

Annex 1

The ACRE Post Market Environmental Monitoring Subgroup

ACRE convenes subgroups as required to examine and report on specific issues. PMEM falls within ACRE's remit and was the focus of an earlier ACRE subgroup¹, which preceded the 2006 EFSA guidance, in which the concepts of PMEM were further developed. Following recommendations from the previous subgroup, Defra commissioned a study on options for General Surveillance in the UK².

The current PMEM expert working group was convened in March 2011 aim to build on the outputs of the earlier subgroup and to update and clarify recommendations taking the 2011 EFSA guidance³ into account. The 2011 expert working group had a core membership of experts in biodiversity and conservation, environmental science and monitoring and in farming, and was comprised of ACRE members and external experts. Invited expert speakers, including representatives from existing UK ESNs and other Member States attended working group meetings. The working group met on five occasions during 2011. Further details can be found on the ACRE website⁴.

The full terms of reference of the group are also provided on the ACRE website⁵. The group specifically considered PMEM for GM crops which could be cultivated in the UK and not the requirements for crops authorised only for import and processing. All aspects of PMEM were discussed, but particular focus was given to General Surveillance and the use of existing ESNs.

The working group acknowledged the possibility that differences in national biodiversity protection goals could mean that specific recommendations would be needed for different parts of the UK. Initially the group's remit was restricted to England, but the general recommendations made in the report would also be relevant for decision makers in Scotland, Wales and Northern Ireland.

¹ ACRE (2004) Advice on managing data from the post-market monitoring of GM crops http://webarchive.nationalarchives.gov.uk/20080727101330/http://www.defra.gov.uk/environment/acre/advice/pdf/acre_advice58.pdf

² Hugo S., Boatman N., Pietravalle S., Murray A., Blackburn J., Wardman O. (2006) Availability and use of general surveillance information for potential changes resulting from GM crop cultivation. Defra final report CB02042 <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=13333&FromSearch=Y&Publisher=1&SearchText=general%20surveillance&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

³ EFSA Panel on Genetically Modified Organisms (GMO). Guidance on the Post-Market Environmental Monitoring (PMEM) of genetically modified plants. EFSA Journal 2011;9(8):2316 <http://www.efsa.europa.eu/en/efsajournal/doc/2316.pdf>

⁴ PMEM subgroup meeting minutes <http://www.defra.gov.uk/acre/sub-groups/env-monitoring/>

⁵ PMEM subgroup terms of reference <http://www.defra.gov.uk/acre/sub-groups/env-monitoring/>

Annex 2

Recent initiatives from the European Commission to strengthen Post Market Environmental Monitoring of GM crops

In 2008 the European Council adopted a set of conclusions on genetically modified organisms⁶. This included conclusions on strengthening post market monitoring. The importance of monitoring at the national level was emphasised. Member States were invited to consider developing and conducting their own monitoring activities and to consider their role in consolidating information collected through monitoring activities. Recent initiatives from the European Commission address these conclusions.

For example, following the 2008 Conclusions, EFSA was mandated to assess monitoring reports and to also update its guidance on the PMEM of GM plants. The revised guidance was published in 2011⁷.

In March 2012, the European Commission organised a public hearing on GM crops, which provided an update on progress with addressing the Council conclusions. Future plans for strengthening PMEM were also presented, in particular for making use of ESNs for General Surveillance⁸.

⁶ Council Conclusions on Genetically Modified Organisms (GMOs)
http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressdata/en/envir/104509.pdf

⁷ EFSA Panel on Genetically Modified Organisms (GMO). Guidance on the Post-Market Environmental Monitoring (PMEM) of genetically modified plants. EFSA Journal 2011;9(8):2316 <http://www.efsa.europa.eu/en/efsajournal/doc/2316.pdf>

⁸ Environmental monitoring of GM crops: 2012 public hearing organised by the European Commission.
http://ec.europa.eu/food/food/biotechnology/docs/agenda_29032012_en.pdf

Annex 3

The European Food Safety Authority and guidance accompanying Directive 2001/18/EC

The European Food Safety Authority (EFSA) was established in 2002⁹ to provide independent scientific risk assessment of food and feed safety. It produces guidance to accompany Regulation (EC) No. 1829/2003 on the risk assessment of GM plants for food and feed safety. It also produces guidance to accompany Directive 2001/18/EC on the environmental risk assessment¹⁰ and post market environmental monitoring¹¹ of GM plants.

In addition to the legislative requirements, the design of PMEM is informed by EFSA's guidance. In August 2011, EFSA published revised guidance on the PMEM of GM plants⁶. The 2011 guidance has been revised substantially relative to the 2006¹² version and as a result many applications currently within the regulatory pipeline do not describe a strategy for implementing PMEM which fully corresponds to the new EFSA guidance.

This report does not aim to duplicate the work of EFSA or re-analyse the guidance. The report considers EFSA's guidance in the context of receiving environments in the UK and availability of existing ESNs. It aims to provide a first step towards bridging the gap between the guidance and practical implementation of PMEM and to provide a scientific basis to support discussions between applicants and regulators.

The EFSA guidance recognises the need for consultation between applicants and national authorities in defining PMEM. It implies that detailed arrangements may not be agreed at the point the application is submitted. At the point of authorisation the requirements for PMEM are specified in the consent, but it is possible that further details may need to be agreed with national regulatory authorities following authorisation. In the UK, ACRE would be consulted to provide scientific advice on the suitability of proposals for monitoring. The EFSA guidance also highlights the ongoing requirement to review and adapt PMEM, based on the results obtained, to ensure that monitoring is fit for purpose.

The EFSA guidance provides further details as to how CSM and GS should be implemented. It provides an indication of how to make decisions about whether CSM is needed. CSM may be necessary if there are uncertainties identified in the ERA that are critical. Uncertainty is described as arising due to limitations in the availability of data to inform the ERA, the range of receiving environments, the diversity of production and management systems across the EU or the efficacy of any management measures put in place to mitigate the risk. A critical uncertainty is described as *an uncertainty that, once resolved, may result in the conclusion that an effect is likely to cause environmental harm*. EFSA advises that if uncertainty could affect the overall conclusion of the ERA then CSM would be required.

The EFSA guidance recommends that GS should make use of three different approaches: a Farm Questionnaire (FQ), the use of existing Environmental Surveillance Networks (ESNs) and a literature review. The ACRE subgroup endorses this approach and has based its discussions on the assumption that GS will take this form.

⁹ European Food Safety Authority, remit: <http://www.efsa.europa.eu/en/aboutefsa.htm>

¹⁰ EFSA Panel on Genetically Modified Organisms (GMO). Guidance on the environmental risk assessment of genetically modified plants. EFSA journal 2010;8(11):1879 <http://www.efsa.europa.eu/en/efsajournal/pub/1879.htm>

¹¹ EFSA Panel on Genetically Modified Organisms (GMO). Guidance on the Post-Market Environmental Monitoring (PMEM) of genetically modified plants. EFSA Journal 2011;9(8):2316 <http://www.efsa.europa.eu/en/efsajournal/doc/2316.pdf>

¹² EFSA Panel on Genetically Modified Organisms (GMO). Guidance document of the scientific panel on genetically modified organisms for the risk assessment of genetically modified plants for food and feed. The EFSA journal 2006 99: 1-100 <http://www.efsa.europa.eu/en/efsajournal/pub/99.htm>

Annex 4

Monitoring of MON810 insect resistant maize and Amflora starch potato

MON810 insect resistant maize

MON810 maize was approved for EU cultivation in 1998 under Directive 90/220/EEC, which preceded Directive 2001/18/EC, and did not require General Surveillance. The Decision authorising cultivation requires monitoring for the development of resistance in the insect pest, the corn borer.

In 2011 MON810 was cultivated on 114,508 hectares across six Member States¹³. The results of monitoring for the development of resistance in corn borers have been reported to the European Commission annually. As yet there is no indication of resistance developing. In addition Monsanto, the consent holder, currently reports results of GS using a farm questionnaire and a literature review. No adverse environmental impacts have been detected through the monitoring undertaken. EFSA has published opinions on the most recent MON810 PMEM reports^{14 15}.

Decisions authorising the cultivation of GM crops are only valid for 10 years. In 2007 Monsanto therefore submitted an application for renewal of authorisation for MON810. This application proposes continued monitoring for resistance of the insect pest, although Monsanto do not class this as being CSM. The GS plan includes; a farm questionnaire, literature reviews, company stewardship activities and the use of existing ESNs. The details of how ESNs will be used are not specified in the application.

In their assessment of this application EFSA recommend¹⁶:

- CSM for the development of resistance in the corn borer and other *Lepidopteran* pests.
- Management measures e.g. refuge areas planted with non GM maize to minimise exposure to non-target *Lepidoptera* in field margins

A Decision on the application for renewal of authorisation remains pending. In the meantime the conditions of the previous consent remain valid and MON810 maize continues to be cultivated.

Amflora starch potato

Amflora starch potato was approved for cultivation in the EU in 2010 and cultivated on 253 hectares in three Member States in the same year. In 2011 Amflora was cultivated on 20ha in two Member States

The consent requires CSM for the first 5 years for stability of the GMO. A study of the effects on potato feeding organisms is also required. GS includes: a farm questionnaire, observations by national seed certification authorities and inspection bodies and a literature review.

The 2010¹⁷ and 2011¹⁸ PMEM reports have been published and EFSA has published opinions on these reports^{19 20}. No adverse environmental impacts have been detected through the monitoring undertaken.

¹³ Monsanto Europe S.A. Annual monitoring report on the cultivation of MON810 in 2011

http://ec.europa.eu/food/plant/gmo/reports_studies/docs/report_2012_mon_810_en.pdf

¹⁴ EFSA Panel on Genetically Modified Organisms. Scientific Opinion on the annual Post-Market Environmental Monitoring (PMEM) report from Monsanto Europe S.A. on the cultivation of genetically modified maize MON 810 in 2010. EFSA Journal 2012;10(4):2610 <http://www.efsa.europa.eu/en/efsajournal/doc/2610.pdf>

¹⁵ EFSA Panel on Genetically Modified Organisms. Scientific Opinion on the annual Post-Market Environmental Monitoring (PMEM) report from Monsanto Europe S.A. on the cultivation of genetically modified maize MON810 in 2009. EFSA Journal 2011;9(10):2376. <http://www.efsa.europa.eu/en/efsajournal/doc/2376.pdf>

¹⁶ EFSA Panel on Genetically Modified Organisms. The EFSA Journal (2009) 1149, 1-85. <http://www.efsa.europa.eu/de/scdocs/doc/1149.pdf>

¹⁷ BASF Plant Science Company GmbH. Post-market monitoring report. For the Cultivation of Amylopectin Potato EH92-527-1 Variety Amflora in 2010 http://ec.europa.eu/food/food/biotechnology/docs/post_market_monitoring_report_en.pdf

¹⁸ BASF Plant Science Company GmbH. Post-market monitoring report. For the Cultivation of Amylopectin Potato EH92-527-1 Variety Amflora in 2010 http://ec.europa.eu/food/food/biotechnology/docs/post_market_monitoring_report_2011_en.pdf

¹⁹ EFSA Panel on Genetically Modified Organisms. Scientific Opinion on the annual Post-Market Environmental Monitoring (PMEM) report from BASF Plant Science Company GmbH on the cultivation of genetically modified potato EH92-527-1 in 2010. EFSA Journal 2012;10(2):2558. <http://www.efsa.europa.eu/en/efsajournal/doc/2558.pdf>

²⁰ EFSA Panel on Genetically Modified Organisms (GMO). Scientific Opinion on the annual Post-Market Environmental Monitoring (PMEM) report from BASF Plant Science Company GmbH on the cultivation of genetically modified potato EH92-527-1 in 2011. EFSA Journal 2012;10(12):3015. <http://www.efsa.europa.eu/en/efsajournal/doc/3015.pdf>

Annex 5

Using legislative and other commitments to identify assessment endpoints: Biodiversity as a case-study

Protection goals and EU legislation

Directive 2001/18/EC does not refer to protection goals, assessment endpoints or measurement endpoints. The EFSA guidance on the PMEM of GM plants defines protection goals in broad terms, for example by referring to 'the conservation of biodiversity'. It is suggested that associated, measurable assessment endpoints should be defined considering the receiving environment and the EU standards implemented by Member States.

The EFSA Panel on Plant Protection Products and their Residues has published a scientific opinion on establishing specific protection goals for environmental risk assessment of pesticides²¹. This report examined European legislation with the aim of identifying environmental protection goals relevant to the risk assessment of pesticides. It concluded that protection goals are broadly defined in EU legislation, but that specific protection goals (or assessment endpoints) are not defined.

Monitoring and reporting requirements under EU legislation

EU legislation establishes certain monitoring and reporting requirements. For example, two EU Directives which are relevant to the protection goal 'conservation of biodiversity', are the Wild Birds Directive (2009/147/EC) and the Habitats Directive (92/43/EEC).

Under the Wild Birds Directive reports are submitted on the status of all birds. In the UK, birds are monitored by the BBS, with good coverage in agricultural landscapes. The Habitats Directive requires surveillance of habitats and species and a report on the implementation of the Directive every six years. Species of community interest are defined in the Annexes of the Directive, but relatively few of these are associated with arable landscapes (see Table 1, below).

Monitoring of farmland biodiversity to meet the requirements of EU legislation may not always take a form which is suitable for GS. For example, whilst sampling density may be able to show an overall trend and allow an assessment of conservation status, it may not be high enough to distinguish the different drivers of the change, and so may not be able to show any impact of GM crops. In addition many species monitored under the Habitats Directive have restricted distribution. It will be necessary to consider whether existing monitoring and reporting to fulfil the requirements of EU Directives could be used to deliver meaningful results for GS of GM crops.

Using domestic policy commitments to define assessment and measurement endpoints

Domestic policy commitments could be used to help define assessment and measurement endpoints for GS. The primary source would be the individual country strategies such as the Natural Environment Framework (Wales), the Strategy for England's Wildlife and Ecosystem Services (Biodiversity 2020), the Scottish Biodiversity Strategy, and the Northern Ireland Biodiversity Strategy. These take into account EU policies and international agreements but also provide a broader framework and so will often include specific commitments for individual species and habitats. For example, Biodiversity 2020²² has outcomes relevant to the farmed environment. The outcome on priority habitats, which includes quantitative targets on extent and condition. The outcome on species

²¹ EFSA Panel on Plant Protection Products and their Residues (PPR). Scientific Opinion on the development of specific protection goal options for environmental risk assessment of pesticides, in particular in relation to the revision of the Guidance Documents on Aquatic and Terrestrial Ecotoxicology (SANCO/3268/2001 and SANCO/10329/2002). EFSA Journal 2010;8(10):1821 <http://www.efsa.europa.eu/en/efsajournal/doc/1821.pdf>

²² Defra Biodiversity 2020: A strategy for England's wildlife and ecosystem services. <http://www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf>

is not, however, quantitative and refers to improvement in the status of wildlife and preventing human-induced extinctions of known species.

The 2012 strategy for England's wildlife and ecosystem services²³ establishes biodiversity indicators for the farmed environment. These indicators comprise breeding birds, butterflies, bats and plant species richness. Work is currently underway to broaden the taxonomic scope of these indicators. A key feature of the indicators is that there are only limited cases where they are directly linked to the Biodiversity 2020 outcomes. Where linked to other commitments on reducing environmental pressures, or taking action to conserve biodiversity, they are assessed by direction of travel rather than by a quantitative endpoint or threshold. These indicators do not correspond to assessment endpoints in that they do not provide a specific definition of the entity and attribute of the environment to be protected. The indicators are used to monitor trends rather than to determine the causes of change.

An ecosystem services approach

The EFSA Panel on Plant Protection Products and their Residues made use of an ecosystem services approach to illustrate how assessment endpoints for the environmental risk assessment of pesticides could be defined²¹. An ecosystems services approach such as this could be used to define an agreed set of assessment endpoints to report on the status of the farmed environment and identify correlations with causal factors.

Table 1. Habitats Directive 92/43/EEC - Species of Community Interest associated with UK arable landscapes

Latin name	Common name	Widespread/restricted
<i>Hirudo medicinalis</i>	Medicinal leech	Localised
<i>Austropotamobius pallipes</i>	White-clawed crayfish	Widespread
<i>Triturus cristatus</i>	Great crested newt	Widespread
<i>Pelophylax (Rana) lessonae</i>	Pool frog	Very restricted
<i>Rana temporaria</i>	Common frog	Widespread
<i>Lepus timidus</i>	Mountain hare	Widespread
<i>Lutra lutra</i>	Otter	Widespread
<i>Mustela putorius</i>	Polecat	Widespread
<i>Luronium natans</i>	Floating water-plantain	Localised
<i>Rhinolophus ferrumequinum</i>	Greater horseshoe bat	Widespread
<i>Barbastella barbastellus</i>	Barbastelle	Widespread

²³ A Strategy for England's wildlife and ecosystem services Biodiversity 2020 Indicators: 2012 Assessment <http://www.defra.gov.uk/statistics/files/England-Biodiversity-indicators-2012-FINALv2.pdf>

Latin name	Common name	Widespread/restricted
<i>Pipistrellus pipistrellus</i>	Common pipistrelle	Widespread
<i>Nyctalus noctula</i>	Noctule	Widespread
<i>Myotis daubentonii</i>	Daubenton's bat	Widespread
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	Localised
<i>Myotis brandtii</i>	Brandt's bat	Widespread
<i>Myotis nattereri</i>	Natterer's bat	Widespread
<i>Myotis bechsteinii</i>	Bechstein's bat	Localised
<i>Plecotus auritus</i>	Brown long-eared bat	Widespread
<i>Eptesicus serotinus</i>	Serotine	Widespread
<i>Plecotus austriacus</i>	Grey long-eared bat	Localised
<i>Myotis mystacinus</i>	Whiskered bat	Widespread
<i>Nyctalus leisleri</i>	Leisler's bat	Widespread
<i>Pipistrellus pygmaeus</i>	Soprano pipistrelle	Widespread

Table 1. Species of Community Interest associated with the arable environment– as a foraging, resting, breeding or navigational resource, based on the habitat descriptions from the published 2007 Article 17 reports. For bats, there were few specific references to arable landscapes (reports generally state that they require a mosaic of habitats), but consultation with Bat Conservation Trust confirmed that bats may use arable land, particularly areas with features such as hedgerows and ponds. The table also shows how widespread the species are. Widespread = <100 10km squares; Localised = 16-100 10km squares, restricted = 6-15 10km squares, very restricted = 5 or under 10km squares. Most species that may be found in an arable environment are widespread. Fish have not been included in the table above, but it is likely that many species (particularly widespread species such as the bullhead) may be found in arable landscapes that have rivers/streams running through them. Water quality issues may also affect fish downstream from arable land.

Annex 5b

The use of the Countryside Survey in reporting to EU Directives

EU Habitats Directive – The CS has been used to report on priority habitats: blanket bog, hedgerows woodland and ponds. It also reported on spatial distribution of habitats to feed into Article 10 of the Directive on ecological networks.

EU Water Framework Directive – The CS contributes to General Surveillance and ecological condition assessment of headwaters and ponds. Habitat data used to characterise trends in water quality.

EC Directive on Renewable Energy – Habitat mapping data from the CS is used to model and map land capability for the production of purpose grown biomass crops.

EU Common Agricultural Policy – CS data is used to report on the condition of farmland habitats.

Annex 6

Limitations in the monitoring by existing environmental surveillance networks

The limitations of existing monitoring in the UK are considered here. This builds on the outputs of an earlier report, published in 2006²⁴, but also takes into account more recent developments in reconfiguring monitoring in the UK (Box 1). The criteria defined in Section 4.6 of this report for the selection of ESNs are also considered.

The 2006 report noted that the following parameters were not monitored by ESNs or that the data collected would not be adequate for GS:

- Soil organisms, soil erosion, soil sediment in water courses
 - no data or data not sufficiently adequate for most GS purposes,
- Pesticide usage, weeds and other vascular plants, soil chemistry and organic matter, terrestrial populations of amphibians and reptiles
 - data available but not robust.

Two additional gaps were identified by the ACRE working group: pollinators and plant health.

The discussion below considers how these gaps may be addressed by existing ESNs and whether or not this would be of long term benefit to GS.

Soils

In England, soil monitoring schemes (Table 1) record geographic, land-use and selected soil chemical, physical and biological properties. Many of the physical and chemical properties are, however, relatively resistant to change over the time scales being considered here, although they may be influenced indirectly by soil management (e.g. changes in soil compaction as a result of changed trafficking compared with soil beneath a non-GM crop). Biological parameters have only relatively recently featured in soil monitoring schemes, and usually involve specialist techniques that are not suitable to/for large scale and long-term monitoring. Overall, soils are poor indicators of potential GM impacts as effects detected in soil monitoring (due either to GM or other biotic pressures) are typically localised and transient, and soil biodiversity is typically spatially very heterogeneous. The ACRE working group concluded that the resources required to attribute any unanticipated change in soil biodiversity to GM cultivation at the field scale would be disproportionate and that use of the Farm Questionnaire to obtain a basic indication of soil quality should be considered further.

Vascular Plants

Weeds represent a particularly useful bio-indicator for effects of GM cropping; they are non-mobile, sensitive to a range of changes in some agricultural practices (e.g. degree and timing of tillage, herbicide regime), support a range of farmland biodiversity, and in some instances respond to changes in crop management on a short time scale. Moreover, many weed species have broad geographic range and are easy to find and identify. They could therefore be of particular importance as early warning indicators of change for GS. It has previously been noted that no specific annual

²⁴Hugo S., Boatman N., Pietravalle S., Murray A., Blackburn J., Wardman O. (2006) Availability and use of general surveillance information for potential changes resulting from GM crop cultivation. Defra final report CB02042 <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=13333&FromSearch=Y&Publisher=1&SearchText=general%20surveillance&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

arable weed survey exists in the UK²³; however the Countryside Survey does record plant species as does the Game Conservancy Sussex study²⁵ (localised), the Environmental Change Network²⁶ (small number of sites, none commercially cropped), and Plantlife's Wildflowers Count²⁷ (previously referred to as the Common Plants Survey).

The CS power analysis (Section 6.4), using species richness, quantified the probability of detecting reductions in species numbers. The results of the FSE, however, demonstrated that the main effects of GM crops were on relative species abundance and dominance. Further analysis of the cover data in the CS may provide a way of detecting these changes. The long time interval between sampling for CS, limits its potential to detect changes within the ten-year period of consent and many biological indicators, including weeds, can vary significantly from year to year. However, the analysis presented in this report illustrates that space-for-time substitutions are a good alternative in this context if the CS survey year is within a suitable time period after commercialisation.

The Wildflowers Count enlists volunteers to record the plants species (from a list of 100 species) found in a randomly assigned 1km plot or transect near where they live, many of which will include arable land). The Wildflowers Count has achieved up to 500 samples a year and may have some value in looking at crop related effects as it includes field margin and weeds in its sampling protocol.

In 2010 JNCC commissioned some research to look how to improve the spatial coverage and temporal frequency of plant monitoring to help answer a range of policy questions and reporting needs²⁸. The research looked at how this could be achieved using new approaches to volunteer based plant surveillance. The initial research did not consider the potential of the scheme to pick up within field effects using weeds. Research is planned to develop the ideas further and the value of within field information will be taken into account for work on stratification and field methods.

Amphibians and reptiles

In the UK monitoring of terrestrial amphibians or reptiles has, in general, been uncoordinated, short-term, patchily distributed, and with widely differing methods and scope²⁹, the exception being the frog spawning in the Environmental Change Network (although this covers a limited area and does not include commercially cropped areas)²³. Amphibians rely on water bodies such as ponds for breeding, but also utilise surrounding land, and could be exposed to GM crops³⁰. In 2007 the National Amphibian and Reptile Recording Schemes (NARRS³¹) were launched, now led by Amphibian and Reptile Conservation (ARC). There is concern, however, that this survey has low power to detect change and would not be able to clearly pick up effects of GM crops due to the small sample size being achieved, confounded by the often low detectability of these cryptic species. Natural England are currently aiming to establish a multi-taxa pond monitoring scheme, based on a long term random

²⁵ The Sussex Study http://www.gwct.org.uk/research_surveys/wildlife_surveys_and_ngc/the_sussex_study/default.asp

²⁶ Environmental Change Network <http://www.ecn.ac.uk/>

²⁷ Plantlife Wildflowers Count http://www.plantlife.org.uk/things_to_do/wildflowers_count/

²⁸ Walker K., Dines T., Hutchinson N., Freeman S. (2010) Designing a new plant surveillance scheme for the UK. JNCC report 440 http://jncc.defra.gov.uk/pdf/jncc440_web.pdf

²⁹ English Nature report 663 Costed plans and options for herpetofauna surveillance and monitoring 2005 http://www.narrs.org.uk/Documents/ENRR_663_Herpetofauna_surveillance_monitoring.pdf

³⁰ Fera (2010) Use of agricultural areas by amphibians. Defra final report PS2340 <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16132#Description>

³¹ Centre for Environmental Sciences, University of Southampton (2011) Understanding the status of UK Biodiversity Action Plan Species: herptiles and freshwater invertebrates. Defra final report WC0777/CR0467 <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17148&FromSearch=Y&Publiher=1&SearchText=herptiles&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

sample network, and working with NGOs specialising in different taxa, including amphibians. Once established, this scheme may have better potential for use in GS of GM crops.

Pollinators

Section 6.2 illustrates the potential utility of the current UKBMS in detecting change in common species associated with agricultural land. In 2009 the Wider Countryside Butterfly Survey (WCBS) was launched as an additional component of the UKBMS (see Annex7). This includes a network of randomly selected 1km squares, many of which include arable land. The WCBS has now been running for 3 years, and in 2010 had 686 samples (in addition to the non-random samples of the traditional component of the UKBMS). Power analysis shows that reasonable power is likely to be achieved to be able to detect change in the populations of many butterfly species. If 1500 WCBS squares were recorded, and assuming that occupancy rates achieved in 2007 are representative, published analyses of power suggest that the scheme will reliably assess (i.e. to detect 50% changes over 10 years) trends for 17 out of the target 22 species³². This scheme is likely to be of use for GS.

There are two national schemes that record moths in the UK. As part of the long running Rothamsted Insect Survey³³, there has been a network of light traps of a standard design that operate every night of the year with the help of volunteers. A national network has been in operation since 1968, although the relatively small size of the network (currently about 80 sites) means that it is unlikely to have much overlap with areas planted with GM crops. Butterfly Conservation runs the National Moth Recording Scheme to bring together records of all macro moths across the UK, Isle of Man and Channel Islands. The collation includes a vast number of records, from a much larger number of sites. The data were collected in many different ways, including *ad hoc* records as well as repeat local surveillance. This dataset would need to be analysed to determine its potential for use in GS.

The Biological Records Centre has recently proposed setting up a Pollinator Monitoring Network focusing on bees and hoverflies. It would include a large-scale, long term stratified monitoring scheme, as well as a rolling programme of targeted rare species monitoring, and periodic campaigns for public participation. The number of sample sites in the network would be likely to be 200-300 and the location of sites would include both semi-natural and intensively managed habitat. This scheme would complement existing amateur surveys of the distribution of bee species, specifically those co-ordinated by the Bees, Wasps and Ants Recording Society³⁴ and the Bumblebee Conservation Trust ('Beewatch')³⁵. The lack of a systematic sampling strategy in these two survey schemes, however, limits the potential for data of this type to be used in GS. Finally, the national network of beekeepers (British Beekeepers Association³⁶) is a valuable resource for detecting changes in the behaviour or dynamics of honey bee colonies.

Plant Health

In the UK the Crop Monitor programme³⁷ is a collaboration of organisations who between them contribute, collate and analyse live information on diseases and management of diseases in oilseed rape, winter wheat and spring bean crops across the UK. Winter barley was also surveyed between

³²Roy, D.B., Middlebrook, I., Cruickshanks, K., Freeman, S., Botham, M.S., Warren, M. & Brereton, T. (2011) Extending the use of butterfly recording data in the UK. Defra final report WC0729

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16074&FromSearch=Y&Status=3&Publisher=1&SearchText=WC0729&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

³³ Rothamsted Insect Survey <http://www.rothamsted.bbsrc.ac.uk/insect-survey/>

³⁴ Bees, Wasps and Ants Recording Society <http://www.bwars.com/>

³⁵ Bumblebee Conservation Trust <http://bumblebeeconservation.org/>

³⁶ British Beekeepers Association <http://www.bbka.org.uk/>

³⁷ UK Crop Monitor <http://www.cropmonitor.co.uk/>

1981 and 2005. Whilst this network could be of use for GS of GM crops, they would not be relevant for the GM crops currently in the regulatory pipeline. In the future, if applications were received for cultivation of oilseed rape, winter wheat or spring beans Crop Monitor would provide a useful tool in addition to the Farm Questionnaire, for collecting information on disease and pest risk, seasonal variation in disease development and the effectiveness of control strategies in the surrounding area.

The British Potato Council offers a blight incident reporting service to the industry³⁸. The service, established in 2003, is based in information collected on a voluntary basis by 300 members of the industry across the UK.

Summary

Overall, the majority of the existing monitoring data gaps are in the process of being addressed. The gap in monitoring of vascular plants was considered to be the most significant of those considered, given the importance of plants as a bio-indicator for the countryside. The Common Plants Survey has the potential to deliver similar professional-volunteer partnership benefits as the BTO brings to bird surveys and is a step towards addressing the temporal limitations of the Countryside Survey.

The working group considers that **it would be disproportionate to seek to revise other ESNs to address those gaps that remain**, for example soils, solely for the purposes of GS monitoring for GM crops. The results are often confounded by other drivers, and effects away from the crops themselves. For example, empirical evidence has shown that the abundance and richness of bees and butterflies in a field plot is more strongly related to flower abundance (in proportional area terms) than to any measures of landscape or farming type. Likewise, bird abundance and richness in winter is most strongly related to seed weight per unit area in field margins.

The outputs of the power analyses (Section 6) of ESNs that are supported by volunteers demonstrates the success of professional-volunteer partnerships to deliver targeted monitoring schemes that have significant coverage and number of sample sizes. The working group recommends that applicants engage with and seek the advice of the professional partner in such arrangements given that they best placed to co-ordinate the collation and quality assurance of the data including the analysis and interpretation.

³⁸ Potato Council blight monitoring <http://www.potato.org.uk/fight-against-blight>

Annex 7

The Wider Countryside Butterfly Survey (WCBS)

The UKBMS includes a network of fixed-route walks (transects) established at a site and surveyed for butterflies each year on a regular (weekly) basis under reasonable weather conditions from the beginning of April until the end of September. Transects are typically chosen by the recorder. To address the bias in site selection and to complement the traditional transects in the UKBMS, the Wider Countryside Butterfly Survey was established and incorporated into the UKBMS in 2009. WCBS is operated by the Centre for Ecology & Hydrology (CEH) / Butterfly Conservation (BC) / and the British Trust for Ornithology (BTO) with support from a range of Government agencies (principally Defra and JNCC).

The WCBS operates the same transect recording method, but differs in that transects are located in a stratified-random sample of 1km squares across the UK, and less within-season sampling is required (a minimum of two visits per site in July / August). In addition the transects are of a more standard length/layout than traditional UKBMS transects, consisting of two parallel 1km lines, each subdivided into 5 sections. Around 700 WCBS sites were sampled in 2010. The WCBS thus provides a statistically representative coverage of the wider countryside, including greater coverage of arable land. This report does not include an analysis of WCBS data due to the short time series available. The WCBS will, however, become an increasingly important environmental monitoring network as further years accrue. The additional sites available in arable land would result in an increased power of the WCBS relative to the traditional UKBMS transects. This would provide an increased power to detect change in butterfly populations in arable land. It would therefore present a more effective tool for General Surveillance.