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Ranchers, Scientists, and Grass-roots Development in the United States and Kenya

CHARIS M. THOMPSON

*Department of the History of Science
Science Center 235
Harvard University
Cambridge, MA 02138, USA*

ABSTRACT

Two initiatives in community-based biodiversity conservation are examined. I describe key aspects of the formation in the mid 1990s of the Malpai Borderlands Group of the Southwest US, and the reorganisation of the Kenya Wildlife Service during 1994–6 and their legacies since then. I review how history, ownership, membership, and valuation were appealed to, created, maintained, and contested in defining what should be saved, by and for whom, and how in each. I also suggest the central role of science and relatively mundane technologies in co-ordinating these parameters. Success or ‘best practice’ as applied to the conjunction of biodiversity conservation and development depends upon this work in contesting and establishing history, ownership, membership and valuation.

KEY WORDS

Biodiversity conservation, local, global, history, membership, ownership, valuation, success

In this paper I draw on fieldwork from the start-up period of two initiatives in biodiversity conservation. I examine key aspects of the formation in the 1990s of the Malpai Borderlands Group of the Southwest US, and the reorganisation of the Kenya Wildlife Service during 1994–6 and its legacy since then. I review how history, ownership, membership, and valuation were appealed to, created, maintained, and contested in defining what should be saved and how in each. I then suggest the central role of science and relatively mundane technologies in co-ordinating these parameters. Success or ‘best practice’ as applied to the

conjunction of biodiversity conservation and development depends upon this work in elucidating and establishing history, ownership, membership and valuation.

THE MALPAI BORDERLANDS GROUP.

The Peloncillo Mountains follow the Arizona-New Mexico line for almost a hundred miles to the Mexican Border. On about 900 000 acres of this range, a group of ranchers, conservationists, government officials, scientists, and sundry other interested folk (collectively called the Malpai Borderlands Group, or MBG) have been carrying out an experiment in conservation. The group was formally incorporated in 1994 as a 501(c) (3) non-profit organisation. It describes itself as a grass-roots organisation whose board is made up of eight local ranchers, and one local ecologist.¹ The Finance Director and the group's Co-ordinator are both local ranchers too. In addition, the group has a co-executive director who is a senior member of The Nature Conservancy (the Conservancy),² and the group's Legal Council is a Washington-based lawyer with the Conservancy. The group also has a board of advisors which includes other local ranchers, and a Scientific Advisory Committee. The Scientific Advisory Committee includes a range conservationist working for the Forest Service, a rangeland management specialist working for the Natural Resources Conservation Service, and eight other wildlife ecologists and conservationists based at nearby universities, or working for state or government lands, or local conservation groups. Thus, although the group is centred around local landowners, it operates with formal input from and connection to representatives of centrally organised conservation interests and public lands.

The collaboration between the Nature Conservancy and MBG was an important departure for US-organised conservation. The Nature Conservancy is known for its buying up of lands for species and habitat conservation. For example, a ranch might be bought by the Conservancy to avoid sub-division. The Conservancy would absorb the drop in value of the land represented by agreeing not to develop or subdivide it in the future. The parcel of land would then be managed as a quasi-park, through the identification of appropriate partners, with the ideal being to restore or preserve 'natural processes'. Scientific monitoring and management of the land, combined with public visitation of the area would be the main human activities. Land title would no longer be in the private sector, and no private sector income – such as from ranching or hunting – would be generated off the land, because people's livelihoods and conservation would typically be taken to be opposed. The Malpai Borderlands Group, however, has heralded a departure in roles for the Conservancy.

In 1990 The Nature Conservancy bought the Gray Ranch, a 500 square mile area of the Malpai Borderlands region, in Hidalgo County, New Mexico, for \$18

million. By early 1991 the Conservancy began conducting scientific and ecological research on the land. During 1992, the Conservancy was approached by Drummond Hadley, a neighbouring rancher in south-eastern Arizona (and heir to some part of a beer fortune), who had been widely recognised for his efforts to mesh sustainable grazing with habitat conservation and restoration. The Hadley family started up a non-profit foundation – the Animas Foundation – which, like the MBG which formed in its wake, was to be ‘dedicated to conserving the undeveloped wildlands and rangelands of the Southwest, and to ensuring the survival of the traditional ways of life of the individuals and communities of these open lands’. After extensive negotiations, The Nature Conservancy and the Animas Foundation completed a transaction that, in the eyes of the Conservancy, stood a good chance of ensuring the continued conservation of the Gray Ranch. The Animas Foundation assumed ownership of the ranch’s acreage, paying the Conservancy \$13.2 million for the Gray Ranch acreage. The difference between the \$18 million and \$13.2 million represented the value of the conservation easements which the Conservancy would retain in perpetuity. Signing over the property rights to a private foundation was a new departure for the Conservancy, and one its ranks found exciting, if a bit nerve-racking.³ Speaking after the official signing of the comprehensive agreement in February of 1993, Conservancy President John Sawhill described the members of the Animas Foundation as ‘committed, visionary conservationists who are dedicated to preserving the ecological integrity’ of the Gray Ranch. The New Mexico chapter’s official listing of the Conservancy’s activities pays particular attention to the Gray Ranch. The case is described both as a departure for the Conservancy, and as a model for a new kind of generalisable conservation partnership:

This is a landmark in private conservation, fulfilling all of the Conservancy’s goals for protecting the Gray Ranch. Furthermore, it creates a model for private-sector co-operation that we trust will inspire similar efforts around the world. These easements will prevent the ranch from being subdivided in the future and set benchmarks for measuring and maintaining the health of the native species and natural communities that inhabit the ranch. The Animas Foundation will continue the Conservancy’s practice of voluntarily paying taxes on the ranch despite the non-profit status. Moreover, the ranch’s existing program of scientific research and public visitation will continue, in addition to cattle ranching. We are very proud of the unprecedented conservation arrangement regarding this very special place.⁴

The Malpai Borderlands Group developed in close tandem with the Animas Foundation, with the Hadleys sitting on both boards. Nonetheless, it was formed explicitly so as to be a grassroots group, independent of the Foundation, and driven by the voluntary association of local landowners. Faced with bush encroachment which reduced available livestock forage and so meant low

stocking rates for cattle, an uncertain beef market, and unpredictable precipitation, pressure on local ranchers to abandon ranching and sub-divide their properties for selling to the recreational market was great. If sub-division, including extensive building and fencing, became common, an ecologically extremely important area of largely open space would be threatened. When the MBG started, the perception was that keeping the wilds open and protecting 'traditional livelihoods' (mainly ranching), should be linked to each other. Instead of pitting the land uses of cattle ranching and (conserved) wildlands one against the other, the issue of maintaining open space as opposed to losing open space became the primary aim of the MBG. Both ranchers and conservationists wanted open space; developers and second-homers wanted sub-division. A common goal – to protect 'open spaces, wild lands, and traditional livelihoods of the Malpai Borderlands region'⁵ – has united unlikely constituencies from the start of the MBG. The group's one sentence mission statement and one sentence policy statement sum this up:

Our goal is to restore and maintain the natural processes that create and protect a healthy unfragmented landscape to support a diverse, flourishing community of human, plant and animal life in our Borderlands Region.

Together, we will accomplish this by working to encourage profitable ranching and other traditional livelihoods which will sustain the open space nature of our land for generations to come.⁶

Perhaps the core element of the Malpai Borderlands Group, the element around which one can most clearly see what is radical about the workings of the group, is the 'grassbanking' scheme. Using the Gray Ranch as a common pool of rangeland that could be drawn upon, the MBG and the Animas Foundation established a grassbanking scheme whereby ranchers could graze their cattle on range other than their own ranch, in exchange for allowing their own ranch and grazing leases⁷ to rest for a specified amount of time. During the rest time, the home ranch has access to the services of the Scientific Advisory Committee, and the MBG's fire, bush removal, and seeding projects aimed at mitigating bush encroachment and restoring rangeland, and thereby increasing stocking rates. To participate in the grassbanking scheme, a rancher must take out a conservation easement on his or her land (these easements are reversible in the event of hardship). The dollar amount of the difference between the real estate value of their home ranch as a property that could be sub-divided, versus the value of the ranch if it could not be sub-divided or developed in the future, is the credit that a rancher has with the grassbanking scheme. This dollar amount can then be redeemed for amounts of forage calculated as time that livestock can graze on grassbanking range.⁸ Charitable foundations interested in conservation are underwriting the grassbanking scheme and local banks have agreed not to penalise ranchers with debts or mortgages for taking out these easements.

Conservation easements are thus procured through a scheme that is driven by, rather than opposed to, the livelihoods of the ranchers.

What the grassbanking scheme achieves is to link together the ranchers' and the conservationists' projects. Consider the following scenario, described to me by one grassbanker:⁹ This rancher was in debt and concerned that he would have to sell his land. Each year, the number of head of cattle that his ranch could support was dwindling due to degradation of the forage from bush encroachment. The rains are reliably unreliable and so is the beef market. The grassbanking scheme offered him an alternative in the short term to selling out, in the form of additional grazing, and also offered long term relief through the potential rehabilitation of his own range. In the process he was part of the articulation of a new definition of his threatened lifestyle *and* a possible solution to the threat. He could obtain a new lease of life as a rancher by becoming a grassbanker and joining the scheme. But by becoming a grassbanker, he also linked the preservation of his lifestyle (and its redefinition) to the conservation and redefinition of the other elements of the scheme. In particular, he incorporated the conservationists' idea of an 'unpredictable environment', where such things as drought and fire were natural variants, into his way of talking about his ranching.

For the conservationists, enrolling this rancher as a grassbanker extended the land that could be restored by adding the rancher's acres to the total. It also raised the possibility of increasing the amount of contiguous land included in the scheme, which was of central importance to the conservationists because it permitted processes such as animal migration, shifting grazing, and plant succession to operate over a larger area.¹⁰ Likewise, and equally importantly, by incorporating this rancher, it added another key custodian – someone for whom the conservation successes were tied to his personal welfare – to the overall scheme. But the conservationists only managed to 'capture' ranchers in so far as pursuing the (redefined) rancher's question of how to 'nurture our cattle and produce profits through unpredictable environments and market swings'¹¹ could be addressed by participating in the grassbanking scheme. The conservationists exchanged a monopoly or closure on the definitions of their objects of concern for an increase in the numbers of stakeholders and area of land and ecological processes that could be conserved.

A second project, the fire program, illustrates the difficulties of collaboration over an area where the land tenure and management is not homogeneous.¹² The so-called Smokey Bear policy of fire suppression has dominated in this area for over forty years. If fires were started, either by accidental or natural means, the fires were rigorously suppressed, to preserve woodland and dwellings and protect humans, livestock and other animals. The results of this policy on the ecology of landscapes have been much studied and discussed in recent years, both in the US and elsewhere. In the last few years, a striking consensus has emerged that fires have been not disrupters of natural ecological systems, but

crucial forces within them, and that fire suppression policies have unnaturally removed this force from ecosystems.¹³

In the Malpai Borderlands area, where bush encroachment is seen as the main reason for the decline of rangeland, the idea that suppression of fires might have been responsible for this trend was readily received. While the effectiveness of fires at large-scale brush removal might be fairly apparent, there were other elements involved in rehabilitating (renaturalising) fires, however. For the ranchers in this area, the question of whether or not fires sterilise the soil where they burn was a pending issue. Burnt fields are easy visual analogues for devastation; if brush was removed, would palatable native grasses grow back in its place? And how much fire could the land withstand? Two local scientists were called in to present their work on the effects of fire on mesquite-invaded grassland.¹⁴ The scientists presented the results of research undertaken at Fort Huachuca, Arizona, a nearby military base. Data on the plant uptake and release of three essential chemicals, phosphorus, nitrogen and carbon, has been collected there since 1973 on three distinct areas each with different fire histories.¹⁵ The presenters concluded that fire every 5–10 years was in fact good for the nutrient pool available to the grasslands. In addition, this frequency coincided well with local tree ring data on pre-suppression era fire frequency, suggesting that this kind of rate of burn was ‘natural,’ and that this ecosystem had evolved with it. Upon burning, carbon and nitrogen levels returned rapidly to pre-fire levels, and nutritious phosphorus was released in great quantities from the incinerated mesquite crowns. The released phosphorous, picturesquely named ‘mesquite ghosts,’ restored the natural nutrient flow to the soil, and, for the researchers, restored fire to its rightful place alongside rainfall and temperature, as ‘a third physical force, responsible for producing grasslands’. As Dr. Ray Turner, MBG ecologist, summarised the presentation:

Perhaps the woody plants that have become recent grassland residents should be viewed as stagnant nutrient pools that impede the flow of nutrients to grasses, while properly spaced fire might be thought of as an agent for keeping the circulation pathways open.

The rehabilitation, in the eyes of those planning the fire project at least, was complete. In the newsletter which all area residents received in July of this year, it was stated simply that ‘(f)ire is crucial to the restoration of our grasslands.’

Scientific certainty notwithstanding, the MBG’s fire program had the same qualities as its grassbanking scheme of being inclusive but entirely voluntary. It was possible for any individual rancher not to buy into the integral role of fire in the maintenance of his or her range without that rancher thereby having to opt out or be excluded. Using the Animas Foundation’s GIS facilities, the MBG’s fire program constructed a detailed map of the area. The map included property boundaries for the whole area, cartographically representing for the first time ever which piece of land was owned by which rancher or state or government

agency. Overlaid on the segmented map were three categories of response to fire. Each land owner could choose either to have fire that burnt on his or her land be put out as was customary, or they could join the 'let burn' category, such that any fire that started on their land would be allowed to run its course, or they could be part of the experimental 'prescribed burn' group. The latter group, in collaboration with the Scientific Advisory Committee, simultaneously became an in-situ experimental base for testing the optimal heat and frequency of fire for these grasslands.¹⁶ Ranchers could participate in the fire project as a simple matter of improving their range; they did not need to become conservationists, politicians, or anything else. And yet, just as with the grassbanking and resting of home range, what it was to be a prudent rancher was altered by the rehabilitation of fire and its new role in range management.

The grassbanking and the fire projects redefine the roles and even self-descriptions of the conservationists and ranchers in relation to each other and to the open spaces in question. Nonetheless, these redefinitions and new connections precisely enable both ranchers and conservationists to operate from within their own domains, making it, at least in theory, a classic 'win-win' situation. The conservationists provide scientific capacity to the ranchers, and the ranchers provide custodians for the processes maintaining open spaces, without either having to subsume their goals to the other.

Wise ranching under the MBG was thus formulated to include principles of active conservation that go beyond sustaining the natural resources upon which livelihoods depend. The need for sustainability alone only weakly engages the users of natural resources, because of the well-known tragedy of the commons – the cost of natural resource depletion is not a direct economic cost for the users. As long as the production of the resource and the use of the resource are unconnected economically and epistemically and in management practice, no matter how definitive doomsayers might prove sustainability to be, it only engages the users weakly. The MBG has changed many ranchers' ideas of the most profitable and flexible use of the range so that it now incorporates fire and shifting grazing, and stands to support more head of cattle and perhaps such ventures as ecotourism and environmentally labelled beef. Likewise, conservation of the Peloncillo mountains now includes ranching and traditional livelihoods as active processes integral to the ecosystem. The costs of natural resource depletion have been partly internalised to the ranchers' bottom line by providing for better or at least more diverse and reliable profits. Simply forcing ranchers and other land users to pay for range rehabilitation would have placed an unbearable burden on an already marginal livelihood and be perceived as unfair and be unenforceable. The fact that landowners / users now have a stake in conservation in the area gives the entire project a feel of sustainability that has in turn attracted a good deal of outside funding from public and private sources. This further increases the stakeholders, with these funders paying for the value to the wider community of the protection of the global commons. If the

community of stakeholders is kept this wide, the chance of the entire group and its affiliates being financially self-sufficient greatly increases.

In an area where autonomy is valued highly and guarded fiercely, the fact that the group is grassroots, and that the ranchers have not 'lost control' is also crucial. The politics of the MBG and its fire, grassbanking, and restoration programs are not easy to parse along the customary lines, which fits the President of the MBG Board of Directors, Bill MacDonald's description of the MBG as 'the radical center'. On the one hand, such things as the transfer of the Gray Ranch and conservation activities from the public sector to the private sector, the voluntarism, and the emphasis on local landowners as custodians, seems to fit clearly within a 'right-wing' position of individual property rights, the nuclear family as the basic economic unit, and the private management of natural resources. On the other hand, the concern for the environment and the creation of a wider social grouping (the MBG) and the co-ordinated and collaborative fire and grassbanking schemes, where economic activity as well as community is defined collectively, seem to speak of a 'left-wing' politics and the reinstatement of the idea of the commons. Bill McDonald told me that the MBG had in some sense been made possible by the end of the Cold War and the fall of the Soviet Union. He felt that it didn't raise the spectre of communism anymore for ranchers to work together to protect their way of life. As long as the MBG was absolutely voluntary – anyone local could join but no one had to – the fact of fighting together for their livelihoods was not a threat to the ranchers' independent way of life and the American West, but a reaffirmation of it.

The Malpai Borderlands Group is resolutely and self-consciously grassroots, despite or even because of its extensive connections regionally, nationally, and transnationally. Its 'norms of association' are predicated first and foremost on local landowners.¹⁷ Meetings are frequent and open and include many informational meetings as well as governance meetings. Mailings are sent to all local residents, and are not membership driven except outside of the local area. The other norm of association is that of voluntarism. No one is required to engage in any part of the MBG. As with any group, the MBG's norms are appealed to when addressing conflict, as well as in enrolment. Wendy Glenn, the group's co-ordinator, expressed these two norms as follows:

As with any new group or program, there are some doubters and some fear that we are 'taking over the neighbourhood'. We are working only with the people that come to us and want to be involved in the projects that we can help them with, if we are able. We send our newsletters and information out to everyone in the area, so they will know what we are doing. The neighbours make the choice of whether to work with us or not. For the ranchers that are involved, it is a chance to improve the land on our places, on the ground, that we could never have done otherwise.

The group is not uncontested in the region, and the operations of the MBG have not been wholly conflict-free. Nonetheless, the group's insistence on local

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inclusiveness, its use of the ideas of novelty and of consensus building where there was once adversarial political impasse, and its simultaneous respect for and efforts to conserve the 'old' ways of life, have persuaded most local ranching families to join the group.

The Kenya Wildlife Service policy framework of 1996 and its legacy

The Kenya Wildlife Service is a parastatal corporation with a mandate to conserve and manage wildlife resources in Kenya as directed in the Wildlife (Conservation and Management) (Amendment) Act of 1989:

KWS's goals are to maintain and develop a viable area system by protecting a representative and sustainable sample of biodiversity, build partnerships in biodiversity conservation and ensure that all custodians benefit, and to take a lead role in developing sustainable nature tourism.¹⁸

It reports to its parent ministry, the Ministry of Tourism and Wildlife, and its director and the chief of security (the anti-poaching forces) are appointed by President Daniel Arap Moi. Its responsibilities include custody of Kenya's fifty-nine National Parks (restricted for wildlife only, and managed by KWS) and National Reserves (where controlled use of areas by humans is allowed, and which are managed by County Councils). Together these 59 protected areas make up approximately 7.5% of the total area of the republic, and their habitat ranges from marine parks, mountain, arid and semi-arid parks to Lake ecosystem parks.

The marine parks include coral reefs and big game fish; the lake ecosystem parks house the soda-lake flamingos, rare sitatunga and crocodile populations; the mountain parks harbour bongo and mountain hogs; the forest parks contain endangered flora and butterflies; and the arid and semi-arid parks are home to the huge diversity and abundance of plains game for which Kenya is most famous. This extraordinary heritage of biodiversity is used for tourism, education and research and is expected to generate revenue for the government and local people. Wildlife tourism is the single biggest foreign exchange earner in the country, accounting for up to 80% of GDP, so wildlife resources are of immense national economic importance. KWS is also responsible for wildlife outside the protected areas, where more than 70% of Kenya's wildlife resides.¹⁹

Since its inception in 1989, the Kenya Wildlife Service has often been perceived as being as notable for the 'charismatic megafauna' running it, as for the ones being protected. White and black Kenyans have headed the parastatal in quick succession, with Richard Leakey, the son of paleoanthropologists Louis and Mary Leakey, and third generation white Kenyan, as the alpha male. In between his two tenures at the helm of KWS, which ran from 1989–1994 and from 1998–2001, conservation biologist David Western headed KWS. Nehemiah Rotich, former head of the East African Conservation Society, replaced Leakey

in early 2001, and was himself forced out by the end of the year and replaced by acting director Joseph Kioko. In both the national and international press, Leakey garners by far the most attention. John Mbaria, environment writer for the East African, wrote a scathing attack on KWS in December 2001 after the removal of Rotich in *The Daily Nation*, in which he described the leadership succession as follows:

The three directors who have come and gone have never let necessity play second fiddle to their egos, and they tended to confuse personal interests with those of the KWS. They appointed their friends and think-alikes to key positions and never attempted to develop KWS as an institution that can survive without them or without donor funding..... Dr Richard Leakey perfected this art.²⁰

Despite the perception of KWS as a state corporation that has relied on donor funding, cronyism, and a single narcissistic and charismatic leader in all its incarnations, there have been efforts of various kinds in all the administrations to make KWS a major organ of community development. During the period from 1994–8, the then director of KWS, Dr. David Western, went as far as to attempt to turn the entire organisation into a country-wide federation of community-based conservation. Drawing on work that he and his colleagues had done in and around Amboseli, Mount Kenya, and elsewhere over the previous thirty years, he and his staff attempted to restructure KWS to make local landowners both the primary custodians of and primary beneficiaries of wildlife. It is the elements of this attempt and their subsequent legacy that concern me here.

The 1994–8 administration of KWS was characterised by its attempt to reorient the nation's wildlife resource conservation away from an exclusive focus on parks and to an ever greater emphasis on local landowners (whether with group or private tenure) and their relations to wildlife. This change was economically motivated. A lack of space for successful inexpensive wildlife conservation within parks alone meant either prohibitively expensive wildlife management techniques within parks, or developing ways to open up space outside parks for wildlife. It was also dictated by conservation logic. Protected areas restrict in and out migration which leads to island biogeographic effects and a loss of biodiversity. Reopening migrations and re-establishing vegetation gradients would mitigate this threat to wildlife. Reintroducing human influence such as the opening up of sporadic wells, fire setting, and partially nomadic pastoralism would reintroduce vital ecological processes. And it was also dictated by concerns of social justice. Animals should not count for more than humans, as many Kenyans charge, and they should not be saved primarily for the enjoyment of the wealthy from abroad. Conservation should not amount to imperialist land-grabbing ('shamba la bibi,' or gardens of the Queen), and local people should be direct stakeholders in this national resource.

The most important elements of the attempt to change KWS from a centralised top-down organisation to a regionally distributed wildlife service were

rooted in local action. The first project involved an independent team of assessors collecting local accounts of wildlife-human conflict and grievances of local people. The team travelled through most major wildlife areas of the country during July and August of 1994 and held long meetings in which ordinary citizens were invited to talk. The assessors themselves undertook not to talk back but just to listen and collect information. The resulting document, *Wildlife-Human Conflicts in Kenya: Report of the Five-Person Review Group*, was completed in December 1994. Selections were published and discussed in the major local newspaper, and letters from citizens were published once a week over a period of two months. Among the remarkable findings contained in this report were figures showing that in some areas more people were being killed by elephants than the other way round. People in all areas expressed not only problems but possible solutions, including ways that compensation for wildlife damage might be allocated. This document highlighted the extent and nature of local resistance to wildlife, stemming mostly from loss of life and damage to crops and property. It also documented the need for compensation and revenue or benefit sharing.

Most significantly, the wildlife-human conflict report spurred the creation by KWS of the community wildlife service, or CWS. The CWS had as its aim the concentration of KWS personnel at the local level, in and around parks instead of in the newly renovated and enlarged Nairobi headquarters. During this period the lush headquarters were not used to anything like their full extent, and their splendour sparked rancour in some observers. One staff member referred to the headquarters as a 'white elephant'. CWS was an institutional means of realising the centrality of wildlife-human conflict resolution. It was paired with an overhaul of the KWS administration itself, reducing the numbers of headquarters staff and increasing regional autonomy, salaries and staff. In the process, the departments at assistant-directorship level were changed to reflect a decreased emphasis on overseas fund-raising, security and headquarters, and an increase of the need for community wildlife officers, representatives for the links and partnerships program, tourism development and diversification beyond parks, and biodiversity monitoring and priority setting.

The second distinctive aspect of the decentralisation of the Kenya Wildlife Service was the development of an intensive program of links and partnerships with other groups and individuals with an interest in any of the aspects of wildlife conservation. Flexible but formal agreements were entered into with landowners, local businesses and local governments, as well as with local and locally active international NGOs. Scientific monitoring and ecological experimentation and appropriate technology were moved from being in a distinct research wing of KWS into the heart of each of the new elements of KWS. Scientific techniques, such as animal counts, GIS surveys, and ecological modelling were thus placed as central to achieving the definition of biodiversity conservation as fundamentally community-based.

In addition, studies were commissioned that addressed the land use patterns over the country, and that introduced the idea of biodiversity conservation as a form of land use. To qualify as a viable land use, biodiversity conservation would need to be economically viable, and so forms of both consumptive and non-consumptive wildlife use were examined in detail, and economic projections were made. The land use study addressed issues such as the lack of formal systems of land tenure, without which community-based conservation organised around local landowners was likely to flounder. And the appraisal of the economics of wildlife and biodiversity conservation as a land use displaced the donor-driven funding logic and hierarchy of the former KWS.

Finally, the KWS administration attempted to implement financial reform and 'culture change' within the organisation itself. This involved revising the mission statement to read as follows:

The Government of Kenya holds in trust for present and future generations locally, nationally and globally, the biological diversity represented by its extraordinary variety of animals, plants and ecosystems ranging from coral reefs to alpine moorlands and from deserts to forests. Special emphasis is placed on conserving Kenya's assemblage of large mammals found in few other places on earth.

It also involved restructuring KWS around three revised goals, each of which was itself a product of the reports on conflict, land use, and reoriented economics. The first goal of a system of viable conservation areas based around minimum protected areas prioritised in terms of biodiversity put the science and conservation itself at the heart of the new KWS, replacing game management. The second goal of sustainable nature tourism focused on diversifying revenue and maximising the value of wildlife to the nation while minimising cultural and environmental damage. This moved away from traditional donor dependence. And the third goal of partnerships attempted to implement at all levels of the organisation the idea that those who bear the cost of conservation should be the people to benefit from it.

Tourism dropped off dramatically in 1997, in large part due to political unrest. Facing revenues well under projected levels, KWS once again approached financial disaster. This meant that the restructured KWS barely had time to formulate, let alone successfully implement, its new policies and restructuring before it came under intense pressure from the ambient political culture to revert to its old ways of donor hand-out dependence. Efforts to recultivate stakeholders from wealthy countries as partners in the conservation of local but globally priceless biodiversity fell by the way side of expediency. Richard Leakey, widely dubbed a 'donor darling' was re-appointed as head, forestalling a serious attempt to make national wildlife conservation policy begin from the ground up.

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John Mbaria voiced the disgust felt by many ordinary Kenyans about the co-optation of wildlife revenues in his article of December 2001. Nonetheless, the principles he advocated to mitigate these problems could almost have been taken straight from the 1996 Policy Framework:

Today, 70 per cent of Kenya's wildlife is found outside protected areas, and so it needs the goodwill and the protection of Kenyans to survive.... So what ought to be of utmost importance to the survival of wildlife is the promotion of the material well-being of the communities that have accommodated and protected animals.... To convert itself into a body ordinary Kenyans can identify with, KWS needs to be managed by an indigenous director who should be encouraged to come up with policies that are people-sensitive. The Government should courageously stop outsider meddling in KWS affairs by converting it into a profit-making body.²¹

Constant financial crises prompted by security concerns, drought, and swings in tourist revenue, continuing tussles over the ivory ban and elephant poaching, and charges of corruption have plagued all KWS administrations.²² As these are all core issues on the national political scene, it is perhaps not surprising that these principles have palpably failed to be implemented nationwide through KWS. What is more encouraging is that the innovative elements that led up to the 1994–6 restructuring found life in specific projects, some co-sponsored by KWS, and in community-based initiatives on private land, many of which share personnel with the 1994–8 regime at KWS. The following statement from the African Conservation Centre, explaining its work with the Ibirikani Group Ranch bordering Amboseli National Park illustrates the persistence of these ideals:

Conservationists and development partners increasingly recognise that efforts to conserve biological diversity will not succeed unless local people perceive those efforts as serving their economic and cultural interests. Conservation strategies must therefore play a dual role of improving the management of natural resources and the quality of life of people. Unless the people who are most directly impacted by conservation projects perceive that those projects serve their economic and cultural interests, long-term conservation of biodiversity will not be feasible.... GIS is one of the tools that is being used to equip communities in the management of their natural resources.²³

Likewise, the Laikipia Wildlife Forum describes its mission to bring together 'the different interest groups in the district who were involved in wildlife, including ranchers, pastoralists from the group ranches, representatives from the small farming communities, the government, the Kenya Wildlife Service and NGOs', emphasises its goals of conserving wildlife by enhancing its economic value, resolving human-wildlife conflict, and facilitating appropriate development projects among local communities in the area, and declares its achieve-

ments as including cultural and ecotourism, ecological monitoring, development of economic models, and disbursement of revenue from wildlife utilisation schemes to community members. It also stresses the importance of the 'synthesis and analysis of historical data about natural resources in the region, land use, human activities and their future projections'.²⁴

Without the financial and national might of KWS, it is unlikely that the Human Wildlife Conflict study or animal counts establishing the presence of wildlife on local landowners' land could have been proven in a manner likely to convince the national and global conservation community. Critics now take it for granted that local landowners are sustaining wildlife and that local development is central to wildlife conservation. They thus correctly diagnose failures of justice and hence conservation when local people are not adequately compensated for supporting wildlife. As well as objecting to such things as huge expatriate salaries paid to NGO staff, tourism industry monopolies, and expatriate wildlife havens, critics also tend to lament the amount of money spent on the routine activities of biodiversity conservation, such as animal counts, however:

While families of victims get Sh30,000 as compensation, KWS does not have qualms using (like it has done in the last two years) Sh3.7 million merely to count elephants! Such counts have always been the most inaccurate of exercises which sometimes include strange arithmetic involving elephant dung.²⁵

What this fails to recognise is that without these bureaucratic and scientific techniques, it would be impossible to establish an ecological history to save and the people, values, and means by which this is to be done. The move to indigenise conservation and to implement community-based conservation goes hand in hand with these ordering and knowledge producing technologies, rather than being opposed to it. KWS will remain an overly politicised and donor-dependent organisation for as long as the knowledge of the ecosystem, the lifestyles of those living on the land, and the systems of values for conserving are not co-ordinated in such a manner as to allow common purpose without subsuming one goal to another. At their best, scientific and bureaucratic techniques are masterful at this.²⁶

History, Ownership, Membership, and Valuation

Biodiversity conservation initiatives need to establish their basic parameters if they are to stand any chance of success. These parameters, as implicitly described above, include building a common ecological and social history; establishing land and resource use/ownership precedent and rules; formulating implicit and explicit criteria of membership; and integrating old and new systems of valuation. In addition, these parameters must reinforce each other's claims. Bureaucratic, and especially scientific information and techniques, are crucial in

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this endeavour. These parameters contain both the basis of success and the possible sources of conflict.

Below I present in schematic form these parameters for the Malpai Borderlands Group (1994–present) and The Kenya Wildlife Service (1994–1996, and its private legacies thereafter) as described above. I have indicated key scientific and bureaucratic techniques whereby the parameters are co-ordinated. And I have also pointed to some of the challenges to the establishment of these parameters in this manner. Together they answer what is being saved, by whom, how, and how success is to be established.

WHAT IS THE COMMON ECOLOGICAL HISTORY?

The MBG implicitly restricts its ecological history to the period during which it has been ranching country. Earlier or coincident Native American, Mexican or other ecologies are not the core part of what the MBG is describing and trying to preserve. The human density during the ranching period of fewer than 100 families means that there is a lot of open space, and both the lifestyle and the open space are being saved from the threat posed by the pressure to subdivide. Ranching plays an ecological role in this history through cattle grazing and custodianship practices that require and thus maintain open space. MBG successfully linked fire regimes from before the Smokey Bear policy to the health of open range through their ability to remove encroaching brush. Native grass reseeding projects promise both better forage and the biological advantages of co-evolution. Endangered species for which the area has historically been range can be encouraged, and then stand as evidence of range health. In sum, the ecological history that frames the MGB rests on naturalising ranching, re-naturalising fire, and re-introducing endangered flora and fauna.

The evidence for this ecological history comes from many quarters. Photographs taken over more than a century to mark the United States-Mexico border provide a key means of visualising changes in habitat and habitation, and establishing indigeneity. Oral histories from older ranchers confirm brush encroachment. Tree rings provide data on fire events. Tracking mechanisms including smoothing dirt roads, and going on photographic hunts, confirm endangered species presence. Numerous experimental plots selectively isolated from particular herbivores test grazing and reseeding and growth patterns before, after, and without fire. And numerous kinds of mapping and modelling devices including aerial photography, GIS and all its associated data collection and entry, and techniques for accounting for biological scale drawn from conservation biology, collate and co-ordinate this ecological picture. The ranchers, scientists and conservationists carrying out these techniques project this ecological history and its future through piecing together these elements.

KWS from 1994–6 also implicitly restricted its ecological history when deciding what to save. Current landowners were considered to be the relevant unit for conservation. Tribal histories prior to current settlement patterns were not considered unless there was an active conflict. The gazetted reserves and parks were not questioned either, even though they date only to the colonial period or later. Nonetheless, the porousness of some of the parks, especially in semi-arid areas where water is seasonally restricted to the inside of parks and where seasonal cattle grazing is beneficial to biodiversity, was opened to discussion. National parks had been closed to local landowners for fifty years, and wildlife-human conflict mitigation had been focused around securing park boundaries and problem-animal control. Making the ecological history support breaching the sanctity of the park boundary was a profound break with earlier conservation thinking, which mirrored the MBG thesis that humans, cattle, and wildlife belong together.

Animal counts to establish the burden borne by local landowners were crucial in negotiating this ecological history. Local knowledge, such as the Maasai theory that cows make trees and elephants make grass was found to be highly compatible with the evidence from elephant specialists that elephants need substantial wildlife corridors outside parks, and that cattle inside parks help increase the carrying capacity of parks. Controlled plots, wildlife corridors and scale models were also all important.²⁷

The establishment of land and resource use/ownership precedent and rules

The MBG made the first ever maps that detailed ownership and use rights for land parcels in the area so as to co-ordinate burns and ecological experiments. Because MBG did not seriously contest land ownership or use rights, but instead based itself on the existing patchwork of public and private lands and existing land use, it did not need to accomplish the kinds of politically and legally complex land reform, land title, or use restrictions that KWS and Kenyan conservation faces. It did, however, involve complex collaboration with the various state, federal and private land owners of the area and the bodies representing them. Again, mapping was tremendously important in this. The area is, however, populated in part with seasonal migrants and through-migrants from Mexico and elsewhere. To my knowledge, and no doubt hampered by immigration restrictions, there have been no serious claims to resource or land rights from these groups during the period of MBG. Neither have use and ownership rights been contested by earlier occupants such as Native Americans, who could plausibly claim affiliation with an earlier and thus 'more natural' nature in the area.

KWS actively sought to legitimate traditional land claims as well as ones recognised by existing legal title. This served to include the ecological role played by pastoralists and to secure the open spaces permitted by semi-nomadic

lifestyles. As such the organisation became an activist body supporting legal standing for Group Ranches and other traditional land claims. Relationships built up between members of the groups in question and members of KWS, with some hiring of the former into the ranks of the latter, were extremely important in this. Efforts were also made nationwide to establish use-rights and ownership where these were under-specified.

Formulating implicit and explicit criteria of membership

The explicit criteria of membership in MBG are very open and inclusive yet voluntaristic, as described above. The core constituency is grassroots, with important legal, bureaucratic, scientific and economic partnerships at the regional, national, and international levels, all of which are included on mailing lists and members of which are invited to group events. The regular newsletters and group-affiliated events underscore this open and collaborative structure. The building of a large MBG workshop facility on the Glenn's ranch to serve as the centre of operations centralises bureaucratic and membership activities.

Despite their openness, the group's conservation goals do not permit of very many kinds of people actually belonging in the area. It is essentially about restricting certain kinds of human presence and activities. Short-term ecotourists are welcome on some working ranches, for example, but retirees living in subdivided 'ranchettes' are not.²⁸ Perhaps most strikingly, although many seasonal and through-migrants actually inhabit the area in question at least some of the time, they are not part of the group's implicit membership. Seasonal workers on ranches are included in so far as they are part of the working ranch, but illegal immigrants who cross the border in this area in large (and deadly) numbers, are not. Neither are the ubiquitous INS officials. This is despite the fact that many area ranchers help immigrants get to safety, and despite the use of the INS vehicles to do various kinds of tracking work like smoothing off dirt roads so that both fresh paw prints and human foot prints show up. It is also despite the large degree of mixing of families between the nearby towns of Agua Priete and Douglas, and despite the common bilingualism. It is as if the political drama of the border passes over but is essentially separate from the ranching use of the area.

The norms of association espoused by the 1994–6 KWS restructuring were those of openness and apoliticality. The arena for successful action, and its concurrent redefinitions of the groups involved and the criteria of success they would establish, was one where any impacted citizen was to be given a stake in the custodianship of the nation's wildlife. Engagement, as a matter of both rights and responsibilities, was to be encouraged at every level of KWS's activities. Unlike the MBG, the related norm of inclusiveness was not invoked, for the redefined conservation activity did not require that urban Kenyans, for example, become direct stakeholders in wildlife conservation, for its success. The other

crucial element of association required that the organisation continually reassert its status as apolitical. This was both to avoid the prior administration's fate of being accused of being political, and to bypass a national political system renowned for so-called tribalism and corruption. To enact devolution to the local (rather than to a single tribal definition of local, say) and to have the space to act in the interests of conservation rather than for the ruling party, openness and apoliticality both had to be maintained.

Supporting semi-sedentarised lifestyles and allowing pastoralists inside parks as part of semi-arid grasslands biodiversity conservation made local landowners active components of the nation's conservation efforts. But it also lent support to lifestyles that were potentially at odds with Kenyan development goals espoused domestically and pushed internationally as part of neo-liberal restructuring. Nomadic pastoralism and the tribes that practice it are widely seen as 'backward'. This meant that it was not immediately obvious that KWS's new organisation was pro-development or pro-government. Likewise, there was not complete agreement within the tribes in question about whether being encouraged to continue old ways of life, or sedentarisation, schooling, and capital infusion were more important. Given the different demographics of Kenya compared to the Malpai families, with the former having a high birth rate, and the latter a below replacement birth rate, intergenerational conflict was of more significance in the Kenyan case.

The norm of openness, by stressing partnerships of many kinds, also opened KWS to the charge that it was not really devolving power at all. Partnerships with transnational NGOs, the World Bank, and other governments and IOs often involved paying salaries way out of line with local salary scales, as well as continuing the expatriation of wildlife income. Developing ecotourism fell much more naturally to well-established travel groups, whose infrastructure allowed them to pick up the latest niche market without much benefiting local people. And local landowners included wealthy foreigners in their wildlife havens just as much as indigenous Kenyans; the call for land reform only extended as far as required by the conservation goal of preserving open land. The 1994–6 KWS administration went to great lengths to indigenise KWS personnel, and so placed much of the scientific monitoring under Kenyan control, but the organisations in partnership could not be changed in the same way, and KWS itself could not do everything and become financially viable.

INTEGRATING OLD AND NEW SYSTEMS OF VALUATION

The grassbank scheme is perhaps the most important new source of value for the MBG (indeed, it has now been trademarked). It has been integrated with existing economics fairly successfully, helped by the clarity of land title, appreciation of

land value, and the grassbank reserves at Grey Ranch. As ranching is a marginal living, however, it has been difficult to find the usual tax incentives for giving or selling land for conservation purposes. Ranchers typically have few investments and little income aside from the value of their ranch against which to take tax reductions. Additionally, many ranchers acquired the land for little or nothing, and so have little basis mitigating steep capital gains tax on land sale. For these reasons, MBG has attempted to persuade congress to enact legislation that would decrease the capital gains tax burden for those selling land for conservation purposes.

In addition to these sources of valuation, the starting of the MBG itself has also led to value-added beef marketing, ecotourism, and conservation grants. While the question of financial self-sufficiency has not been as politically and operationally pressing as for the Kenyan examples, there has been a concerted effort to attract long-term charitable investment in the group from the start. Being a charity does not have the problematic ring that being donor-dependent has in the African context. In both cases, the area and its lifestyles are being saved not just as a local area of environmental importance but as a national and even global commons, with much to teach other projects. While this ought perhaps to mean that it makes sense that these broader constituencies should help pay for the effort, much work has to be done to craft donors as stakeholders and not sources of hand-outs.

The principle issues of valuation at stake in the 1994–6 restructuring of KWS were the twin strands of social justice and the devolution of wildlife conservation so that the people bearing the cost of wildlife should also be the people benefiting from it. The social justice claims resonated well with post-colonial sentiment; the need to make sure that wildlife didn't have more rights than local people resonated well with human rights and anti-corruption agendas. Value-added industries, including ecotourism and non-consumptive utilisation, fit well with general development agendas. But the boldest part of the revaluation, the devolution, foundered on the suspicion that the parks were going to be sacrificed to local development schemes. Among the wealthy donor community and the government, the parks and reserves are the jewel in the crown and the slogan of this KWS administration of 'beyond parks' threatened that fundamental role for KWS. The idea that tourists might not be safe, that poaching might resume, and that parks might deteriorate led to the retrenching of the KWS to its parastatal role. As it turned out, the experiment in community-based conservation spawned many exciting local initiatives more like the MBG which continue to this day, but it was impossible in the Kenyan and international political climate to manage the government body responsible for wildlife in a manner whose politics were 'apolitical.' On a strictly political timescale (between elections), the financial restructuring from donor hand-outs to donor responsibility, and from centralised government agency to local sustainable development could not be carried out.

CONCLUSIONS

Both the examples of biodiversity conservation discussed in this paper partook of the enthusiasm of the 1990s for community-based conservation, and put local landowners at their centre. Establishing both initiatives involved building a local ecological history, ownership, membership or valuation with its own knowledge techniques, and all potentially subject to contestation and instability. In my field of science and technology studies, as in many academic fields, the tendency to define the local by opposition to the global and / or universal, and to separate the politics of the local from the politics of the global is common. Things local are often treated in a holistic and venerating manner, whether in celebrations of indigenous knowledges (sometimes called 'ethnoscience')²⁹ or in various revivals of tacit and exclusionary skill-based accounts of culture and science (what Evelyn Hammonds calls 'the new internalism').³⁰ These moves are crucial correctives to an over-generalised understanding of both the universalising, colonising and homogenising nature of 'modernity'³¹ and the putative role of a disembodied, sceptical and universal science and technology in that supposed global and relentless imperialism. Groups who exist largely outside the mainstream political culture, and laboratory studies, respectively, have been the natural environs for making these arguments. As more scholars focus on the life sciences and environmental sciences, however, it is becoming increasingly clear that the local and the global are relative terms that enable as well as eclipse each other. The geopolitical scales of local, regional, national and transnational in the developmental environmental arena are particularly interestingly interdependent, even when at odds with one another.³² Both the formative elements of the Malpai Borderlands Group and the Kenya Wildlife Service 1994–6 restructuring are excellent examples of where political association and scientific and bureaucratic knowledge and techniques are being deployed such that the local and the global are mutually reconstructing. Perhaps our mistake was to think that conservation is applied science instead of seeing it as the apotheosis of the rise of science and bureaucracy characteristic of modernity.

It is notoriously difficult to assess whether or not biodiversity conservation is working. It depends on who is measuring it on what parameters over what kinds of time-scales.³³ A conventional form of environmental assessment, that involves an outside team assessing a local initiative according to standardised instruments, seems to be counter-indicated by the kinds of relations between the local and remote that characterises these initiatives. This kind of conservation is perhaps most important in that it allows each actor to assess success as part of their motivation for participation. This is clearly widely generalisable. Their successes are our successes.

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NOTES

¹ The local ranchers on the board of directors include one woman; the Finance Director and the Co-ordinator are also women. Two of the directors are also responsible for the setting up of the Animas foundation (see below). The local ecologist is a prominent wildlife ecologist related to one of the directors by marriage.

² The Nature Conservancy is a Washington-based conservation NGO which has state-specific chapters.

³ John Cooke, co-executive director of the MBG and senior Washington-based Conservancy member, told me in November 1995 that the Conservancy was taking the case of Gray Ranch, and the grassroots MBG that formed around it, as a test case of a new and exciting direction for their organisation. Peter Warren, field ecologist with the Arizona chapter of the Conservancy and a member of the Scientific Advisory Committee, said that he thought that co-operation with representatives of government lands and in particular with rural landowners, was the only way ahead in what have often been deadlocked scenarios in the Southwest. He confessed, despite his excitement at the Malpai group's initiative and his role in it, to being somewhat unsure about what the role of NGOs like the Conservancy now ought to be.

⁴ New Mexico Chapter Newsletter, Spring 1993.

⁵ Warner Glenn, *Eyes of Fire*, p.28

⁶ Malpai Borderlands Group Newsletter, 1996.

⁷ As much as 60% of some of the lands grazed by ranchers in this area are leased from the State (New Mexico and Arizona) or Federal Government (USDA Dept. of Forests, and the Bureau of Land Management).

⁸ The grassbank forage is valued at a dollar figure per Animal Unit per Month (AUM). A horse or bull is worth 1.25 animal units; a cow is worth 1 animal unit; a yearling is worth 0.4 or 0.6 animal units. If a rancher had an easement value of \$50,000, and the AUM was worth \$10, the rancher would have 5,000 AUMS to use as he or she liked.

⁹ BD, November 1995.

¹⁰ By mitigating against island biogeographic effects, increasing contiguous area improves the carrying capacity of the land and the survival rate of species by more than the factor by which the area is increased. Thus, doubling the area more than doubles the carrying capacity and more than halves the extinction rate, as long as the area is of sufficient size.

¹¹ BD, July 1996

¹² Other grasslands restoration projects are in effect, including brush removal, and seeding with native grasses, which, for the purposes of brevity, I will not characterise here. There is also an endangered species program that has worked to tie the interests of landowners to the protection of endangered species. This program is somewhat different from the fire and grassbanking schemes, being based more on an aesthetic and supplemental norm of engagement. Negotiations between ranchers and the Beef Marketing Board are also important.

¹³ Important texts on the matter of fire include Pyne 1995. For the contested role of fire in Kenyan savannah ecosystems, see e.g. Western and Gichohi 19XX. Media reports of fires (even in areas where the annual fire season is dreaded by human residents, such as much of the coast of California) now characteristically contain references to the beneficial

effects of fire in removing brush and allowing different, often endangered, plants to flourish, that nourish wildlife, insects and birds.

¹⁴ Dr. Robert Webb of the US Geological Survey, and researcher at the Desert Laboratory, Tucson, and Thomas Biggs of the University of Arizona's geosciences department, presented to the MBG the results of work on the effect of fire and fire frequency on soil nutrients in 1996.

¹⁵ One quadrant has been burned every 2–3 years since data collection began; one every 5–10 years, and one has not been burned.

¹⁶ The first prescription fire in the MBG's area was the 1995 'Baker Burn'. Ranchers with grazing leases in the prescription area for an upcoming burn refrain from grazing those pastures so as to allow for the accumulation of enough fuel for a hot burn.

¹⁷ The MBG does not, however, embody an attempt to reflect and assert the will of the people against an alienated government or environmental hegemony, and the personal beliefs of the actors are underdetermined by the norms of association. The activism is thus engaged rather than oppositional, raising the question as to the usefulness of rubrics such as 'resistance' for this kind of grassroots activism. See Scott 1990 and Jasanoff forthcoming, for an account of the changing role of NGOs in environmental governance, and their emerging unique position to take on technical bridging work as well as (and often instead of) more conventional representational, oppositional and ideological activist work.

¹⁸ Kenya Wildlife Service Home Page. <http://www.kenya-wildlife-service.org/>

¹⁹ Kenya Wildlife Service 1994, p. 20. Biodiversity was recently defined as 'all life forms and life processes on which such life forms depend and of which they are part,' (definition generated by the break-out group on biodiversity at the Policy Framework Workshop, 9–10 August, 1995, Naivasha, Kenya.

²⁰ Mbaria 2001.

²¹ Ibid.

²² See recent books by KWS directors Western and Leakey, both key players in Kenya's ivory wars: Western 1997, Leakey 2001. For recent examples of the continuing saga of poaching and financial crisis, see e.g. Wanjiru 2002.

²³ Lucy Chege-Waruingi, African Conservation Centre, January 2002.

²⁴ Laikipia Wildlife Forum web page, 2002. <http://www.laikipiawildlife.com/>

²⁵ Mbaria 2001. Where aerial and other counts are not feasible, dung is used to gauge elephant numbers because it known roughly how many boluses of dung are produced per elephant per day.

²⁶ See e.g. Latour 1987; Porter, 1995.

²⁷ See Thompson 2002.

²⁸ Bill MacDonald, Congressional Testimony, Committee on Finance, US Senate, June 12, 2001.

²⁹ See, for an interesting example, Watson-Verran and Turnbull 1995.

³⁰ See, for example, Shapin 1994; and the other reviewers' articles in the same publication, for a range of contemporary motivations for and against localist approaches to science and technology studies.

³¹ See, for a range of views on the questions of indigenous vs. Western science, e.g. Harding 1993; Hess 1995; Visvanathan 1996; Gusterson 1996; Scott, 1996; and Agrawal 1995.

³² See, for example, Wynne 1996; Comaroff 2000; Tsing, forthcoming.

³³ See, for example, Takacs 1996.

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