Slender-billed vulture. Photo: Paul Insua-Cao/RSPB

Saving India's Vultures from Extinction: Policy Statement

- The populations of **four vulture species** found in India and endemic to Asia have undergone such dramatic declines since the 1990s that they are now at the most severe risk of global extinction – **'Critically Endangered'**.
- Vultures play a key ecological role as scavengers and provide important benefits to society with human health benefits in India.
- Losing vultures has **already** had **serious social, human health, economic** ($34bn in rabies treatments alone) **and environmental impacts**.
- The sole or **main cause** of the dramatic decline in *Gyps* vulture populations was veterinary use of the non-steroidal anti-inflammatory drug (NSAID) **diclofenac.** Its veterinary use as a painkiller has now been banned.
- Although declines in *Gyps* vulture populations have at least slowed since the veterinary diclofenac ban, **there has been no strong recovery in India,** contrasting with a marked recovery in Nepal where diclofenac use has been more effectively stopped.
- **Illegal veterinary use of diclofenac has continued** in India along with **increased veterinary use of other NSAIDs, aceclofenac, nimesulide, ketoprofen, flunixin** that are also proven to be **toxic to vultures**.
- Two alternative NSAIDs are available, **meloxicam and tolfenamic acid**, which have been **shown to be safe to vultures**.
- There are other emerging threats to vultures, currently less important than toxic veterinary NSAIDs in India, but still a cause for concern in some areas. These include accidental killing of vultures by poison baits and collisions and electrocution by power infrastructure.

We need to restore vulture populations and their important ecological and social role.
Our priority is for an environment that is free from vulture-toxic veterinary drugs.

Priority actions to counteract the principal threats to vultures in India are assessed annually as part of updating the Blueprint vulture recovery plan of the Saving Asia's Vultures from Extinction (SAVE) consortium.
This Blueprint is the key reference and source for the Convention of Migratory Species Vulture Multi-species Action Plan.

For these documents and more information visit www.save-vultures.org

The populations of four vulture species in India and endemic to Asia have undergone such rapid and dramatic declines since the 1990s that they are now listed by IUCN as being at the most severe risk of global extinction – 'Critically Endangered'

From the early 1990s into the new millennium, populations of South Asian vultures underwent a dramatic and sudden collapse, most heavily impacting four of India's nine species of vultures; three *Gyps* vulture species and the red-headed vulture (see table below). These four species are now recognised as Critically Endangered globally (BirdLife International 2019). Numbering tens of millions in India alone, the white-rumped vulture was considered the most abundant large raptor in the world, but now only an estimated 8,000 individuals remain, of which 6,000 are in India. The reduction in population size of the three *Gyps* species was estimated through systematic monitoring to be between 96.8% for Long-billed vulture and 99.9% for white-rumped vulture within a period of just fifteen years (Prakash *et al.* 2007). These four species might soon be extinct in the wild, both in India and globally, as the majority of the populations of all four species are found in India.

Vulture species	Global threat status[1]	Est. population in India / global
White-rumped (aka Oriental white-backed) Vulture (*Gyps bengalensis*)	Critically Endangered	6,000/ 10,000
Indian (aka Long-billed) Vulture (*Gyps indicus*)		15,000/ 15,500
Slender-billed vulture (*Gyps tenuirostris*)		750/ 1,000
Red-headed Vulture (aka King Vulture) (*Sarcogyps calvus*)		no India estimate/ 2500-10,000
Egyptian Vulture (*Neophron percnopterus*)	Endangered	no India estimate/ 50,000
Himalayan Griffon (Himalayan Vulture) (*Gyps himalayensis*)	Near-threatened	no India estimate/ 300,000
Cinereous Vulture (*Aegypius monachus*)		no India estimate/ 15,600-21,000
Bearded Vulture (aka Lammergeier) (*Gypaetus barbatus*)		no India estimate/ 1,300-6,700
Eurasian Griffon (*Gyps fulvus*)	Least Concern	no India estimate/ >500,000

Healthy white-rumped vulture.
Photo: Goran Ekstrom

Impact of diclofenac poisoning.
Photo: BNHS

[1] This list follows the globally-recognised standard of the IUCN Red List of Threatened Species (IUCN 2012), which provides an objective framework for the classification of species according to their extinction risk. "Critically Endangered" is the highest threat status and species listed as such are considered to be facing an extremely high risk of extinction in the wild. The basis for these four species being listed as such is that their populations have undergone a reduction of more than 80% in three generations and the cause of the population decline has not ceased.

Vultures play a key ecological role as scavengers and provide important benefits to society in India. Losing vultures has already had serious social, economic and environmental impacts.

Vultures feed on dead animal carcasses, and in so doing clean up the environment. In India a key service they provided was to dispose of the millions of cattle carcasses, so cleaning up the environment. The loss of vultures has had immediate social, cultural and financial implications, which have yet to be fully quantified; cattle have had to be disposed of in new ways and there has been a significant increase in the population of feral dogs and with it elevated risks of rabies and dog attacks (Markandya et al. 2008). With 20,000 cases of rabies in humans in India annually (World Health Organisation), any increase in dog numbers has significant implications for humans.

Vultures feeding on a carcass. Photo: Paul Insua-Cao/RSPB

The sole or main cause of the decline in *Gyps* vulture populations was veterinary use of the non-steroidal anti-inflammatory drug (NSAID) diclofenac. This use has now been banned, but illegal sale of human diclofenac for veterinary use remains a problem in many parts of India.

By 2004, several scientific publications showed conclusively that the reason for the calamitous vulture population declines was the veterinary use of the NSAID diclofenac (Oaks *et al.* 2004, Green *et al.* 2004, Prakash *et al.* 2005). This drug was and still is commonly used for treating people and millions of doses per year were used to reduce pain in cattle since the mid-1990s (Pain *et al.* 2008). Diclofenac is present in all tissues of cattle for a few days after treatment and a very small concentration renders the tissues toxic to vultures consuming them (Oaks *et al.* 2004, Swan *et al.* 2006a, Green *et al.* 2006). Scientific modelling showed that less than 1% of cow carcasses containing diclofenac would be required to cause the vulture population to decline at the rate observed (Green *et al.* 2004) and surveys of diclofenac concentrations in the tissues of cattle available as food to vultures showed that there was sufficient diclofenac in them to account entirely for the decline.

The impact of diclofenac was so severe that a complete ban of diclofenac for veterinary purposes to remove it from the vultures' food supply was the only option available to save them. In 2006, diclofenac was banned for veterinary use throughout India under Section 26A of the Drugs and Cosmetics Act. Since 2015, the human-use form of the product is limited to vials of no more than 3 ml to discourage illegal misuse of the human formulations in veterinary practice. A cow requires about five times the human dose. This further step appears to be helping to reduce illegal veterinary use.

The decline in *Gyps* vulture populations has stopped or at least slowed since the ban on veterinary diclofenac, but there has been no strong recovery in India, contrasting with a marked recovery in Nepal. Illegal veterinary use of diclofenac has continued in India and there has been increased veterinary use of other NSAIDs, which have also been proven to be toxic to vultures.

Pharmacy and cattle carcass surveys show that diclofenac is still being used to treat cattle in India, though to a lesser extent than before, despite being illegal, and that other NSAIDs have partly replaced it. Some of those alternatives, such as aceclofenac and ketoprofen, have been proven to be toxic to vultures in similar ways to diclofenac. Others are strongly suspected to be toxic and are undergoing safety testing by the Indian Veterinary Research Institute.

This continued use of toxic NSAIDs is sufficient to explain the lack of a population recovery. A larger reduction in the use of diclofenac in Nepal was followed by a strong increase in vulture populations there. At least 12 different NSAIDs are known to be used in India for veterinary purposes, including diclofenac (Cuthbert *et al*. 2011). A summary of the main alternative NSAIDs currently being used in veterinary practice is shown in Annex below.

Diclofenac produced by many different manufacturers.
Photo: Chris Gomersal/RSPB

Two veterinary NSAIDs, meloxicam and tolfenamic acid, have already been shown to be safe to vultures and their use is increasing.

There are strong reasons for hope. The NSAID called meloxicam has already undergone safety testing and been proven to be safe to vultures (Swarup *et al.* 2007).Tolfenamic acid has more recently been shown to be a second safe alternative. There will likely be more safe options to come.

Uptake in meloxicam is growing as a vulture-safe alternative.
Photo: Chris Gomersal/RSPB

Indian Vultures
Photo: Mandy West

There are other threats to vultures which are currently less important than toxic veterinary NSAIDs in India but are still a cause for concern in some areas. These include accidental killing of vultures by poison baits and collisions and electrocution by power infrastructure (pylons, wires, wind-turbines)

Poison baits: There is no evidence of vultures being deliberately poisoned in India, but there are several incidents annually of vultures being poisoned at baited carcasses, particularly in Assam. Poisoned vultures die quickly and often close to the source. The poison baits responsible are usually laid to kill feral dogs and other carnivores which killed livestock, but accidentally kill a variety of scavengers, including vultures. The rise in feral dog numbers in India as a result of the food supply not consumed by vultures, has probably led to an increase in such poisoning incidents. Outside South Asia, this is the predominant threat to vultures (Botha *et al.* 2017).

Power infrastructure: Vultures are being killed as a result of electrocution on pylons, and collision with wind turbines and power lines. These are likely to become an increasing threats to vultures and other soaring birds and needs addressing through pre-emptive planning and risk mapping in relation to vulture concentrations. Nevertheless, the severity of the threat to vultures and their recovery is currently far lower than that of toxic NSAIDs.

Food shortages: Vulture numbers prior to the crash were high because they benefitted from the carcasses of the millions of domestic cattle disposed of every year. Although it is unlikely that they will ever return close to those levels, evidence suggests that, despite changing carcass disposal practices and other factors, there is still enough food to support far more vultures than at present. Therefore, food shortages are a matter of local rather than national concern for vultures and certainly don't account for the dramatic declines that have occurred.

Energy infrastructure, if not well planned can be a threat to all soaring birds including vultures

Photos:
Chris Bowden/RSPB
& Ankit Joshi

We need to save vultures and restore their important ecological and social role. An environment for vultures, free from toxic NSAIDs in carcasses is the overwhelming current priority. To ensure the survival of vultures in India and globally and therefore to address this priority requires these policy actions:

Needed now:

- Safety-testing on vultures for all currently permitted veterinary NSAIDs
- Withdrawal of approval for veterinary use of NSAIDs shown to be toxic to vultures invoking section 26A of Indian Drugs & Cosmetics Act.
- Promotion of the use of meloxicam and tolfenamic acid as veterinary drugs that poses no risk to vultures, through education and awareness programmes.
- Ensuring that diclofenac is totally removed from the food supply of vultures - through stronger enforcement and closer monitoring, and that the unsafe drugs: aceclofenac, nimesulide, ketoprofen, flunixin & carprofen are not supplied to the government veterinary services as a first step.
- Banning of veterinary aceclofenac as it has been shown to metabolise into diclofenac and is therefore equally toxic
- Banning of veterinary ketoprofen and nimesulide - both have been shown to be toxic to vultures
- Establishment of vulture safe zones (VSZs) based upon agreed SAVE criteria, where the prevalence of toxic NSAIDS is low enough over a large area not to threaten the local vulture population. This will require state-level government commitment to remove vulture-toxic NSAIDs from the environment, even before they have been banned at the federal level
- Maintain vulture captive breeding programmes, with a view to reintroductions into the wild as soon as the environment has been made sufficiently safe, and the monitoring system with tracking devices is in place for the released birds.
- Proceeding with the release programme to help re-establish and augment wild populations and to monitor the ongoing safety of the environment including NSAID use and prevention of setting poison baits.
- An effective system is in place to collect dead vultures and analyse and report the causes of mortality

Longer-term

- Licensing system in place that permits only veterinary NSAIDs that have been cleared as safe to vultures
- Safety-testing on vultures of all new veterinary NSAIDs
- Refusal of approval for veterinary use of NSAIDs shown to be toxic to vultures
- Ascertain the impact of power infrastructure on vultures and other soaring birds and conduct sensitivity mapping to inform decision-making for development planning

White-rumped vulture: Photo: Paul Insua-Cao/RSPB

References

BirdLife International, 2022, *IUCN Red List for birds.* http://datazone.birdlife.org/home

Botha A. J., Andevski J., Bowden C. G. R., Gudka M., Safford R. J., Tavares J. and Williams N. P., 2017, *Multi - species Action Plan to Conserve African - Eurasian Vultures. CMS Raptors MOU Technical Publication No. 5. CMS Technical Series No. 35*. Coordinating Unit of the CMS Raptors MOU, Abu Dhabi, United Arab Emirates.

Chandramohan, S, Mallord JW, Manickam K, Sharma AK, Mahendran K, Gupta, R, Chutia, K, Mathes, K, Pawde, A, Prakash, NV, Ravichandran, P, Saikia, D, Shringarpure, R, Timung, A, Galligan, TH, Green, RE, Prakash, VM. (2022). Experimental safety testing shows that the NSAID tolfenamic acid is not toxic to *Gyps* vultures in India at concentrations likely to be encountered in cattle carcasses. Sci. Total Environ. 809: 152088. doi: 10.1016/j.scitotenv.2021.152088

Cuthbert R.J., Dave R., Chakraborty S.S., Kumar S., Prakash S., Ranade S.P., & Prakash V., 2011, Assessing the ongoing threat from veterinary non-steroidal anti-inflammatory drugs to Critically Endangered Gyps vultures in India, *Oryx: 45(3), 420–426*

Fourie T., Cromarty D., Duncan N., Wolter K. and Naidoo V., 2015, The Safety and Pharmacokinetics of Carprofen, Flunixin and Phenylbutazone in the Cape Vulture (Gyps coprotheres) following Oral Exposure. *PlosOne 1-12* doi:10.1371/journal.pone.0141419.

Galligan, T. H., Taggart, M. A., Cuthbert, R. J., Svobodova, D., Chipangura, J., Alderson, D., Prakash, V. M. and Naidoo, V. 2016, Metabolism of aceclofenac in cattle to vulture-killing diclofenac. Conservation Biology. 30: 1122–1127. doi: 10.1111/cobi.12711

Galligan, TH, Green, R E, Wolter, K, Taggart, MA , Duncan, N., Mallord, J W, Alderson, D, Li, Y & Naidoo, V. (2022). The non-steroidal anti-inflammatory drug nimesulide kills Gyps vultures at concentrations found in the muscle of treated cattle. Science of the Total Envt 807 (Pt.2) 150788. doi: 10.1016/j.scitotenv.2021.150788

Green R.E., Newton I., Shultz S., Cunningham A., Gilbert M., Pain D.J., Prakash V., 2004, Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent. *Journal of Applied Ecology 41, 793–800*.

Green R.E., Taggart M.A., Das D., Pain D.J., Kumar S., Cunningham A.A., Cuthbert R., 2006, Collapse of Asian vulture populations: risk of mortality from residues of the veterinary drug diclofenac in carcasses of treated cattle. *Journal of Applied Ecology 43: 949-956*.

Green R.E., Newton I., Shultz S., Cunningham A., Gilbert M., Pain D.J., Prakash VV. Prakash, R.E. Green, D.J. Pain, S.P. Ranade, S. Saravanan, N. Prakash, R. Venkitachalam, R. Cuthbert, A.R. Rahmani and A.A. Cunningham, 2007, Recent Changes In Populations Of Resident Gyps Vultures In India, *J. Bombay Nat Hist Soc. 104, May-Aug 2007*

Green, R.E., Taggart, M.A., Senacha, K.R., Raghavan, B., Pain, D.J., Jhala, Y., and Cuthbert, R., 2007, Rate of Decline of the Oriental White-Backed Vulture Population in India Estimated from a Survey of Diclofenac Residues in Carcasses of Ungulates. *PloS ONE **2,** e686.*

Green R.E., Taggart M.A., Das D., Pain D.J., Kumar S., Cunningham A.A., Cuthbert R., 2007, Collapse of Asian vulture populations: risk of mortality from residues of the veterinary drug diclofenac in carcasses of treated cattle. *Journal of Applied Ecology 43: 949-956*.

Markandya A., Taylor T., Longo A., Murty M. N., Murty S. Dhavala K., 2008, Counting the cost of vulture decline—An appraisal of the human health and other benefits of vultures in India. *Ecological Economics, 67, 194–204.* https://doi.org/10.1016/j.ecolecon.2008.04.020

MoEFCC, 2020. Action Plan for Vulture Conservation in India. 2020-2025. Ministry of Environment, Forest & Climate Change, Govt of India

Nambirajan K, Muralidharan S, Ashimkumar AR,& Jadhav S. 2021. Nimesulide poisoning in white-rumped vulture Gyps bengalensis in Gujarat, India. Env Science and Pollution Research: doi.org/10.1007/s11356-021-14702-y

Naidoo V., Wolter K., Cromarty D., Diekmann M., Duncan N., Meharg A.A., Taggart M.A., Venter L., and Cuthbert R., 2010, Toxicity of NSAIDs to Gyps vultures: a new threat from ketoprofen *Biology Letters doi: 10.1098/rsbl .2009.0818*

Oaks, J. L., Gilbert, M., Virani, M. Z., Watson, R. T., Meteyer, C. U., Rideout, B., Shivaprasad, H. L., Ahmed, S., Chaudhry, M. J. I., Arshad, M., Mahmood, S., Ali, A. and Khan, A. A. 2004. Diclofenac residues as the cause of vulture population decline in Pakistan. *Nature 427: 630–633*. doi: 10.1038/nature02317

Pain D.J., Bowden C.G.R., Cunningham A.A., Cuthbert R., Das D., Gilbert M., Jakati R.D., Jhala Y., Kahn A.A., Naidoo V., Oaks J.L., Parry-Jones J., Prakash V., Rahmani A., Ranade S.P., Baral H.S., Senacha K.R., Saravanan S., Shah N., Swan G., Swarup D., Taggart M.A., Watson R.T., Virani M.Z., Wolter K., and Green R.E., 2008, The race to prevent the extinction of South Asian vultures, *Bird Conservation Int, 18:S30–S48. BirdLife International 2008*. doi: 10.1017/S0959270908000324

Prakash V., Green R.E., Rahmani A.R., Pain D.J., Virani M.Z., Khan A.A., Baral H.S., Jhala Y.V., Naoroji R., Shah N., Bowden C.G.R., Choudhary B.C., Narayan G., Gautam P., 2005, Evidence to support that diclofenac caused catastrophic vulture population decline, *Current Science 88:1533-1534*

Prakash V., Green R.E., Pain D.J., Ranade S.P., Saravanan S., Prakash N., Venkitachalam R., Cuthbert R., Rahmani A.R., and Cunningham A.A., 2007, Recent changes in populations of resident Gyps vultures in India, *J. Bombay Nat Hist Soc, 104 (2), May-Aug 2007*, BNHS, Mumbai, India

Prakash, V., Galligan, T. H., Chakraborty, S. S., Dave, R., Kulkarni, M. D., Prakash, N., Shringarpure, R. N., Ranade, S. P. and Green, R. E. (2017) Recent changes in populations of Critically Endangered *Gyps* vultures in India. *Bird Cons. Int.* 29: 55-70.

SAVE 2022, A Blueprint for the Recovery of Asia's Globally Threatened Vultures. Online: https://save-vultures.org/action-plans/

Sharma P, 2012, Aceclofenac as a Potential Threat to Critically Endangered Vultures in India: A Review, *Journal of Raptor Research, 46(3):314-318. 2012.* The Raptor Research Fndn

Swan G.E., Cuthbert R., Quevedo M., Green R.E., Pain D.J., Bartels P., Cunningham A.A., Duncan N., Meharg A.A., Oaks J.L., Parry-Jones J., Shultz S., Taggart M.A., Verdoorn G., Wolter K., 2006a, Toxicity of diclofenac to Gyps vultures. *Biology Letters, 2: 279-282*. doi: 10.1098/rsbl.2005.0425

Swan, G., Naidoo, V., Cuthbert, R., Green, R.E., Pain D.J., Swarup, D., Prakash, V., Taggart, M., Bekker, L, Das D, Diekmann J, Diekmann, M., Killian E, Meharg A, Patra Rc, Saini M, Wolter K., 2006, Removing the Threat of Diclofenac to Critically Endangered Asian Vultures. *PLoS Biology 4, 396-402*. doi: 10.1371/journal.pbio.0040066

Swarup D., Patra R.C., Prakash V., Cuthbert R., Das D., Avari P., Pain D.J., Green R.E., Sharma A.K., Saini M., Das D., Taggart M., 2007, The safety of meloxicam to critically endangered Gyps vultures and other scavenging birds in India, *Animal Conservation, 10: 192-198*. doi: 10.1111/j.1469-1795.2006.00086.x

Zorrilla, I., Martinez, R., Taggart, M. A. and Richards, N. (2014). Suspected flunixin poisoning of a wild Eurasian griffon vulture from Spain. Conserv. Biol. 29: 587-592. doi: 10.1111/cobi.12417

Annex: Safety of commonly used NSAIDs in veterinary practice in India

Drug name (& Status in India)	Threat / safety	Known effect
Meloxicam	**Confirmed Safe**	Demonstrated safe for vultures (Swarup D. *et al.* 2007)
Tolfenamic acid	**Confirmed Safe**	Demonstrated safe for vultures (Chandramohan et al. 2022)
Carprofen	**Toxic at high doses**	At toxic levels for vultures in cattle tissues around the injection site (Fourie *et al*. 2015)
Flunixin	**Toxic**	Demonstrated toxicity to *Gyps* vultures in Spain & Italy, with dead wild birds showing gout & flunixin in tissues. Not yet fully safety-tested on vultures. (Zorrilla et al. 2014, Eleni et al. 2019)
Nimesulide	**Confirmed Toxic**	Widely banned globally due to safety issues in humans but only for under 12s in India. Increasingly popular in India & Nepal. Demonstrated toxicity to vultures. (Galligan et al. 2022, Karikalan et al. 2023). Also dead wild vultures with gout and nimesulide but no diclofenac (Nambirajan et al. 2021)
Aceclofenac **[Banned Aug 2023]**	**Confirmed toxic**	Metabolises into diclofenac in cattle so equivalent effect to diclofenac (Galligan *et al.* 2016, Sharma 2012)
Ketoprofen **[Banned Aug 2023]**	**Confirmed toxic**	Trials carried out on Gyps vultures showed toxicity at concentrations found in treated cattle in India (Naidoo *et al.* 2009). National ban in Bangladesh 2021.
Diclofenac **[Banned 2006]** **[Vial size restriction of human formulations to <3ml 2015]**	**Confirmed toxic**	Confirmed highly toxic in 2003 (Oaks *et al.* 2004), and main cause of recent Asian vulture declines.

Note that the following NSAIDs have not been fully safety-tested but are also licensed and commonly available for veterinary use in India: **paracetamol, phenyl butazone, metamizole, piroxicam, ibuprofen.**