Tulsa Law Review

Volume 28
Issue 4 *International Agriculture Symposium*

Summer 1993

NAFTA, Agricutlure, and the Environment

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NAFTA, AGRICULTURE, AND THE ENVIRONMENT*

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I. INTRODUCTION

The proposed North American Free Trade Agreement (NAFTA) promises to lead to significant changes in U.S.-Mexican agricultural trade. Barriers to trade in some products will be eliminated immediately, while trade in more politically sensitive areas will liberalized over a five, ten, or fifteen year period, depending on the commodity.[1] In some cases, to further cushion the adjustment to free trade, NAFTA also calls for "safeguard" import quotas that would increase over time. Imports below the safeguard would enter at the NAFTA tariff rate, while those above the safeguard would enter at the pre-NAFTA rate. A good example of where both a fifteen year transition and safeguard quotas will be employed is corn. The United States has a large competitive advantage over Mexico in corn, and there were great concerns about low-income Mexican corn growers being overwhelmed by U.S. producers in the absence of a long transition period. For wheat and soybeans, two other products where the United States has a clear competitive advantage, Mexican import restrictions will be liberalized over ten years.

On the U.S. side, the most sensitive products are fresh fruits and vegetables, particularly tomatoes. Competition from Mexico to supply

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1. NAFTA's agricultural provisions are described in detail in U.S. DEPARTMENT OF AGRICULTURE, NAFTA AGRICULTURE FACT SHEETS: COMMODITIES AND OTHER TOPICS (Sept. 1992) (Unpublished), and U.S. DEPARTMENT OF AGRICULTURE, PRELIMINARY ANALYSIS OF THE EFFECTS OF THE NORTH AMERICAN FREE TRADE AGREEMENT ON U.S. AGRICULTURAL COMMODITIES (Sept. 1992) (Unpublished). For a more general discussion, see Alan Barkema, *The North American Free Trade Agreement: What Is At Stake for U.S. Agriculture?*, 77 FED. RESERVE BANK OF KANSAS CITY ECON. REV., 1992, at 5-20.

fresh horticultural products is already intense, and could increase significantly under NAFTA. Liberalization periods for these products range from zero to fifteen years, depending on the crop and season of the year. As a rule, U.S. import tariffs will be phased out most quickly during those months of the year when few Mexican products are exported, and most slowly during the times when the bulk of Mexican exports to the United States occur. Other politically sensitive products for the U.S. that will be subject to long phase-outs of trade barriers include orange juice and sugar.

Environmental groups have leveled a number of charges against NAFTA. Many of them concern the possible migration of "dirty" industries from the United States to Mexico in an attempt to escape U.S. environmental regulations. There is a special concern about relocation of industries along the border area, which is already heavily polluted in many areas. In agriculture there are environmental concerns as well. Among other things, many environmental groups argue that fruit and vegetable production will be transferred from the United States, where standards on the handling and application of pesticides are strict, to Mexico, where they are weak. Not surprisingly, many other groups have jumped on the environmental bandwagon. Labor unions have discovered the virtues of being "green," as have horticultural producers in Florida and California.

The objective of this article is to analyze the potential impact of NAFTA on agriculture and the environment. This article focuses on fresh horticultural products. Aside from wheat, corn, and other grains, NAFTA's effects on agricultural production and trade are likely to be the greatest in this area.[2] In addition, environmental issues are the most visible for horticulture, at least in the eyes of many U.S. environmental groups and much of the U.S. public. Readers may recall the uproar that followed the airing of a *60 Minutes* piece in 1989 on possible health risks to children consuming apples treated with the pesticide Alar. Another noteworthy event from that year included the destruction of millions of dollars of produce from Chile, following the detection of poison in two Chilean grapes. U.S. public opinion surveys show that consumers view

2. Studies of potential impacts on U.S. and Mexican agricultural production and trade include David G. Abler & Daniel Pick, *NAFTA, Agriculture and the Environment in Mexico*, 75 AM. J. OF AGRIC. ECON. (forthcoming 1993); PETER S. LIAPIS ET AL., U.S. DEP'T. OF AGRICULTURE STAFF REPORT NO. 9212, MODELING PREFERENTIAL TRADING ARRANGEMENTS FOR THE AGRICULTURAL SECTOR: A U.S.-MEXICO EXAMPLE (1992); U.S. DEP'T. OF AGRICULTURE, AGRICULTURE IN A NORTH AMERICAN FREE TRADE AGREEMENT; ANALYSIS OF LIBERALIZING TRADE BETWEEN THE UNITED STATES AND MEXICO (Foreign Agricultural Economic Report No. 246) (1992).

pesticide residues as the second most serious threat to food safety, outranked only by spoilage.[3] The most significant fresh horticultural products, in terms of the value of U.S. imports from Mexico, are tomatoes, peppers, cucumbers, and melons.

II. KEY ENVIRONMENTAL ISSUES

There are three key environmental issues surrounding NAFTA and horticulture. The first involves pesticide residues on Mexican produce exported to the United States. Many U.S. environmental groups claim that Mexican pesticide regulations are lax, and that the additional Mexican exports expected under NAFTA will be tainted with unsafe pesticides. Not surprisingly, many U.S. horticultural producers agree, although their concern is more with the competitive advantage given to Mexican producers due to the perceived lax standards. Lifetime health risks per person from pesticide residues on food are generally recognized to be extremely small,[4] but these risks are multiplied by a population of millions of U.S. fresh produce consumers.

A comprehensive analysis of pesticide problems with Mexican produce found that violations of U.S. pesticide residue standards are low, (less than 5%), and not significantly different from other countries or from U.S.-produced horticultural goods.[5] Most violations involve a pesticide commonly used in the United States, but applied to a product in Mexico not approved by the U.S. Environmental Protection Agency (EPA). With a few exceptions, Mexican and U.S. pesticide tolerances are currently in agreement, and NAFTA calls for elimination of the remaining differences. Mexican grower associations have done much in the last five years to provide growers with more information about U.S. pesticide regulations. Nevertheless, there are concerns because of weaknesses in testing procedures used by the U.S. Food and Drug Administration (FDA) and because only about 1% of all imported produce is tested for pesticide residues.[6]

3. *See, e.g.*, FOOD MARKETING INSTITUTE, TRENDS 92: CONSUMER ATTITUDES & THE SUPERMARKET 1992 (1992).

4. WORLD HEALTH ORGANIZATION, PUBLIC HEALTH IMPACT OF PESTICIDES USED IN AGRICULTURE (1990).

5. MARK L. NEWMAN, PESTICIDE REGULATIONS AND THE NAFTA NEGOTIATIONS, NAFTA: EFFECTS ON AGRICULTURE, 1991, at 34-83; *see also* GENERAL ACCOUNTING OFFICE, FOOD SAFETY AND QUALITY: FIVE COUNTRIES' EFFORTS TO MEET U.S. REQUIREMENTS ON IMPORTED PRODUCE (GAO/RCED-90-55) (1990).

6. GENERAL ACCOUNTING OFFICE, PESTICIDE MONITORING: FDA'S AUTOMATED IMPORT INFORMATION SYSTEM IS INCOMPLETE (GAO/RCED-92-42) (1991) (indicating the figure is higher for Mexico).

The second environmental issue concerns pesticide poisonings of Mexican farm workers. Pesticide application practices in Mexico have often been criticized, and justifiably so.[7] There are few Mexican regulations on pesticide handling and use, and those that do exist are widely ignored. Workers hardly ever wear protective gear and are rarely given safety information. They generally cannot understand the information that they do receive because they are illiterate or the information is printed in English. There are no official statistics on pesticide poisonings in Mexico, which reflects the low priority assigned by the government to this problem. However, anecdotal evidence from a variety of areas indicates that pesticide poisonings are a serious problem. This is especially true in the northwest Mexican state of Sinaloa, which is Mexico's major horticultural exporter.[8] Sinaloa accounts for 50-60% of the total value of Mexican horticultural exports.

In California agriculture, where records on pesticide poisonings are kept, an estimated 1,500 pesticide-related illnesses occur annually.[9] Given that safety standards are much stricter in California than in Mexico, one would expect the problem to be significantly greater in Mexico. For the world as a whole, the World Health Organization estimates that up to 20,000 deaths and one million illnesses occur each year because of pesticide poisonings.[10] The vast majority of these occur in developing countries, and reflect unsafe pesticide handling, mixing, and application procedures.

The third environmental issue involves damages to the physical environment. This includes water pollution from fertilizers and pesticides, as well as two problems with irrigation systems known as waterlogging and salinization. Effects of water pollution on human health are uncertain and hard to quantify.[11] Nitrogen in fertilizer can produce nitrates,

7. *See* Sandra Archibald et al., Shared Markets, Shared Risks: Pesticides in Mexico and the U.S. (1991) (Unpublished, Project on U.S.-Mexico Relations, Stanford University); Agnus Wright, *Rethinking the Circle of Poison: The Politics of Pesticide Poisoning Among Mexican Farm Workers*, 51 LATIN AM. PERSP., 1986, at 26-59; Lane Simonian, *Pesticide Use in Mexico: Decades of Abuse*, 18 THE ECOLOGIST, 1988, at 82-87; and Lilia Albert, *Children and Pesticides in Mexico*, 9 J. OF PESTICIDE REFORM, 1989, at 2-4.

8. Wright, *supra* note 7. For statistics on the State of Sinaloa, *see* 4 ROBERTA L. COOK ET AL., IMPLICATIONS OF THE NORTH AMERICAN FREE TRADE AGREEMENT (NAFTA) FOR THE U.S. HORTICULTURAL SECTOR, NAFTA: EFFECTS ON AGRICULTURE 1-475 (1991) (containing statistics on the state of Sinoloa); *see also* Abler & Pick, *supra* note 2.

9. Archibald et al., *supra* note 7.

10. WORLD HEALTH ORGANIZATION, *supra* note 4.

11. K. P. CANTO ET AL., HEALTH EFFECTS OF AGRICHEMICALS IN GROUNDWATER: WHAT WE KNOW, AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION: EMERGING MANAGEMENT AND POLICY (1987).

which can be washed away from fields by rain or irrigation and eventually find their way to drinking water supplies. On rare occasions, nitrates have caused infants to become ill or die of methemoglobinemia (more commonly known as blue-baby syndrome). Nitrates are also suspected to cause cancer, especially stomach cancer, and non-Hodgkin's lymphoma, although the evidence is inconclusive and the magnitudes of these risks are unknown. Pesticide residues in drinking water have also been linked to cancer, although the evidence once again is not definitive. Several pesticides have been canceled by the EPA in recent years because of concerns about cancer and reproductive disorders. Pesticide residues have been found in human tissue in areas of heavy agricultural activity in Mexico.[12]

There is much stronger evidence linking pollution from fertilizers and pesticides to the death of aquatic life. In a process known as eutrophication, fertilizer washed from fields into surface waters stimulates algae growth, which blocks sunlight needed by aquatic vegetation. This loss in vegetation can then move up the food chain, leading to the death of economically important aquatic life. Pesticides can also be washed into water supplies, and can reach concentration levels sufficient to kill fish and other aquatic life. It has been alleged that shrimp catches off the coast of Sinaloa have declined significantly and that agricultural chemicals are the cause.[13] Shrimping is an economically important industry in Sinaloa. In the United States, about two million fish are killed annually by pollution from fertilizers and pesticides.[14]

Horticultural production for export in Mexico is almost entirely on irrigated land. Naturally, some water seeps into the ground from irrigation ditches and canals. In what is called waterlogging, this seepage can cause the subsoil water table to rise to the root zone of crops, killing them. The problem can be compounded by salinization, which occurs when waterlogging brings harmful salts to the surface. Tomatoes, for example, have a very low tolerance for salt. Salinization also occurs when salt is left behind as irrigation water evaporates. These are

12. Lilia Albert et al., *Organochlorine Pesticide Residues in Human Adipose Tissue in Mexico: Results of a Preliminary Study in Three Mexican Cities*, 35 ARCHIVES OF ENVTL. HEALTH, 1980, at 262-69; *see also* Keith A. Redetzke et al., *Organochlorine Pesticides in Adipose Tissue of Persons from Ciudad Juarez, Mexico*, 46 J. OF ENVTL. HEALTH, 1983, at 25-27. As a caveat, the pesticides here are organochlorines which are very persistent (i.e., slow to break down into more environmentally benign compounds). DDT, for example, is an organochlorine. Organochlorines are no longer used in Mexico on production of fruits and vegetables for export.

13. Wright, *supra* note 7; *see also* M. T. L. Rosales & R. L. Escalona, *Organochlorine Residues in Organisms of Two Different Lagoons of Northwest Mexico*, 30 BULL. OF ENVTL. CONTAMINATION AND TOXICOLOGY, 1983, at 456-63.

14. J. H. CLARK ET AL., ERODING SOILS: THE OFF-FARM IMPACTS (1985).

problems common to most irrigation systems, and are usually manageable, but may be reaching serious proportions in Sinaloa and other Mexican horticultural production regions.[15]

III. PROBABLE EFFECTS OF NAFTA

Unfortunately, NAFTA's probable effects on these environmental problems are far from clear. The most serious limitation on our ability to forecast NAFTA's effects is a real lack of knowledge about where things stand today. Agricultural data collected by the Mexican government, even on such basic variables as production, acreage, and prices received by farmers is reputed to be unreliable and, in many cases, very misleading. Few resources have been devoted by the Mexican Ministry of Agriculture, SARH (Secretaría de Agricultura y Recursos Hidrulicos), to the collection of data; additionally, the personnel assigned to this task have often been negligent. Consequently, serious analyses of Mexican horticulture have been based on data collected by private growers' associations, who market produce and therefore collect reliable data as a normal part of doing business.[16]

Nevertheless, Mexican horticultural exports could increase significantly under NAFTA. Current U.S. import tariffs are generally a small percentage of import value (around 5-10%), and, as a result, some studies conclude that NAFTA will have little effect.[17] However, horticultural crops are only a small percentage of irrigated acreage in the major Mexican production regions. For example, the figure for Sinaloa is about 8%. This could expand significantly at the expense of crops such as corn and wheat, which together account for over 45% of irrigated acreage in Sinaloa. This is especially true since NAFTA will significantly reduce producer prices of corn and wheat in Mexico. As a result, the author speculates that NAFTA will lead to about a 50% increase in horticultural acreage in Sinaloa and more than a 30% increase in supply.[18]

This additional production can be absorbed by U.S. consumers, or offset by lower production in the United States. The demand for horticultural goods in the United States is fairly price-inelastic,[19] which means

15. *See* LIAPIS ET AL., *supra* note 2.

16. *See, e.g.*, COOK, *supra* note 8; Abler & Pick, *supra* note 2. The most important growers' association is CAADES (Confederacion de Asociaciones Agricolas del Estado de Sinaloa). Officials at CAADES stress the validity of their data, as opposed to the government data.

17. *See* LIAPIS ET AL., *supra* note 2; COOK, *supra* note 8.

18. Abler & Pick, *supra* note 2.

19. K. S. HUANG, U.S. DEP'T. OF AGRICULTURE TECHNICAL BULL. NO. 1714, U.S. DEMAND FOR FOOD: A COMPLETE SYSTEM OF PRICE AND INCOME EFFECTS (1985).

that changes in price have little effect on consumption. This implies that additional Mexican horticultural supplies will not primarily be absorbed by consumers, since the lower prices caused by the increased supplies will not change consumption much. Rather, they will come at the expense of U.S. producers. Florida, which competes with Sinaloa for the winter fresh vegetable market, would appear to be most at risk. California, which markets its horticultural products during the summer and fall, faces less competitive threat. However, competition could increase from the states of Baja California Norte and Sonora.

To the extent that horticultural production is transferred from the U.S. to Mexico, NAFTA's environmental effects will partially depend on relative fertilizer and pesticide intensities in the two countries. Producing a ton of tomatoes in Mexico, rather than the United States, will entail more pesticide use in Mexico but less in the United States. In this regard, U.S. horticultural producers use significantly more chemicals than their Mexican counterparts. For example, fertilizer and pesticide expenditures are significantly higher in Florida than in Sinaloa, whether expenditures are measured on a per acre basis or a per ton of output basis.[20] To the extent that some land in Mexico is shifted to horticultural crops from other crops, NAFTA's environmental impacts will also partially depend on relative chemical intensities within Mexico. Unfortunately, while data on chemical usage on horticultural crops is reliably collected by growers' associations, chemical usage data for other crops are sparse and of dubious validity. Available data for Sinaloa suggests that horticultural crops are substantially more fertilizer-intensive than other irrigated crops.[21]

In the last ten years, interest in "sustainable" or "low-input" agriculture has grown. This is agriculture with few commercial fertilizers and pesticides, or none according to the extreme proponents of this idea.[22] Possible alternatives to insecticides include releasing insects that prey on crop-destroying insects, or releasing sterile insects to mate with fertile ones. One successful alternative to insecticides and herbicides is

20. Abler & Pick, *supra* note 2; COOK, *supra* note 8. Generally, there are large differences when expenditures are compared on a per acre basis. Because Sinaloan yields per acre are significantly below Florida yields, however, the differences narrow to some extent when expenditures are compared on a per ton of output basis.

21. Abler & Pick, *supra* note 2.

22. Alternatives to chemicals in horticultural production are discussed by Mark A. Bennett et al., *Integrated Crop Management*, 29 AM. VEGETABLE GROWER, Mar. 1991, at 48-49; B. Lamont, *More Production on Less Acreage*, 28 AM. VEGETABLE GROWER, Apr. 1990, at 58-62; May 1990, at 38-42; June 1990, at 41-51; and Philip E. Neary, *High-Input Sustainable Agriculture*, 28 AM. VEGETABLE GROWER, Mar. 1990, at 60-62.

plastic mulch, which limits growth in insects and weeds. However, the more far-fetched claims of "sustainable" agriculture proponents are not realistic. Unfortunately, there are no whole-scale, effective alternatives to fertilizers and pesticides at this time. For the foreseeable future, sustainable agriculture should be viewed more as an agenda for agricultural researchers than an agenda for policy makers. Thus, sustainable agriculture cannot be expected to solve environmental problems associated with NAFTA.

IV. THE ECONOMIC VALUE OF THE ENVIRONMENT

The discussion above indicates that NAFTA's environmental effects in horticulture will probably be negative for Mexico, but positive for the United States. Thus, should someone concerned with environmental issues be for or against NAFTA's provisions in this area? The answer depends on the value that people place on a clean environment in Mexico relative to the United States.

Some environmentalists maintain that the environment is unique and irreplaceable, and therefore no "price" can or should be assigned to it. This argument is typically used against policies that trade off environmental objectives against economic interests, such as the 1992 controversy surrounding logging in the western U.S. and the spotted owl. The argument is of no merit, however, because if taken literally it would make daily living impossible. Virtually every human activity, especially in modern societies, impinges on the environment in one way or another. In agriculture, as noted above, there are presently no realistic, large-scale alternatives to chemical fertilizers and pesticides.

Another argument sometimes heard is that environmental policies, by protecting the resources used in production of goods and services, actually promote economic objectives. In some parts of Africa, for example, the environment has become so deteriorated (through soil erosion and/or deforestation) that environmental protection would actually increase agricultural production. Examples like this are the exception, however. The strong language in which U.S. environmental legislation and regulations are often written fails to recognize the inevitable tradeoffs between environmental goals and other objectives.

In any event, the argument that no economic value can be placed on the environment does not help us in this case because two environmental objectives are pitted against each other. Consequently, some rule for comparison is necessary. NAFTA's environmental costs and benefits

must be weighed against each other using some common unit of measurement. The problem is that there generally are no markets where environmental goods are bought and sold. Thus, one cannot determine the value of a spotted owl in the same way as the value of a car or a house.

Economists have developed two broad sets of techniques for determining the economic value of the environment: revealed preference and contingent valuation. Revealed preference techniques attempt to infer the value that people place on the environment by looking at real-world decisions. For example, the economic value of a park depends on the value that people place on its scenic amenities. Even if entrance to the park is free, people are in essence paying anyway because it costs time and money to travel to the park. The amount that people pay, in time and money, for travel to the park is a measure of the economic value of the park's amenities.[23] In this example, people reveal their preferences for environmental goods by their actions.

Contingent valuation techniques, on the other hand, attempt to determine the value that people place on the environment by simply asking them, through surveys or experiments. People are typically asked what they would be willing to pay (in taxes, in higher prices for goods that they purchase, or in some other way) to have safer food, cleaner water, less polluted air, or some other environmental good. Relative to revealed preference techniques, contingent valuation has the advantage of providing direct answers. There is no need, for example, to statistically ferret out differences in wages across occupations due to risk of death from the many other factors that affect wages. Contingent valuation can also provide answers to questions that revealed preference techniques could never answer. For example, what is the value of a spotted owl in a forest not accessible by the general public?

The disadvantage of contingent valuation is that it is based on intentions expressed in hypothetical circumstances, rather than actions in real-world situations where people have something to lose by making a wrong choice. People may not think carefully about the survey questions, may not care about their answers, may give poor answers because the questions cover an unfamiliar topic, or may not answer the survey at all.

Nonetheless, all the evidence we have using either type of technique indicates that the environment is valued much more highly in the United

23. This is an example of the "travel cost" method of valuing the environment.

States than in Mexico. With respect to worker poisonings from pesticides, revealed preference considerations indicate that Mexican farm workers are much more willing to accept health risks than U.S. workers. Although Mexican workers are not well-informed about specific health risks from pesticides or safety measures, they are quite aware that exposure is unhealthy.[24] The fact that they permit exposure indicates that they view it as an acceptable price in exchange for employment. That is obviously not the case in the United States. The tragedy here is that the Mexican economy currently does not offer unskilled farm workers better employment opportunities elsewhere, or opportunities for acquiring skills that would lead to better jobs. Either of these would improve the negotiating position of those who remained farm workers, making the unenviable choice between health and a job unnecessary.

Costs to workers and society from pesticide poisonings in the United States and Mexico can also be compared by looking at wages for hired farm workers. This is because human health costs depend in part on foregone earnings from illness and death, which in turn depend on wages. Wages for hired workers on horticultural farms are currently about four dollars per day in Sinaloa, as opposed to about six per hour in Florida.[25] Even if we double the Sinaloan wage to reflect the greater purchasing power of a dollar in Sinaloa than in Florida (owing to a lower cost of living in Sinaloa), we are still left with a huge difference. Of course, a human life has an intrinsic value above and beyond a person's economic activities. Many people would therefore reject the idea that the "value" of a life is different between high- and low-wage areas.

Costs to society from water pollution from pesticides, another environmental concern associated with NAFTA, are undoubtedly much greater in the United States than in Mexico. The costs of illness and death once again depend on foregone earnings, which on average are significantly higher in the United States. Per capita national income in 1990 was about $2,500 in Mexico, as opposed to about $22,000 in the United States. Adjusting for the lower cost of living in Mexico than in the United States raises Mexican per capita income to about $6,000, which is significantly greater than $2,500 but still far less than $22,000.[26]

Contingent valuation techniques have also been used to assess the willingness of the U.S. public to pay for water quality. One study found

24. *See* Wright, *supra* note 7.

25. Florida wages are from SCOTT A. SMITH & TIMOTHY G. TAYLOR, PRODUCTION COSTS FOR SELECTED VEGETABLES IN FLORIDA, 1991-1992 (Florida Cooperative Extension Service Circular 1064) (1992). Sinaloa wages are from unpublished CAADES cost-of-production data.

26. These figures are from WORLD BANK, WORLD DEVELOPMENT REPORT 1992 (1992).

Cape Cod residents willing to pay $500 to $2,500 per household per year to protect water supplies from nitrate pollution.[27] Similar studies have not been done in Mexico, but the figures surely could not be this large because they would constitute a very high percentage of the typical household's income. As further indication of concern in the United States, several contingent valuation studies have found consumers willing to pay higher prices for pesticide-free produce.

The revealed preferences of society at large, as expressed by the choices of public policymakers, also suggest that the environment is valued significantly more in the United States than in Mexico. Studies of U.S. environmental policies over time, or environmental policies across countries over time, suggest that the environment is a luxury good.[28] At levels of per capita national income below $4,000 or $5,000, there are few effective environmental policies, as measured by either environmental outcomes (such as deforestation or air pollution) or expenditures on environmental protection by the public and private sectors. Above this threshold, however, things change very quickly. Environmental problems such as water pollution, inadequate sanitation, and air pollution all diminish rapidly as per capita income increases. The explanation is that only wealthy countries like the United States can afford to devote scarce resources to environmental protection. Poorer countries like Mexico have other priorities that they perceive to be more important. A recent study estimates that the EPA, when making its pesticide cancellation decisions, values each applicator cancer case avoided at around forty million.[29]

The bottom line is that, on economic grounds, it is better to have a given amount of environmental damage from horticultural production in Mexico than in the United States. As noted above, however, the environmental damage per acre or per ton of horticultural crops is not the same in Mexico as in the United States. Poor worker safety measures make

27. S. F. Edwards, *Option Prices for Groundwater Protection*, 15 J. OF ENVTL. ECON. AND MGMT., 1987, at 475-87. Two of the main causes of nitrate pollution are agricultural: nitrogen fertilizer and animal manures.

28. A luxury good is one whose consumption rises more than proportionately as income increases. For empirical evidence, *see* Don Coursey, The Demand for Environmental Quality (1992) (Unpublished, Washington University); *see also* John M. Antle, *Environment, Development, and Trade Between Low and High Income Countries*, 75 AM. J. OF AGRIC. ECON. (forthcoming 1993). Additional evidence on the relationship between per capita income and environmental problems is in WORLD BANK, *supra* note 27.

29. Maureen L. Cropper et al., *The Determinants of Pesticide Regulation: A Statistical Analysis of EPA Decision Making*, 100 J. OF POL. ECON., 1992, at 175-97. However, this figure may be too high, see David G. Abler, *Issues in Pesticide Policy: Discussion*, 21 NORTHEASTERN J. OF AGRIC. AND RESOURCE ECON., Oct. 1992, at 93-95.

the health risks per acre or per ton much higher in Mexico (though workers are willing to accept these risks). On the other hand, horticultural production is significantly less chemical-intensive in Mexico than in the United States.

V. POLICY IMPLICATIONS AND CONCLUSIONS

Even if one rejects the idea that horticultural production should be transferred from the United States to Mexico on environmental grounds, Mexican environmental lapses in no way justify rejection of NAFTA. Trade policies are a very uncertain and indirect way of addressing environmental concerns. Each of the three environmental problems identified above calls for other, more direct policies. Pesticide residues call for better information among the U.S. public. Although there is a great deal of concern, it is not well-informed. They may also call for better monitoring of all domestic and imported produce, not just Mexican produce. Poisonings among Mexican field workers call at a minimum for better information on safe application practices and health impacts, if not better enforcement of existing Mexican legislation in this regard.

Damages to the physical environment through water pollution, waterlogging, and salinization all reflect a failure to price the environment correctly. At present, Mexican farmers face no penalties or taxes for environmental side-effects of production, and thus have no incentive to consider them when making fertilizer, pesticide, and irrigation usage decisions. However, it may be noted that the same is true for U.S. farmers. Mexican policy has actually encouraged excessive use of these inputs through government subsidies. During the late 1980s, subsidies were on the order of 80% for irrigation, 40% for fertilizer, and 50% for pesticides.[30] Mexico is typical of most developing countries in this regard. During drought years, Mexican horticultural producers have also been favored over other farmers through preferential access to rationed irrigation water.[31] Fortunately, subsidies are being reduced. For example, fertilizer subsidies were phased out in 1991.

In addressing these environmental problems, as well as environmental problems associated with NAFTA in other sectors, the choice of the specific policy instruments to be used will be critical.[32] Poor choices can

30. Abler & Pick, *supra* note 2.

31. DAVID R. MARES, THE U.S.-MEXICAN WINTER-VEGETABLE TRADE: CLIMATE, ECONOMICS, AND POLITICS, U.S.-MEXICO RELATIONS: AGRICULTURE AND RURAL DEVELOPMENT (Bruce F. Johnson et al. eds., 1987).

32. Policy instruments to control water pollution from agriculture are discussed in David G. Abler & James S. Shortle, *The Political Economy of Water Quality Protection from Agricultural*

be very expensive and show little in the way of environmental benefits. On the other hand, most economists believe that the tradeoffs between economic well-being and the environment need not be severe if instruments are chosen well.

Chemicals, 20 NORTHEASTERN J. OF AGRIC. AND RESOURCE ECON., Apr. 1991, at 53-60. Policy instruments in a more general environmental setting are discussed in 1 P. BOHM & C. RUSSELL, COMPARATIVE ANALYSIS OF ALTERNATIVE POLICY INSTRUMENTS, HANDBOOK OF NATURAL RESOURCE ECONOMICS (A. Y. Kneese & J. L. Sweeny eds., 1985).