



## The United Nations' Scientific Fraud against DDT

By Donald Roberts, Roger Bate, and Richard Tren

*For over seventy years, DDT has been a vital insecticide in the battle against disease. Yet it is vilified for largely illegitimate concerns about its impact on the environment and human health. Through a mix of environmental fervor, self-interest, and disregard for evidence-based policy, United Nations (UN) agencies are misleading the public about DDT—mistakenly claiming it is not needed and can be eliminated globally by 2020.<sup>1</sup> Such claims must be withdrawn, and the aggressive timeline for the elimination of DDT must be shelved. Furthermore, the World Health Assembly, the governing body of the World Health Organization, must prioritize the needs of malarial countries ahead of the political agenda of UN agencies and set a positive agenda for the use of DDT and the development of much-needed new public-health insecticides. Independent donors should continue to fund DDT use where needed for malaria control. The campaign against DDT means it is used far less than is efficient or desired by malaria-control programs.*

Malaria can be controlled in many ways, depending on the type of disease and the type of mosquito spreading the disease. The most common methods are the use of insecticide-treated bed nets (ITNs) and indoor residual insecticide spraying (known as IRS). It can also be controlled through the prophylactic use of antimalarial drugs by at-risk populations and tourists. All three methods (ITNs, IRS, and drugs) work with varying degrees of success and at varying costs.

For many environmentalists and environmental activist groups, the campaigns against DDT in the 1960s and 1970s and the ultimate banning of DDT for most uses in the United States by the Environmental Protection Agency in 1972 were defining moments. In some cases, entire organizations were founded on the DDT issue, and significant amounts of money were raised in the fight against

this chemical. Any revelation that DDT may not actually be as harmful as supposed would inflict great reputational harm, so it is little wonder that many groups and individuals continue to fight hard against DDT and those who defend it.

DDT is deployed only through IRS, and it has been remarkably effective in controlling malaria

### Key points in this *Outlook*:

- UN agencies are misleading the public by claiming that malaria can be controlled without insecticides, notably DDT. The stated aim is to stop DDT use globally by 2020.
- UN agencies are committing scientific fraud by deliberately and incorrectly interpreting data on malaria control using non-insecticide methods.
- While DDT is no panacea, it is still a critical weapon in the battle against malaria and other insect-borne diseases.

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for over seventy years. Unfortunately, it is often vilified as a cause of environmental harm, and this claim persists even though only small amounts are sprayed on inner house walls for malaria control. As described in detail elsewhere, most of the allegations made about its effects are false.<sup>2</sup> For instance, it is alleged that DDT brought the American bald eagle to the brink of extinction, yet the eagle was endangered many years before DDT was introduced, and populations recovered during years of heavy DDT use. The bald eagle's decline was caused by shooting and poisoning as well as land use changes, and its recovery was due to improved and enforced legal protections and specific activities to reintroduce it. Similar evidence exists for other bird species supposedly harmed by DDT, such as the peregrine falcon. Many believe that DDT is linked to a wide range of human ailments; however, after many decades of use and thousands of studies, there is still no evidence to satisfy the most basic epidemiologic criteria to prove that DDT is harmful to human health. Yet thanks to years of negative and biased publicity about DDT, these fears persist. Such allegations of harm have limited DDT's modern use.

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Malaria scientists and officials with responsibility for malaria-control programs still see great value in DDT. Richard Nchabi Kamwi, M.D., minister of health for Namibia, writes: "Unfortunately because of the stigma associated with insecticides and DDT in particular, we are often left to defend these insecticides alone. If we are to achieve our goals of malaria elimination though, we are going to need a more robust and global effort to defend the tools we need to get there."<sup>3</sup> Leslie Ramsammy, M.D., minister of health for Guyana, explains that "DDT is the most effective and affordable chemical we have to control malaria. . . . [T]he global response to the burgeoning malaria rates in the world should allow for DDT residual spraying."<sup>4</sup>

Given these statements and DDT's proven effectiveness in malaria control, one might imagine that the United Nations would be working to secure the rights of sovereign nations to use the most appropriate public-health tools

for their circumstances. Regrettably, that is not the case. DDT use is not governed by a rational debate about its merits amongst relatively balanced, if opposing, interests but by vested interests opposed to its use. Far from being an impartial arbiter and defender of sound scientific evaluation in the debate over DDT, the UN is merely a conduit for anti-DDT interests.

## The UN versus Insecticides

The UN Stockholm Convention on Persistent Organic Pollutants (POPs), which came into force in 2004, governs the use of DDT. DDT is the only chemical under the POPs convention that is granted an exemption for use in public health. It is against this background that the Stockholm Convention Secretariat (the Secretariat) and the financial mechanism of the convention, the Global Environment Facility (GEF), the UN Environment Program (UNEP), and groups within the Pan American Health Organization (PAHO) and World Health Organization (WHO) have engaged in scientific malfeasance to achieve political goals, the most obvious being DDT elimination by 2020.<sup>5</sup>

The GEF was established in 1991 and is a partnership of ten agencies, including the World Bank, which houses the GEF. The GEF has allocated over \$9 billion in funds for projects with the aim of improving the environment and has raised over \$40 billion from other partners for its projects. At stake is not only increased power over the use of chemicals for the control of diseases but also the reputational benefits of achieving a goal deemed desirable by environmental groups. In addition, one cannot discount the fact that many millions of dollars have been spent by numerous governments through the UN system to rid the world of POPs and find alternatives to DDT. Control over the use of insecticides for public health also gives agencies control over these funds.

This *Outlook* spotlights a peer-reviewed paper in *Research and Reports in Tropical Medicine*, which exposes false claims about an insecticide-free malaria-control project managed by UNEP and financed by GEF in Mexico and Central America (Mexico/CA).<sup>6</sup> The project was designed to demonstrate successful control of malaria through the use of "environmentally sound" methods without DDT and other insecticides. Almost inevitably, the project's backers claimed it achieved this objective. A proper analysis of epidemiologic data, however, revealed no such success; reductions in malaria cases and deaths in the region were achieved primarily

through pharmacosuppression (therapeutic and prophylactic use of antimalarial drugs). Claims that environmental interventions were effective are invalid.

## Mexico/CA Project

The Regional Program of Action and Demonstration of Sustainable Alternatives to DDT for Malaria Vector Control in Mexico and Central America (Mexico/CA Project) was conducted in eight countries: Belize, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama, and El Salvador. It was executed by PAHO's Sustainable Development and Environmental Health Program and implemented by UNEP. It was cofinanced by the GEF with additional support from the Commission for Environmental Cooperation of North America (CEC), PAHO, and participating country governments. The project's aim was to improve coordination and national capacity so new, integrated disease vector (mosquito) control techniques could be implemented, thereby eliminating the need for DDT reintroduction.<sup>7</sup> The objectives of the project (as stated by UNEP) were to "[d]emonstrate feasibility of integrated and environmentally friendly methods for malaria vector control without the use of DDT" and "assess the effects of these methods on malaria occurrence."<sup>8</sup>

**Malaria-Control Methods.** According to UNEP, the key interventions in the project were as follows: 1) reduction of contact between mosquitoes and people via treated bed nets, meshes on doors and windows, the planting of repellent trees like neem and oak, and the liming of households; 2) control of breeding sites by clearing vegetation; draining stagnant water, ditches, and channels; and using biological controls such as fish and bacteria in some countries; and 3) elimination of places near houses that attract and shelter mosquitoes through, for example, the cleaning and tidying up of areas in and around homes, alongside the promotion of personal hygiene.<sup>9</sup>

The project's final evaluation, published in November 2009, mentions various pharmaceutical methods of prophylaxis and treatment within human populations.<sup>10</sup> However, those methods were ongoing components of malaria control in each country prior to the Mexico/CA Project, operating nationally in each country before and during the project. The available evidence suggests that national malaria-control programs (NMCPs) functioned regardless of the presence or absence of project personnel. Thus, antimalarial treatment (the major component of

the NMCPs) in demonstration areas was not part of the epidemiological evaluation of the Mexico/CA Project.<sup>11</sup> Likewise, use of ITNs had no obvious definable role in the Mexico/CA Project. Project successes are therefore advertised as having been achieved without mention of the accompanying use of insecticides.

**Experimental Design.** The project included demonstration areas, where the GEF environmental interventions would be implemented, as well as control areas within epidemiologically similar areas, where the interventions would be excluded, for proper comparisons.<sup>12</sup> As stated by Cesar Chelala, a medical consultant affiliated with the Mexico/CA Project, demonstration areas were selected "based on the high incidence of transmission and the persistence of malaria in those places."<sup>13</sup>

An epidemiological evaluation identified 202 demonstration areas and 51 control areas.<sup>14</sup> The former included a total population of 159,018 and the latter 50,834.

## Highly Publicized Claims of Project Achievements.

The public statements regarding the Mexico/CA Project proclaimed dramatic and very impressive reductions in malaria cases for its environmentally benign interventions. The final report of the Mexico/CA Project, published by the environmental sector of PAHO in December 2008, claims "a 63% reduction in the number of people with the disease without using DDT or any other type of pesticide."<sup>15</sup>

These statistics and claims of success were repeated in an official press release issued by UNEP, WHO, and GEF in May 2009.<sup>16</sup> UNEP executive director Achim Steiner also repeated these claims and characterized the project as "calculated and tested science."<sup>17</sup> Similar claims have been made in the popular media<sup>18</sup> and used by anti-insecticide activist groups as evidence that malaria control is possible without insecticides.<sup>19</sup> Regrettably, the claims of malaria control through application of GEF interventions are incorrect and fundamentally misleading.

## Scientific Evaluation, Reasons for Success in Malaria Control, and Public Misstatements

Countries in Latin America were forced away from using DDT in compliance with the North American Free Trade Agreement, wherein the CEC pressured Mexico in the mid-1990s to stop production and use of DDT.<sup>20</sup> Without DDT, countries used more expensive insecticides, which had to be sprayed more frequently, creating problems for

malaria control.<sup>21</sup> Over time, the countries in Central America moved to greater use of pharmacosuppression. Malaria cases have fallen as a result of this widespread and expensive distribution of malaria treatments, but not through the environmental controls touted by the UN. Officials of GEF, UNEP, and the Secretariat, however, ignore the use of pharmacosuppression in their discussion of successful malaria control in Mexico/CA. Furthermore, these officials falsely attribute changes in malaria burdens to GEF's environmental interventions. A separate epidemiological evaluation, which was designed to measure any changes in disease rates, found no statistical differences in malaria rates in demonstration areas versus in control areas, and this was consistent across all eight countries.<sup>22</sup> Malaria rates in most countries were falling, but with no difference between the demonstration areas and controls, the decline cannot be attributed to the environmental interventions. But UNEP, GEF, the Secretariat, and other officials ignored those findings. Furthermore, despite the fact that the control areas were a crucially important part of the project, they were not even mentioned in the 2008 final report.<sup>23</sup> Ultimately, the success of reduction in malaria was most likely entirely due to pharmacosuppression.

One might wonder why a control program would require insecticides and vector control if pharmacosuppression is such a powerful method of malaria control. This is a complex issue, but it is important to note that even though reductions in malaria cases have been achieved in Mexico/CA, its model of widespread distribution of the antimalarial drugs chloroquine and primaquine is not transferable elsewhere. First, widespread drug resistance to chloroquine in Africa and Southeast Asia would make the intervention largely useless there. Second, primaquine is a radical treatment for vivax malaria, whereas in Africa over 90 percent of malaria cases are caused by the more deadly strain of falciparum malaria.<sup>24</sup> Third, pharmacosuppression is expensive and requires more sophisticated health systems than exist in most of Africa, where the greatest incidence of malaria lies. So even if UNEP, GEF, and their partners were straightforward about the real reason for the declines in malaria in the project areas, there would be no reasonable argument that it has any application in other areas, or any usefulness for global malaria-control policy. But as we explain below, we believe the motivations of UNEP and GEF are not to improve global malaria policies, but to gain control and power over the use of insecticides. There could be multiple motivations for seeking greater control

over insecticides, and one can and should be ever mindful of the fact that governmental and intergovernmental agencies continually seek to remain relevant and to expand their programs, power, and budgets.

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The Global Environment Facility is making no practical contributions to solving pressing problems of insecticide resistance, finding improved insecticides, or improving how DDT and other insecticides can be used to control malaria.

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### **Motivations for False Claims of Success**

UNEP, GEF, the Secretariat, and environmental health units of the WHO and PAHO have been the driving force behind the Mexico/CA Project and subsequent similar projects. Public statements reveal their quest for greater control over DDT use and malaria-control policies. There is a long history of activism against the use of insecticides in public health. In 1997, the World Health Assembly (WHA), the governing body of the WHO, approved Resolution 50.13, which calls on countries to reduce their reliance on insecticides in disease control. This resolution passed due to lobbying efforts by activist groups and powerful governments of malaria-free countries. The resolution was adopted in the absence of any credible evidence that insect-borne diseases can be controlled without public-health insecticides.<sup>25</sup>

The Stockholm Convention Conference of Parties (COP) authorized the Secretariat to assess the ongoing need for DDT in disease control, an activity that one would expect to be led by the WHO, the world's lead technical agency for public health. Yet it is led by the Secretariat, with the WHO involved only as a collaborator.<sup>26</sup> As the Secretariat explained, "The priority of WHO is malaria control. This priority at times superseded the goal of the elimination of DDT and altered the focus of the strategy. It is essential that the Secretariat takes ownership of this strategy while gaining endorsement from WHO and UNEP Chemicals to ensure that the focus on elimination of DDT is maintained."<sup>27</sup>

Although strategies appear focused on DDT, their stated goals go far beyond this issue. The May 2009

UNEP, WHO, and GEF joint press release announced a “rejuvenated international effort to combat malaria with an incremental reduction of reliance on the synthetic pesticide DDT.”<sup>28</sup> This effort is embodied in the global program Demonstrating and Scaling-Up of Sustainable Alternatives to DDT in Vector Management (Global DSSA Program), which consists of ten GEF projects in forty countries to test nonchemical methods to control malaria, at an estimated cost of \$78.3 million.<sup>29</sup> The program is supposed to be building on the results achieved from the Mexico/CA Project. The UNEP/GEF long-term goal for the Global DSSA Program (as described by UNEP’s Jan Betlem) is to reformulate “the WHO Global Malaria Program in order to promote global vector-borne disease control interventions while at the same time eliminating the application of DDT and reducing the use of other chemicals.”<sup>30</sup> Additionally, Betlem cites WHA Resolution 50.13 as a factor in the UNEP/GEF plan for reformulating WHO’s Global Malaria Program. So anti-insecticide advocates come full circle. They lobbied for the WHA resolution and then used it to justify their plans for deciding how to control malaria.

## Reporting and Transparency

Over the span of several months, we attempted to obtain additional information on the Mexico/CA Project from officials at GEF, UNEP, and PAHO, but repeated requests were either not followed through or were ignored. We made a final attempt upon reviewing the 2008 final report of the project and examining the epidemiologic analysis, as described above, to inquire about the conflicting information and data in these reports and the public statements made by their respective organizations. To date, no response has been received.<sup>31</sup>

The 2008 final report of the Mexico/CA Project claims that several manuscripts were submitted for peer-reviewed publication. Specifically, the report claims that manuscripts were submitted to, among others, *The Lancet*, *PAHO Bulletin*, and *Malaria Journal*. As of January 2011, two years after the final report was published, there is no evidence of peer-reviewed studies. We must conclude either that no studies were submitted for peer review or that studies were submitted and rejected. The final report does include two pieces written for the non-peer-reviewed literature, by Cesar Chelala, among its list of publications. However, these pieces can in no way be considered objective evaluations as they merely promote the invalid claims described above.

The lack of project transparency and the apparent failure to publish any report in the peer-reviewed literature is obviously a lesser transgression compared to the claims of success that are not supported by any scientific evidence. But with greater transparency, such malfeasance would have been more difficult. Nevertheless, the failure of these agencies to communicate adequately and provide stakeholders with information is unacceptable, especially since the project was conducted with public funds.

## When Malign Interests Align, the Poor Suffer

A careful observer must wonder how such claims of success could have been made without notice. The reasons are many and varied, and some are obvious from the above travesty in Central America. An environmental treaty has trumped health policy, even at agencies charged with improving public health. According to a 2009 GEF report, since May 2001 “GEF has committed US\$360 million to projects in the POPs focal area and leveraged some US\$440 million in co-financing, bringing the total value of the GEF POPs portfolio to US\$800 million.”<sup>32</sup> The GEF has invested only \$22 million into six projects allegedly researching alternatives to DDT for vector control.<sup>33</sup> This multibillion-dollar agency has, with a relatively small investment, leveraged great power over one of the most important tools for malaria control.

As with the Mexico/CA Project, other GEF projects largely focus on what the GEF defines as “environmentally sound” approaches to control malaria. The Stockholm Convention requires the COP to develop both chemical and nonchemical alternatives to DDT. Yet while promoting its anti-insecticide propaganda (as it did in the Mexico/CA Project), we find no evidence that the GEF invests any meaningful funds to find a chemical to replace DDT. Overall, the GEF is making no practical contributions to solving pressing problems of insecticide resistance, finding improved insecticides, or improving how DDT and other insecticides can be used to control malaria. In reality, the GEF collects great sums in malaria-control funds for its exclusive use in campaigns against DDT and other insecticides needed in malaria-control programs.

Unlike WHO’s Public Health and Environment Department, WHO’s Global Malaria Program does not have the funding or personnel to attend Stockholm Convention meetings discussing chemicals desperately

required in malaria control.<sup>34</sup> Similarly, the opinions and entreaties of health ministers from malarial countries, such as Kamwi and Ramsammy mentioned above, are drowned out in the international discussions dominated by anti-insecticide UN agencies and activists. Health officials in these countries also have to deal with numerous other public-health problems and are often too busy to attend the meetings where global policy is decided.

Additionally, corporate self-interest is all on the anti-DDT side. DDT production in China ceased within the last two years, so DDT is currently manufactured by only one company in India, the state-owned Hindustan Insecticides Limited (HIL). HIL has no seat at the malaria policy table and, as a state-owned company, lacks the incentives and corporate self-interest to defend its product. Furthermore, it is not clear that the Indian government is actively supporting HIL's interests, perhaps because of the numerous, diverse, and competing issues and projects that it is actively engaged in. The market size for expanded DDT use is not large enough for Indian officials to bother with the political costs of combating the diverse opposition to the chemical. The reduction in producers and limitations in supply has reportedly pushed up the price of DDT recently, as basic economic theory of supply and demand would predict.

At different times over the past decade, the leading manufacturers of public-health insecticides have opposed the use of DDT. In a leaked e-mail, a senior executive of Bayer explained that his company opposed the use of DDT because it was a commercial threat.<sup>35</sup> Likewise, Vestergaard-Frandsen, a leading manufacturer of long-lasting insecticidal nets, once posted to its website comments reflecting its corporate opposition to the use of IRS and DDT in IRS programs, and argued forcefully against DDT during a debate held in the United Kingdom's House of Commons.<sup>36</sup> More recently, at a November 2010 meeting in Geneva hosted by the anti-insecticide groups Biovision and Millennium Institute, an executive of Syngenta, representing the insecticide industry group CropLife, stated publicly that industry supports a "quick replacement" for DDT.<sup>37</sup> The industry position is based on the fact that there are alternatives to DDT. Interestingly, the industry position also holds that malaria control should be based on integrated vector management principles, including "systemic resistance control and management." Industry seemingly discounts the fact that to control for resistance it is essential to have a wide range of different chemicals with differing modes of action; removing DDT will make resistance management more trying, not easier.

Furthermore, in citing the prospect of mosquito resistance to DDT, the industry ignores the fact that DDT acts primarily as a spatial repellent and is still effective even in the face of toxic resistance. In essence, instead of defending sound science and a proper evaluation of risks and benefits, the insecticide industry has acted with myopic self-interest to promote its products against DDT.<sup>38</sup>

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Grand talk of malaria elimination is increasingly carried out, while activists and UN agencies work to limit the array of weapons that can be deployed against the disease.

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Additionally, anyone defending DDT is often attacked in the media.<sup>39</sup> For instance, anti-DDT campaigners routinely characterize any defender of DDT as being in the pocket of big business, particularly the insecticide industry. This, for the reasons given above, is ludicrous, but it is a useful, if lazy, way of dismissing the arguments. These attacks are purposeful attempts to weaken the few DDT defenders. Furthermore, such acts make those funding global malaria-control programs "play safe," promoting only the use of largely noncontroversial mosquito bed nets. This harms malaria control, since it essentially establishes one-size-fits-all disease-control programs. Regrettably, grand talk of malaria elimination is increasingly carried out, while activists and UN agencies work to limit the array of weapons that can be deployed against the disease.

DDT will not eradicate malaria, even though it did help eliminate it from two dozen countries in the last century. It is simply part of the antimalaria arsenal. DDT is not the best intervention in all circumstances, and as nations become wealthier its use will naturally diminish as they will be able to afford some of the alternative insecticides. Additionally, as the quality of housing improves, DDT may not be the most appropriate chemical as it is best used on wattle and daub structures as opposed to Western-style houses. But arbitrarily setting a date by which its use should cease could lead to the deaths of thousands of children every month.

The debate is loaded against DDT—all the vested interests inside the malaria tent benefit from limiting DDT use—but its use has continued because it is still

the best intervention in key locations. However, when the UN promotes its withdrawal, based on unscientific and unsubstantiated data, the case for its continued use becomes harder to sustain and its eradication, rather than that of malaria, becomes more likely. The Stockholm Convention Secretariat is unabashedly vocal about exercising authority over malaria-control policy and relegating WHO to the role of collaborator on key issues of malaria-control policy. The remedy to these worsening conditions is for the senior WHO leadership to stop kowtowing to UNEP and assert its authority over decisions about public-health insecticides and malaria-control policy; if it does not, much more than DDT will be imperiled.

## A Way Forward

Comparisons derived from faulty studies that suggest GEF interventions produced major malaria reductions are not legitimate. Based on the weight of evidence, all claims made regarding the results of the Mexico/CA Project should be withdrawn, and the use of such claims in attempts to halt the use of DDT and other public-health insecticides in other malarial regions should be stopped immediately. Even though GEF funds are managed under the auspices of malaria control, in truth, false claims show how GEF funds and programs are driven by an anti-insecticides ideology. GEF's malaria-control funding should be removed and transferred to the WHO Global Malaria Program.

The Secretariat's timeline for DDT elimination by 2020 should be canceled; it is scientifically illogical and dangerous to those at risk of malaria. Furthermore, as the above project description shows, the agencies involved cannot be trusted to present the truth about alternatives to DDT.

WHA Resolution 50.13 should be rescinded and replaced with a resolution that reaffirms the rights of countries to use DDT until a true replacement is found and made available. Such a resolution should also set out a positive and proactive agenda for the development of much-needed new public-health insecticides.

In determining public-health policies, UN agencies should be impartial and should strictly adhere to sound scientific procedures, and they should be rigorous in ensuring that evidence-based policies are promoted that can best advance the interests of the poor and vulnerable. Regrettably, the UN agencies described in this *Outlook* have failed in this regard and have promoted a political agenda ahead of a public-health agenda. Allowing science

to be subordinated to a political process is perhaps not new. However, when the stakes are high and can often mean the difference between life and death, as they are with malaria control, it is incumbent on policymakers to speak out forcefully against this political interference and defend sound science and the rights of malarial countries. Manipulation of data, as described in this *Outlook*, is never acceptable and would never be accepted on other issues where the victims had a more powerful voice. Perhaps because the topic is insecticides and DDT in particular, which is already stigmatized and has few allies, these agencies have succeeded thus far in promoting alternative approaches for which there is no evidence.

As the WHO is ultimately responsible for setting malaria-control policies, the senior leadership of this organization should firmly and unequivocally advance the interests of sound science and evidence-based decision making and take a principled stand against the GEF/UNEP agenda.

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*The views of the lead author do not purport to reflect the positions of the US Department of Defense or the Uniformed Services University of the Health Sciences.*

## Notes

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2. For a detailed history, see Donald Roberts, Richard Tren, Roger Bate, and Jennifer Zambone, *The Excellent Powder: DDT's Political and Scientific History* (Indianapolis, IN: Dog Ear Publishing, 2010); and Roger Bate, "The Rise, Fall, Rise, and Imminent Fall of DDT," *AEI Health Policy Outlook* (November 2007), [www.aei.org/outlook/27063](http://www.aei.org/outlook/27063).

3. Richard Nchabi Kamwi, "Free the Fight against Malaria," *Wall Street Journal Europe*, November 8, 2010.

4. "DDT Effective in Fight against Malaria," *Kaieteur News*, October 17, 2010, [www.kaieteurnews.com/2010/10/17/ddt-effective-in-fight-against-malaria](http://www.kaieteurnews.com/2010/10/17/ddt-effective-in-fight-against-malaria) (accessed November 15, 2010).

5. The Stockholm Convention is a UN convention that arose from UNEP efforts to control and/or ban the production and use of certain persistent organic pollutants. The PAHO is an international public-health agency and is the Regional Office for the Americas of the WHO and part of the UN.

6. Donald R. Roberts and Richard Tren, "International

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9. UN Environment Program, “Speech by Achim Steiner, UN Environment Programme (UNEP) Executive Director at the Helsinki Chemicals Forum 2009,” [www.unep.org/Documents.Multilingual/Default.asp?DocumentID=588&ArticleID=6191&l=en](http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=588&ArticleID=6191&l=en) (accessed September 27, 2010).

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11. Arbelaez Montoya, M.P., “Análisis Epidemiológico de la Malaria en las Comunidades de los Proyectos Demostrativos en Meso América” [Epidemiological Analysis of Malaria in the Communities of the Demonstration Projects in Central America] (presentation, V Reunión del Comité Directivo [Fifth Meeting of the Steering Committee], Mexico City, Mexico, July 1–2, 2008), [www.mex.ops-oms.org/contenido/malaria/reunion.htm](http://www.mex.ops-oms.org/contenido/malaria/reunion.htm) (accessed September 27, 2010).

12. Ibid.

13. Cesar Chelala, “Taking a Bite out of Malaria,” *Americas* (October 2008): 38–45.

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