The role of societal impacts and ecosystem services in the definition of favourable conservation status

BASC
The British Association for Shooting & Conservation

1. EXECUTIVE SUMMARY

Favourable conservation status

- "Favourable conservation status" as defined by the Habitats Directive applies to habitats, plants, insects and animals of "community interest". This does not include birds.

- It is defined as maintaining the range and population of the species at least at what they were when designated. If the original population was not sustainable then it involves increasing the population to a sustainable level.

- There is no direct analogue of favourable conservation status in the birds directive.

- Settled European case law, the African-Eurasian Waterbird Agreement and the environmental liability directive make reference to conservation status of birds, equating to a de facto acceptance of favourable conservation status for birds.

Social and cultural requirements

- The birds directive, habitats directive, environmental liability directive and the African-Eurasian Waterbird Agreement all require the consideration of social, cultural and economic requirements when designating and managing protected European sites and species.

- Ecosystem services appear to be the most appropriate way of assessing social, cultural and economic impacts.

- Ecosystem services have been the subject of numerous reviews at international (Millennium Ecosystem Assessment), national (UK National Ecosystem Assessment) and habitat (Ecosystem services provided by waterbirds) levels.

Recommendations

- Societal and economic factors should be properly addressed at the time of site designation, and explicitly included in the future management of designated sites and protected species.

- Ecosystem services are the most appropriate way for considering social and economic factors.

2. FAVOURABLE CONSERVATION STATUS

2.1. Habitats directive

Favourable conservation status is clearly defined within Article 1 of the Habitats Directive (Box 1). This definition is clearly linked to those habitats, animals and plants "of community interest", listed in Annex 1 and Annex 2 of the habitats directive. These annexes do not include birds.

(e) conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2.

The conservation status of a natural habitat will be taken as "favourable" when:
- its natural range and areas it covers within that range are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable as defined in (i);

…

(i) conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;

The conservation status will be taken as "favourable" when:
- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis;

Box 1: Favourable conservation status, as defined by Article 1 of the habitats directive

The habitats directive is transposed in to UK law by the Conservation of Habitats and Species Regulations 2010, which consolidated the various amendments made to the Conservation (Natural Habitats, &c.) Regulations 1994. As with the habitats directive, these regulations are restricted to habitats, plants and animals of community interest, but do not include birds.

2.2. Favourable conservation status and birds

2.2.1. The birds directive

There is no direct comparison of favourable conservation status in the Birds Directive , but this is likely to be due to the fact that it pre-dates the Habitats Directive by 13 years. Article 4(4) of the directive establishes a similar tone (Box 2).

[1] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

Article 4

…

4. In respect of the protection areas referred to in paragraphs 1 and 2, Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article. Outside these protection areas, Member States shall also strive to avoid pollution or deterioration of habitats.

Box 2: Requirements to protect Special Protection Areas from Article 4(4) of the birds directive

It is important to note that in the view of JNCC (Jones, 2002):

> *"…favourable conservation status is best seen as a tool for determining the ecological requirements of the various bird species (e.g. the purpose of setting conservation objectives and undertaking surveillance), but the concept cannot be applied to the Birds Directive uncritically"*

There have, been several court cases which have sought to more directly impose the habitats directive definition of favourable conservation status on to the birds directive. For example, paragraph 30 of the decision in the Scots Court of Session case of **In the Petition of the RSPB and the Wildfowl and Wetlands Trust Ltd v. Secretary of State for Scotland [2000] Env. L.R. 168:**

> *"I would hold that the objective is to ensure that the conservation status of the vulnerable species is favourable. Therefore, disturbance which adversely affected the conservation status of the birds on the site would be significant. In particular disturbance should not impair the protection of the quality of the living conditions of the birds on the site and so affect their ability to maintain themselves on a long term basis as a viable component of their natural habitat."*

Furthermore, Birdlife International have released a position paper (Walicsky & Rybanic, 2006) which details their preferred methods for designating favourable conservation status of SPAs.

Much of the birds directive is transposed to UK law through the Wildlife and Countryside Act 1981 (as amended) and the Wildlife and Natural Environment Acts.

2.2.2. The African-Eurasian Waterbird Agreement

Unlike the Birds Directive, the African-Eurasian Waterbird Agreement (AEWA) recognises the maintenance of favourable conservation status as a fundamental principle (Box 3).

ARTICLE II

Fundamental Principles

1. Parties shall take co-ordinated measures to maintain migratory waterbird species in a favourable conservation status or to restore them to such a status….

Box 3: Recognition of favourable conservation status in AEWA

[2] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

2.2.3. The environmental liability directive

The Environmental Liability Directive (ELD) aims to "establish a common framework for the prevention and remedying of environmental damage" by making those that cause damage to the environment (Box 3)(including water, land and the species using the sites) financially and legally responsible.

1. 'environmental damage' means:

(a) damage to protected species and natural habitats, which is any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species. The significance of such effects is to be assessed with reference to the baseline condition, taking account of the criteria set out in Annex I;

Box 4: The definition of environmental damage from Article 2(1)(a) of the environmental liability directive

Article 2(3)(b) of the ELD explicitly defines the species and habitats protected by this directive as:

- Birds listed in annex 1 or article 4(2) of the birds directive (rare, vulnerable or regularly migrating birds)
- The habitats of those birds defined above
- The animals, insects and habitats listed in annex 1 and 2 of the habitats directive

Article 2(4)(b) then goes on to define the favourable conservation status of the protected species (same as the habitats directive), clearly including birds, thus defining favourable conservation status for birds with regards to environmental damage, and presumably, in general.

2.3. Societal impacts on conservation status

Article 2 of the birds directive (Box 4) is potentially important in the context of this report as it allows for consideration of social and cultural factors when designating SPAs.

Article 2

Member States shall take the requisite measures to maintain the population of the species referred to in Article 1 at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level.

Box 5: The need to balance populations against societal requirements from Article 2 of the birds directive

It is not clear from various EU court cases how the provisions of Article 2 (to allow consideration of social and cultural factors) can be taken in to account when designating and, to some degree, managing sites. For example, it has been argued[4,5,6,7] that "Article 2 does not constitute an autonomous derogation" from the specific aim of Article 4 of the birds directive (which lays down the requirement for designation and management of Special Protection Areas).

[3] Council Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage
[4] C-435/92 APAS v Préfets de Maine-et-Loire and de la Loire Atlantique (1994) ECR I-67, paragraph 20
[5] C-44/95 Regina v Secretary of State for the Environment, ex parte Royal Society for the Protection of Birds (Lappel Bank)(1996) ECR I-3805 paragraph 25
[6] C-355/90 Commission v Spain (Santoña marshes) (199)] ECR I-4221, paragraphs 17 & 18
[7] C-57/89 Commission v Germany (Leybucht) (1991) ECR I-883, paragraphs 20-22

2.2. Favourable conservation status and birds

2.2.1. The birds directive

Furthermore, there is a clear precedent from site designation to date to focus entirely on ecological factors, and cases which have sought to challenge this[8,9,10] have specifically ruled against the consideration of economic or recreational factors when designating SPAs.

Annex 1 of the ELD (Box 5) allows for societal factors when assessing impacts on conservation status, with an apparent particular focus on ecosystem services. This is a departure from the rather more strict definition laid down by the habitats directive. However, there is no evidence that this has led to

ANNEX I
CRITERIA REFERRED TO IN ARTICLE 2(1)(A)

The significance of any damage that has adverse effects on reaching or maintaining the favourable conservation status of habitats or species has to be assessed by reference to the conservation status at the time of the damage, the services provided by the amenities they produce and their capacity for natural regeneration. Significant adverse changes to the baseline condition should be determined by means of measurable data such as:

- the number of individuals, their density or the area covered,
- the role of the particular individuals or of the damaged area in relation to the species or to the habitat conservation, the rarity of the species or habitat (assessed at local, regional and higher level including at Community level),
- …

Box 6: The need to consider societal impacts when assessing environmental damage from Annex 1 of the environmental liability directive (emphasis added)

AEWA also recognises the importance of birds to society in the agreement's preamble (Box 7).

…
AWARE of the economic, social, cultural and recreational benefits accruing from the taking of certain species of migratory waterbirds and of the environmental, ecological, genetic, scientific, aesthetic, recreational, cultural, educational, social and economic values of waterbirds in general;

CONVINCED that any taking of migratory waterbirds must be conducted on a sustainable basis, taking into account the conservation status of the species concerned over their entire range as well as their biological characteristics

Box 7: Preamble to the African-Eurasian Waterbird Agreement)

[8] C-3/96 Commission v Netherlands (Dutch IBAs)(1998) ECR I-3031, paragraph 59
[9] C-247/85 Opinion of Mr Advocate General Cruz Vilaça delivered on 2 December 1986. Commission of the European Communities v Kingdom of Belgium. Failure to comply with a directive - Conservation of wild birds.
[10] C-378/01 Commission v Italian Republic (2003), ECR I – 2864 paragraph 15

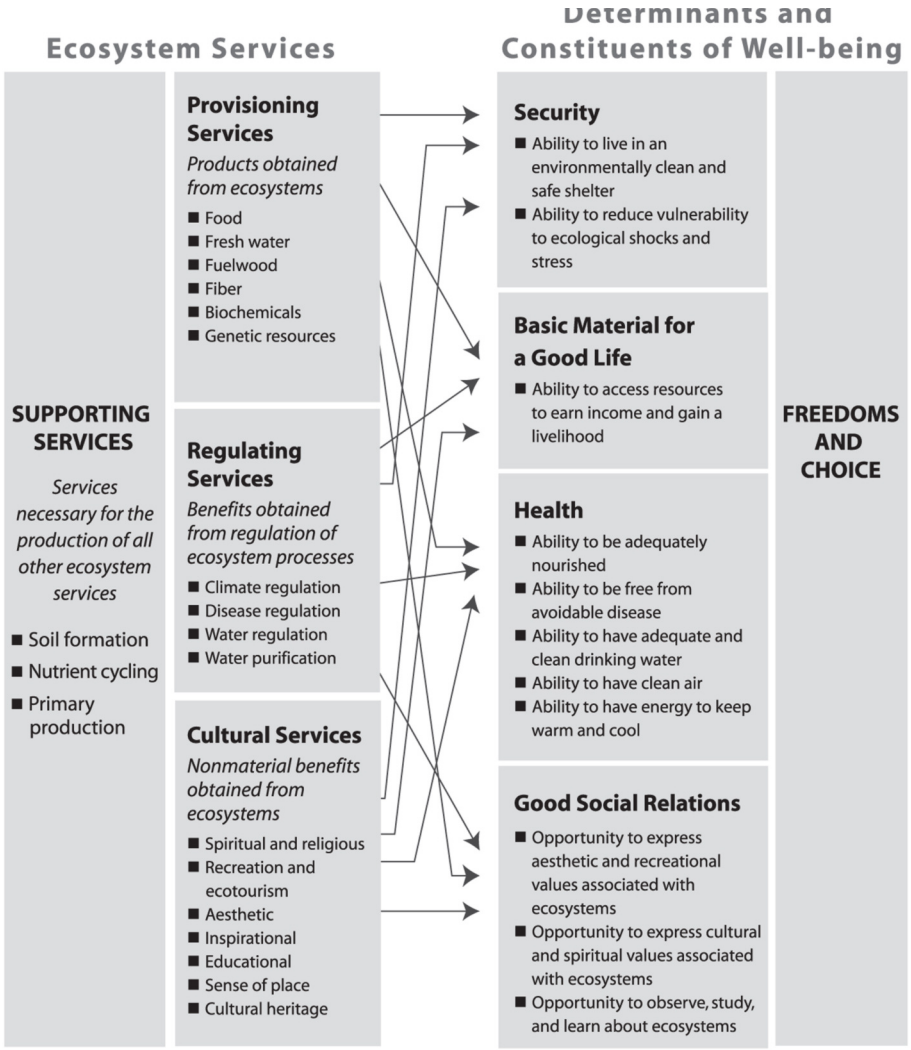
3. ECOSYSTEM SERVICES

The three directives discussed thus far (birds directive, habitats directive and environmental liability directive) and AEWA allow, to differing degrees, the consideration of societal impacts when designating and monitoring protected areas and species. The ELD most clearly states this by allowing for consideration of "the services provided by the amenities they produce". This is very similar to the accepted definition of ecosystem services, as defined by the Millennium Ecosystem Assessment (MA)(World Resources Institute, 2003):

> *"Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth."*

The MA identified supporting, provisioning, regulating and cultural services as the four key categories of ecosystem services (Figure 1). These were used in the more recent UK National Ecosystem Assessment (NEA)(UK National Ecosystem Assessment, 2011), and in a subsequent paper that focused on the ecosystem services provided by waterbirds (Green & Elmberg, 2013).

Figure 1: Definition and interrelatedness of the four key categories of ecosystem services (Figure 1 from World Resources Institute, 2003)



Green & Elmberg (2013) identified the difficulties in applying these four categories to species (rather than ecosystems), as, for example, hunting of wildfowl is both a provisioning service (providing meat and feathers), but also a cultural service (providing both recreational and spiritual value). They do however go on to list a number of evidenced ecosystem services based on each of the four key categories (Table 1). These services are, with some qualification, likely to be applicable to other birds.

Table 1: Selected examples of ecosystem services provided by waterbirds (From Table 1 of Green & Elmberg, 2013)

Table 1. Selected examples of ecosystem services provided by waterbirds

Category	Ecosystem service	Waterbird taxon	References
Provisioning	Meat	Anatidae	Krcmar *et al*. (2010)
	Down	Common eider, geese	Sveinsson 2013; and Kear (1990)
	Feathers for clothing and ornaments	Anatidae, herons, others	Green & Figuerola (2005) and Frisch *et al*. (2007)
	Grease for waterproofing	Geese	MacMillan & Leader-Williams (2008)
Supporting	Animal propagule dispersal	Anatidae, coots	Green & Figuerola (2005) and Frisch *et al*. (2007)
	Plant propagule dispersal	Anatidae, shorebirds	Green *et al*. (2002*b*), Klein *et al*. (2008) and Brochet *et al*. (2009)
	Nutrient cycling	Geese, cormorants	(Iacobelli & Jefferies, 1991), Gauthier *et al*. (2006) and Kameda *et al*. (2006)
	Stimulating primary productivity	Geese	(Cargill & Jefferies, 1984), Bazely & Jefferies (1985) and Nolet (2004)
	Stimulating decomposition	Ducks	Bird *et al*. (2000) and van Groenigen *et al*. (2003)
	Reduction of methane production	Swans	Bodelier *et al*. (2006)
	Plant diversity	Anatidae	Maron *et al*. (2006), Jasmin *et al*. (2008) and Hidding *et al*. (2010)
	Animal diversity	Anatidae, others	Fabricius & Norgren (1987) and Georgiev *et al*. (2005, 2007)
	Protection from predators	Geese	Fabricius & Norgren (1987) and Allard & Gilchrist (2002)
	Bioindicators of plants	Anatidae, coots	Elmberg *et al*. (1993), Wicker & Endres (1995) and Green *et al*. (2002*a*)
	Bioindicators of animals	Anatidae	Elmberg *et al*. (1993, 2010) and Gunnarsson *et al*. (2004)
	Bioindicators of nutrients/contaminants	Herons, grebes, ducks	Fasola *et al*. (1998), Nummi *et al*. (2000) and Burger & Eichhorst (2007)
Regulating	Pest control	Ducks	Hamilton *et al*. (1994), Teo (2001) and Miles *et al*. (2002)
	Disease surveillance	Ducks	Munster *et al*. (2005), Wallensten *et al*. (2007) and Ziegler *et al*. (2010)
	Regime shifts of wetlands	Cormorants	Leah *et al*. (1980) and Dirksen *et al*. (1995)
Cultural	Recreational hunting	Anatidae	Losey & Vaughan (2006), Grado *et al*. (2011) and Withey & van Kooten (2011)
	Birdwatching	Geese	MacMillan & Leader-Williams (2008)
	Ecotourism	Geese	Edgell & Williams (1992)
	Conservation flagships	Anatidae, flamingoes	Kear (1990) and Galicia & Baldassarre (1997)
	Art	Flamingoes, others	Mas (2000) and Arnott (2007)

'Category' refers to the standard classification as outlined by the Millennium Ecosystem Assessment (2005). A maximum of three references is given per example. The waterbird taxa correspond to the studies cited, other taxa are also likely to provide the same service.

The focus of the following sections will be the UK ecosystem. Where possible it will draw on published work, but this is a large and still relatively young field, so some of the more obvious ecosystem services are poorly studied. Therefore much will be based on supposition. The aim of the following sections is to identify ecosystem services, but not to attempt to value them.

3.1. Supporting

Supporting services are necessary for the production of all other ecosystem services, but they can be difficult to identify as they are often the result of complex ecological interactions (for example providing clean water). Often the difference between a supporting and a regulating service is the time scale over which it acts, with supporting services acting over lifetimes whereas regulating services tend to be day-to-day (World Resources Institute, 2003).

Green & Elmberg (2013) identified many supporting services provided by waterbirds, most of which are applicable to birds in general. Some of the more prosaic services identified include nutrient cycling, stimulating primary productivity, and decomposition, and reducing methane production. Often these services are provided as a by-product of normal feeding and foraging behaviour, for example, nitrogen deposition on grasslands, and aeration of leaf litter and humus whilst feeding.

Animal and plant propagule dispersal are two services that clearly apply across a range of bird taxa. For example, the dispersal of many trees (such as oak, holly, cherry and yew) is greatly enhanced by birds inadvertently transporting propagules. Furthermore, birds can accidentally transport small terrestrial and aquatic organisms over large distances.

The planting and managing of woodlands, hedgerows, moorlands and wetlands contribute to plant, animal and bird diversity, and as such could be considered a supporting service (though arguably they provide a regulating service as well). That these areas are often planted and managed in order to supply a huntable surplus is secondary, in this context, to the direct provision of habitat (gapping hedges, planting copses etc), and the complementary increase in bird diversity as a result.

3.2. Regulating

Regulating services are the services that aspects of an ecosystem produce through regulation. Although this can appear a slightly circular definition it includes services such as pollination and pest and disease regulation. For waterbirds Green & Elmberg (2013) identified pest control, disease surveillance and regime shift of wetlands. These three categories can be expanded to include all birds, for example, the role of birds in controlling invertebrate agricultural pests and human pests such as mice and mosquitoes.

The role of birds in habitat regulation is easy to imagine, but difficult to evidence. Green & Elmberg identified the role of cormorants in regulating small freshwater habitats and there is evidence for the effect of geese on arctic habitats (Abraham, Jefferies, & Alisauskas, 2005; Samelius & Alisauskas, 2009) as well as Scottish machair habitat (Walton & Mackenzie, 2009).

Carbon capture and sequestration are further examples of regulating services that can be linked to the management of habitat for birds. For example, the management of upland areas of moor for grouse, or lowland wetlands for waders and waterfowl will allow for the sequestration of an as yet unknown quantity of carbon in the acidic soils often associated with these habitats. Furthermore, woodlands, copses and hedgerows planted to enhance game shooting will allow for carbon capture.

3.3. Provisioning

Provisioning services are the goods that people can obtain from an ecosystem. Clearly the most obvious provisioning service provided by birds is that of providing meat. At least 400,000 grouse are shot each year (PACEC, 2006) along with at least 150,000 woodcock and 100-150,000 woodpigeon (Murray & Simcox, 2003). Furthermore, several thousands of teal, wigeon and mallard and at least 30,000 geese are shot each year on the coast (Murray &

Simcox, 2003). Many of these will be eaten by the shooter (especially in the case of coastal birds), with the remainder being sold to local sources and game dealers.

There are several ways of assessing the worth of this service, for example the value of the game meat to the hunter when sold to a game dealer, the value of the meat to the game dealer when sold along the food chain, the cumulative value of the meat along the length of the food chain, or the avoided cost to the hunter (ie the money saved by not having to purchase an equivalent portion of meat).

Feathers still have a number of uses in this country including fly-tying, millinery, decoration, and painting (woodcock pin feathers). There are no published figures on the scale of these activities.

It could be argued that the sale of bird shooting rights represents a provisioning service, though the shooting itself is a cultural service. There is no information on the scale of the sale of shooting rights, but shooting takes place on 15 million hectares (PACEC, 2006). The majority of this land will be shot over under informal agreements with a minority of mostly large shoots renting or buying shooting rights. A recent survey of large shoot providers that sell shooting days found that 44% lease their shooting rights (Horne & Thomas, 2013).

3.4. Cultural

There is little to add to the list provided by Green & Elmberg (2013), which included recreational hunting, bird watching, other forms of bird related ecotourism, conservation flagships and art. There is potential for overlap between these services, for example Scottish geese provide hunting, bird watching and conservation flagship services, and in many other instances, the designation of a bird species as a conservation flagship tends to increase its ecotourism value.

Teasing apart the value of the cultural service that is the ability to go hunting is complicated and includes facets such as enjoyment, comradeship and physical and psychological wellbeing. The expectation is that the value of these services is at least equal to the minimum expenditure by hunters necessary to hunt (for example maintaining a gun, feeding a dog, buying shooting days etc), otherwise there would be no motivation to hunt.

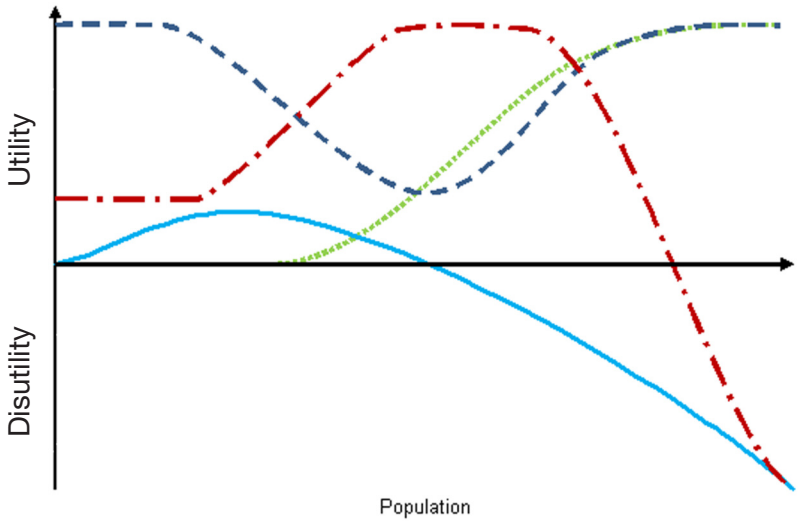
A study in Scotland in 1997 (Sankey & Shedden, 1998) found that goose watching and shooting contributed £5.4 million per year to the local economy, of which £3.6 million (approximately £5.5 million when adjusted for inflation up to 2012) could be directly attributed to the presence of the geese themselves. This compares with a total expenditure by shooters of £2 billion per year on goods and services (PACEC, 2006) across the whole of the UK. With an estimated 480,000 live quarry shooters in the UK this equates to an average expenditure of £4,000 per year per shooter. Obviously this average hides a large range.

4. CONFLICT

It can be difficult to place an economic or ecological value on ecosystem services, and this can lead to conflict. For example, the direct economic benefits of building a new port are relatively easy to assess in terms of jobs and goods provided. Whereas the benefits derived from the land without a port are considerably more difficult to quantify. These can consist of explicit economic benefits such as the income derived from tourism and lease of land to wildfowling clubs, implicit economic benefits such as avoided costs (eg the lack of a need for a water treatment plant due to the natural waste treatment ability of a wetland), and other non-economic ecosystem services (such as carbon sequestration). Similar scenarios can be constructed around inland developments such as infrastructure and housing.

Understanding how these various services fit together and are valued can be complicated, especially in light of the different expectations of various stakeholder groups. For example, the expectations of farmers and ecologists are likely to differ when it comes to species that damage crops. In these instances graphs such as Figure 2 can be helpful.

Figure 2: A conceptual graph to demonstrate how the perceptions of a species utility can vary with population size and stakeholder point of view



Ecology – There is some utility to all species, even at low population levels (eg. The ecosystem services conducted by that species). The utility increases as the species population increases, up to a point. At some point the population begins to saturate the environment, at which point its utility does not increase, and beyond this point it can provide a disutility as the population size degrades the environment.

Bird watching – There is a utility associated with rare species (eg. Rare vagrants), but as the population increases the perceived utility decreases (eg. Blackbirds). At higher population levels the utility increases once again as spectacle of observing large flocks increases (eg. Geese)

Farming – There is a limited utility attached to any population size due to the inherent ecosystem services of most species (pest control etc). However, above a certain population size the species begins to cause damage and becomes a disutility.

Hunting – At low populations there is little or no opportunity to hunt and so the species provides little or no utility. However, as the population increases, so does the opportunity to hunt and therefore the species utility. Above a certain threshold the increasing population provides no further utility as it saturates the hunters ability to hunt them.

5. DISCUSSION

Article 4 of the Birds Directive requires member states to protect species by designating Special Protection Areas (SPA) for sites which hold significant proportions of species of community interest, and Article 2 allows for consideration of societal and economic factors. However, it has not been possible to find an instance where these factors have been allowed to influence decisions at the designation stage. This demonstrates the importance of protection (ecological factors) at the time of designation at the cost of societal and economic factors.

The population level of a species when a site is designated is often taken to mean its favourable conservation status (FCS), at that site. If the population is declining or unstable then a greater threshold may be set which will allow the population to stabilise and maintain itself in the long term. Conservation objectives are then set to allow the population to grow or maintain its current level (ie to achieve or maintain FCS). Once this target has been met there is no common agreed course of action, and the default to date has been to allow the population to continue growing. However, clearly this cannot continue indefinitely as the most numerous, aggressive or adaptable species (probably already in FCS) will begin to degrade the environment at the expense of rarer, submissive or less flexible species (probably unable to achieve FCS, or heading towards unfavourable conservation status). This process is beginning to occur at some sites, for example, the Fédération Nationale des Chasseurs (FNC: French national hunting association) are seeking to control the population growth of migratory greylag geese, and SNH are trying to halve the population of resident greylag geese on Orkney in Scotland as both populations are causing damage to agriculture and may be impacting on other species. Contrary to this is the recent decision by the Netherlands to prioritise a large wintering population of migratory geese over the economic damage to farms (€17 million per year in 2010)(van Bommel & van der Have, 2010), environmental damage to protected areas and the loss of shooting for the country's hunters by banning the shooting of wintering geese.

Based on the successes of site designation in the last decades it is now apparent that it is at the management stage, especially for species already in FCS and continuing to grow, that it will be necessary to take account of societal, environmental and economic factors. At this point a thorough understanding of the ecosystem services provided by the individual species will be an invaluable tool in deciding which actions to take. There is currently no explicit recognition of this, and there is little data available on the comparative ecosystem services provided by individual species.

BASC believes that societal and economic factors should be properly addressed at the point of site designation, and going forward with future management of species.

6. REFERENCES

Abraham, K. F., Jefferies, R. L., & Alisauskas, R. T. (2005). The dynamics of landscape change and snow geese in mid-continent North America. Global Change Biology, 11(6), 841–855(15). Retrieved from http://www.ingentaconnect.com/search/expand?pub=infobike://bsc/gcb/2005/00000011/00000006/art00001

Green, A. J., & Elmberg, J. (2013). Ecosystem services provided by waterbirds. *Biological reviews of the Cambridge Philosophical Society*. doi:10.1111/brv.12045

Horne, J., & Thomas, R. (2013). Fair Game 2013. *The Game Shooting and Fishing Census.*

Jones, W. (2002). *EC Habitats directive: Favourable conservation status. JNCC Committee Meeting December 2002. JNCC 02 D07.*

Murray, M., & Simcox, H. (2003). *Use of wild living resources in the United Kingdom - a review*.

PACEC. (2006). The economic and environmental impacts of sporting shooting. Cambrindge: PACEC.

Samelius, G., & Alisauskas, R. (2009). Habitat alteration by geese at a large arctic goose colony: consequences for lemmings and voles. *Canadian Journal of Zoology*, 87(1), 95–101. Retrieved from http://www.ingentaconnect.com/content/nrc/cjz/2009/00000087/00000001/art00011

Sankey, S., & Shedden, C. (1998). Geese and Local Economies in Scotland. *A Report to the National Goose Forum*. Edinburgh & Dunkeld.

UK National Ecosystem Assessment. (2011). *The UK National Ecosystem Assessment Technical Report*. Cambridge. Retrieved from http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx

Van Bommel, F., & van der Have, T. (2010). Toenemende aantallen ganzen, toenemende kosten? *De Levende Natur*, 111(1), 22–24.

Walicsky, Z., & Rybanic, R. (2006). Position paper of the Birds and Habitats Directives Task Force on the Favourable Conservation Status of Special Protection Areas (SPAs).

Walton, P., & Mackenzie, I. (2009). The conservation of Scottish Machair : A new approach addressing multiple threats simultaneously, in partnership with crofters. *The Glasgow Naturalist*, 25(Supplement), 25–28.

World Resources Institute. (2003). *Ecosystems and human well-being : a framework for assessment. A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment.* Island Press. Retrieved from http://www.unep.org/maweb/en/Framework.aspx

The British Association for Shooting and Conservation
Marford Mill, Rossett, Wrexham LL12 0HL
Tel: 01244 573 000
Fax: 01244 573 001
Email: enq@basc.org.uk
www.basc.org.uk

Front cover image by Northeastwildlife.co.uk