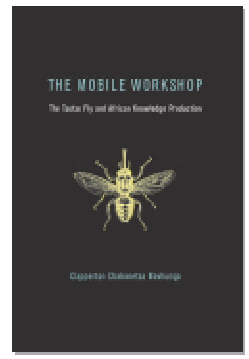
The Mobile Workshop

Clapperton Chakanetsa Mavhunga



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6 Exposing the Fly to Its Enemies

The Umzila results, already described, show clearly … that settlement properly planned will protect itself. … Umzila's results even suggest that someday in the very far distant future the question will be settled by the natural increase of the now protected native population. "Properly planned" settlement in fly [country] will not consist in the giving out of isolated farms, scattered over the face of the country. …

There must be a definitely planned settlement scheme, affecting a large block of country together, on some sound agricultural basis. The closer the settlement can feasibly be the better, and first and foremost amongst the conditions of occupation must stand the effective clearing of the less freely deciduous types of woodland. …

Secondly, no ingress of large game must be allowed from areas still under fly. The best barrier … might be a strong, patrolled fence; but if the fringes of the area are sufficiently closely settled it is likely, even from our present imperfect success on the lightly settled border, that this fact alone, with shooting, will suffice to keep off the elephants, buffalos and elands. It is these three animals that probably chiefly matter.

Umzila's principle—the settling and clearing of the low-lying guard-area only, the enclosed hill mass then taking care of itself and being perhaps disposed of later at an enhanced value—would be well worth consideration and investigation. Under such a scheme, carried out with thoroughness, it seems at present fairly certain that cattle could, after a few years, be kept safely and in numbers on the dolerite.

If, on the other hand, the settlement should have to be a gradual growth from small beginnings, its safest base would be the deciduous part of the British border, a block at a time being settled and special measures being taken against buffalos.

The settlement of the two permanent fly-areas themselves would mean the end of the menace. (Swynnerton 1921a, 375–376)

This passage is taken from Charles Swynnerton's study of *ndedzi* in Muzvirizvi. He was laying out the various methods that the Gaza king Mzila had used and recommending them to the governments of southern and eastern Africa.

Among other stratagems, Swynnerton proposed five basic methods that the Gaza king used and which were deployed throughout southern Africa. The first involved controlled *ndzilo* (fire) to destroy not just the *xifufunhunhu* (insect) but also its habitat and hides, thereby exposing it to its predators. The second was forest clearance, intended for a similar purpose, as well as to separate *sviharhi* (animals) and the *ndedzi* that subsisted on them, on one side, from people and their *tihomu* (cattle) threatened by the flies, on the other. This was called *barrier clearance*. The third measure was prophylactic settlement, which involved the strategic deployment of people between *vachena*'s ranches and an advancing *ndedzi* front. It involved deliberately overcrowding people to cause deforestation and overgrazing, thus denying *ndedzi* its perfect living conditions. The fourth, albeit not unconnected, stratagem was to use fences to create permanent and patrolled game-free, cattle-free buffer zones that blocked and redirected the movement of *vanhu* and *tihomu*. The fifth was the use of *magocha* to shoot *sviharhi* and create buffer zones between *ndedzi*-infested areas and *tiko* (villages). The fourth method is the subject of the next chapter. This one, meanwhile, discusses the first two stratagems, with all places referenced shown on the map (see figure 6.1). The keywords in *xitsonga* and *chidzimbahwe* are listed in the glossary for easy reference.

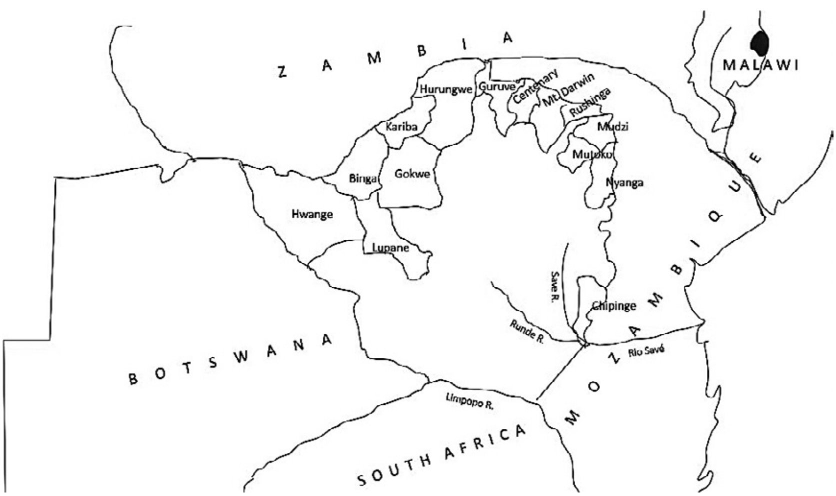

Figure 6.1
The fronts against *mhesvi*, 1909–1970.
Source: Author.

In a sense, this chapter builds on and contributes to literature on arboricides or herbicides, which currently is strongest in the United States, where some of the chemicals and equipment used to deny *ndedzi* shelter originated. The richest literature focuses on the farm—specifically, on *mishonga yesora* (herbicides) deployed against weeds. This category included, by 1945, herbicides such as 2,4 dichlorophenoxyacetic acid (2,4-D), a growth regulator, which mimicked a plant's own hormones and caused the plant to literally grow itself to death (Anderson 2001, 2005; Daniel 2002). The role of institutions and scientists has received attention, with farmers fundamentally defining how industrial chemicals were adopted and deployed. This is how herbicides, along with the tractor, displaced cultural techniques between 1890 and 1940 (Fitzgerald 1990, 2003; Kline 2000; Williams 1987).

The chapter extends the concept of *herbicide* (better yet, *arboricide*) beyond the substances used to kill "problem plants" and toward the theory and practice of killing them (Mavhunga 2011, 152). Where the US literature limits herbicides to chemicals and their agricultural targets (weeds), I extend arboricide to cover all kinds of techniques used to manage or eliminate trees or whole forests and the multiplicities of mobilities within them that facilitate the spread of trypanosome-carrying *ndedzi*. Here, we see very direct mobility of *ruzivo rwavatema/vutivi bya vantima* into Rhodesia's program of forest clearance as an anti-*ndedzi* strategy.

Fire and Late Season Burning

In chapter 1, we discussed the widespread use of *ndzilo* (fire, fires) in pest-control management in the community. With *valungu*'s aggressive occupation and their establishment of Southern Rhodesia as white-ruled territory, Swynnerton (1921a, 325) observed that "under the white man everyone burns when he pleases." The first *ndzilo* were now being set while the grass was still "half ready to burn," even when there was hardly any leaf litter on the ground or enough wind to swirl the flames up into the treetops above and penetrate the thickets. As a result, the effects of *ndzilo* were drastically reduced, allowing flies driven from one burning place to fly above the flames into the burnt area and find refuge in the unburnt spots and leaves. The purpose of using *ndzilo* late was to destroy young shoots and germinating plants while sparing the more resilient, thick-stemmed, and taller trees. At the same time, discontinuing the use of *ndzilo* encouraged the roots of pyrophytic (*ndzilo*-tolerant) plants to shoot out and become undergrowth (383).

Swynnerton recommended that the *Companhia de Moçambique*, the authority in charge of Muzvirizvi at the time and which had commissioned his research, adopt the seasonal firing techniques that Mzila in particular had used well to control *ndedzi* in Muzvirizvi. Indeed, his son, Ngungunyana, might have continued his father's practice had the circling British and Portuguese not forced his strategic but doomed withdrawal to Bilene. Swynnerton advised authorities to delegate "the kraal natives themselves [to do] the actual burning." Even though certain trees protected *svimun'wana* (springs) and kept them wet, he was adamant: "Better an occasional spring lost than a continuance of the tsetse" (Swynnerton 1921a, 383). Here, he cited *Umzila's principle*: "The Zulu clearings, sufficient to remove *ndedzi*, do not seem to have caused any shortage of water. … There should be no discontent over it amongst the natives," he said, "as late burning represents their own old custom, and, whatever their infringements, they still speak of it as the correct method" (384). People usually burned the grass around their huts and granaries early to protect against increased late winter valley *ndzilo*, which usually started as children burned grass to flush out mice and as adults cleared new land to plant crops. The plowed or hoed strips provided inadequate fireguard. Contrary to Swynnerton, however, the practice was not Mzila's "invention" but standard practice throughout Africa; in fact, to say Swynnerton "saw" or "found" *ndzilo* to be effective in controlling pests like *ndedzi* is to say that *vatema* were the ones he saw, found, and learned from.

As he had learned while still the manager at Gungunyana Farm, late fire burning could be "so postponed and regulated as to serve most useful purposes" against *ndedzi*. The grass would be mature and very dry, yielding "a really fierce fire" that destroyed *mahlomalavisi* (chrysalises) and breeding places. The scorching *ndzilo* also brought about "the probable hardship to the *ndedzi* itself of a widespread and thorough removal of shade, concealment and food at a hot, dry time," rather than "burning by small installments, [which] makes escape easy" (Swynnerton 1921b [1960], 31). Late burning (see figure 6.2) also caused indirect effects. It found the grass and fallen leaves in their driest and most abundant state, the weather hot and the winds great, the flames therefore achieving maximal destruction of low woody growth and temporary elimination of high shade.

There was no need to burn every year, but only every second year; even then, it was not just "the best method" but "the right time to burn" that mattered. It was best to burn late one year and skip burning altogether the next to ensure "an extra accumulation of … extraordinarily dry, effective fuel." Whether burning annually or every other year, the hottest and driest

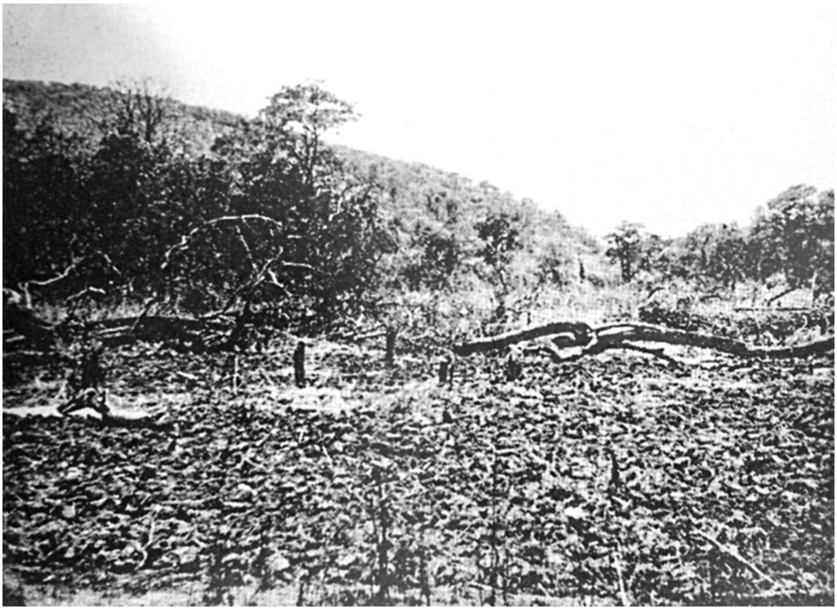

Figure 6.2
Late burning in Southern Rhodesia.
Source: Proceedings and Transactions of the Rhodesia Scientific Association 1960.

months (September–October) were best, especially just before the rains (Swynnerton 1921a, 1921b [1960], 32).

As Swynnerton had learned from Mzila, late burning provided rich ash for “the excellent grasses left us here by the Zulus [Gaza], who burned late and regularly” (Swynnerton 1921a, 384). Regular firing suppressed the dense wooding that otherwise kept good plants down. The flames killed or maimed flying *ndedzi* and scared away *sviharhi*. Fire denied *ndedzi* shelter, destabilized it into flight, and rendered it visible to swooping *svinyenyana* (birds). It also destroyed insectivorous *xinyenyana* (singular of *svinyenyana*) populations, whose breeding season started in October, the perfect time for late burning. However, Swynnerton concluded that “useless fires” were destroying forests anyway, so *svinyenyana* “may as well therefore be destroyed by useful ones” (385).

To be clear, Swynnerton’s work in Muzvirizvi was commissioned by the Portuguese via the *Companhia de Moçambique*. However, his recommendations of late burning every other year, with fines for unplanned *ndzilo* and guards deployed to monitor, was not confined to Mozambique. This recommendation was also implemented in Southern Rhodesia following the Nemakonde *n'gana* outbreak of 1927.[1] These organized or controlled grass *ndzilo* were "fierce and complete" but did not eliminate the pest, which took refuge in pockets inaccessible to the flames—especially in swampy breeding areas, where *mahlomalavisi* remained virtually untouched. The 1928 flames were even less ferocious and incomplete and caused only a "negligible" effect on *mahlomalavisi* and the *ndedzi* population.[2]

The *ndedzi* surge continued. By 1933, the early optimism surrounding late burning had evaporated. Elsewhere that year, Tanganyika had a "successful" burning experience, Uganda "promising," and Nigeria "not so favourable." As Chief Entomologist Rupert Jack of Southern Rhodesia noted in his annual report, the problem of late burning lay in its dependence on "extensive areas of heavy grass," whereas most of Southern Rhodesia's *ndedzi* areas were in mopane country of very thin and scanty grass. Test after test had given "very discouraging results" and it was "obvious that general application of this measure [was] out of the question."[3]

Moreover, by the early 1940s, some tree types were exhibiting resilience to *ndzilo*, which seemed to stimulate rather than suppress increased regrowth from root suckers.[4] Indeed, the role of *ndzilo* in the maintenance of open savannah and the prevention of thicket formation presented "a complex ecological problem of great importance in applying anti-tsetse measures."[5] This was particularly so in southeastern Rhodesia's mixed thicket (bushland), which, when left undisturbed and unprotected from *ndzilo*, became "a tangled mass of almost impenetrable thicket, known locally as 'Jessie bush.'"[6] It was the perfect haunt for *ndlopfu* (elephant) and *mhelembe* (rhinoceros). Whereas open-type savannah woodland could be maintained through recurrent *ndzilo*, soil erosion was a problem; however, no soil-disturbing agents such as *tihomu* were allowed in.[7]

Up until 1955, emphasis within Africa's entire *mhesvi*-control fraternity had been on the positive effects of *moto* (fire) on vegetation composition. New research that year called such bullishness into question. Fifty percent of *mhesvirutondo* blood meals were now known to come from the pig family of animals that *vachena* called Suidae, in areas in which *nguruve* constituted just 10 percent of game population (Weitz and Jackson 1955). In the Fort Johnston area of Nyasaland (Malawi), where the Muslims regarded *nguruve* as unclean, *njiri* (warthog) thrived well after locals hunted all other *mhuka* for the pot (Mitchell and Steele 1956). Foliage constituted almost all of the animal's diet, but after seeds ripened and food translocation to roots was advanced, roots—not just grass—became an important dietary factor. In the dry July–October period, *njiri* survived almost entirely on roots, and the *nguruve* had “adapted their breeding season to coincide with the period at which the grass roots contain[ed] maximum food value; that is before the food reserves have been drawn upon for the growth of new spring foliage” (Mitchell 1963, 27). Most grass types, especially *zengeni* or *shengezhu* (what *vachena* called *Hyparrhenia spp.*), continued to produce some foliage fed from food reserves stored in the roots. Other grasses, like *tsangadzi* (what *vachena* called *Loudetia superba*), stored food in large rhizomes and deferred shoots until mid-October, regardless of *moto*.

This evidence showed that late burning achieved the opposite effect of what was intended. As Mitchell demonstrated:

> Frequent late burning has resulted in the displacement of woody vegetation by coarse grasses *Hyparrhenia* spp. and *Loudetia superba* in particular. Protection from fire or very early patch burning result in thickening up of woody vegetation and a suppression of the coarse grasses. Frequent late burning therefore, by increasing *Loudetia superba* and *Hyparrhenia* spp. dominance, renders conditions favourable for an increase in the population of warthog and a consequent increase in the density of *Glossina morsitans*. It is thought probable that the intensification of burning which has taken place over the last sixty or seventy years in Northern Rhodesia has been in some measure responsible for the spread of tsetse which has occurred over the same period. (Mitchell 1963, 28, citing Trapnell 1959)

Based on this damning analysis, enthusiasm dampened and focus turned even more energetically toward other methods. One thing was clear: No method worked everywhere, because no two contexts were the same.

Mechanical Forest Clearance

Swynnerton undertook two experiments in 1918 in Chipinge, one year before the Rhodesian government started its own in Gwai and Shangani. His first was designed to establish the effects of clearing undergrowth in primary forest. He instructed his workers to clear out an 80 × 70 yd. area and to drive two black oxen through it the next day. Only three *ndedzi* accosted the oxen, whereas swarms had attacked them before. In the uncleared areas, fifteen flies were caught. He concluded that clearing undergrowth was effective in “banishing” *ndedzi* (Swynnerton 1921a, 374).

The second experiment sought to ascertain the width of undergrowth clearing necessary “to protect a strip of road from attacks by *G. brevipalpis* in sunny weather” (Swynnerton 1921a, 374). Swynnerton proved that only minimal clearing was needed to proof a piece of road so long as *tihomu* moved along it in sunshine, when *ndedzi* was sheltering from the sun and predators. By contrast, “a considerably wider clearing would be needed to render it safe at all hours and in all weathers" when *ndedzi* was out and active (374).

The Division of Entomology's experiments from 1918 on were intended to test the efficacy of barrier clearing and must be regarded not merely as experiments but as the only measures the government had to contain *mhesvi*. The first was discriminate and targeted a dry-season concentration area for *mhesvi* in the Sepani vlei of Sebungwe. Discriminative clearing (targeting of specific types of trees or forests) was based on the idea that *mhesvi* did not just move or live randomly throughout *sango*.[8] The experimental objective was to determine the effect on *mhesvirutondo* of eliminating evergreen trees along the riverbank. The experiment was abandoned due to two continuous seasons of abnormally high rainfall that discouraged the normal concentrations of *mhesvi* and *mhuka*.[9]

The second experiment was a barrier-clearing exercise that involved cutting down all trees, eliminating undergrowth, and late burning, with the aim of preventing the spread of *impukane zegangeni* (*mhesvirutondo*) from the Shangani to the Gwai Rivers. The work was abandoned following the outbreak of influenza in Matabeleland North. Further experiments in discriminate elimination of evergreens followed in Gwai in 1927, with the objective of determining whether depleted shade might discourage *mpukane*. However, the experiment was terminated in the next year to focus solely on "game destruction."[10] Settling *abazingeli* (hunters) along the Gwai was deemed a far cheaper way of clearing the "true habitat" and keeping *mpukane* at bay.[11] Jack found discriminate clearance "almost as distasteful as destruction of game" but was prepared to give it a chance if it could eliminate *mpukane*.[12] In 1933, preliminary experiments started in poisoning indigenous trees with the objective of "furnish[ing] some information on methods of treating cleared barriers."[13]

Experiments later conducted in Hurungwe in 1957 were promising, not least because the settlement of *vatema* from Bikita and Chivhu followed right after discriminate clearing. *Mhesvi* disappeared within six months. The advantage of cleared areas was their inhospitableness to *mhesvi* breeding long after, before regeneration occurred—sometimes as much as ten years later. In areas where *shiri* (birds) swarmed, tree destruction exposed *mhesvi* that might take refuge in the trunks' greyish, camouflaged bark containing cracks inaccessible by beaks.

Although selective or discriminate clearance suited evergreen river lines, block clearance was preferred in expansive areas that had to be rendered unsuitable to *mhesvi*, thus forming a wide barrier to *mpukane* crossing from infected to uninfected areas. As Jack noted, there had to be a considerable population of *vatema* suffering from a shortage of safe grazing for their *izink-omo* for such block clearance to provide sufficient incentive for them to settle there and thereby offer themselves as free labor to government. Second, there had to be "good tribal discipline"—that is, loyal *vatema* that could be counted upon to supervise fellow *vatema* in the absence of a white man, whose health was susceptible to fever in these margins between European-occupied territories along the Zambezi and southeastern borderlands.[14]

Barrier clearing consisted of clearing lines through *sango* wide enough to prevent *mhesvi* from crossing. The clearings had to be between one and ten miles wide. It would have been easier to maintain the cleared strips of land by settling *vatema* in it, but few were prepared to move to these unsuitable areas.[15] The Division of Entomology also considered planting conifers or eucalyptus as a thicket barrier against *mhesvi* encroachment from Mozambique. Indeed, experiments in Tanganyika had shown *mhesvi* to dislike the interior of extensive thickets. However, the division found the method "doubtful to say the least."[16] The experiment was tried in a smaller area in eastern Chipinge, but went no further.

In any case, there was doubt whether *mhuka* were even responsible for bringing *mhesvi* across the border or any certainty about whether a border clearing would help. In 1935, Jack gave three reasons for why a strategy focused on controlling the traffic of *mhuka* was a bad idea: (1) The *mhesvirutondo* followed *vanhu* for up to ten miles, or even more; (2) it also caught rides on *vafambi* (travelers) and didn't need *mhuka*; and (3) it could always fly, stop, fly to cross on its own.[17] Jack had advised the government in 1932 that a much narrower clearing was more reasonable for *mhesvirupani*, which did not catch rides on *mhuka* as much. Hence, the clearance axis could go alongside open grasslands (natural clearing) and high ridges (altitude inhospitable to *mhesvi*), thus minimizing the work of chopping trees down. Using such a method, the Tsetse Branch had employed local *vatema* to clear about thirty miles of the border at a cost of about £1,500 over three years. Between 1932 and 1934, the length of the border clearing in Chipinge was extended to thirty-five miles.[18] Again, barrier clearance was front and center in *Umzila's principle*.

However, as the 1940s show, unlike the Gaza king, the Rhodesians failed to control the movement of *vanhu* and *mhuka* to any commanding degree. In 1939, a *ndedzi* invasion from Mozambique breeched this barrier, burst forth into Chipinge, and infected one thousand *tihomu* with *n'gana*, leaving four hundred dead at thirty-two farms. In response, the government embarked on an extensive program to double the width of the clearing, slash regrowth, and burn the cut grass and wood. It recruited a large workforce composed of locals under two white supervisors and cleared the Budzi to Cheredza River frontage near Mt. Chirinda. After a drastic decline of *n'gana* to just 132 cases producing twenty-four deaths at nine farms in 1940,[19] the cases rose again in 1941 on a far wider scale than before.

This time, *mafrayi* were dispatched to extend the clearings in the Nyamadzi valley, which Jack's successor Chorley identified as "the main channel along which the two types of *mhesvi* involved enter the Colony."[20] In 1943, several farms—Wolverhampton, Helvetia, Chibudzana, Sherwood, East Leigh, Southdown, and Grampians—were subjected to "total clearing" on the outward (border-facing) side and "partial clearing" on the inner side facing the farms.[21] The following year, the border clearings on the Mount Selinda, Farfell, Pendragon, and Bayswater farms were widened, slashed, and burned.[22] Meanwhile, the coniferous and eucalyptus barrier proposal was seriously considered, but shelved due to Chipinge's distance from the Mutare-Beira railway line.[23] By 1952, the total area of barrier clearing had reached 59,188 acres, and the government was putting some of this land to tea crops (private growers) and conifers (Forestry Department).[24]

By 1954, (white) public objections to game destruction had forced the government to appoint a Commission of Inquiry to find other *mhesvi* and *n'gana* control methods. It recommended only discriminative bush clearing combined with close settlement and OCPs, with strictly supervised discriminative game elimination continuing as a temporary strategy until the former methods were perfected. More funds were allocated for mechanical bush clearing and OCPs spraying, with hunting gradually restricted to controlled hunting areas (CHAs) under the Department of National Parks and Wild Life Management (DNPWLM; Cockbill 1967).

It became clear in 1955 that *mhesvi* was reestablishing a stranglehold on the border clearing, with control operations being confined to eliminating regrowth.[25] *Vatema* were flocking to the better wages and working conditions that the white farmers and tea and wattle companies offered, shunning the backbreaking work of felling huge trees.[26] Some local farmers were overgrazing their lands and failing to organize *moto* fierce enough to destroy the regrowth, thus promoting overgrown bushes habitable to *mhesvi* and grass too short to sustain a raging, *mhesvi*-killing fire. The operations were assuming "more and more the character of pasture improvement … than anti-tsetse operations."[27] Meanwhile, senior officials were dismissing discriminate clearing as a "spectacular and very expensive failure" and a wild goose chase based on an unproven assumption that whole *mhesvi* populations concentrated in specific areas when only small fractions did—and, even then, because specific *mhuka* were in the locale.[28]

This is what made organochlorine pesticides attractive—the element of mass destruction.

These developments in Southern Rhodesia must be placed in the broader African context. In 1952, Glasgow claimed quite boldly: "Of all the various methods of control which have been devised for various types associated with particular vegetation, the only method which can be guaranteed to succeed with any types of tsetse in any situation is sheer clearing" (Glasgow 1960, 86)—that is, the complete removal of all woody vegetation and its replacement by pasture or fields. Some were not so sure about sheer clearing, however.

Chemical and Mechanized Phytocides

Here, we can make very direct connections to the US literature we began the chapter with. Arboricides were coming from the United States, Canada, and the United Kingdom. In 1958, investigations were launched into the practicability of killing trees with organic arboricides or phytocides in the control of regrowth in clearings. The research continued in the 1960–1961 operational year (Cockbill 1961). Two soluble chemicals were selected: 2,4-Dichlorophenoxyacetic acid, a common pesticide/herbicide for controlling broad-leaf plants, and 2,4,5-Trichlorophenoxyacetic acid, a chlorophenoxy acetic acid herbicide used to defoliate broadleaf plants.[29]

The 2,4-D chemical is an organic compound (chemical formula: $C_8H_6Cl_2O_3$) that kills broadleaf weeds by inducing them to grow uncontrollably while sparing other plants around them. It was first published as a selective herbicide in 1944. The next year, American Chemical Paint Company started selling a 2,4-D herbicide it called *Weedone*. It became the first such compound to selectively destroy broadleaf plants while leaving narrow-leaved ones alone, and thus it "replaced the hoe" (Hamner and Tukey 1944). Later, Dow Chemicals became the biggest manufacturer of the herbicide.

The World Health Organization (WHO) International Agency for Research on Cancer (IARC) has listed 2,4-D as "possibly carcinogenic to humans," though it admits this classification is based on "inadequate evidence in humans and limited evidence in experimental animals" (Loomis 2015; IARC 2015). 2,4-D is placed alongside coffee and red meat, in a category of carcinogenicity called Group 2B, which is much milder than Group 1, but it is still extremely toxic ("Agents Classified" 2015). The "2,4-D General Fact Sheet" (2015) notes, significantly, that the chemical was an active ingredient of the notorious Agent Orange that US troops used extensively in the Vietnam War, even though 2,4,5-T was responsible for the health effects associated with the bombing. 2,4-D caused fertility problems in men (abnormally shaped sperm; NPIC 2015).

The chemical 2,4,5-T (chemical formula: $C_8H_5Cl_3O_3$) is a synthetic chlorophenoxy acetic acid herbicide also designed to defoliate broadleaf vegetation. Like 2,4-D, it was developed in the 1940s and used extensively as an agropesticide before being gradually discontinued in the 1970s. It also gained notoriety as an ingredient of Agent Orange (composed of 50 percent 2,4,5-T and 50 percent 2,4-D). Today, it is associated with US carpet bombing in Vietnam, but this belies its earlier devastating deployment by the British in Malaya (Sodhy 1991) and, as we will discuss later, similar deadly chemicals in Rhodesia against *varwiri verusununguko* (freedom fighters), whom *vachena* called "terrorists." During manufacturing, traces of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), a persistent, carcinogenic organic pollutant with long-term effects on the environment, contaminates 2,4,5-T. Although such contaminants can be reduced with good temperature control, pre-1970s manufacturing did not have such controls. Consequently, the US Department of Agriculture terminated all 2,4,5-T use in food crop production in 1985. Internationally, dicamba and triclopyr have since replaced 2,4,5-T because of confirmed evidence from intentional overdoses and unintentional high-dose occupational exposures that caused weakness, headache, dizziness, nausea, abdominal pain, myotonia, hypertension, renal and hepatic injury, and delayed neuropathy (CDC 2016).

Both 2,4-D and 2,4,5-T were used extensively in Southern Rhodesia's arboricide against *mhesvi*. They were diluted to 3 percent and 6 percent mixtures in lighting paraffin, according to a method borrowed from similar experiments in Mozambique. Lighting paraffin was more expensive than diesel, but it was preferred because it caused less rapid leaf fall and permitted much more of the applied toxin to penetrate into plant tissue. Application to the foliage was made with pneumatic knapsack sprayers at 75 lb. per square inch. About fifty tree types exhibiting coppicing were treated, each with 3 percent and 6 percent mixtures applied to the foliage in January, February, March, and April. Twenty-three types of trees were cut at about two feet from ground level and the cut ends of their stumps treated with the 6 percent mixture over the same period. As a control, corresponding trees were cut and left untreated to indicate the extent of regrowth under the prevailing conditions. During February, March, and April, deep cuts were made into standing trees and a 6 percent mixture applied to bark and sapwood. Two growing seasons were needed before researchers could offer opinions on the exact effects, though early results indicated that some trees were "fairly resistant to 2,4,5-T and 2,4 D applied in this way," whereas others were more susceptible. Already there was fear that using these arboricides on some types within a mixed association might spread chemical resistance instead of killing the trees, as was happening with trypanicides.[30]

On the advice of giant British agrochemical company Fisons Pest Control Ltd., a follow-up trial was conducted in 1966–1967. This time, the arboricidal agent was no longer a butyl ester concoction but the weed-killing compound Tordon 22K, manufactured by Dow AgroSciences Canada Inc. of Calgary. Tordon 22K was applied to freshly cut stems of regenerated *misasa* (*B. spiciformis*) at Lettie Swan Farm in Chipinge District. The trees had grown to a height of eight to ten feet and their stems up to three inches in diameter. Before the experiment, the vegetation had been suppressed through slashing and burning, in line with the anti-tsetse program to create a barrier to *ndedzi* incursions from Mozambique. In 1958, Lettie Swan Farm was excluded from annual treatment, leading to rapid regeneration of woods. At the same time, the tree growth stunted the grass cover to a level at which annual seasonal fires ceased to occur. The coppice thickened, and when the experiment team moved in the regenerating shoots were so dense that operators found it impossible to move with pneumatic knapsack sprayers through them to apply a foliar spray.[31]

The only solution was to cut each shoot clean through and apply arboricide using paintbrushes to the freshly cut ends. This application was carried out on February 1, 1966. Then, on December 9, the arboricide was applied as a foliar spray to half of the surviving leaf-bearing shoots, with the rest used as controls. The shoots that had been cut and left untreated as controls on February 1 were divided on December 9 so that half of them became controls and the rest were treated with foliar-sprayed arboricide at a concentration of 1:100. The results suggested that Tordon 22K in water could prevent regrowth. Applied as a 1 percent foliar spray to untreated cut stems, the pesticide "killed or prevented regrowth of about the same proportion as the 4% foliar application following application to the freshly cut stems."[32] Tordon 22K cost £22.10 per gallon; added to the cost in man hours (labor), the cost of spraying was £12 per acre to remove *misasa* that had regenerated on Lettie Swan farm.[33]

Bulldozers, Chainsaws, and Preexisting Methods

South of Chipinge, the thinking within Tsetse Branch until 1943 was that while the Runde and Savé Rivers offered a natural barrier to the movement of *vanhu* and *sviharhi* when in flood, during the dry season they carried very little water. In fact, the Runde was even completely dry. In either case, there was quite considerable pedestrian traffic across both rivers. At Chivirira Falls on the Savé Gorge, the river was only about a hundred yards wide. There was nothing to stop the *ndedzi* advance from Mozambique continuing quickly across the Savé into the Gonarezhou Forest in the Ndanga and Chivi Districts. Chorley therefore advised the government to take "very drastic measures" to avert a sure disaster. There were no objections.[34]

Border-clearing work commenced on the Rupembi River in the Savé Valley in 1955. The primary tool of mechanized tree destruction was the mechanical chainsaw, which still required significant labor from *vatema*, albeit working in pairs and in far fewer numbers than the axe-felling "gangs" required.[35] The operations were a kind of experiment in comparing costs and efficiency of mechanical chainsaws to that of hand labor with axes. The area selected was composed of thickets in deciduous woodland impenetrable to *xindedzi xa nhoveni* (*mhesvi* of the forest) and *xindedzi xa nkova* (*mhesvi* of the valley) during the dry season. The project's success would be judged according to the effect on traffic control figures and by random catches. Further, the future incidence of *n'gana* or the presence of the *xitsongwatsongwana* (microorganism) that caused it in *tihomu* in Musikavanhu African Reserve would indicate the efficiency of the clearing as an anti-*mhesvi* measure.[36]

Two years later, the methods were extended to four main forest clearing operations: in the Savé West and Savé East Game Destruction Scheme, the Rupembi and Honde River Discriminative Clearing Scheme, and the Bandai Clearing Scheme. By 1958, the two latter schemes were finished and the first abandoned; the Savé East scheme was the only remaining one, in which *mafrayi* were busy with drainage line bush clearing. The Tsetse Branch hoped to put the area to close settlement.[37] It was also during that year that "the very large task of modifying the vegetation of the black basalt zone so as to form an adequate barrier to further advance of tsetse" began.[38] Teams of *mafrayi* were tasked with felling trees in the alluvium of the drainage systems of the Rupembi and Honde rivers running southeast across the international boundary between Beacons 105 and 108. The lower reaches of these rivers inside Mozambique were thick with *ndedzi*, leading to the importance of creating a barrier clearing to curb any likely westward movement.

Meanwhile, another team of *mafrayi* with axes was deployed to hand-clear an area in Bandai of approximately four thousand acres lying at the southern end of the Ndanga East Reserve on the Savé's west bank. The objective of the clearing was to cut off any likely cross-border invasion into the Peri dip and Rupangwana dip area. The Tsetse Branch hoped that after the initial clearing, the Native Affairs Department would take over the slashing and late burning necessary to suppress regeneration and promote grass growth.[39] However, owing to lack of locals wanting to perform *mafrayi* work, the work was suspended after just a thousand acres had been cleared. It was only in September 1958 that work to clear the outstanding acreage resumed.[40]

In July 1958, the government approved a budget for three Caterpillar D7 *mabhurudhoza* (corruption of bulldozers), to be operated by the Conservation and Extension Department. The D7 was a medium *bhurudhoza* made by the Caterpillar Tractor Company of Peoria, Illinois, and Stockton, California.

The first D7 was made in 1938, setting the stage for many versions with different horsepower ratings in subsequent decades (see figure 6.3). The first machine arrived on the Mkwasine River on December 3, 1958, followed by the second on January 20, 1959. Before they moved in, District Entomologist John Farrell had mapped the vegetation communities to guide the machine teams—composed of drivers, axmen, and mop-up personnel. The two machines soon proved inadequate.[41]

While the D7 *mabhurudhoza* were busy at work on the Mkwasine, *ndedzi* was captured on the Chiredzi in April 1959, thus providing "a more precise indication of the direction which operations should take."[42] After completing the Mkwasine drainage clearing up to the Sangwe Reserve boundary fence, the machines rolled into the Chiredzi river valley. Riverine drainage was cleared for eight miles along the Mkwasine on the western side of the Sangwe boundary fence. Thirty miles of tributaries entering the Mkwasine in this vicinity were also cleared. The width of the clearing was 50–70 yd. on either bank. On the Madela tributary, the removal of *chinanga* (the hooked-thorn tree *vachena* now called *Acacia nigrescens*) woodland created a clearing half a mile wide, inside which occasional trees were spared for shade. The *mabhurudhoza*'s progress was 0.8 acres per hour per machine; all told, they cleared 2,165 acres at a cost per acre of just under £7.[43] In August 1959, the *bhurudhoza* teams moved into the Nyamasikana tributary of the Mkwasine close to Chidhumo Clinic, clearing 690 acres by the

Figure 6.3
The Caterpillar D7 *bhurudhoza*.
Source: https://www.youtube.com/watch?v=My1fzbOxwi8.

end of September. Inside the first three hundred acres, the working teams piled all felled bush at the white landowner's request. It was an expensive undertaking; the clearing itself cost £7. 8s. per acre, but the piling cost £5 per acre.[44]

By the early 1960s therefore, the *bhurudhoza* had entered the anti-*ndedzi* operations. In addition to the 2,900-acre clearance at Mwangazi, these monsters also blazed through 2,700 acres at Lusongo. Both motorized destructions of trees were aimed at creating a barrier to the path of *xindedzi xa nhoveni* advancing from Mozambique. The bulldozing operation cost per acre was £6.10s.; the fairly flat terrain and limited density of forest depressed the costs somewhat. By contrast, the clearing of eighty acres in Musikavanhu African Reserve had cost £14 per acre on account of the heavy riverine bush near the Savé River. These *mabhurudhoza* were driven by *vatema* working in teams to not only fell or uproot trees, but also construct and repair roads or tracks. The road works cost £18. 18s. per mile to carve out.[45]

That was not the only job the *bhurudhoza* teams were charged with. The land was very rocky, and complete clearance using machinery was impossible, meaning that trees left standing had to be cut or treated by hand. Instead of chopping whole trees down with axes, particularly for the tough-as-rock hardwoods like *musimbiri* (ironwoods), the *bhurudhoza* team members on foot ringbarked the trunks to expose the sapwood, then applied Tordon 22K. In Mwangazi alone, these teams treated 362 acres using a combination of sheer felling and ringbarking.[46]

Machines did not replace axes in difficult terrain; 206 acres of riverine bush could only be removed by felling with axes in a section where the Mkwasine passed a ravine, right near the Sangwe Reserve boundary. The road would meander through bush, trying to find maneuverable space between the big trees. Where there was a corner (and the line had to be straight), Farrell instructed people to stump the trees so that the tracks could be straighter. Stumping was also performed when there were tough roots and big trees and the grader found it hard to clear.[47]

There were finer details that hand clearance could perform that machines could not; thus, the axmen covered all stumps with piles of brushwood “in the hope that fire would kill them in due course.” The financial cost aside, locals (both *vachena* and *vatema*) raised concerns that riverbank clearing—especially the uprooting effects of *mabhurudhoza*—would result in massive soil erosion. Therefore, during the Chiredzi clearance, the decision was made that actual riverbanks would only be hand-cleared at a cost of £10 per acre. In other areas, with narrow bands of riverine thicket, axmen were deployed to cut and stump.

The *bhurudhoza* work was completed in 1961 and resulted in a marked improvement in the *n’gana* situation, but there was “a marked a deterioration with the whole picture” similar to “the worst times of 1957 and 1960.”[48]

Questioning Discriminative Clearance

Two constituencies questioned vegetation clearance as a technique for controlling *mhesvi*. The first was *vachena* concerned about environmental consequences without any tangible evidence of the effect. The writings of Edward Bursell, then lecturing at the Division of Biological Sciences at the University College of Rhodesia, exemplify this white critique. In a 1967 paper, for instance, Bursell described the method as “a dismal failure”; the Pilsons had shown the method to affect “only a certain fraction of the total (tsetse) population” (Bursell 1967, 33–34). In other words, discriminative clearing was based on a misreading of the mobilities of a peripatetic insect.

As he noted two years later, the "theory" of discriminative clearing was based on the concept of "stereotyped behavior"—namely, the observation that tsetse populations seemed unevenly distributed in the general environment, higher in some "concentration areas" than in others. Such concentration areas were conspicuous by their vegetational features, "sometimes as a contact between two vegetation types, sometimes by the presence of a double-storeyed canopy, and so on." *Mhesvi* was always present in high densities in such areas, presumably as a sign of "some innate behaviour pattern, an attraction for the tsetse of that particular concatenation of physical features."[49] Whatever the reason, concentration areas played a "special part in the economy of the tsetse population," and the weaponizable aspect was that if the trees could be cut down, the *mhesvi* population would be eliminated.

Instead, the theory of discriminate clearance defined the major functions of *mhesvi*'s everyday life—sex, feeding, and sheltering—according to vegetational differences. Therefore, it was useless to massacre every tree in sight. Just targeting the "true habitat" of *mhesvi* within a larger forest ecosystem could lead to a rapid decline in the *chipukanana*'s population density and drive it to eventual extinction. A large-scale operation of that nature had been undertaken in Abercorn in Northern Rhodesia and had exterminated *mhesvi* over three hundred square miles after felling trees covering just 2.2 percent of the entire area. Another scheme, somewhat smaller in scale, was undertaken in Hurungwe in 1957 with very promising results, even if the speed of elimination could not be predicted. In the small Hurungwe pilot scheme, the settlement of *vatema* followed right after discriminate clearing, and *mhesvi* disappeared within six months.[50]

In areas *shiri* (birds) occupied in droves, Bursell urged that tree destruction was an ineffective form of indirect assistance to this predator for a different reason: Bark offered *mhesvi* camouflage and physical protection. The bark's color was gray and somewhat charred, and it had cracks into which the *chipukanana* retreated. For *mhesvirupani* and *mhesvirutondo*, arboricide was ineffective short of wholesale clearance, because *muunze*, *musasa*, *munhondo*, and *mupfuti* all had suitable bark. Thus, Bursell considered the rationale of discriminative clearing "essentially apocryphal," having found in its support the theory of discriminative clearing. His ideas came from discussions between glossinologists at the Central Tsetse Research Laboratory "at about the time when the concept of discriminative clearing was born."[51] Tremendous goodwill had accompanied the Abercorn success, and it was subsequently extended to the whole south-central-east Africa region. Substantial reductions in *mhesvi* population density were recorded in some areas, whereas in others only negligible reductions were reported. Instead of admitting the limitations of discriminate clearing as an anti-*mhesvi* strategy and reexamining exactly why Abercorn had succeeded, glossinologists sought excuses. Bursell lamented the cost of such stubbornness:

> Had we done so we should not have lost sight of the fact, that there had been an outbreak of rinderpest in the area just prior to the clearing operations, and that the consequent reduction in the density of game animals might have had something to do with the spectacular results achieved. But we decided to soldier on, even though evidence for the plasticity of tsetse in relation to vegetation became more formidable with every new situation that was investigated, even though the empirical basis of the method was eroding and a theoretical basis was all but lacking. In some areas the tsetse population would appear to be associated with the evergreen vegetation of major drainage lines; in others such vegetation was deserted in favour of an ecotone between savannah woodland and the open grassland of *mbuga*s or vleis; in yet others the fly appeared to be associated with a sparse acacia woodland, with the trees widely scattered in rolling grasslands, and so on. There seemed to be progressively less in the way of a common denominator between the conditions favoured by the same species of tsetse in different regions of the country, certainly as far as vegetation was concerned. Or perhaps the common denominator was so common as to be useless for practical purposes, namely, shade.[52]

Bursell anticipated criticism that he was taking an extremist position from those of his peers who saw discriminative clearing as an imperfect yet still necessary method. Since 1959, he had dismissed the method as a "spectacular and very expensive failure"; each time, supporters of the scheme had given examples of success that had not been reported in scientific publications. In recent times, several researchers had shown that discriminative clearing may well have been a wild goose chase: "The apparent concentration of tsetse populations in specific parts of the general environment, on which the concept of discriminative clearing was based, may represent little more than an artifact of sampling. That it is not the whole population which is so concentrated, but only a small fraction of it, comprising males in a particular stage of the hunger cycle, when they happen to be particularly susceptible to sampling by traditional techniques. This discovery completely destroys the empirical basis of a control method which has no theoretical basis and which doesn't work."[53] Like the late burning and sheer clearing, therefore, the manner in which discriminative clearing was deployed appears to have been a misreading of *mhesvi*'s mobilities.

In directing its attack against the physical environment, the Tsetse Branch was attacking *mhesvi* at its strongest point, not its weakest. Instead of discriminative clearing, what was necessary, according to Bursell, was sheer clearing, the effectiveness of which was known and well documented. It deprived the *chipukanana* "completely of its requirement for shade and so cause[d] exposure of all stages of the life cycle to lethal levels of direct insolation." Bursell was not necessarily suggesting wholesale clearance of vegetation, but saying that "unless one does this, one may do nothing."[54] Any strategy had to be built on the vulnerable part of the life history of *mhesvi*, where the *chipukanana* was most closely dependent on its environment.

In other words, the attack on *mhesvi* was to be made not on *mhesvi* itself, but the environment; the attack therefore needed to focus not on the habitat of *mhesvi*, per se, but on that of its host. *Mhesvi*'s feeding habits, "its blood-sucking mode of life," involved "as many striking morphological and physiological specializations as any other function."[55] For example, these included the structure of its mouth parts and their efficiency in piercing the epidermis of vertebrates; the salivary glands and their secretion that contained an anticoagulant to prevent blood from clotting during its passage through the fine tracts of the alimentary system; the midgut, where proteases dominated the enzymes that digested blood proteins; the excretory system, which played a key role in the disposal of certain nitrogenous constituents of the blood meal; and the metabolic system, with its biochemically adaptive propensity toward a rich protein diet.[56]

The second critique of vegetation clearance came from *vatema* in *ndedzi*-infested areas. For them, trees were not merely "flora" and *sviharhi* no mere "fauna," but social institutions. Even today, stumps of the big, evergreen hardwoods of the *khaya* (*munanga*) cut down during the 1960s can still be seen along the Muchingwidzi and Runde rivers.[57] Figure 6.4 shows one of the trees cut down by the *ndedzi* people.[58] Some trees, like the *muchakata* and *marula*, were sacred; underneath them, *vanhu* held rainmaking and other ceremonies to commune with their ancestral spirits, and other riverine groves were burial grounds of their ancestors. Because the trees were protected, they grew densely, thus making them reliable refuge for *ndedzi*—especially *xindedzi xa nkova*.

Watson Machiukele was born in 1933 and was in his thirties when *vanhu vetsetse* (the tsetse people) arrived with their axes, chainsaws, *mabhurudhoza*, and chemical phytocides in the Chivonja area of Chipinda Pools on the Runde: "The people of Mafanele who were staying there had to be removed by *vanhu vetsetse*. They were cutting down the big trees, because they said

Figure 6.4
The stump and entire trunk of a very hard tree felled during the 1960s, still intact on the banks of the Muchingwidzi.
Source: Black Bvekenya Project 2011.

that is where tsetse lays its eggs. We were not happy about the tree cutting because the big trees that held the land together were being removed. The wind coming from the east was strong, and the trees were like mountains shielding us from it. Some of these trees were sacred; it was where we communed with our ancestral spirits. Tsetse destroyed the resources we used to communicate with our ancestors."[59]

With a sense of guilt, Machiukele continued: "I was one of the people involved in cutting the trees for *vanhu vetsetse*."[60] Machiukele's dilemma was that he could not stand up to *hurumende*. Without the money, he was certain to default on paying taxes, in a district administered by a man named Allan Wright, whose reputation for cruelty had earned from *vatema* the name *Chibwechitedza* (one whose heart is as hard as a rock and slippery as a pebble).

Conclusion: The Machine in the Garden, The Bulldozer in the Countryside

The concept of arboricide has been extended to account for the theory, practice, and instruments of destroying forests and rendering geophysical space into a means and way of controlling *mhesvi*. This is an instance in which means and ways are no longer just so-called expertise or physical, human-made artifacts, unless we are prepared to consider the land so cleared an artifact. There is no question now that *hurumende* relied on local *ruzivo* for its strategy to control *mhesvi* using arboricidal methods. Local people assisting Swynnerton, and Swynnerton himself, were the bridge that enabled the mobility of that *ruzivo* into *hurumende*'s official practices.

The chapter started to touch on the important theme of chemicals deployed against *mhesvi* that have since been classified as *almost certainly* carcinogenic. I emphasize *almost certainly* because of the way in which bench scientists are careful to avoid making definitive pronouncements based on built lab-generated or circumstantial evidence, absent actual field observations, fearing legal consequences. As will become even clearer in later discussions on OCPs, that reticence is due to fear of court battles, especially for scholars in the United States and Europe. The toxicity of 2,4-D and 2,4,5-T also raises two important questions in the context of *vatema*'s history. One relates to the health effects of these two substances when washed into water bodies; the other marks a shift in pest control from *vatema*'s organic means and ways and into synthetic industrial pesticides, with negative health and environmental consequences.

Industrial chemicals are one dimension of mass destruction; the other is "the bulldozer in the countryside" (Rome 2001) or "the machine in the garden" (Marx 1964). In the first instance, this narrative differs from Romer in its location—deep in the forest, not in urban sprawl. In the second, where Marx was concerned with technology's violent interruption of pastoral scenery as the United States industrialized, the focus of this chapter is located far from the whistling sound of steam locomotives that animated Henry David Thoreau's *Walden* (1854). Concern about the machine tearing through *sango* is inspired by Leo Marx, no doubt. However, whereas his machine was creating industrial space, my *bhurudhoza* is opening the land to motor vehicles carrying DDT and other OCPs; to fences demarcating *mhesvi*-infested from *mhesvi*-free land; and to destroy evergreen hardwoods that harbored *mhesvi* and which in some cases were sacred to *vatema*. Therein lies a shared interest in what Marx calls "the landscape of the psyche" (Marx 1964, 28) and the rationale for extending arboricide beyond instruments to theory and practice, to an ideology of *mhesvi* management by destruction rather than strategic deployment within a shared environment with other species.