Chancellor, R. D. & B.-U. Meyburg eds. 2004
Raptors Worldwide
WWGBP/MME

# Conflicts in Raptor Conservation: an overview

Beatriz Arroyo, Steve Redpath and Javier Viñuela

## INTRODUCTION

Throughout the world, raptor populations have declined and species have become threatened as a result of human activities. Consequently, these activities often bring into conflict different sectors of society that have opposing views about priorities. Thus there are conflicts between those who wish to maintain healthy, viable populations of raptors and those who may be more concerned with deriving economic returns either from the habitats on which raptors depend, the prey which the raptors eat, or indeed from exploitation of the raptors themselves. This paper briefly reviews the main areas of conflict and considers how best we can manage these conflicts and move forward.

## WHAT IS THE GOAL?

Before detailing the types of conflicts between raptor conservation and human activities, it should be emphasised that conflicts may also arise because different sectors of society define the objectives of raptor conservation differently. Some people may think that the objective of raptor conservation is to maintain sustainable raptor populations, others may wish to aim for maximum population sizes, or yet to achieve a given population size. Aims may also focus on local (i.e. population) or international (i.e. species) priorities. Agreement on the goals (by evaluating the pros and cons of each objective) would help reach agreement on the means to achieve them, but such an evaluation is beyond the purpose of this paper and, furthermore, raptor conservation goals may differ among different situations. For the purposes of this paper we consider the goal of raptor conservation to be to maintain viable and sustainable raptor populations.

## LAND USE AND RAPTOR CONSERVATION

The largest and most challenging conflicts concerning raptor conservation arise over land use. At a national and international scale, the economic

pressures for exploitation are often so great that the costs to raptors and biodiversity in general are ignored, despite international treaties and pressure. The world's natural habitats continue to be lost and fragmented either as a result of the exploitation of those natural resources or to make way for alternate forms of land use such as agriculture (Meyer & Turner 1994). Unsurprisingly, this loss of habitats has had a dramatic impact on raptors that depend on them (Thompson *et al.* 2003). Whether it be forest, prairie or grassland, the loss of habitat has been quoted as the main reason for the decline of raptors in tropical areas (Brandl *et al.* 1985; Bierregaard 1998; Thiollay 1993, 1996, 1998, 2001), and elsewhere (Bosakowski *et al.* 1996; Akçakaya & Raphael 1998; Clayton *et al.* 1999; Carrete *et al.* 2002; Thompson *et al.* 2003). Of the 29 most vulnerable diurnal European raptors, 27 are still adversely affected by habitat loss and fragmentation (Stroud 2003).

Loss of certain habitat types may also be related to an impoverishment of food supply critical for the maintenance of healthy raptor populations. For example, in western France, a loss of pasture and fodder crops since the 1970s (transformed mainly into cereal and rape-seed crops) has been associated with a decrease in the overall abundance of voles *Microtus arvalis* in the same area, the main food supply of Montagu's Harriers *Circus pygargus*. This decline has also coincided with an overall decline in maximum densities of Montagu's Harriers (Butet & Leroux 2001; Arroyo *et al.* 2003). Similarly, a steep decline in Hen Harrier *C. cyaneus* in Orkney, UK, since the 1970s has coincided with the virtual disappearance of rough grass in the area, habitat favoured by the main local prey of harriers (Amar *et al.* 2003 a,b).

Even when the overall availability of given habitats is not an issue, the way those habitats are managed also has an influence on raptors. For example, intensification of agriculture, such as the increased use of pesticides, has had and still has a significant impact on many raptors. Well known is the impact that the use of DDT had on many raptor populations in the 1950s and 1960s (Newton 1979; Ratcliffe 1993). Today, even though the use of chemicals may not be having such a drastic direct effect on raptors (although see Oaks *et al.* 2004), declines in populations of many insect and bird species living in farmland on which raptors depend are thought, at least in part, to be a result of the intensive use of pesticides (Pain & Pienkowski 1997; Newton 1998; Donald *et al.* 2000). The clearest examples of how agriculture intensification has an impact on raptor populations come from the two raptor species most typical of agricultural habitats: Lesser Kestrel *Falco naumannii* and Montagu's Harrier. Lesser Kestrels in intensively cultivated areas had larger home ranges than in those with traditional systems, differences that were due to differences in prey availability between areas, and which were reflected in productivity and population trends (Tella *et al.* 1998). In the case of Montagu's Harrier, the use of increasingly powerful combine harvesters and earlier varieties of cereal has advanced harvest time in many areas. A recent analyses showed that 60% of nestlings in areas of France and Spain (the strongholds for that species in western Europe) are now unfledged at harvest time and would die to the harvesters in the absence of conservation measures, which would make populations unsustainable (Arroyo *et al.* 2002). Technological advancements may also conflict with the maintenance of raptor populations, even in situations

when the quality of habitat is not affected. For example, the implementation of wind-farms as a form of alternative energy sources may create problems for some raptor species (de Lucas, this volume).

Furthermore, the spatial patterns of habitat will influence a wide range of demographic processes. For example, Redpath (1995) showed that Tawny Owls *Strix aluco* breeding in fragmented forest were at lower breeding density and had higher turnover and lower breeding success than owls in larger forests. Northern Spotted Owls *Strix occidentalis caulina* reproductive output was also associated to the level of interspersion of older forest with other vegetation types (Franklin *et al.* 2000).

Because of the economic pressure associated with land use issues, the principal way to safeguard natural habitats and their related raptors has been either through national legislation to protect areas, such as National Parks, or through conservation organisations buying areas of land which they manage for biodiversity. In North America, for example, the Endangered Species Act has helped safeguard areas for endangered raptors, such as the Northern Spotted Owl *Strix occidentalis* (Franzreb 1993; Gutiérrez this volume). However, legislation alone is insufficient to ensure a favourable conservation status for raptors (Stroud 2003). Additionally, and because of the influence of spatial habitat patterns on demography, even with legislation in place, the size and distribution of protected areas will be crucial in determining the long-term viability of raptor populations, and in some cases (particularly when dealing with predators with large home ranges) population viability will depend largely on what happens outside protected areas (Linnell *et al.* 2001). A thorough discussion about whether it is best to implement management through reserves or through extensive alteration of habitat management practices is thus critical.

Finally, because not all raptor species have the same habitat requirements, conflicts may also arise in relation to which species to benefit. For example, when forests are cut down, forest species suffer (e.g. Widen 1997). In contrast, increased forest cover negatively affected Golden Eagle *Aquila chrysaetos* productivity (Whitfield *et al.* 2001). It is thus also important to discuss whether raptor conservation should be tackled at the single species or at the broader, ecosystem-based level (Simberloff 1998; Sergio *et al.* 2003), particularly in those cases when raptor conservation depends mainly on land use choices.

## COMPETITION FOR SHARED RESOURCES

Raptor conservation may also conflict with other interests, when raptors are viewed as competitors of shared resources, such as livestock or game. Among hunters, raptors have traditionally been considered as a limiting factor for gamebird populations, and have been killed to protect game until their legal protection in the 1970s . Raptor culling for game interests had a strong impact on raptor populations in the middle of the 20$^{th}$ century (Newton 1998). Currently, conflicts between raptors and gamebird interests are not widespread across the world, but still occur particularly when the economic interest of hunting is strong (Martínez *et al.* 2002). Furthermore, where they occur they can be very contentious. For example, the illegal use of poison to eliminate foxes and corvids for game interests has an enormous impact on scavenging

raptors, and this has been identified as a critical conservation issue for raptors in the Iberian Peninsula, as well as other countries (Mañosa 2002; Whitfield *et al.* 2003). Poisoning has affected both numbers and distribution of wintering Red Kites *Milvus milvus* in Spain, affecting European numbers as a whole (Viñuela & Villafuerte 2003). Similarly, raptor culling is still important in the UK in areas where Red Grouse *Lagopus lagopus scoticus* driven shooting is the main economic resource of the area (Etheridge *et al.* 1997; Holmes *et al.* 2003). Similar conflicts arise when large raptors prey upon livestock (Davies 1994; Marquiss *et al.* 2003) and when hawks and falcons prey upon racing pigeons (Shawyer *et al.* 2003).

The extent to which the impact of raptors has a material cost varies enormously between systems. Whilst stakeholders may commonly complain that raptors have a large effect on their stock, the level of the conflicts may be real or only perceived. For example, the perception by grouse managers that raptors can, in some circumstances, reduce the size of the grouse harvest has been supported by recent research (Redpath & Thirgood 1997, 1999; Thirgood *et al.* 2000a, 2000b). This work strongly suggested that high densities of Hen Harriers and Peregrine Falcons *Falco peregrinus* can limit grouse populations at low density and reduce shooting bags. Grouse densities of >60 grouse per sq.km are required for driven shooting (where hunters stand in blinds while the grouse are driven overhead by lines of human beaters). Driven grouse shooting generates the greatest income for grouse moor owners, so high densities of raptors may lead to significant loss of income and potentially a change in land use and loss of moorland habitat.

In another example, the perception by shepherds that predation by White-tailed Eagles *Haliaeetus albicilla* on lambs causes considerable economic loss is less strongly supported by data. A recent study by Marquiss *et al.* (2003) showed that there was great variation between eagles in how many lambs they ate, and that most lambs eaten were scavenged rather than killed by the eagles. The number of lambs killed was small compared to losses from other causes, and the problem of predation was limited to a few pairs, rather than being widespread in the species (Marquiss *et al.* 2003).

In contrast, scientific evidence that raptors affect populations of gamebirds in lowland habitats is lacking , particularly in southern Europe, and the perception that raptor predation has caused the decline of many species of songbirds in the UK has not been supported by the scientific evidence (Newton *et al* 1997; Thomson *et al.* 1998).

## RAPTORS AS A NATURAL RESOURCE

The last area of conflict we consider is in relation to varying perceptions of raptors as a natural resource. Some sectors of society consider them a renewable harvestable resource (Kenward *et al.* 1991), whereas others consider them as an untouchable wildlife asset, and thus view raptor harvesting as totally unacceptable . Such a conflict is particularly marked in relation to some falconry issues. Falconry has contributed to conservation of raptor populations (Kenward 1977; Hartley 2000). For example, falconers were essential in the recovery of Peregrines and other raptors in the USA and other countries (Cade

*et al.* 1988). However, harvesting raptor eggs, nestlings or adults for falconry purposes may sometimes be performed in unsustainable ways. Trapping for falconry is considered as a conservation issue for some raptor species (Brücher 1993; Gaucher *et al.* 1995; Li *et al.* 2000). Barton (2000) estimated 1,900 falcons caught per year in the United Arab Emirates. The impact of this removal on raptor populations is difficult to measure, but it is likely to be greater when adults rather than chicks are removed (Conway *et al.* 1995).

Raptors may also be considered as a huntable resource. Despite being protected by law, raptor hunting in some areas is still an important "sport", and it is proving almost impossible to control or eliminate, due to the important locally social acceptance of such an activity. For example, in Georgia, the mortality of migratory raptors resulting directly from hunting and trapping ranges between 1,500 and 3,000 birds during the autumn migration (Van Maanen *et al.* 2001). Malta is another well-known spot where hunting of raptors is extremely important. BBC Wildlife reported that, in one instance, Maltese customs seized 23 Steppe Eagles *Aquila nipalensis*, nine Ospreys *Pandion haliaetus* and 11 Eagle Owls *Bubo bubo* (Birdlife Malta 2003).

## WAYS FORWARD

How can we most effectively conserve viable populations of raptors threatened by human activities? An initial response is often to rely on legislation but, as we discuss below, this is, in certain circumstances, ineffective. We consider there to be four main components to the successful management of conflicts: science, dialogue, legislation and pragmatism. We consider each of these in turn below.

As an overall framework, the management of conflict should ideally include a clear identification and understanding of the conflict, and the design, implementation and monitoring of various resolution measures. Within this framework, the role of science is paramount. Well designed, objective and rigorous studies can provide clear information on all the ecological aspects of the conflict. Thus surveys, observational and experimental studies can provide information on raptor population trends and status; the extent of the threat to raptor populations; the requirements for viable populations, and the effectiveness of alternative mitigation strategies. However, science in itself cannot resolve conflicts. Sometimes the science is ignored, or considered biased if it is done by one group of stakeholders such as conservation biologists, and in such cases original positions may be maintained and defended. In some instances, especially where large-scale, randomised experiments are unfeasible, the science delivers ambiguous results and stakeholders argue over the interpretation of the data and focus on aspects of the research that support their argument.

Dialogue between stakeholders is vital to manage conflicts effectively. It is increasingly recognized that stakeholders must be involved in decision-making, especially when decisions affect the economic or social well-being of local people (Western & Wright 1994; Hulme & Murphree 2001). Dialogue is necessary to understand what the drivers of the conflict are, so that appropriate mitigation measures can be considered. Dialogue helps build partnerships and move personal positions, and dialogue between scientists and stakeholders is

also critical for exchanging information and thus improving the understanding of the conflict. Ideally, stakeholders should be involved in discussions from the outset. Previous studies of raptor impacts on game or livestock, such as Redpath & Thirgood (1997), and Marquiss *et al.* (2003) were driven by ecological science and did not consult with stakeholders to explicitly agree on the criteria by which an impact of raptors on their prey populations might be demonstrated unequivocally. This latter approach is important in developing relevant science to address the key issues and to ensure that the results are accepted by stakeholders.

Legislation is obviously important to protect raptors and their habitats. As specified above, it has been important in protecting some raptor species from detrimental effects from human activities, particularly in those cases where raptors have no direct material impact on humans. However, when raptors do have a material impact on humans, and raptors are killed because of their perceived material impact, legislation alone may be totally ineffective. In the UK, there is a high level of legal protection for raptors and yet for those species perceived as a concern by other stakeholders, illegal control is still rife (Holmes *et al.* 2003). In such cases, legislation needs to be supported by programmes that address and hopefully reduce the causes of conflict (Stroud 2003). In such instances, there will be great benefits in bringing all parties to work together to look at the full range of solutions and this is where pragmatism is vital. If the goal is to maintain viable and sustainable raptor populations then mitigation options need to be considered openly and objectively, and the one most likely to achieve the goals accepted. Such options will inevitably involve issues that may be uncomfortable to certain groups of stakeholders, such as harsher penalties for those breaking the law, or allowing the legal control of raptors. The benefits of considering all options openly with stakeholders are potentially great, as all would become involved in the process of developing solutions

Ultimately, some conflicts arise through differences in perceptions as to how nature conservation in general, and raptor conservation in particular, should be best achieved. Should we consider that raptors (like other predators) should be managed (and thus management plans including optimal population sizes etc. to be drawn up), or preserved (and simply aim for carrying capacity)? Discussion among raptor conservationists is needed to focus on the best way of achieving the most healthy populations possible into the future. As specified above, an important first step is to agree a common goal, whether that is the conservation of viable populations, the conservation of ecologically healthy populations, or the preservation of populations. Clarity in the goal will help in negotiations with other groups of stakeholders and a degree of flexibility and pragmatism, provided it does not jeopardise the goal, is likely to increase the likelihood of achieving a management solution.

So, what should be done in situations where raptors do have a material impact on resources shared with humans? A good example of such a situation is the conflict between harriers and grouse (see above, Thirgood *et al.* 2000c). Persecution of harriers is rife throughout upland Britain, even in areas where harriers could be expected to have little impact on grouse. Two reasons for the

degree of illegal control are likely; first harriers are perceived as a threat to grouse stocks everywhere and second, whilst many keepers claim they would be happy with low densities of harriers on their grouse moor, they fear that leaving one or two pairs will attract conservationists and thus lead to increased harrier populations and the demise of the grouse moor. A consequence of this is that grouse managers favour active control of harriers whereas raptor conservationists favour stronger protection measures for harriers and pressure to change land management practices (Redpath *et al.* 2004). A forum has recently been established to aid discussion between stakeholders, and one of numerous possible solutions has been tested (Galbraith *et al.* 2003). However, the degree of polarisation between the two key stakeholder groups suggests that a consensus is a long way off being achieved, without some flexibility from both sides. For raptor conservationists this raises the question of whether it is better to strengthen the legal protection of harriers, or to consider some form of management and work more actively with land managers and grouse hunters. Clearly, this raises a number of legal, historical and moral issues which we have not the space to go into here. However, ultimately the issue must be which approach will lead to a healthy, more viable and well distributed harrier population? This is one specific, well studied conflict, but the issues it raises are general and often challenging. However, to achieve goals, all stakeholders have to rise to those challenges and openly consider the best approaches that will lead to healthy and more viable raptor populations.

## REFERENCES


**AKÇAKAYA, H.R. & M.G. RAPHAEL 1998**. Assessing human impact despite uncertainty; viability of the northern spotted owl metapopulation in the northwetern USA. *Biodiversity and Conservation* 7:875-894.

**AMAR, A, S. REDPATH & S. THIRGOOD 2003a**. Evidence for food limitation in the declining hen harrier population on the Orkney Islands, Scotland. *Biol Conserv* 111: 377-384

**AMAR, A, S. REDPATH, X. LAMBIN & E. MEEK 2003b**. Could the hen harrier (*Circus cyaneus*) decline in Orkney be due to a shortage of food? In: Thompson, DBA, Redpath, SM, Fielding AH, Marquiss, M. & Galbraith CA (Eds.). *Birds of prey in a changing environment*. The Stationery Office, Edinburgh. Pp: 377-391.

**ARROYO, B.E., V. BRETAGNOLLE & J. T. GARCIA 2003.** Land use, agricultural practices and conservation of Montagu's Harrier. *In:* Thompson, DBA, Redpath, SM, Fielding AH, Marquiss, M. & Galbraith CA (Eds.). *Birds of prey in a changing environment*. The Stationery Office, Edinburgh. Pp: 449-463.

**ARROYO, B.E., J.T. GARCIA & V. BRETAGNOLLE 2002.** Conservation of the Montagu's Harrier (*Circus pygargus*) in agricultural areas. *Anim. Conserv.* 5: 283-290.

**BARTON, N.W.H. 2000.** Trapping estimates for Saker and Peregrine Falcons used for falconry in the United Arab Emirates. *J Raptor Res* 34: 53-55

**BIERREGAARD, R.O. 1998.** Conservation status of birds of prey in the South American tropics. *J Raptor Res* 32: 19-27 Birdlife Malta. 2003. www.birdlifemalta.org - press releases

**BOSAKOWSKI, T., R. SPEISER, D.G. SMITH & L.J. NILES 1993**. Loss of Cooper's hawk nesting habitat to suburban development: inadequate protection for a state-endangered species. *J Raptor Res* 27:26-30.

**BRANDL, R., H. UTSCHICK & K. SCHMIDKE 1985.** Raptors and land-use systems in southern Africa. *African Journal of Ecology* 23:11-20.

**BRÜCHER, H. 1993.** Illegal trade in birds of prey: a growing problem between eastern and western Europe. *Ring* 15:49-52.

**BUTET, A. & A.B.A. LEROUX 2001.** Effects of agriculture development on vole dynamics and conservation of Montagu's harrier in western French wetlands. *Biological Conservation* 100:289-295.

**CADE, T.J., J.H. ENDERSON, C.F. THELLANDER & C.M. WHITE 1988.** *Peregrine falcon populations: Their management and recovery*. The Peregrine Fund, Inc., Boise, ID.

**CARRETE, M., J.A. SÁNCHEZ-ZAPATA, J.E. MARTÍNEZ, M.A. SÁNCHEZ & J.F. CALVO 2002.** Factors influencing the decline of a Bonelli's eagle *Hieraaetus fasciatus* population in southeastern Spain; demography, habitat, or competition?. *Biodiversity* and *Conservation* 11:975-985.

**CLAYTON, K.M. & J.K. SCHMUTZ 1999.** Is the decline of burrowing owls *Speotyto cunicularia* in prairie Canada linked to changes in Great Plains ecosystems? *Bird Conservation International* 9:163-185.

**CONWAY, C.J., S.H. ANDERSON, D.E. RUNDE & D. ABBATE 1995.** Effects of experimental nestling harvest on prairie falcons. *Journal of Wildlife Management* 59:311-316.
**DAVIES, R.A.G. 1994**. Black eagle *Aquila verreauxii* predation on rock hyrax *Procavia capensis* and other prey in the Karoo. PhD thesis, University of Pretoria.
**DONALD, P.F., R.E. GREEN & M.F. HEATH 2000.** Agricultural intensification and the collapse of Europe's farmland bird populations. *Proc Royal Society*, 268: 25-29.
**ETHERIDGE, B, R.W.SUMMERS & R.E. GREEN 1997.** The effects of illegal killing and destruction of nests by humans on the population dynamics of the hen harrier *Circus cyaneus* in Scotland. *J Appl Ecol* 34: 1081-1105
**FRANKLIN, A.B.,, D.R.ANDERSON, R.J. GUTIERREZ & K.P.BURNHAM. 2000.** Climate, habitat quality, and fitness in Northern Spotted Owl populations in northwestern California. *Ecological Monographs* 70: 539-590
**FRANZREB, KE. 1993.** Perspectives on the landmark decision designating the northern spotted owl (*Strix-occidentalis caurina*) as a threatened subspecies. *Environmental management* 17: 445-452
**GALBRAITH, C.A., D.A.STROUD & D.B.A.THOMPSON 2003.** Towards resolving raptor-human conflicts. In: Thompson, D.B.A., Redpath, S.M., Fielding A.H., Marquiss, M. & Galbraith C. A. (Eds.). *Birds of prey in a changing environment*. The Stationery Office, Edinburgh. Pp: 527-253.
**GAUCHER, P., J.-M. THIOLLAY & X. EICHAKER 1995**. The sooty falcon *Falco concolor* on the Red Sea coast of Saudi Arabia: distribution, numbers and conservation. *Ibis* 137:29-34.
**HARTLEY, R.R. 2000.** Falconry as a conservation tool in Africa. pp. 373-378. *In* R.D. Chancellor & B.-U. Meyburg [Eds.] . *Raptors at Risk* August 1998. WWGBP & Hancock House.
**HOLMES, J, I. CARTER, M. STOTT, J. HUGHES, P. DAVIES & D. WALKER 2003.** Raptor persecution in England at the end of the twentieth century. *In:* Thompson, D.B.A , Redpath, S.M., Fielding A.H., Marquiss, M. & Galbraith C.A. (Eds.). *Birds of prey in a changing environment*. The Stationery Office, Edinburgh. Pp: 481-485
**HULME, D. & M. MURPHREE (Eds). 2001** *African wildlife and livelihoods: the promise and performance of community conservation*. James Currey, Oxford.
**KENWARD, R. E. 1977.** Captive breeding - a contribution by falconers to the preservation of falconiformes. pp. 378-381. *In* R.D. Chancellor [Ed.] . Proceedings, World Conferenceon Birds of Prey, Vienna, 1975. ICBP.
**KENWARD, R.E., V. MARCSTRÖM & M. KARLKBORN 1991.** The goshawk (*Accipiter gentilis*) as predator and renewable resource. *Gibier Faune Sauvage* 8:367- 378.
**LI, Y.M., Z X. GAO, X.H.LI, S. WANG & J. NIEMELA 2000.** Illegal wildlife trade in the Himalayan region of China. *Biodivers Conserv* 9: 901-918
**LINNELL, J.D.C., R. ANDERSEN, T.KVAM, H. ANDREN, O. LIBERG, J. ODDEN & P.F. MOA 2001.** Home range size and choice of management strategy for lynx in Scandinavia. *Environmental Management* 27: 869-879
**MAÑOSA, S. 2002.** The conflict between gamebird hunting and raptors in Europe. Report on Workpackage 3 of the European Project REGHAB N° EKV-2000-00637, 81 pp. (http://www.uclm.es/irec/reghab/inicio.html)
**MAR QUISS, M., M. MADDERS & D. CARRS 2003.** White-tailed eagles (*Haliaetus albicilla*) and lambs (Ovis *aries*). *In:* Thompson, D.B.A., Redpath, S.M., Fielding A.H., \Marquiss, M. & Galbraith C.A. (Eds.). *Birds of prey in a changing environment*. The Stationery Office, Edinburgh. Pp: 471-479
**MARTÍNEZ J., J. VIÑUELA & R. VILLAFUERTE 2002.** Socioeconomic and cultural aspects of gamebird hunting. Report on Workpackage 1 of the European Project REGHAB N° EKV-2000-00637, 81 pp. (http://www.uclm.es/irec/reghab/inicio.html)
**MEYER, W.B., & B.L. TURNER (Eds). 1994.** *Changes in land use and land cover: a global perspective*. Cambridge University Press, Cambridge.
**NEWTON, I. 1979**. *Population Ecology of Raptors*. T. & A.D. Poyser, Berkhampstead.
**NEWTON, I, L. DALE & P. ROTHERY 1997**. Apparent lack of impact of Sparrowhawks on the breeding densities of some woodland songbirds. *Bird Study* 44: 129-135
**NEWTON, I. 1998**. *Population Limitation in Birds*. Academic Press, London, UK.
**OAKS J. L., M. GILBERT, M. Z. VIRANI, R. T. WATSON, C. U. METEYER, B. A. RIDEOUT, H. L. SHIVAPRASAD, S. AHMED, M. J. I. CHAUDHRY, M. ARSHAD, S. MAHMOOD, A. ALI & A. A. KHAN 2004**. Diclofenac residues as the cause of vulture population decline in Pakistan. *Nature*.
**PAIN, D.J. & M.W. PIENKOWSKI (Eds) 1997.** *Farming and birds in Europe. The common agricultural policy and its implications for bird conservation*. Academic Press, London.
**RATCLIFFE, D. 1993.** *The Peregrine Falcon*. 2nd. Edition. T & AD Poyser, London.
**REDPATH, S.M., B.E.ARROYO,F. LECKIE, P. BACON, N. BAIFIELD, R.J. GUTIERREZ & S. THIRGOOD 2004.** Using decision modelling with stakeholders to reduce human-wildlife conflict: a raptor - grouse case study. *Cons. Biol.* In press.
**REDPATH, S.M. 1995**. Habitat fragmentation and the individual - tawny owls *Strix \aluco* in woodland patches. *J Anim Ecol* 64: 652-661
**REDPATH, S.M. & S. J. THIRGOOD 1997.** *Birds of Prey and Red Grouse*. The Stationary Office, London.
**REDPATH, S.M. & S. J. THIRGOOD 1999.** Functional and numerical responses in generalist predators: hen harriers and peregrines on Scottish grouse moors. *Journal of Animal Ecology* 68: 879-892.

**SERGIO, F, P. PEDRINI & L. MARCHESI 2003.** Reconciling the dichotomy between single species and ecosystem conservation: black kites (*Milvus migrans*) and eutrophication in pre-Alpine lakes. *Biol Conserv* 110: 101-111.

**SHAWYER, C.R., R. CLARKE & N. DIXON 2003.** Causes of racing pigeon (*Columba livia*) losses, including predation by raptors, in the United Kingdom. *In:* Thompson, D.B.A., Redpath, S.M., Fielding A.H., Marquiss, M. & Galbraith C.A. (Eds.). *Birds of prey in a changing environment.* The Stationery Office, Edinburgh. Pp: 263-268.

**SIMBERLOFF, D. 1998.** Flagships, umbrellas and keystones: is single species management passé in the landscape era? *Biological Conservation* 83: 247-257

**STROUD, D.A. 2003.** The status and legislative protection of birds of prey and their habitats in Europe. *In:* Thompson, D.B.A., Redpath, S.M., Fielding, A.H., Marquiss, M. & Galbraith, C.A. (Eds.). *Birds of prey in a changing environment.* The Stationery Office, Edinburgh. Pp: 51-83

**TELLA, J.L.,M.G. FORERO, F. HIRALDO & J.A.DONAZAR D 1998.** Conflicts between lesser kestrel conservation and European agricultural policies as identified by habitat use analyses. *Conservation Biology* 12: 593-604.

**THIOLLAY, J.-M. 1993.** Response of a raptor community to shrinking area and degradation of tropical rain forest in the south- western Ghâts (India). *Ecography* 16:97- 110;.

**THIOLLAY, J.-M. 1996.** Distributional patterns of raptors along altitudinal gradients in the northern Andes and effects of forest fragmentation. *J Trop Ecol* 12: 535-560

**THIOLLAY, J.-M. 1998.** Current status and conservation of falconiformes in tropical Asia *J Raptor Res* 32: 40-55

**THIOLLAY, J.-M. 2001.** Long-term changes of raptor populations in northern Cameroon. *J Raptor Res* 35 (3): 173-186

**THIRGOOD, S.J., S. M. REDPATH, P. ROTHERY & N. AEBISCHER 2000a.** Raptor predation and population limitation in red grouse. *Journal of Animal Ecology* 69:504-516. **THIRGOOD, S.J., S. M. REDPATH, D. T. HAYDON, P. ROTHERY, I. NEWTON & P. J. HUDSON 2000b.** Habitat loss and raptor predation: disentangling long- and short-term causes of red grouse declines. *Proc. Royal Society* B: 267:651-656.

**THIRGOOD, S. J., S. M. REDPATH, , I. NEWTON & P.J. HUDSON 2000c.** Raptors and grouse: conservation conflicts and management solutions. *Conservation Biology* 14: 95-104.

**THOMPSON, D.B.A.,O.M.SHAW, H.T.RILEY, M.C.SHEWRY, E.C.MACKEY, P. ROBERTSON & K. MORTON 2003.** An overview of land use change and implications for raptors. *In:* Thompson, D.B.A., Redpath, S.M., Fielding, A.H., Marquiss, M. & Galbraith, C.A. (Eds.). *Birds of prey in a changing environment.* The Stationery Office, Edinburgh. Pp: 307-321

**THOMPSON, D.L., R.E.GREEN, R.D.GREGORY & S.R.BAILLIE 1998.** The widespread declines of songbirds in rural Britain do not correlate with the spread of their avian predators. *Proc Royal Soiety* 265: 2057-2062

**VAN MAANEN, E., I. GORADZE, A. GAVASHELISHVILI & R. GORADZE** Opinion; Trapping and hunting of migratory raptors in western Georgia. *Bird Conservation International* 11:77-92.

**VIÑUELA, J. & R. VILLAFUERTE 2003.** Predators and rabbits (*Oryctolagus cuniculus*) in Spain: a key conflict for European raptor conservation. *In:* Thompson, D.B.A., Redpath, S.M., Fielding, A.H., Marquiss, M. & Galbraith C.A. (Eds.). *Birds of prey in a changing environment.* The Stationery Office, Edinburgh. Pp: 511-526.

**WESTERN, D. & R. M. WRIGHT (Eds). 1994.** *Natural Connections: Perspectives in Community-based Conservation.* Island Press, Washington, DC.

**WHITFIELD, D.P., D.R.A. McLEOD, D.R.A., J. WATSON, A.H. FIELDING & P.F. HAWORTH 2003.** The association of grouse moor in Scotland with the illegal use of poisons to control predators. *Biol Conserv.* 114: 157-163.

**WHITFIELD, D.P., D.R.A. McLEOD, A.H. FIELDING, R.A. BROAD, R.J. EVANS & P.F. HAWORTH 2001.** The effects of forestry on golden eagles on the island of Mull, western Scotland. *Journal of Applied Ecology* 38:1208-1220.

**WIDEN, P. 1997.** How, and why, is the Goshawk (*Accipiter gentilis*) affected by modern forest management in Fennoscandia? J Raptor Res 31: 107-113

Beatriz Arroyo and Steve Redpath
Centre for Ecology and Hydrology
Hill of Brathens, Banchory,
Aberdeenshire
AB31 4BW
UK

Javier Viñuela
Instituto de Investigación en Recursos
Cinégeticos (IREC)
Ronda de Toledo c/n
13005-Ciudad Real
Spain