



# THE ENVIRONMENTAL & CULTURAL HERITAGE OF THE IRISH LANDSCAPE AT BIRR, CO. OFFALY (IRELAND)

Course ID: ARCH 365Z  
July 12–August 8, 2020

Academic Credits: 8 Semester Credit Units (Equivalent to 12 Quarter Units)  
School of Record: Connecticut College

## DIRECTORS:

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Prof. John Feehan, University College Dublin & Irish Heritage School



*The whole landscape  
a manuscript. We  
had lost the skill to  
read. A part of our  
past disinherited. But  
fumbled like a  
blindman, along the  
fingertips of instinct.*

John Montague



## INTRODUCTION

This field and laboratory-based field school provides students with an in depth understanding of how the natural environment is formed, impacted, managed and understood through both natural and cultural lenses. The environmental landscapes for this program are predominantly based in the very heart of the Irish Midlands (in the vicinity of Birr Town), providing ready access to an extraordinarily wide range of natural habitats and culturally important archaeological sites. This location acts as a convenient springboard to a variant range of landscapes and study sites further afield.

This field school is holistic in nature, affording students insights into the natural environment: from the bedrock geology that literally forms the foundations for the topography to the glacial and post-glacial geomorphology, ecology, archaeology and traditional and contemporary economy (and indeed mindsets) of the Midlands. Thus, this program is designed to provide foundational knowledge to students from diverse disciplines including environmental science, geology, geography, ecology, archaeology, anthropology and other backgrounds.

An important element of this program is the volume of fieldwork and the scale and variety of fieldtrips to different locations. These will provide students an opportunity to experience, appreciate, as well as record (through mapping and survey exercises) and interpret the variation in environments and landscape types within Ireland – and how these influence the country’s cultural and natural heritage.

The program provides a practical introduction to all aspects of the ecological and cultural heritage of the Irish landscape. It aims to give students a sound introduction into how to map, record and interpret

geology, as a foundation to the landscape, and to relate it to broader cultural heritage - aiming to inform and inspire the participants how landscape is expressed in the cultures and human life of the region. The program compares the Midlands to other diverse natural/social landscapes in Ireland and ultimately equips students with skills and understanding that can subsequently be applied to the landscape of any other part of the world. At the heart of the program is the students' direct field experience of the geological landforms and habitats, and the cultural sites they will visit and become acquainted with. There will be an introductory lecture for each phase of the study, followed by library research and personal reading and where relevant by microscope and other work in a laboratory setting.

#### ACADEMIC CREDIT UNITS & TRANSCRIPTS

**Credit Units:** Attending students will be awarded 8 semester credit units (equivalent to 12 quarter credit units) through our academic partner, Connecticut College. Connecticut College is a private, highly ranked liberal arts institution with a deep commitment to undergraduate education. Students will receive a letter grade for attending this field school (see grading assessment and matrix). This field school provides a minimum of 160 direct instructional hours. Students are encouraged to discuss the transferability of credit units with faculty and registrars at their home institution prior to attending this field school.

**Transcripts:** An official copy of transcripts will be mailed to the permanent address listed by students on their online application. One more transcript may be sent to the student home institution at no cost. Additional transcripts may be ordered at any time through the National Student Clearinghouse: <http://bit.ly/2hvurkl>.

#### PREREQUISITES

There are no academic prerequisites for this field school. What is required is enthusiasm, a sense of excitement and a readiness to give it everything. Students must be willing to engage with the local community, in which they are working and living, in a professional and respectful manner, both during the official work hours and when 'off duty'. A moderate level of fitness is advisable as this program entails a lot of fieldwork and walking.

#### DISCLAIMER – PLEASE READ CAREFULLY

Our primary concern is with education. Traveling and conducting field research involve risk. Students interested in participating in IFR programs must weigh whether the potential risk is worth the value of education provided. While risk is inherent in everything we do, we do not take risk lightly. The IFR engages in intensive review of each field school location prior to approval. Once a program is accepted, the IFR reviews each program annually to make sure it complies with all our standards and policies, including student safety.

The IFR does not provide trip or travel cancellation insurance. We encourage students to explore such insurance on their own as it may be purchased at affordable prices. [insuremytrip.com](http://insuremytrip.com) or [Travelgurad.com](http://travelgurad.com) are possible sites where field school participants may explore travel cancellation insurance quotes and policies. If you do purchase such insurance, make sure the policy covers the cost of both airfare and tuition. See this [Wall Street Journal article about travel insurance](#) that may help you with to help to decide whether to purchase such insurance.

We do our best to follow schedule and activities as outlined in this syllabus. Yet local permitting agencies, political, environmental, personal, or weather conditions may force changes. This syllabus, therefore, is only a general commitment. Students should allow flexibility and adaptability as research work is frequently subject to change.

You should be aware that conditions in the field are different than those you experience in your home, dorms or college town. Field work, which is so central to the program, involves work in the outdoors. The Irish weather is very variable, and you should be prepared for field work in all weather conditions – including rain. You are required to bring suitable waterproof clothing and footwear as well as

sunscreen. ***Students MUST be in good physical condition and able to walk three-five miles (5 – 8 km) a day on rough and hilly ground.***

If you have any medical concerns, please consult your doctor. For all other concerns, please consult the project director, as appropriate.

## LOCATIONS

As part of the program students will visit the following different geoarchaeological locations:

### **BIRR**



Birr will act as the 'base' for entire program. Birr is a small town (population c. 6000) that nonetheless contains all modern amenities and is well served by public infrastructure. The town is well known as one of Ireland's most important Heritage Towns, with significant early and later medieval archaeology and history, dating from at least Saint Brendan's 6<sup>th</sup> century CE monastery. Today the town is best known for its mid-18<sup>th</sup> and early 19<sup>th</sup> century CE elegant Georgian streetscapes. At the centre of the town is Birr Castle, a 17<sup>th</sup> century CE structure built adjacent the location of the original 12<sup>th</sup> century CE castle site. The castle remains the home of the Earls of Rosse to this day. The demesne landscape of the castle, which evolved from the oak parkland of the late medieval castle, is one of the finest in Ireland.

A large area of land surrounding Birr (and a large amount of County Offaly in general) is underlain by raised bog, much of which is currently being exploited for fuel and the generation of electricity by Bord na Móna, the state's peat development company. The conservation of the resulting cutaway bog is currently a major exercise in ecological restoration in the region. Approximately 24 km north-east of Birr is one such restoration project - the Lough Boora Parklands, a key destination for our fieldwork.

Located directly south of Birr are the Slieve Bloom Mountains, made up of rocks of considerable geological interest, as these mountains represent a highly significant episode in the geological history of Ireland. The rocks that make up the Slieve Blooms date to the Devonian and Silurian periods, 350 to 440 million years ago. At the beginning of that time, the area that is now the north-west of Ireland and the area that is now the south-east of Ireland, were on opposite sides of a shrinking ocean known as the Iapetus Ocean. By about 410 million years ago, these two areas collided and a great mountain-building phase was in progress. The present-day Slieve Bloom Mountains lie along, or are very close to, the 'Iapetus Suture', the notional line that marks where these two areas with very different early geological histories amalgamated to create the area now known as Ireland. Several of the fieldtrips, and much of the field instruction in recording techniques, will be undertaken to the foothills of these mountain ranges.



### **THE BURREN**



Students will undertake a fieldtrip in the Burren. The Burren is underlain by limestones of the Lower Carboniferous (Visean) period. The limestone formed as sediments in a tropical sea which covered most of Ireland approximately 350 million years ago. The Burren is one of the finest examples of a Glacio-Karst landscape in the world. At least two glacial advances are known in the Burren area. However, it is probably the effects of the last glaciation (the Midlandian) that are most in evidence in this National Park. It is thought that most of the Burren was overrun

by ice during this glaciation. This is evident by the presence of fresh deposits of boulder clay at altitudes of just under 300 metres. Of particular interest is the impact of the first farmers who arrived into this region on their surroundings, with the removal of tree cover resulting in a dramatic and catastrophic

change to the landscape. Students will spend five days in the Burren and will be housed in hostel accommodation. The Burren is Ireland's most biodiverse area, internationally famed not just for its geology but also for its flora and fauna, and the rich archaeological heritage preserved here. During their stay, students will be introduced to all aspects of the geological and cultural heritage of this unique area. They will also become aware of how agricultural history shaped the geological and cultural character of the Burren as they see today.

### **CLARE ISLAND**

Students will spend their overnight fieldtrip in Clare Island, a small island (population only c.150) located in Clew Bay off the coast of County Mayo (northwest Ireland), which is accessed by a daily ferry service. The island's physical appearance today reflects a geological history of over 500 million years. Major geological boundaries, now expressed as faults, run through the island. Repeated movements along these faults have produced the complex distribution of rock types that have been the focus of geological research for numerous generations of geologists. Today the island is known for its association with the Gaelic Chieftain and pirate Gráinne O'Malley and still boasts archaeological remains dating to the medieval period. More recently, the island has become well known for academic surveys of its unique biology. In the early 20<sup>th</sup> century, the Northern Irish naturalist Robert Lloyd Praeger conducted extensive biological surveys of the island. Nearly 100 years later a further six volumes were commissioned by the Royal Irish Academy, who recently engaged one of the program instructors, Prof. John Feehan, to compile these studies into a coherent volume.



### **DIGGING THE LOST TOWN OF CARRIG PROJECT IN THE IRISH NATIONAL HERITAGE PARK, CO. WEXFORD**



The Program will include a visit to the Irish National Heritage Park in Ferrycarrig, Co. Wexford, to take a tour of the park – a 35 acre open air museum which recreates life in Ireland from 9,000 years ago to the time of the Norman Invasion. The visit will include a guided tour of the Digging the Lost Town of Carrig Project and the IFR summer excavation program (co-founded by Dr Mandal). The excavation is of the first Norman castle built in Ireland after the invasion in 1169 CE.

### **RESEARCH AND COMMUNITY OBJECTIVES**

The Program will include a study of the Camcor River in Birr, in partnership with the local community. The study will take the same approach as undertaken throughout the Program, from the bedrock and the formation of the river valley, to the establishment and evolution of the flora, fauna and micro fauna in the river and its banks. It will pose questions such as 'Why here?' in determining the human settlement of the area and examine how it has evolved with its surrounding landscape.



A component of the research study will look at the challenges of protecting the natural environment in the town of Birr and will include a **Service Learning** element working with the local community in environmental survey and protection. **COURSE OBJECTIVES**

On successful completion of the program, students will:

- Have a good base understanding of the merits of taking a holistic, 'landscape wide', approach to environmental science, or indeed any form of research inquiry – be that archaeological, ecological etc;

- Have a good understanding of the basic elements of Irish solid and glacial geology and how geology as 'bedrock' is instrumental in shaping the ecology, society and economy of the Irish Midlands (and other studied landscapes);
- Have a good understanding of the basic elements of environmental recording, including solid and glacial geology and geological mapping;
- Become familiar with the ecology of the principal natural habitats of central and western Ireland and their characteristic flora and fauna: woodland, peatlands (fen, raised and blanket bog), karst and limestone pavement, grasslands and freshwater aquatic habitats;
- Understand how the natural environment is instrumental in shaping the ecology and economy of the Irish Midlands (and other studied landscapes) today, including its terrestrial and aquatic flora and fauna, agriculture, food and water and biodiversity – as well as the environmental challenges faced by each of these; students will be acquainted with the survey and monitoring techniques used to assess the above;
- Be familiar with an outline of the archaeological heritage of Ireland, and in particular how the archaeological heritage of the Irish Midlands (and other studied landforms) is expressed relative to, and influenced by, the underlying geology and topography –i.e. how people and place are co-defined and inscribed in landscape;
- Have participated in and contributed to on-going research on the environmental health of the Camcor River in Birr; and
- Have participated in community based environmental service work.

#### **GRADING MATRIX**

**Fieldwork Participation (50%):** Students are required to participate fully in the daily schedule. Assessment will be undertaken by the supervisory team and will be based on attendance, willingness to work and to try diverse tasks, attention to detail and accuracy, participation in teamwork and contribution to discussions.

**Field Journal (25%):** Students are expected to maintain a field journal and present it for evaluation during their final week. This notebook should record student's daily activities, including details on geological mapping exercises, notes on all fieldwork, check-lists of flora and fauna and details of lectures and laboratory exercises, as well as personal observations.

**Presentation (10%):** At the end of Week 3, students will be required to give a 3-minute presentation on a research topic of their choice, but which must be related to the program. The presentation will be given to the group in the form of a 'Ted Talk' and may use power point or other visual aids.

**Research Paper (15%):** Students will be assigned a research paper based on their studies - linking geology to natural history, culture, development and future. Using their fieldwork as their foundation, students will write an essay (1,500 words of text plus appropriate in-text citations, illustrations, and bibliography) incorporating the teachings from their fieldtrips and their wider program of study.

Students will be allocated time to undertake research. The paper is due two weeks after the last day of the field school (though students may submit earlier if they so wish – such as if they are intending to undertake continued travel) and should be submitted via email as per the instructions that will be given in the program orientation. Students will be assessed on their ability to organise and interpret information, their comprehension of the readings and the strength of their argument, the quality of their presentations, and their readiness to work in groups.

#### **CULTURE, LOCAL ENVIRONMENT & ETIQUETTE**

Birr is a quintessentially classic, small, friendly and safe Irish town, [some 130km] west of Dublin. All the relevant local government agencies are aware of the students' presence, and they and all the people of the town are anxious to ensure that your stay is safe and enjoyable. Students are asked to respect local sensitivities and traditions and to understand that the presence of such a large team of outsiders in town does not entitle participants to any special treatment or privileges.

This project may occasionally involve the participation of Irish university students and volunteers from the local community. Although everyone will speak English students should expect surprising cultural differences and exciting opportunities to learn about the lives of others as well. IFR students will be immersed in Irish culture through learning, language, food and music, and should be prepared for the rewards and challenges that life in a different culture will offer.

## ACCOMMODATION



With the exception of the extended field trips in the Burren and on Clare Island, the students will be housed in Home Stay accommodation in the town of Birr, Co. Offaly (see schedule). Home Stay students live with local families, and experience true home life in provincial Ireland. Students are to keep the accommodation clean and tidy at all times and to be respectful towards their Home Stay family and roommates. Students will walk (or be dropped to and collected from) a designated meeting point (normally Birr Square or Birr Community School). Breakfast and dinner will be provided along with a packed lunch. At

weekends students are encouraged to avail of their free time and explore Ireland. Food will be provided during extended fieldtrips.

In the Burren and on Clare Island accommodation will be in (single sex) shared dormitory style rooms in local hostels, with meals provided in a communal setting.

## TRAVEL & MEETING POINT

We suggest you hold purchasing your airline ticket until six (6) weeks prior to departure date. Natural disasters, political changes, weather conditions and a range of other factors may require the cancellation of a field school. The IFR typically takes a close look at local conditions 6-7 weeks prior to program beginning and make Go/No Go decisions by then. Such time frame still allows the purchase deeply discounted airline tickets while protecting students from potential loss if airline ticket costs if we decide to cancel a program.

Students will be met in Birr, Co. Offaly. Since students will arrive on different flights at different times of the day, we will meet all students on the Sunday (first day of arrival) at Dooly's Hotel ([doolyshotel.com](http://doolyshotel.com)) at 6pm. Directions and travel information will be issued to all students once they are enrolled in the field school.

If you fail to make the meeting, please call/text or email Dr Stephen Mandal. You will be sent his local cell phone number once you are enrolled in the course.

## VISA REQUIREMENTS

Citizens of the US and Canada do not require visas to enter Ireland. You will need your passport to be valid for at least 90 days and will enter on a tourist visa. Citizens of other countries are asked to visit the Ireland Consulate web page at their home countries for specific visa requirements.

No vaccinations are required for entry to Ireland but anyone working in archaeology in Ireland needs to have an up-to-date tetanus shot.

## EQUIPMENT LIST

Bring a basic travel/fieldwork kit, which is to include but not necessarily be limited to:

- Clothing suitable for wet and cool (as well as warm!) weather.
- Hiking-style waterproof shoes or boots.
- Sunscreen: when in the field students should wear an SPF daily to protect against UV exposure and windburn. Despite its relatively cool summer temperatures, Ireland has high UV in the summer months.
- A peaked or wide-brimmed sunhat for outdoors.
- Insect repellent (essential for periods of fieldwork).

- Laptop/tablet: a device on which you can prepare and submit your presentation and written assignments.
- Writing materials, including a strong field notebook.

## **PROGRAM SCHEDULE**

All IFR field school begins with safety orientation. This orientation includes proper behavior at the field area, proper clothing, local cultural sensitivities and sensibilities, potential fauna and flora hazards, review IFR harassment and discrimination policies and review of the student Code of Conduct.

### **WEEK 1**

During the first week, the students will acquire a solid understanding of the natural framework of the landscape of the Irish Midlands, through a series of lectures and field studies, including field mapping. They will become familiar with the natural habitats surrounding Birr and develop an ability to see and interpret the interaction between the natural environment and the human world. The week will conclude with an exercise interpreting the influence of geology and landscape on archaeology, history and human possibility – a thread the students will revisit throughout their program of study.

### **WEEK 2**

Using their training from Week 1 as a foundation, students will come to understand the ecology of the Midland region. Emphasis will be placed on the microscopic examination of plants, on floral evolution and the interaction between plants and their pollinators.

At the end of Week 2, students will visit the Digging the Lost Town of Carrig Project – archaeological excavations being undertaken in partnership with the IFR – in the Irish National Heritage Park, Co. Wexford.

### **WEEK 3**

During Week 3 the students will spend two days in the Burren, County Clare. The Burren is Ireland's most biodiverse area, internationally famed for its karst geology and the rich archaeological heritage preserved here. During their stay the students will be introduced to all aspects of the natural and cultural heritage of this unique area – specifically how the two interplay. They will also become aware of how agricultural history has shaped the natural and cultural character of the Burren, and how modern agricultural practice works to conserve and enhance that threatened heritage.

A further two days will be spent on Clare Island, County Mayo. The island became the focus of international study in 1914-15 when scores of the most renowned naturalists, geologists and other scientists chose it as the focus of an incredibly detailed natural and cultural study. The study was the most detailed undertaken in the world at the time. Then, a hundred years later, the New Survey of Clare Island was started. The field trip will look at the findings of those two incredible studies and focus on the skills required to assess the environment and the physical landscape.

At the end of Week 3, students will present their Ted Talks on their chosen research topics.

### **WEEK 4**

During the final week, the students will return to the Midlands and participate in a community-based research at the Camcor River in Birr. They will learn about the European legislative framework for cultural heritage assessments for Environmental Impact Statements. They will use their newly acquired skills to sample and analyse the river in a number of different environments (both fast flowing and still) and use the data collected to assess the water quality. They will also participate in an environmental service learning project in partnership with the local community.

### **DAILY SCHEDULE \***

Unless stated otherwise in the detailed schedule below, students will be committed to program activities from Monday to Friday inclusive, attending lectures and field visits, carrying out laboratory work or undertaking research. The normal working day is from 9:00 am to 5:00 pm with a morning tea break from 11:00 to 11:30 am and lunch from 1:30 to 2:15 pm – variations to the schedule will exist during fieldtrips

and during laboratory sessions. In preparation for their field visits, students will be introduced to the different areas of the country through a series of lectures (as outlined in the schedule below). Students will have weekends free to explore the area and other parts of the country.

		<b>MORNING</b>	<b>AFTERNOON</b>
<b>WEEK 1: GEOLOGY, LAND AND LANDSCAPE</b>			
12-Jul-20	<i>Sunday</i>		Welcome
13-Jul-20	<i>Monday</i>	Orientation	Lectures: Geology of the Midlands in relation to the world at large (with particular reference to the United States)
14-Jul-20	<i>Tuesday</i>	Fieldwork: Visit to Glenbarrow and its environs for a geological field trip, including geological/geographic mapping and interpretation	Fieldwork: Geological/geographic mapping exercise on the Silver River
15-Jul-20	<i>Wednesday</i>	Fieldwork: Esker visit at Knockbarron to interpret glacial geomorphology	
16-Jul-20	<i>Thursday</i>	Lecture: Interpreting the influence of geology and landscape on archaeology, history and human possibility through mapping and landscape assessment. Birr Town as a case study.	Fieldwork: Birr Town case study
17-Jul-20	<i>Friday</i>	Fieldwork: Birr Town case study continued	
<b>WEEK 2: FLORA AND FAUNA</b>			
20-Jul-20	<i>Monday</i>	Lecture: Bogs in Ireland, their formation, exploitation and restoration	Fieldwork: Study in the Bog of Galros, interpreting the influence of geology and landscape on archaeology, history etc.
21-Jul-20	<i>Tuesday</i>	Lecture: The flora of central Ireland; floral biology; Fieldwork: Lough Boora Flora study & collection of material for microscope work; Laboratory work: Working with plant materials	
22-Jul-20	<i>Wednesday</i>	Lecture: Aquatic invertebrates and biological sampling; Fieldwork: Invertebrate sampling in Midland rivers; Laboratory work: Working with aquatic invertebrate samples	
23-Jul-20	<i>Thursday</i>	Laboratory work: Working with plant materials	Laboratory work: Working with aquatic invertebrate samples
24-Jul-20	<i>Friday</i>	Fieldwork: Visit to the Digging the Lost Town of Carrig Project at the Irish National Heritage Park, Wexford	
<b>WEEK 3: THE BURREN &amp; CLARE ISLAND (FIELDWORK ALL WEEK)</b>			
27-Jul-20	<i>Monday</i>	Fieldwork: Travel to the Burren National Park at Carran.	Fieldwork: Tour to significant medieval (Cathair Mór) and Neolithic (Poulnabrone) archaeological sites
28-Jul-20	<i>Tuesday</i>	Fieldwork: Trip investigating the Prehistory and the Early Christian period on the Termon Plateau and its surrounds	Fieldtrip to the Early Christian Cahercommaun and prehistoric Roughan Hill – monuments and landscapes that give an indication of the organisation and structure of their respective societies
29-Jul-20	<i>Wednesday</i>	Fieldwork: Travel to Clare Island	Fieldwork: Study of the natural and cultural heritage of Clare Island
30-Jul-20	<i>Thursday</i>	Fieldwork: Study of the natural and cultural heritage of Clare Island (continued)	
31-Jul-20	<i>Friday</i>	Travel back to Birr	

		<b>MORNING</b>	<b>AFTERNOON</b>
<b>WEEK 4: CULTURE AND ENVIRONMENT</b>			
03-Aug-20	<i>Monday</i>	Independent research	
04-Aug-20	<i>Tuesday</i>	Lecture: Environmental Impact Assessment (Cultural Heritage)	Workshop: Cultural Heritage Assessment of local landscape
05-Aug-20	<i>Wednesday</i>	Service Learning: Environmental Survey in Birr	
06-Aug-20	<i>Thursday</i>		
07-Aug-20	<i>Friday</i>	Lectures: Program wrap up	Independent research time; Evening cultural event
08-Aug-20	<i>Saturday</i>	Depart program	



*\*Please note: amendments to this schedule may be made to take account of weather conditions or urgent unforeseen circumstances.*

## **REFERENCES AND FURTHER READING**

*PDF files of all mandatory readings will be provided to enrolled students via a shared Dropbox folder.*

### **Mandatory Readings**

Viney, Michael (2003). *Ireland. A Smithsonian Natural History*. Belfast, The Blackstaff Press: Chapters 1-8, 12 and 17.

David, Bruno and Julian Thomas (2008). *Handbook of Landscape Archaeology*. Walnut Creek, Left Coast Press. Chapters 1, 2 and 4.

Jones, Carleton (2004). *The Burren and the Aran Islands. Exploring the Archaeology*. Cork, The Collins Press.

### **Recommended Further Reading/Field Reference Guides**

Averis, Ben (2013). *Plants and Habitats: An Introduction to Common Plants and Their Habitats in Britain and Ireland*. Ben and Alison Averis.

Blamey, Marjorie, Richard Fitter and Alistair Fitter (2013). *Wild Flowers of Britain and Ireland (2<sup>nd</sup> Revised Edition)*. Bloomsbury Natural History.

D'Arcy, Gordon (1992). *The Natural History of the Burren*. London, Immel.

Feehan, John (2003). *Farming in Ireland: History, Heritage and Environment*. University College Dublin Faculty of Agriculture.

Feehan, John (2004). *A Long-Lived Wilderness. The Future of the North Midland Peatlands*. ERM in collaboration with the National Wetlands Park Committee.

Feehan, John (2007). *Cuirrech Life. The Curragh of Kildare, Ireland*. School of Biology and Environmental Science UCD in association with the Department of Defence.

Feehan, John (2007). *The State of Nature in Offaly*. Offaly County Council.

Feehan, John (2009). *The Wildflowers of Offaly*. Offaly County Council.

Feehan, John (2013). *The Geology of Laois and Offaly*. Offaly County Council, in association with Laois County Council and the Geological Survey of Ireland.

Feehan, John (2014). *Cluain Mac Nóis i nDeilbne hEthra: The Landscape of Clonmacnoise, County Offaly, Ireland*. Offaly County Council in association with Bord na Móna.

Feehan, John (2016). *The Carran and Templecronan Looped Walks*. Clare's Rock Hostel, Carran.

Feehan, John and Alison Rosse (2005). *An Atlas of Birr*. Department of Environmental Resource Management at University College Dublin in association with Offaly County Council.

Feehan, John (1979). *The Landscape of Slieve Bloom: a study of its natural and human heritage*. Blackwater Press, Dublin (revised edition 2009).

O'Connell, Jeff W. and Anne Korff (eds.) (2001). *The Book of the Burren*. Kinvara, TirEolas (2<sup>nd</sup> edition).

Viney, Michael (2003). *Ireland. A Smithsonian Natural History*. Belfast, The Blackstaff Press.