring and groundwater quality (saturated calcium carbonate, pH, temperature and alkalinity conditions)	Maintain appropriate levels of tufa formation	Petrifying springs are springs that typically form small calcareous or 'tufa' deposits. On contact with the atmosphere at the spring head, carbon dioxide is lost from calcium saturated water to the atmosphere or is depleted by the photosynthetic activities of plants. This results in the precipitation of a calcium carbonate marl or tufa. Seepage flow rates are crucial for the development of tufa. See Lyons (2015) and Lyons and Kelly (2016) for further details
Ecosystem function: water quality - nitrate level	mg/l	Maintain nitrate levels at less than 10mg/l	Attribute and target based on Lyons and Kelly (2016). Nitrate levels were recorded at PS054a, PS103 and PS104 by Lyons (2015), where baseline levels were 1.72mg/l, 3.11mg/l and <0.07mg/l, respectively
Ecosystem function: water quality - phosphate level	µg/l	Maintain phosphate levels at less than 15µg/l	Attribute and target based on Lyons and Kelly (2016). Phosphate levels were recorded at PS054a, PS103 and PS104 by Lyons (2015), where the baseline levels were 7µg/l, 6µg/l and 4µg/l, respectively

Vegetation composition: community diversity	Variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Lyons and Kelly (2016) describe eight plant communities of Irish petrifying springs based on relevé data. The habitat in the Keelhilla Nature Reserve fen sub-site (PS054a) and in the Rinnamona Lough Fen sub-site (PS104) falls mainly into the *Schoenus nigricans* springs group, the habitat in the Keelhilla Nature Reserve waterfall sub-site (PS054b) falls into the *Brachythecium rivulare-Platyhypnidium riparioides* tufaceous streams and flushes group and that at Rinnamona Lough Stream Head sub-site (PS103) falls into the *Carex lepidocarpa* small sedge springs group (Lyons, 2015). Further information on the vegetation communities associated with this habitat is presented in Lyons and Kelly (2016)
Vegetation composition: positive indicator species	Number per spring	At least three positive/high quality indicator species as listed in Lyons and Kelly (2016) and no loss from baseline number	Based on Lyons and Kelly (2016), where the lists of positive and high quality indicator species are presented. Lyons (2015) recorded 4 positive indicator species at PS053, 16 at PS054a, 1 at PS054b, 2 at PS095a, 8 at PS095b, 11 at PS103 and 14 at PS104. Species recorded included long-stalked yellow-sedge (*Carex lepidocarpa*), black bog-rush (*Schoenus nigricans*), variegated horsetail (*Equisetum variegatum*), common butterwort (*Pinguicula vulgaris*), the stonewort *Chara vulgaris* and the bryophytes *Aneura pinguis, Bryum pseudotriquetrum, Campylium stellatum, Palustriella commutata, P. falcata, Pellia endiviifolia, Philonotis calcarea, Scorpidium cossonii* and *S. scorpioides*. See Lyons (2015) for full species lists recorded. Of particular note, the high quality indicator liverwort *Leiocolea bantriensis*, which is Near Threatened in Ireland (Lockhart et al., 2012), was recorded at the sub-site PS054a by Lyons (2015)
Vegetation composition: negative indicator species	Cover (DAFOR scale)	Potentially negative indicator species should not be Dominant or Abundant; potentially negative woody species should be absent in unwooded springs; invasive species should be absent	Based on Lyons and Kelly (2016), where the lists of potentially negative herbaceous, bryophyte, algal and woody species are presented. See Lyons and Kelly (2016) also for details on potentially invasive species. If two or more potentially negative bryophyte/alga species are present, and if at least two are Frequent, or at least one is Abundant, then the habitat fails for this attribute. See Lyons and Kelly (2016) for further details. Lyons (2015) recorded the potentially negative bryophyte species *Cratoneuron filicinum* at PS053, PS054a, PS095a, PS095b and PS103 and *Platyhypnidium riparioides* at PS054b and PS095b, and the potentially negative herbaceous species hemp-agrimony (*Eupatorium cannabinum*) at PS103. The potentially negative woody species grey willow (*Salix cinerea*) and ling (*Calluna vulgaris*) were recorded at PS054a, an unwooded spring, but were very rare, and the grazing level was deemed appropriate (Lyons, 2015)
Vegetation composition: algal cover	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of algae less than 2%	Algal cover is indicative of nutrient enrichment from multiple sources (McBride et al., 2011)
Vegetation structure: sward height	Centimetres	Field layer height between 10cm and 50cm (except for bryophyte-dominated ground <10cm)	Attribute and target based on Lyons and Kelly (2016)
Physical structure: trampling/dung	Cover (DAFOR scale)	Cover should not be Dominant or Abundant	Attribute and target based on Lyons and Kelly (2016). Trampling was recorded as Abundant at Doomore (PS053) by Lyons (2015) who stated that the flush in the sub-site was trampled, but the springhead was too steep and inaccessible to be affected

Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021)

7230 Alkaline fens

To maintain the favourable conservation condition of Alkaline fens in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Alkaline fen has not been mapped in detail for East Burren Complex SAC and thus the total current area of the qualifying habitat in the SAC is unknown. The habitat is documented to occur frequently in the SAC, particularly in the southern and eastern parts. Alkaline fen is thought to occur around practically all of the calcareous waterbodies in the SAC, e.g. Lough Bunny, Lough Atedaun, Lough Cullaun, Ballyeighter Loughs, Lough George, Muckanagh Lough, Lough Oona, Kilmacduagh marshes, Templebannagh Lough, Lough Briskeen, Lough Sheeaun and Skaghard/Travaun Loughs. Some small wetlands in the high Burren also contain alkaline fen, notably Rinnamona Lough Fen and Carran turlough (NPWS internal files)
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for habitat area above
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat in O'Neill et al. (in prep.). See also Kelleghan et al. (in prep.) and Bobbink and Hettelingh (2011). Increased nutrients can lead to changes in plant and invertebrate species through competition and subsequent structural changes to micro-habitats. These nutrients favour growth of grasses rather than forbs and mosses and leads to a higher and denser sward
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	In order for peat to form, water levels need to be slightly below or above the soil surface for c.90% of the time
Ecosystem function: hydrology - groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients; water supply	Maintain, or restore where necessary, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). Fen groundwater levels are controlled by regional groundwater levels in the contributing catchment area (which sustain the hydraulic gradients of the fen groundwater table). Regional abstraction of groundwater may affect fen groundwater levels
Ecosystem function: hydrology - surface water flow	Drain density and form	Maintain, or restore where necessary, as close as possible to natural or semi-natural drainage conditions	Drainage, either within or surrounding the fen habitat, can result in the drawdown of the groundwater table. The depth, geometry and density of drainage (hydromorphology) will indicate the scale and impact on fen hydrology. Drainage can result in loss of characteristic species and transition to drier habitats
Ecosystem function: water quality	Various	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus, with the latter tending to be the limiting nutrient under natural conditions. Water supply should also be relatively calcium-rich
Vegetation composition: community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	See Curtis and McGough (1981) for details on vegetation communities recorded in this SAC. Information on the vegetation communities associated with alkaline fens is provided by O'Neill et al. (in prep.). See also the Irish Vegetation Classification (Perrin, 2018; www.biodiversityireland.ie/projects/ivc-classification-explorer)

Vegetation composition: typical brown mosses	Percentage cover at a representative number of monitoring stops	Maintain adequate cover of typical brown moss species	For lists of typical bryophyte species, including high quality indicator species, see O'Neill et al. (in prep.). Bryophytes recorded in the habitat in the SAC include *Calliergon giganteum, Calliergonella cuspidata* and *Scorpidium scorpioides* (NPWS internal files)
Vegetation composition: typical vascular plants	Percentage cover at a representative number of monitoring stops	Maintain adequate cover of typical vascular plant species	For lists of typical vascular plant species for the different vegetation communities, including high quality indicators, see O'Neill et al. (in prep.). In this SAC, typical species recorded in the habitat include black bog-rush (*Schoenus nigricans*), long-stalked yellow-sedge (*C. lepidocarpa*), purple moor-grass (*Molinia caerulea*) and the high quality indicator species early marsh-orchid (*Dactylorhiza incarnata*) (NPWS internal files). See also Goodwillie (1972)
Vegetation composition: native negative indicator species	Percentage cover at a representative number of monitoring stops	Cover of native negative indicator species at insignificant levels	Negative indicators include species not characteristic of the habitat and species indicative of undesirable activities such as overgrazing, undergrazing, nutrient enrichment, agricultural improvement or impacts on hydrology. Native negative indicators may include *Anthoxanthum odoratum, Epilobium hirsutum, Holcus lanatus, Juncus effusus, Phragmites australis* and *Ranunculus repens*. See O'Neill et al. (in prep.)
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species less than 1%	Attribute and target based on O'Neill et al. (in prep.). Non-native species can be invasive and have deleterious effects on native vegetation. A low target is set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on O'Neill et al. (in prep.). Scrub and trees will tend to invade if fen conditions become drier
Vegetation composition: algal cover	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of algae less than 2%	Attribute and target based on O'Neill et al. (in prep.). Algal cover is indicative of nutrient enrichment from multiple sources (McBride et al., 2011)
Vegetation structure: vegetation height	Percentage cover at a representative number of monitoring stops	At least 50% of the live leaves/flowering shoots are more than either 5cm or 15cm above ground surface depending on community type	Attribute and target based on O'Neill et al. (in prep.). While grazing may be appropriate in this habitat, excessive grazing can reduce the ability of plant species to regenerate reproductively and maintain species diversity, especially if flowering shoots are cropped during the growing season
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of disturbed bare ground not more than 10%	Attribute and target based on O'Neill et al. (in prep.). While grazing may be appropriate in this habitat, excessive areas of disturbed bare ground may develop due to unsuitable grazing regimes. Disturbance can include hoof marks, wallows, human footprints, vehicle and machinery tracks. Excessive disturbance can result in loss of characteristic species and presage erosion for peatlands
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Attribute and target based on O'Neill et al. (in prep.)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021)

Transitional areas between fen and adjacent habitats	Hectares; distribution	Maintain adequate transitional areas to support/protect the alkaline fen habitat and the services it provides	In many cases, fens transition to other wetland habitats. It is important that the transitional areas between fens and other habitats are maintained in as natural condition as possible in order to protect the functioning of the fen. In this SAC, alkaline fen occurs in association with *Cladium* fen* (7210) and other wetland vegetation. See the conservation objective for the priority Annex I habitat Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae in this volume

8240 Limestone pavements*

To restore the favourable conservation condition of Limestone pavements* in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Limestone pavements* occurs in intimate association with other Annex I habitats in East Burren Complex SAC: Alpine and Boreal heaths (habitat code 4060); *Juniperus communis* formations on heaths or calcareous grasslands (5130); Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) (6210); Petrifying springs with tufa formation (Cratoneurion)* (7220). Therefore, these habitats cannot easily be mapped or considered separately. As part of the National Survey of Limestone Pavements and Associated Habitats, Wilson and Fernandez (2013) mapped the indicative area of limestone pavement, including mosaics with associated habitats, as 11,390.5ha (see map 7). Wilson and Fernandez (2013) surveyed four sub-sites in the SAC: Gortlecka (site code NSLP02), Abbey East (NSLP04), Slievecarran (NSLP09) and Cloonselherny (NSLP17). This survey should be consulted for further details
Distribution	Occurrence	No decline. Map 7 shows indicative distribution, including mosaics with other habitats	See the notes for habitat area above. Distribution based on data from Wilson and Fernandez (2013). This habitat can be split into exposed pavement and wooded pavement. In this SAC, limestone pavement includes smooth, blocky and shattered types. Wooded pavement occurs in some parts of the SAC, for example in the NSLP sub-sites Gortlecka (NSLP02), Slievecarran (NSLP09) and Cloonselherny (NSLP17) (Wilson and Fernandez, 2013), and in other areas of the SAC, such as the Glen of Clab (NPWS internal files)
Vegetation composition: positive indicator species	Number at a representative number of monitoring stops	At least seven positive indicator species present	Positive indicator species for exposed and wooded pavement are listed in Wilson and Fernandez (2013). Positive indicator species recorded in exposed pavement in the SAC by Wilson and Fernandez (2013) include herb-robert (*Geranium robertianum*), wall lettuce (*Mycelis muralis*), wood sage (*Teucrium scorodonia*), wild thyme (*Thymus polytrichus*), wall-rue (*A. ruta-muraria*), rustyback fern (*A. ceterach*), brittle bladder-fern (*Cystopteris fragilis*), *Fissidens dubius* and *Neckera crispa*. Those recorded in wooded pavement include hazel (*Corylus avellana*), hawthorn (*Crategus monogyna*), spindle (*Euonymus europaeus*), ash (*Fraxinus excelsior*), blackthorn (*Prunus spinosa*), false brome (*Brachypodium sylvaticum*), wood anemone (*Anemone nemorosa*), wood sanicle (*Sanicula europaea*), *Thamnobryum alopecurum* and *Thuidium tamariscinum*
Vegetation composition: bryophyte layer	Percentage at a representative number of monitoring stops	Bryophyte cover at least 50% on wooded pavement	Attribute and target based on Wilson and Fernandez (2013)
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Collective cover of negative indicator species on exposed pavement not more than 1%	Negative indicator species are listed in Wilson and Fernandez (2013). Negative indicator species for wooded pavement overlap with non-native species (below)
Vegetation composition: non-native species	Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1% on exposed pavement; on wooded pavement not more than 10% with no regeneration	Attribute and target based on Wilson and Fernandez (2013). Red valerian (*Centranthus ruber*) was recorded within the Abbey East sub-site (NSLP04), and red valerian and wild clematis (*Clematis vitalba*) were recorded in the Cloonselhenry sub-site (NSLP17) by Wilson and Fernandez (2013)

Vegetation composition: scrub	Percentage at a representative number of monitoring stops	Scrub cover no more than 25% of exposed pavement	Attribute and target based on Wilson and Fernandez (2013). Scrub removal as part of the BurrenLIFE and Burren Farming for Conservation projects was noted in the Gortlecka sub-site (NSLP02) by Wilson and Fernandez (2013)
Vegetation composition: bracken cover	Percentage at a representative number of monitoring stops	Bracken (*Pteridium aquilinum*) cover no more than 10% on exposed pavement	Attribute and target based on Wilson and Fernandez (2013). Bracken was recorded at one monitoring plot in the sub-site Cloonselhenry (NSLP17) by Wilson and Fernandez (2013) but at less than 10% cover
Vegetation structure: woodland canopy	Percentage at a representative number of monitoring stops	Canopy cover on wooded pavement at least 30%	Attribute and target based on Wilson and Fernandez (2013)
Vegetation structure: dead wood	Occurrence in a representative number of monitoring stops	Sufficient quantity of dead wood on wooded pavement to provide habitat for saproxylic organisms	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Physical structure: disturbance	Occurrence in a representative number of monitoring stops	No evidence of grazing pressure on wooded pavement	Attribute and target based on Wilson and Fernandez (2013)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (see Nelson et al., 2019, 2021) and other rare or localised species, as well as archaeological and geological features, which often support distinctive species. The Burren is recognised as having one of the most important diverse and species-rich assemblages of insect and invertebrate species in Ireland, the best known of which is the Lepidoptera (moths and butterflies), but extends into many other groups. Several species occur as distinct races or subspecies confined to the Burren, e.g. Burren green (*Calamia tridens occidentalis*), dingy skipper (*Erynnis tages baynesi*) and Mere's pug (*Eupithecia intricata hibernica*) (Bond and Gittings, 2008). See also: Mantell and Anderson (2020); Randle et al. (2019); Woodrow et al. (2018); Nelson et al. (2011); Asher et al. (2001); Speight (1999); Morris (1967, 1974); Bradley and Pelham-Clinton (1967); Lansbury (1965)

8310 Caves not open to the public

Caves not open to the public (8310) is integrally linked to lesser horseshoe bat (*Rhinolophus hipposideros*) (1303) as part of the habitat for the species; therefore, a separate conservation objective has not been set for the habitat in East Burren Complex SAC. See map 10. See the conservation objective for lesser horseshoe bat in this volume and the conservation objectives supporting document for lesser horseshoe bat (NPWS, 2018) for further details

Attribute	Measure	Target	Notes

91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*

To maintain the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* within East Burren Complex SAC has not been surveyed in detail and thus the total current area of the qualifying habitat in the SAC is currently unknown. A band of alluvial woodland occurs along a karstic stream in a narrow limestone valley at the north-east corner of Lough Gortlecka in the SAC which has been mapped as 2.27ha (NPWS internal files). See map 8. It is important to note that further areas of the habitat may be present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. The mapped area is shown on map 8	Distribution based on NPWS internal files. See the notes for habitat area above. It is important to note that further areas of the habitat may be present in the SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage; metres; centimetres	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover at least 20% and height at least 20cm; bryophyte cover at least 4%	The target aims for a diverse structure with a canopy containing mature trees, shrub layer with semi-mature trees and shrubs, and well-developed field layer (herbs, graminoids and dwarf shrubs) and ground layer (bryophytes). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008). See also the Irish Vegetation Classification (Perrin, 2016; www.biodiversityireland.ie/projects/ivc-classification-explorer)
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy	The target species for 91E0* are alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and willows (*Salix* spp.). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)
Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river and lake floodplains, but not for woodland around springs/seepage areas. In this SAC, the habitat occurs along a karstic stream in a limestone valley. The stream appears and disappears along its length and floods much of the valley floor after heavy rain (NPWS internal files)
Woodland structure: dead wood	Number per hectare	At least 19 stems/ha of dead wood of at least 20cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem. Dead wood comprises old senescent trees, standing dead trees, fallen dead wood (including large branches) and rotten stumps of any tree species. Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)

Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local distinctiveness	Occurrence; population size	No decline in distribution and, in the case of red listed and other rare or localised species, population size	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red listed and other rare or localised species. The Alluvial forests habitat at Gortlecka is considered to be a unique variant of this woodland habitat type (NPWS internal files). The relatively high frequency of hazel (*Corylus avellana*) within the habitat at Gortlecka is characteristic of native woodlands in the Burren
Woodland structure: indicators of overgrazing	Occurrence	All five indicators of overgrazing absent	There are five indicators of overgrazing within 91E0*: topiary effect on shrubs and young trees, browse line on mature trees, abundant dung, severe recent bark stripping, and trampling (Daly et al., in prep.)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover at least 90% of canopy; target species cover at least 50% of canopy	The Alluvial forests habitat at Gortlecka is dominated by hazel (*Corylus avellana*), ash (*Fraxinus excelsior*), wych elm (*Ulmus glabra*) and rusty willow (*Salix cinerea* subsp. *oleifolia*) (NPWS internal files)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including alder (*Alnus glutinosa*), willows (*Salix* spp.), oak (*Quercus* spp.), ash (*Fraxinus excelsior*) and birch (*Betula pubescens*)	The habitat at Gortlecka has been noted as being exceptionally species-rich, with over 80 vascular plants recorded including hazel (*Corylus avellana*), ash (*Fraxinus excelsior*), wych elm (*Ulmus glabra*), willows (*Salix* spp.), wood melick (*Melica uniflora*), remote sedge (*Carex remota*), ramsons (*Allium ursinum*), bugle (*Ajuga reptans*), wood anemone (*Anemone nemorosa*), marsh-marigold (*Caltha palustris*), golden saxifrage (*Chrysosplenium oppositifolium*), lesser celandine (*Ficaria verna*), meadowsweet (*Filipendula ulmaria*), heath bedstraw (*Galium saxatile*), water mint (*Mentha aquatica*), lesser twayblade (*Neottia cordata*), early-purple orchid (*Orchis mascula*) and adder's-tongue (*Ophioglossum vulgatum*) (NPWS internal files)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	Negative indicator species (i.e. any non-native species, including herbaceous species) should be absent or under control. In general, the following are the most common non-native invasive species in 91E0* woodlands: sycamore (*Acer pseudoplatanus*), beech (*Fagus sylvatica*) and horse-chestnut (*Aesculus hippocastanum*) (Daly et al., in prep.)
Vegetation composition: problematic native species	Percentage	Cover of common nettle (*Urtica dioica*) less than 75%	Common nettle (*Urtica dioica*) is a positive indicator species for 91E0* but, in some cases, it may become excessively dominant. Increased light and nutrient enrichment are factors which favour proliferation of common nettle (Daly et al., in prep.)

1065 Marsh Fritillary *Euphydryas aurinia*

To maintain the favourable conservation condition of Marsh Fritillary (*Euphydryas aurinia*) in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied 1km grid squares	Number in a 10-year cycle	No decline, subject to natural processes	There are confirmed records of marsh fritillary (*Euphydryas aurinia*) since 2010 from 22 1km squares (M2900, M2901, M3000, R2493, R2594, R2596, R2693, R2694, R2696, R2697, R2794, R2795, R2894, R2895, R2898, R2994, R2999, R3094, R3194, R3291, R3796 and R3897; see map 9) in East Burren Complex SAC. These will not all be occupied in the same year given the size and extent of habitat so this measure should be assessed over a 10-year cycle
Proof or breeding: larval webs	Number at a representative number of sub-sites	Proof of breeding, confirmed by detection of webs; number of webs should exceed 50 webs in at least one year in six	A number of occupied sub-sites within this SAC have been counted frequently. A figure of 50 webs per year is taken as a baseline based on this partial information, but this will need to be revised when a longer time series of monitoring data is available
Potential habitat: area	Hectares	Area of potential habitat stable or increasing, subject to natural processes	Potential suitable habitat for marsh fritillary (*Euphydryas aurinia*) is defined as areas of vegetation where devil's-bit scabious (*Succisa pratensis*) is present in a sward with mean height less than 50cm and with less than 10% cover of scrub more than 1m high. In East Burren Complex SAC, a 2012 survey estimated that there could be 3,200ha of suitable habitat (Ravenscroft et al., 2013). Suitable marsh fritillary habitat in the Burren was considered to correspond most to the weak winterage vegetation class of Parr et al. (2009), but it was not exclusive to these areas
Habitat quality	Distribution	No decline, subject to natural processes	Ravenscroft et al. (2013) devised a habitat quality index for the Burren. Larval webs were associated with higher quality habitat (scoring more than 5). Habitat of this quality is widespread in East Burren Complex SAC (Ravenscroft et al., 2013) and there should be patches of high quality habitat present in all areas of occupied habitat

1303 Lesser Horseshoe Bat *Rhinolophus hipposideros*

To restore the favourable conservation condition of Lesser Horseshoe Bat (*Rhinolophus hipposideros*) in East Burren Complex SAC, which is defined by the following list of attributes and targets:

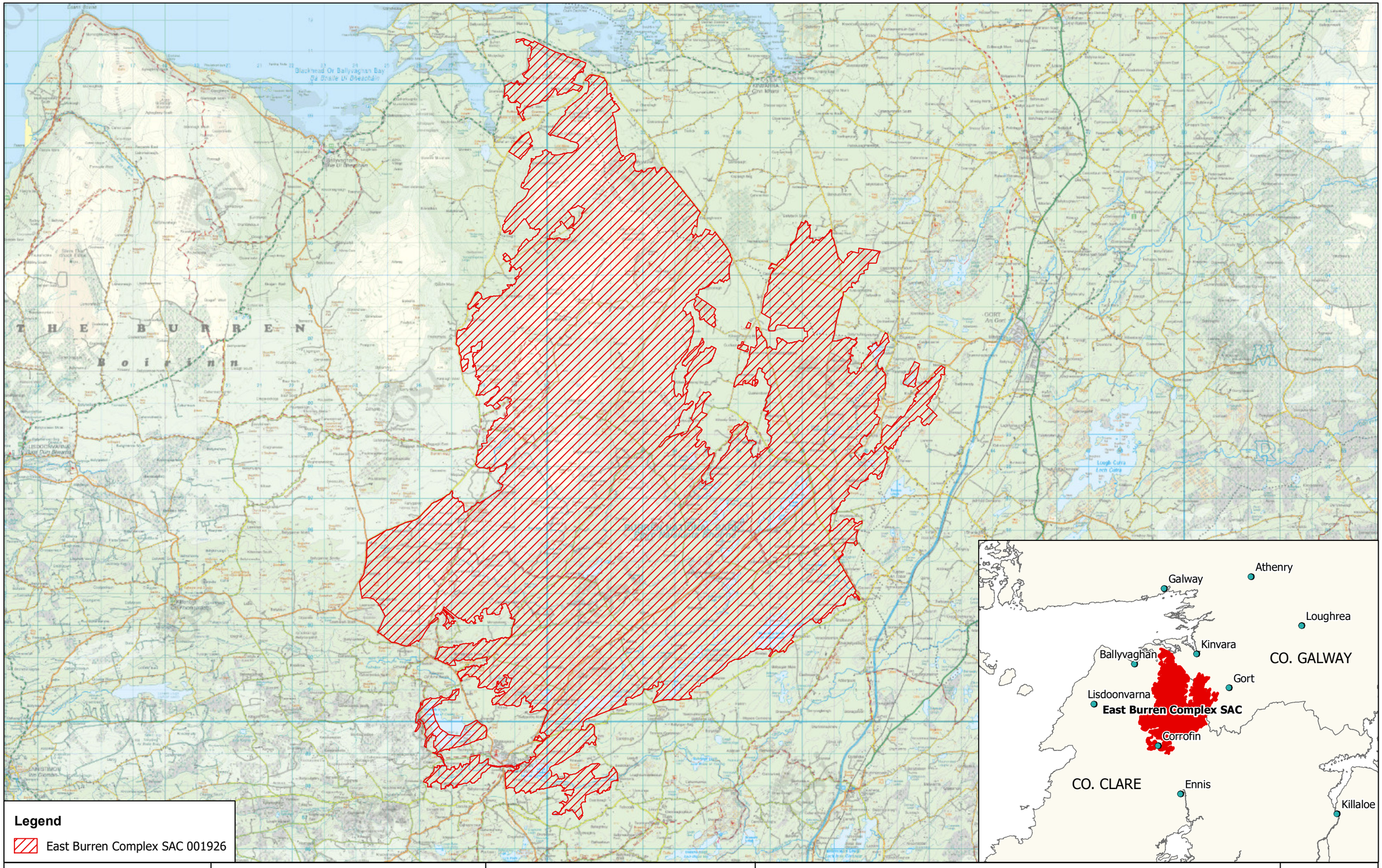
Attribute	Measure	Target	Notes
Population per roost	Number	Minimum number of 103 bats for the linked summer roosts (roost id. 132 and roost id. 825 in NPWS database), minimum number of 150 bats for the summer roost with roost id. 216 and minimum number of 100 bats for the summer roost with roost id. 130; minimum number of 50 bats for the winter roost with roost id. 126 and minimum number of 108 bats for the winter roost with roost id. 144. See map 10	A figure of 100 bats for summer roosts and 50 bats for winter roosts was set as a minimum qualifying standard (MQS) when SACs were being selected for lesser horseshoe bat (*Rhinolophus hipposideros*). NPWS conduct annual counts at each qualifying roost. Qualified means from the 2016-2020 summer data and 2017-2021 winter data have been calculated whereby the year with the highest maximum count and the year with the lowest maximum count were removed and the mean of the remaining years was calculated. This mean is set as the target figure for the relevant summer and winter roosts in East Burren Complex SAC. However, in the case of the summer roost with roost id. 130, where a mean of 63 bats was recorded, the target is instead set at the MQS of 100 bats. Also, in the case of winter roost with roost id. 126, where a mean of 44 bats was recorded, the target is instead set at the MQS of 50 bats. See NPWS (2018) for further information on all attributes and targets
Winter roosts	Condition	No decline	East Burren Complex SAC has been selected for lesser horseshoe bat because of the presence of two internationally important winter roosts (roost id. 126 and roost id. 144 in NPWS database). Damage or disturbance to these roosts or to the habitat immediately surrounding the roosts will lead to a decline in their condition (Mitchell-Jones et al., 2007). See the conservation objectives supporting document for lesser horseshoe bat (NPWS, 2018) for further information on all attributes and targets
Summer roosts	Condition	No decline	East Burren Complex SAC has been selected for lesser horseshoe bat because of the presence of two internationally important summer roosts (roost id. 216 and roost id. 130 in NPWS database) and two linked roost sites that together form an additional internationally important roost (roost id. 132 and roost id. 825). Damage or disturbance to the roosts or to the habitat immediately surrounding the roosts will lead to a decline in their condition (Kelleher and Marnell, 2006)
Auxiliary roosts	Number and condition	No decline	Lesser horseshoe bat populations will use a variety of roosts during the year besides the main summer maternity and winter hibernation roosts. Such additional roosts within the SAC may be important as night roosts, satellite roosts, etc. Night roosts are also considered an integral part of core foraging areas and require protection (Knight and Jones, 2009). In addition, in response to weather conditions for example, bats may use different seasonal roosts from year to year; this is particularly noticeable in winter. Several other winter and summer roosts that support lesser horseshoe bats, but at numbers below the MQS figures, are known from East Burren Complex SAC. A database of all known lesser horseshoe bat roosts is available on the National Biodiversity Data Centre website. NB further unrecorded roosts may also be present within this SAC

Extent of potential foraging habitat	Hectares	No significant decline within 2.5km of qualifying roosts	Lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Schofield, 2008). See map 10 which shows a 2.5km zone around the above roosts and identifies potential foraging grounds
Linear features	Kilometres	No significant loss within 2.5km of qualifying roosts. See map 10	This species follows commuting routes from its roost to its foraging grounds. Lesser horseshoe bats will not cross open ground. Consequently, linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5km around each roost (Schofield, 2008)
Light pollution	Lux	No significant increase in artificial light intensity adjacent to named roosts or along commuting routes within 2.5km of those roosts. See map 10	Lesser horseshoe bats are very sensitive to light pollution and will avoid brightly lit areas. Inappropriate lighting around roosts may cause abandonment; lighting along commuting routes may cause preferred foraging areas to be abandoned, thus increasing energetic costs for bats (Schofield, 2008)

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter (*Lutra lutra*) in East Burren Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. Favourable Conservation Status (FCS) target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 203.6ha along river banks/ lake shoreline/around ponds	No field survey. Areas mapped to include 10m terrestrial buffer, identified as critical for otters (NPWS, 2007), along rivers and around water bodies
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 42.5km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 527.6ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013)
Barriers to connectivity	Number	No significant increase	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed



Legend

East Burren Complex SAC 001926

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MAP 1:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021

Moneen Mountain SAC

East Burren Complex SAC

Termon Lough SAC

Corofin Wetlands SPA

Legend

- East Burren Complex SAC 001926
- Corofin Wetlands SPA 004220
- Moneen Mountain SAC 000054
- Termon Lough SAC 001321

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MAP 2:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
OVERLAPPING AND ADJACENT SITES

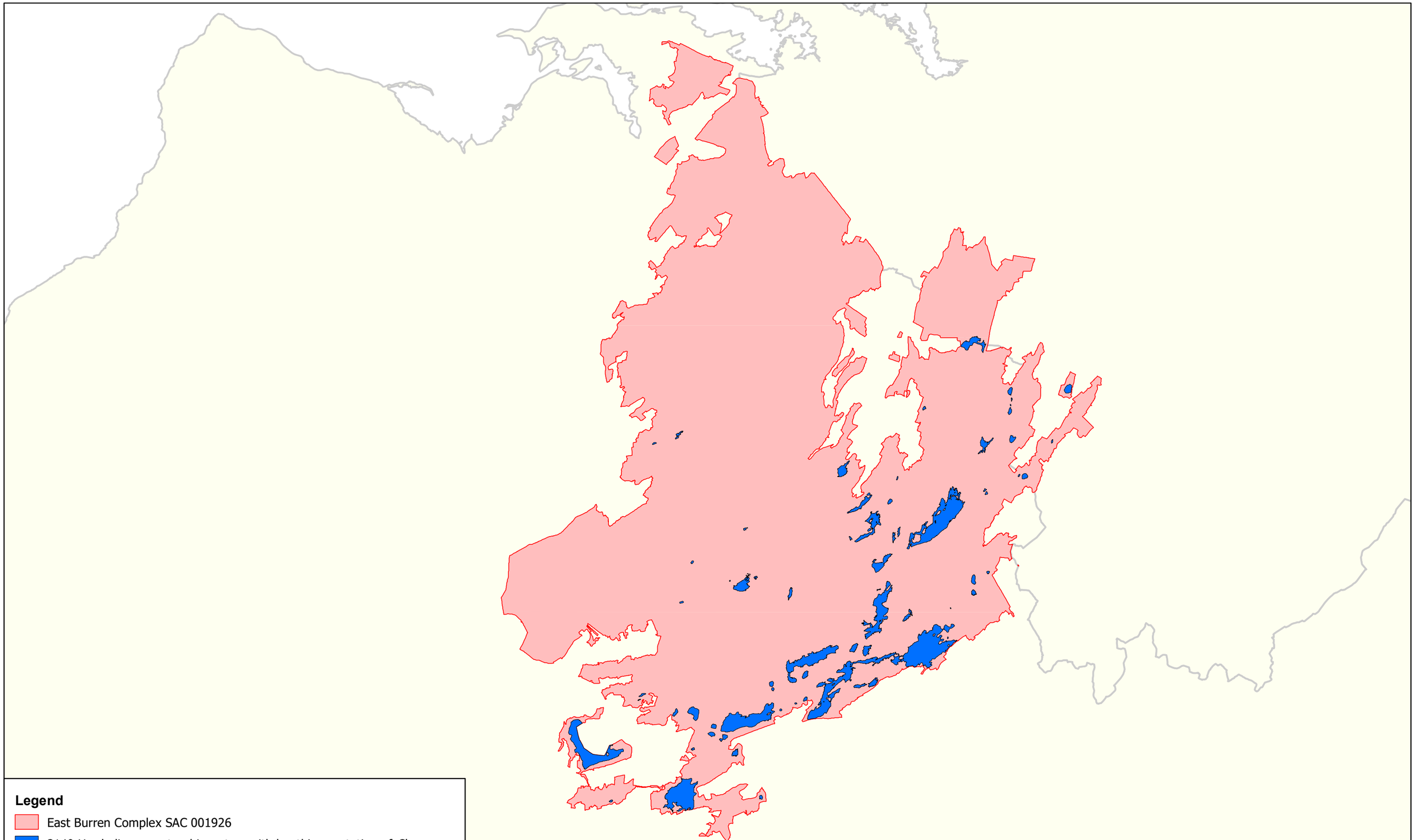
Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021



Legend

- East Burren Complex SAC 001926
- 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.*
- OSI Discovery Series County Boundary

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MAP 3:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
INDICATIVE LAKE HABITATS

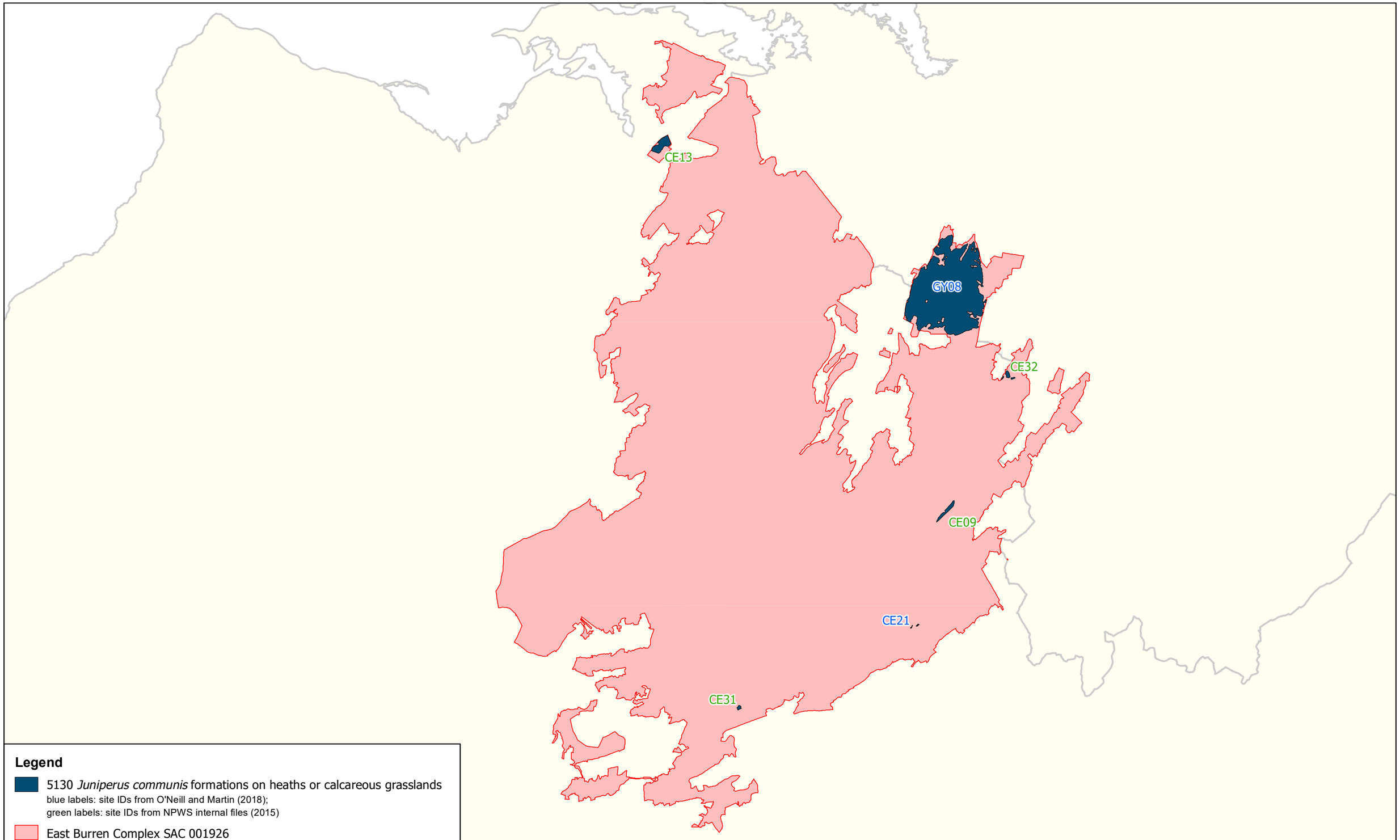
Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021



Legend

- 5130 *Juniperus communis* formations on heaths or calcareous grasslands
  blue labels: site IDs from O'Neill and Martin (2018);
  green labels: site IDs from NPWS internal files (2015)
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

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MAP 4:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
JUNIPER

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021

Legend

- 6130 Calaminarian grasslands of the *Violetalia calaminariae*
- 6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

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MAP 5:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
GRASSLAND HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021

PS054b
PS054a
PS053
PS095b
PS095a
PS103
PS104

Ordnance Survey Ireland

Legend

- 7220 *Petrifying springs with tufa formation (*Cratoneurion*)
  labels show sitecodes from Lyons (2015)
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

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MAP 6:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
PETRIFYING SPRINGS

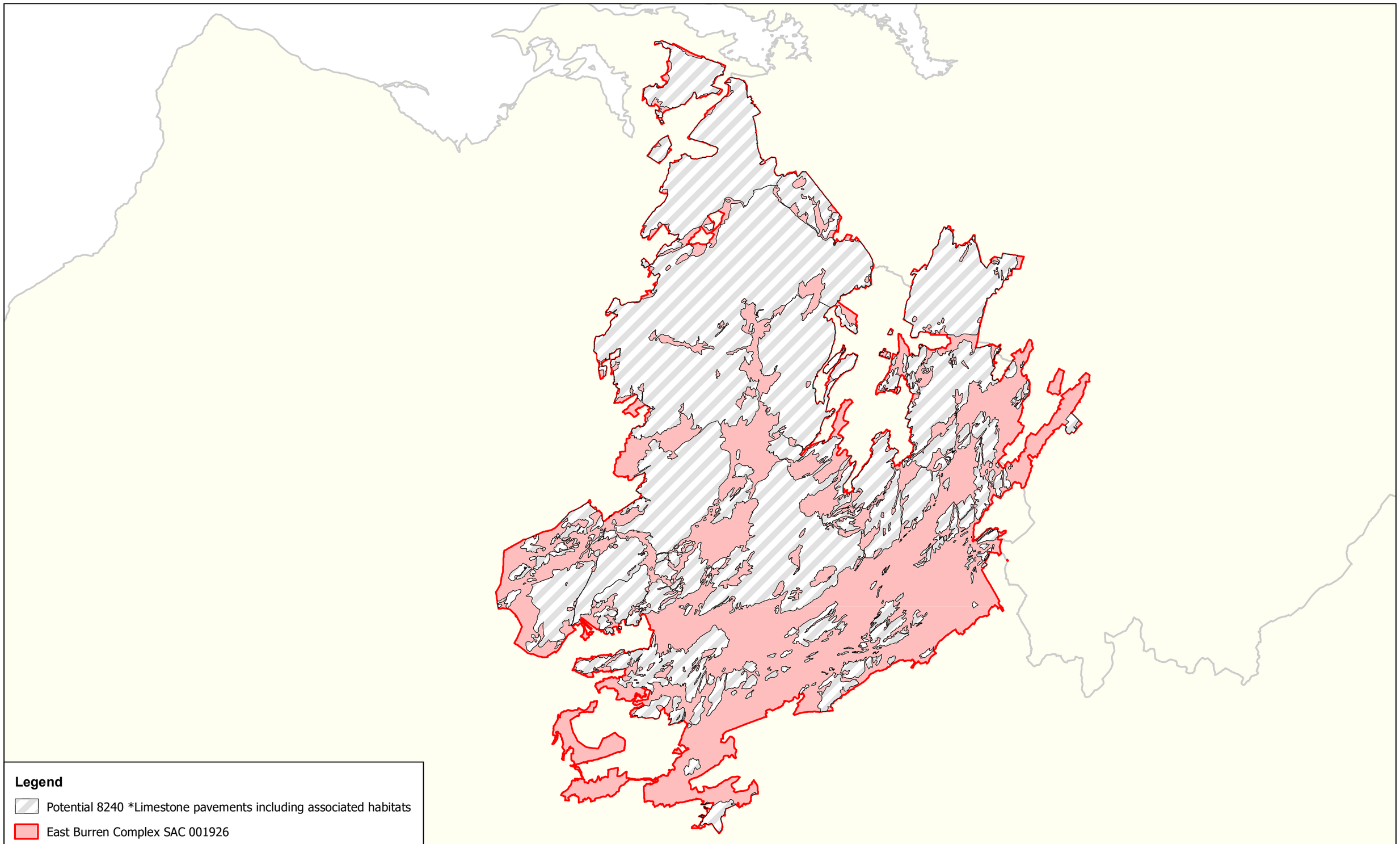
Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021



Legend

- Potential 8240 *Limestone pavements including associated habitats
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

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MAP 7:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
LIMESTONE PAVEMENT

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021

Legend

- 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion, Alnion incanae, Salicion albae*)
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

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MAP 8:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
WOODLAND HABITATS

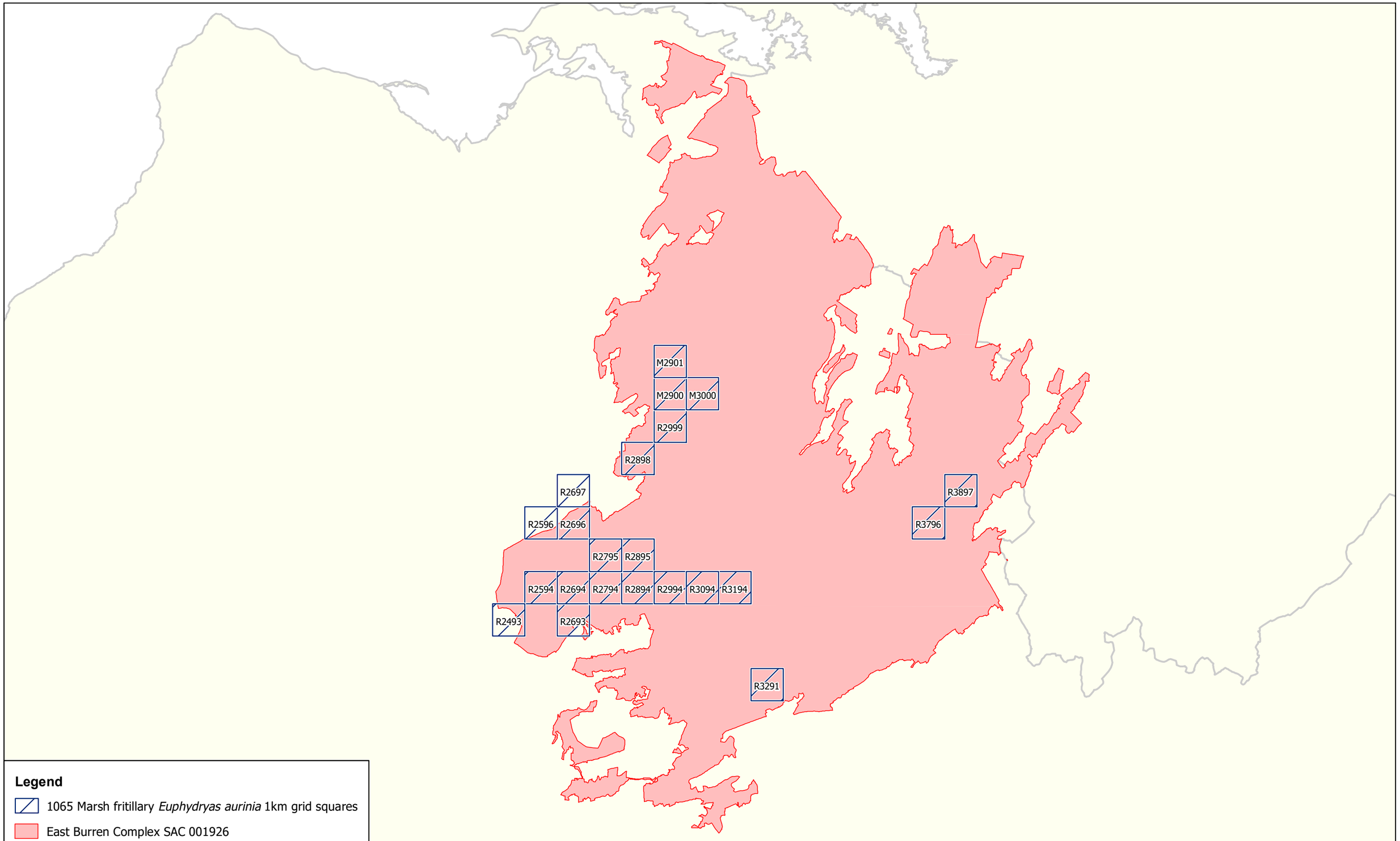
Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: January 2022



Legend

- 1065 Marsh fritillary *Euphydryas aurinia* 1km grid squares
- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
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MAP 9:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
MARSH FRITILLARY

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021

Roost ID 126

Roost ID 216

Roost ID 130

Roost ID 144

Roost ID 825

Roost ID 132

Legend

- East Burren Complex SAC 001926
- OSI Discovery Series County Boundary
- 8310 Caves not open to the public

1303 Lesser Horseshoe Bat *Rhinolophus hipposideros*

- Roost Location
- Foraging Range (2.5km)
- Potential Foraging Grounds

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MAP 10:
EAST BURREN COMPLEX SAC 001926
CONSERVATION OBJECTIVES
LESSER HORSESHOE BAT AND CAVES

Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 001926; version 3.01
CO. CLARE/GALWAY

0 1 2 4 Kilometres

N

Date: December 2021