

University of St Andrews

Sustainability Development Working Group

Sustainability in the Curriculum – Report

1. Introduction

- 1.1. This paper is intended to provide an overview of information gathered April 2017 concerning the sustainability-related learning and teaching activities that are underway across the University.

2. Background / context

- 2.1. Background description –. The information has been gathered from the Pro Deans review of the Course Catalogue and information received from Directors of Teaching (DoTs) following a presentation to the LTC meeting on 5 April 2017 and follow-up emails to Directors of Teaching.

- 2.1.1. The information presented here was gathered over 4 weeks. First, the Pro Deans (Curriculum) identified relevant modules codes and descriptions (Annex A). Second, further information was received from Directors of Teaching following a presentation to Learning and Teaching Committee on 5 April 2017. The Directors of Teaching from 13 out of 20 Schools and Units across the University have responded to requests for information (65% response rate). Some provided detailed narratives explaining how sustainability is conceptualised in teaching activities as well as module descriptors, while most provided a list of modules. Additional information was provided about individual members of staff with an interest in sustainability and research centres that relate to sustainability.

2.2. Overview of sustainability in the curriculum

- 2.2.1. Sustainability-related learning and teaching is underway across most of the Schools and Units. Based on the information thus far, 194 modules relate to sustainability across undergraduate, post-graduate, executive education and public outreach events across the curriculum (Annex A & B).
- 2.2.2. A review of the activities shows sustainability spans topics of localism, human-nature relations, technological development, behaviour change, ethics and corporate social responsibility. The Proctor has offered some broad themes to organise our teaching related to sustainability around:
- Culture and politics of sustainability
 - International sustainability
 - Energy & Renewables
 - Economics of climate change
 - Climate science
 - Biodiversity and habitat conservation

3. Recommendation

- 3.1. Use this consultation and the new Transition Research Facilitator to better publicise and promote learning and teaching on sustainability, including the opportunities for applied learning under the Living Lab initiative (see website for more details: <http://www.transitionsta.org/living-labs/>). We recommend that the Transition Research Facilitator further publicizes the Living Lab approach amongst Directors of Post-Graduate Research, Directors of Teaching and academics working on sustainability-related research.
- 3.2. Directors of Teaching and academics have expressed interest in a cross-University symposium discussing sustainability in the curriculum. This event would provide opportunities for talk about common interests and peer to peer learning on the pedagogical approaches used in sustainability-related learning and teaching.

4. Further information

- 4.1. Further information if required can be obtained from

Authors

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Date 20 April 2017*

Annex:

- A. Summary of modules
- B. Detailed List of Modules per School

Annex A - Summary of Modules

School	Modules identified by Pro Deans Curriculum	Revised number of modules following DoT contact	DoT
1. Art History	X	10	Dr Alistair Rider
2. Biology		77	Dr Gerald Prescott
3. Chemistry	X	7	Professor Phil Lightfoot
4. Classics	X	11	Dr Ralph Anderson
5. Computer Science		6	Dr Dharini Balasubramaniam
6. Divinity	1	1	Dr William Hyland
7. Earth and Environmental Science	X	13	Dr Ruth Robinson
8. Economics and Finance	X	8	Dr Ian Smith
9. English	X	5	Dr Christine Rauer
10. English Language Teaching		5	Mrs Kerith George-Briant
11. Geography and SD	X	23	Dr Matt Southern
12. History	X		Professor Simon MacLean
13. International Relations	X	4	Dr Ryan Beasley
14. Modern Languages	X		Dr Elise Hugueny-Leger
15. Management	X	6	Martin Dowling or Dr Sandra Romenska
16. Mathematics and Statistics			Dr Monique Mackenzie
17. Medicine			Dr Alan Hughes
18. Philosophy, Social Anthropology & Film Studies	X	8	Dr Lisa Jones
19. Physics and Astronomy	X	10	Dr Bruce Sinclair
20. Psychology and Neuroscience			Dr Michael Oran
Total		194	

Annex B - Detailed List of Modules per School

Art History: Dr Alistair Rider

These modules are:

AH31: The Arts of Islam, Ilse Sturkenboom

AH3104: The Age of Klimt, Olbrich and Mucha, Jeremy Howard

AH4130: Realism and Symbolism in Russian Art 1860 - 1910, Jeremy Howard

AH4156: Seeing the Sixties, Alistair Rider

AH4174: Pilgrimage to Santiago de Compostela, Kate Rudy

AH5190: Experimental Art of the 1960s, Alistair Rider

AH5504: Theory and Practice of Museums, Art Galleries and Related Organisations, Part 1: Collections in Context, Ann Gunn

AH5505: Theory and Practice of Museums, Art Galleries and Related Organisations, Part 2: Audiences and Management, Ann Gunn

AH5560: Theory and Practice of Museums, Art Galleries and Related Organisations, Part 1: Collections in Context, Ann Gunn

AH5561: Theory and Practice of Museums, Art Galleries and Related Organisations, Part 2: Audiences and Management, Ann Gunn

Biology: Dr Gerald Prescott

BSc Hons modules

BL1101 Biology 1

BL1102 Biology 2

BL2303 Evolutionary Biology

BL2304 Invertebrate Zoology

BL2307 Ecology

BL2308 Vertebrate Zoology

BL2309 Applied Molecular Biology

BL2310 Comparative Physiology

BL3000 Field Course

BL3307 Evolution

BL3308 Aquatic Ecology

BL3309 Ecosystems and Conservation

BL3311 Infection and Disease

BL3315 Developmental Biology

BL3316 Animal Plant Interactions

BL3318 Biology of Marine Organisms
BL3319 Animal Behaviour: A Quantitative Approach
BL3320 Statistical and Quantitative Skills for Biologists
BL3323 Terrestrial Zoology
BL4211 Antimicrobials - Mode of Action and Resistance
BL4213 Molecular Virology
BL4215 Bacterial Virulence Factors
BL4216 Structure-based Drug Discovery
BL4249 Scientific Diving
BL4251 Tropical Marine Biology
BL4254 Fisheries Research
BL4255 Marine and Environmental Biotechnology
BL4256 Marine Bioacoustics
BL4258 Foraging in Marine Mammals
BL4259 Marine Mammals and Man
BL4260 Biological Oceanography
BL4262 Environmental Drivers of Marine Habitats
BL4263 The Question of Culture in Cetaceans
BL4266 Conservation Research Methods
BL4268 Scientific Communication in Biodiversity and Conservation
BL4270 Plant-environment Interactions
BL4275 Evolution in Action
BL4278 Biology of Dinosaurs and Other Extinct Vertebrates
BL4280 Evolution and Human Behaviour
BL4281 Animal Communication and Cognition
BL4282 Biology and Behaviour of Social Insects
BL4285 Complex Systems in Animal Behaviour
BL4301 Polar Ecology: A field course in Antarctica
BL5441 Animal Cognition

MSc programmes with a core of sustainability

Ecosystem-Based Management of Marine Systems (MSc)

BL5111 Quantitative Methods for Biology

BL5113 Statistical Modelling of Biological Data
BL5304 Ecosystem-based Management of Marine Systems
ID5011 Geographic Information Systems for Environmental Management
BL5303 Marine Systems Research Methods
BL5322 Marine Management, Policy and Planning
BL5323 Advanced Modelling

Marine Mammal Science (MSc)

BL5201 Biology of Marine Mammals
BL5202 Case Studies in Marine Mammal Biology
BL5104 Conservation and Management of Marine Mammals
BL5103 Population Biology of Marine Mammals
BL5121 Current Issues in Marine Mammal Behaviour
BL5122 Current Issues in Biologging
BL5125 Advanced Bioacoustics for Marine Mammal Science

Sustainable Aquaculture (Distance Learning, PGCert, PGDip, MSc)

BL4801 Aquaculture and Fisheries
BL4802 Biology for Aquaculture
BL4803 Biology for Aquaculture – Invertebrates
BL4804 Biology for Aquaculture – Vertebrates
BL5801 Nutrition for Aquaculture
BL5802 Management, Husbandry and Sustainability
BL5803 Health and Disease
BL5804 Markets, Products, Processing and Food Safety
BL5805 Local and Global Impacts of Aquaculture
BL5806 Nutrition – Invertebrates
BL5807 Nutrition – Vertebrates
BL5808 Health and Disease – Invertebrates
BL5809 Health and Disease – Vertebrates
BL5821 Breeding and Genetics
BL5822 Advanced Welfare and Ethics
BL5823 Recirculation Aquaculture Systems
BL5824 Ornamental and Aquaria Production

BL5825 Larval Rearing
BL5899 Sustainable Aquaculture Research Dissertation

School of Chemistry - Prof. Phil Lightfoot (DoT, Chemistry) 19/4/17

The degrees we offer in the School of Chemistry are underpinned by the principle that Chemistry is a cause for 'good' in the world, and hence students are taught to appreciate throughout the ideas of sustainability in chemical products and processes and minimising the use of harmful, expensive and unsustainable procedures.

Some specific lecture- and lab-based modules that address particular aspects of 'Sustainability' are listed below. Please also note that our lab courses and research projects throughout the 4 or 5 year degrees also emphasise sustainable and environmentally-friendly approaches to chemistry. Students on the MChem degrees also have an option of a year working in industry, often with direct relevance to sustainability.

CH1301: The Impact of Chemistry

This module is an 'introduction to chemistry', mainly for non-chemists and aims to show the enormous positive impact chemistry has on our lives. It covers, at an elementary level, the use of chemistry in food production, fossil fuels versus alternative fuels (e.g. nuclear, solar, hydrogen-based, bio-fuels) and chemical pollution and its control (e.g. acid rain, ozone hole, global warming, recycling, indoor pollution etc).

CH2501: Inorganic Chemistry 2

A part of this module discusses 'molecules in the atmosphere'. This covers the chemical basis of global warming through an understanding of the interaction of light energy with the bonds within molecules, and explains, for example, why carbon dioxide is such a problem in global warming, whereas other key gases in our atmosphere (nitrogen, oxygen, water) are not.

CH3441: Mini-projects

This module focuses on team work on a research-type problem. In every year a selection of the topics offered include topics such as making the laboratory class use greener, less harmful reagents, making chemicals from biomass waste, using catalysts to efficiently produce important molecules with minimum waste.

CH3612: Synthetic Methodology

A part of this module discusses the use of modern catalysts that allow carbon-carbon bonds in important molecules to be made in a more sustainable way than more traditional methods.

CH5611: Asymmetric Synthesis

A major part of this module discusses how catalysts are now used to replace previous processes that tended to use harmful reagents, generate unwanted side products, and often involved separating and removing undesired forms (isomers) of the desired products.

CH5713: Surface Chemistry and Heterogeneous Catalysis

This module includes a discussion of how modern catalytic processes are designed to enhance their sustainability by reducing their energy demand and enabling much reduced generation of unwanted by-products. Consequently, they are replacing older, much less environmentally-benign processes.

CH5715: Energy Conversion and Storage

This module discussed important contemporary applications of chemistry in the conversion of natural energy into useful forms, and the efficient and environmentally-benign storage of energy. The emphasis is on different types of fuel cells and batteries for both stationary and portable applications.

Classics: Dr Ralph Anderson¹

Further information may be received in due course across Ancient History, Classical Studies, Latin, Greek undergraduate modules.

In Honours:

1. AA4001 Cities and Urban Life in Late Antiquity (300-700 CE) (Carlos Machado)
2. AA4002 From Pompeii to Aquileia: the Archaeology of Roman Italy (50 BCE - 300 CE) (Carlos Machado)
3. AA4121 The Ancient City of Rome (Jon Coulston)
4. AN4425 (now recoded with an AA prefix) Networks and Islands: The Archaeology of the Cyclades (Rebecca Sweetman)
5. AN4426 Roman Slavery (Myles Lavan)
6. CL4433 Religions of the Greeks (R. Anderson)
7. CL4438 Animals in Greco-Roman Antiquity (Sian Lewis)
8. CL4500 Pleasure, Goodness and Happiness: Hellenistic Ethics (Alex Long)
9. CL4502 Ethics and Lifestyles: Philosophy and Ways of Living in Antiquity (C. Addey)

In subhonours:

AN1002 Roman History from Foundation to Empire (team taught)

Contains elements of sustainability. One of the major contributory factors in the collapse of the Roman Republic and its replacement by an imperial system of government was the politicisation of the army as Rome's empire grew. The Roman army originated as a citizen militia, which was adequate for the needs of a small city-state. However, demand for longer periods of service further from home undermined the ability of the Roman citizen to be both soldier and subsistence-farmer, while the army's successful campaigns channelled ever more wealth back to Rome, where it fell disproportionately into the hands of the already-wealthy political elite, who used it to buy up agricultural land and slave to farm it. In effect, the Roman militia captured its

¹ Further information may emerge in due course.

own replacements as farmers. The Roman response was to enlist landless men who, being dependent on their army pay, loot, and the patronage of their commanders when they retired, became more loyal to their leaders than to the state, and ever more willing to take part in civil war to support their leaders' political ambitions.

AN2003 Mediterranean Communities

Studies the history of human habitation in the Mediterranean from the very beginning to the 6th century CE, though focusing on the period ca. 1000 BCE to 600 CE, with particular attention to archaeology and the interaction of human society and the natural environment. Contains discussion of the impact of humans on the ancient environment and of the environmental pressures on human society that prompted the development of extensive networks as a form of environmental risk-buffering.

Researchers who might be interested in a symposium:

Sian Lewis – just publishing a co-authored sourcebook on animals in antiquity (the first multi-species one ever, I think, at least in English). Sian and I are also planning to run a conference on 'haptic landscapes'/'landscapes of experience' etc. next year.

The archaeologists might also be interested: Jon Coulston, Rebecca Sweetman, Eleri Cousins.

Myles Lavan – currently working on new methods for estimating the population of the Roman empire at various times (harder than you might think, ancient statistics being rare, patchy and often unreliable)

Jason Koenig is conducting research on mountains in ancient culture, and would probably be interested.

See also the new Centre for Landscape Studies: <http://landscape-studies.wp.st-andrews.ac.uk/>

Computer Science: Dr Dharini Balasubramaniam

Modules relating to energy / environmental factors applied to Computer Science and IT:

CS4202 Computer Architecture (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/CS4202.html>)

Computers construction, the trade-offs between cost and performance in computer design.

IS5106 Green Information Technology (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/IS5106.html>)

Environmental factors related to the use and IT services and systems, trade-offs that must be made with use of IT services and systems today to make them environmentally friendly(ier).

Hardware, service provision, users, green metrics, social, governmental and legal perspectives

Modules of data management:

IS5102 Database Management Systems (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/IS5102.html>)
Data modelling, database design, database management, database theory, business intelligence, data mining

CS5044 Information Visualisation and Visual Analytics (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/CS5044.html>)
Overview of the area of information visualisation and how it is applied in different professional and casual contexts, principles and methods of creating effective information visualisations, different ways of visualising data, critical assessment of existing visual displays of data.

CS5052 Data-Intensive Systems (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/CS5052.html>)
programming paradigms, algorithmic techniques and design principles for large-scale distributed systems, engineering and working with systems which need to process big data.

ID5059 Knowledge Discovery and Datamining (<https://info.cs.st-andrews.ac.uk/student-handbook/modules/ID5059.html>)
Historical/philosophical perspectives of mining large data sets, model selection algorithms and optimality measures, tree methods, bagging and boosting, neural nets, and classification in general.

Divinity

DI4824 Theology in Latin America (M. Aguilar)

Economics: Dr Ian Smith

EC1002 Microeconomics and EC2001 Intermediate Microeconomics. include lectures on externalities (these are often illustrated by external environment costs such as carbon emissions or pollution and problems with common resources more generally).

EC3303 Economic Growth (R. Stefanski)

EC4405 Economics of the Environment (J. Jin)

EC4410 International Trade (J. Jin)

EC4419 Economics of Development (M. Leighton)

EC4420 Inequality and Redistribution (T. Cuhadaroglu)

EC4424 The Economics of Migration (S. Braun)

English: Dr Christine Rauer

EN3202 Literature and Ecology, Prof. John Burnside, jb44

EN3214 The Country and the City in Scottish Literature, Dr Peter Mackay, pm83
EN3215 Atomic Cultures: Anglophone Writing and the Global Cold War, jjp5
EN4369 Victorian Literature and Science, Dr Greg Tate, gpt4
EN4406 Contemporary British Fiction, Dr James Purdon, jjp5 [Note that the title of this module may change in the next couple of years]

English Language and Teaching: Mrs Kerith Bryant

ET1006: Lindsay and George, the Sustainability Officers come in and deliver a lecture about sustainability in the university, and then students devise a poster, which focuses on different aspects eg. Power, recycling, events etc. The posters are put up in the department and are available for other students to look at.

ET1020, ET1021, ET1022 and ET1023, all January Intake Foundation programmes, the theme of Sustainability is explored in a module called Exploring Academic Identities. Students are encouraged to define sustainability from a particular perspective. Posters are created and then presented at a S-led conference with accompanying workshops. Lindsay, the Sustainability Officer was the keynote speaker this year. A short video of our first conference is available here: <https://www.youtube.com/watch?v=19ywni3xxSQ> This year's conference had a wider scope and discussed the sustainability of the black cab industry with Uber on the scene, as well as the sustainability of Prostate cancer treatment.

S3 First Chances Summer School: Kerith George-Briant gives a lecture on Sustainability. Pamela Forbes in Admissions would be able to give you more information on how the Sustainability theme is developed throughout the project.

Action: contact Pamela Forbes (Admissions) for further information

Earth Sciences

ES1001 Planet Earth (S. Mikhail)
ES1002 Earth Resources and Environment (M. Singer)
ES2001 Dynamic Earth: the Earth System (T. Raub)
ES2003 Dynamic Earth: Earth Surface Processes (N. Allison)
ES3004 Processes and Products in Sedimentary systems (T. Prave)
ES3008 Geochemistry (N. Allison)
ES3010 Advanced Environmental Field Methods (M. Claire)
ES3011 Global Biogeochemical Cycles (A Zerkle)
ES3012 Advanced Geological and Environmental Field Methods (T Prave)

ES5005 Isotope Geochemistry: theory, techniques and applications (A. Burke)
ES5010 Advanced Geochemistry (E. Stueeken)
ES5011 Water in the Environment (M. Singer)
ES5050 Earth's Greatest Hits (J. Rae)

Geography & Sustainable Development

GG1001 Welcome to the Anthropocene
GG1002 A world in Crisis

GG2011 Geographies of Global Change
GG2012 (Re)constructing Environments, People and Places

GG3100 Reconstructing Past Environments (K. Roucoux)
GG3229 Environmental Management in Scotland (C. Warren)
GG3238 Development voice, power and identity in global times
GG3239 European Population Trends
GG3240 Ice and Climate
GG3262 Climate and Weather Systems (D. Benn)
GG3264 Oceans and Climate (W. Austin)
GG3274 Socio-ecological systems

SD1000 What is Sustainable Development? (A. Brown)
SD1004 Sustainable Development Goals: Challenges and Opportunities

SD2001 Sustainable Development: Frameworks for Implementation (T. Stojanovic)
SD2002 Sustainable Development: Tools for Action (J. Long)

SD3001 Methodologies for Sustainable Development
SD3110 Environmental Economics (N. Hanley and E. McLaughlin)
SD3111 Home and Energy Geographies

SD4111 Governance for Sustainability (T. Stojanovic)
SD4110 Transitioning to Sustainability: community, nature and governance (R. White)
SD4112 Global Energy Politics (D. McCauley)

SD4113 Environment and Development Economics

Management: Martin Dowling & Dr Sandra Romenska

Sustainability features in optional modules in the Honours and post-graduate programmes:

MN4100 Contemporary Issues in Management (J. Bebbington) – core

MN4227 Corporate Social Responsibility (J.Ferguson)

MN4266 Non-Governmental Organisations (NGOs): contexts, contributions and challenges (E.Burt)

MN4238 Sustainable Development and Management (S.Russell)

MN5001 Contemporary Global Issues in Management (R. Woodfield) – core

MN5513 Ethics, Organisations and Management (S. Mansell)

MN5311 Responsible Investment (K. Bouslah)

MN5821 Managing Non-Governmental Organisations (E. Burt)

In addition, the School is developing new sustainability-related courses for our Executive Education programmes with Science Po.

Philosophy, Social Anthropology & Film Studies, including Music

Music: Dr Jane Pettegree

MU2002: Jonathan Kemp interested in examining ways that Scottish music links with the environment – lots of bits of music we sample have titles based on places or plant names, for example. We don't yet teach honours modules in this area, but could imagine a project about music and the Scottish environment which would be really interesting.

MU2002 Scottish Music – this module looks at a wide range of folk and art music from 1500 to the present day, considering how it emerges from and expresses Scottish identity. This includes discussion of how music in Scotland has connected with the Scottish landscape. Current course content includes discussion of e.g.: James Oswald 'Airs for the Seasons' (a botanical catalogue in music); Neil Gow, 'Farewell to Whisky' (which was inspired when poor harvests in 1799 led to a year-long ban on whisky production); Hamish MacCunn, "Land of the Mountain and the Flood" (programme music 'describing' a stormy Scottish landscape); Peter Maxwell Davis, "Orkney Wedding with Sunrise" (which places human activities in the Orkney environment); and one lecture that includes discussion of film music composed for documentaries about rural Scotland.

Other activities

Music staff have also been active this year in other activities using music to promote environmental awareness e.g. a series of public concerts and talks themed 'Planet Music' promoted by the Music Centre, including Byre Opera's production of Janáček's *The Cunning Little Vixen* in June (themes concerned with cycles of death and renewal).

PY4618 Animals, Minds and Language (D. Ball)

PY4625 Philosophy and Public Affairs: Global Justice (E. Ashford)

PY4647 Humans, Animals, and Nature (B. Sachs)

SA3064 The Anthropology of Migration (M. Fumanti)

SA4860 Anthropology of Amazonia (P. Gow)

SA4866 Anthropology and Eurasia (S. Bunn)

Physics & Astronomy: Dr Bruce Sinclair

AS1001 discusses runaway greenhouse effect in the context of Venus

PH1012 Group Discovery Project in some years focuses on a range of renewable energy technologies (powering all of St Andrews on renewables)

PH1011, PH2011: properties of matter and thermal physics has science and problems on the effect of insulation and double glazing on heat flow

PH3012 Thermal and Statistical Physics (S. Lee)

covers the mathematical physics needed to model/calculate various thermal situations

PH4027 Optoelectronics and Nonlinear optics module.

PH4031 Fluids (M. Jardine)

covers material relevant to water or air flow round turbines

PH4040/1: Discusses pros and cons and the underlying physics of nuclear power generation

PH5265 Solar Power