

Wildlife corridors in india: Viable legal tools for species conservation?

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Abstract

Wildlife corridors, used by various species to migrate, breed and feed, are increasingly becoming relevant as essential tools for wildlife conservation. Rapid increase in industrial and infrastructural development, especially around forests, has resulted in widespread habitat fragmentation and isolation. Added to this, the growing development (for tourism, linear infrastructure etc.) around protected areas, and the altered de facto boundaries of these, have exacerbated this need. There is, however, no ‘hard’ statutory recognition afforded in India to wildlife corridors in spite of their established relevance in ecological conservation. Nor is there a strict prohibition on development within, and around important corridors in India. Even so, wildlife corridors have found passing mention in certain conservation law and guidelines framed thereunder, which seek to protect wildlife habitat and reduce human – wildlife conflict. These extant legal spaces have largely proved ineffective in the protection and conservation of corridors, and corridor protection and management continues to be a dormant legal space in India.

This paper seeks to analyse the various barriers to corridor conservation and management, and whether the existing legal measures are underutilised in providing legal protection to wildlife corridors, without the need of a parallel institutional framework. Through an understanding of the criticality of corridors to wildlife conservation, the adequacy of existing legal structures has been examined by the authors, and recommendations made for augmenting the current legal framework with more concrete strategies.

Keywords

Wildlife, Corridor, Law, India, Conservation

Introduction

The need to protect wildlife corridors is increasingly gaining traction globally, as habitat fragmentation becomes one of the biggest challenges to biodiversity conservation. However, despite the immediate and growing threats of climate change and other anthropogenic pressures on natural habitats, a wildlife corridor

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has yet to be formalised as a legal tool for ecological conservation in India or, indeed, elsewhere in the world. The difficulty stems from the very nature of a corridor, which may be completely different in function and form depending upon the species that is used to typify it. Nevertheless, their criticality in biodiversity conservation is moot. In this article, the authors seek to first highlight the importance and role of corridors in habitat conservation and climate change adaptation in Part I. In Part II, the potentialities for corridor conservation and management within existing legal frameworks have been attempted to be brought out – this discussion is limited to the relevant international and European legal instruments, American federal statutes and Indian laws. Part III then examines in detail the status of critical wildlife corridors in India, their status and the various challenges that are being faced in their conservation.

This article seeks to analyse the various barriers to corridor conservation and management, and also to examine whether the existing legal measures are underutilised in providing legal protection to wildlife corridors, without the need of a parallel institutional framework. Through an understanding of the criticality of corridors to wildlife conservation, the adequacy of existing legal structures in India has been examined by the authors, and recommendations made for augmenting the current framework. This has been done chiefly through a study of secondary sources: mainly scholarly articles, statutory law and scientific reports.

Part I: The role and integrity of wildlife corridors in biodiversity conservation

Definition and importance to biodiversity

Corridors, in the larger space of ecological conservation, occupy a unique niche. Their role and vitality in species conservation is well documented, but their definition is a source of constant confusion. They have been generally understood to be ‘linear landscape elements, meant to establish/facilitate connectivity across habitats and increase survivorship by increasing the diversity of specific gene pools’.¹ In more technical parlance, ecological literature defines corridors as a ‘fundamental landscape element (the other two are patch and matrix), being narrow strips of land which differ from the matrices on either side’.² While the general definition emphasises the functional role of a corridor, it gives little clarity as to its form and context. The technical definition is a sort of complement to this – silent on the functional aspects, elaborating upon the form and context. There are, however, differences of opinion as to the functional role of a corridor – some argue that they are merely temporary-use habitat connectors, while others hold the view that they are permanent integral parts of the habitat ranges of animals.³ Further, there is a stream of thought which emphasises the delineation between linkages and habitats (either temporary or permanent), in order to minimise human–wildlife conflict (essentially conceptualising corridors as non-habitat linkages between habitats).⁴ The structure and functionalities of corridors are also highly specific to the species that use them. For example, the seasonal migration patterns, prey/food availability and water requirements are completely different for tigers and elephants – and therefore the corridors connecting their habitats must be different in terms of function, form and context.

These conceptual differences, however, are not to take away from the crucial value of habitat linkages in ecological conservation. The obvious function of corridors is to facilitate physical movement, which is

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1. S. Varma et al., ‘Elephant Corridors in Kameng Elephant Reserve’ in Surendra Varma, Prabal Sarkar and Vivek Menon (eds.), 58 *Ecology and Conservation of Asian Elephants in Kameng Elephant Reserve, Arunachal Pradesh* (Wildlife Trust of India, New Delhi, 2008).
 2. M. Gordon, R.T.T. Forman, *Landscape Ecology* (John Wiley and Sons: New York, 1986) 23.
 3. A. Venkataraman, ‘What is an Asian Elephant (*Elephas Maximus*) Corridor?’ in V. Menon S. Kumar Tiwari, P. S. Easa and R. Sukumar (eds), *Right of Passage: Elephant Corridors of India* (Wildlife Trust of India, New Delhi, 2005).
 4. *Ibid.* at 31.

crucial to the long-term viability of animal population: feeding/foraging, seasonal migrations as well as permanent movements in case of habitats being rendered unfit (due to climate change or other anthropogenic factors) are facilitated by, and occur through, corridors.

Habitat connectivity is essential for biodiversity – the insularisation of populations is largely inimical to their biodiversity and participation in natural evolutionary processes. Smaller population sizes have been scientifically proven to be more vulnerable to extinction – owing to environmental, demographic and genetic stochasticity.⁵ It is also a proven scientific fact that inbred populations show reduced ability to survive and reproduce ('biological fitness').⁶ In the context of today's world, where habitat fragmentation has become an increasingly common happenstance, corridors have a crucial role in sustaining wildlife populations through reducing the impact of habitat isolations.

Ecological dynamics

In order to embark on this discussion, it is important to first understand 'source' and 'sink' populations. 'Source' populations are those localised populations where the birth rate exceeds the death rate, and are a source of perpetuity of the species/sub-species. 'Sinks' are populations where deaths exceed births, and depend on an influx of individuals for their sustenance.⁷ These terms are usually used in the context of single-species conservation in spatially fragmented habitats. Typically, sink populations occur in areas adjoining human habitats and are usually marginalised as a result of this. Linkages such as corridors, then, must logically play a crucial role in sustenance of sink populations. It has, in fact, been theoretically proven that active dispersal from source populations can maintain 'evolutionarily stable sink populations'.⁸

Fragmented sub-populations of single species, known as 'regional populations', interact through linkages (such as corridors) to supplement the 'meta population' gene pool.⁹ The success of this mechanism is premised on the inviolate nature of the source populations, and therefore the protection of source habitats is a *sine qua non* for the efficacy of corridors in ecological conservation. There is, therefore, a cyclical causative nexus between the scientific management of protected areas and the positive effects of corridors in promoting biodiversity and sustenance of meta populations. Add to this the omnipresent variable of human-wildlife conflict and it becomes apparent how delicate and complex the exercise of corridor delineation and management actually is.

Minimum viable habitats and conservation strategies

The concept of a 'minimum viable habitat' area necessary for the survival of a species is now logically more appealing, in view of the preceding discussion. As a rule for most species, a minimum contiguous area is desirable for their long-term viability, for the various reasons already stated above. It is also intuitive knowledge that owing to increased anthropogenic pressures on existing regional populations, source populations now occur largely in core zones of protected areas. It therefore logically follows that corridors would be at their most effective when linking protected areas and increasing the continuity of source population habitats. Habitat conservation and management strategies are usually characterised by advocacy and study

5. R. Sukumar, *The Asian Elephant: Ecology and Management* (Cambridge University Press: Cambridge, 1989) 202–203.

6. B. Charlesworth S. Dolgin, S. E. Baird and A.D. Cutter 'Inbreeding and Outbreeding Depression in *Caenorhabditis* Nematodes' (2007) 61(6) *Evolution* 1339–1352.

7. H.R. Pulliam, 'Sources, Sinks and Population Regulation' (1988) 132(5) *The American Naturalist* 652.

8. See Charlesworth et al., above n. 6 at 652–661.

9. Ministry of Environment and Forests, *National Tiger Conservation Authority (Normative Standards for Tourism Activities and Project Tiger) Guidelines, 2012* at 70–71.

in the area of land-use planning around protected areas (especially in identified wildlife corridors). Studies into the impact of land-use patterns (mainly urbanisation and agriculture) on biodiversity and genetic flow have been carried out, and it has been found (for one species of wood mouse) that genetic flow and diversity are greater across arable lands than urban spaces.¹⁰ A study in the urban context¹¹ also concluded a positive association of higher diversity with larger patch sizes – which suggested that corridors are optimal tools for biodiversity conservation even in urban spaces.

The importance of corridors in climatological terms also merits mention. The ability of species to adapt to climate change is dependent upon both their genetic resilience, as well as the accessibility of alternate habitats. The cumulative impacts of climate change (such as the impact of altered seasonal patterns in already fragmented/changed habitats) can even create a higher degree of stochasticity, or vulnerability, in ecosystems.¹² The argument for the role of corridors in augmenting both genetic resilience, as well as increasing habitat contiguity through their linkage function (across climatic gradients) has already been set out above. Thus, while the universal efficacy and optimal design of wildlife corridors is yet to be empirically proven and discovered; the fact of their role in biodiversity conservation cannot, in view of the preceding discussion and present-day contexts, be underscored enough. With this conclusion, and the fact that the protection of corridors through the limitation of land-use changes around protected areas requires a favourable legal framework, the legal status and protection accorded to corridors becomes the next logical focal point of discussion.

Part II: Legal frameworks for corridor protection and management – A comparative perspective

International law

Generally, international law instruments (multilateral treaties and conventions) are examples of soft law – which essentially means that they do not provide for sanctions on contracting parties for failing to adhere to, or achieve, the terms of the instrument(s). Further, none of the major international instruments relevant to biodiversity conservation – the Convention on Biological Diversity, 1992 ('CBD'); the Convention on Wetlands of International Importance, 1971 ('Ramsar Convention'); the Convention on the Conservation of Migratory Species, 1979 ('Bonn Convention') or the World Heritage Convention, 1972 – expressly refer to wildlife corridors. This is not a huge failing, since legal provisions have the ability to be sufficiently enabling without referring to the exact term – Article 8(a) of the CBD, for example, exhorts the development of 'a system of protected areas', and 8(d) the 'protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings'. Article 10 of the European Council Directive 92/43/EEC ('the Habitats Directive') also provides for the conservation of corridors without actually referring to the term. These measures include, by necessary implication, the development and conservation of corridors, in signatory countries where habitats have become fragmented as a result of anthropogenic pressures (which is true for almost every country today).

10. A. Wilson, B. Fenton, G. Malloch, B. Boag, S. Hubbard, and G. Begg, 'Urbanisation versus Agriculture: a comparison of local genetic diversity and gene flow between wood mouse *Apodemus sylvaticus* populations in human-modified landscapes' (2016) 39(1) *Ecography* 87–97.

11. J. Beninde, M. Veith and A. Hochkirch 'Biodiversity in Cities needs Space: A Meta-analysis of Factors Determining Intra-urban Biodiversity Variation' (2015) 18(6) *Ecology Letters* 581–592.

12. K.L. Masters and P.A. Townsend, 'Lattice-work Corridors for Climate Change: A Conceptual Framework for Biodiversity Conservation and Social-ecological Resilience in a Tropical Elevational Gradient' (2015) 20(2) *Ecology and Society* 1.

What is a greater concern with legal frameworks for habitat conservation, not only of an international legal character but even in domestic legal regimes (as shall be discussed in the sections to follow) is the ability of law (by its nature, a static fact) to keep up with, or be adaptable towards, fast-changing environmental contexts – due to, among other anthropogenic factors, climate change. It may be justifiable in the contexts of most of the international instruments mentioned previously, since they were (except the CBD) signed at a time when climate change was not so conspicuous a part of the mainstream policy discourse.¹³ In spite of this, the Ramsar Convention hints at some elbow room for dynamism in managing protected areas designated under it ('Ramsar wetlands') by requiring states to inform the Secretariat if 'the ecological character of any wetland included in its territory and included in the List has changed, is changing, or likely to change as the result of technological developments, pollution or other human interference.'¹⁴ Even in the other conventions, subsequent Conferences of Parties ('CoPs') have reached agreements and decisions in response to contemporaneous issues. The 7th CoP of the CBD held in 2004, for example, adopted a programme of work on protected areas. In furtherance of this, it established an Ad-Hoc Open-Ended Working Group on Protected Areas, whose mandate includes, *inter alia*, contributing to the further development, management, monitoring and evaluation of national and regional systems of protected areas, including ecological corridors.¹⁵ In the face of these positive developments, it is a rude reminder of the soft nature of such international law instruments that India, even as a signatory of the CBD, has still not accorded formal legal recognition to ecological corridors.

In spite of all this, there have been efforts to incorporate the conservation of habitat linkages in jurisdictions, which merit critical examination. The common law jurisdiction of the United States and the civil law regime of Europe have been selected for this comparative review – seeing as how the system in India (originally a common law jurisdiction) has evolved today into a synthesis of the two with codified legislation as the primary source of law, supplemented with judicial interpretations and pronouncements.

European law

The Bern Convention on the Conservation of European Wildlife and Natural Habitats, 1979 ('Bern Convention') obliges its parties to take all measures necessary for the conservation of the natural habitats of wild flora and fauna species. It is, on a reading, more mandatory in its prescriptions than the CBD, by specifically imposing the obligation to take 'necessary legal and administrative measures' in furtherance of its objectives.¹⁶ It is theoretically more effective in its working inasmuch as it, unlike most other international conventions, provides for a comprehensive monitoring and implementation system to periodically assess compliance as well as the effectiveness of the Bern Convention. This system incorporates:

- Compulsory biennial reports submitted by parties on the use of the exceptions allowed under Article 9;
- Voluntary general reports submitted by parties on the status of implementation (every four years);
- Legal reports analysing the implementation of the Bern Convention country-wise, commissioned by the Secretariat;

13. A. Cliquet, 'International and European Law on Protected Areas and Climate Change: Need for Adaptation or Implementation?' (2014) 54(1) *Environmental Management* 721.

14. See Article 3(2) of the Ramsar Convention. Available at: www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf (Last accessed 22 January 2016).

15. Decision VII/28 of the Conference of the Parties, Convention on Biological Diversity (Kuala Lumpur, 2004) at para. 25. Available at: www.cbd.int/convention/wgpa.shtml (Last accessed 22 January 2016).

16. Articles 4–7 of the Bern Convention. Available at: www.persona.uk.com/a21Ton/Core_dox/J/J2.pdf (Last accessed 22 January 2016).

- National reports submitted to and analysed by the Group of Experts regarding their target species/habitats; and
- Reports submitted by parties and observers on the follow-up of Recommendations made by the Standing Committee under Article 14.

Even on the point of climate change adaptability, various Standing Committee recommendations within the framework of the Bern Convention have stressed on the establishment and preservation of sufficient connectivity between protected areas for various species.¹⁷

Besides the Bern Convention, the European Council also adopted two directives relevant in this regard – commonly known as the Birds¹⁸ and Habitats¹⁹ Directives. These have a greater legal force than the international conventions discussed above, derived from Article 288 of the Treaty for the functioning of the European Union ('the EU Treaty'), which states that a directive 'shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods'. If the Member State fails to adequately comply with the directive, the European Court of Justice ('ECJ') has the jurisdiction (under Article 260 of the EU Treaty) to direct the Member State to comply, or even impose a lump-sum penalty in case of failure to nationally transpose directive obligations.

Another positive feature of the two EU directives is the elucidation of *qualitative* goals, as against the mere prescription of conservative or restorative procedures. For example, the Birds Directive requires the maintenance of populations at levels that correspond to 'ecological, scientific and cultural requirements' (Article 2). The Habitats Directive, too, enjoins its Member States to maintain or restore natural habitats and species at a 'favourable conservation status' (Article 2). According to the definition, the conservation status of a natural habitat will be considered as favourable when 'its natural range and the areas it covers within that range are stable or increasing, when the specific structure and functions which are necessary for its long-term exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable [which is defined separately]'. These provide one solution, in theory, for the problem of static conservation laws in rapidly changing ecological contexts. It is, however, also noteworthy that as per the European Commission's own data, only 17 per cent of habitats and species covered by the Habitats Directive are at a 'favourable conservation status'.²⁰

It is also worthwhile to note that Article 10 of the Habitats Directive – perhaps most relevant to this discussion – mentions landscape features, which are 'essential for the migration, dispersal and genetic exchange of wild species' (clearly referring to corridors). The mandate in this provision is couched in extremely soft language, however – it enjoins Member States to 'endeavour, where they consider it necessary' to 'encourage the management' of such landscape elements. Harking back to the discussion in the first part of this article, this provision seems to view corridors as temporary use habitat connectors, rather than permanent habitat range elements. This approach is indicative of the delicacy with which corridor conservation is approached, not only in Europe, but elsewhere in the world as well – as is subsequently discussed.

17. See Bern Convention Standing Committee Recommendations No. 135 of 2008; 143 of 2009 and 159 of 2012.

18. European Council Directive 2009/147/EC, originally adopted in 1979 and amended in 2009.

19. See discussion at para. 2, page 6 *supra*.

20. European Commission, *Composite Report on the Conservation Status of Habitat Types and Species as required under Article 17 of the Habitats Directive 7-9* (EEC, 2009). Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009DC0358&from=EN>. (Last accessed 23 January 2016).

American law

Examining the legal frameworks for corridor protection and habitat connectivity in national contexts will lend a better perspective to the interplay of politics and economics that are reflected in legal conservational outcomes. In the United States, federal statutes such as the Endangered Species Act ('ESA'), the Migratory Bird Treaty Act ('MBTA') and the Marine Mammal Protection Act ('MMPA') all exist for the protection of migratory species and thus also corridors, but they have their limitations. The ESA, for one, is largely reactive and does not provide any real protection to species or habitats until, as is evident, they are endangered. The MBTA and MMPA, as is also apparent from their titles, exist for the benefit of specific animals – there is a lack of an integrated framework for the conservation of migratory species and corridors. There are also significant jurisdictional complexities in determination of land-use policies: the Bureau of Land Management, the Forest Service, the Fish and Wildlife Service and the National Park Service are the major land management agencies of the American state²¹ – coordination between which is integral for effective corridor designation and management. Moreover, the legislations do not aim to preserve corridors for their functional benefits, but do so incidentally and in a limited manner by looking to protect the minimum viable populations of certain species²² (and do not aim for a net gain in either habitat areas or meta-populations).

Even apart from the above limitations in the text of the law and policies, the successful policy interventions to conserve corridors in the US have been highly qualified for other reasons as well. Recently, a pronghorn migratory corridor in the western US was accorded protected status in the forest's management plan.²³ This policy success was only possible in the small area where the threat to the corridor was almost absent even prior to the change. The economic and social interests at play (or 'the stakeholders' rights argument') in the rest of the relevant landscape did not allow for a substantial change in the land-use pattern that was required for the protection of this corridor ('the ecological argument'). This partial success was achieved through the unconnected pursuits of two separate strategies, through two separate groups of stakeholders, for whom the conservation question was framed in different terms – an important lesson.

Indian law

India is a signatory to all the international conventions mentioned in the beginning of this Part, and consequent to its ratification has enacted legislation in furtherance of the objectives of biodiversity and habitat conservation common to them. The Wild Life (Protection) Act, 1972 ('WLPA') is the major statute in this regard. It provides for the notification and management of protected areas such as sanctuaries, tiger reserves and national parks – but fails to address habitat connectivity in a concrete way.²⁴

This is not to say that there is a total paucity of legal solutions for corridor protection, if the problem is phrased as one of management of land-use patterns around protected areas ('PAs'). The National Tiger Conservation Authority (under the Ministry of Environment and Forests) in 2012 issued guidelines for tourism in and management of tiger reserves in India (in response to a Supreme Court direction).²⁵ These guidelines are the only Indian legal instrument which specifically allude to the criticality of corridors in

21. V.J. Meretsky, J. W. Atwell and J. B. Hyman 'Migration and Conservation: Frameworks, Gaps and Synergies in Science, Law and Management' (2011) 41(1) *Environmental Law* 495.

22. *Ibid.* at 473.

23. D.N. Cherney, 'Securing the Free Movement of Wildlife: Lessons from the American West's Longest Land Mammal Migration' (2011) 41(2) *Environmental Law* 609–610.

24. While the provision for conservation reserves (s. 36A) intends to preserve, *inter alia*, ' . . . those areas which link one protected area with another . . . ', this has not been utilised in the way, or to the extent, that was perhaps envisioned.

25. *Supra* n. 9, at 70–71.

conservation efforts. While guidelines form a part of what are commonly referred to as ‘delegated legislation’ in India, and lack in-built sanctions for default (unlike statutes), those with their roots in a statute have been held to be enforceable without exception.²⁶ Even non-statutory guidelines have been clothed with enforceability by the Supreme Court of India, if they have created a legitimate expectation from the issuing authority, or even if departing from them undermines the public purpose which they are intended to serve.²⁷ In essence, these guidelines ensure there is not a complete absence of enforceable legal provisions for corridor conservation in India.

Besides this, a number of other statutory tools are also available for conserving connective landscape elements like corridors, depending upon the context:

The expansion of buffer zones of protected areas (beyond the existing boundaries, and not at the expense of the core protection zone) is a possible solution, but the alteration of boundaries for sanctuaries²⁸ and national parks²⁹ is a high-cost, low-return strategy, requiring the recommendation of the National Board for Wild Life (‘NBWL’). Practically, the expansion of boundaries of PAs is virtually impossible, given the anthropogenic pressures on the periphery of buffer zones and beyond – making the move a politically unviable one.

Restraining the change in land-use patterns around PAs through notification of community reserves³⁰ (for private lands), which requires the prior alignment of local community goals with conservation objectives.

Providing for an additional (albeit lower) degree of protection in areas around PAs in the form of conservation reserves,³¹ eco-sensitive zones,³² or as reserved forests.³³ These are practically still vulnerable to change in land-use, especially for infrastructure or defence projects.

It is clear that the legal framework available for protection of corridors in India is still nascent – to say nothing about the adaptability of this framework. Still, the picture isn’t completely bleak – the preceding discussions showed that there are extant legally enforceable provisions for corridor conservation. There have also been favourable judicial and executive interventions in this area, which shall be discussed in more detail in the following part – along with the challenges that are invariably faced.

Part III: Corridors in India – Impediments and developments

Impediments to conservation

Wildlife corridors are threatened by various social, economic and anthropogenic factors. India’s growing population of more than a billion puts tremendous pressure on its natural spaces. Growing need for land, infrastructure and energy requirements of such a large population have slowly pushed the natural spaces into

26. *Knittex Overseas Pvt Ltd v State Bank of Patiala and Ors*. AIR 2008 P&H 59; *Raheja Hospital and Psychiatric Research Institute v. Lt Governor of Delhi and Ors* 121 (2005) DLT 193; *Damayanti Verma (Deceased) v Life Insurance Corporation of India and Anr*. Writ Petition (Civil) No. 4342/2007. Available at <http://delhicourts.nic.in/JULY11/Damayanti%20Verma%20Vs.LIC.pdf> (last accessed 4 July 2016).

27. *Narendra Kumar Maheshwari v Union of India* AIR 1989 SC 2138.

28. Section 26A(3) of the WLPAs.

29. *Ibid.* s. 35(6).

30. *Ibid.* s. 36C.

31. *Ibid.* s. 36A.

32. Ministry of Environment and Forests, *Guidelines for Declaration of Eco-Sensitive Zones Around National Parks and Wild Life Sanctuaries* (MoEF, New Delhi, 2011).

33. Sections 3–20 of the Indian Forest Act, 1927.

silos of PAs. Most PAs are surrounded by human habitation, agriculture, mining and, roads and railways cutting across wildlife corridors that connect these source areas to one another. However, the long-term survival of species depends on maintaining viable habitats and connecting corridors which ensures variation in gene pool, and avoids risks associated with habitat fragmentation and isolation of species. Further, for ensuring viable habitats it is essential to maintain large, contiguous landscapes.

For a developing country like India, most PAs are connected by patches of forests, grasslands or agricultural land in most areas. However, socio-economic pressures have led to fast-depleting corridor spaces. The biggest concern for corridor management is the growing linear infrastructure network in the country. Linear infrastructure projects – roads, trains and power lines, make deep intrusions into forests over thousands of kilometres across the country, causing widespread fragmentation of forests, land degradation and erosion in mountains, and wildlife casualties through road kills, electrocution and train accidents. Worldwide, a new field of applied research is developing on ‘road ecology’³⁴ which aims to quantify the ecological impact of roads and study the mitigation measures needed to lower the risk to individuals, communities and ecosystems.

The situation is further exacerbated by the central government’s policies: the Union Ministry of Environment, Forests and Climate Change has even eased the clearance process for linear infrastructure to begin work as soon as the project receives approval in principle from local authorities.³⁵ Some of the prominent examples of linear infrastructure cutting across PAs and critical corridors are NH 72 and 74 crossing Rajaji National Park, NH 6 and 7 crossing through the biodiversity-rich central India landscape intersecting six tiger corridors in the Vidarbha region of Maharashtra,³⁶ NH 37 through Kaziranga National Park, and NH 54 through Borail Wildlife Sanctuary in Assam among many others. National and state highways intersect and traverse through almost 26 of the 42 PAs declared as tiger reserves in the country.³⁷ Mining and irrigation projects pose another major threat to corridors. Tadoba Tiger Reserve is connected to other habitats in Andhra Pradesh in the South, Gadchiroli in the East and Nagpur in the North through three major corridors. Irrigation and mining projects in the area have led to widespread fragmentation and discontinuous migratory routes for tigers. An irrigation canal cutting across Brahmapuri forest division adjoining the tiger reserve and recent clearances³⁸ to mining projects in Chandrapur on the fringes of Tadoba have already led to the cutting off of critical corridors in the area; future development in the area will only lead to isolation of the reserve. Apart from linear infrastructure and mining and irrigation projects, increasing population is leading to illegal encroachments across the PA network. PAs like Kaziranga National Park have faced widespread destruction due to illegal encroachments in and around the National Park cutting off major migratory routes of elephants. The *Numaligarh Refinery* case in Kaziranga³⁹ where four elephants died trying to cross an illegal wall construction depicts the sad state of corridor management in the country. If the country’s corridor network is to be protected, it is essential to integrate corridor management into the environmental law framework. The case studies discussed hereinafter portray the various issues with corridor management in critical landscapes. An attempt has been made to devise legal measures that can help in providing legal protection to critical corridors in these areas.

34. See generally R. van der Ree, D. Smith et al., *The Handbook of Road Ecology* (Wiley Blackwell: Hoboken, 2015).

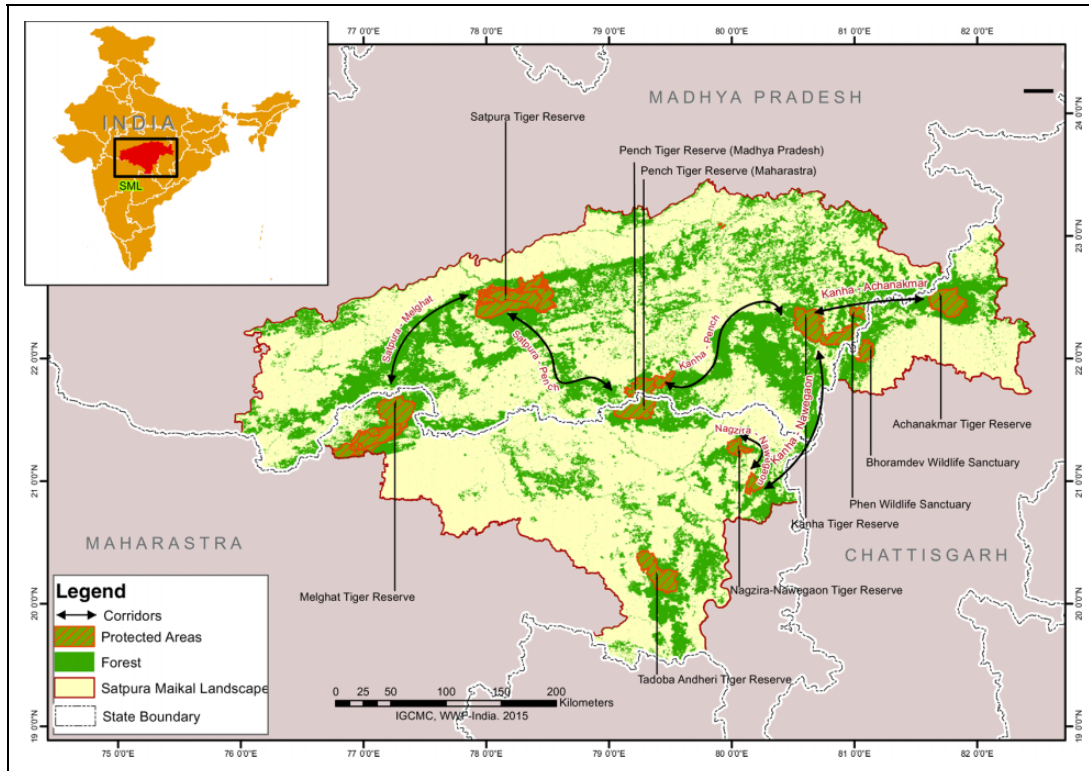
35. D.K. Dash ‘Javadekar eases green norms for linear projects’ *The Times of India* 1 January 2015.

36. A. Saxena, B. Habib et al., ‘Proposed mitigation measures for habitat contiguity and reducing wild animal mortality on NH 6 & 7 in the central India landscape’ *Technical Report* (WII and NTCA, New Delhi, 2015).

37. See A. Rajvanshi et al., *Roads, Sensitive Habitats and Wildlife Environmental Guidelines for India and South Asia* (WII and CEC Ltd., New Delhi, 2001).

38. N.M. Ghanekar, ‘Maharashtra: Tadoba Tiger Reserve faces coal mine threat’ *DNA India*, August 30, 2015.

39. *Rohit Choudhury v. Union of India*: M.A. No. 787 of 2015 in Application No. 38 of 2011 before the National Green Tribunal.



Note: The corridor indicated is notional and not to scale, but is based on field observations of animal movements in the region.

Kanha-Pench corridor in the Satpuda Maikal Landscape

Central India holds a large percentage of the tiger population and the Satpuda Maikal Landscape ('SML') is a global priority landscape for tiger conservation. Nonetheless, the area is rife with development, infrastructure and mining projects leading to widespread habitat fragmentation. The SML map below depicts the fragmented PAs across the landscape with important corridors identified by WWF-India. The Kanha-Pench ('K-P') corridor is clearly identifiable as the thin green patch connecting the two tiger reserves.

The Kanha-Pench (K-P) corridor complex harbours around 120 tigers creating a healthy meta-population of tigers in central India, along with other critical flora and fauna. The landscape also supports diverse land use, forest protection regimes and traditional forest-dwelling tribal communities.⁴⁰ The single corridor is spread over a large area and functions as a network falling under several forest division jurisdictions, with numerous pockets of permanent human settlements. There are approximately 440 villages⁴¹ in the corridor complex between Kanha and Pench and the numbers seem to keep increasing. However, human-wildlife conflict is not the biggest threat in the region. Linear

40. See generally J. Jena et al., 'Lifeline for Tigers: Status and Conservation of the Kanha-Pench Corridor' (WWF India, New Delhi, 2014).

41. *Ibid.* at 9.

infrastructure development in the last decade has become a major threat to the corridor. National Highway-7 (NH 7) is a major barrier for animal movement in the corridor. Numerous road-kill accidents have been documented in the area, but development demands in the region are high and at present the MoEF and the National Highways Authority of India ('NHAI') are in the process of widening the highway to four lanes. The project is in the middle of a litigation tussle with the National Green Tribunal ('NGT'), the Supreme Court and the Maharashtra High Court passing contradictory orders. Conservationists feel that an alternative route on NH 69 could be used to avoid the widespread damage the expansion of NH 7 could have on the ecology of the area.⁴² However, the government has cleared the project and the expansion work is underway. The NGT had ordered a stay on tree felling and all construction work, but the work continued under orders from the Maharashtra High Court. While the tussle still continues, the Supreme Court has recently ordered the petitioners to present mitigation measures to the Maharashtra High Court. A report by the Wildlife Institute of India ('WII') suggested mitigation measures for the project costing the NHAI an extra \$215,000 which the NHAI incorporated into the project plan. The mitigation measures suggest the building of flyovers and underpasses for ease of passage for wildlife. Despite these measures, the project will greatly disrupt the ecology of the area and it remains to be seen how well a system of underpasses made popular by the United States, (in states like Montana, for example, where the wildlife crossing structures on Highway 93⁴³ have been largely successful in protecting wildlife from road accidents) will fare in the Indian context.⁴⁴ Given the topographical and vegetational differences between the two countries, however, transposing this concept directly may not be advisable. Adaptive structures, such as the canopy bridge serving lion-tailed macaques in Tamil Nadu's Anamalai Tiger Reserve⁴⁵ are perhaps a more effective solution in this regard.

Another threat to the K-P corridor is the proposed broadening of a narrow-gauge railway track from Nainpur to Balaghat; this will severely impact the corridor. The length of the track is 74.9 km, of which 17.9kms run through the K-P corridor.⁴⁶ The line cuts the corridor into two halves at the Nainpur and Pandiyachapara sections, two critical linkages.⁴⁷ The conversion of the railway track to broad gauge would allow for a considerable increase in speed of the train, which was limited to approximately 40 kmph due to the narrow gauge line. Having been rejected once, the project was cleared by the Forest Advisory Committee ('FAC') with certain conditions and mitigation strategies. The FAC directed WII to formulate a mitigation strategy, approved by the NTCA, before Stage II clearance. The project is awaiting Stage II clearance at present; conservationists feel is now only a procedural delay.

The functional status of various corridors within central India is rapidly declining with increased threats of development projects, linear infrastructure and the changing socio-economic status of the communities living within and around the corridors. It therefore becomes imperative that the

42. N. Sinha 'Saving tigers caught in the headlights' *The Hindu*, 9 April 2015.

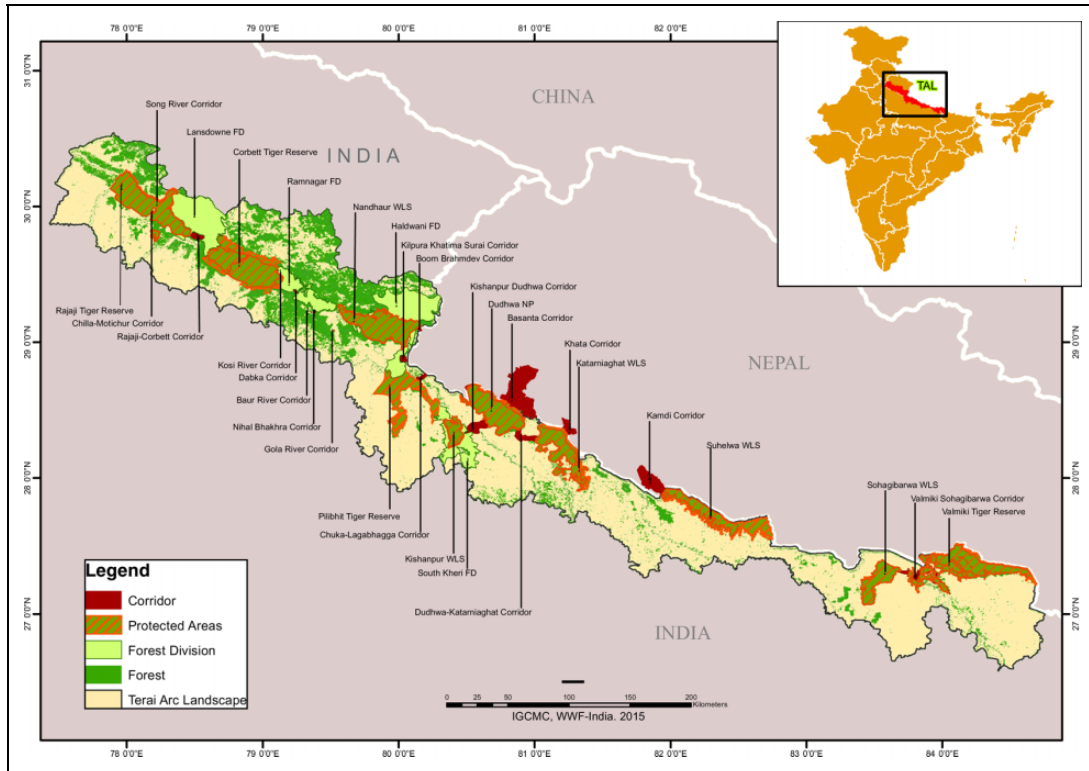
43. See Hardy, A.R., J.Fuller, et al. 'Evaluation of Wildlife Crossing Structures and Fencing on US Highway 93 Evaro to Polson Phase I: Preconstruction Data Collection and Finalization of Evaluation Plan' *Final Report* (2006). Available at: www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/wildlife_crossing/final_report.pdf (Last accessed 6 July 2016).

44. J.P. Purdum, (2013) *Acceptance of Wildlife Crossing Structures on US Highway 93 Missoula, Montana* (Master's thesis), Retrieved from University of Montana ScholarWorks (Paper no. 47), available at <http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=1066&context=etd> (Last accessed on 7 July 2016).

45. G. Raghunathan, 'Bridging the Gap' *Conservation India*, 12 November 2012. Available at: www.conservationindia.org/gallery/bridging-the-gap (last accessed 7 July 2016).

46. See J. Vattakaven, *Fragmentation Threat in the Kanha-Pench Corridor: Implications of the Gondia-Jabalpur Railway Line on Corridor Connectivity and Tiger Dispersal* (WWF India, New Delhi, 2010).

47. *Ibid.* at 9.



Note: The corridor indicated is notional and not to scale, but is based on field observations of animal movements in the region.

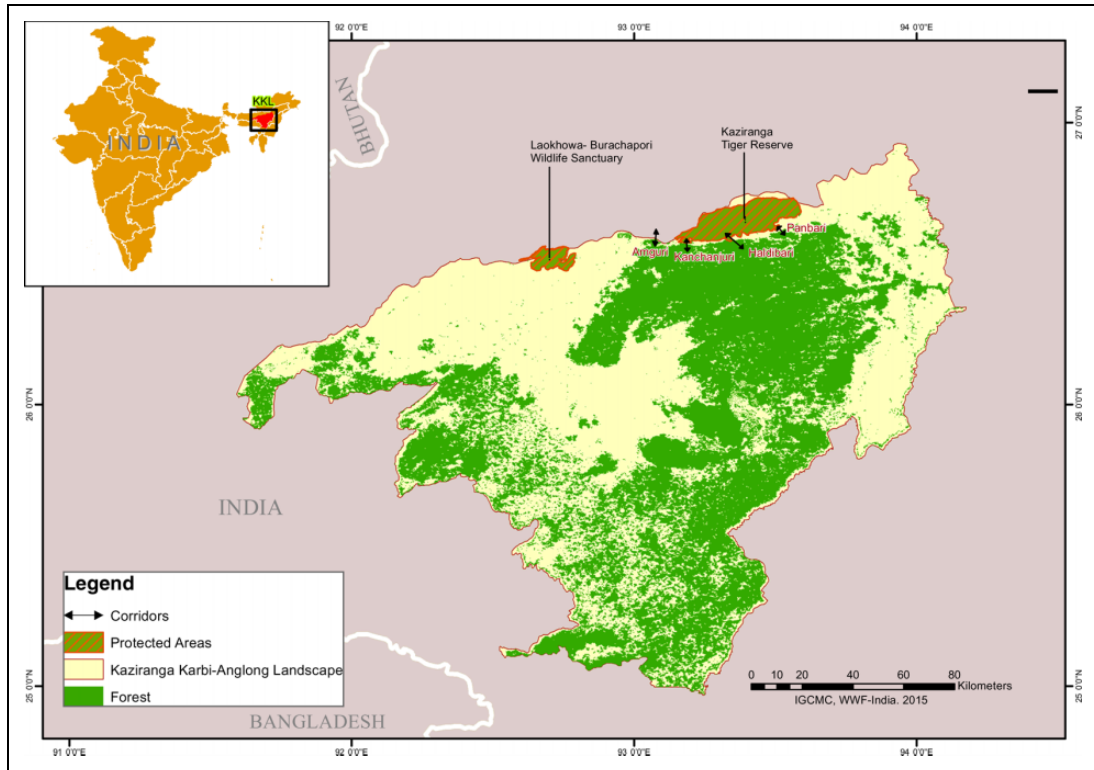
status of critical corridors like K-P are maintained and legally safeguarded by bringing them under a uniform regime.

Kilpura Khatima Surai Corridor in the Terai Arc Landscape

The Terai Arc Landscape ('TAL') spreads across 810 km of the Indian states of Uttarakhand, Uttar Pradesh and Bihar, and the low-lying hills of Nepal. The landscape boasts of some of India's most well-known Tiger Reserves and Protected Areas such as Corbett Tiger Reserve, Rajaji National Park, Dudhwa Tiger Reserve, Valmiki Tiger Reserve and Nepal's Bardia Wildlife Sanctuary, Chitwan National Park, and Sukhla Phanta Wildlife Sanctuary. In total, the landscape has 13 Protected Areas, nine in India and four in Nepal, covering a total area of 49,500 sq. km: 30,000 sq. km lies in India.⁴⁸

The image below (Source: WWF India) shows the PAs in the landscape and the various corridors that connect the source areas. The Kilpura Khatima Surai ('KKS') is a critical corridor that connects Corbett National Park to other source areas. It is the only tiger corridor that connects Uttarakhand and Uttar Pradesh and the last remaining connectivity between the tiger populations of lower Himalayas and Terai. Apart from being a priority tiger corridor, KKS is also among the 'Priority II Elephant corridors'

48. See www.wwfindia.org/about_wwf/critical_regions/terai_arc_landscape/about_terai_arc_landscape/ (Last accessed 23 January 2016).



Note: The corridor indicated is notional and not to scale, but is based on field observations of animal movements in the region.

identified by the Elephant Task Force of the Ministry of Environment, Forests and Climate Change ('MoEF').⁴⁹ In the last century, the region has seen rapid transformation from dense wilderness and malarial forests,⁵⁰ to a largely agrarian area with a densely populated landscape dominated by fields of wheat, rice and sugarcane, interspersed with roads and railway networks. Today less than two per cent of the contiguous natural habitat remains protected as PAs.⁵¹ One of the most pressing concerns in the area is the widening of National Highway ('NH') 125 which passes through the wildlife corridor. Recently, the Uttarakhand forest department approved the widening of NH 125 based on the 'Project Summary' which wrongfully stated that the road does not pass through any National Park/Sanctuary/Wildlife corridor/Eco-sensitive zone. These kinds of incidents are not uncommon and linear infrastructure across PAs and corridors has been prioritised as indispensable to development. As the needs of a growing economy increase, protection of wildlife corridors now rests on mitigation measures like over and under passes to ease the movement of wildlife.

49. M. Rangarajan et al., 'Gajah: The report of the Elephant Task force' (Ministry of Environment and Forests, New Delhi, 2010). Available at: www.moef.nic.in/downloads/public-information/ETF_REPORT_FINAL.pdf (Last accessed 23 January 2016).

50. R. Tilson, P.J. Nyhus (eds), *Tigers of the World: The Science, Politics and Conservation of Panthera tigris* (Academic Press: Cambridge, 2010) 164–167

51. *Ibid.*

Kaziranga–Karbi Anglong Landscape

The Kaziranga–Karbi Anglong Landscape (KKL) in the central part of Assam is an area where the Kaziranga National Park (KNP), a world heritage site and home to two-thirds of the world's population of the one horned rhino, is known to be contiguous with the now partially disjointed Karbi Anglong (KA) hills forming a critical corridor network. Kaziranga National Park, the biggest PA in this landscape is connected with the rest of the landscape through four corridors, namely Panbari, Haldhibari, Amguri and Kanchanjhuri, which are facing various developmental and anthropogenic pressures.⁵² NH 37, which divides the low-lying areas of Kaziranga and the hills of Karbi Anglong is one of the primary concerns in KKL. Assam receives a lot of rainfall during the monsoons, and each year KNP is flooded forcing wildlife to take refuge in the Karbi Anglong Hills southwards, which is across the highway (see the KKL map above). A number of animals are killed on the road each year due to speeding traffic. The matter has been in litigation since 2012 when petitioner Rohit Choudhary⁵³ challenged the widening of a stretch of the highway. The Highway was supposed to be de-notified as a highway and moved away from KNP, as one of the conditions under the environmental clearance granted to Numaligarh Refinery Limited in 1991. The condition stipulated that the work on the diversion of the highway should start before construction of the refinery begins and that it should be completed before the commissioning of the refinery project. However, the refinery started functioning in defiance of the conditions. At present, the NGT has passed several orders directing the state government and the forest department to put in place short-term mitigation measures to reduce the number of road kills and accidents.

Recently, the Numaligarh refinery came under fire again for illegal construction within the no-development zone of the national park obstructing a key elephant migratory route through the Deopahar forest area.⁵⁴ The NGT has stayed construction of the wall, calling the forest clearance an 'abuse of law'.⁵⁵ The NGT has, in fact, taken a keen interest in the case and pulled up park authorities and government authorities against the sheer expanse of illegal development around the National Park. The corridors within the KKL Landscape are threatened by a multitude of problems ranging from the speeding traffic on NH 37, the expansion of unplanned settlements, manual stone quarries in the hill slopes of Bagori, agricultural practices, to the mushrooming of hotels and resorts around the corridors in the last few years. This, in addition to the threat of poaching and illegal wildlife trade in the area, will have a long-lasting impact on the last remaining patch of rich biodiversity in Assam. While judicial intervention has led to a considerable decline in encroachments and illegal construction in the landscape, a faulty environment and forest clearance system needs to be evaluated by the state authorities. It is clear that unless corridors are protected under a legal regime, political, social and anthropogenic pressures will slowly lead to the disintegration of these integral ecological connectors.

Legal measures for corridor protection

On the basis of these case studies, it is clear that unless some form of legal protection is provided to corridors, it will become increasingly difficult to prevent development and other socio-economic factors from destroying corridor connectivity. However, there is no law which specifically defines or protects wildlife corridors, or prohibits development within, and around important corridors in India. However, wildlife corridors have been mentioned in certain environmental and wildlife laws and guidelines. Most of

52. See www.wwfindia.org/about_wwf/critical_regions/kaziranga_karbi_anglong/about_kaziranga_karbi_anglong/ (Last accessed 24 January 2016).

53. *Rohit Choudhury v Union of India and Ors*: Original Application No. 174 of 2013 before the National Green Tribunal.

54. U. Bhattacharya, 'How Development is Killing Assam's Endangered Elephants' *NDTV* 12 October 2015.

55. See Saxena et al. above n. 35.

these legal measures have hardly been used by the government to protect wildlife corridors and have remained largely dormant in the area of corridor protection and management.

Notification of eco-sensitive zones

An eco-sensitive zone is one which surrounds a protected area and acts as a 'shock absorber', with restricted commercial activity, to reduce pressure on the PAs. Considering most wildlife corridors are threatened by increased industrial activity and human habitation, it can be advantageous to use this provision for the declaration of a corridor as an ESZ.

The Ministry of Environment and Forests (MoEF) issued certain guidelines in 2011, to notify eco-sensitive zones in accordance with the Wildlife Conservation Strategy 2002, the National Wildlife Action Plan (2002), the National Board for Wildlife's letter dated 27 May 2005, and the Supreme Court's directions to states, to declare ESZs around protected areas.

According to these MoEF Guidelines, a corridor can be included in an eco-sensitive zone. Section 4.2 of the Guidelines states: 'In cases where sensitive corridors, connectivity, and ecologically important patches, crucial for landscape linkages, are even beyond 10 KM width, these should be included in the Eco-sensitive Zone.' As a primary step towards notifying ESZs, an inventory of the different land-use patterns and the different types of activities, types and number of industries operating around each of the PAs as well as important corridors is to be taken. This could be done by the appropriate Range officers, who can take stock of activities within 10 km of their range. Further, the process provides for the formation of a small committee comprising the appropriate wildlife warden, an ecologist, a local government official and an official of the local Revenue department; this can suggest the extent, requirement and management of the eco-sensitive zone.

It is pertinent to note that approximately 107 ESZ notifications have been announced by the MoEF on its website, and the ministry is in the process of finalising the proposals.⁵⁶ While the Guidelines clearly specify an area of up to 10KM to be demarcated as an eco-sensitive zone, a reading of the draft notifications indicates a trend contrary to the intention of creating an ESZ to conserve the forests, wildlife and environment. Just a bare reading of the draft notifications shows that most states have notified an average area of 100 meters to 4 Km as an ESZ. There are certain critical areas like Khangchendzonga National Park with a proposed ESZ of 200 meters, raising concerns for the other ecologically critical protected areas and corridors. At this point, it has become necessary to use the legal space for the protection of corridors in light of the recent developmental pressures.

Conservation reserves

Both conservation and community reserves are the result of gradual move towards inclusion of local communities in biodiversity conservation in India. Protected areas in India were based on a preservationist principle which has affected millions of people and their livelihoods over the last 40 years.⁵⁷ The recent inclusion of community and conservation reserves within the law was a result of a global push for community practices for biodiversity protection and a more inclusive system of governance. However, the law does not define how a CR is to be identified or chosen; probably for the reason that adequate freedom should be given to the local communities to determine the need for a CR (community or conservation). For example, Aghanashini Lion-tailed Macaque Conservation Reserve in Karnataka holds the largest

56. See www.moef.gov.in/content/esz-notifications (Last accessed 24 January 2016).

57. Kanagavel, A., R. Pandya, *et al.* 'Community and conservation reserves in southern India: status, challenges and opportunities.' (2013) 5(17) *Journal of Threatened Taxa* 5256–5265. Available at: <http://dx.doi.org/10.11609/JoTT.o3541.5256-65> (Last accessed 5 July 2016).

population of the 'Endangered' Lion-tailed Macaque *Macaca silenus*. A study conducted in 2012⁵⁸ found that the reserve was established for the protection of the species and threatened corridors in the area. In the beginning, the communities felt that declaring the area a conservation reserve would hamper their rights of resource use, but with the involvement of a local NGO and the forest department, the 299.52 km stretch was formally declared as a conservation reserve on 13 June 2011. It is managed in collaboration with the FD and gram panchayats without restricting resource use of the community.

Section 36A of the Wildlife Protection Act, 1972 states that: 'The State Government may, after having consultations with the local communities, declare any area owned by the Government, particularly the areas adjacent to National Parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve for protecting landscapes, seascapes, flora and fauna and their habitat.'

As of September 2015, there are 66 conservation reserves (CR) in the country.⁵⁹ Most seem to be areas in the buffer zones of PAs (like Darlaghat CR on the edge of the Darlaghat WS; Saraswati CR on the edge of the Saraswati WS), and even villages on the fringes of forest areas (such as Borgad in Maharashtra) have been declared as CRs. From the list, it can be seen that areas as small as 0.67 sq. km have been notified as CRs. Certain CRs – like Sudhmahadev in J&K (142 sq. km) and Afghanashini in Karnataka (299 sq. km) – are appreciably large areas. The average size of a conservation reserve in India is about 36 sq. km – which is by no means a negligible area. Conservation reserves evince a unique approach to protect threatened species, their habitats, and corridors, with minimal interference with the livelihoods of local communities – who have historically lived harmoniously with the ecology of the areas they inhabited. The specific provision under law enables a conservation reserve to be declared on any government land; this serves a conservation function of protecting habitat or connecting corridors, providing very wide potential for its use. Using this legal space as an instrument to protect corridors and ecologically sensitive areas, therefore, seems like a strategy worth pursuing – especially since many CRs (Borgad and Chharidhandh, to name two) have been notified following pressure and lobbying from conservation groups. The MoEF has proposed a draft policy for proposals affecting NPs and WLS,⁶⁰ where it has shown a proclivity towards declaration of areas around PAs as conservation reserves rather than denotifying them completely, in case of infrastructural or other proposals – and granting of additional areas in lieu to the PAs.

Community reserves

Section 36C of the Wildlife Protection Act, 1972 states: 'The State Government may, where the community or an individual has volunteered to conserve wild life and its habitat, declare any private or community land not comprised within a National Park, sanctuary or a conservation reserve, as a community reserve, for protecting fauna, flora and traditional or cultural conservation values and practices.'

The WLPA also mandates that after the notification of the community reserve, 'no change in the land use pattern shall be made within the community reserve, except in accordance with a resolution passed by the Management Committee and approval of the same by the State Government'.

Legally, the law is clear in its mandate to provide communities with the right to protect biodiversity; however the implementation of this provision has been difficult. While community-conserved areas (CCAs) have been successfully established in North-East Indian states for the protection of threatened species,⁶¹ there is hesitance on the part of communities, in proposing community reserves legally, mainly owing to

58. Ibid.

59. See <http://wiienviis.nic.in/Database/cr/8229.aspx> (Last accessed 24 January 2016).

60. See www.moef.nic.in/sites/default/files/np-sanc.pdf (Last accessed 24 January 2016).

61. PTI 'Rare black-necked crane spotted in Arunachal valley' *The Hindu* 6 January 2012. Available at: www.thehindu.com/sci-tech/energy-and-environment/rare-blacknecked-crane-spotted-in-arunachal-valley/article2780243.ece (Last accessed 4 July 2016).

restrictions on land use change and the fear of losing resource rights. The Kadalundi-Vallikunnu estuary located in Kozhikode (Calicut), and Malappuram districts of Kerala State was the first Community Reserve of India, declared in 2007. The estuary faced several threats from sand mining, waste disposal, coir retting, and infrastructure development. However, the local community was not convinced about the declaration of a community reserve in the area due to concerns about the prospective loss of their livelihoods. However, government and NGO efforts in the area helped to garner support for the cause and the reserve was established in 2007. A coir factory was also set up outside the mangrove area by the reserve management committee to compensate for any livelihood loss.⁶²

As most corridors are threatened with changing land patterns which promote commercial development, notification of community reserves can be used as an important legal measure to protect wildlife corridors. As of October 2015, there are only 26 community reserves in India.⁶³ 22 of these are in Meghalaya, two in Punjab, and one each in Kerala and Karnataka.

CRs provide the appropriate legal protection for corridors and habitats outside PAs but their implementation has not been satisfactory. Lack of trust in the government, resistance to legal designations, and the historical role of the forest department in control of forest resources, have all diluted the potential of these legal measures. It is important that the concerned communities and the forest department are involved in the process together and there is a good working relationship between the two. For example, the forest department should involve local communities in capacity-building exercises and train them in forest management. The local communities should be provided with the opportunity to participate in forest management, and assured of their rights in the forest. It would also be beneficial for local NGOs to bridge the gap between the forest department and the communities and assist the communities in management of the reserves.

Biodiversity heritage sites

Section 37 of the Biodiversity Act 2002, states that the state government may notify areas of biodiversity importance as Biodiversity Heritage Sites (BHS) under the Act. The state government may then frame rules for the management and conservation of all heritage sites. The National Biodiversity Authority's 'guidelines for selection and management of BHS' provide for restrictions to be imposed on development activities in the demarcated areas; however, the same seems to be an option for the communities, and the Act does not provide for any concrete restrictions on development. This means that the community, by declaring a BHS, may at best get legal recognition for conservation efforts in the area, but might not be able to prohibit a development threat completely.

At present there are only seven biodiversity heritage sites notified in the country. Most of the state notifications have not provided for any stringent restrictions on development activities in the notified area. The only state to put considerable restrictions within a BHS is Maharashtra and even that is restricted to the collection of species and plants from the area in 'Glory of Allapalli' – clearly not commensurate with the legal protection intended in the act.

Identifying compatible land use in corridors: ESZ guidelines as a valuable tool

While demarcation of existing corridors in terms of legal categories such as an ESZ, community reserve or conservation reserve is an essential starting point, the focus must ultimately be on the land uses that are compatible with the ecological functions of the corridor. Identifying compatible land uses that can be sustained within the wildlife corridors thus becomes crucial. However, it is important to recognise that

62. Ibid at 56.

63. See www.wiienvs.nic.in/Database/Community%20Reserves_8228.aspx (Last accessed 24 January 2016).

changing land use patterns around protected areas have made it increasingly more difficult to impose restrictions through favourable legal instruments.

When it comes to identifying the compatible land uses that can be sustained within the wildlife corridor, the ESZ guidelines clearly point to a four-fold classification of activities that are *allowed*, *promoted*, *regulated* or *prohibited* within the notified area and the same has been adapted by the states in the notifications. As a way forward, the same four-fold classification could also be adapted in conservation reserves and community reserves. It is important to list the compatible land uses in both conservation and community reserves because a general survey of the notified community and conservation reserves does not provide any guidance whatsoever on compatible land uses that can be sustained within the notified area.

The broad list of activities which could be *allowed*, *promoted*, *regulated* or *prohibited* within an ESZ is enshrined within the guidelines. An excerpt below depicts the classification for reference:

S. No.	Activity	Prohibited	Regulated	Permitted	Remarks
1	Commercial Mining	Y			Regulation will not prohibit the digging of earth for construction or repair of houses and for manufacture of country tiles or bricks for housing for personal consumption.
2.	Felling of trees		Y		With the approval of the concerned authority
3.	Setting up of industries causing pollution (air, water and land pollution)	Y			
4.	Establishment of hotels and resorts		Y		As per approved master plan
5.	Organic farming			Y	Should be actively promoted

Conclusion

This article has attempted to, at the outset, establish that the scientific and intellectual bases for corridor conservation are well-founded and beyond doubt. The conservation and effective ecological management of corridors becomes a difficult exercise for two principal reasons: the complex semantics of the exercise of definition (the form and functionalities for corridors being different depending on the species using them) and the complex politics at play owing to the competing economic pressures between various stakeholders. Policy decisions in favour of ecological conservation always have an opportunity cost in the form of livelihood/economic loss for people, which serve to disincentivise decision-making authorities. As is evident from the discussions in Part III, corridors in India face a number of threats to their protection. It can also be seen that the present legal framework, though not totally unequipped to conserve and protect them (sections 36A, 38-O and 38 V of the WLPA are cases in point), needs to be supplemented with political will and a growing awareness about 'the ecological argument' alluded to previously.

In the face of these challenges, solutions must be creative. While extant spaces must be fully and effectively utilised, lessons can also be learnt from the discussions on international legal frameworks in Part II. The prescription of qualitative conservation goals in European instruments – through the incorporation of terms such as 'favourable conservation status' of natural habitats (Article 3 of the Habitats Directive), which hold responsible authorities to a higher degree of care in conservation – is a feature worth incorporating into our own statutory framework. Not only will this do away with the difficulty of defining a nebulous concept like a corridor, it will ensure that conservation schemes (such as the MoEF's protection of

wildlife outside protected areas) work towards results rather than merely following procedures with no definite objectives or goals. The US experience with conserving habitat linkages is instructive in the methodology that must supplement the law – for the problem is not only one of the law being unable to keep up with fast-paced environmental change, but equally one of its implementation being difficult owing to competing interests in land-use patterns. The (qualified) success story of the pronghorn corridor taught us that for effective policy change, the process must involve a dialogue between all stakeholder groups, and the problem must be phrased in a way so as to reconcile the competing interests between those groups. This is a tall order; but without this, even the most effective legal frameworks for corridor conservation will be rendered infructuous.

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