CHAPTER 9

Demarcating Wilderness and Disciplining Wildlife

Radio Tracking Large Carnivores in Yellowstone and Chitwan National Parks

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In the twentieth century, as national parks became sites for scientific research and objects of scientific management, they began – tentatively and incompletely – to leave behind their roots in nineteenth-century landscape aesthetics. Some new parks were established as scientific preserves where scientists could study apparently pristine ecosystems with minimal interference from competing human activities. Many existing parks, historically oriented toward recreation and nature preservation, found themselves caught between two visions. While they made room for park-based scientific research and attempted to integrate science into their management and interpretation practices, they also sought to prevent research and science-based management from undermining their identity as aesthetic or moral refuges from modern civilization. The clash between scientific and aesthetic visions of the parks should not be exaggerated; scientific insights into the geophysics of Yellowstone's geysers lent gravity to the spectacle of Old Faithful, and scientists were often drawn to study the natural phenomena of the parks because of their aesthetic appeal and cultural significance. Nonetheless, tensions did exist and regularly erupted into full-blown controversies over the proper relation between the scientific and aesthetic values of national parks.[1]

Although scholars have investigated the history of such tensions with regard to parks in the United States, Africa and, to a lesser extent, other regions of the world, the story that emerges has often been simplistic. Scientists have either been lionized as seekers of truth fighting a two-front war against starry-eyed romanticists and obstinate bureaucrats or unveiled as callous rationalists unable to appreciate aesthetic or moral values or the needs and hopes of local people. This essay attempts to avoid such extremes as well as the unsatisfying middle of 'sometimes one, sometimes the other'. Instead it shows how a

particular scientific intervention and the criticisms to which it was subjected transformed discourses around wilderness and wildness in two national parks in the 1960s and 1970s, a crucial moment in the development of the national park as a land-use institution with global reach. One of the parks, Yellowstone, was, perhaps needless to say, the inheritor of a long tradition of disputes over park management. The other, Chitwan National Park in Nepal – then known as Royal Chitwan National Park – was established only in 1973, a year after Yellowstone celebrated its hundredth anniversary. The scientific intervention in question was the use of wildlife radio tracking to study large carnivores, which profoundly influenced the way territory was demarcated and wild animals were disciplined at these two very different but intimately connected sites.[2]

It is common to speak of the 'national park idea' or the 'Yellowstone model', but national parks have always been more than a concept or a set of principles; they have also been collections of very concrete practices that travel within what are often surprisingly small circuits. In describing the relationships between parks such as Yellowstone and Chitwan, there are two pitfalls to be avoided. The first is a comparative approach that ignores the contemporary connections and shared heritage linking the sites under consideration. The second is a diffusionist approach that emphasizes connections between sites but understands them only in terms of a one-way transfer from centres to peripheries. The new national parks that emerged around the world after the Second World War in both developed and developing nations were neither autochthonous inventions nor slavish copies of Yellowstone. They were the contingent products of the intersection of a universalizing discourse and highly mobile practices with various local conditions.

Yellowstone: Conflicting Ideas and Practices of Wilderness

The story begins with John and Frank Craighead's research on Yellowstone's grizzly bears (*Ursus arctos horribilis*) from the late 1950s to the early 1970s, which environmental historians have seen as a turning point in the U.S. National Park Service's often awkward relationship to science since its founding in 1916. The twin brothers' involvement in national park science began when the Park Service invited John Craighead to submit a proposal for studying grizzly bears in the northern Rocky Mountains. The invitation was motivated by concern about the increasingly dangerous interactions between the shrinking grizzly population of the Northern Rockies – the last refuge of the species in the United States outside of Alaska – and park visitors, whose numbers had grown explosively since the end of the Second World War. Park Service officials hoped that new techniques of wildlife management would help Yellowstone and Glacier National Parks maintain viable populations of grizzlies

while minimizing attacks on tourists. Beginning with their postwar dissertation research at the University of Michigan, which had introduced several new methods for monitoring and censusing raptor populations, the Craighead brothers had rapidly risen to prominence among U.S. wildlife biologists. As a result of the Park Service's invitation, they co-led a study of grizzlies from 1959 to 1971 that pioneered a number of new research techniques, transformed the way the U.S. parks managed their bear populations, and resulted in a bitter and highly public dispute over the proper role of science and scientists in the parks.[3]

Wildlife radio tracking played a central role in this dispute for two reasons. First, more than any other technique deployed by the Craigheads in the course of their multifaceted research programme, radio tracking symbolized the application of innovative science and technology to the problems of conservation. The Craigheads were among the first to conduct field research with the technique, which at the time of their first field season in Yellowstone in 1959 had only just become a possibility. Wildlife radio tracking emerged in the United States from the intersection of wildlife management and Cold War technology in the decade or so after the launch of Sputnik in 1957, with generous funding from the Office of Naval Research and the National Science Foundation. As a way of demonstrating their discipline's maturation into a 'real' science, the Craigheads and other wildlife biologists touted radio tracking's roots in avionics and space research and its similarities to the sophisticated instrumentation of the physical sciences. The Park Service, then in the midst of an initiative to expand and modernize park facilities, also tried to capitalize on the technique's space-age associations. A few years after the Craigheads' study had begun, for example, the Yellowstone administration boasted in a press release that the park was hosting wildlife research involving the latest in 'modern devices'.[4]

At a moment in U.S. history when the physical sciences and engineering were seen as central to national security and economic prosperity, radio tracking's associations with Cold War technoscience helped bolster wildlife biologists' claims to authority. These associations also had a negative side, however, which became evident over the course of the 1960s as scepticism toward narratives of inevitable scientific and technological progress grew. In the case of national parks, this scepticism complemented a longer tradition of anti- or countermodernism. Radio tracking suited the technocratic ethos of many postwar wildlife managers, whose primary goal was the production of sustainable harvests of huntable game, but it sat less easily with the Park Service, which had always prided itself on serving higher goals. Many visitors to and employees of the national parks valued the parks precisely because they provided an escape, however temporary and self-contradictory it might be, from civilization and its gadgets. To these critics, the Park Service's embrace of radio tracking, at least in the Craigheads' first years in the park, represented

a betrayal of core national park values. The hiker who spotted a grizzly in Yellowstone's back country would be robbed of a vital encounter with wildness, they suggested, if the grizzly turned out to be one of those the Craigheads had trapped, tattooed, ear-tagged and radio-collared.[5]

Among the most influential of the Craigheads' critics, despite his hesitance to speak on the matter in public, was Adolph Murie, a wildlife biologist and wilderness advocate with a long career in the Park Service. Murie had begun studying wildlife in the national parks in the 1920s and saw the parks as sanctuaries where wildlife could live without human persecution and where modern men and women could find spiritual rejuvenation. In 1963, justifying his opposition to a proposal to use recreational hunters to reduce Yellowstone's growing elk population, he explained to a colleague that there were

> scientific and other values in parks, but in my opinion the most fundamental values are in the realm of the esthetic and the spiritual. Our park ideals are an expression of the best in us. Our better instincts are given free play, and we have an opportunity to show tolerance and kindness toward our fellow creatures. This, I believe is uplifting to the human race.[6]

To Murie, radio tagging seemed neither tolerant nor kind and, most importantly, threatened to undermine the parks' aesthetic and spiritual values. Although he limited his written criticism of radio tracking to private correspondence and internal Park Service memos, by the end of the decade Murie was joined by other critics who were less shy about publicly criticizing the Craigheads and the parks for their reliance on 'invasive' techniques of wildlife research and management.[7]

These critics gained important allies within the Yellowstone administration when a new superintendent, Jack Anderson, took the reins in the summer of 1967. Together with Yellowstone's chief biologist, Glen Cole, Anderson began limiting the Craigheads' ability to conduct research where, when and how they saw fit. The conflict over research methods and park aesthetics was exacerbated by a disagreement between the Craigheads and the park administration over bear management. When the Craigheads found that their recommendations were being ignored, they turned to the popular press, which largely sided with them against the Park Service. The latter retorted that the Craigheads were abusing the privilege of conducting research in the park by trying to dictate park policies through the media rather than working through established channels.[8]

In 1969, as the dispute rose into national visibility, Anderson told John Craighead that the 'conspicuous marking of park wildlife seems to have reached the point where it detracts from the scenic and esthetic values obtained from viewing wildlife' and urged him to bring the tagging studies to an end.[9] Attack-

ing the Craigheads' use of traps, tranquilizers, tags, tassels and tattoos suited both the Park Service's turn toward a more 'natural' look for the parks in the 1960s as well as the Yellowstone administration's desire to terminate the Craigheads' research without seeming to be punishing whistleblowers or rejecting science. In 1971, the Craigheads refused to sign a memorandum of agreement that would have allowed them to continue working in the park, but only at the cost of severe restrictions on their research. With the Craigheads on the way out, Anderson instructed rangers to begin removing tags, tassels and collars from grizzlies and other wild animals in preparation for Yellowstone's 1972 centennial anniversary, when the park would host the Second World Congress on National Parks.[10]

As noted earlier, there were two reasons that wildlife radio tracking played a central role in the controversy over science and aesthetics in Yellowstone in the 1960s and 1970s. The first reason was that the technique served as an icon of Cold War technoscience for boosters and critics alike. The second reason was that radio tracking made possible new kinds of field practices and produced new kinds of data. That is, in addition to being an icon or a symbol, radio tracking was a tool whose use as part of a broader social and technical system transformed ways of knowing about and relating to the objects it was used to study. How significant was that transformation? Radio tracking might be seen as merely extending bird banding and other techniques for individually marking and tracking of wild animals that by 1960 had been in wide use by biologists for decades.[11] The extension was so dramatic in scope, however, that it necessitated qualitative shifts in field practices and data analysis methods, which eventually helped produce new understandings of grizzly bear habitat and behaviour. Ultimately, despite the breakdown of the relationship between the Craigheads and the Park Service and the temporary ban on tagging, these shifts profoundly changed Yellowstone's relation to science and to scientific views of ecosystem management.

Radio tracking had not been part of the Craigheads' initial research proposal to the Park Service, but by the time of their first field season in Yellowstone in 1959 it had come to seem like a singularly promising component of the project. The Craigheads' overall goal was to understand the demographics and distribution of the park's bear population, which required developing what they called, in an article published in *National Geographic* in 1960, 'identity cards' for bears.[12] Their initial proposal had focused on conventional marking techniques, such as attaching brightly coloured plastic ear tassels to individual bears so that they could be individually identified from a distance. Radio tracking did not replace such methods, but it did expand the horizon of research possibilities. In their *National Geographic* article, the Craigheads explained that miniaturized transmitters might make it possible to track bears as they prepared for winter, something that had proven nearly impossible with

visual tags. It would allow researchers to locate marked bears at will rather than by accident and therefore, as they elaborated in a technical article several years later, 'to place observations on a quantitative level'.[13] As Gregg Mitman has argued, radio tracking was well suited to postwar U.S. biologists' vision of nature as the subject of expert surveillance and control.[14] On the basis of the data acquired through a combination of conventional tagging, radio tracking and field observation, the Craigheads would eventually argue for the necessity of managing the bears as part of a larger ecosystem that extended beyond the park's official borders. In the 1970s and 1980s, that concept would come to serve as a rallying point for conservationists under the rubric of the 'Greater Yellowstone Ecosystem'.[15]

Years before then, however, techniques developed by the Craigheads had already begun to transform the park's bear management practices. In April 1960, after reviewing Craigheads' first published scientific article on grizzlies, the Park Service's regional chief of interpretation told the Yellowstone superintendent that their techniques for trapping, tranquilizing, tagging and translocating bears would be useful for managing 'troublesome' bears.[16] Troublesome or 'problem' bears were those animals, most often black bears but sometimes grizzlies, that begged for food along roadsides or raided campgrounds in search of food. They were bears, in other words, whose behaviour violated an evolving understanding of the importance and nature of 'wildness' in park wildlife. As Alice Wondrak Biel has shown, bear feeding was tolerated and even, under certain conditions, encouraged in Yellowstone in the early twentieth century. By the 1960s, however, there was a widespread consensus, supported by Murie and other wilderness advocates, that feeding and the 'tame' bears that it produced – often disparaged as animal 'beggars' or 'bums' – undermined the value of the parks both as nature preserves and as sites for moral and spiritual rejuvenation.[17] Yellowstone and other parks adopted new policies under which problem bears that failed to respond to aversive conditioning and forced relocation and that continued to exhibit inappropriate behaviours, such as searching for food in campgrounds, were eventually killed. It was in the intermediate stage after identification as a problem animal but before execution as an incorrigible that radio tracking made the key biopolitical difference. By rendering individual animals locatable and identifiable, it enabled park administrators to assert a fine-grained disciplinary power in the name of the preservation of wildness.[18]

Radio tracking also contributed to a redefinition of the relevant territorial scope for wildlife management in the parks. As Michael Lewis has argued, radio tracking studies of large carnivores are particularly well suited to expansive conceptualizations of protected areas. The technique helps scientists map the enormous expanses over which individual animals can range, which often exceed the boundaries of any single park or reserve.[19] Similar information can, of course, be acquired using conventional tags. When a grizzly that had

been captured and tagged near Yellowstone's geographical centre was shot by a hunter outside the park boundaries, as happened repeatedly during the Craigheads' twelve-year study, it was clear that the bear's 'home range' or at least its occasional wanderings exceeded the park's territory. But only radio tracking, with its potential for producing nearly continuous tracking data, could quantify the amount of time spent by the bears in various areas within and beyond the park. By the late 1960s, drawing from a vast collection of such data, the Craigheads had begun arguing strenuously that a bear management plan that considered Yellowstone as an island or fortress, insulated against threats and developments in the territories beyond its borders, was bound to fail.[20]

After Anderson and Cole's arrival in 1967, the Yellowstone administration became highly resistant to the Craigheads' attempts to redefine the park's territory as a porous and vulnerable component of a broader landscape. The differences between the two parties came to a head over the issue of the park's open-pit garbage dumps. In line with the Park Service's turn toward a more natural look for the parks in the 1960s, the Yellowstone administration had proposed closing the last remaining dump at Trout Creek, located near the geographical centre of the park. The dump had long served as a gathering place for grizzlies, and much of the Craigheads' research had been based on bears trapped and observed there. The Craigheads argued that most of the park's bears relied on the dump for at least part of their sustenance during the summer months and that a sudden closure would inevitably send hungry bears into campsites in search of food. The result, they argued, would be more bears identified as problem bears and eventually killed, which would threaten the survival of an already dangerously small population.[21]

Cole, Yellowstone's chief biologist, argued in response that only a portion of bears, those most likely to become problem bears in any case, had become reliant on garbage. The impact of closing the Trout Creek dump on the population as a whole would thus be minimal.[22] Behind this immediate conflict lay a deeper divergence in spatial imaginations of the park, which were in turn linked to differing ideas of wilderness. If the fate of the park and its bears were inextricably tied to developments outside the park borders, as the Craigheads suggested, then the only choice was between intentional and unintentional human manipulation. In contrast, if the park could be isolated from surrounding areas, as Cole and Anderson suggested, then it might be allowed to manage itself naturally. Moreover, the question of territory was also one of jurisdiction and interagency relations. If Yellowstone's bear population was, in fact, a regional population whose survival depended in part on decisions made by the state and federal agencies that managed surrounding lands, then the Park Service would be obligated to coordinate its bear policy with those other agencies. Each conception of territory entailed its own philosophy of wilderness and its own political consequences.

As of 1972, the year of Yellowstone's centennial, the park administration's perspective seemed to have won out in regard to both the aesthetics of wildlife tagging and the question of dump closure. Not only had the Craigheads been forced to terminate their research, but tagging even of relocated problem bears had been abandoned. The Trout Creek dump had been closed without the slow weaning-off period or the provision of alternative food sources that the Craigheads had recommended. These conflicts over research methods and management policy served as proxies for deeper questions about the nature of wildness and wilderness in the United States' most iconic national park. By abandoning tagging, Anderson and Cole took a stand against the intensive surveillance and management of the park's wildlife; by closing the dumps, they endorsed natural processes over human manipulation and wagered that the park could survive, with its bear population intact, as a wilderness island in a sea of cultivated or managed land. As I have argued elsewhere, this victory was short-lived but had long-term consequences for national park management in the United States.[23]

Chitwan: Hunting Traditions in the Era of Conservation

Just as the Yellowstone administration seemed to have definitively rejected the Craigheads' vision of an intensively managed, spatially porous national park in favour of hands-off research methods and so-called natural regulation within a sharply bounded territory, several of the Craigheads' students were attempting to transplant their ideas and practices from the Northern Rockies to the forests and grasslands of South Asia.[24] Maurice G. Hornocker, the first of John Craighead's graduate students to work on the grizzly project, had since earned his doctorate under Canadian wildlife biologist Ian McTaggart-Cowan with a study of Idaho's mountain lions (*Puma concolor*) and had, in turn, advised the doctoral research of one of the Craigheads' former undergraduate research assistants, John C. Seidensticker. In 1971 the Smithsonian Institution asked Hornocker to investigate opportunities for research on Bengal tigers (*Panthera tigris tigris*) in India, which was in the process of launching an ambitious new conservation programme called Project Tiger. After visiting India, Hornocker recommended Seidensticker, who had just finished a radio tracking study of mountain lions, as the lead researcher for an intensive tiger study.[25] For reasons described by Michael Lewis, however – including nationalism, Cold War geopolitics and cross-cultural misunderstandings – the chances of the project winning approval from the Indian government were far smaller than the Smithsonian initially believed. By the summer of 1972, when the Second World Congress on National Parks was convening in Yellowstone and Jackson Hole, Seidensticker and the Smithsonian had begun to doubt that approval would be forthcoming.[26]

A serendipitous meeting with the Nepalese delegation to the national parks conference provided an alternative. Although Nepal's tiger population was minuscule in comparison to India's, there were several sites on its southern border where the intensive study of tiger behaviour that Hornocker and Seidensticker had envisaged could be conducted. A key member of the Nepalese delegation was Kirti Man Tamang, a former forest officer who had recently served as the general manager of the Tiger Tops tourist lodge in Chitwan, a royal hunting reserve designated as Nepal's first national park in 1970 but not officially established until 1973. At the time, Tamang was studying for his doctorate in wildlife management at Michigan State University and searching for funding for research in Nepal. In the months after Tamang and Seidensticker's meeting it became clear to the Smithsonian that Indian approval would not be forthcoming and that Nepal, while not ideal in terms of the Smithsonian's long-term goals in South Asia, would be more than adequate in the short term. In December 1972, Tamang and Seidensticker visited Chitwan together and obtained official approval for the study in Kathmandu.[27] It took nearly an additional year for the Smithsonian and the Nepalese government to agree on a contract and for the necessary radio tracking gear and other equipment to make it through Nepal's customs office, but by the end of 1973 Tamang, Seidensticker and their assistants had made their first attempts to capture and collar one of Chitwan's tigers.[28]

Seidensticker's original research proposal had been modelled on his own radio tracking study of mountain lions, which had in turn been modelled on Hornocker's mountain lion work and on the Craigheads' grizzly study. Techniques such as chemical immobilization and radio tracking that had succeeded with large carnivores in the Rocky Mountains, he suggested, would work just as well with their equivalents in South Asia. In practice – as many biologists before and after Seidensticker also discovered – such techniques required significant adaptations to work with the particular animals and environments in question. Though capturing mountain lions had hardly been easy, tigers were comparatively more dangerous and more elusive. Tamang's experience as a forest officer and manager at the Tiger Tops Jungle Lodge, Chitwan's only wildlife tourism concession, proved crucial in the project's beginning stages, when procedures for capturing live tigers were still being developed. Later visitors to the project would note that experienced elephant drivers and *shikaris* (native hunters), such as Prem Bahadur Rai, a hunting guide who had previously tracked tigers for Nepal's royal family, continued to play an essential role in the project's scientific work even after the basic procedures were established.[29]

Those procedures were influenced as much by Nepal's aristocratic hunting traditions as they were by space-age developments in the northern Rockies. To catch a tiger, the project staff would, after determining the animal's general location, wind two long sheets of white muslin cloth through the trees or tall

grasses to form a funnel. Armed with a dart gun, one of the researchers would wait in a tree at the end of the funnel while the other project staff, mounted on elephants, attempted to drive the tiger out of hiding. When the darting was successful, the immobilized tiger would be weighed, measured and fitted with a radio collar and left to recover while researchers kept watch from a safe distance.[30] Except for the fact that the tiger was immobilized rather than killed, the procedure was virtually identical to that used in aristocratic tiger hunts throughout the twentieth century by Nepalese elites and foreign visitors, including the British royalty whose extravagant hunts have been described by John MacKenzie.[31] The connections between scientific research and hunting traditions were evident to visitors to Chitwan. When the president of the U.S. branch of the World Wildlife Fund, Russell Train, participated in a leopard tagging in Chitwan in 1981, he noted that while he was glad that large-scale hunts were a thing of the past, 'a sad aspect of the matter is that the training and keeping of elephants is a rapidly disappearing art. Our tiger project is one of the last – perhaps even the last – examples of their utilization in this fashion.'[32] Scientific research was not just dependent on the hunting tradition; it was also helping to keep key elements of that tradition alive in the era of conservation.

Generally speaking, government officials in Nepal such as Hemanta Mishra, then a young forest officer, strongly supported the Smithsonian project. As Seidensticker noted several months before fieldwork began, the fact that Nepal's government had granted permission to use radio tracking equipment – 'a sensitive issue everywhere on the Indian subcontinent' – was an important sign of support.[33] For some observers, however, the Smithsonian-Nepal Tiger Ecology Project raised concerns about conflicts between hands-on science and the preservation of wildness that resembled those expressed regarding the Craigheads' research. Particularly vocal was the management of Tiger Tops, which claimed that the appearance of collared tigers at the viewing stations that it baited with live goats or buffalo on most evenings would disappoint its visitors and threaten its bottom line. As Tiger Tops's research director Charles McDougal explained to the Nepalese government, 'a tiger with a radio hanging around its neck is no longer an attraction.' If the study had to be conducted in the park, McDougal requested that the government order the researchers to avoid collaring the lodge's 'resident tigers', a male and two females with cubs that regularly appeared at the bait stations.[34] Tiger Tops's position was supported by a number of prominent international conservationists, including the European leadership of the World Wildlife Fund and the International Union for the Conservation of Nature, who argued that the study would compromise the tiger's status as an icon of wildness while siphoning money from more pressing conservation needs.[35]

Nepalese officials were not without their own concerns about the impact of radio tagging in the park, but they also recognized, as the Yellowstone ad-

ministration had in the early years of the Craigheads' research, that the ability to easily locate and identify individual animals provided them with a powerful management tool. The park did not have to worry about tigers begging at roadsides or raiding campground trash bins, but it did have 'problem' animals of its own. Unlike Yellowstone, which was located in a sparsely populated area, Chitwan was surrounded by an agricultural zone whose population had grown dramatically as a result of postwar economic development and population redistribution efforts by the Nepalese government in partnership with international aid agencies. The result was an increasing number of deadly attacks by tigers on livestock and, less often, on humans, which in turn led to accusations from local villagers that the government valued tigers' lives over their own. The government regularly called on Smithsonian project staff to capture tigers that had killed humans or livestock, particularly when the attacks took place outside park boundaries. In December 1978, one of the study's radio-collared tigers killed a man just beyond the park boundary. Villagers responded with what Mishra, who had replaced Tamang as the Nepalese leader of the project in 1977, later described as a 'small riot'. Within twenty-four hours Mishra and the project staff had tracked down and immobilized the tiger, which was then transported to the National Zoo in Kathmandu.[36] In contrast to the days of Jim Corbett, the famous British tiger hunter-turned-conservationist, 'man eaters' could now be repurposed as zoological ambassadors rather than killed outright.[37]

Radio tracking thus helped the Chitwan administration to police the borders of the park and to reduce, though never eliminate, the friction produced at the meeting-point of wilderness and civilization. The use of the technique also contributed to a reconceptualization of the territory of Chitwan National Park in terms of the territories of the tigers that inhabited it. After a few years of research with radio tracking and other methods, enough data had accumulated to suggest that tigers of both sexes were highly territorial, which was something that wildlife biologist George Schaller had postulated in his influential 1967 work *The Deer and the Tiger* but had been unable to prove definitively.[38] If that was the case, then there was a limit to the number of tigers that could be squeezed into the park. Especially in light of the rapid agricultural development of surrounding areas, any hope of expanding the population beyond the dozen or so tigers then known to inhabit the park would depend on expanding the park's boundaries.

Such arguments played a major role in the Nepalese government's decision to expand the park in the late 1970s to nearly double its original size and later to create an adjacent reserve as a buffer area into which tigers could roam without immediately encountering human settlements.[39] Whereas the Craigheads' evidence of the enormous 'home ranges' of individual grizzlies had been a threat to the autonomy of the Yellowstone administration from the

government agencies that managed the land surrounding the park, evidence of tiger territoriality provided an opportunity for the Chitwan administration and the National Parks and Wildlife Conservation Office of which it was a part to expand their own territorial reach.

Soon after the decision to expand the park had been made, the Smithsonian-Nepal Tiger Ecology Project began to wind down. The relationships among the Smithsonian, the Nepalese government, and the WWF–U.S. (which had funded much of the project despite the opposition of WWF's European leadership) had never been without tension, but all three parties had reasons to bring the radio tracking study to a close. As early as 1976, Smithsonian administrators in Washington had begun to feel constrained by the project's focus on tigers. They began urging the project's leaders, both American and Nepalese, to focus on the broader goal of discovering 'parameters for delineating natural reserve areas', even though, for the moment, they would have to continue presenting their work 'under the tiger rubric'. In the long term, however, Smithsonian administrators believed that the only way to truly broaden the work of the project was to shift attention away from the tiger.[40]

The Nepalese government also had reasons for seeking change. Among them was the high-risk nature of radio collaring for both researchers and tigers. In 1979, the park's largest male tiger drowned in a small pool after being struck with an immobilizing dart. Researchers had captured around twenty-six tigers since 1973, some of them repeatedly, and by 1979 nearly half of the park's tigers wore radio collars. Soon after the accident, the National Parks and Wildlife Conservation Office told the Smithsonian that it believed it was time to begin wrapping up the project.[41] Finally, when Russell Train took over the presidency of WWF–U.S. in 1979, he sought to strengthen the organization's own research programmes and deemphasize its role as a grant maker to organizations such as the Smithsonian.[42] Fieldwork ended with the completion of Mishra's radio tracking study of one of the tiger's main prey species in mid-1981. Tiger Tops research director McDougal, who had vociferously opposed the study a few years earlier, agreed to help monitor the tigers whose collars were still operational.[43]

Transnational Networks of Expertise

In 1969, in the middle of one of many rounds of tortuous contract negotiations with the Yellowstone administration, John Craighead tried to convince Superintendent Anderson that the novel wildlife research techniques that he and his brother had developed represented the future of national park wildlife management. 'At the risk of appearing immodest', he wrote, 'I think I can say that the techniques of color marking, immobilizing, handling, radiotracking, and data

gathering that we, our colleagues, and our students developed or perfected in the course of ten years of research effort in the Park are now being widely applied in other national parks throughout the world.'[44] Despite the Craigheads' important contributions, they were hardly the only ones to have 'developed or perfected' such techniques, and in 1969 many of those techniques, including radio tracking, were still being used in only a few parks, most of them in the United States. However, as the introduction of radio tracking and other techniques to Chitwan by his former students Hornocker and Seidensticker in the 1970s suggests, there was also an element of truth to his claim. In the 1970s and 1980s, the Craigheads' research methods would influence research and management practices for large carnivores in numerous parks beyond the United States. That influence would most often be exercised as it was in the case of Chitwan: through tightly connected circuits of expertise that made it possible for people with disparate backgrounds and complementary sets of skills, such as Tamang and Seidensticker, to work together.

To return to a point made in the introduction, this was a case neither of simple diffusion nor of independent development, but rather of contingent and mutual adaptation. Though there is not space here to do so, the story could be continued by showing how developments in new parks such as Chitwan subsequently influenced canonical parks such as Yellowstone as well as other recently established parks. Just as researchers such as Tamang and Mishra returned from sojourns in the United States or Europe with new perspectives on conservation in Nepal, so researchers such as Seidensticker or Hornocker returned from research trips to South Asia with new perspectives on conservation in the United States. Network-building events such as the World Congress on National Parks, held every ten years since 1962, were complemented by training and technical assistance programmes and by informal transnational links between scientists and park managers. These piecemeal connections gradually led to the construction of a global network of park professionals with a shared toolkit of ideas and practices that could be imported and adapted to local conditions and then, in many cases, reexported and readapted once again. The radio tracking of large carnivores in Yellowstone and Chitwan is only one example of how techniques circulating within these networks helped to transform practices of wilderness and wildness – of territory and discipline – across national borders.

Notes

1. For the U.S. context, see Alfred Runte, *National Parks: The American Experience,* 3rd ed. (Lincoln, 1997); Richard West Sellars, *Preserving Nature in the National Parks: A History* (New Haven, 1997); James A. Pritchard, *Preserving Yellowstone's Natural Conditions: Science and the Perception of Nature* (Lincoln, 1999); Alice Wondrak Biel, *Do*

(Not) Feed the Bears: The Fitful History of Wildlife and Tourists in Yellowstone (Lawrence, 2006).

2. More details on radio tracking in Yellowstone and Chitwan can be found in Etienne Benson, *Wired Wilderness: Technologies of Tracking and the Making of Modern Wildlife* (Baltimore, 2010).
3. On the Craigheads' grizzly project, see Sellars, *Preserving Nature,* 249–52: Pritchard, *Preserving Yellowstone's Natural Conditions,* 201–50; Biel, *Do (Not) Feed the Bears,* 86–112; Benson, *Wired Wilderness,* 52–93; Gregg Mitman, 'When Nature *Is* the Zoo: Vision and Power in the Art and Science of Natural History', *Osiris* 11 (1996): 117–43; Alston Chase, *Playing God in Yellowstone: The Destruction of America's First National Park* (Boston, 1986).
4. On radio tracking's Cold War connections, see Mitman, 'When Nature *Is* the Zoo'; Benson, *Wired Wilderness,* 5–51. For 'modern devices', see Memo for the Press from Yellowstone National Park, 20 October 1961, Box N-371, Natural and Social Sciences Records, Yellowstone National Park Heritage and Research Center, Gardiner, Montana (hereafter, Yellowstone Archives). On the Park Service's 'Mission 66' initiative to modernize park facilities, see Ethan Carr, *Wilderness by Design: Landscape Architecture and the National Park Service* (Lincoln, 1998), 135.
5. On the Cold War U.S. technological sublime, see David Nye, *American Technological Sublime* (Cambridge, MA, 1996), 225–56; Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870–1970* (Chicago, 2004), 443–72.
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