

ENVIRONMENTALLY SENSITIVE AREAS IN NORTHERN IRELAND

Monitoring and evaluation of the ESA scheme between 1993 and 2003

Report to the Department of Agriculture and Rural Development

by

Agri-environment Monitoring Unit

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1. INTRODUCTION

1.1. The ESA scheme

The Environmentally Sensitive Area (ESA) Scheme in Northern Ireland was introduced in 1988 by the Department of Agriculture (DANI), now the Department of Agriculture and Rural Development (DARD), to help safeguard areas of the countryside where the landscape, wildlife or historic interest is of particular importance. The ESA programme marked a significant change in direction for agricultural policy. In the CAP reform in 1992, the European Union introduced the Agri-Environment Regulation (EEC) No. 2078/92, which aimed to “encourage farmers to make undertakings regarding the requirements of environmental protection and maintenance of the countryside”. The ESA scheme is the main focus for delivery under this regulation. Since designation of the initial ESA in 1988, the scheme was expanded in 1993-94, to cover 20% of the agricultural land area of Northern Ireland. Each ESA has a significant environmental interest, in terms of landscape, ecological or heather moorland. The five designated areas are:

The Mourne and Slieve Croob ESA

The Antrim Coast, Glens and Rathlin ESA

The West Fermanagh and Erne Lakeland ESA

The Sperrins ESA

The Slieve Gullion ESA

Participation within the scheme is voluntary and farmers enter into a ten-year agreement, with an option to come out after 5 years. In return for following habitat specific management prescriptions, farmers receive an annual area-based payment. In addition there has been the opportunity to take out enhancement plans, where grants are available to fund work such as hedgerow restoration, repair of dry stone walls and regeneration of heather moorland.

Agri-environment schemes now reside under the Northern Ireland Rural Development Plan (NIRDP) 2000-2006, which includes the ESA scheme, the Countryside Management Scheme (CMS) and the Organic Farming Scheme

(OFS). The present ESA scheme closed to new applicants at the end of 1999. Farmers will stay in the scheme until the end of their agreements then can transfer to the new scheme. The new ESA scheme was introduced in 2001 in compliance with the Rural Development Regulation (EU) No. 1257/99 and has more options than the previous scheme and also certain minimum environmental standards. It has the same range of habitats and payments as the CMS, which was introduced in 2000 and covers the remaining 80% of Northern Ireland.

1.2. Scheme uptake

By the end of 2000 there was around 135,000ha of land under ESA agreement and 4,250 farmers/landowners participating in the scheme. This is equivalent to about 65% of the total eligible land area within the ESA boundaries. The total area of each habitat and feature under agreement for all the ESAs has been calculated (Table 1). There have also been 133,230m of traditional field boundaries restored through capital grants provided under enhancement plans.

Most existing ESA farmers are expected to transfer to the new ESA scheme when their agreements come to an end. As of the end of 2003, there were around 360 farmers with new ESA agreements. The target for ESA (old and new) in the Rural Development Plan is for 5000 agreements by 2006.

Table 1. Areas of habitat and features under ESA agreement (*West Fermanagh and Erne Lakeland ESA only, ** Antrim Coast, Glens and Rathlin ESA only)

HABITAT		
CODE	HABITAT	AREA (ha)
I	Improved grassland	51193.78
U	Unimproved grassland	33295.37
R	Rough grazing	17417.76
W	Woodland / scrub	2699.05
M	Moorland	26457.06
SRD	Species-rich dry grassland	169.77
SRW	Species-rich wet grassland	86.09
SRH	Species-rich haymeadow	5.11
WP*	Wet pasture	1090.12
H*	Haymeadow	1166.99
L*	Limestone grassland	1028.74
OW*	Overwintering sites	45.07
CHO**	Chough Option	265.27
ARS	Ancient monument	227.7
WCI	Wildlife corridor improved	31.21
WCR	Wildlife corridor rough	21.57
WCU	Wildlife corridor unimproved	90.82
TOTAL	All Habitats	135291.48

1.3. Monitoring programme

Since their first introduction, DARD has been committed to monitoring the performance of agri-environment schemes in relation to their stated environmental objectives of maintenance and enhancement of biodiversity, landscape and heritage features. A long-term monitoring programme was established in 1992 to determine if the ESA scheme is fulfilling these objectives. This is an integrated multi-disciplinary programme to evaluate the effectiveness of ESA management prescriptions on target habitats. Biological and landscape monitoring has been carried in all ESAs by Queen's University Belfast. The monitoring programme has also assessed impact on other key areas including heritage features and socio-economic issues.

The main aims and objectives of the monitoring programme are:

1. To determine the impact of the ESA scheme on biodiversity.
2. To assess the impact of the ESA scheme on the rural landscape.
3. To provide feedback into the effectiveness of management prescriptions and results to be implemented into the policy decision-making process.

Since the establishment of the monitoring programme, UK policies for biodiversity and rural development have evolved, mainly in response to policies introduced by the European Union. In addition to reporting of scheme performance *per se*, there is now a requirement for DARD to report on the performance of these schemes within a wider policy context. The main policy driver for biodiversity is currently the UK Biodiversity Action Plan (BAP). Agri-environment schemes are one of the main vehicles by which BAP objectives and targets for many habitats and species are expected to be met and delivered.

The European Commission has provided a list of common evaluation questions, which may provide suitable impact indicators for agri-environment schemes.

(DTZ Pidea Consulting, 2004). Future monitoring programmes will take account of these and also BAP objectives. A separate monitoring programme for the Countryside Management Scheme has been established by QUB (Flexen *et al*, 2004).

This overview report summarises and evaluates the main results of the ESA monitoring programme to date. Detailed presentation of results can be found in the relevant monitoring reports.

2. BIOLOGICAL MONITORING

2.1. Monitoring methods

Monitoring plant species is the most widely used method of assessing ecological changes in the environment. Vegetation is the key to the most ecosystems and plant diversity may often be correlated with animal diversity. Plant species diversity is indicative of the wildlife value of a habitat. Recording detailed changes at the plant species level is widely used to examine long-term environmental change, such as the relationship between plant composition and agricultural management (e.g. Hopkins & Wainwright, 1989).

Habitat diversity was measured by a combination of plant and invertebrate species richness, the relative proportions of species in each of the plant strategy groups (Grime *et al.* 1988), and the frequency and distribution of indicator species. Comparison was made over time to determine changes in biodiversity with respect to participation in the ESA scheme.

Ground beetles and spiders were monitored as they are habitat specific, easily trapped in pitfall traps and are good indicators of biological change (Kirby, 1992). The wealth of information on the ecological requirements of individual ground beetle species (Lindroth 1974) has proven useful in environmental quality assessment (e.g. Eyre & Rushton 1989; Rushton *et al.* 1989). Spiders are sensitive to habitat architecture and, as such, provide useful indicator species (Coulson & Butterfield, 1985). A quality scoring system for spider species (Cameron *et al.*, 2004) was used to provide a comparable diversity score for monitored sites. Invertebrate monitoring in association with plant species provides a comprehensive assessment of the biodiversity of a habitat. Species lists of ground beetles and spiders have been compiled for each target habitat. Rare and threatened species have been found within the ESAs and their status and distribution documented (Hegarty *et al.* 1994, 1995). These species act as performance indicators in assessing the effectiveness of the ESA scheme.

Soil sampling of target habitats was carried out and soil nutrient levels compared between years. This was to determine if soil fertility on habitats was declining due to reduction of fertiliser inputs under ESA agreement.

2.2. Monitoring schedule

A baseline biological monitoring programme in the West Fermanagh and Erne Lakeland ESA was completed in 1993 (Hegarty *et al.* 1994). The monitored habitats were woodland, heather moorland, hay meadow, wet pasture, unimproved grassland and limestone grassland. Baseline surveys of heather moorland in the Mourne and Slieve Croob ESA, the Sperrins ESA, the Slieve Gullion ESA and the Antrim Coast, Glens and Rathlin ESA were completed in 1994 (Hegarty *et al.* 1995). Woodland sites within the Antrim Coast, Glens and Rathlin ESA were also surveyed. These surveys provided baseline data on the wildlife value of a range of sites from target habitats on participant and non-participant farms within the ESA boundary. Plant species and invertebrates (i.e. ground beetles and spiders) were monitored as indicators of habitat quality and to determine the effects of ESA scheme prescriptions.

All the Northern Ireland ESAs were re-monitored three years after baseline monitoring in a partial survey to allow an initial appraisal of the effectiveness of the scheme and to facilitate modification of prescriptions if necessary. The West Fermanagh and Erne Lakeland ESA was re-surveyed in 1999 six years after baseline biological monitoring (Cameron *et al.* 2000). A complete re-survey of all of the other four ESAs was carried out in 2000 (Cameron *et al.*, 2001). Data on plant and invertebrate species composition were compared between years for ESA participant and non-participant farms to determine the effects of ESA scheme prescriptions on monitored habitats.

Further monitoring was carried out in 2003 in the West Fermanagh and Erne Lakeland ESA. This provided a long-term assessment of the effects of the scheme by comparing 1993 baseline data with 2003 data from participant farms only (Cameron *et al.*, 2004). This permits a more precise evaluation of the

scheme over a longer time period during which management prescriptions have had a greater opportunity to become apparent. Remonitoring of heather moorland under agreement on the other four ESAs is planned for summer 2004.

2.3. West Fermanagh and Erne Lakeland ESA

The monitoring programme indicates that after ten years the plant and invertebrate species richness of all habitats under ESA agreement was being maintained (Cameron *et al*, 2004). In many cases the range of species on target habitats has changed to include more desirable species from a conservation point of view. Hence a lack of change in overall species number is not necessarily a failure of the scheme to deliver positive enhancements.

There was a general increase in the cover of rushes (*Juncus* species) recorded on unimproved grassland, wet pasture and hay meadows under ESA agreement. This may be due to reduced stocking densities or less intensive management. Greater rush control may be necessary, particularly on sites where cover exceeds 50%.

Soil analysis showed there was a significant decrease in mean soil phosphorus level between 1993 and 2003 on wet pasture and limestone grassland under ESA agreement. There was also a decrease for hay meadows, a trend following from 1999 analysis. This decline of soil fertility is most likely due to reduced fertiliser inputs on grassland habitats. This is a positive effect of ESA management as plant species diversity is correlated with decreased soil fertility. On wet pasture there was an apparent decrease in certain plant species associated with high soil fertility.

There was a significant increase in the mean cover of heather (*Calluna vulgaris*) on heather moorland under ESA agreement between 1993 and 2003. Dwarf-shrub cover had increased or been maintained on 85% of agreement sites. On the remaining sites, cover remained low at <25%. These sites of degraded heath may need further reduction in stocking levels if habitat condition is to

improve. There was a notable decrease in the frequency of several grass species on heather moorland. In particular, mat grass (*Nardus stricta*) had declined on participant farms indicating an improvement in the quality of the heather moorland. There was a general decrease in bare ground cover and an increase in *Sphagnum* mosses, both indicators of reduced trampling or poaching activity.

Ground beetles are indicators of habitat quality. The ground beetle, *Carabus clatratus*, identified as an indicator species, increased on participant hay meadows and decreased on non-participant hay meadows between 1993 and 1999. *Carabus nitens* identified as an indicator species on heather moorland in 1993 maintained its presence on participant farms in 1999 and 2003, but was not re-recorded on non-participant farms in 1999.

Spider species composition can indicate changes in vegetation structure and therefore can be related to habitat management and condition. Changes in spider populations on heather moorland and wet pasture between 1993 and 2003 indicate a more diverse vegetation structure. These habitats are supporting more 'specialist' species with specific habitat preferences, which may be a positive effect of ESA management. Spider species quality scores increased for heather moorland and limestone grassland between 1993 and 2003. All these changes suggest that habitat quality is improving due to less intensive management. There were several new county records for spiders recorded on habitats under agreement, mainly heather moorland, in 1999 and in 2003.

The mean number of plant species recorded in woodland under ESA agreement did not change significantly between 1993 and 2003. However there was an increase in cover of several woodland indicators such as bluebell (*Hyacinthoides non-scripta*), wood anemone (*Anemone nemorosa*) and wood sorrel (*Oxalis acetosella*). This, together with significant increases in ivy (*Hedera helix*) and lesser celandine (*Ranunculus ficaria*), may be due to reduced disturbance by livestock. There was also a general decrease in the amount of bare ground. The mean cover of bramble (*Rubus fruticosus*) increased slightly in participant

woods. Bramble may shade out ground flora species leading to an eventual decline in species diversity. Ungrazed woods had more woody species regenerating than those woods that still showed signs of occasional grazing in 2003.

The monitoring results indicate that species diversity is being maintained on habitats on participant farms in the West Fermanagh and Erne Lakeland ESA. There were indications of enhancement on habitats under agreement. For example an increase in heather cover on heather moorland on ESA participant farms and a decrease in undesirable species, such as mat grass, probably due to reduced grazing pressure. Possible areas of concern are an increase in bramble in ungrazed woodlands and an increase in rushes on hay meadows, unimproved grassland and wet grasslands. These may have implications for management and will need to be monitored and causes investigated in future research.

2.4. Other ESA schemes

A complete re-survey of sites in the other four ESAs was carried out in 2000 (Cameron *et al*, 2001). Data on plant and invertebrate species composition were compared between 1994 and 2000 for ESA participant and non-participant farms to determine the effects of ESA scheme prescriptions on heather moorland in the Mourne and Slieve Croob ESA, the Sperrins ESA, the Slieve Gullion ESA, and heather moorland and woodland in the Antrim Coast, Glens and Rathlin ESA.

In general, species diversity has been maintained on heather moorland in the Antrim Coast, Glens and Rathlin, Slieve Gullion and the Sperrins. There were indications of positive effects of the ESA scheme such as increased heather (*Calluna vulgaris*) cover on participant sites and increases in bryophytes, probably due to reduced trampling by livestock. There were negative indicators on non-participant sites such as increases in grass species indicative of heavy grazing such as mat grass (*Nardus stricta*).

Generally the picture in the Antrim Coast and Glens ESA is positive with species diversity being maintained between 1994 and 2000. There was an increase in species diversity in terms of the number of species recorded and a slight increase in heather cover. Another positive indicator was an increase in the number of ground beetle and spider species on participant farms. Possible areas of concern were an increase in grassland species and mat grass on sites that had been previously heavily grazed. Increases in these species are usually due to high grazing pressure. Further decreases in stocking rate may be beneficial on sites that were heavily grazed prior to ESA agreement.

Although the Antrim Coast, Glens and Rathlin form one ESA, Rathlin Island has been considered separately due to the distinct composition and character of the flora and fauna. Heather moorland sites on Rathlin had greater plant and invertebrate species diversity in terms of mean numbers of species per site than the other ESAs. There were no significant changes in the mean numbers of plant, ground beetle or spider species between 1994 and 2000 for ESA participants or non-participants, indicating that species diversity is being maintained on heather moorland sites on Rathlin. Although not statistically significant, the mean cover of heather (*Calluna vulgaris*) and bell heather (*Erica cinerea*) increased between years on ESA participant sites. High grazing levels were recorded in the 1997 survey of heather consumption. The heather on Rathlin is very short due to climatic suppression, so effects of grazing on heather height are difficult to determine.

In the Sperrins ESA there has been a loss of grass species on participant farms and an increase in heather, *Sphagnum* mosses and stress-tolerator species. These are all indicators of a decrease in grazing pressure and an improvement in habitat condition. There has also been an increase in the amount of dead heather recorded in the Sperrins. This is of potential concern as it may lead to long-term loss of heather cover even if positive grazing management has been implemented. This may have been caused by damage by the heather beetle (*Lochmaea suturalis*) and this species will be particularly noted in future monitoring. The ground beetle species *Carabus nitens*, identified as an indicator species during baseline monitoring, decreased in frequency on non-participant

sites. Numbers of spider species and individuals increased significantly on both participant and non-participant farms in the Sperrins and this increase was greater on participant farms. There were several new spider records for Northern Ireland.

The plant species diversity of heather moorland on Slieve Gullion ESA for participant or non-participant sites was maintained between 1994 and 2000. Reduced grazing pressure on participant farms has had a positive influence on dry heath vegetation in the Slieve Gullion ESA with a significant increase in *Calluna vulgaris* and a decrease in grassland species. Western gorse (*Ulex gallii*) has also increased, probably as a result of decreased grazing levels. Although not apparent from the current re-monitoring, the spread of bracken (*Pteridium aquilinum*) is a potential cause for concern as it can lead to shading out of heather and other species.

There were no significant changes in mean numbers of plant, higher plants, ground beetle or spider species between years for the Mourne and Slieve Croob ESA participants or non-participants, indicating that species diversity has been maintained. Dwarf-shrub cover was low on the Mourne sites and appears to have decreased between 1994 and 2000. There has also been an increase in purple moor-grass (*Molinia caerulea*) on all sites. These results are indicative of high grazing intensity, leading to a general increase in grass species and a decline in ericaceous species. There is also evidence of previous uncontrolled burning at some sites, which may have been a contributory factor. Monitored sites in the Mourne and Slieve Croob ESA were mainly heavily grazed prior to ESA agreement and heather cover was extremely low (i.e. 5-10%) at baseline monitoring. As in the Antrim Coast and Glens further decreases in stocking rate may be beneficial on such sites.

There is little history of controlled heather management on ESAs in Northern Ireland. In 1997 baseline monitoring of plant species diversity and composition was carried out on a number of heather sites that had recently been either burned or flailed. These were re-surveyed in 1998 and 2000 to provide information on the suitability and effectiveness of these management practices

in Northern Ireland. Examination of the effects of burning and flailing for heather moorland management indicated that heather regenerated more rapidly after burning but both methods gave satisfactory results and could be used depending on prevailing circumstances. A rotational system of burning part of the moor each year should be adopted to maintain the desired mosaic of uneven heather stands and prevent congregation and overgrazing by sheep on recently burned patches.

There was a decrease in the number of plant species recorded in Antrim Coast, Glens and Rathlin ESA participant woodland sites between 1994 and 2000. Although certain woodland indicator species may have disappeared or declined from some sites, other ecologically important species were newly recorded in 2000. Several of the species not re-recorded on participant sites were non-desirable in conservation terms. Reduction of grazing pressure may be allowing more competitive plant species to become dominant. Some grazing and trampling by livestock may therefore have a positive effect in maintaining species diversity. A significant decrease in bare ground cover was recorded between 1994 and 2000. The proportion of ruderal species (i.e. those that exploit disturbed habitats) decreased on participant sites, a further indication of reduced disturbance. However there was also a decrease in the proportion of desirable stress-tolerating species and an increase in undesirable competitor species on non-participant sites. Observations on presence and abundance of seedlings and saplings suggest that although there was successful seedling recruitment at several sites these were not often surviving to sapling stage. This may be due to competition from more aggressive plant species in the field layer or increased shading by shrub cover following grazing exclusion.

The effects of grazing exclusion on woodlands in the Antrim Coast, Glens and Rathlin ESA are as yet unclear. Changes in woodland occur over an extended period of time and at present there are both positive and negative effects of grazing exclusion. Due to the diverse nature of the woods in this ESA, ideally site-specific management plans should be implemented for each wood. Previous studies suggest that permanent total grazing exclusion is not necessary to ensure woodland regeneration.

2.5. Species specific programmes

Biological monitoring of the Chough Option

The decline of the chough population in Northern Ireland has been attributed to the loss of their habitat due to changing farming practices. The Department of Agriculture and Rural Development (DARD) introduced the Chough Option into specific areas suitable for chough in the Antrim Coast, Glens and Rathlin Environmentally Sensitive Area (ESA) in 1997 with the aim of maintaining and restoring suitable chough feeding habitat.

Monitoring by QUB to determine the effects of the option commenced in 1998 with a baseline survey of vegetation and surface-active invertebrates on a range of fields used by the chough. Re-monitoring was carried out in 2002 and data compared between years (Cameron *et al*, 2004). Results indicate that suitable chough habitat is being maintained with some areas of short sward and the presence of known invertebrate prey items. Current literature recommends very short swards close to chough nesting sites although maintaining these may be at the expense of other species.

Monitoring of the remnant chough population by the RSPB since 1998 has shown that they utilise land under Chough Option management almost exclusively. Many other factors have been implicated in the decline of chough populations. In the absence of a viable population these factors may prove difficult to determine. However, it would appear that agri-environment scheme farmland management on the north Antrim coast is providing the best hope for survival of the chough in Northern Ireland and is also benefiting other farmland birds.

3. LANDSCAPE MONITORING

Landscape assessment was carried out in all five ESAs in Northern Ireland during 1995 (Millsopp *et al*, 1997) The Northern Ireland Land Classification (Cooper, 1986) provided a stratified sampling technique by characterising the ESA landscape into land class groups. Random 25 ha squares were selected in proportion to the land class group areas, resulting in a sampling intensity of 1.5%-2.0% by ESA area. This provided a greater dispersion and representation of samples. A total of 183 squares were monitored in all ESAs, recording cover types such as vegetation, buildings, field boundaries and historical features. An extensive map based database was completed for each ESA using PC ARC/INFO and ArcView.

Habitat descriptions and the recording of current management help to assess the effectiveness of the ESA scheme. With the addition of information such as farm ownership and ESA scheme participation, estimates of the area of habitats under the ESA scheme were predicted. This enabled certain habitats to be targeted and management proposals to be assessed.

This survey was repeated in 1998. Data were compared between 1995 and 1998 to determine changes in the distribution and abundance of land cover elements with respect to the ESA scheme (Cameron *et al*, 1999). By considering the ESA as a whole and ESA participant farms, estimates were made on the effect of the ESA scheme on various land cover elements.

Due to the low occurrences and dispersed nature of some landscape elements which occurred infrequently in the survey, small variations in these caused large percentage changes in estimates. Coefficients of variation (CVs) were therefore used to give an indication of the reliability of the estimates. T-tests were also carried out between data sets for the two years to determine if differences were statistically significant.

The results indicated a continued rise in ESA scheme participation with the consequent increase in areas of threatened habitat under the protection of the scheme.

Lengths and numbers of boundaries increased in all ESAs except Slieve Gullion and this increase was mainly due to increases in fences. Dry stone walls increased in the Mourne & Slieve Croob and the Sperrins ESAs. Some boundary removal (mainly hedges) was noted in all ESAs except the Antrim Coast Glens & Rathlin. Removal occurred almost exclusively on non-ESA farms with the exception of the West Fermanagh & Erne Lakeland ESA where some removal was noted on an ESA participant farm. Estimates of complete, stock-proof boundaries increased in the Mourne & Slieve Croob, Fermanagh and Sperrins ESAs. Levels of boundary management increased in all ESAs except Slieve Gullion over the three-year period. The West Fermanagh & Erne Lakeland ESA had the highest proportion of unmanaged overgrown boundaries/hedges. Boundaries with species-poor ground flora increased in both the Sperrins and Slieve Gullion indicating a possible need for the review of boundary management in these areas.

No significant changes were noted on heather moorland between years, with areas of wet and dry heath remaining at levels recorded in 1995. Areas of heather moorland under ESA agreement increased considerably over the three-year period.

Estimates of improved grassland increased in the Sperrins ESA although this change was from unimproved species-poor grassland. Areas of grassland classified as unimproved species-rich increased whilst those classified as unimproved species-poor decreased in all ESAs except the Antrim Coast Glens & Rathlin. This was not significant at this stage but may be indicative of future trends.

Areas of all woodland types remained the same over the three-year period. Woodland area under ESA agreement increased and there were some positive

indicators such as new planting of mixed woods in the Antrim Coast Glens & Rathlin ESA.

There were no significant changes in the numbers of derelict traditional buildings although there was an increase in all ESAs, which may be indicative of future trends. Newly restored traditional buildings were recorded in the Mourne and Slieve Croob ESA, the West Fermanagh and Erne Lakeland ESA and the Sperrins ESA.

Monitoring indicated that practices such as field boundary removal and drainage and reseeded was continuing within the ESA boundaries. These changes were, however, mainly limited to farms not participating in the ESA scheme. The ESA scheme is therefore instrumental in maintaining the characteristic landscape of each ESA by encouraging farmers to maintain major landscape elements and preserve vulnerable habitat.

Landscape monitoring is planned for 2005. Changes in land cover occur slowly and continued monitoring after a ten-year period should further highlight the impacts of agri-environment schemes in maintaining valuable land cover elements, vulnerable habitats and the character of the farmed landscape.

4. HERITAGE FEATURE SURVEYS

An ancilliary element of the ESA scheme is the recognition that the built heritage of an area is an important component of its cultural environment. As most artefacts of this heritage are on farmland, their preservation and enhancement should be monitored.

There are approximately 3,000 recorded historic monuments and archaeological sites occurring within ESAs. Under Rural Development Regulations all agri-environment payment schemes are conditional on farmers following 'Good Farming Practice', which stipulates that they must retain and maintain built heritage features. Specific protection against damage is given under the ESA scheme, which has prescriptions relating to livestock grazing and management of scrub or trees. Supplementary feeding sites and cultivation or planting on monuments are not permitted.

A survey of archaeological sites in Mournes and Slieve Croob ESA and Antrim ESA was carried out by the Historic Monuments Branch of the Environment and Heritage Service (DOE) in 1994 (McErlean, 1994). The survey of 87 sites included those on land of participants and non-participants of the ESA scheme. Of the sites, 51% showed recent damage and livestock grazing was the major concern, with 23% damaged by cattle and sheep. This study highlighted the fact that ESA regulations could provide opportunity for protection of sites. Resurvey is recommended to see if ESA agreements have prevented further damage.

Landscape monitoring between 1995 and 1998 (Cameron *et al*, 1999) assessed condition of historic features within ESAs. Results indicated that recent disturbance due to livestock had occurred but that it was not sufficient to cause further deterioration in the condition of monuments. Most disturbance or damage was noted on sites not under ESA agreement.

A pilot survey of condition and management of the archaeological resource in an area of north-east Antrim was carried out in 2001/2 by QUB (Gormley *et al*, 2002). A sample of 200 sites was surveyed and the main threat identified as

gradual damage caused to monuments by livestock. Results showed that of 20 sites on land under ESA management agreement, 75% were in fair/good condition and 25% were in poor condition. This survey identified the possible need for greater compliance monitoring to ensure protection of heritage features.

5. SOCIO-ECONOMIC SURVEYS

Attitudes

The impact of the programme in one ESA (Mournes and Slieve Croob) on attitudes, farm structure, perceptions, factors affecting participation and rural infrastructure has been well documented (Moss and Chilton, 1997). This study showed a shift in attitudes towards farming and conservation amongst scheme participants between 1990 and 1995.

A general survey of management practices and attitudes of farmers in all ESAs was carried out in 1998 by the ESA Monitoring Unit. Of those farmers interviewed, 65% had joined the scheme, 11% said they would still like to do so and 24% stated that they would not join.

In a survey of the West Fermanagh and Erne Lakeland ESA, 90% of joiners thought ESA scheme was a positive development for the farming community whereas 50% of non-joiners believed this to be the case (O'Harte, 1997). Participants were found to be more environmentally aware and had a greater desire not to engage in activities that may have a negative effect on the environment, for example hedge removal.

In a study of farmers from several ESA schemes in 2000, 80% of participants viewed the integration of conservation and farming as possible (Matthews, 2000). Non-joiners found problems with the scheme in its restrictiveness, stocking rates and payment rates.

Income

The farm management survey carried out in 1998 found that 81% of ESA participants were in the scheme because of the assured income it provided. More participants than non-participants felt it increased the value of their farm. If the ESA payments stayed the same, 91% of farmers stated they would remain as participants for the full 10 year period. However if the ESA payments were reduced by 25%, 45% stated they would remain in, and if reduced by 50%, 21% would remain in the scheme. There was good consistency across all ESAs.

A study of farmers in ESAs in 2000 found that 70% of participants rated the scheme as important or very important for farm income (Matthews, 2000). Around 60% of farmers stated financial reasons primarily for joining the scheme and 40% stated concern for environment.

Enhancement work

Participant farmers in Mourne and Slieve Croob ESA had carried out more enhancement works, such as rebuilding stone walls and hedge planting, than non-participants (Moss and Chilton, 1997).

A study on farmer attitudes in Co. Antrim showed that the majority of farmers were very responsive to the idea of external financial support as an incentive to either plant more hedges or manage existing ones more effectively (Hamilton, 1998). ESA joiners had planted more hedges due to grants and information from DARD.

Access

There are substantially fewer rights of way on farms in Northern Ireland ESAs in general than there are in England and Wales. A survey of attitudes of farmers towards countryside access in 1998 showed that 50% of ESA participants would permit access on their land whereas 35% of non-participants would permit access (McGinn, 1998). There were found to be some geographical differences. Farmers in the West Fermanagh and Erne Lakeland were most likely to allow members of the public to walk on their land, while farmers in the Slieve Gullion ESA were least likely to allow this. Participants were found to be more favourable to different forms of access than non-participants of the scheme and were more open to payments for access.

6. CONCLUSIONS

The biological monitoring programme indicates that plant and invertebrate species richness of sampled habitats under ESA agreement has been maintained. In many cases the range of species on target habitats has changed to include more desirable species from a conservation point of view. Hence a lack of change in overall species number is not necessarily a failure of the scheme to deliver positive enhancements.

There were indications of enhancement of plant and invertebrate communities on habitats under agreement. For example, management prescriptions are having a positive effect on heather moorland with an increase or maintenance of heather cover on most ESA participant farms due to reduced grazing levels. Decreases in soil fertility on wet pasture, limestone grassland and hay meadows in the West Fermanagh and Lakeland ESA are likely to be due to reduced fertiliser inputs on grasslands under agreement. This may have led to changes in plant species composition and should in the long-term increase species diversity.

Monitoring of grassland sites in the West Fermanagh and Lakeland ESA indicates that the scheme has been successful in maintaining the condition of semi-natural grasslands. In many cases this has been simply achieved by continuation of appropriate traditional management practices in relation to fertiliser application, stocking levels and hay meadow cutting dates. This grassland management is encouraged under ESA agreement and should contribute to delivery of targets for BAP priority habitats of 'purple moor-grass and rush pastures', 'upland calcareous grassland' and 'lowland meadows'.

The effects of grazing exclusion on woodlands under ESA agreement are as yet unclear. Changes in woodland occur over an extended period of time and at present there are both positive and negative effects of grazing exclusion. Due to the diverse nature of the woods in this ESA, ideally site-specific management plans should be implemented for each wood. Previous studies suggest that permanent total grazing exclusion is not necessary to ensure woodland regeneration. Longer term monitoring should determine the success of

woodland enclosure although effects will vary between individual sites. Grazing pressure from domestic and feral stock is one of the main factors currently affecting the woodland habitat in Northern Ireland. Positive management under the ESA scheme, including stock exclusion or control, should contribute to delivery of BAP targets for achieving favourable condition of woodlands. Most of the monitored woods in the West Fermanagh and Lakeland ESA and Antrim Coast, Glens and Rathlin ESA corresponded to the BAP priority habitat of 'mixed ashwoods'.

There is evidence to suggest that the ESA scheme has generally been successful in the maintenance and enhancement of biodiversity on target habitats. Monitoring has also determined that on some areas, such as degraded heath, modifications to the ESA prescriptions may prove beneficial. High stocking levels currently have the most significant impact on the condition of heather moorland throughout Northern Ireland. The ESA scheme should significantly contribute to the delivery of BAP targets for improving condition of 'upland heathland' and 'blanket bog' by encouraging appropriate stocking levels and more sensitive management practises.

Surveys have shown that the main threat to heritage features and archaeological sites is damage by livestock grazing and trampling. Management under ESA agreement should provide the opportunity for protection of sites. However further monitoring of this resource is recommended to see if management prescriptions have prevented further deterioration of sites.

Studies on the attitudes of farmers with ESA agreements have shown an apparent shift to a position of greater understanding for the environment and wildlife. However the main reason stated for joining agri-environment schemes is the increased farm income.

The results of landscape monitoring between 1995 and 1998 showed a continued rise in ESA scheme participation with the consequent increase in areas of threatened habitat under the protection of the scheme. Monitoring indicated that practices such as field boundary removal and drainage and

reseeding was continuing within the ESA boundaries. These changes were, however, mainly limited to farms not participating in the ESA scheme. There was an increase in the estimated length and number of field boundaries in most ESAs. This should be viewed in the context of overall declines in boundaries in Northern Ireland reported in the Northern Ireland Countryside Survey 2000 (Cooper & McCann, 2000).

The ESA scheme has therefore been instrumental in maintaining the characteristic landscape of each ESA by encouraging farmers to maintain major landscape elements and preserve vulnerable habitat. Changes in land cover occur slowly and continued monitoring after a ten-year period should further highlight the impact of agri-environment schemes in maintaining and enhancing the rural landscape.

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