

Provided by the author(s) and University College Dublin Library in accordance with publisher policies. Please cite the published version when available.

Title	Field boundary stone walls as exemplars of 'novel' ecosystems
Author(s)	Collier, Marcus
Publication date	2013
Publication information	Landscape Research, 38 (1): 141-150
Item record/more information	http://hdl.handle.net/10197/3949
Publisher's version (DOI)	http://dx.doi.org/10.1080/01426397.2012.682567

Downloaded 2017-12-11T23:15:35Z

The UCD community has made this article openly available. Please share how this access benefits you. Your story matters! (@ucd_oa) 

Some rights reserved. For more information, please see the item record link above.



Field boundary stone walls as exemplars of 'novel' ecosystems.

Author: Marcus J. Collier

Available at: <http://www.tandfonline.com/doi/abs/10.1080/01426397.2012.682567>

Abstract

In some parts of Europe, stone wall field boundaries pervade agricultural landscapes, yet despite their prominence there has been very little research into field boundary walls anywhere. However, these anthropogenic features within cultural landscapes may offer insight into current debates on 'novel' ecosystems because of their artifice, their longevity in the landscape particularly in remote or exposed regions, and their morphology. In a review of the available, published literature in Europe, it was found that no publications exist that examine or illustrate specific ecological characteristics of field boundary stone walls, despite this longevity. Using examples from Ireland, where these structures are locally abundant, this paper aims first to draw attention to the poorly representative literature on this topic, and thus stimulate research that will detail the potential ecological characteristics of these ancient forms of field boundary. It then briefly explores the potential for these walls to be considered as 'novel' ecosystems within current debates on the issue.

Key words: Dry stone walls, novel ecosystems, field boundaries, agricultural landscapes.

Introduction

Field boundaries (hedgerows and stone walls) dominate and define the socio-cultural history of many European agro-environmental landscapes. Hedgerows have now come to be recognised for their ecological (Barr and Petit, 2001; Baudry, et al., 2000; Marshall and Moonen, 2002) and additionally for their social-ecological (Oreszczyn and Lane, 2000) values, particularly in highly managed landscapes. However, virtually nothing is known of any similar values for field boundary, or 'dry' (i.e. un-mortared), stone walls (Collier and Feehan, 2003) despite their relative abundance and frequency in managed landscapes in Europe. Therefore, this paper first reviews what little data exist in the wider European context to underscore this lack of information, and explores where the potential ecological values of field boundary stone walls may be, particularly in landscapes where they have been in use for a long period of time. The aim is to propose that this be explored at differing spatial scales and to request that they be investigated as exemplars of 'novel' or 'emerging' ecosystems (Hobbs, et al., 2006) in their own right.

Enclosure in Europe was historically linked to land reform and agricultural change over the centuries, with many hedgerow systems are several hundred years old. Linear woodlands and hedgerows have long been studied for their biodiversity values. Such field boundary surveys (almost exclusively confined to hedgerows) have often focussed on species assemblages and distribution in, for example, Ireland (Webb, 1988), the UK (Bickmore, 2002; Petit, et al., 2003), France (Burel and Baudry, 1990), Spain (Schmitz, et al., 2007), Italy (Chincarini and Padoa-Schioppa, 2001), Norway (Fry, 2001) and Denmark (Aude, et al., 2003). Additional values are now being placed on, for example, ecosystem services including pest control (Kremen, et al., 2007), water soil infiltration and nutrient interception (Caubel, et al., 2003; Merot, 1999). Field boundary stone walls, on the other hand, are often far older, though there are no studies on the ages of field boundary stone walls, excepting those from antiquity (e.g., Caulfield, et al., 1998), and thus their modern values and functions may extend beyond their original functions, as is the case for hedgerows. It may be that such values differ over time and regionally and culturally, and depend on such variables as utility and rock type. Thus, a case example from Europe may best serve as a platform for exploring the issue.

Ireland as a case example

Agricultural landscapes in Ireland, notably in western regions and uplands, are a case in point. Here, dry stone walls have been utilised as field boundaries for several millennia (Aalen, et al., 1997; Caulfield, et al., 1998) and, along with earth embankments, they are the only remaining prehistoric boundary features still in functional use today (Feehan, 2003). Through the ages, dry stone wall construction has become intertwined with the lives of countless individuals and communities (Allport, 1990; Anon., 2002; Hannay, 1957; Lindner, 1946; Russell, 1933), and the sheer diligence and labour involved in building and maintaining them points towards an interrelationship that may now be viewed as culturally embedded. In Ireland, much has been written on their morphology, history and construction styles (e.g. Conry, 2000; D'Arcy, 2006; McAfee, 1997; Ó Maithiú and O'Reilly, 1997; O'Sullivan and Moore, 1979). With the turn towards the

exploration of new values in landscapes and given their pervasiveness, few, if any, studies have sought to establish their potential biodiversity or ecological values, such as their potential as:

- platforms for supporting endemic flora and fauna
- refuges for disparate species
- linkages or corridors
- seed reserves
- shelter for scrub and other adjacent habitats
- nesting and roosting locations in exposed areas.

Further, in open and exposed landscapes low in vegetative cover, dry stone walls may provide niche opportunities, and thus ecological opportunities otherwise absent. With new pressures in the landscape, this blind spot in landscape research may ultimately impede land use planning, landscape character assessment and other biodiversity assessments.

Dry stone wall ecology

Two substantial publications deal with stone wall ecology in any format: Segal (1972) and later Darlington (1981) produced seminal volumes on the flora of urban walls and walls of old buildings, within which both briefly and speculatively refer to probable ecological aspects of field boundary walls; no supporting data are supplied. Left un-examined for many years, recent theorists have revisited the ecological potential of urban walls (Francis, 2011) and in the meantime field boundary stone walls have not received any attention in the discussion. However, some debates are emerging. Thorson (2002) has recently speculated on the habitat quality of remnant field boundary walls in North America, particularly those that are now encased in second growth woodland after land abandonment in the 18th century, though he affirms that this is based on experiential, qualitative assessments and observation. Explicit quantitative exploration to identify any specific structural qualities and / or potential micro-climactic properties that may make dry stone walls in exposed landscapes serve as ecological niches or corridors do not exist, though these have been speculated upon (Collier, 2005; Francis, 2011). For example, abandoned or partially managed fields with dry stone wall boundaries can often give rise to spontaneous scrub vegetation similar to what are known in North America as ‘fencerows’ – the spontaneous emergence of vegetation beneath wire fences or telegraph lines due to bird activity or wind shelter (Fritz and Merriam, 1993), and thus may enhance ecological values of the dry stone wall. Such spontaneity along dry stone walls, perhaps to termed ‘wallrows’, may further augment available niche and resting/nesting sites, and thus colonising and connectivity opportunities.

What brings this aspect of neglected research into focus is that there is now a growing body of research that seeks to understand whether human-fabricated and artificial surfaces may give rise to what is termed as ‘emerging’ (Milton, 2003) or ‘novel’ ecosystems (Hobbs, et al., 2006). Though hitherto speculated upon in relation to urban areas (Kowarik, 2011), field boundary stone walls appear to fulfil many of the proposed characteristics of emerging or ‘novel’ ecosystems in that they (1) manifest human agency and (2) may contain unusual species combinations as a result of (3) biotic and abiotic stresses (Hobbs, et al., 2006). Such

dry stone walls are also (4) largely un(der)managed in the modern age and may be undisturbed due to their considerable bulk, historical associations and the probable expense of removing and replacing them with technological substitutes. However, it is uncertain as to when an ecosystem may be considered ‘novel’ (Lindenmayer, et al., 2008). In light of this, some degree of interest should now be turned towards existing and long-standing anthropogenic structures, such as dry stone walls, embedded as they are within agricultural landscapes and thus are exposed to the vagaries of land use change, development and even urbanisation.

Methods

To establish a baseline, an extensive literature review was carried out between 2005 and 2010. Publically available and accessible literature on field boundary stone walls was assessed, focussing on data available for agriculturally managed landscapes first in Ireland and then for the rest of Europe – since there were so few sources available. Table 1 shows the relevant published and accessible sources referring to the faunal values of dry stone walls in Europe, while table 2 shows the published and accessible sources referring to the floristic value of dry stone walls. Though not exhaustive, these tables are highly representative of research where these landscape features occur and are explicitly mentioned.

INSERT TABLES 1 AND 2 ABOUT HERE

Discussion

Many of the walls recorded in the literature are not dry stone walls, but did offer some insight into potential ecological traits common to both urban and agricultural landscapes – such as substrate, location, aspect, exposure. Of those that identified dry stone walls in particular, any data may be considered to be hearsay, unsubstantiated or qualitative (based on subjectivity) (e.g. Brooks and Agate, 1999; Carr and Bell, 1991; Simkins, 2004), and thus un-tested or verified experimentally. The remainder are studies carried out in agricultural landscapes with field boundary stone walls and which make tangential references to certain ecological aspects of dry stone walls in the study, for example making reference to an assumed botanical or biological value (e.g. Dooge and Harding, 1982) or a value derived from an observation on possible habitat values (e.g. Gray, et al., 1995; Owen, 1995). There are few, if any, references to the context of the dry stone wall within the wider landscape, the management and uses of adjacent fields, soil pH, geomorphology, biogeochemical characteristics, length, aspect and, especially, age or location. This may be because there has never been a systematic exploration of field boundary stone walls in modified, ‘cultural’ landscapes, a commonality that is overlooked or not commented upon. Furthermore, there has never been an examination of the anthropogenic nature of these dry stone walls and this relationship to potentially novel ecosystems arising, over time, within and around these structures. Clearly, the picture is incomplete, and quantitative research specific to field boundary stone walls is practically nil, and there is no consideration to the possibility that though anthropogenic in nature, dry stone walls may have acquired novel ecosystem status with age and longevity in the landscape. Using the literature as a starting point Table 3 is an attempt, by no

means exhaustive, to identify areas where further exploration may yield fruit and where certain characteristics may be isolated as indicators of novelty or emergence and thus of interest to landscape researchers.

INSERT TABLE 3 ABOUT HERE

Conclusion

This paper contends that field boundary stone walls, such as those found in the Irish farming landscapes as well as many parts of Europe, may be exemplars of ‘novel’ ecosystems as is evidenced tangentially in numerous studies in similar landscapes. Why this may be the case is unknown and un-researched. However, certain characteristics such as stone type, wall age, adjacent agricultural activities, percentage cover and so on, may give rise to ecological opportunities, and thus dry stone walls may be ideal exemplars of ‘novel’ ecosystems (Hobbs, et al., 2006; Hobbs, et al., 2009). Such stone walls may also have an inherent resilience brought about by their physical structure and longevity, affording researchers the opportunity to identify, classify and assess key elements of the landscape that may confer resilience to future change, as is increasingly being focussed upon in other disciplines, now increasingly important as society seeks to establish dynamic indicators of environmental change.

Acknowledgements

I would like to acknowledge the supportive and constructive comments of the three reviewers and the editor. My thanks also go to Dr. Grace O’Donovan who commented on an early draft of this paper.

References

- Aalen, F. H. A., Whelan, K. & Stout, M. (Eds.), (1997) *Atlas of the Irish Rural Landscape*. Cork. Cork University Press.
- Allport, S. (1990) *Sermons in Stone: the stone walls of New England and New York*. New York. W.W. Norton.
- Anon. (2002) *Dry stone walls: the national collection. The story of the Millennium Wall*. Sutton Coldfield. Dry Stone Walling Association of Great Britain.
- Aude, E., Tybirk, K. & Bruus Pedersen, M. (2003) Vegetation diversity of conventional and organic hedgerows in Denmark. *Agriculture, Ecosystems & Environment*, **99**:135-147.
- Barr, C. & Petit, S. (Eds.), (2001) *Hedgerows of the world: their ecological functions in different landscapes: proceedings of the tenth annual IALE(UK) conference, held at Birmingham University, 5th-8th September 2001*. Aberdeen. IALE (UK).
- Baudry, J., Bunce, R. G. H. & Burel, F. (2000) Hedgerows: an international perspective on their origin, function and management. *Journal of Environmental Management*, **60**:7-22.
- Baur, B., Froberg, L. & Baur, A. (1995) Species diversity and grazing damage in a calcicolous lichen community on top of stone walls in Oland, Sweden. *Annales Botanici Fennici*, **32**:239-250.

- Bellinzoni, A., Caneva, G. & Ricci, S. (2003) Ecological trends in travertine colonisation by pioneer algae and plant communities. *International Biodeterioration & Biodegradation*, **51**:203-210.
- Bernáldez, F. G. (1991) Ecological consequences of the abandonment of traditional land use systems in central Spain. *Options Méditerranéennes*, **15**:23-29.
- Bickmore, C. J. (2002) *Hedgerow Survey Handbook: a standard procedure for local surveys in the UK (Consultative Document)*. Bangor. Countryside Council for Wales / English Nature.
- Brandes, D. (1992) Flora und Vegetation von Stadtmauern. *Tuexenia*, **12**:315-339.
- (1995) The flora of old town centres in Europe. In H. Snkopp, M. Ntimata & A. Huber (Eds.), *Urban Ecology as the Basis of Urban Planning* (pp. 49-58). Amsterdam. SPB Academic Publishing.
- (1998) *Urban flora of Sousse, Tunisia*. Online publication available at: http://rzbl04.biblio.etc.tu-bs.de:8080/docportal/servlets/MCRFileNodeServlet/DocPortal_derivate_00001189/Document.pdf;jsessionid=51B4030C7FAE9E329BDD5AC59F602F1C Accessed: September, 2011.
- (2002) *Some remarks on the flora of walls and ruins in Eastern Crete*. Braunschweig. Working Group for Vegetation Ecology/ Institute of Plant Biology, Technical University Braunschweig.
- Brandes, D. (2004) *Spontaneous flora of the old town centre of Metz (France)*. Online publication available at: <http://www.biblio.tu-bs.de/geobot/metz.pdf> Accessed: September, 2011.
- Brandes, D. & Brandes, E. (1999) *The flora of Maltese walls*. Braunschweig. Working Group for Vegetation Ecology/ Institute of Plant Biology, Technical University Braunschweig.
- Brooks, A. & Agate, E. (1999) *Dry stone walling: a practical handbook*. Wallingford. British Trust for Conservation Volunteers.
- Burel, F. & Baudry, J. (1990) Structural dynamic of a hedgerow network landscape in Brittany France. *Landscape Ecology*, **4**:197-210.
- Caneva, G., De Marco, G., Dinelli, A. & Vinci, M. (1992) The wall vegetation of the Roman archaeological areas. *Science and Technology for Cultural Heritage*, **1**:217-226.
- Carr, S. & Bell, M. (1991) *Practical Conservation: Boundary Habitats*. London. The Open University/ Hodder and Stoughton.
- Caubel, V., Grimaldi, C., Merot, P. & Grimaldi, M. (2003) Influence of a hedge surrounding bottomland on seasonal soil-water movement. *Hydrological Processes*, **17**:1811-1821.
- Caulfield, S., O'Donnell, R. G. & Mitchell, P. I. (1998) C dating of a Neolithic field system at Ceide Fields, County Mayo, Ireland. *Radiocarbon*, **40**:629-640.
- Chincarini, M. & Padoa-Schioppa, E. (2001) The ecological evaluation of hedgerows: a first attempt at a practical approach. In C. J. Barr & S. Petit (Eds.), *Hedgerows of the world: their ecological functions in different landscapes* (pp. 81-86). Aberdeen. IALE (UK).
- Collier, M. J. (2005) An ecological evaluation of field boundary stone walls in Ireland. Conference paper presented at: *ENVIRON 2005: 15th Irish Environmental Researchers' Colloquium*, Institute of Technology, Sligo, 28th-30th January, 2005.
- Collier, M. J. & Feehan, J. (2003) Developing a field boundary evaluation and grading system in Ireland. *Tearmann: The Irish Journal of Agri-environmental Research*, **3**:27-46.
- Conry, M. J. (2000) *The Carlow Fence: Traditional Granite Fencing and Dry Stone Walling in County Carlow*. Carlow. Chapeltown Press.

D'Arcy, G. (2006) *The Burren Wall*

Daniel, H. & Lecamp, E. (2004) Distribution of three indigenous fern species along a rural-urban gradient in the city of Angers, France. *Urban Forestry & Urban Greening*, **3**:19-27.

Darlington, A. (1981) *Ecology of Walls*. London. Heinemann Educational.

Delany, M. J. (1961) The ecological distribution of small mammals in north-west Scotland. *Proceedings of the Zoological Society of London*, **137**:107-126.

Dooge, D. & Harding, P. T. (1982) *Distribution atlas of woodlice in Ireland*. Dublin. An Foras Forbartha.

Dover, J., Sparks, T., Clarke, S., Gobbett, K. & Glossop, S. (2000) Linear features and butterflies: the importance of green lanes. *Agriculture, Ecosystems and Environment*, **80**:227-242.

Dover, J. W. & Sparks, T. H. (2001) Green lanes: biodiversity reservoirs in farmland. In C. J. Barr & S. Petit (Eds.), *Hedgerows of the World: their ecological functions in different landscapes* (pp. 241-250). Aberdeen. IALE (UK).

Duchoslav, M. (2002) Flora and vegetation of stony walls in East Bohemia (Czech Republic). *Preslia*, **74**:1-25.

Erlinge, S. (1977) Spacing strategy in stoat *Mustela erminea*. *Oikos*, **28**:32-42.

Feehan, J. (2003) *Farming in Ireland: History, Heritage and Environment*. Dublin. Department of Environmental Resource Management / UCD.

Francis, R. A. (2011) Wall ecology: a frontier for urban biodiversity and ecological engineering. *Progress in Physical Geography*, **35**:43-63.

Fritz, R. & Merriam, G. (1993) Fencerow habitats for plants moving between farmland forests. *Biological Conservation*, **64**:141-148.

Froberg, L., Solhoy, T., Baur, A. & Baur, B. (2003) Oribatid mites (Acari: Oribatida) associated with lichens in the Great Alvar of Oland, Sweden. *Entomologisk Tidskrift*, **117**:161-164.

Fry, G. (2001) Multifunctional hedgerows in Norway. In C. J. Barr & S. Petit (Eds.), *Hedgerows of the world: their ecological functions in different landscapes* (pp. 53-61). Aberdeen. IALE (UK).

Gilbert, O. (1992) *Rooted in Stone – the natural flora of urban walls*. Peterborough. English Nature.

Gray, J. S., Kahl, O., Janetzki, C., Stein, J. & Guy, E. (1995) The spatial distribution of *Borrelia burgdorferi*-infected *Ixodes ricinus* in the Connemara region of County Galway, Ireland. *Experimental and Applied Acarology*, **19**:163-172.

Guseinov, E. (2004) Natural prey of the jumping spider *Menemerus semilimbatus* (Hahn, 1827) (Araneae: Salticidae), with notes on its unusual predatory behaviour. *Arthropoda Selecta (Special Issue)*, **1**:93-100.

Hannay, F. R. (1957) *Dry stone walling*. London. Faber.

Haslam, S. M. (2001) The cropped walls of Malta. In C. J. Barr & S. Petit (Eds.), *Hedgerows of the world: their ecological functions in different landscapes* (pp. 87-92.). Aberdeen. IALE (UK).

Hill, P. (2002) *Molluscan fauna in heritage drystone walls of the Arnside and Silverdale AONB (Lancashire and Cumbria)*. Countryside Management Service Arnside / Silverdale Area of Outstanding Natural Beauty.

Hobbs, R. J., Arico, S., Aronson, J., Baron, J. S., Bridgewater, P., Cramer, V. A., Epstein, P. R., Ewel, J. J., Klink, C. A., Lugo, A. E., Norton, D., Ojima, D., Richardson, D. M., Sanderson, E. W., Valladares, F., Vila,

- M., Zamora, R. & Zobel, M. (2006) Novel ecosystems: theoretical and management aspects of the new ecological world order. *Global Ecology and Biogeography*, **15**:1-7.
- Hobbs, R. J., Higgs, E. & Harris, J. A. (2009) Novel ecosystems: implications for conservation and restoration. *Trends in Ecology & Evolution*, **24**:599-605.
- Holland, P. G. (1972) The pattern of species density of old stone walls in Western Ireland. *Journal of Ecology*, **60**:799-805.
- Hruška, K. (1987) Syntaxonomical study of Italian wall vegetation. *Plant Ecology*, **73**:13-20.
- Hynes, J. A. & Fairley, J. S. (1978) A population study of fieldmice in dry-stone walls. *The Irish Naturalists' Journal*, **19**:180-184.
- Ivimey-Cook, R. B. & Proctor, M. C. F. (1964) The plant communities of the Burren, Co. Clare. *Proceedings of the Royal Irish Academy, B*, **64**:211-302.
- Karschon, R. & Weinstein, A. (1985) Wall flora and vegetation at Qal'at Nimrud, the castle of Banyas. *Israel Journal of Botany*, **34**:59-64.
- Kent, D. H. (1961) The flora of Middlesex walls. *London Naturalist*, **40**:29-43.
- Klemens, F. (2003a) 11 years "flat-sharing" with midwife toads: long-term observations at a population living in a garden and yard. *Zeitschrift fuer Feldherpetologie*, **10**:129-142.
- (2003b) Strategies for the conservation of the midwife toad in the southern Black Forest. *Zeitschrift fuer Feldherpetologie*, **10**:143-147.
- Kowarik, I. (2011) Novel urban ecosystems, biodiversity, and conservation. *Environmental Pollution*, **159**:1974-1983.
- Kremen, C., Williams, N. M., Aizen, M. A., Gemmill-Herren, B., LeBuhn, G., Minckley, R., Packer, L., Potts, S. G., Roulston, T. a., Steffan-Dewenter, I., Vázquez, D. P., Winfree, R., Adams, L., Crone, E. E., Greenleaf, S. S., Keitt, T. H., Klein, A.-M., Regetz, J. & Ricketts, T. H. (2007) Pollination and other ecosystem services produced by mobile organisms: a conceptual framework for the effects of land-use change. *Ecology Letters*, **10**:299-314.
- Lindenmayer, D. B., Fischer, J., Felton, A., Crane, M., Michael, D., Macgregor, C., Montague-Drake, R., Manning, A. & Hobbs, R. J. (2008) Novel ecosystems resulting from landscape transformation create dilemmas for modern conservation practice. *Conservation Letters*, **1**:129-135.
- Lindner, R. M. (1946) *Stone Walls and Men*. New York. Odyssey Press.
- Lisci, M., Monte, M. & Pacini, E. (2003) Lichens and higher plants on stone: a review. *International Biodeterioration & Biodegradation*, **51**:1-17.
- Makhzoumi, J. M. (2000) Landscape ecology as a foundation for landscape architecture: application in Malta. *Landscape and Urban Planning*, **50**:167-177.
- Marshall, E. J. P. & Moonen, A. C. (2002) Field margins in northern Europe: their functions and interactions with agriculture. *Agriculture, Ecosystems and Environment*, **89**:5-21.
- McAfee, P. (1997) *Irish stone walls: history, building, conservation*. Dublin O'Biren Press.
- Merot, P. (1999) The influence of hedgerow systems on the hydrology of agricultural catchments in a temperate climate. *Agronomie*, **19**:655-669.

- Milton, S. (2003) 'Emerging ecosystems': a washing-stone for ecologists, economists and sociologists. *South African Journal of Science*, **99**:404-406.
- Miscervic, Z. (1982) A study of sandflies (Diptera, Phlebotomidae) in micro-habitats of supporting stone walls in the region of Dobric south east Serbia (Yugoslavia). *Acta Veterinaria*, **32**:37-45.
- Moorkens, E. & Killeen, I. (2004) *A survey of the molluscan fauna of a mixed farm in South County Cork, 2004*. Dublin. National Parks and Wildlife Service / Department of Environment, Heritage and Local Government.
- Ó Maithiú, S. & O'Reilly, B. (1997) *Ballyknockan: A Wicklow Stonecutters Village*. Dublin. Woodfield Press.
- O'Meara, M. (2001a) *The Amphibians, Reptiles and Mammals of Waterford City and County. Fauna of Waterford series No. 2*. Waterford Wildlife.
- O'Meara, M. (2001b) *The Lepidoptera of Waterford City and County. Fauna of Waterford series No. 1*. Waterford Wildlife.
- (2002a) *The Spiders of Waterford City and County. Fauna of Waterford series No. 5*. Waterford Wildlife.
- O'Meara, M. (2002b) *The Woodlice of Waterford City and County. Fauna of Waterford series No. 7*. Waterford Wildlife.
- O'Sullivan, A. M. & Moore, S. J. (1979) Composition of Field Boundaries 1974. In Anon. (Ed.), *Atlas of Ireland* (pp. 47). Dublin. Royal Irish Academy.
- Oreszczyń, S. & Lane, A. (2000) The meaning of hedgerows in the English landscape: different stakeholder perspectives and the implications for future hedge management. *Journal of Environmental Management*, **60**:101-118.
- Owen, J. (1995) A Note on *Otiorhyncus uncinatus* Germar (Coleoptera) in Co Tipperary. *The Irish Naturalists' Journal*, **25**:34.
- Palm, T. (1986) Coleoptera from Stenshuvud, S. E. Sweden. *Entomologisk Tidskrift*, **107**:53-58.
- Payne, R. M. (1978) The flora of walls in south-eastern Essex. *Watsonia*, **12**:41-46.
- Petit, S., Stuart, R. C., Gillespie, M. K. & Barr, C. J. (2003) Field boundaries in Great Britain: stock and change between 1984, 1990 and 1998. *Journal of Environmental Management*, **67**:229-238.
- Potter, C. (2001) *Dry Stone Walls A Crumbling Legacy in our Fragile Limestone Landscape*. 63.
- Rishbeth, J. (1948) The flora of Cambridge walls. *Journal of Ecology*, **36**:136-148.
- Rubelo, R. & Leclair, M. H. (2003) Site tenacity in the terrestrial salamandrid *Salamandra salamandra*. *Journal of Herpetology*, **37**:440-445.
- Russell, C. E. (1933) *Bare Hands and Stone Walls : some recollections of a side-line reformer*. New York. Scribner.
- Rutschke, J., Koepe, D. & Deichsel, G. (2004) Observations of anthropogenous influences on the reptile fauna of the Peloponnes (Greece). *Herpetofauna*, **25**:17-28.
- Ryser, J., Luescher, B., Neuenschwander, U. & Zumbach, S. (2003) Midwife toads in the Emmental, Switzerland. *Zeitschrift fuer Feldherpetologie*, **10**:27-35.

Scheers, H. & Van Damme, R. (2002) Micro-scale differences in thermal habitat quality and a possible case of evolutionary flexibility in the thermal physiology of lacertid lizards. *Oecologia*, **123**:323-331.

Schmitz, M. F., Sanchez, I. A. & de Aranzabal, I. (2007) Influence of management regimes of adjacent land uses on the woody plant richness of hedgerows in Spanish cultural landscapes. *Biological Conservation*, **135**:558-570.

Segal, S. (1972) *Notes on wall vegetation*. The Hague. W. Junk.

Sequeira, F., Gonçalves, H., Faria, M., Meneses, V. & Arntzen, J. (2001) Habitat-structural and meteorological parameters influencing the activity and local distribution of the golden-striped salamander, *Chioglossa lusitanica*. *Herpetological Journal*, **11**:85-90.

Simkins, J. (2004) *Dry Stone Walls and Wildlife*. Cumbria. Dry Stone Walling Association of Great Britain.

Smith, P. G. & Racey, P. A. (2005) The itinerant Natterer: physical and thermal characteristics of summer roosts of *Myotis nattereri* (Mammalia: Chiroptera). *Journal of Zoology*, **266**:171-180.

Thorson, R. M. (2002) *Stone by Stone: the magnificent history in New England's stone walls*. New York. Walker & Company.

Webb, R. (1988) *The Status of Hedgerow Field Margins in Ireland*. Dublin. An Foras Forbartha.

Woodell, S. & Rossiter, J. (1959) The flora of Durham walls. *Proceedings of the Botanical Society of the British Isles*, **3**:257-273.