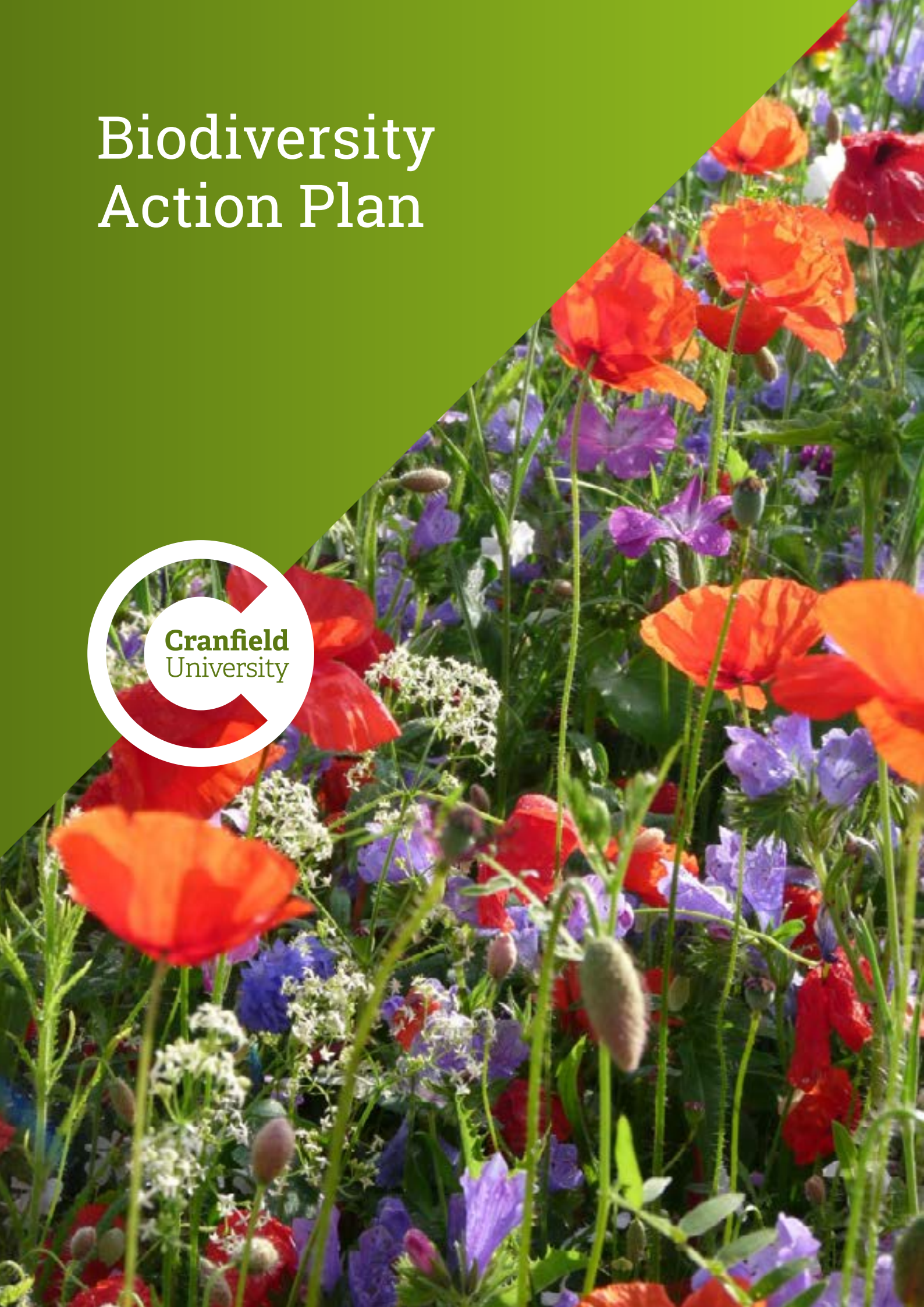
Biodiversity Action Plan

Cranfield University



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Version 1 2016
Biodiversity Working Group

Foreword

By Professor Sir Peter Gregson,
Chief Executive and Vice-Chancellor

Biodiversity is key to the survival of life on Earth. Its loss deprives future generations of irreplaceable natural resources, and compromises sustainability. At Cranfield we are fortunate to be located in a wildlife rich setting, providing opportunities for students, staff and visitors, to enjoy the benefits of experiencing our biodiversity.

As a landowner and a University we have a responsibility to conserve protected species and 'practise what we teach' on our patch. Our Biodiversity Action Plan has been developed over recent years spurred on by Defra's (Department for Environment, Food and Rural Affairs) Biodiversity 2020: a strategy for England's wildlife and eco-system services.
It will help meet our environmental objectives and obligations, and provide an opportunity to acknowledge, conserve and enhance biodiversity as part of Cranfield's future growth plans.

Further to this, our plan opens up the potential for expanding our well respected research and teaching in the 'natural capital and ecosystem services' and moves us nearer to integrating this in a 'campus living laboratory'. We have a wealth of globally recognised expertise on our doorstep, which we should recognise and profit from. This offers the exciting possibility of linking this "natural capital" to the other important capitals – built, human, social and financial.

We have made significant progress but more remains to be done. I am delighted to endorse this action plan, which forms the basis for our ongoing conservation and ecological restoration efforts to improve our environment for all.

Professor Sir Peter Gregson
Chief Executive and Vice Chancellor

Introduction

The UK Biodiversity Partnership and UK government defines biological diversity as *'the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes which they are a part of: this includes the diversity between species and of ecosystems'*. We depend on biodiversity as a life support system, we need it for air, food and water. Biodiversity 2020: A strategy for England's wildlife and ecosystem services aims to halt overall biodiversity loss, support healthy well-functioning ecosystems, and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people.

The University's Cranfield campus is a hot spot for biodiversity due to its rural setting amongst a habitat mosaic of scrubland, woodland, wetland and farmland. The University also has an airfield which needs to be taken into consideration when implementing actions.

Enhancing biodiversity on the campus is a key objective under our IS0 14001 certified Environmental Management System; demonstrating continuous improvement is important in maintaining this standard.

The plan is organised by habitat area, each containing campus wide actions, actions for developing and improving designated 'Biodiversity Action Areas (BAAs)' on campus, and engagement opportunities. Key species have also been identified with recommendations. It is intended that we will be able to focus resources to maximise biodiversity improvements on campus. The plan will be reviewed annually and will inform a schedule of implementation which is a live document and details how we will deliver the action plan.

Benefits

The benefits of protecting and improving biodiversity on campus include:

- Ensuring we are complying with our compliance obligations relating to habitats and species, and maintaining the ISO 14001 standard
- Increasing the amenity value of our campus, providing more visually appealing natural spaces for staff, students and their families, and visitors to enjoy
- Providing a rich resource for research studies
- A more sustainable and ecologically responsible University.

Objectives

This plan has six primary objectives:

1. To identify the species and habitats present on the University campus to inform landscape strategy and as a baseline for future change
2. To identify opportunities to conserve and enhance biodiversity across the campus and increase the area of land for focused action
3. To prioritise actions in line with likely impact, available resources, environmental and other University objectives
4. To help increase the amenity value of our campus by promoting key features, engaging and involving staff and students to foster appreciation and awareness
5. To monitor and measure the benefits of biodiversity improvements, maximizing opportunities for research
6. To inform and be informed by cutting edge research across the University.

Summary of campus wide actions

There are several campus wide actions that need to be taken in order to encourage the conservation, sensitive maintenance and improvement of biodiversity. These are outlined below and further detail is given in the key habitat plans section of this document.

1. **Establish regular monitoring** from a baseline of existing habitat and species information gained through past surveys in order to focus our efforts where they will be most beneficial.

2. **Ensure sensitive grounds maintenance** to maintain and improve biodiversity on campus.

3. **Ensure biodiversity impact and enhancement is considered in new and future developments** (e.g. informing and providing evidence for BREEAM assessments for University building projects and landscape strategy and design).

4. **Engage and involve staff**, students and visitors to the campus.

Summary of engagement opportunities

In the key habitat area plans and more generally, engagement opportunities / actions have been identified to raise awareness. These can be summarised into the categories below.

1. **Encourage staff and students to report wildlife findings:**
   staff and students are encouraged to report their wildlife observations on campus via various channels including social media, the intranet, email and ArcGIS technology which makes it easier for individuals to send a sighting directly.

2. **Improve and develop signage and interpretation boards around campus:**
   located at areas listed as a 'Biodiversity Action Area' and areas of significance.

3. **Organise a programme of events that include:**
   a. lunchtime biodiversity walks – these popular walks are designed to increase awareness of the biodiversity we currently have on campus and give staff/students a break from the office. A programme of themed walks will give further focus and variety.
   b. monitoring and recording events – these include Bioblitz, hedgerow and tree surveys.
   c. seasonal events – potentially including autumn apple day, an event around bees and pollinators, and 'Cranfield Spring Watch.'
   d. practical conservation events on and off campus – we currently work with the Forest of Marston Vale and the Wildlife Trust to attend volunteering events such as tree planting and scrub clearance at nature reserves. Potential events on campus include the creation of further wildflower areas, 'sustainability gardens' and practical woodland tasks.

4. **Communicate the progress of the biodiversity action plan:**
   updates on our action plan will be given via communication channels including Perspectives, the intranet and by email. Results of Bioblitz wildlife recording events are published.

5. **Identify opportunities for student projects as part of the 'Living Lab':**
   the Biodiversity Working Group will work to provide students with an offering of on-site potential project ideas.

Above: A scrub clearance task taking place at 'Totternhoe Knolls' during March 2015

Key habitat plans

The following action plans outline the habitats found in the Phase 1 habitat survey undertaken in 2012. Each habitat plan is divided into campus wide actions to protect/ enhance these habitats, and action areas for more focused attention, research and management. Biodiversity Action Areas (BAAs) are numbered and correspond to the numbers on the map (see Appendix 1). Further detail and recommendations for key species can be found in the next section.

Grassland

Habitat description	The campus has many areas of amenity grassland, from formal areas outside, maintained grassed areas between buildings, sports pitches, and informal open space punctuated by trees. There is also a wide area of grassland on the airfield subject to CAA (Civil Aviation Authority) guidelines.
Campus wide actions	• Review maintenance of amenity grassed areas on technical and residential sites and identify further locations to introduce annual/less frequent mowing regimes to provide habitat for pollinators. • Ensure airfield mowing regime consistent with CAA guidelines. • Reduce use of pesticides/herbicides on non-airfield grassed areas (especially near watercourses). • Bulb planting for spring amenity and for pollinators.
Biodiversity Action Areas	**1 and 6 BESS* plots:** These experimental meadow plots (18 plots altogether) have been sown with a variety of native grasses and flowers. They are part of a major research project into improving biodiversity, cultivating a variety of seed mixes and managing the meadows using different mowing techniques. Researchers from Cranfield, Sheffield and Exeter Universities are monitoring these sites. The results of this research will help inform how to best improve the quality of our urban parks and green spaces for a wide range of species including birds, butterflies, bees and other insects. It is hoped that Cranfield can use the results of the research to enhance biodiversity in our green spaces, and retain the plots once the project has ended.

* For more information on BESS (Biodiversity and Ecosystem Service Sustainability) please go to http://www.nerc-bess.net/

Biodiversity Action Areas	**5, 10, 13, 12 set asides:** Areas of grassland by building 39, rear of Mitchell Hall, building 46, the cycle path and Martell house are set aside for naturally growing flowers and grasses including our county flower, the Bee Orchid. These are left unmown until orchids and wildflowers have flowered and seeded. **7, 8 and 9 Seeded wildflower plots:** These are similar to the BESS plots. These plots have been sown with wildflower and grass seeds. **Proposed 18:** A number of wildflower plots can be planted elsewhere on campus, for example a plot near the 'play area' on the green by Mitchell road could foster involvement of student families.
Engagement opportunities	• Communication boards to give more information. • Biodiversity walks to continue. • Staff and student involvement in surveying and communicating sightings. • Involve local community in creating new wildflower area.

Trees and woodland

Habitat description	The campus benefits from a large variety of specimen trees within grassed areas, a number of mature fruit trees and a small broadleaved ash woodland.
Campus wide actions	• Complete tree survey which inform management plan and landscape strategy. • Review and revise tree replacement policy. • Trees with TPOs (Tree Preservation Orders) are to be protected unless dead or dying. • Orchards are now valued and are offered protection. Heritage fruit trees on the residential site should be protected as some varieties may be very uncommon or rare. • Retain some dead wood and log piles as habitat unless they are a health and safety risk. • Bat surveys to be completed before tree work on trees with potential bat roosts. • Any trees removed to be replaced by similar or native to support wider biodiversity.
Biodiversity Action Areas	2 **Woodland:** This dense broadleaved wood/copse includes a small clearing with scrubland and a footpath which runs from Handley Page Close to the sewage works and along the brook back to Duncan Road. The woodland edges provide suitable habitat for a variety of shrubs, grasses, flowers, birds and invertebrates. Actions to improve the diversity and access include scalloping the edges, layering scrub and creating a new woodland walking path which forms a 'figure of 8' shape.

Biodiversity Action Areas	The woodland would benefit from careful management to increase diversity, including the following tasks: • Selective felling to reduce overcrowding • Species to be favoured, and those to be progressively reduced • Introduction of coppicing to increase structural diversity • Interplanting with climax species, more understorey shrubs and appropriate ground flora. **Proposed 19:** We plan to maintain old fruit trees and foster the growth of new fruit trees along The Drive.
Engagement opportunities	• Involve local community in creating and maintaining woodland path. • Organise an 'Apple Day' in October for resident students. • Fruit tree pruning event with specialist guest. • Improved communication boards and encourage reporting of sightings and surveys.

The woodland edges provide suitable habitat for a variety of shrubs, grasses, flowers, birds and invertebrates.

Hedgerow

Habitat description	Hedgerows are included under the Bedfordshire Biodiversity Action Plan as a priority habitat due to their dramatic loss over the last few decades. A variety of native and non-native hedgerows can be found around the campus. These provide shelter and food for mammals, birds and insects and their connectivity is important to create wildlife corridors through which species can move, connecting one side to the campus to the other.
Campus wide actions	• Enhance existing hedgerows by gapping with native species, leaving some parts to grow naturally, controlled and sympathetic management. Hedges should not be trimmed during nesting season and when berries are ripe.
Biodiversity Action Areas	**11 Hedgerow:** Hedgerow along Technical Site boundary (College Road) acts as an important wildlife corridor. This hedgerow must be maintained and enhanced where possible. **4 Fedden sports field hedgerow and woodland edge:** Improve the presence of fruit bearing species to provide food for nesting birds.
Engagement opportunities	• Work with the local community to complete hedgerow survey of all campus hedgerows. • Organise volunteering events with outside agencies such as the Wildlife Trust to lay and maintain stretches of hedgerow.

Scattered and dense scrub

Habitat description	Cranfield has several areas of land that are undergoing natural succession from grassland to woodland. This 'scrub' habitat is important for a wide variety of species. The area along Merchant Lane and along the permissive boundary footpath has a rich diversity fauna and flora. Farmland birds such as reed buntings, linnets, and migrant species are found here in good numbers, as well as species of butterflies, dragonflies, moths, and common spotted orchids. A wide variety of trees, shrubs and grassland provides suitable habitat for birds of prey such as Tawny owl, Barn owl, and Kestrel. This area is used by many staff and students for lunch time and evening walks and was the main point of focus during Bioblitz surveys 2014 -2015
Campus wide actions	Some of the scrub habitat identified is earmarked for development as part of the Campus Masterplan. Any development will be subject to planning conditions relating to conserving protected species and should take into consideration and mitigate for this diverse habitat. Conservation of areas that are rich and pleasing to walk around is encouraged.
Biodiversity Action Areas	**17 Fallow land:** Land near the test area has been left fallow to develop into long grasses with scrub land and fruit bearing hedgerow. There is strong evidence of mammal life, as well as Mansion bees and nesting birds. Management can take place to maintain this diversity of plant life and stop further succession. Much of the land however, is off limits due to access restrictions.
Engagement opportunities	• Involve local community in sightings and surveys.

Water

Habitat description	The Chicheley Brook runs through the campus and connects to the River Great Ouse in Newport Pagnell which then flows through Bedford. A number of other surface water drainage channels also run through the site, entering the brook, and balancing ponds also feature namely near the sewage treatment works **(Action Area 3)** and near the Nissan tech park **(Action Area 15)**. There is also a water feature outside Martell House although this is ornamental in nature.
Campus wide actions	• Maintain water quality through pollution prevention across site activities. • Ensure stimming of banks is carried out sensitively. Avoid strimming during nesting season.
Biodiversity Action Areas	16 **Brook and drainage ditches:** Currently little management takes place apart from litter picking around the edges. Species reported in the brook include 'Three Spined Stickleback' fish. However this species has appeared to have declined dramatically since 2012. Caddisfly larvae, Water Crickets, and a variety of dragonfly larvae have also been recorded in the brook although low in numbers. There is an opportunity to develop the brook habitat continuing the wildlife corridor from the hedgerow **(Action Area 4 and 11)**. The brook can be enhanced by creating riffles, pools, scalloped banks and shaped bank edges. In addition, oxidation plants can be planted within the brook.

Biodiversity Action Areas	**15 Storm pond:** located near Nissan this is currently overgrown and choked with vegetation. In 2009, a survey confirmed the presence of Great Crested Newts. A 'Habitat Suitability Index' survey was carried out in 2012 as part of the Arbtech Survey and the pond conditions were deemed 'Excellent for Great Crested newts'. If these water sources are left neglected, succession will continue and Great Crested Newts will disappear. The ponds need sensitive remediation to ensure they remain early-mid succession stages and continue to be a habitat for the newts. **3 Lagoon:** The lagoon acts as a flood defence and therefore it needs maintenance. However we need to balance this with the need to minimise open water near to the airfield and to maintain as a feature and wildlife habitat. In order to further increase the habitat value surrounding the storm lagoon, a process of partial scrub clearance could be implemented. This would create a mixture of habitat resources, improving invertebrate density and therefore amphibian and mammal use of the area (Arbtech 2012). Trees and shrubs around the lagoon should be retained but some willows need to be cut back. Dredging activity will require a survey for Great Crested Newts and other species. Bee hives have been installed here so early and late flowering species are to be conserved or introduced to ensure a good supply of forage for the bees.
Engagement opportunities	• Involve local community with bee keeping and planting of bee friendly flowers. • Create communication boards, sightings and surveys.

Ornamental and formal landscaped areas

Habitat description	The campus hosts a variety of ornamental formal landscaped areas mostly between buildings, and along pathways
Campus wide actions	• There is an opportunity to integrate more formal hard and soft landscaping schemes with native species that support biodiversity and human interaction as part of the landscaping strategy. • Grounds maintenance to encourage habitat for invertebrates by for example leaving fallen leaves on planted areas.
Biodiversity Action Areas	There are currently no specific action areas in this category except for wildflower plots 8 and 9 near building 63 and CSA described in grassland section. **Proposal 20:** 'Sustainability Garden' Technical site to champion edible ornamentals and perennials that support biodiversity such as pollinators.
Engagement opportunities	• Involve local community in sightings and surveys.

Buildings

Habitat description	Cranfield has a wide variety of buildings of different types and ages. Some have supported nesting birds such as swifts, and potentially bats.
Campus wide actions	• Installing bird and bat boxes onto new builds will help to achieve BREEAM points (see www.breeam.com). Although special consideration need to be taken for developments adjoining the airfield. **Swift boxes:** The University must consider where on campus they wish to encourage nesting. Swifts reportedly used to use Stafford Cripps roof eaves for nesting. **Bat boxes:** Bat boxes have already been installed in various locations especially near the brook area of the campus. There has been no evidence of occupancy, but we can look for signs for example looking for droppings or using a bat detector. • Maintenance work to buildings needs to consider presence (and continued presence) of birds and bats. Ensure glass in new buildings is 'anti bird strike' as this continues to be an issue as many buildings on campus have large glass panes.
Biodiversity Action Areas	No specific action areas currently.
Engagement opportunities	• Involve local community in sightings and surveys.

Key species

The following are species which are of particular concern or of special interest on campus. This are split into ‘Amphibian and Reptiles’, ‘Bird Species’, ‘Mammal species’ and ‘Plants and insects’. Recommendations for their conservation are included

Amphibians and reptiles

Species spotted on campus	Description of presence and conservation concern	Recommendations
Great Crested Newt ***Triturus cristatus*** 	Species of Great Crested Newts (GCN) have been confirmed in the storm pond near **(Action Area 15)** the Technology Park. No presence is confirmed in Chicheley Brook or the drainage ditches, although they may be present in the balancing lagoon. Great Crested Newts are listed in both Annex IV of the EC Habitats Directive and in Schedule V of the Wildlife and Countryside Act 1981. It is an offence to kill a Great Crested Newt.	According to the Bedfordshire and Luton species Action Plan (May 2008) all ponds that contain GCN population must have protection and enhancement actions in place. In order to further increase the habitat value surrounding the balancing lagoon, a process of partial scrub clearance could be implemented. This would create a mix of resources for many faunal uses, improving invertebrate density and therefore amphibian and mammal use of the area (Arbtech 2012). If development is to occur within 100m of the storm drain **(Action Area 15)**, Great Crested Newt Surveys would be needed.
Common Toad ***Bufo bufo*** 	Common Toads Protected in the UK under the Wildlife and Countryside Act, 1981, and classified as a Priority Species in the UK Biodiversity Action Plan. They commonly breed in larger, deeper pools of water. They have been spotted throughout campus.	To encourage Common Toad: areas of open water on the campus site must be maintained. Logs piles and a hibernaculum can be created near these open water sources, this will help the toad survival while hibernation
Grass Snake ***Natrix Natrix*** (photo: Ken Sargent) 	Grass Snakes have been spotted near the sewage treatment works. Grass Snakes were put onto the 1997 UKBAP list as numbers have declined due to habitat destruction. All native reptiles are legally protected from deliberate killing or injury.	To encourage Grass Snakes; maintain some open water, and provide suitable spots of basking and hibernacula. Log piles, exposed rocks, and tin sheets placed in areas of scrub will help to encourage snakes. (Arbtech Report)

Birds

Species spotted on campus	Description of presence and conservation concern	Recommendations
Farmland bird Species (Yellow Hammer, Skylark, Common Linnet, House Sparrow, Grey Partridge, Starling, Lapwing, Reed Bunting, Common Cuckoo, Common Bullfinch) 	Cranfield Campus is ideal habitat for farmland birds due to open countryside, surrounding farmlands, and mosaics of hedgerow, scrubland and trees. The UK Government has a commitment to reverse the long-term decline in the number of farmland birds. These birds made a steep decline in the mid 1970s and mid 1980s- with some species such as the Grey Partridge and Tree Sparrow declining over 80%. Farmland intensification, removal of hedgerow and draining of wetlands is responsible for the decline of these birds. The species listed are all listed as either 'Red' or 'Amber' status under the RSBP birds of conservation concern list. (Source 1)	The encouragement of farmland birds could be achieved on campus by creating resource rich habitat-for example creating a mosaic of grassland, scrubland and woodland edge where possible. Also by preventing succession of current scrubland on campus. Field corners, beetle banks and blocks or strips of nectar rich/flower rich margin would provide a major boost to the potential populations of these birds (Arbtech report). Plans are underway to expand our current hedgerow on campus, and integrate these with seed rich plants especially along the border of the campus (See section 5). These hedgerows will act as a habitat corridor for birds. Improving diversity of plant species around the brook and lagoon will also help to encourage these species.
Kingfisher ***Alcedines*** 	Kingfishers have been spotted fishing near the lagoon area, and along the brook as far as building 111. They are considered a UK BAP (UK Biodiversity Action Plan) species of conservation concern and are protected under the Wildlife and Countryside Act (Schedule 1). The species has declined since 1975 due to water pollution and poor water quality which reduces prey population. Also hard winters can severely reduce the population.	To attract Kingfishers, Cranfield University must improve the water quality of the brook and encourage more prey species such as fish and invertebrates. In order to do this, the banks and bed for the brook can be profiled. Also, the creation of riffles and bays with deeper sections will also benefit this species. It's critical to monitor the water quality of the brook and prevent the build up of litter.

Species spotted on campus	Description of presence and conservation concern	Recommendations
Spotted Flycatcher *Muscicapa striata* 	Spotted Flycatchers have been spotted nesting on campus near the CSA, in August 2015. This species has declined drastically since the 1990s mainly due to habitat destruction. They are likely to nest in ivy clad buildings on campus. Due to its dramatic decline, this species is now listed under the UK BAP.	Careful management of woodlands, and suitable habitat around the campus can help to encourage this species back to breed. Recommendations include restructuring woodlands with unbroken canopy cover to increase the amount of ride-edge and glade habitat. Ivy clad trees must be preserved as these make good nesting habitats. Where natural nest sites are lacking, open fronted nest boxes should be provided. **(Source 2)**
Barn Owl *Muscicapa striata* 	Barn Owls have suffered decline in the 20th century largely due to use of pesticides. Barn Owls pellets have been found around the airfield scrubland area and in **Action Area 17** (see habitat map). This habitat is ideal due to the mosaic of grassland and scrubland which provides habitat for prey animals such as small mammals and occasional birds voles, and mice. Evidence of Tawny and Little Owls have also been found.	This species will benefit from the creation and maintenance of wildlife corridors. Providing a nest box may also be beneficial in selected areas. Large birds on the airfield need close monitoring and if necessary, measures taken to discourage them and encourage suitable habitats in other areas of the campus. **(Source 3)**
Red Kite *Milvus milvus* 	This graceful bird was saved from national extinction, and only survived to present day due to reintroductions throughout England. These are now regularly spotted gliding over the scrubland area near Merchant lane, and over nearby farmland.	This species will benefit from the creation of wildlife corridors. Large birds on the airfield need close monitoring and if necessary measures taken to discourage them and encourage suitable habitats in other areas of the campus.

Species spotted on campus	Description of presence and conservation concern	Recommendations
Swifts *Apodidae* 	Swifts used to be abundant on campus with many nests reported in Stafford Crips roof. However, numbers have dwindled after building roof work left no nesting space on swifts. They are sometimes seen flying overhead on campus, they are distinguishable by their unique dashing flight and calls.	Install discreet 'Swift bricks' which are concrete nest boxes which are designed to look and act like bricks. These should be placed on strategic places on campus.

Sources:
1 https://www.rspb.org.uk/forprofessionals/farming/whyfarming/whyfarming/fbi/
2 http://www.forestry.gov.uk/pdf/spotted-flycatcher.pdf/$FILE/spotted-flycatcher.pdf
3 http://www.barnowltrust.org.uk/barn-owl-facts/encourage-wild-barn-owls/

Mammals

Species name	Description of presence and conservation concern	Recommendations
Bats Pipistrellus *pygmaeus, Nyctalus noctula, Pipistrellus pipistrellus* 	Three species of bat have been recorded on and near campus with bat detection equipment and observations. They have also been discovered in some of the older buildings on campus including building 41 (Stafford Cripps), 50, 42 and 39. These were also recorded during the Bioblitz 2014 using bat detectors. Please see Appendix figure for details. All species of bat in the UK are fully protected under the Wildlife and Countryside Act 1981 and are part of the UK Biodiversity Action Plan. Ignorance of bat presence is no defence under the law. All sites must be investigated if work is to be carried out i.e. buildings – roofs, confined spaces, airbricks etc. and felling of trees.	Before refurbishment or demolition work takes place in any one of the older, clay tiled buildings on campus, a bat survey needs to take place to determine if the building is being used by bats. Bat boxes have been erected on trees away from night time lights, and near the brook. Cranfield could encourage bats by improving aquatic habitats to help support population of aquatic insects which bats feed on. Also, careful management of the woodland to create open glades with scrubland will help to encourage flying insects and flight pathways for bats. (Arbtech 2012)
Brown Hares *Lepus europaeus* 	Brown Hares are classified as a priority species in the UK Biodiversity Action Plan. Formally abundant, hares have suffered population decline. They have been spotted on campus near the airfield, scrubland and nearby farmlands.	Due to health and safety concerns, hares, or any other large bird or mammal cannot be encouraged on the airfield area of campus. To reduce the risk of small aircrafts colliding with wildlife, control measures will need to take place if number of hares on the airfield exceeds a certain limit. Wildlife control on the airfield is explored in a separate report (See guidance and further reading section.)

Plants and insects

Species name	Description of presence and conservation concern	Recommendations
Bee Orchid ***Ophrys apifera*** 	Bee Orchids are known as the 'County Flower of Bedfordshire' grow sporadically on campus in improvised soil. Although these are not a rare species, we have chosen to set aside areas of improvised soil on campus which Bee Orchids are known to grow on.	During the months of March-August, areas where Bee Orchids are known to grow must be left unmown. Mowing inhibits the growth of the Bee Orchid.
Common Spotted Orchid ***Dactylorhiza fuchsia*** 	Common Spotted Orchids have been discovered on campus near Martell House by the pond, Mitchell Hall orchid conservation areas and scrub area up near Merchant Lane. These and other locations have been identified and recorded with GPS.	Mowing must be controlled in these areas of conservation concern to let the flowers grow and subsequently seed.
Bees 	9 species of Bees have been recorded on campus during the Bioblitz event. Bees are a very important species which are vital to pollinate our crops and wildflowers. Sadly, the bee population in the UK has declined dramatically over the last 80 years, with two species becoming extinct.	By maintaining wildflower plots, and planting pollinator friendly plants on campus this will help bees to thrive.

Appendices

Appendix 1

Habitat Map showing Biodiversity Action Areas

The map below illustrates habitats on campus and indicates the location of 'Biodiversity Action Areas' which are given a number. The 'proposed' Biodiversity Action Areas appear as a lilac colour.

Legend

- Hedgerow
- Amenity Grassland

Habitats

- Broadleaved Woodland
- Dense Scrub
- Farmland
- Marshy Grassland
- Neutral Grassland
- Open Water
- Scattered Scrub
- Scattered Woodland

Appendix 1 (Continued)

Date established	Biodiversity Action Area	M^2	Area Description
2012	1	750	BESS plot bank rear of Closes
2016	2	250	Proposed new woodland path
2016	3	N/A	Seasonal Lagoon by sewage treatment works
2016	4	160	Hedgerow by Fedden sports field
2011	5	90	Rear of Mitchell Hall - area set aside for Bee Orchids
2013	6	20	BESS plots by building 39
2013	7	280	Rear of building 39 - area set aside for Bee Orchids and wildflowers
2014	8	60	Building 63 Sown wildflower plot
2014	9	70	Cranfield Students Association (CSA) Sown wildflower plot
2014	10	100	Long grass set aside adjacent to building 43
2014	11	200	Hedgerow along College Road
2012	12	240	Building 46 Cycleway - area set aside to provide wildlife corridor B
2014	13	200	Martell Cycle way - vegetation allowed to grow to provide wildlife corridor.
2012	14	240	Martell House set aside for Bee Orchids and wildflowers
2015	15	2800	Technical site balancing pond with confirmed species of Great Crested newts
2014	16	2500	Chicheley Brook The drainage ditch also connects into the book. Heley Brook connects to River Ouse in Newport Pagnell. The drainage ditch also connects into the book. Pagnell. The drainage ditch also connects into the book.
2015	17	4800	Fallow land adjacent to Test Area
2017	18	100	Wildflower plot
2015	19	200	Old and new fruit trees planted around The Drive
2017	20	300	Sustainability Garden

The table above gives a description of the 'Biodiversity Action Areas' both existing and proposed. This includes the areas of the BAA appearing as square metres. Please note these are updated each year.

Appendix 2

Further information and guidance documents

Phase 1 Habitat Survey

In 2013, a Phrase 1 Survey was completed by Arbtech consultancy. This acts as a rough outline of habitats on campus and its biodiversity potential particularly for protected species.

Greater Crested Newt Survey (2009)

The report was written by Landscape planning Ltd in May 2009, this details the result of field surveys taken for ponds around the Nissan and Traffic Master area and judged the suitability for amphibians particularly Great Crested Newts. This report confirmed the presence of great crested newts at the storm pond by Nissan.

Bioblitz Survey 2014 – full report and appendices can be found on the University's Intranet here

Summary Results of the Bioblitz 2014 survey

A full account of the species seen is given in the files that make up the Bioblitz Report Appendices.

There were two new species recorded for the administrative county of Bedfordshire. These were the weevils Eutrichapion punctigerum and Hypera meles. See Appendix 10 of the report for more information.

The lichen Caloplaca albolutescens was confirmed for Bedfordshire for the first time: earlier records have not been fully satisfactory. See Appendix 3 and Appendix 17 of the report.

A second for Bedfordshire was the spider Achaearanaea riparia. See Appendix 15 of the report.

Amongst some 170 species of flora recorded, two species were particularly noteworthy at the county level, Rough Hawk's-beard Crepis biennis and Flixweed Descurainia sophia. Some dozen other species were also highlighted as being of note. See Appendix 2 of the report.

The micro moth Luquetia lobella was recorded, this being for the first time in Vice County 30 away from the long-running light trap at Cockayne Hatley in the far east of Bedfordshire. Another moth, the Double Dart Graphiphora augur, was recorded for the first time in Bedfordshire for 11 years.

Wildlife Hazards to Aviation at Cranfield Airport Report (2014)

Cranfield University is unique for having its own airport. Wildlife on the airfield has to be managed in a particular way in order to minimise the risk of strikes to birds and mammals. Refer to this document when exploring grounds management/ maintenance for the airfield.

Orchards are now valued and are offered protection. Guidance on wildlife and management can be found at the following link : http://ptes.org/wp-content/uploads/2014/06/orchard-guide-edition2.pdf

Appendix 3

Species recorded or reported on campus. Records from 'Bioblitz 2014' (recorded by the Bedfordshire Natural History Society) and observations over several years which have been validated by experienced staff. Please refer to the Bioblitz report appendices for further species lists.

Bird species

Some birds have been observed on passage and don't usually breed in this area.

Name (in alphabetical order)	Latin name	Status on and around Campus grounds only	Conservation importance (Green, Amber, Red)*
Barn Owl	*Tyto alba*	Uncommon resident (B off campus)	Green
Blackbird	*Turdus merula*	Abundant resident (B)and winter migrant	Green
Blackcap	*Sylvia atricapilla*	Common summer visitor (B), scarce winter visitor	Green
Blue Tit	*Cyanistes caeruleus*	Abundant resident (B)	Green
Bullfinch	*Pyrrhula pyrrhula*	Uncommon resident (PB)	Amber
Buzzard	*Buteo Buteo*	Uncommon resident (B off campus)	Green
Canada Goose feral	*Branta canadensis*	Uncommon (NB)	No Status
Carrion Crow	*Corvus corone*	Common resident (B)	Green
Chaffinch	*Fringilla coelebs*	Common resident (B)	Green
Chiffchaff	*Phylloscopus collybita*	Common summer visitor (B), scarce winter visitor	Green
Collared Dove	*Sreptopelia decaocto*	Common resident (B)	Green
Common Tern	*Sterna hirundo*	Summer visitor (NB)	Amber
Cuckoo	*Cuculus canorus*	Rare summer visitor (PB)	Red
Curlew	*Numenius arquata*	Rare passage migrant (NB)	Amber
Dunnock	*Prunella modularis*	Common resident (B)	Amber
Fieldfare	*Turdus pilaris*	Winter visitor (NB)	Red

Garden Warbler	*Sylvia borin*	Summer visitor (B)	Green
Golden Plover	*Pluvialis apricaria*	Uncommon winter visitor (NB)	Green
Goldcrest	*Regulus regulus*	Uncommon resident (B) & winter visitor	Green
Goldfinch	*Caduelis carduelis*	Common resident (B)	Green
Great Tit	*Parus major*	Common resident (B)	Green
Green Wood-pecker	*Picus viridis*	Uncommon resident (B)	Amber
Greenfinch	*Chloris chloris*	Common resident (B) and winter migrant	Green
Grey Heron	*Ardea cinerea*	Uncommon resident (NB)	Green
Grey Partridge	*Perdix perdix*	Uncommon resident (PB)	Red
Grey Wagtail	*Motacilla cinerea*	Uncommon resident (B)	Red
Greylag Goose feral	*Anser Anser*	Uncommon (NB)	Amber
Hobby	*Falco subbuteo*	Rare summer visitor (NB)	Green
House Martin	*Delichon urbica*	Uncommon summer visitor (B)	Amber
House Sparrow	*Passer domesticus*	Common Resident (B)	Red
Jackdaw	*Corvus monedula*	Common Resident (B)	Green
Kestrel	*Falco tinnunculus*	Uncommon resident (PB off campus)	Amber
Kingfisher (Schedule 1	*Alcedo atthis*	Uncommon resident (PB off campus)	Amber
Lapwing	*Vanellus Vanellu*	Uncommon resident (PB off campus)	Red
Lesser White-throat	*Sylvia curruca*	Common summer visitor (B)	Green
Linnet	*Carduelis cannabina*	Common Resident (B)	Red
Little Egret	*Egretta garzetta*	Rare and uncommon visitor (NB)	Green
Little Owl	*Athene noctua*	Uncommon resident (PB)	No Status
Long-tailed Tit	*Aegithalos caudatus*	Common Resident (B)	Green
Magpie	*Pica pica*	Common Resident (B)	Green
Mallard	*Anas platyrhynchos*	Uncommon Resident (B)	Amber
Marsh Harrier	*Circus aeruginosus*	Rare winter passage (NB) however a pair may be breeding nearby	Amber
Marsh Tit	*Poecile palustris*	Rare winter passage (NB)	Red

Meadow Pipit	*Anthus pratensis*	Winter visitor uncommon summer visitor (NB)	Amber
Merlin	*Falco columbarius*	Rare winter passage (NB)	Red
Mistle Thrush	*Turdus viscivorus*	Uncommon resident (B)	Red
Moorhen	*Gallinula chloropus*	Uncommon resident (B)	Green
Nuthatch	*Sitta europaea*	Rare visitor uncommon (NB)	Green
Pheasant	*Phasianus colchicus*	Common Resident (B)	No Status
Pied Wagtail	*Motacilla alba*	Common Resident (B)	Green
Raven	*Corvus corax*	Rare uncommon resident (NB)	Green
Red Kite	*Milvus milvus*	Uncommon resident (PB off campus)	Amber
Redwing	*Turdus iliacus*	Winter visitor (NB)	Red
Red-Legged Partridge	*Alectoris rufa*	Uncommon resident (PB)	No Status
Redstart	*Phoenicurus phoenicurus*	Rare summer passage (NB)	Amber
Reed Bunting	*Emberiza schoeniclus*	Uncommon resident (PB)	Amber
Robin	*Erithacus rubecula*	Common resident (B)	Green
Rook	*Corvus frugilegus*	Common resident (B)	Green
Sand Martin	*Riparia riparia*	Summer visitor (NB)	Green
Sedge Warbler	*Acrocephalus schoenobaenus*	Uncommon summer visitor (NB)	Green
Siskin	*Carduelis spinus*	Uncommon winter visitor (NB)	Green
Skylark	*Alauda arvensis*	Uncommon resident (B)	Red
Song Thrush	*Turdus philomelos*	Uncommon resident (B)	Red
Spotted Flycatcher	*Muscicapa striata*	Rare uncommon summer visitor (PB has in past B)	Red
Starling	*Sturnus vulgaris*	Common resident (B)	Red
Stock Dove	*Columba oenas*	Uncommon resident (B)	Amber
Stonechat	*Saxicola torquata*	Uncommon winter visitor (NB)	Green
Swallow	*Hirundo rustica*	Common summer visitor (B)	Amber
Swift	*Apus apus*	Uncommon summer visitor (PB has in past B)	Amber

Tawny Owl	*Strix aluco*	Uncommon resident (PB) has in past B)	Green
Treecreeper	*Certhia familiaris*	Uncommon resident (B)	Green
Whitethroat	*Sylvia communis*	Common summer visitor (B)	Amber
Willow Warbler	*Phylloscopus trochilus*	Common summer visitor (B)	Amber
Wood Pigeon	*Columba palumbus*	Common resident (B)	Green
Wood Warbler	*Phylloscopus sibilatrix*	Rare summer passage (NB)	Red
Wren	*Troglodytes troglodytes*	Common resident (B)	Green
Yellowhammer	*Emberiza citrinella*	Uncommon resident (B off campus)	Red

Status on and around Campus (breeding (B), non-breeding (NB), possibly breeding (PB), passage (P), resident (R), Winter (W) or Summer (S) visitor)

RSPB Birds of Conservation species concern:	Species that meet the following criteria:
Red list criteria	IUCN Global Conservation Status listed species- globally threatened bird species HD Historical decline- Species that have suffered a severe decline between 1800 and 1995 without substantial recovery BDP breeding population decline, species that have suffered severe decline in UK breeding population size of more than 50%.
The Amber list Criteria	SPEC Species of European Conservation status HDrec species of historical decline but with substantial recent recovery over the last 25 years WDMp non breeding population decline BDMR breeding range decline less than 25%
The Green list criteria	All regulary occurring species that do not qualify under red or amber criteria

Key:*
For a complete list of criteria listed species please go to:
http://www.rspb.org.uk/Images/BoCC_tcm9-217852.pdf

Mammals

Common name (in alphabetical order)	Latin name	Conservation Importance
Badger	*Meles meles*	Protected
Bank Vole	*Myodes glareolus*	See Bioblitz report
Brown Hare	*Lepus europaeus*	UK BAP
Chinese Water Deer	*Hydropotes inermis*	None
Common Pipistrelle	*Pipistrellus pipistrellus*	UK BAP
Common Shew	*Sorex araneus*	See Bioblitz report
Field Vole	*Microtus agrestis*	See Bioblitz report
Fox	*Vulpes vulpes*	None
Grey Squirrel	*Sciurus carolinensis*	None
Muntjac Deer	*Muntiacus reevesi*	None
Noctule	*Nyctalus noctula*	UK BAP
Rabbit	*Oryctolagus cuniculus*	None
Soprano Pipistrelle	*Pipistrellus pygmaeus*	UK BAP
Water Shrew	*Neomys fodiens*	Protected under UK Wildlife and Countryside Act 1981
Wood Mouse	*Apodemus sylvaticus*	See bioblitz report

Key:*
UK BAP (UK Biodiversity Action Plan) go to http://jncc.defra.gov.uk/page-5155 for more information.

Amphibians and Reptiles

Common Name (in alphabetical order)	Latin Name	Conservation Importance
Great Crested Newts	*Triturus cristatus*	UK BAP
Common Toad	*Bufo Bufo*	UK BAP
Grass Snakes	*Natrix Natrix*	UK BAP

UK BAP: this indicates that a species is classified as a Priority species under the UK Biodiversity Action Plan. Action plans are created for the UKs most threatened species to aid recovery. For more information visit the 'Join Nature Conservation Committee' on http://jncc.defra.gov.uk/ukbap

Notable Invertebrates:

Below is a list of invertebrate species of significance. These were recorded during the Bioblitz 2014. Some invertebrates were listed as a new record for the county.

Family	Common Name	Latin name	Notes
Apionidae (Weevil)	n/a	*Eutrichapion punctigerum*	New record for Bedfordshire
Curculionidae	Clover Head Weevil	*Hypera meles*	New record for Bedfordshire
Noctuidae (Moth)	Double Dart	*Graphiphora augur*	Recorded in Bedfordshire for first time in 11 years
Oecophoridae (Moth)	N/A	*Luquetia lobella*	New record for Bedfordshire
Theridiidae (Spider)		*Achaearanaea riparia*	Second recording in Bedfordshire

Notable Ground flora and lichens:

Below is a list of plant species of significance. These were recorded during the Bioblitz 2014. Some plant species were listed as a new record for the county.

Family	Common Name	Latin name	Notes
Apiaceae	Greater Burnet-saxifrage	*Pimpinella major*	
Brassicaceae	Flixweed	*Descurainia sophia*	Rare agricultural weed
Compositae	Rough Hawk's-beard	*Crepis biennis*	Rare in Bedfordshire
Crassulaceae	White Stonecrop	*Sedum album*	
Euphorbiaceae	Dwarf Spurge	*Euphorbia exigua*	
Orchidaceae	Bee Orchid	*Ophrys apifera*	County Flower of Bedfordshire
Orchidaceae	Common Spotted-orchid	*Dactylorhiza fuchsii*	First time spotted on campus
Rubiaceae	Field Madder	*Sherardia arvensis*	
Teloschistaceae (Lichen)	n/a	*Caloplaca albolutescens*	Confirmed record for Bedfordshire

Common Spotted Orchid (Dactylorhiza fuchsii)

Bee Orchid (Ophrys apifera)

Wild Carrot (Daucus carota)

Trees and shrubs

Below is a list (not exhaustive and some species will require specialist confirmation) of some notable trees and shrub species found on Cranfield Campus grounds. These were recorded by experienced staff.

Common Name	Latin Name
Apple	*Malus*
Aspen	*Populus tremula*
Black Italian Poplar	*Populus x Canadensis*
Black Mulberry	*Morus nigra*
Blackthorn	*Prunus spinosa*
Buddleia	*Buddleja davidii*
Bullace	i*nsititia*
Cappadocian Maple	*Acer cappadocicum*
Cherry Plum	*Prunus cerasifera*
Cockspur thorn	*Crataegus prunifolia*
Common Ash	*Fraxinus excelsior*
Common Beech	*Fagus sylvatica*
Common Elder	*Sambucus nigra*
Common Hawthorn	*Crataegus monogyna*
Common Hazel	*Corylus avellana*
Common Hornbeam	*Capinus betulus*
Common Horse-chestnut	*Aesculus hippocastanum*
Common Lime	*Tilia x europaea*
Common Walnut	*Juglans regia*
Common Whitebeam	*Sorbus aria*
Common Yew	*Taxus baccata*
Copper Beech	*Fagus sylvatica 'Purpurea'*
Corkscrew Willow	*Salix babylonica*
Cotoneaster	*Cotoneaster lacteus*
Damson	*Prunus domestica*
Dogwood	*Cornus sanguinea*
English Elm	*Ulmus minor var. vulgaris*
False Acacia	*Robinia pseudoacacia*
Field maple	*Acer campestre*
Garden Privet	*Ligustrum ovalifolium*
Goat Willow	*Salix caprea*
Golden Chain tree	*Laburnum*
Gorse	*Ulex europaeus*

Common Name	Latin Name
Grey Alder	*Alnus incana*
Grey Poplar	*Populus x canescens*
Grey Willow	*Salix cinerea*
Guelder rose	*Viburnum opulus*
Himalayan Birch	*Betula utilis*
Holly	*Ilex aquifolium*
Italian Alder	*Alnus cordata*
Laurel	*Prunus lusitanica*
Lombardy Poplar	*Populus Italica*
London Plane	*Platanus x hispanica*
Narrow-leaved Ash	*Fraxinus augustifolia*
Norway Maple	*Acer platanoides*
Pedunculate Oak	*Quercus robur*
Red Horse-chestnut	*Aesculus x carnea*
Red oak	*Quercus rubra*
Rowan	*Sorbus aucuparia*
Sessile Oak	*Quercus petraea*
Silver Birch	*Betula pendula*
Silver Birch cultivar	*Betula pendula 'Birkalensis'*
Silver Lime	*Tilia tomentosa*
Silver Maple	*Acer saccharinum*
Snakebark Maple spp	*Acer capillipes*
Snow Berry	*Symphoricarpos albus*
Spindle	*Euonymus europaeus*
Stag's horn sumach	*Rhus typhina*
Swedish Whitebeam	*Sorbus intermedia*
Sweet Chestnut	*Castanea sativa*
Sweet gum	*Liquidambar styraciflua*
Sycamore	*Acer pseudoplatanus*
Tibetan cherry	*Prunus serrula*
Tree of Heaven	*Ailanthus altissima*
Tulip tree	*Liriodendron tulipifera*
Turkey oak	*Quercus cerris*
Wayfaring	*Viburnum lantana*
Weeping Willow	*Salix babylonica*
Western Balsam	*Populus trichocarpa*
White Popular	*Populus alba*
Wild Pear	*Pyrus pyraster*
Willow-leaved Pear	*Pyrus salicifolia*
Yellow Buckeye	*Aesculus flava*

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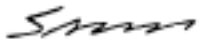
Signature	
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