Applying the Precautionary Principle to DDT

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Summary

The precautionary principle has been invoked to justify a worldwide ban on DDT. However, this justification is based upon a selective application of the principle so that such a ban gets credit for any potential public health and environmental risks it might reduce but no discredit for any risks it might generate for human mortality or morbidity (due to increased malaria incidence caused by cessation of DDT use). Previously I have developed a framework for applying the precautionary principle in order to help devise precautionary policies in situations where an action–similar to a ban on DDT–simultaneously results in uncertain benefits as well as uncertain harm to public health and/or the environment. Here, as an experiment, I apply this framework to a policy which would ban DDT. This experiment reveals that such a one-size-fits-all global policy, despite its claim to be precautionary, would, in fact, be incautious since it is likely to add to the numbers of malaria deaths that would occur otherwise. Specifically, the experiment indicates that under a precautionary approach, it makes sense to have a two-tiered approach toward DDT such that the policy for countries where malaria has been eradicated is different from that in countries where malaria is still prevalent. Thus, in developed countries, a ban on DDT makes precautionary sense. On the other hand, in countries where malaria is an ongoing threat, indoor spraying of DDT ought to be encouraged, until it is phased out automatically if and when equally safe and cost-effective substitutes are available and have been accepted by the beneficiaries of indoor spraying in the developing world.

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Introduction

A popular formulation of the precautionary principle is that contained in the Wingspread Declaration (Raffensperger and Tickner 1999: 8): "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not established scientifically."

But, as noted elsewhere, the Wingspread Declaration's version of the precautionary principle offers no guidance in instances where a measure ostensibly designed to forestall uncertain public health and environmental problems might itself add to the world's health and environmental burden thereby offsetting, if not negating, the presumed benefits of that measure (Goklany 2000a, 2000b).

In earlier papers, I have presented a framework to resolve such dilemmas resulting from the application of the precautionary principle, and applied it to specific issues such as a ban on genetically modified crops and greenhouse gas emission reductions (Goklany 2000a, 2000b, 2000c). Here, I propose to employ the same framework to investigate whether it would be prudent to ban DDT usage worldwide. I will, in effect, undertake a qualitative risk-risk analysis where I will compare the risk of a global ban on DDT against the risk of not imposing such a ban. I will also undertake a risk-risk analysis for adopting different policies for different areas of the world depending on whether or not malaria is prevalent in those areas. Before launching on these analyses, I will first recapitulate the framework before applying it to a ban on DDT.

A Framework for Applying the Precautionary Principle Under Competing Uncertainties

Few actions are either unmitigated disasters or generate unadulterated benefits, and certainty in science is the exception rather than the rule. How, then, do we formulate precautionary policies in situations where an action could simultaneously lead to uncertain benefits and uncertain harms? Before applying the precautionary principle, it is necessary to formulate hierarchical criteria on how to rank various threats based upon their characteristics and the degree of certainty attached to them. Consequently, I offer six criteria to construct a precautionary "framework."

The first of these criteria is the *public health criterion*. Under this criterion, removal of threats to human health should take precedence over removal of threats to the environment. In particular, the threat of death to any human being outweighs similar threats to members of other species.

However, in instances where an action under consideration results in both potential benefits and potential harm to public health, additional criteria have to be brought into play. These additional criteria are also valid for cases where the action under consideration results in positive as well as negative environmental impacts unrelated to public health. I identify five such criteria as follows:

- *The immediacy criterion*. All else being equal, reducing more immediate threats should be given priority over reducing threats that could occur later. Support for this criterion can be found in the fact that people tend to partially discount the value of human lives that might be lost in the more distant future (Cropper and Portney 1992). While some may question whether such discounting may be ethical, it may be justified on the grounds that if death does not come immediately, with greater knowledge and technology, methods may be found in the future to deal with conditions that would otherwise be fatal which, in turn, may postpone death even longer. For instance, U.S. deaths due to AIDS/HIV dropped from a high of 43,115 in 1995 to 13,426 in 1998 (CDC 2000). Thus if an HIV-positive person in the United States did not succumb to AIDS in 1995, because of the advances in medicine there was a greater likelihood in 1998 that he would live out his “normal” life span. Thus, it would be reasonable to put greater effort into reducing premature deaths that occur sooner. This is related to, but distinct from, the adaptation criterion noted below.

- *The uncertainty criterion*. Threats of harm that are more certain (have higher probabilities of occurrence) should take precedence over those that are less certain if otherwise their consequences would be equivalent. (I will, in this study, be silent on how equivalency should be determined for different kinds of threats.)
- *The expectation value criterion*. For threats that are equally certain, precedence should be given to those that have a higher expectation value. An action resulting in fewer expected deaths is preferred over one that would result in a larger number of expected deaths (assuming that the “quality of lives saved” are equivalent). Similarly, if an action poses a greater risk to biodiversity than inaction, the latter ought to be favored.
- *The adaptation criterion*. If technologies are available to cope with, or adapt to, the adverse consequences of an impact, then that impact can be discounted to the extent that the threat can be nullified.
- *The irreversibility criterion*. Greater priority should be given to adverse outcomes that are irreversible, or likely to be more persistent.

In the following pages I first will outline the potential benefits and harm to public health due to a global ban on DDT use. I will then use the relevant criteria to determine the appropriate policy regarding DDT pursuant to a comprehensive application of the precautionary principle.

The Public Health Risks of Banning DDT

Whether a ban on DDT adds to the public health risk in an area depends on whether or not malaria is prevalent in that area. The global death rate due to malaria was 18 per 100,000 in 1998, down from 194 per 100,000 in 1900 (WHO 1999a). This more than 10-fold reduction is due to better nutrition, new drugs, draining and filling of wetlands (swamps and marshes), insecticide-impregnated mosquito nets and spraying of insecticides (particularly DDT) inside homes. Despite these per capita reductions, each year over a million people die from malaria. The vast majority of this death toll occurs in developing countries since malaria–thanks partly to DDT–has, for practical purposes, been almost completely eradicated in the developed world.

There is good evidence that, despite build-up of any mosquito resistance to DDT, the global death toll would be higher if in-home spraying of DDT where malaria is currently endemic were to be discontinued worldwide. First, DDT combats malaria through three separate mechanisms (Attaran et al. 2000). Studies find that indoor DDT spraying repels mosquitoes, and significantly fewer mosquitoes venture into houses that have been sprayed with DDT. In a study by Grieco et al. (2000), 97 percent fewer mosquitoes entered a DDT-sprayed hut compared to unsprayed huts. By contrast, compared to the unsprayed huts, 66 percent fewer mosquitoes entered the one sprayed with deltamethrin, a pyrethroid touted as a substitute for DDT (Raloff 2000). In other words, 11 times as many mosquitoes entered the deltamethrin-sprayed hut as entered the DDT-sprayed hut. This suggests that if in the long run mosquitoes develop resistance to both DDT and deltamethrin, the former is likely to be more effective in controlling malaria.

If despite DDT's repellency, mosquitoes come into contact with DDT, it acts as an irritant which drives them away, sometimes even before they bite (Raloff 2000). And if they are not driven away, its toxicity can kill them. Developing resistance only affects the last of these mechanisms. Based on a probability model of mosquito behavior, Roberts et al. (2000a) suggest that the combined effect of DDT repellancy and irritability dominates over its toxicity in reducing malaria. According to their model, toxicity accounted for less than 10 percent of DDT's effectiveness for three species [*Anopheles darlingi* (Ituxi River), *A. gambiae* (Tanzania), *A. punctulatus* (Irian Jaya)], less than 40 percent for *A. darlingi* (Suriname), and less than 20 percent for *A. funestus* (Tanzania).

The first two mechanisms (i.e., repellency and irritancy) for reducing exposure to carriers of malaria parasites are important for another reason, namely, some species are becoming resistant to some of the pesticides which are themselves used as DDT substitutes. For example, *A. funestus* in South Africa seems to have increased resistance to pyrethroids (Raloff 2000, Bate 2000).

Second, resistance to DDT is still limited to certain species of anopheles mosquitoes in some locations (Roberts et al. 2000b, Bate 2000).

More importantly, alternatives to DDT, even if available, do not necessarily lead to equivalent reductions in malaria incidence if the alternatives are more expensive because cost is an important factor in developing countries. Attaran et al. (2000) note that if India switched from DDT to malathion, the next cheapest option, the number of people at high risk of contracting malaria who would not be protected would increase by 71 million (equivalent to 25 percent of the entire U.S. population), assuming level funding. Raloff (2000) reported that deltamethrin, which costs three to four times as much as DDT, now consumes 89 percent of Belize's malaria control budget, which starves funds from surveillance, elimination of mosquito breeding grounds, or even malaria treatment. The additional cost, while it may seem trivial to inhabitants of the developed countries, is very significant in developing countries where the average household spends more than 50 percent of its income for the most basic of necessities: food (Meade and Rosen 1996). For instance, the average Nepalese family, with a per capita income of $220 per year (at market exchange rates; World Bank 2000), spends 63 percent of its budget on food (Kathmandu Post 2000). This means very little is left over for other basic necessities such as shelter, clothing, education and health. In India, for instance, the average per capita health expenditure is $10 per year (McNeil 2000)–-the price in the U.S. of less than half a year's supply of vitamin supplements. Of that $10, $3.50 is spent on drugs (McNeil 2000). Not surprisingly, governments in developing countries have to weigh costs and cost-effectiveness very carefully before selecting the types and extent of public health measures that they implement.

Given the higher costs and, possibly, the greater efficacy of DDT, it is not surprising that despite the theoretical availability of substitutes, malaria rebounded in many poor areas where (and when) DDT usage was discontinued (WHO 1999a; Roberts 1999, Roberts et al. 1997, Sharma 1996, Whelan 1992, Guarda et al. 1999, Bate 2000). For instance, malaria incidences in Sri

Lanka (Ceylon) dropped from 2.8 million in the 1940s to less than 20 in 1963 (WHO 1999a, Whelan 1992). DDT spraying was stopped in 1964, and by 1969 the number of cases had grown to 2.5 million. Similarly, malaria was nearly eradicated in India in the early 1960s, and its resurgence coincided with shortages in DDT (Sharma 1996). The population at high- to medium-risk of contracting malaria in Colombia and Peru doubled between 1996 and 1997 (Roberts et al. 2000b). Malaria has also reappeared in several other areas where it had previously been suppressed, if not eradicated (e.g., Madagascar, Swaziland, the two Koreas, Armenia, Azerbaijan, Turkmenistan; Roberts et al. 2000b, and references therein). Similarly, Roberts et al. (1997) showed that Latin American countries (e.g., Ecuador, Belize, Guyana, Bolivia, Paraguay, Brazil and Venezuela) which had discontinued or decreased spraying of DDT inside homes saw malaria rates increase. Guarda et al. (1999) also note that in 1988, when DDT use was discontinued, there were no cases of *Plasmodium falciparium* reported in Loreto, Peru. The number of cases increased to 140 in 1991. By 1997, there were over 54,000 cases and 85 deaths (see, also, Goklany 2000c).

But the best argument for indoor-spraying of DDT is that in many areas where malaria experienced a resurgence, reinstating DDT use once again led to declines in malaria cases. For example, Ecuador, which had previously seen its malaria rates rebound once DDT spraying had been reduced, saw those rates decline once again by 61 percent since 1993, when DDT use was increased again (Roberts et al. 1997). The same cycle occurred in Madagascar where the malaria epidemic of 1984-86, which occurred after the suspension of DDT use, killed 100,000 people. After two annual cycles of DDT spraying, malaria incidence declined 90 percent (Roberts et al. 2000b).

These examples also indicate that banning DDT would not only increase mortality and morbidity due to malaria, but that these increases would occur relatively rapidly.

Also, a recent study (Whitworth et al. 2000) raises the worrying possibility of interactions between HIV-1 and malaria. Their study showed that HIV-1 infection is associated with increased prevalence and intensity of *P. falciparum* infection in adults with acquired immunity to malaria, and that it might also be associated with increased incidence of clinical malaria [see Taylor and Hoffman's (2000) commentary on the Whitworth study]. Given the prevalence of both HIV and malaria in Africa and that dealing with the former is costlier and much more difficult, this study reinforces the need for reducing exposure to malaria carriers.

Finally, DDT used for malaria control can also be effective in reducing other mosquito-borne diseases such as leishmaniasis, dengue, and yellow fever (Davies et al. 1994, Severo 1955).

The Public Health Risks of Not Banning DDT

Some studies have suggested that contact with or ingesting DDT could contribute to several ailments such as breast cancer, multiple myeloma, hepatic cancer and non-Hodgkin lymphoma. However, these effects have not been confirmed despite several efforts to replicate the studies (Attaran et al. 2000, Smith 2000). Smith (1991) notes, for instance, that there is no doubt that DDT causes changes in livers of various types of rodents and tumors, but not in some other animals, and that it is not clear how that relates to carcinoma in humans.

Other studies suggest that DDT may interfere with maternal lactation. Similarly it has been suggested that DDT exposure in the uterus or in perinatal stages could have subtle effects on a child's development. While these studies have been questioned, it is perhaps more significant for our purpose here that it is unclear what effect this might have on public health. (Smith 2000). The fact that these effects are disputed indicates that even if they are real, they are most probably not of the same order of magnitude as either the 300 million malaria cases or the 1.1 million estimated deaths due to malaria in 1999 and/or they are delayed (WHO 1999a).

There are good reasons, with respect to evaluating the impacts of a future ban on DDT use, to question the relevance of historical epidemiological information regarding DDT's negative public health impacts. Notably, much of the DDT in aquatic and avian species which has found its way into human tissue is the result, not of indoor-DDT spraying, but of past spraying for agricultural pest control. But because agricultural spraying has been largely discontinued worldwide and many countries who no longer have a major malaria problem have banned DDT, DDT use has dropped dramatically in the last few decades despite the absence of a global ban. Attaran et al. (2000) estimate that Guyana's entire population at high-risk of contracting malaria could be protected by the amount of DDT needed to spray 0.4 square kilometres of cotton. Not surprisingly, global DDT consumption, which had averaged 68,800 tonnes per year between 1971 and 1981, had declined over 95 percent by 1990 to 2,800 tonnes (Pesticide Action Network, undated). Equally importantly, indoor spraying has been estimated to have only 0.04 percent of the environmental impact as spraying an equivalent amount of DDT on agricultural fields (Attaran et al. 2000).

Because of the combination of reduced usage and lower environmental impacts from indoor spraying as compared to agricultural use, levels of DDT and its metabolites have been dropping in human and wildlife species for the past several decades. For instance, in the U.S., DDT and related compounds declined 65 percent between 1971 and 1984 in national samples of freshwater fish (Schmitt et al. 1990). Between 1980-88, DDT in fall run coho salmon declined 40 and 60 percent in Lakes Erie and Michigan, respectively (CEQ 1992). Between 1966 and 1985, levels of DDE, a derivative of DDT, in waterfowl dropped from 0.70 to 0.09 ppm in the Atlantic flyway, from 0.65 to 0.05 ppm in the Pacific flyway, and from 0.15 and 0.25 ppm to below detection levels in the Mississippi and Central flyways (CEQ 1993). And between 1974 and 1996, DDE levels in herring gull eggs from colonies in the five North American Great Lakes declined 85 to 93 percent (CEQ 1999).

Similarly, between the 1960s and 1990s, studies on various aquatic and avian species in the Baltic show that total DDT (including its metabolites) declined 8-12 percent per year for herring and cod, and 11 percent per year in guillemot eggs (Olsson et al. 2000; Skei et al. 2000).

Perhaps most importantly, DDT in human adipose tissue dropped by 80 percent between 1970 and 1983 (USBOC 1987). Similarly, o,p'- and p,p'- DDT concentrations declined from 1.066 mg/kg of human adipose tissue to 0.066 mg/kg in Canadian citizens (UNEP/GEMS 1991). DDT concentrations in similar tissue also dropped by an order of magnitude in the Netherlands. Finally, based on a review of about a hundred studies, Smith (1999) concludes that DDT levels in human breast milk declined 11 to 21 percent per year in the U.S. and Canada since 1975, and between 9 and 13 percent per year in Western Europe. Notably, Smith's analysis suggests that DDT levels in human breast milk have also declined substantially since the early- to mid-1970s in parts of Asia/Middle East, Latin America and Eastern Europe, although data for these regions are more sparse.

All these trends suggest that the public health benefits of a future global ban on DDT would be even smaller than the putative impacts of past DDT use outlined above.

Applying the Framework to Public Health Impacts of a DDT Ban

Applying the Precautionary Principle for Developing Countries

In order to establish whether or not the precautionary principle supports a particular course of action it is necessary to use the framework presented previously to evaluate and weigh the risks that might be reduced–as well as those that might be generated–directly or indirectly by the implementation of that action.

In the foregoing we saw that malaria strikes 300 million people and kills over a million people each year, that indoor DDT spraying has proven to be a very successful method of containing malaria, and that its effectiveness under real world conditions (where costs and ease of use are critical) is often not matched by other theoretically available methods of malaria control. Thus banning DDT would almost certainly increase the number of malaria cases and associated deaths beyond what would otherwise occur. These effects would, based on historical experience, be manifested relatively soon after an effective ban is put in place. Even a small increase (say 5 percent) in these numbers would over a short period (say, ten years) translate into 150 million additional cases and 550,000 deaths.

By contrast, the public health consequences of continuing or expanding indoor spraying of DDT are uncertain and, if they occur at all, delayed. Thus, in terms of reducing risks to public health, a global ban on DDT will almost certainly be counterproductive. Applying the human mortality, uncertainty and immediacy criteria to the public health impacts of banning DDT, one must conclude that the precautionary principle requires that indoor spraying of DDT use should be continued– and even encouraged–in developing countries where malaria continues to be a problem and where it can be reduced by such spraying, at least until equally cost-effective methods of controlling malaria are generally available.

If, and when, equally effective but cheaper options become available, become public knowledge, and are generally accepted as such by potential malaria victims and their public health officials, the marketplace will almost inevitably drive out DDT. (Why should any one want to use an inferior product which, moreover, is not cost-effective?) By the same token, if malaria-carrying mosquitoes become sufficiently resistant to DDT to the extent that its use would no longer be cost-effective (compared to other options), economics, once again, would automatically phase out DDT use. Thus, it is superfluous to require that indoor spraying of DDT be phased out once cost-effective alternatives become available. In fact, if the goal is to phase out DDT as soon as possible and without any counterproductive increases in human mortality, we should bolster programs to: (a) research and develop safer and more cost-effective alternatives to DDT, (b) constantly monitor and evaluate the effectiveness and impacts of DDT and potential substitutes, and (c) disseminate such cost-effectiveness and impacts-related information accurately to the general public and public health authorities in areas where malaria is or could become a problem.

It might be argued that for DDT, the immediacy criterion may be invalid and overruled by the irreversibility criterion because–over time–DDT accumulation in the environment may lead to irreversible environmental harm. There are two counters to this. First, the death of a human being is equally irreversible, and more heinous than the death of a bird, for instance. That is, there is no moral equivalency between these two outcomes.

Second, the experience of developed countries which have banned DDT indicate that its most critical adverse environmental effects–the declines in species such as the bald eagle, the peregrine falcon, and the osprey–are reversible, albeit slowly. Thus, in the U.S., a quarter century after the ban on DDT, these avian species were no longer endangered (EDF 1997, Goklany 1998). These improvements are in accordance with the previously-noted trends in DDT and its metabolites (e.g., DDE) in various fish and bird species which are now a fraction of what they used to be (see, also, National Research Council 1999; Goklany 1994, 1996, 1998). In other words, the experience of the developed world indicates that major environmental problems due to DDT can eventually correct themselves.

It has also been argued that DDT use should be discontinued because mosquitoes may develop resistance to it. But, as noted, the development of such resistance disables only one of the three pathways by which DDT acts to reduce malaria transmission. Morever, as noted above, mosquitoes may also develop resistance to chemicals used to substitute for DDT, e.g., pyrethroids. Also, if DDT is not used, what difference does it make whether mosquitoes develop any resistance? It makes more sense to use DDT until its use ceases to be cost-effective, for whatever reason (whether due to the buildup of resistance or availability of more cost-effective alternatives). In fact, DDT's use buys time during which better alternatives can be developed and perfected while, in the meantime, reducing human mortality.

Because of the efficacy of DDT in containing malaria, it can be argued that it is critical that the development of DDT resistance among malaria carriers be slowed down as much as possible. Therefore DDT uses other than indoor spraying should be discouraged where such spraying will contain malaria. Such a policy would be entirely consistent with the precautionary principle.

The improved health of the population due to reductions in malaria incidence will, in turn, have other indirect benefits for human well-being. First, a healthier population is more productive because it can devote more time and energy to economic pursuits (World Bank 1993, Barro 1997, WHO 1999a, Bloom 1999). Easterlin (1996), based on a United Nations study, notes that when malaria was eradicated, in Mymensingh (now in Bangladesh), crop yields increased 15 percent because farmers could spend more time and energy on cultivation. In other areas, elimination of seasonal malaria enabled farmers to plant a second crop. Similarly, according to the World Bank (1993, 18), the near-eradication of malaria in Sri Lanka between 1947 and 1977 is estimated to have raised its national income by 9 percent. A joint study by the Harvard University Center for International Development and the London School of Hygiene and Tropical Medicine that if malaria had been eradicated in 1965, Africa's GDP would have been 32 percent higher today (*Guardian* 2000, HUCID and LSHTM 2000).

While healthier is wealthier, so is wealthier healthier (Pritchett and Summers 1996, Goklany 2000d). Cross country data show that infant mortality and life expectancy (surrogates for health, as well as critical indicators of human well-being in their own right) improve as the level of economic development increases (see Figure 1 and 2; Goklany 2000b).* In fact, wealth and health reinforce each other in a virtuous cycle of progress (Goklany 2000d).

A healthier, wealthier and longer-lived population is also more likely to invest time, money, and effort to more fully develop its human capital which, then, aids in the creation and diffusion of technology. In turn, that accelerates economic growth (Barro 1997, Goklany 2000d). Moreover, greater education, particularly of women, has been found to be an important factor in reducing mortality rates and improving public health. Also, the increase in life expectancy encourages greater investment in human capital (Goklany 2000d). Expected benefits to individuals, families and societies of investing in higher education, post-doctoral research fellowships and residencies increase significantly if individuals are anticipated to live to sixty rather than a mere thirty or so, as was the case, for instance, in India in the 1920s (Simon 2000). Thus, it is not surprising that levels of education have gone up with life expectancy or that more and more aspiring researchers today spend what in another day and age literally used to be a lifetime to acquire skills and expertise necessary to pursue specialized careers in medicine, research and institutes of higher learning. And once having acquired these skills, these individuals are poised to help others come along the same path. Thus human capital breeds additional human capital, which further improves public health and strengthens economic growth.

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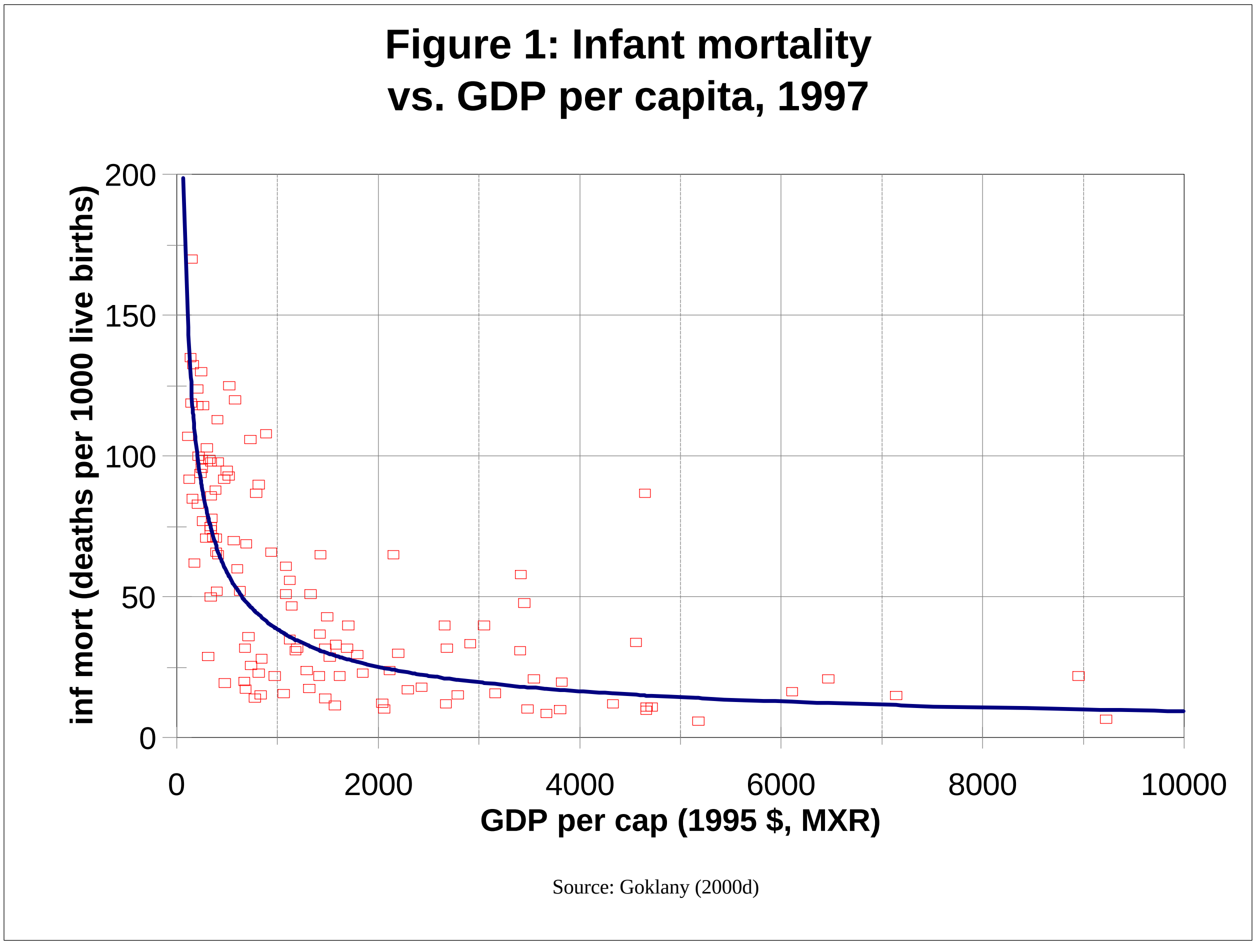
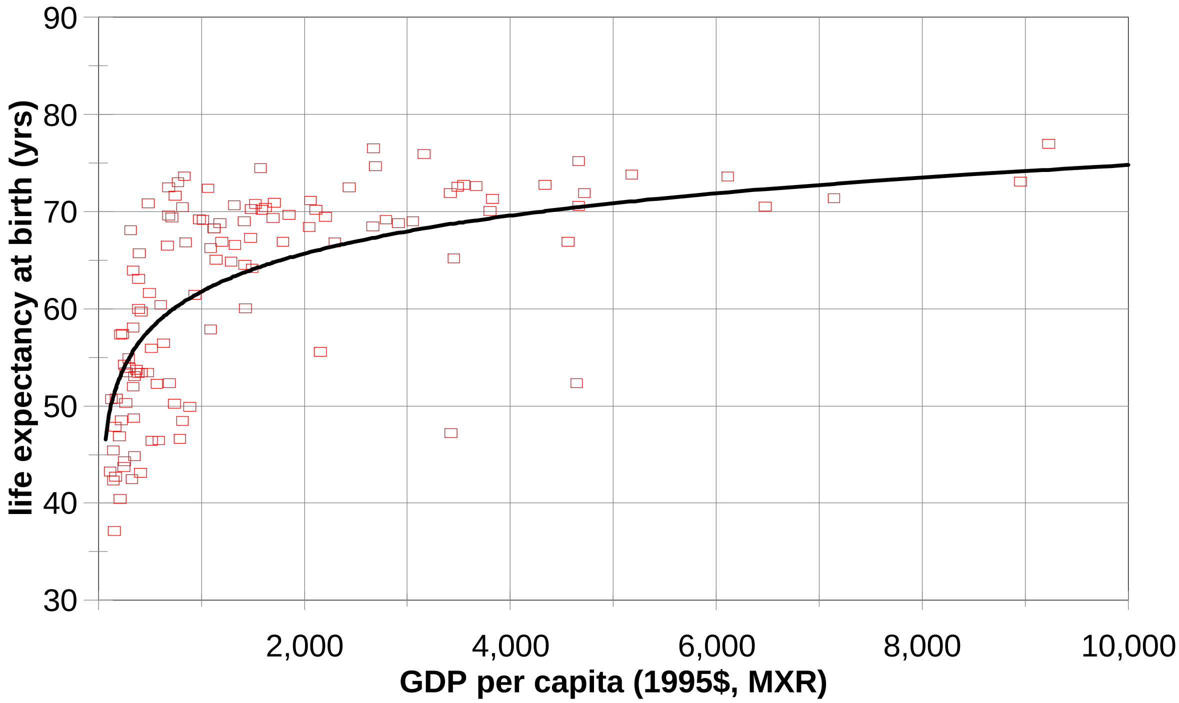
* Figures 1 and 2 are from Goklany (2000b). Economic development is measured as GDP per capita in 1995 U.S. dollars using market exchange rates (MXR).The continuous line in Figure 1 is fitted using a log-log relationship. For Figure 1, N and R^2 were 147 and 0.79, respectively. The slope of log (infant mortality) against log (GDP per capita) is significant ($p < 0.001$). For Figure 2, N = 148 and $R^2 = 0.65$. The continuous line is fitted using a log-linear relationship The slope of life expectancy against log (GDP per capita) is also significant ($p < 0.001$). In both Figures, the x-axis scale is cut off at $10,000 per capita to better illustrate the dependence of infant mortality and life expectancy at low levels of economic development.



Source: Goklany (2000d)

Figure 2: Life Expectancy vs. GDP per Capita, 1997



Source: Goklany (2000d)

In addition, as noted in greater detail elsewhere, increases in the level of economic development help countries move through their environmental transitions, which ultimately leads to a cleaner environment (Goklany 1995, 1998, 1999a). The environmental transition may well help account for the level of concern in developed countries over DDT despite the fact that the most significant of their DDT-related environmental problems seem to be correcting themselves. Moreover, low fertility rates, i.e., low birth rates, are correlated with high levels of economic development, which too might help improve environmental quality (Goklany 1995, 1998, 1999b).

Applying the Precautionary Principle for Developed Countries

Although malaria once was prevalent in many of the richer countries, these countries have virtually no incidences of malaria today. DDT contributed significantly to the eradication of malaria in many of these countries including the U.S. (Zucker 1996, Bate 2000). However, today DDT plays virtually no role in reducing human mortality and improving public health in the developed countries. And if it did, these countries could afford equally safe and effective substitutes, despite any extra cost. Therefore the major impact of DDT use in the richer countries would be its potential negative impacts on the environment and, more speculatively, on human health (NRC 1999). Thus, a ban on DDT in the richer countries–which most of them have, in fact, instituted–might be justified under a precautionary principle.

Applying the Precautionary Principle Worldwide

The above discussion indicates that prohibiting DDT use worldwide would most likely lead to substantial net increases in death and disease. This is because the net harm caused by such a ban in the developing countries far outweighs its net benefits to the developed world. Those harms are greater in magnitude, more certain and are likely to occur more rapidly than the benefits. Thus, under the precautionary principle, there ought not to be a global ban on DDT use.

However, we saw above that the precautionary principle supports vastly different policies when it is applied separately to developed countries and to developing countries where DDT use can reduce malaria's toll. Thus a uniform global policy to DDT with identical requirements for all countries will be sub-optimal, as are virtually all one-size-fit-all policies. However, if one insists on a uniform global policy, under a precautionary principle it must be one that encourages the indoor spraying of DDT.

Conclusion

The precautionary principle has been invoked to justify policies for a worldwide ban on DDT. However, these justifications are based upon a selective application of the precautionary principle which considers the risks that might be reduced by such a ban but ignores the far larger, more certain and more immediate risks that such a ban would inevitably bring in its wake. Specifically, these justifications overlook the likely outcome of a global DDT ban on human health and mortality in developing countries. Thus, contrary to claims that a global ban on DDT use is based on caution, it would, in fact, increase the disease burden and overall risks to public health worldwide. In turn, economic development in malaria endemic countries will continue to be adversely impacted.

An even-handed application of the precautionary principle which considers not only the public health and environmental risks that might be reduced by a global ban on DDT use, but also the risks that might be generated in the real world, argues for a substantially different policy. Specifically, the precautionary principle argues that DDT use should not be banned worldwide because it will surely increase death and disease in human beings. In fact, indoor spraying of DDT ought to be encouraged in countries where such spraying would diminish malaria incidence. Such spraying should continue so long as equally safe and cost-effective substitutes are unavailable. It should be discontinued only after "informed consent" for a suspension of DDT spraying has been obtained from the beneficiaries of such spraying, i.e., the populations at risk of contracting malaria.

In belated recognition of the public health benefits of DDT use in various developing countries, the idea has been advanced that a global ban should be postponed to 2007. But this too would be contrary to the precautionary approach. Under a postponement, there are only two possibilities in 2007. First, a cost-effective substitute is not found, in which instance the case for banning DDT use will be no stronger in 2007 than it is today. Second, a cost-effective substitute is indeed discovered, in which case economic considerations will prevail and use of DDT will be discontinued automatically. In either case there is little to be gained by writing a postponement into a legally binding international agreement. Instead of playing God with DDT and malaria by placing a deadline on global DDT use, it would be more fruitful to invest more heavily in research and development of alternative approaches to more cost-effectively combat malaria.

A better case can be made under the precautionary principle for a ban on DDT use in developed countries. However, a global ban will do little to further advance their public health or environmental quality. Developed countries have rid themselves of malaria and, if the need should ever arise, they can afford substitutes. Thus access to DDT is no longer critical to protect their public health. Not surprisingly, many have already banned DDT use. This has helped reduce the environmental impacts of DDT within their borders and, in fact, many of its worst impacts are being reversed, despite the absence of a global ban.

The likelihood that developing countries still in the grip of malaria have a lot to lose from a global ban on DDT whether it is immediate or postponed, and developed countries very little to gain, leads to the inexorable conclusion that in the policy calculus of many self-styled environmental groups in rich countries like Sweden, Denmark, Germany, U.K. and U.S., the lives of tens–if not hundreds of–thousands of lives in Asia, Africa and Latin America are not too high a price to pay for marginal environmental benefits in their countries.

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