Vanderbilt Journal of Transnational Law

Volume 41
Issue 2 *March 2008*

Article 7

2008

The Regulation of DDT: A Choice between Evils

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ABSTRACT

DDT has the potential for great benefit and great harm. It is currently the most efficient method for controlling malaria, particularly for those countries the disease affects most. However, it also causes global pollution and damages the health of humans and wildlife. These characteristics of DDT make regulating DDT difficult because they create a need for the continued use of DDT to prevent the debilitating effects of malaria, but also a need to ban the use of DDT in order to prevent its negative environmental and health effects. These conflicting needs correlate to diverging interests of developing and developed countries. The Stockholm Convention is an international attempt to regulate DDT use while recognizing this tension. It permits DDT use for public health purposes, though ultimately pursues an objective of total elimination of the chemical. After examining malaria, DDT, and the Convention in some detail, this Note suggests several reforms to the Stockholm Convention in order to more effectively reconcile the need for DDT with the need to eliminate DDT from manufacture or use.

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I. INTRODUCTION

Every thirty seconds, a child dies from malaria.[1] And while children are most susceptible to the disease—experiencing the highest rates of mortality from infection—they are not its only victims. Today malaria kills approximately one million people per year and infects hundreds of millions more, often to the point of incapacitation.[2] Although malaria infects populations around the world,[3] its "tragedy is most pronounced among the poor" in developing countries.[4] Developing countries lack the financial and technological resources to combat the disease, and thus are not able to thwart its spread; poverty, indeed, breeds disease—malaria included.[5] However, disease also breeds poverty; malaria's effects extend beyond those on human health, inhibiting economic production.[6] As the disease sweeps across a population, it incapacitates or kills individuals, making them unable to contribute to the workforce. The aggregate effect of this decline in workers is an economy incapable of any significant advancement. However, the deleterious effects of malaria are almost entirely preventable.[7] The solution: a chemical called Dichloro-diphenyl-trichloroethane (DDT).

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1. David L. Mulliken et al., *DDT: A Persistent Lifesaver*, NAT. RESOURCES & ENV'T, Spring 2005, at 3, 6.

2. Andrew P. Morriss & Roger E. Meiners, *Property Rights, Pesticides, & Public Health: Explaining the Paradox of Modern Pesticide Policy*, 14 FORDHAM ENVTL. L. REV. 1, 2 (2002).

3. D.R. Roberts et al., *DDT House Spraying and Re-emerging Malaria*, 356 LANCET 330, 330 (2000), *available at* http://www.malaria.org/ddtlancet.html.

4. Morriss & Meiners, *supra* note 2, at 2.

5. William Onzivu, *Globalism, Regionalism, or Both: Health Policy and Regional Economic Integration in Developing Countries, an Evolution of a Legal Regime?*, 15 MINN. J. INT'L L. 111, 117 (2006) [hereinafter Onzivu, *Globalism, Regoinalism, or Both*].

6. *Id.*

7. Morriss & Meiners, *supra* note 2, at 2.

DDT has proven to be a very effective means to prevent the spread of malaria. It has a successful, albeit short, history of use to combat the disease. It facilitated the U.S. military's invasions during World War II by protecting them from various diseases,[8] and it all but eliminated malaria from the United States and most of Europe.[9] Even small quantities of DDT have successfully reduced the number of malaria victims in many countries.[10] Unfortunately, the use of DDT has been banned in most countries,[11] and it suffers from a stigma that discourages its use, even for the most pressing of epidemics. That stigma is not undeserved; it stems from the harmful effects of the chemical on the environment, wildlife, and human health.[12]

The problem of DDT and its relationship to malaria presents a choice between two evils. When used, DDT causes irreparable harm to the environment and human health. When not used, malaria sweeps across countries, killing hundreds of millions of people. The choice, therefore, involves two inevitable harms—from malaria or from the derivative effects of DDT. Neither option is ideal, and both necessitate prioritizing inherently invaluable alternatives. The issue becomes how to reconcile the need for DDT, primarily a need of developing countries (those that malaria most affects), with the need to eliminate DDT, primarily a need of developed countries (those more concerned with the harm to the environment). The issues raised by this reconciliation and the continued use of DDT are international in scope. Because of its ability to travel long distances, the effects of DDT span the globe and reach populations and environments even where the chemical is neither used nor produced.[13] Thus, its treatment is a matter of international concern.

The existence of these international concerns prompted an attempt to address the problem of DDT using international law; in 2004, countries came together and ratified an international treaty called the Stockholm Convention.[14] The Convention calls for the

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8. Mulliken et al., *supra* note 1, at 3.

9. *Id.* at 4.

10. *See id.* at 6 (describing Indoor Residual Spraying (IRS) programs, in which small amounts of pesticides are applied to houses, repelling or killing mosquitoes when they land on the treated structures).

11. Morriss & Meiners, *supra* note 2, at 3.

12. Peter Lallas, *The Stockholm Convention on Persistent Organic Pollutants*, 95 AM. J. INT'L L. 692, 694 (2001).

13. *See, e.g., id.* at 694 (describing the contamination that occurs from POPs in regions even where communities "had nothing to do with the creation of these substances, and even though they are located hundreds or thousands of miles from the point of production, use, or release of the contaminants").

14. Stockholm Convention on Persistent Organic Pollutants, May 22, 2001, 40 I.L.M. 1531, *available at* http://www.pops.int/documents/convtext/convtext_en.pdf [hereinafter Stockholm Convention]; *see also* Julie B. Truelsen, *Developments in Toxics in 2004: The Ratification of the Stockholm Convention and the Rotterdam Convention,*

elimination of a classification of chemicals known as persistent organic pollutants (POPs), a category which includes DDT.[15] The treaty, however, created an exception for DDT, in an attempt to resolve the tension between the need for DDT and the need to eliminate it.[16] Rather than completely banning DDT, as the treaty does for other POPs, it allows for the continued use of DDT for limited public health purposes.[17]

Although the Stockholm Convention acknowledges the need to treat DDT differently, it does not adequately resolve the problem of DDT use due to the disparate and concomitant interests of countries involved in the dilemma. Part II of this Note discusses the history and characteristics of malaria and DDT in order to present the difficulty of choosing between banning DDT and allowing its use. It also explains the Stockholm Convention's attempt to resolve the problem. Part III analyzes the choice more critically and then evaluates the Stockholm Convention. Part IV proposes a solution for how to regulate the use of DDT while reconciling the need for, and desire to eliminate, both the chemical and malaria.

II. BACKGROUND

A. *Malaria: A Global Killer*

Malaria is a global disease; in 1995, it affected more than forty percent of the world's population.[18] Moreover, the disease is an ongoing threat; the number of malaria cases is increasing around the world (and the rate of increase is accelerating),[19] it is reappearing in areas where it had previously been eradicated, and it is emerging more often in industrialized countries.[20] Malaria is as fatal as it is pervasive, second only to the HIV/AIDS pandemic among infectious diseases in deadliness.[21] Indeed, the disease kills approximately one to two million people per year, and infects another 650-750 million.[22]

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15 COLO. J. INT'L ENVTL. L. & POL'Y 217, 217 (2004) (discussing the Stockholm Convention).

15. Stockholm Convention, *supra* note 14, art. 3(1)(b).

16. *Id.* Annex B.

17. *Id.*

18. Don Mayer, *The Precautionary Principle and International Efforts to Ban DDT*, 9 S.C. ENVTL. L.J. 135, 143 (2002); Mulliken et al., *supra* note 1, at 6.

19. Roberts et al., *supra* note 3.

20. *Id.*

21. Vasant Narasimhan & Amir Attaran, *Roll Back Malaria? The Scarcity of International Aid for Malaria Control*, 2 MALARIA J. 8 (2003), *available at* http://www.malariajournal.com/content/pdf/1475-2875-2-8.pdf.

22. Mulliken et al., *supra* note 1, at 6; World Health Organization, Parasitic Diseases, http://www.who.int/vaccine_research/diseases/soa_parasitic/en/print.html.

Its ravaging effects are due in part to the fact that it is extremely communicable. The basic reproduction number for malaria—the number of people one ill person can infect with the contagious disease—is 100, meaning that one malarious person can be responsible for making 100 others sick.[23] The death toll from malaria is most readily appreciated by way of illustration: every day, malaria kills the same number of persons as would die from loading up seven Boeing 747 airliners and deliberately crashing them.[24]

Although malaria affects individuals across the globe, people in poor, developing countries in warm climates are particularly susceptible.[25] Mosquitoes, the carriers of the disease, breed easily in warm climates, and developing countries often lack the financial and technological resources to combat the problem.[26] Indeed, almost 60% of malaria cases occur in the poorest 20% of the world's population,[27] and "about ninety percent" of the deaths malaria causes occur in sub-Saharan Africa, one of the poorest and warmest regions of the world.[28] Malaria indisputably affects poorer nations, as countries with a high rate of malaria have economic growth rates 1.3% lower than nonmalarious nations,[29] and the GNP of malarious countries is reduced by more than half as compared to nonmalarious countries.[30] The disease presents a cause-and-effect quandary with respect to its economic implications. In part, the malaria epidemic is the effect of the nations' poor economic situations; they have fewer financial resources to devote to the prevention and treatment of malaria, and so the disease continues to spread. Malarious countries often spend as much as 40% of public health expenditures on the disease.[31] However, malaria also contributes as a partial cause of the economic problems.[32] Those individuals who are infected are often incapacitated (if not killed), and thus cannot contribute to the

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23. Malcolm Gladwell, *The Mosquito Killer*, NEW YORKER, July 2, 2001, at 42, *available at* http://www.gladwell.com/pdf/malaria.pdf.

24. Mulliken et al., *supra* note 1, at 6.

25. Morriss & Meiners, *supra* note 2, at 2.

26. *Id.*

27. Press Release, World Health Org., WHO Gives Indoor Use of DDT Clean Bill of Health for Controlling Malaria (Sept. 15, 2006), *available at* http://www.who.int/mediacentre/news/releases/2006/pr50/en/index.html [hereinafter WHO Press Release].

28. *Id.*; Onzivu, *Globalism, Regionalism, or Both*, *supra* note 5, at 122.

29. Mulliken et al., *supra* note 1, at 6.

30. *Id.*

31. Narasimhan & Attaran, *supra* note 21.

32. WORLD HEALTH ORGANIZATION [WHO], *Rolling Back Malaria*, *in* THE WORLD HEALTH REPORT 1999: MAKING A DIFFERENCE 49, 51 (1999), *available at* http://www.who.int/whr/1999/en/whr99_ch4_en.pdf [hereinafter WHO, *Rolling Back Malaria*].

economy of the household or of the nation.[33] Africa, for example, "loses about $12 billion a year due to the drop in economic productivity due to malaria."[34] What limited finances these developing countries do have are spent fighting the disease rather than for other purposes, further stagnating the economies. Moreover, the disease poses a risk to the public, depresses tourism, and prevents sustainable use of the land, all of which have further prohibitive effects on the development of the economies.[35]

Malaria is caused by the Plasmodium protozoan parasite, which is transmitted by the bite of an Anopheles mosquito.[36] The nature of the disease generates two possible methods for preventing it: attacking the parasite itself or attacking the carrier mosquito.[37] Attacking the parasite is accomplished through the use of prophylactic drugs.[38] The drugs slow the parasite's replication, which allows the body's natural immune system to better respond to the intrusion and prevent the parasite from taking over. A more common way to prevent the spread of malaria is through an attack on the carrier-mosquito (vector-control).[39] Because vector-control does not depend on individualized treatment, it is a cheaper, longer-lasting, and more efficient way to combat malaria. Drugs, nets, and pesticides can be used to target the mosquito.[40]

Pesticides are perhaps the most effective, but also the most controversial, method for malaria control.[41] The particular variety of mosquito that carries malaria and infects humans generally bites between sunset and sunrise,[42] often resting on structures (such as doorframes of houses) during the day before attacking its victim during the night.[43] Thus, pesticides are sprayed on structures where mosquitoes wait during the day, reducing the number of mosquitoes

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33. Tina Rosenberg, *What the World Needs Now is DDT*, N.Y. TIMES, Apr. 11, 2004, *available at* http://query.nytimes.com/gst/fullpage.html?res=9F0DEEDA1738F932A25757C0A9629C.

34. Mulliken et al., *supra* note 1, at 6.

35. William Onzivu, *International Environmental Law, the Public's Health, and Domestic Environmental Governance in Developing Countries*, 21 AM. U. INT'L L. REV. 597, 606 (2006) [hereinafter Onzivu, *International Environmental Law*].

36. Mulliken et al., *supra* note 1, at 6; World Health Organization, Parasitic Diseases, *supra* note 22.

37. Mulliken et al., *supra* note 1, at 6.

38. *Id.*

39. *Id.*; WHO, TECHNICAL SER. NO. 936, MALARIA VECTOR CONTROL AND PERSONAL PROTECTION: REPORT OF WHO STUDY GROUP 2 (2006), *available at* www.who.int/malaria/docs/WHO-TRS-936s.pdf [hereinafter WHO MALARIA VECTOR CONTROL REPORT].

40. Morriss & Meiners, *supra* note 2, at 31–32.

41. Four pesticides are commonly used to prevent malaria. Mulliken et al., *supra* note 1, at 6. Because the *Anopheles* mosquito adapts quickly, the four pesticides must be rotated in use to prevent the mosquito from developing resistance to them. *Id.*

42. *Id.*

43. *Id.*

entering the house to bite their victims, thereby reducing transmission of the disease.[44] This type of spraying is known as Indoor Residual Spraying (IRS),[45] which is currently the most commonly used method to combat malaria.[46] The effectiveness of IRS as a prevention mechanism is of greatest import for the international community because of the pervasiveness and destructiveness of malaria.

B. *DDT: A Global Pollutant*

Because malaria is such an infectious disease, the most effective method for combating it will be one that works quickly, targets large areas, and endures for long periods of time. Moreover, because malaria so disproportionately affects poor countries that do not have the financial resources to spend on disease control, the method must be cost-effective.[47] DDT fulfills these criteria. It is a pesticide that can almost entirely prevent the spread of malaria.[48] Indeed, the use of DDT eradicated malaria in the United States.[49] It is an intentionally produced chemical,[50] though knowingly produced in only two countries today: China and India.[51] DDT has been classified as a persistent organic pollutant (POP) because it persists in the environment for such long periods of time.[52] It is this characteristic of persistence that is DDT's virtue and vice. It enables the chemical to successfully combat malaria for long periods of time. However, its persistence also makes the chemical dangerous, as its negative effects on the environment and humans continue even after its immediate use has concluded.[53] DDT is, to say the least, a controversial chemical. Despite its effectiveness in combating malaria, only six countries use it for routine malaria control, and only ten others for

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44. WHO, GLOBAL MALARIA PROGRAMME: INDOOR RESIDUAL SPRAYING 1 (2006), *available at* www.who.int/malaria/indoorresidualspraying.html [hereinafter WHO GLOBAL MALARIA PROGRAMME].

45. *See, e.g., id.* at 5 (discussing the IRS method); WHO Press Release, *supra* note 27 (discussing the WHO's recommendation for use of IRS not only in epidemic areas, but all areas with high malaria transmission).

46. WHO GLOBAL MALARIA PROGRAMME, *supra* note 44, at 1.

47. *See* WHO, *Rolling Back Malaria*, *supra* note 32, at 56 (noting that an intervention "must not only be effective, but also cost-effective"); Morriss & Meiners, *supra* note 2, at 2 (explaining that malaria is most pronounced in underdeveloped countries, which cannot afford costly treatments for the disease).

48. Morriss & Meiners, *supra* note 2, at 2.

49. Mulliken et al., *supra* note 1, at 4.

50. Morriss & Meiners, *supra* note 2, at 7.

51. Rosenberg, *supra* note 33.

52. Lallas, *supra* note 12, at 692.

53. Erin Perkins, *The Stockholm Convention on Persistent Organic Pollutants: A Step Toward the Vision of Rachel Carson*, 2001 Y.B. COLO. J. INT'L ENVTL. L. & POL'Y 191, 192.

emergencies.[54] Its potential for both great harm as well as great benefit has made DDT's existence, though short-lived, a contentious one.

DDT was discovered accidentally by a graduate student in 1874.[55] However, scientists did not realize its potential as a pesticide until four decades later, during experiments for wool protection.[56] From then on, DDT's popularity increased dramatically. The United States Department of Agriculture (USDA) performed tests on the chemical and soon implemented it for military use.[57] Factories were established to manufacture immense quantities of the chemical for use during World War II.[58] DDT was sprayed directly on soldiers as well as their camp equipment to protect them from various pests, including lice and mosquitoes.[59] The chemical proved very effective in warding off diseases at a time when "more soldiers suffered from disease than from battle wounds."[60] Indeed, without DDT, the United States may not have successfully invaded Italy and Saipan, for DDT allowed them to ward off epidemics such as typhus and dengue that would have depleted the troops.[61] Not only was DDT more effective than other pesticides that it replaced, but it was also much safer.[62] It was able to combat multiple diseases simultaneously; it controlled nearly thirty diseases (including malaria, dengue, yellow fever, plague, dysentery, and cholera).[63] DDT was "seen as a godsend for the military."[64]

Just after the war, DDT reached the zenith of its popularity. Building on its heroism in facilitating Allied victories and the war effort, it segued into mainstream use and became the primary method of insect control throughout the world.[65] The success of DDT derived from its persistent quality; it killed pests efficiently, and its effects lasted longer than any other method of treatment.[66] The United States was able to completely eliminate mosquito-transmitted malaria from within its borders using DDT, reducing the number of American cases from one million to zero in just twelve years, from 1940 to 1952.[67] DDT was a lauded chemical; indeed, the scientist who

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54. Rosenberg, *supra* note 33.
55. Mulliken et al., *supra* note 1, at 3.
56. *Id.*
57. *Id.*
58. *Id.*
59. *Id.*
60. *Id.*
61. *Id.*
62. Morriss & Meiners, *supra* note 2, at 7.
63. Mulliken et al., *supra* note 1, at 4.
64. *Id.* at 3.
65. *Id.* at 4.
66. *Id.*
67. *Id.*

researched DDT and informed the USDA of its potential was awarded the Nobel Prize in Physiology or Medicine for his work.[68] The impact of DDT's success in the world of public health "is hard to overestimate."[69]

However, DDT's fame was short-lived. In the 1950s, the United States began to restrict some uses of DDT as reports of its unintended consequences emerged.[70] Perhaps the most troubling of these was (and still is) that POPs, including DDT, are carcinogenic in humans and can damage the nervous system.[71] DDT's persistence, equally present in animal organisms as in the environment, exacerbates these dangers. DDT dissolves into the body fat of mammals and remains there for long periods of time, meaning the harm of the chemical endures long after exposure.[72] DDT's ability to travel great distances—either by water after it condenses or by air current after it vaporizes—magnifies these persistent effects.[73] The chemical thus exists throughout the world, even where it has neither been produced nor used.[74] In fact, indigenous populations in the Arctic have the highest levels of concentration of DDT in their food and bodies among populations of the world, despite the fact that they do not use the chemical.[75] As the unintended, and primarily negative, consequences of DDT were revealed, public opinion began to oppose the use of DDT.[76] The publication of Rachel Carson's *Silent Spring* in 1962 solidified this trend in public opinion.[77] The book blamed pesticides, specifically DDT, for harming the environment, vividly describing its deleterious effects on wildlife as well as humans.[78] She wrote, and

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68. *Id.*; Drury Stevenson, *No Purchase Necessary*, 38 CORNELL INT'L L.J. 251, 255 (2005) (book review).

69. Gladwell, *supra* note 23, at 44; Morriss & Meiners, *supra* note 2, at 8.

70. Morriss & Meiners, *supra* note 2, at 13.

71. Lallas, *supra* note 12, at 694.

72. Mayer, *supra* note 18, at 149–51.

73. Pep Fuller & Thomas O. McGarity, *Beyond the Dirty Dozen: The Bush Administration's Cautious Approach to Listing New Persistent Organic Pollutants and the Future of the Stockholm Convention*, 28 WM. & MARY ENVTL. L. & POL'Y REV. 1, 4 (2003); Lallas, *supra* note 12, at 694.

74. Fuller & McGarity, *supra* note 73, at 4; *see also* Stockholm Convention, *supra* note 14, pmbl. ("[a]cknowledging that the Arctic ecosystems and indigenous communities are particularly at risk because of the biomagnification of persistent organic pollutants . . . .").

75. *See* Mayer, *supra* note 18, at 152–53 (describing the effects of DDT on Broughten Island, despite that it is located thousands of miles from any factory that manufactures or uses the chemical); Lallas, *supra* note 12, at 694 (explaining that contamination in indigenous communities occurs even though "the communities have nothing to do with the creation of the substances . . . and they are located . . . thousands of miles from the point of production, use, or release of the contaminants.").

76. *See* Morriss & Meiners, *supra* note 2, at 23 (describing the publication of Carson's book as "turning the tide of popular opinion against DDT").

77. *Id.*

78. RACHEL CARSON, SILENT SPRING 109 (1962).

the mainstream public read, about robins dying when they ate earthworms that had been exposed to DDT, young eagles doomed to early deaths because of DDT, and salmon dying from DDT in its water supply.[79] Carson's compelling writing elicited a very negative reaction from the American public regarding DDT, one that has endured to the present time.[80] Conspicuously absent from the book was any mention of the more than five million lives DDT had saved from malaria.[81] As a result, the public reaction responded to a presentation of the chemical that eviscerated any memory of its benefits.

In 1972, EPA administrator William Ruckelshaus banned the use of DDT in the United States after nearly a year of hearings on the matter.[82] Ruckelshaus' decision went against the recommendation of the hearing administrator, who had found that "there is a present need for the essential uses of DDT" and that DDT posed no great threats to humans or wildlife.[83] However, the EPA's decision reflected public and political opinions of the time, which strongly opposed DDT due to its perceived harms.[84] Following the ban of DDT in the United States, the use of DDT waned internationally.[85] American decisions carry disproportionate weight worldwide; therefore, DDT's toxic image coupled with America's denunciation of the chemical has effectively made DDT unavailable, even for malarious nations.[86] Political pressures, financial funding, and social opinion all contributed to a decline in the use of DDT throughout the world for agricultural and public health uses;[87] low levels of DDT use continue today as major donors are reluctant to finance the use of DDT and global institutions discourage its use.[88] Indeed, not a single industrial country currently uses DDT.[89] The chemical that once was seen as a savior in fighting diseases globally is now shunned throughout the world.

The alternatives to DDT for malaria control—including nets, other chemicals, and drugs—have proven to be less effective, both with regard to cost and to success.[90] Indeed, the strongest correlation

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79. *Id.*; Rosenberg, *supra* note 33.
80. Mulliken et al., *supra* note 1, at 4.
81. CARSON, *supra* note 78; Rosenberg, *supra* note 33.
82. Mulliken et al., *supra* note 1, at 5.
83. *Id.*
84. *See id.*
85. *Id.* at 6.
86. Rosenberg, *supra* note 33.
87. Mulliken et al., *supra* note 1, at 6.
88. Rosenberg, *supra* note 33.
89. *See* Amir Attaran et al., *Balancing Risks on the Backs of the Poor*, 6 NATURE MED. 729, 729 (2000).
90. *See* Morriss & Meiners, *supra* note 2, at 32–33 (claiming DDT has proven to be the most effective method known for preventing the spread of malaria).

with an increase in malaria is a decrease in the use of DDT.[91] Actual case studies support this conclusion: Madagascar, Venezuela, Belize, and South Africa all experienced increased rates of malaria in their populations after banning the use of DDT.[92] Similarly, Columbia and Peru experienced a doubling of the risk of malaria when they stopped DDT spraying in the 1990s.[93] When South Africa abandoned the use of DDT for malaria control in 1996, switching instead to pyrethroids, malaria rates skyrocketed from about 6,000 cases to 61,000 cases over the span of five years.[94] In 2000, South Africa returned to using DDT in order to regain control of the epidemic, and as a result decreased the number of malaria cases by 45,000 over two years.[95] The World Health Organization (WHO) delegates reported in 2000 that no cost-effective or proven alternatives that are less toxic than DDT exist to replace it.[96] In fact, the use of alternative means of protection not only seems less effective in combating malaria, but essentially results in mere risk transformation.[97] Organochlorides, the chemicals that replace DDT, have more immediate and significant risks of toxicity, which are exaggerated by users' unfamiliarity with them.[98] The number of accidental pesticide poisonings, for example, has increased 14% over the decade following the ban of DDT.[99]

Despite DDT's effectiveness in public health uses, public opinion still remains against the use of DDT for any purpose, primarily due to the influence of many non-governmental organizations (NGOs), including the World Wildlife Fund and Greenpeace.[100] The lobbying efforts of NGOs, particularly environmental groups, have resulted in making DDT largely unavailable for malaria control.[101] These groups advocate total elimination of DDT, rather than just limitations on its use, out of a concern that if DDT's production is permitted for public health use, it will also be used for agriculture.[102] The NGOs fear that absent a total ban on DDT, use of the chemical will continue uninhibited, which will result in deleterious levels of pollution.[103] What was originally considered to be DDT's virtue has been relegated

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91. Roberts et al., *supra* note 3.

92. Mulliken et al., *supra* note 1, at 6; *see also* Donald R. Roberts et al., *DDT, Global Strategies, and a Malaria Control Crisis in South America*, 3 EMERGING INFECTIOUS DISEASES 295, 301 (1997), *available at* http://www.cdc.gov/ncidod/eid/vol3no3/roberts.htm [hereinafter Roberts et al., *DDT*].

93. Morriss & Meiners, *supra* note 2, at 31.

94. Mulliken et al., *supra* note 1, at 6.

95. *Id.*

96. Morriss & Meiners, *supra* note 2, at 34.

97. Mayer, *supra* note 18, at 168.

98. *Id.* at 167–68.

99. *Id.* at 168.

100. *See* Morriss & Meiners, *supra* note 2, at 36.

101. *Id.* at 30.

102. *Id.* at 36.

103. *See id.*

to its vice; the very persistence that makes DDT so effective in treating diseases and eradicating pests also makes it harmful to the environment, humans, and wildlife.

C. *The Stockholm Convention: A Global Attempt to Regulate DDT*

The concern over toxic chemicals—and DDT specifically—has not evaded the attention of the international community. Indeed, in response to the growing concern about the effect of POPs on the global environment, two international treaties have been recently ratified: the Rotterdam Convention and the Stockholm Convention.[104] The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention), ratified in 2004, covers the "manner of international trade of toxics."[105] Its goal is to "promote shared responsibilities and cooperative efforts among Parties in the international trade of certain hazardous chemicals," helping "developing countries to enforce their decisions to ban imports of banned or severely restricted chemicals in certain developed countries."[106] The Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention) extends the Rotterdam Convention, focusing on the elimination of the production, use, and trade of POPs.[107] Both treaties are legally binding for the parties who ratify them.[108] Because the Stockholm Convention addresses the elimination of DDT,[109] which directly impacts the malaria epidemic, this Note will focus on it rather than the Rotterdam Convention.

The need for international action has become apparent as the environmental consequences of toxins have become more visible. POPs, in particular, warrant international action because of their characteristics of persistence, ability to travel long distances, and bioaccumulation.[110] Preparation for the Stockholm Convention began in 1997-1998 when the United Nations Environment Programme (UNEP) held eight regional workshops around the world to build awareness and technical understanding of POPs.[111] Shortly thereafter, actual negotiations began.[112] These negotiations lasted almost four years and involved the participation of more than 120 governments.[113] Significantly, NGOs, indigenous communities, and

104. Truelsen, *supra* note 14, at 217.
105. *Id.* at 219.
106. Fuller & McGarity, *supra* note 73, at 5.
107. Truelsen, *supra* note 14, at 219–20.
108. *Id.* at 217.
109. Stockholm Convention, *supra* note 14.
110. Lallas, *supra* note 12, at 694.
111. Perkins, *supra* note 53, at 196.
112. *Id.* at 196–97.
113. Fuller & McGarity, *supra* note 73, at 5.

international organizations were also involved.[114] The widespread participation reflected the gravity with which the international community viewed the issue of toxic pollution, as well as the international character of the problem. Moreover, it ensured that the differing interests of the affected parties were represented, or at the very least considered, in the negotiations and final resolution.[115] The inclusive nature of the negotiations process was particularly important because it allowed developing countries, which have a strong interest in continuing to use DDT to combat malaria, to participate in the creation of the treaty.[116] DDT was the primary contentious issue, and discussions focused on whether a complete ban was feasible and appropriate given DDT's public health use to combat malaria.[117] The treaty negotiations culminated in the presentation of the Convention for signing in May of 2001,[118] and it took effect on May 17, 2004, ninety days after it received approval by a fiftieth country.[119] As of January 14, 2007, 152 countries have signed the Convention, and 136 have ratified it.[120]

The Stockholm Convention mandates the restriction or elimination of POP pesticides and industrial chemicals in order to achieve its objective of "protect[ing] human health and the environment from persistent organic pollutants."[121] The Convention's objective derives from its realization that POPs "possess toxic properties . . . [and] bioaccumulate . . . across international boundaries," and its awareness of "health concerns, especially in developing countries," from these POPs.[122] The action-forcing provision of the Convention is divided into two sections: parties are required to eliminate those toxins listed in Annex A, and to restrict (as distinguished from eliminate) those toxins listed in Annex B.[123] Although it currently applies to the twelve POPs considered most dangerous to the environment, known as the "dirty dozen,"[124] the Convention includes a process by which new chemicals can be

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114. Lallas, *supra* note 12, at 693; Perkins, *supra* note 53, at 197.

115. *See* Lallas, *supra* note 12, at 696 (describing the active engagement of developing countries in the negotiations process); Perkins, *supra* note 53, at 197 (describing the participation of these organizations in the negotiation process).

116. Lallas, *supra* note 12, at 696.

117. Perkins, *supra* note 53, at 197.

118. Fuller & McGarity, *supra* note 73, at 3.

119. Stevenson, *supra* note 68, at 252.

120. Stockholm Convention, Status of Ratifications, http://www.pops.int/reports/statusOfRatifications.aspx (last visited Feb. 3, 2008).

121. Stockholm Convention, *supra* note 14, art. 1.

122. *Id.* pmbl.

123. *Id.* Annexes A–B.

124. Lallas, *supra* note 12, at 692. The "dirty dozen" are: DDT, chlordane, aldrin, dieldrin, endrin, heptachlor, mirex, toxaphane, hexachlorobenzene, polychlorinated biphenyls (PCB), PCDD, and PCDF. Stockholm Convention, *supra* note 14, Annexes A–B.

added.[125] The division of toxins into two annexes allows exemptions from the total ban of all POPs; it recognizes that the use of POPs is necessary in extenuating circumstances requiring immediate action.[126] The Convention also restricts importation of both Annex A and Annex B chemicals: it is allowed only for their disposal or for a use permitted under the Annexes.[127] The exportation of toxins is subject to the same restrictions as importation, although the toxins can also be exported to States not party to the Convention, so long as the State certifies compliance with Treaty Provisions and a dedication to protecting public health and the environment.[128] The Convention's commitment to elimination or significant restriction of toxins pervades the agreement.

In furtherance of the goal of elimination, the Convention also requires parties to promote and facilitate awareness and education regarding POPs, both to their government officials as well as to the general public.[129] In addition, it mandates that developed nations provide technical and financial assistance to developing countries on ways to eliminate POPs.[130] Each party to the treaty must develop Implementation Plans describing how it proposes to achieve the objectives agreed to, and subsequently to report regularly to a Conference of the Parties on its progress in carrying out its plans.[131] The Convention does not presently have consequences for non-compliance, though it directs that procedures for dealing with non-compliance should be developed.[132]

The only toxin currently included in Annex B—and thus subject to restriction rather than elimination—is DDT.[133] Parties gain "exemptions," and thus are allowed to use DDT, if they identify an "acceptable purpose" for its use.[134] The acceptable purpose that exempts DDT is "disease vector control," for the treatment of malaria.[135] This disease vector control must be "in accordance with the WHO [World Health Organization] recommendations and when

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125. Stockholm Convention, *supra* note 14; Lallas, *supra* note 12, at 692.

126. Stevenson, *supra* note 68, at 255.

127. Stockholm Convention, *supra* note 14, art. 3.

128. *Id.*

129. *Id.* arts. 9–10; Perkins, *supra* note 53, at 198.

130. Stockholm Convention, *supra* note 14, arts. 9–10; Perkins, *supra* note 53, at 198.

131. Perkins, *supra* note 53, at 198–99. As of January 14, 2007, thirty-eight countries had submitted Plans of Implementation. Stockholm Convention, National Implementation Plans, http://www.pops.int/documents/implementation/nips/submissions/default.htm (last visited Feb. 2, 2007).

132. Stockholm Convention, *supra* note 14, art. 17.

133. *Id.* Annex B; Onzivu, *International Environmental Law*, *supra* note 35, at 628.

134. Stockholm Convention, *supra* note 14, Annex B; Lallas, *supra* note 12, at 699.

135. Stockholm Convention, *supra* note 14, Annex B, Part I.

locally safe, effective, and affordable alternatives are not available to the party."[136] Although the exemption is potentially available to any country, parties must register in writing with the Secretariat to qualify for exemption to use DDT, attesting that it needs DDT for the acceptable purpose.[137] Registered exemptions expire five years after they are entered,[138] and will only be extended after submission of a Report to the Secretariat justifying a continuing need for the exemption.[139] While receiving the Exemption, the party must report to the Secretariat every three years on "the amount used, the conditions of such use, and its relevance to the disease management strategy."[140] Additionally, the development of effective and economically viable alternatives must continue despite the use of DDT;[141] the Convention requires that parties receiving an exemption for DDT use must develop an Action Plan including: (1) the development of other mechanisms to ensure that DDT use is restricted to disease vector control; (2) implementation of alternative methods; and (3) measures to strengthen health care and reduce incidence of the disease.[142]

Of the initial ninety-one parties that signed the Convention, thirty-one requested an exemption.[143] In creating such exemptions, the Stockholm Convention allows different obligations among parties based on individual needs.[144] Ultimately, however, the objective of the agreement, including even the Annexes, is the same: the elimination of DDT.[145]

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136. *Id.* Annex B, Part II.
137. *Id.* art. 4, ¶ 3.
138. *Id.* art. 4, ¶ 4.
139. *Id.* art. 4, ¶ 6.
140. *Id.*
141. *Id.*
142. *Id.* Annex B, Part II, ¶ 5(a).
143. International POPs Elimination Network, *DDT & Malaria: Answers to Common Questions*, *available at* http://www.ipen.org/ipenweb/library/4_3_p_doc_10.html. The countries that requested DDT exemptions are: Algeria, Bangladesh, Cameroon, China, Comoros, Costa Rica, Cote d'Ivoire, Ecuador, Eritrea, Ethiopia, India, Iran, Kenya, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Papua New Guinea, Russian Federation, Saudi Arabia, South Africa, Sudan, Swaziland, Togo, Uganda, United Republic of Tanzania, Venezuela, Yemen, Zambia, and Zimbabwe. *Id.*
144. *See* Lallas, *supra* note 12, at 692–93 ("These issues include, for example: how to address differences among countries relating to capacity to comply and other factors . . . .").
145. Stockholm Convention, *supra* note 14, Annex B, Part II, ¶ 5.

III. ANALYSIS

A. *Disparate Interests*

The dual nature of DDT—the vice and virtue of its persistence, and its concomitant potential for great harm and great benefit to humans and the environment—presents a problem for nations around the world. Because countries prioritize actions based on a need to protect their citizens from real and immediate threats to them, the disproportionate effect of malaria on developing countries as compared to developed countries will cause the priorities of developed and developing countries to differ significantly in the resolution of how to regulate DDT.[146] Because malaria is endemic in many developing countries, they have a pressing concern to find and implement a mechanism to prevent the spread of malaria.[147] Because DDT is such an effective and cheap solution, these developing nations have a need for DDT.[148] Developed countries, in contrast, do not generally suffer from outbreaks of malaria, and therefore have less of an interest in protecting the use of DDT.[149] Developed countries' financial resources also allow pursuit of other means of controlling the disease (such as drugs or synthetic chemicals) and a consequently lower level of dependence on DDT if the need for malaria control does arise. Because the most immediate and visible threat for developed countries is not malaria—which has largely been eliminated—but rather the negative effects on the environment and human health that stem from toxins such as DDT,[150] the priority of developed countries is to ban those chemicals that harm the environment—like DDT. The regulation of DDT must reconcile these disparate interests of developing and developed countries.

In considering the dichotomous interests of developing and developed countries, the regulation of DDT must undoubtedly involve international efforts. DDT circulates globally,[151] making it difficult

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146. *See* Morriss & Meiners, *supra* note 2, at 2 ("This tragedy [of malaria] is most pronounced among the poor in underdeveloped countries."); Onzivu, *Globalism, Regionalism, or Both*, *supra* note 5, at 119 ("The developing world continues to bear a disproportionate burden of disease."); *see also* discussion *supra* Part II.A.

147. *See* WHO, *Rolling Back Malaria*, *supra* note 32, at 51–52 (describing the level of the malaria crises in developing regions).

148. *See* Morriss & Meiners, *supra* note 2, at 3 (calling DDT a chemical that "would solve a pressing health problem at low cost").

149. *See, e.g.*, WHO, *Rolling Back Malaria*, *supra* note 32, at 51 (noting that "malaria causes nearly 250 times more deaths in the world's poorest countries than in the richest.").

150. *See* Rosenberg, *supra* note 33 ("To Americans, DDT is simply a killer. . . . Malaria is a disease Westerners no longer have to think about.").

151. Perkins, *supra* note 53, at 191. For example, some of the highest levels of DDT pollution are found in indigenous communities in the Arctic. Lallas, *supra* note 12, at 694.

for individual states to adequately protect the health of their citizens or their environment.[152] An individual country's prohibition of the production or use of DDT within its borders will not prevent the secondary consequences of DDT, as it has been widely demonstrated that even countries that neither use nor produce DDT suffer the adverse effects of the chemical.[153] Indeed, the welcome utility of DDT in one place creates "unwelcome changes elsewhere," so that no single country can control the chemical on its own.[154] Moreover, international efforts are necessary because DDT is a solution to a global problem. Malaria affects populations around the world,[155] and indeed, health threats (including malaria) generally transcend national borders in today's world.[156] Malaria has reappeared even in nations where the disease was thought to be eradicated,[157] demonstrating a resilience that suggests the threat of the disease is perpetual. As such, the regulation of DDT must occur at an international level.

B. *Uncertainty of the Harm of DDT*

The actual secondary effects of DDT are far more uncertain and far less harmful than its reputation throughout the world would suggest. Many independent studies of DDT have produced no sound evidence to support its ban because the harmful consequences of DDT on the environment and humans have not been shown to be of a magnitude great enough to outweigh its safe, effective, and inexpensive nature.[158] This is particularly true for the use of DDT for public health purposes. DDT is used for malaria eradication differently today than it was in the 1950s and 1960s. The harmful consequences that earned DDT its bad reputation stemmed from the 1950s' practice of spreading the chemical indiscriminately over large areas.[159] Today, a very limited amount of DDT is sprayed on a

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152. Perkins, *supra* note 53, at 191.

153. Lallas, *supra* note 12, at 694.

154. Mayer, *supra* note 18, at 172–73; *see also* discussion *supra* Part II.B.

155. Roberts et al., *supra* note 3.

156. *See* Onzivu, *International Environmental Law*, *supra* note 35, at 599 ("In an era of globalization . . . health threats transcend national borders.").

157. *See* Mayer, *supra* note 18, at 168–69 ("At the time of the ban [of DDT use], malaria was close to being eradicated, but malaria reappeared after the ban and currently causes 'millions of deaths each year throughout the world.'"); Roberts et al., *supra* note 3 ("Malaria is reappearing in urban areas and in countries that previously eradicated the disease.").

158. Mulliken et al., *supra* note 1, at 4–5 (describing various groups that studied the pros and cons of a DDT ban, and the conclusion of each that "there was no sound evidence to support such a ban.").

159. *See* Attaran et al., *supra* note 89, at 729 (blaming the "massive agricultural use of DDT" for the ecological effects of the chemical); Morriss & Meiners, *supra* note 2, at 6–9 (describing "widespread spraying" programs of the 1950s and 1960s).

targeted area, usually doorframes, for the Indoor Residual Spraying (IRS) programs.[160] The effectiveness of IRS comes from DDT's combination of lethal and repellant properties;[161] even if mosquitoes are resistant to the chemical, and not killed when they land, they will nonetheless be repelled and stopped from transmitting the disease.[162] The IRS programs use such small amounts of DDT that they cause essentially no discernable effect on the environment.[163] The substantial difference in the amounts used in the 1950s and today suggests that the effects of the chemical on the environment and in humans should not be equated. In fact, the amount of DDT the United States used to treat a 1,000 acre cotton field in the 1960s would be sufficient to protect all of Guyana for an entire year today.[164]

The uncertainty of the harmful effects of DDT suggests that the interest of developed countries in protecting the environment should not simply trump the interest of the developing countries in using DDT. Indeed, a cost-benefit analysis supports the view that the vices of DDT do not necessitate a global ban of the chemical: the effectiveness of DDT in malaria eradication outweighs the risks of its harms, particularly when those risks are ambiguous in the small quantity of DDT that is required for public health purposes.[165] Several hundred of the world's leading experts in malaria appealed to UNEP to delay a complete ban of DDT, primarily because they anticipated millions of deaths would result.[166] The WHO now recommends using DDT for public health purposes even in non-epidemic regions,[167] a reversal of the position it had held since 1969.[168] The WHO cites "the science and the data" that prove "DDT presents no health risk when used properly" to justify its advocacy of the chemical.[169] The WHO's diametric change in position epitomizes

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160. Mulliken et al., *supra* note 1, at 6; *see also* Attaran et al., *supra* note 89, at 729 (explaining that DDT spraying for IRS is less intensive, less frequent, and more contained than the widespread agricultural use). IRS programs consist of spraying only 2 g/m^2 of DDT on the houses, which results in 0.04% of the effect of spraying and entire cotton field. Attaran et al., *supra* note 89, at 729.

161. Mulliken et al., *supra* note 1, at 7; *see also* Attaran et al., *supra* note 89, at 729 (describing DDT working not only by killing mosquitoes, but also by driving mosquitoes off sprayed walls before they bite and by deterring their entry in the first place).

162. Mulliken et al., *supra* note 1, at 7.

163. *Id.*; *see* Roberts et al., *supra* note 3 (explaining that "claims of risks of DDT to human health and the environment have not been confirmed by replicated scientific study," and that a "sprayed house will only have a very small amount of DDT.").

164. Mulliken et al., *supra* note 1, at 7.

165. *Id.* at 6.

166. Mayer, *supra* note 18, at 174.

167. WHO Press Release, *supra* note 27.

168. Gladwell, *supra* note 23, at 49.

169. WHO Press Release, *supra* note 27.

the duality of DDT; its persistence is both its virtue and its vice, and health concerns result from both its use and elimination. It is this dual nature that makes the decision of how to regulate DDT such a challenge.

C. *Ineffectiveness of the Alternatives to DDT*

Much of the reason that continued use of DDT is necessary to combat malaria is that alternatives are simply not as effective.[170] This ineffectiveness stems primarily from their prohibitive costs. It costs approximately $1.44 to spray one house every year with DDT.[171] Other insecticides have been shown to cost five times that amount.[172] Bed-covering nets that repel the night-biting mosquitoes cost about $5-$10 apiece.[173] In countries where the per capita income remains in the hundreds of dollars per year, these alternatives are simply too expensive.[174] Countries cannot afford to switch away from DDT for their malaria control strategy.[175]

Using drugs to treat malaria on a case-by-case basis is also not as effective as preventative spraying with DDT. This is primarily due to the development of resistance to anti-malaria drugs.[176] In fact, resistance has arisen to all classes of antimalarial medicines but one.[177] Because of this resistance, "[s]afe, effective and affordable options are running out," and the "discovery of new antimalarials is not keeping pace."[178] Mosquitoes seem to be able to adapt their biting activity, and the parasite that actually causes the disease is able to adapt to drugs easily.[179] Moreover, case-by-case treatment with antimalarials is also inefficient because the treated person can return

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170. Morriss & Meiner, *supra* note 2, at 32.

171. Roberts et al., *DDT*, *supra* note 92, at 301.

172. *Id.*

173. Morriss & Meiner, *supra* note 2, at 32–33.

174. *Id.* at 32. In sub-Saharan Africa, households have been found to spend between two and five dollars on malaria treatment, and between twenty cents and fifteen dollars on prevention each month. WHO, *Rolling Back Malaria*, *supra* note 32, at 51. It has been estimated that those who can afford it spend between five and thirteen percent of their expenditures on protection and treatment. *Id.*

175. Roberts et al., *DDT*, *supra* note 92, at 301. Indeed, Mexico tried DDT alternatives for malaria control from 1986 to 1988, but discontinued their use because of unfavorable responses and high costs. *Id.*

176. *See* Centers. for Disease Control & Prevention, Malaria, http://www.cdc.gov/malaria/drug_resistance.htm (last visited Feb. 3, 2008) ("The development of resistance to drugs poses one of the greatest threats to malaria control and has been linked to recent increases in malaria morbidity and mortality.").

177. WHO, GUIDELINES FOR THE TREATMENT OF MALARIA RESISTANCE 12 (2006), *available at* http://www.who.int/malaria/docs/TreatmentGuidelines2006.pdf.

178. WHO, *Rolling Back Malaria*, *supra* note 32, at 49.

179. TITUS BRADLEY, MALARIA AND DRUG RESISTANCE (1996), *available at* http://www.tulane.edu/~dmsander/ WWW/224/Bradley/Resistance.html.

to the same house where the infected mosquito resides, and thus becomes susceptible to re-infection.[180]

Vaccination is another potential alternative to the use of DDT for malaria control. However, while vaccination may be feasible, several critical obstacles make it unavailable at any time in the near future: lack of immune correlates of protection, lack of reliable and predictive animal models, and the developmental and antigenic diversity and variability of the parasite.[181] Only with a major commitment to further research, including funding, will the development of such a vaccine have potential for success.[182]

D. *Critique of the Stockholm Convention*

1. Inadequate Recognition of Developing Countries' Unique Public Health Needs

The Stockholm Convention is an attempt on an international level to address the need to regulate, and ultimately ban, DDT because of its deleterious effects on the global environment.[183] The Convention acknowledges the existence of distinct interests in the regulation of DDT; it gives separate recognition to the need of developing countries.[184] However, this recognition is an acknowledgment that developing countries have particular health concerns from POPs, presumably because of their inability to produce and purchase alternatives.[185] Significantly, the agreement does not recognize the special health concerns of developing countries that result from malaria. Thus, the Convention's recognition of the special interests of developing countries actually contravenes those countries' true needs; it promotes an interest that would suggest a decrease in the use of DDT (to protect them from POP risks) rather than an increase in the use of DDT (to protect them from malaria). In so doing, the Stockholm Convention aligns the objective of developing and developed countries to one of eliminating the use of POPs, including DDT. This alignment of interests, however, is not entirely accurate; the interests of developed countries and developing countries diverge because of their disparate rates of malaria infection.[186]

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180. Roberts et al., *DDT*, *supra* note 92, at 301.
181. WHO, Parasitic Diseases, *supra* note 22.
182. *Id.*
183. Stockholm Convention, *supra* note 14.
184. *Id.* pmbl.
185. *See id.* (declaring the parties are "[a]ware of the health concerns, especially in developing countries, resulting from local exposure to persistent organic pollutants, in particular impacts upon women and, through them, upon future generations").
186. *See* discussion *supra* Part III.A.

2. Objective of Total Elimination

The lack of acknowledgment of developing countries' unique interest in the use of DDT for health purposes is problematic because it is symptomatic of the larger problem of the Stockholm Convention: its overriding purpose of elimination of all POPs, including DDT. The Convention clearly asserts this purpose: Annex A lists all POPs that must be eliminated, and Annex B expresses "the goal of . . . ultimately eliminating the use of DDT."[187] The ultimate objective of elimination is also implicit from the other provisions of the Convention. The parties must research and develop safe alternatives, and DDT will be banned once such alternatives exist.[188] This focus on the total elimination of POPs, including DDT, will undermine the exemption's purpose, which is to ensure that countries that need DDT to combat their malaria epidemics will have it available for use.[189] The goal of elimination will also result in the continued stigma against the use of DDT. The Treaty perpetuates a negative view of DDT; although the Convention endorses its use, it is only on a very limited basis—in emergency situations when no other viable alternatives exist.[190] It will likely make parties, and even non-parties, reluctant to use or manufacture DDT, notwithstanding its availability in Annex B.[191] This reluctance may stem from a desire to comport with the overall purpose of the Convention or from wariness due to the stigma associated with continued use of POPs in light of the purpose. A decrease in the manufacture or funding of DDT will limit the supply available, which consequently will increase the price.[192] For developing countries already financially constrained and expending most of their limited resources on malaria treatment,[193] this increase in price will make DDT unaffordable, and thus inaccessible.

3. Inappropriate Use of Precautionary Principles

The Stockholm Convention espouses the use of precautionary principles, "[a]cknowledging that precaution underlies the concerns of

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187. Stockholm Convention, *supra* note 14, Annex B, Part II, ¶ 5; *see also* discussion *supra* Part II.C.

188. Stockholm Convention, *supra* note 14, art. 11; *Id.* Annex B, Part II, ¶ 5(b).

189. *See id.* Annex B (stating the acceptable purpose for DDT exemption is disease-vector control).

190. Stockholm Convention, *supra* note 14, Annex B, Part II, ¶ 2.

191. Attaran et al., *supra* note 89, at 729.

192. *Id.* For example, the use of DDT worldwide declined significantly after the United States enacted a ban of the chemical. *See* Mulliken et al., *supra* note 1, at 6.

193. *See* Narasimhan & Attaran, *supra* note 21 ("In countries with a heavy malaria burden, the disease accounts for as much as 40% of public health expenditure.").

all the Parties and is embedded within this Convention."[194] The precautionary principle, one approach to implementing a preventative strategy, "reflects the adage: better safe than sorry."[195] It is often used instead of remedial measures for issues of environmental harm.[196] The principle advocates taking precaution to protect the environment and the public whenever the possibility of risk appears, even in the absence of clear evidence and regardless of the cost of taking such precautions,[197] because "remediation is seldom effective in cost or in fact" for such problems.[198] Harm done to the environment cannot be reversed using any current technology, regardless of the price.[199] In recognition of the fact that any damage that DDT causes, however speculative or far into the future, cannot be fixed using remedial measures, the Stockholm Convention chose to use precautionary principles.

However, precaution is not always the best approach, particularly when problems requiring precaution are intertwined with problems requiring more immediate attention. Instead, a cost-benefit analysis or risk assessment must be performed in order to determine the best means to eliminate or regulate the problem.[200] The deliberations on POPs are one example of such a situation, in which risk assessment is necessary to determine whether to take precaution.[201] Several variables about the regulation of DDT factor into this determination, including: whether it imperils human health or life, whether it threatens irreversible or reversible harm, whether it undermines short-term or long-term well-being, whether it burdens developing or developed nations, whether it imposes certain or uncertain risks, whether it imposes high or low short-term costs, and whether alternatives are available and affordable.[202] In the case of DDT, these factors must be evaluated in light of the risks of harm DDT causes to the environment and human health, as well as the risks of harm DDT's ban will cause to human health due to the damage from malaria.

The cost-benefit analysis suggests that the precautionary approach embodied in the Convention's purpose is misguided. The benefit to human health outweighs the uncertain costs of DDT's environmental effects. A regulation to eliminate DDT without the availability of alternatives would imperil human health and burden

194. Stockholm Convention, *supra* note 14, pmbl.
195. Mayer, *supra* note 18, at 163.
196. *See id.* at 178 (claiming that all problems of international environmental law suggest the use of precaution, rather than remediation, is the rational path).
197. *Id.*
198. *Id.* at 173.
199. *Id.*
200. *Id.* at 170.
201. *Id.*
202. *Id.* at 170–71.

underprivileged nations.[203] Implementing an entirely preventative measure against environmental harm disregards the risks to human health and is therefore not prudent.

4. Requirements for Exemption

The Convention's requirements also make it difficult to qualify for exemptions, which results in only limited country-specific exceptions.[204] Countries can use DDT only if the use is: for disease vector control; in accordance with WHO guidelines; when safe, effective, affordable alternatives are not available; upon approval of the Secretariat; and with continued promotion of research and development of safe alternatives.[205] The result of such limited exceptions, in combination with the ultimate goal of effectuating a complete ban, is that the treaty will likely end DDT manufacture, or at least make the supply of DDT very scarce.[206]

In addition to the potential inhibitory effects the Stockholm Convention may have on the supply of DDT, it also contains potential problems in its implementation. Many countries do not have the legal and regulatory framework in place to employ the requirements of the Convention.[207] Even the United States, which does have some legislation regarding toxins, would have to significantly alter that legislation to meet the requirements of the Convention.[208] Moreover, many developing countries do not have the financial resources either to implement new regulatory regimes effectively or to eliminate the use of POPs as the Convention requires.[209] The countries that need DDT are disproportionately underdeveloped and poor,[210] and their limited financial resources are often needed in areas of more pressing concern, such as combating poverty and improving education, rather than trying to fulfill the requirements of the Convention.[211] The requirements of the Annex are very costly, adding even more difficulty to the ability of countries to qualify for limited use of DDT.[212] Furthermore, there is no guarantee that a party will maintain exemption status once it has qualified for it; the Convention does not give countries any assurance that its DDT use will be approved in the future.[213] Exemption statuses are reanalyzed every

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203. *Id.*
204. Lallas, *supra* note 12, at 692.
205. Stockholm Convention, *supra* note 14, Annex B.
206. Attaran et al., *supra* note 89, at 729.
207. Perkins, *supra* note 53, at 200.
208. *Id.*
209. *Id.*
210. Morriss & Meiner, *supra* note 2, at 2.
211. Perkins, *supra* note 53, at 200.
212. *Id.*
213. Stockholm Convention, *supra* note 14, Annex B, Part II.

three years,[214] and a party could lose its ability to use DDT upon the review. Thus, although the Convention currently recognizes the continued use of DDT for public health use in eradicating malaria, it contains no protection for that use beyond three years.

5. Lack of Consequences for Non-Compliance

The Convention is also problematic because it contains no mechanism for enforcement, nor any penalties for non-compliance.[215] There is, therefore, no downside to signing it.[216] Thus, although participation now is fairly high, this high rate of participation does not guarantee any results. Because the parties will not be penalized (at least formally) for their non-compliance, they lack incentives to comply. Effectively, therefore, no global solution has been attained. While the Stockholm Convention has proposed an aspirational solution, without an enforcement mechanism its propositions fall short of solving the problem of reconciling the need for DDT with the need to ban DDT.

IV. PROPOSED REFORM

The decision of how to regulate DDT certainly involves choosing between the lesser of two evils: banning the use of DDT will result in the persistence of the malaria epidemic but a termination of its harmful environmental effects, while permitting the use of DDT will result in the ability to control the malaria epidemic but a perpetuation of global pollution. While ultimately a policy choice, balancing the effects of each supports a decision to permit the use of DDT; if the world has a real hope of eradicating epidemic levels of malaria, DDT must be involved. DDT has proven to be most effective not only in thwarting the disease's spread, but in actually eliminating the disease altogether.[217] It is also the most efficient method known at this time; it is affordable for developing countries, widely successful even in small quantities, and can be applied so as to protect large areas.[218] Moreover, alternative methods for the prevention and treatment of malaria—such as nets, vaccines, and antimalarials—are not feasible at this time due to inhibitory costs, incomplete research, or unsuccessful efforts.[219] The harmful effects of DDT, in contrast, have not been conclusively proven for the small

214. *Id.*
215. *Id.* art. 17; Stevenson, *supra* note 68, at 258.
216. Stevenson, *supra* note 68, at 258.
217. Rosenberg, *supra* note 33.
218. Morriss & Meiners, *supra* note 2, at 2.
219. *See* discussion *supra* Part III.B.

quantities of the chemical that would be used to safeguard public health.[220] Therefore, although environmental harm generally suggests using precautionary measures for control of toxins—manifested in an outright ban of their use—in the case of DDT, society cannot afford to advocate a precautionary approach to the regulation of DDT. Compelling a ban of DDT would greatly imperil human health or life, burden developing nations, and impose certain risks and high short-term costs, all without the existence of an affordable alternative.[221] Moreover, these effects would occur based on a *potential* for environmental consequences, when the consequences of malaria are very certain and presently being realized.[222] The use of DDT, consequently, should be regulated rather than completely banned. This regulation should occur at an international level because the issues involved—pollution from DDT and malaria—are of international concern.

The Stockholm Convention is a worthwhile effort to regulate POPs—and DDT specifically—and because many parts of the Convention work, its framework should be maintained. Above all, the Stockholm Convention provides an effective framework for the regulation of DDT. Because it is an international solution, both the negotiation process and the commitments of the Parties occurred on an international level.[223] The foundation of the Convention, therefore, wisely attempts to incorporate the diversity of interests implicated.

However, the Stockholm Convention should be altered in order to improve its effectiveness and to better recognize the need to use DDT to combat malaria. First, the objective of total elimination of DDT that infuses the Convention should be removed.[224] The Convention should be amended to add a statement to the purpose, acknowledging that total elimination of POPs (specifically DDT) is neither feasible nor desirable because of the competing health concerns. Additionally, references in Annex B stating that the ultimate goal is total elimination of DDT should be omitted.[225] The amended purpose section will lessen the stigma associated with DDT, which contributes

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220. *See* Mulliken et al., *supra* note 1, at 7 (explaining that the amounts of DDT used for malaria control offer "no discernable threat to the environment").

221. *See* Mayer, *supra* note 18, at 171 (outlining the factors to consider in use of precautionary principles).

222. *See* Attaran et al., *supra* note 89, at 729 ("The scientific literature is unpersuasive of the need to withdraw DDT; it is clear that doing so risks making malaria control ineffective, unaffordable, or both.").

223. Lallas, *supra* note 12, at 693; Perkins, *supra* note 53, at 197; *see also* discussion of negotiations for the Stockholm Convention *supra* Part II.C.

224. Stockholm Convention, *supra* note 14, Annex A; *Id.* Annex B, Part II, ¶ 5; *see also* discussion of objective, *supra* Part III.C.2.

225. Stockholm Convention, *supra* note 14, Annex B, Part II, ¶ 5; *see also* discussion of objective, *supra* Part III.C.2.

to the reluctance of developed countries to provide financial assistance for the production of DDT as well as the reluctance of developing countries to use the chemical.

By changing the worldwide perception of DDT, the altered purpose would encourage countries that need the chemical for public health purposes to apply for exemptions and continue to use it. An international ban on the production of DDT, such as the Stockholm Convention advocates, will result in a decrease in the supply of DDT as well as a concomitant increase in price.[226] Without such a ban on production, an adequate supply of DDT will exist to fulfill the demand for it and DDT will therefore remain accessible to countries that need it. Moreover, the supply will remain at an affordable price for developing countries, a necessary characteristic considering the poverty that prevails in the vast majority of countries that require DDT.[227]

While some prudence in the use of DDT is advisable, even admirable, it should not induce countries to abandon the method most able to treat the health crisis. Resisting complete elimination of the DDT supply will ensure that in public health emergencies, the most effective and efficient method of treatment will be available so as to limit malaria's deleterious effects. If the international community does not ban DDT, and thus tacitly approves of its use, that use will continue where it is necessary. Only through preventing the spread of malaria can the epidemic be controlled; that prevention will be achieved by the continued use of DDT.[228] While the Convention currently allows countries to use the chemical for such public health purposes, the infusion of the goal of elimination of DDT throughout the Convention is too restrictive. The addition of an amendment to abolish the goal of elimination of DDT will maintain a preference for the discontinuation of DDT use, but will recognize that total elimination is an unrealistic, and ultimately undesirable, goal.

The Convention should also be altered to make the requirements for receiving an exemption for DDT use easier to obtain.[229] Making the requirements easier will encourage countries that need the chemical to combat malaria to apply for and be granted exemption to use DDT, and thus make the countries more able to eradicate malaria quickly and more effectively. The current requirements of the Convention burden the governments of developing countries with excessive reporting and bureaucratic requirements.[230] Altering the

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226. Attaran et al., *supra* note 89.

227. *See* Morriss & Meiners, *supra* note 2, at 2 (explaining that the countries malaria most affects cannot afford expensive treatment alternatives).

228. WHO Press Release, *supra* note 27.

229. *See* discussion *supra* Part III.C.

230. *See* Mulliken et al., *supra* note 1, at 7 (noting that such obligations "could be very burdensome for poor countries, such as Eritrea and Mozambique, that are

Convention's requirements will ensure that the decision on whether and when to use DDT is not removed from public health experts and scientists in developing countries.[231]

Experts in developing countries need the majority of the discretion in the use of DDT because they are better able to understand and evaluate their need for DDT as they confront the realities and consequences of the malaria epidemic on a daily basis. The absence of the malaria epidemic in developed countries contributes to their reluctance to advocate DDT's continued use;[232] because the problem is not visible in those developed countries, the countries' representatives cannot fully comprehend the pervasiveness and gravity of the disease, and thus do not fully comprehend the need for DDT.[233] Easing the requirements for exemption and returning more control to experts in developing countries will increase the likelihood that DDT is available where needed,[234] and will therefore address developing countries' interests in the regulation of DDT.

Although DDT use should be permitted, that use cannot be unconstrained. The Stockholm Convention's limit on the use of DDT for public health purposes only, specifically to combat malaria, should be maintained. This limit will promote the interest of developed countries, as it will ensure DDT is only used where absolutely necessary, for the singular purpose of malaria prevention. Because IRS programs for malaria prevention use only small amounts of DDT, global pollution from the toxin will be minimal. Adding a provision to the Convention punishing countries for non-compliance with the limited-use provisions will help guarantee that the limitations are abided by, and the chemical is only minimally used. Consequences should be carefully drafted so as to most effectively persuade countries to fulfill their obligations, but not deter them from committing to the Convention. Constraining the use of DDT to malaria prevention, along with enforcement of the constraint, will further the interest of developed countries in eliminating secondary effects of the chemical.

These changes to the Stockholm Convention will better reconcile the needs of developed and developing countries in the regulation of DDT. It will acknowledge developing countries' need for continued

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struggling to rebuild after civil wars and may have other far more urgent national priorities than complying with the standards of the international bureaucracy").

231. *Id.*

232. *See* Rosenberg, *supra* note 33 (explaining that "[m]alaria is a disease Westerners no longer have to think about.").

233. *Id.*

234. This requirement is thus derived from a concern that the Stockholm Convention, as it exists, is so restrictive that countries that actually need DDT will not use it, perpetuating the malaria outbreaks. It therefore speaks to ensuring a minimal use of DDT, a goal that is inherently different (though not inapposite) to the goal of the Stockholm Convention.

use of the chemical because of its inimitable effectiveness in combating malaria, and ensure that DDT is available for that purpose. It will also recognize developed countries' interests in diminishing the use of DDT so as to minimize global pollution.

V. CONCLUSION

The regulation of DDT is a difficult problem because it necessitates choosing between two evils—harm to the environment or loss of human life. Moreover, the choice can only be made upon a prioritization of inherently invaluable alternatives, as neither human lives nor the environment can be appropriately quantified. Thus, the choice will ultimately result in the acceptance of some certain harm, and any regulation will necessarily involve negative consequences from accepting that harm. This Note has argued that the choice also involves reconciling the interests of developed countries and developing countries. Although the Stockholm Convention attempts to reconcile the need for DDT and the need to eliminate DDT, it is ultimately ineffective. The deficiencies of the Stockholm Convention suggest an alternative solution. The Convention should be amended to eradicate the ultimate goal of a global ban of DDT, and instead explicitly acknowledge the need for DDT to combat malaria. Additionally, the Treaty should be amended to make qualifying for an exemption to use DDT easier. The continued use of DDT is justified given a balancing of its benefits against its costs. The immediacy of the benefits of DDT warrants allowing countries to continue to use the chemical for limited health purposes, even at some potential cost to the environment.

The interests of developed and developing countries—while distinguishable—are not incompatible. Controlling malaria, while a more pressing concern for developing countries, also helps developed countries—by reducing the chances of the disease spreading to currently-eradicated areas and by preventing loss of life generally. And protecting the environment and human health from the effects of DDT, while a more evident interest of developed countries, is also an interest of developing countries—for they too suffer the negative consequences of the chemical's pollution. A more efficient and effective method of regulating, rather than banning, DDT will therefore be mutually beneficial, and help solve two pressing concerns in the world today.

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