

THE MONTREAL PROTOCOL'S MULTILATERAL FUND: AN ENVIRONMENTAL AND
ECONOMIC SUCCESS

by

BRETT TIESZEN

B.S., Kansas State University, 2008

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF ARTS

Department of Economics
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2010

Approved by:

Major Professor
E. Wayne Nafziger

Abstract

Although the ozone layer is vital to life on Earth, as a common resource it has been the subject of rational exploitation. With ozone depletion a global (rather than merely regional) problem, measures to address it have necessarily been international efforts. The international treaty that addressed ozone depletion, the Montreal Protocol (with its subsequent amendments), has widely been hailed as a success. However, the triumphs of the Montreal Protocol are inseparable from its Multilateral Fund, whose creation was a prerequisite for developing nations, including juggernauts China and India, to ratify the Protocol.

Since its inception the Fund has supplied over \$2.5 billion to initiatives that support the phase-out of ozone-depleting chemicals in developing nations. These projects have increasingly employed market mechanisms to achieve efficient results, and have generated positive profits for participating firms. Funded initiatives have included upgrading capital, educating maintenance workers, production buyouts, public awareness, and institutional strengthening. Aside from ensuring the success of the overall Protocol, this last item will likely be the Multilateral Fund's most enduring legacy, as inherent shortcomings of the Fund have largely been attributed to its status as a pioneering financial mechanism.

The Multilateral Fund has broken new ground in international environmental regulation and shown that success on ecological issues is indeed possible at the global level, leading many to hope that the Fund will serve as a model for future mechanisms to address climate change. While the more complex chemistry and economics of climate change make such a ready duplication of the Multilateral Fund's success unlikely, the Fund's role in strengthening

institutions that address ecological concerns has undoubtedly smoothed the way for future international environmental action.

Table of Contents

List of Figures.....	v
List of Tables	vi
CHAPTER 1 - The Ozone Layer: Global Public Good.....	1
Saving the Ozone Layer	1
The Chemistry of Ozone.....	1
Economic Background: (Global) Public Goods and the Tragedy of the Commons	3
The Montreal Protocol.....	5
CHAPTER 2 - Creation of the Multilateral Fund.....	7
Establishment of the Multilateral Fund	7
The Role of China and India in the Fund's creation	7
CHAPTER 3 - The Work of the Fund	13
How the Fund Works.....	13
What the Fund has Supported.....	14
Fund Amounts	17
CHAPTER 4 - Evaluations of the Multilateral Fund's Success.....	19
Importance and Impact of the Fund.....	19
Shortcomings of the Multilateral Fund.....	21
CHAPTER 5 - Looking to the Future.....	24
Future of the Fund	24
Lessons From the Multilateral Fund and Applicability Towards Future Projects	24
References.....	26

List of Figures

Figure 1.1 Ozone density in the atmosphere with respect to altitude (NOAA et al. 1999).....	2
Figure 2.1 A graphical representation of the previous table with China and India emphasized (Secretariat 2010).....	12
Figure 3.1 The organization of entities overseeing the Multilateral Fund (UNEP/GRID-Arendal 2010).....	14
Figure 4.1 Projections for the abundance of ozone-depleting molecules under subsequent revisions to the Montreal Protocol show the treaty’s impact on pollution levels (UNEP/GRID-Arendal 2010).....	23

List of Tables

Table 2.1 The top recipients of Multilateral Fund tons approved for phase-out shows China's clear dominance (Secretariat 2010)	11
Table 3.1 Multilateral Fund replenishment amounts by three-year organizational periods (Secretariat 2010).....	18

CHAPTER 1 - The Ozone Layer: Global Public Good

Saving the Ozone Layer

Human pollution has damaged many parts of Earth's ecology, but one type of pollution that is no longer frequently brought up as a cause for concern is depletion of the ozone layer, one of the few international environmental challenges that have been successfully addressed. The agreement responsible for saving the ozone layer was the Montreal Protocol and its subsequent amendments. Although stratospheric ozone levels will not make a full recovery until decades into the future, the Protocol has been successful in stemming further damage. But any story of the Montreal Protocol's success would be incomplete without inclusion of the agreement's Multilateral Fund, a mechanism through which industrialized nations have transferred over \$2.5 billion to assist less developed nations in transitioning away from the use of ozone-depleting substances. To solve a truly globally problem like ozone depletion required a global solution, and the Multilateral Fund provided the political carrot necessary for developing nations to agree to solve a problem to which they had not been major contributors. By providing direct monetary assistance, the Multilateral Fund has established a paradigm possibility for international relations in international economics. First though, some knowledge of the physical properties of ozone will help to make the economic issues more clear.

The Chemistry of Ozone

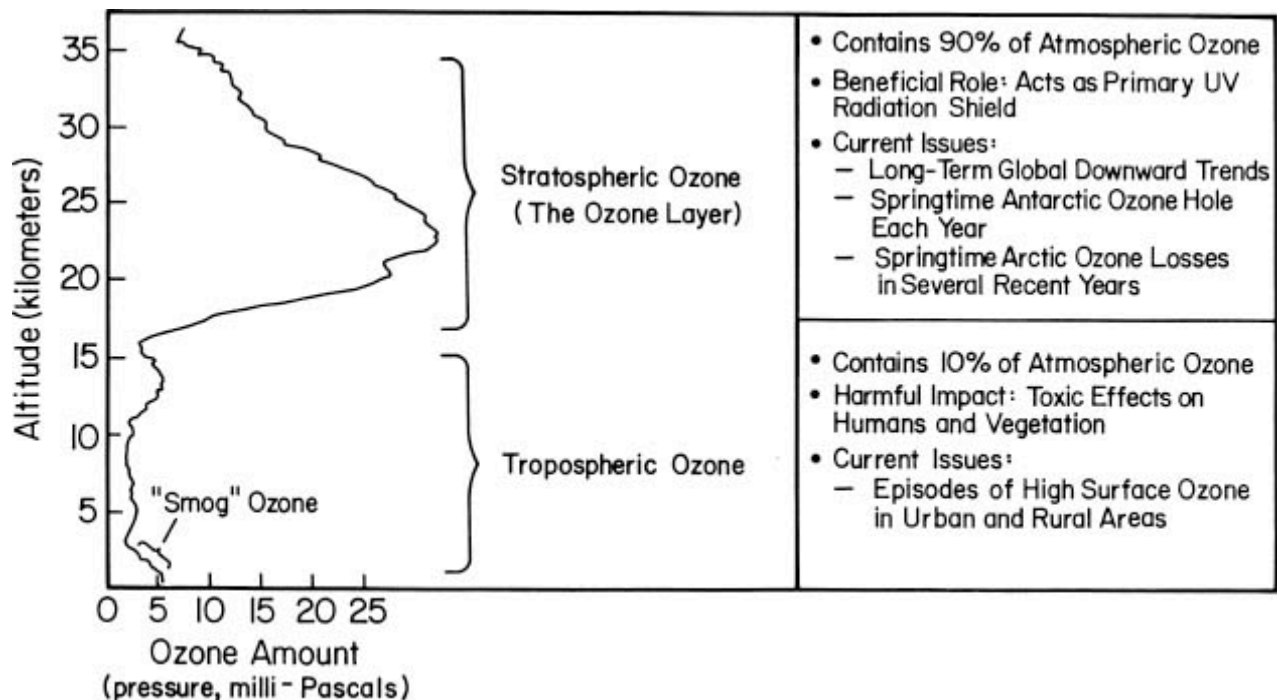
Most oxygen in the Earth's atmosphere occurs as diatomic oxygen, molecules that are formed by a pair of oxygen atoms. This is the oxygen we breathe. In contrast, ozone is a molecule that is also made up solely of oxygen atoms, but has three oxygen atoms rather than

two and is much more reactive. Ozone occurs naturally in the Earth's atmosphere, but at a much lower rate than diatomic oxygen.

The density of ozone is not uniform throughout the atmosphere; the highest concentrations are found near the Earth's surface and at an elevation of 15 to 30 km above sea level. Low-level (tropospheric) ozone is emitted at ground level by human-generated activity. Such ozone is a localized or regional pollutant that irritates both plant and animal life (vanLoon and Duffy 2005).

However, high-elevation (stratospheric) ozone is vital to almost all life on Earth. This is ozone one speaks of when referring to the “ozone layer.” Although not truly a distinct layer of the atmosphere, stratospheric ozone screen out much of the sun's ultraviolet radiation that would damage cell life if it were not filtered out by the upper atmosphere. The chart below from the National Oceanic and Atmospheric Administration shows the change in ozone presence with respect to altitude.

Figure 1.1 Ozone density in the atmosphere with respect to altitude (NOAA et al. 1999)



Ozone in the stratosphere is frequently disassembled (broken into an oxygen atoms) and regenerated (recombined from oxygen atoms) by natural processes, but this balance has been threatened by human production of chemicals that deplete ozone.

Many ozone-depleting chemicals initially appeared as wonder substances that were valued for their non-toxicity and lack of reactivity with other chemicals. However, this inertness allowed the chemicals to exist in the atmosphere until reaching the stratosphere. Once at high elevations and exposed to increased solar radiation, ozone-depleting chemicals break up and release highly reactive components. These compounds are capable of staying in the upper atmosphere for over a hundred years, acting as catalysts for the repeated destruction of ozone around the globe, regardless of where they were initially released.

Economic Background: (Global) Public Goods and the Tragedy of the Commons

Economics recognizes some products and services as ill-suited to be provided by the private market. These items are termed “public goods” and are identified by non-rivalry and non-excludability. Non-rivalry occurs when one person's consumption of something does not affect another person's enjoyment of the same. An example could be consumer protection legislation: one person benefiting from rigorous testing of prescription medications does not affect anyone else's enjoyment of safe medicines. Non-excludability takes place when it is unreasonably hard to choose who receives the benefits of a good or, alternatively, when it is unreasonably difficult to prohibit non-paying individuals from benefiting from an item. (Everyone downstream from a dam will benefit from flood control, regardless of whether or not they paid the taxes to construct it.) Many public goods are provided by the government, but most are “impure” public goods in that they are excludable or rival to some extent.

Some public goods are provided freely provided by the environment, the ozone layer being one such case. However, the free and unowned character of natural resources like the atmosphere can be a double-edged sword.

Biologist Garrett Hardin (1968) coined the phrase “tragedy of the commons” to describe how, given a common resource available free of charge, rational parties will attempt to capture as much of the resource as possible. With all actors attempting to maximize their share, the resource will be depleted and become available to no one. Hardin writes that the problem occurs in reverse in with pollution, where:

“It is not a question of taking something out of the commons, but of putting something in. ... The calculations of utility are much the same as before. The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of ‘fouling our own nest,’ so long as we behave only as independent, rational, free-enterprisers.”

Such tragedies of common resources are frequently countered by government establishment and enforcement of private property rights. The Coase Theorem implies that government regulation will not be necessary if private property rights are established. However, this result holds best when there are few parties involved and the dimensions of the externality (pollution) are well defined. Even if it were possible to assign private property rights to slices of the ozone layer, it would be impossible to identify exactly which polluters were responsible for damaging one’s personal ozone (Rosen and Gayer 2008).

While localized pollution may be addressed on a national or regional level, ozone-depleting substances act on a global level. This fact necessitated a worldwide international response.

The Montreal Protocol

Scientists had been concerned about the possibility of ozone depletion as early as the 1960s, when concern centered on the emissions of high-flying supersonic aircraft, but it was not until the mid-1970s that a link between certain chemicals and ozone depletion was confirmed. The discovery of an “ozone hole” over Antarctica helped verify the link between certain chemicals and ozone depletion, and the dramatic story helped bring the issue to public attention. (The “hole” in the ozone layer consisted of a reduced concentration of ozone over Antarctica, not an absolute lack of ozone. It would therefore be more analogous to a hole in the ground than a hole in a window.)

Concern in industrialized nations about ozone destruction led to the Vienna Convention for the Protection of the Ozone Layer in 1985, a generalized agreement with no regulatory teeth. Following groundwork laid by the Vienna meeting, the Montreal Protocol on Substances That Deplete the Ozone Layer was agreed upon two years later. The Montreal Protocol laid out specific chemicals to be prohibited and deadlines by which they were to be phased out, allowing different timeframes for industrialized and less-developed nations. States that emitted less than .3 kilograms of ozone-depleting substances per capita were addressed by the fifth article of the Protocol and came to be known as Article 5 nations. However, the timeframe concessions offered by the original Montreal Protocol were not enough to convince most developing nations to sign it. The Protocol also prohibited the trade of ozone-depleting substances between nations party to the Montreal Protocol and non-party nations in an attempt to avoid free riding.

After the Montreal Protocol agreement, scientific evidence increasingly revealed that the rate and magnitude of ozone depletion had been underestimated. The Protocol was designed to be updated and revised as necessary, so amendments led to continuous expansion and strengthening of the treaty in the following 20 years. The parties met to bump-up the deadlines banning the use of ozone-depleting chemicals, add new chemicals to the list of those being phased out, and develop other means to ensure the success of the treaty's intent (vanLoon and Duffy 2005).

CHAPTER 2 - Creation of the Multilateral Fund

Establishment of the Multilateral Fund

One of the Montreal Protocol's unique strengths is the fact that it was designed to be easily reopened and adjusted based on regularly scheduled scientific, economic, environmental, and technological assessments. The first of such changes to the Montreal Protocol were made at the 1990 meeting of the parties in London (Benedick 2007).

Some discussions revolved around scientifically-based concerns about which chemicals would need to be phased out and when, but it was also at this meeting that the geopolitical South, led by India and China, made clear that it would not follow developed nations in lock-step without economic assistance in replacing ozone-depleting substances. These demands resulted in the creation of the Multilateral Fund for the Implementation of the Montreal Protocol, a mechanism to provide technical and monetary assistance. With the Multilateral Fund on the table the Montreal Protocol was finally accepted by major developing nations.

The London amendments to the Montreal Protocol were not scheduled to take effect until January 1992. However, it was agreed that an Interim Fund be established in 1991 to help realize the promise of the Multilateral Fund financing prior to the Amendment officially entering into force (Kelly 2004).

The Role of China and India in the Fund's creation

Although developed nations had moved quickly to replacements for ozone-depleting chemicals (many doing so even before signing the Montreal Protocol), the transition was not embraced as readily or as rapidly in the developing world. This was partly because of the 10-year

window that the Montreal Protocol allowed less developed countries “because they faced financial, technical, and institutional difficulties that wealthy nations did not share.” However, the burdens of transition were not distributed equally, but “were magnified in China and India, which, unlike most low-income countries, had significant [ozone-depleting substance] production capacity and enormous demand for commodities containing discredited substances, particularly the widely-used coolant chlorofluorocarbons (CFCs)” (Sims 1996).

In fact, the Asian giants had opposed the 1987 Montreal Protocol outright, arguing that the global South should be allowed some ecological concessions to favor development. Both nations refused to sign the treaty until the 1990 amendments moved to minimize the impact of transition on less-developed nations. “As a former senior official in India's Ministry of Environment and Forests observed, it was grossly unfair to expect low-income countries to ‘adopt policies and spend money to solve problems created by other countries’” (Sims 1996).

As developed nations cut their production and usage of ozone-depleting substances, less-developed nations began to account for a bigger percent of the world's remaining emissions. China's surging economic growth positioned the nation as the world's largest producer and consumer of substances that damage the ozone layer by 1996. Citing the importance and demand for ozone-depleting substances, “Chinese ministries agreed that China would not sign the [Montreal] Protocol until provisions were added to ensure financial and technical aid to China and other developing countries” (Zhao and Ortolano 2003).

Working together, China and India argued that the developed nations that had done more to damage the ozone layer needed to do more to fix it. They also declared that developing nations had more immediate issues of poverty and disease to contend with, pressing the case for financial and technological transfers to make a reduction in ozone depletion economically viable for less-

developed nations. Wealthy nations came to see that the control-based regulatory concessions offered under the Montreal Protocol were not sufficient—they would need to become tangible assistance in order for developing countries to forgo significant expansion in their use of ozone-depleting chemicals (Zhao and Ortolano 2003). The initial estimates for the magnitude of that aid were substantial: \$1.4 billion for China and \$1.964 billion for India (Sims 1996).

In the end China and India were successful not only in spurring the establishment of the Multilateral Fund, but also in increasing the dollar value of the Interim Fund. China and India made ratification of the Protocol conditional on “the commitment to raise the Interim Fund from US\$160 million to US\$240 million” (Kelly 2004).

For India, fiery Environmental Minister Maneka Gandhi, was “instrumental in eliciting a more substantive concession of financial and technical assistance for ODS phase-out.” Nevertheless, Gandhi also faced domestic criticism for not using the pull potential of Southern leverage to extract even larger concessions from the North (Sims 1996).

Zhao and Ortolano (2003) claim that although there were other justifications for China's ratification of the Montreal Protocol, the Multilateral Fund was the “dominant incentive.” In a virtuous circle, once China had signed the Montreal Protocol, the Multilateral Fund gave it a compelling reason to fulfill the treaty's obligations, as Article 5 nations that did not meet procedural requirements would be ineligible for Multilateral Fund monies. Chinese leaders had previously stated an interest in increasing production efficiency through technological and industrial growth. Acceptance of the Montreal Protocol furthered these goals, as the country would be unable to export commodities to party signatories if they contained ozone-depleting substances. Moreover, with the Multilateral Fund prioritizing efficiency above equity, China stood to convert its status as the developing world's largest user of ozone-depleting chemicals

into windfall gains. China's desire to increase the amount it received from the Fund spurred improvement in national implementation strategies (Sims 1996).

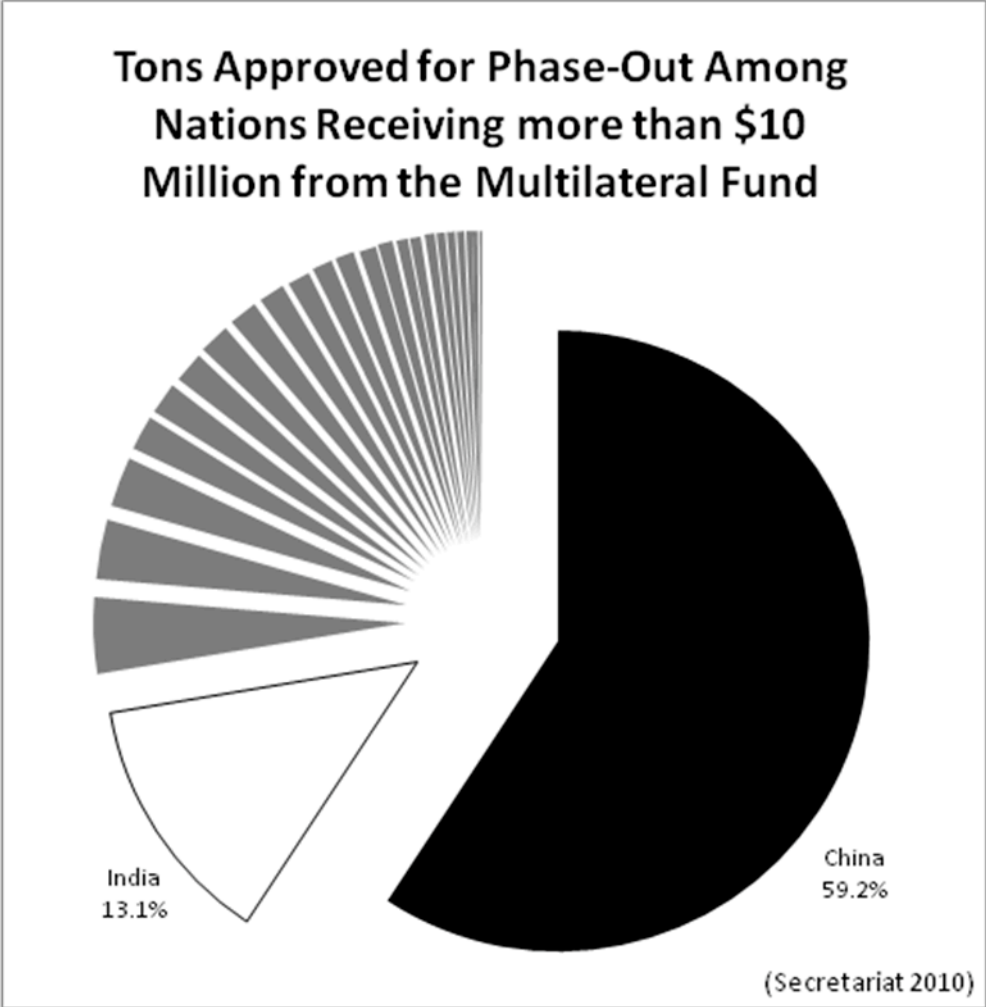
Table 2.1 makes readily apparent the degree to which China benefitted from Multilateral Fund payments, and India's uncontested status as the second most-benefitted nation. As of July 2009, China had received \$851 million from the Multilateral Fund—a full one-third of all Fund dollars (United Nations Environment Programme/GRID-Arendal 2010).

Table 2.1 The top recipients of Multilateral Fund tons approved for phase-out shows China's clear dominance (Secretariat 2010)

Country	Tons approved for phase-out			
	Consumption	Production	Total	Percent
China	113324	142565	255889	59.24%
India	25756	31004	56760	13.14%
Mexico	4763	12355	17118	3.96%
Brazil	13403	0	13403	3.10%
Indonesia	11211	0	11211	2.60%
Thailand	7775	0	7775	1.80%
Argentina	4365	2746	7111	1.65%
Iran	6956	0	6956	1.61%
Venezuela	2492	4418	6910	1.60%
Malaysia	6446	0	6446	1.49%
Nigeria	5810	0	5810	1.35%
Korea, DPR	3349	1750	5099	1.18%
Turkey	4495	0	4495	1.04%
Egypt	4253	0	4253	0.98%
Syria	3796	0	3796	0.88%
Philippines	3335	0	3335	0.77%
Algeria	2558	0	2558	0.59%
Pakistan	2435	0	2435	0.56%
Jordan	2223	0	2223	0.51%
Colombia	1869	0	1869	0.43%
Romania	1579	175	1754	0.41%
Lebanon	1616	0	1616	0.37%
Morocco	1324	0	1324	0.31%
Chile	1228	0	1228	0.28%
Cuba	588	0	588	0.14%
TOTAL	236949	195013	431962	100.00%

*This list only includes nations receiving more than \$10 million
(Secretariat 2010)

Figure 2.1 A graphical representation of the previous table with China and India emphasized (Secretariat 2010)



CHAPTER 3 - The Work of the Fund

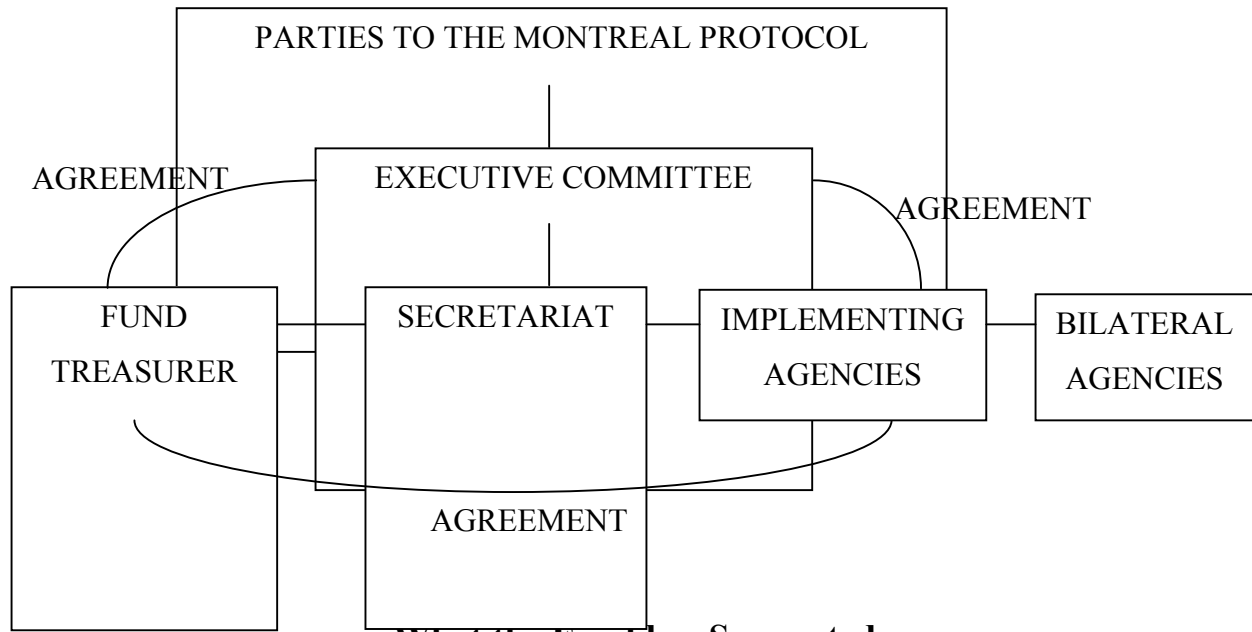
How the Fund Works

The Multilateral Fund is administered by a 14-member Executive Committee drawn from seven developed nations and seven Article 5 states. The Executive Committee is assisted by a Secretariat office in Montreal that manages day-to-day operations and makes recommendations to the Committee. The Fund Treasurer receives funds and distributes them to the Secretariat and implementing agencies.

Financial and technical transfers occur as grants or concessional loans and are provided through four partner agencies. The World Bank is the largest disperser of funds, focusing on large-scale projects at the plant or national level. The United Nations Industrial Development Organization (UNIDO) provides plant-level investment projects, while the United Nations Development Programme (UNDP) focuses on technical assistance and demonstrating feasibility. The fourth agency, the United Nation Environment Programme (UNEP), does not provide investment assistance, but rather supports institutional strengthening, such as developing National Ozone Units in nations with a small volume of consumption. There is also an allowance that up to 20 percent of a party's contributions may be delivered through their own agencies to eligible activities. (Secretariat 2010).

The Fund's stated purpose is to cover the incremental costs of transitioning away from the use of ozone-depleting chemicals. Of course, "since the Fund's inception, there has been debate on ... what could reasonably be considered to be an agreed incremental compliance cost" (Kelly 2004).

Figure 3.1 The organization of entities overseeing the Multilateral Fund (UNEP/GRID-Arendal 2010)



What the Fund has Supported

The Multilateral Fund has supported a vast array of projects to eliminate ozone-depleting chemicals in diverse uses on every inhabited continent. Once an Article 5 nation becomes party to the Montreal Protocol, the Fund acts as a clearinghouse to help identify what the nation must do to fulfill phase-out requirements and networks the Article 5 nation with other parties who are able to provide resources necessary to reach those goals.

The size of firms receiving capital upgrades from the Multilateral Fund range from small and medium sized enterprises with very low levels of investment and ability to enact environmentally-centered reform to some of the world’s largest manufacturers in their respective fields (UNEP 2007).

As one of the common use of ozone-depleting chemicals had been as coolants in refrigerators and air conditioners, many Multilateral Fund projects centered on replacing cooling devices. A typical example is the replacement of inefficient household fridges in Brazil, a project

that even successfully recaptured dangerous substances before they were released. In Thailand, an initiative was created to replace chillers (air conditioning units for large buildings) with newer units (UNEP 2007). The Multilateral Fund has gone beyond helping consumers to at times spur upgrades among producers, such as when Chinese manufacturers received help switching to newer compressors for commercial refrigerators.

With many locations upgrading their cooling technology, it became imperative that the ability to maintain newer air conditioners exist. Recognizing this need, the Multilateral Fund agreed to support training for maintenance personnel, providing the human capital necessary to support the upgrades to physical capital that were being funded. Training projects have targeted both vocational educators (teaching the teacher) and direct education of maintenance workers (UNEP 2007).

Another major utilization of ozone-depleting chemicals has been as an agricultural fumigant. Funded programs have included supporting changes in tobacco cultivation in Macedonia and Malawi and vegetable production in Lebanon. In both cases the offending chemical, methyl bromide, was replaced through a combination of non-chemical means, and generally resulted in increased production—in the case of Lebanon, production grew sufficiently for the nation to actually begin exporting.

Where possible, the Multilateral Fund has worked to employ market mechanisms to achieve greater efficiency at the lowest cost. Fund monies were originally awarded on a project-by-project basis, but in 1997 China implemented a program targeting the entire halon sector at once. By employing a reverse auction where funds were provided to the firms willing to eliminate the most tons of ozone-depleting substances at the lowest rates, the project achieved its goals with a high success rate and spawned a wave of innovation in program implementation.

In Mexico, the government worked with Multilateral Fund implementing agencies to pay the largest CFC (a powerful ozone-depleting chemical) manufacturing plant to cease production. Some of the equipment was repurposed, but most of the money simply compensated the production company for foregone profits. On the surface this would seem like a less-efficient project that could generate perverse incentives, but the plant in question was the largest in Latin America. Its cessation of production, combined with the transition of some plant equipment to production of substitute (and non-ozone depleting) goods had a significant effect on the availability of CFCs, the most egregious ozone depleting chemicals. The negative impact on supply of ozone-depleting substances and positive effect on supply of replacement chemicals caused the buyout to be specially commended by Multilateral Fund's Executive Committee (UNEP 2007).

However, the World Bank's Montreal Protocol Unit has found that "investment projects alone are not sufficient to attain a significant reduction in [ozone-depleting substances] in many developing countries. Non-investment projects, including training, networking, institutional strengthening, and policy and regulatory-related activities, are equally important in ensuring the long-term sustainability of country programs." As a result some Multilateral Fund monies are spent even very indirectly, such as on public awareness, encouraging nations and industries to meet Protocol deadlines so that they remain eligible for continued funding. Since 2001, the Executive Committee has awarded UNEP \$200,000 per year to support public awareness campaigns (Kelly 2004).

Other approved non-investment projects include Japan's initiation of dialogue between China and Mongolia to prevent smuggling of ozone-depleting substances across their shared

border. The Fund has also supported “Green Customs Initiative” efforts to train customs officials in non-industrialized nations to reduce trade in goods of environmental concern (UNEP 2007).

One strength of the Fund’s role as an information clearinghouse is that information on successful projects is disseminated, enabling them to be replicated in far-flung nations, as when a program targeting end-users of refrigeration and air conditioning that was initiated in Ghana and Georgia was later expanded to Costa Rica (UNEP 2007).

The groundbreaking nature of the Multilateral Fund forced it to support not only projects directly, but also the support and development of national institutions, “a tacit acknowledgment of the need to develop basic institutional capacity in developing countries to address ozone sector matters.” Although industrialized nations questioned the appropriateness of such expenses, the Multilateral Fund has continued to insist that developing nations must play a larger role in the submission of projects, an outcome that will only occur with strong national institutions. (Kelly 2004).

Fund Amounts

As of November 2009, the Multilateral Fund had received pledges of \$2.55 billion in from 49 industrialized nations since operations began in 1991. Donations are solicited in three-year cycles based on perceived needs for the upcoming period, but have remained relatively constant once beyond the initial period that covered the Interim Fund. (Secretariat 2010).

**Table 3.1 Multilateral Fund replenishment amounts by three-year organizational periods
(Secretariat 2010)**

Three-year Period	Replenishment Amount
1991-1993	\$240.0 million
1994-1996	\$455.0 million
1997-1999	\$466.0 million
2000-2002	\$440.4 million
2003-2005	\$474.0 million
2006-2008	\$400.4 million
2009-2011	\$490.0 million

(Secretariat 2010)

CHAPTER 4 - Evaluations of the Multilateral Fund's Success

Importance and Impact of the Fund

The most direct impact of the Multilateral Fund has been its contribution to the success of the overall Montreal Protocol in dramatically reducing the consumption and production of ozone-depleting chemicals. As of December 2008, ozone-producing substances had been reduced by 258,574 tons of consumption and 195,013 tons of production. Ninety percent of pledged commitments had been paid, allowing the Fund to support over 6,000 projects in 147 developing nations. Furthermore, 143 of those nations have created National Ozone Units. The Fund has demonstrated the possibility of success when targeting only incremental costs. (Secretariat 2010).

Although the Multilateral Fund has spent over \$2.55 billion, from a global perspective those expenses have paid for themselves many times over by reducing ultraviolet radiation. UNEP has calculated that “implementation of the Montreal Protocol add up to some US\$460 billion in reduced damage to fisheries, agriculture, and materials worldwide. In addition, more than 20 million cases of skin cancer and nearly 130 million cases of eye cataracts will be avoided” (Kelly 2004). For the international community as a whole, the Multilateral Fund has been extremely cost effective.

The Montreal Protocol has also made a significant contribution to slowing global climate change. Many ozone-depleting chemicals are also potent greenhouse gases. One class of ozone-depleting chemicals, CFCs, have a climatic effect 20,000 times that of an equal number of

carbon dioxide molecules. A study by NASA found that “if CFCs had continued to increase at the growth rates of the 1970s, they would by 1989 have surpassed carbon dioxide in their greenhouse impact” (Benedick 1991). In light of the continuing failure of international agreements to specifically address climate change, it is fair to argue that the Montreal Protocol has had the most substantial effect on climate change of any treaty to date.

At times the Multilateral Fund has generated externalities that positively affected other ecological issues. In Jordan, a nation where water is precious, the phasing-out of agricultural methyl bromide reduced water usage to only 35% of the amount previously needed (UNEP 2007). The elimination of ozone-depleting chemicals from production processes has also improved air qualities in the cities of some less-developed nations (Luken and Grof 2004).

Beyond environmental impacts, the Multilateral Fund has helped firms realized positive profits by complying with the Montreal Protocol. Many agricultural producers and industrial plants alike have not been harmed by or seen changes as cost-free, but have instead realized economic profits for their businesses. In one example, a Pakistani shoe manufacturer received assistance to move away from using ozone-depleting blowing agents to form shoe soles. Customer reaction to the new product was so encouraging that the company used its own money to buy an additional extruding machine before the part of the project funded by the Multilateral Fund was complete (UNEP 2007).

A positive institutional effect of the Multilateral Fund has been to draw non-governmental groups together to address ecological issues. Although the World Bank’s foremost concern is poverty alleviation, not environmental issues, the Bank has played a vital role as a Fund administrator. Writing for the World Bank, Kelly (2004) notes that “the reputational risk to the Bank might have been greater had it *refused* to assist other UN agencies to implement a

global call to action to protect the ozone layer.” The Multilateral Fund has increased the institutional capacity and know-how of these organizations, benefits that will be more fully realized as other international environmental agreements are enacted.

Finally, despite the positive externalities of its actions, the Multilateral Fund has remained true to its designated task of ozone protection—an environmental rather than a developmental goal. In fact, its goal of eliminating or replacing ozone-depleting substances was not intended to have any direct social impact (Kelly 2004).

Shortcomings of the Multilateral Fund

For all the success of the Multilateral Fund, it is not without flaws, though most have been defended as reasonable given its pioneering nature. Bove (2003) writes that “by lacking guidance on organizational issues, much time has been spent sorting out the minutiae involved with being a prototype. These delays can be avoided with diligent planning in future international environmental treaties.” He notes that since the Montreal Protocol is the first treaty to give industrialized and less-developed nations an equal share in the dialogue “little ground has been gained in finding solutions to controversial issues that have arisen.”

One continuous issue the Multilateral Fund has faced is financial inputs not meeting expectations, primarily donor countries that have not met payment obligations. This has also included nations paying in ways not anticipated by the Multilateral Fund, which has caused distribution and accounting problems. Phase-out goals have been harmed by the delays to replenishment and disbursement of funds. Financing provided as concessional loans also continues to be a lingering issue for the Executive Committee (Bove 2003).

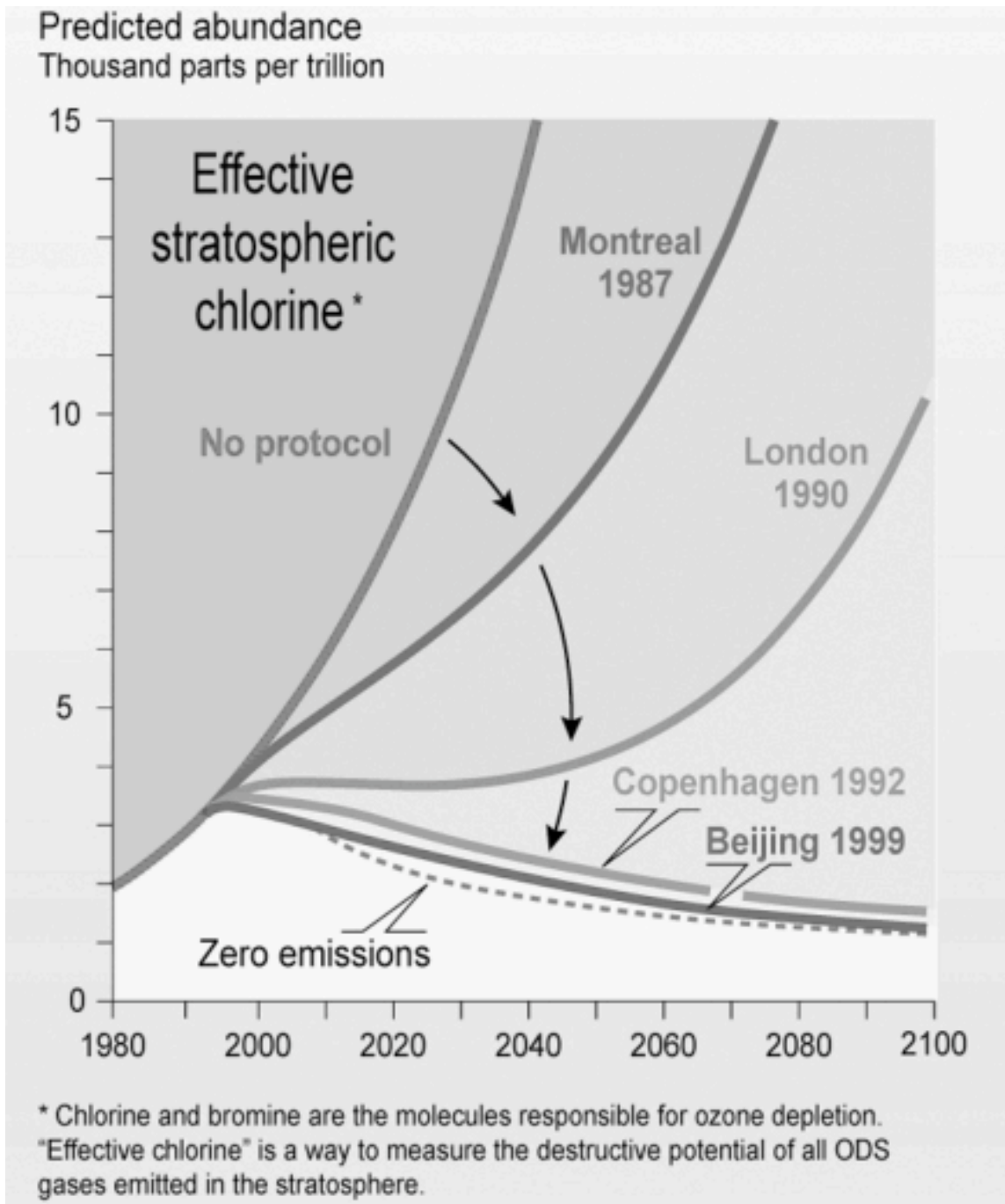
It has also been argued that developed nations may have never intended to fully fund the Multilateral Fund in the first place, creating it as a hollow promise to entice developing nations

into sign on to the larger Montreal Protocol. This has led some Protocol experts to believe that “developed countries slowed their contributions to the [Multilateral Fund] once they had met their initial objective of having developing countries ratify the Protocol” (Zhao and Ortolano 2003).

There are also concerns about the oversight of some project implementations. Specifically, some cooling and refrigeration projects have seen an excessively long lag between approval and implementation: “Thirty-five percent of approved projects in the refrigeration sector remain unimplemented. The foam sector and process agents sector each have not implemented sixteen percent of their approved projects, and the solvent sector has failed to implement twelve percent of its approved projects” (Bove 2003).

Even the ecological record of the Multilateral Fund is not without fault, as some approved projects have yielded results that, although not harmful to the ozone layer, were ecologically damaging in some other way (Luken and Grof 2004).

Figure 4.1 Projections for the abundance of ozone-depleting molecules under subsequent revisions to the Montreal Protocol show the treaty's impact on pollution levels (UNEP/GRID-Arendal 2010)



(UNEP/GRID-Arendal 2010)

CHAPTER 5 - Looking to the Future

Future of the Fund

The Multilateral Fund has reached the point where its most direct applicability is in the past. Having already addressed the most cost-efficient projects to reduce ozone depletion in its earlier years, the Multilateral Fund is reaching the point where remaining projects have lower cost-efficiency and are more painstaking to administer. Part of the difficulty in administration stems from the nature of remaining ozone-depleting applications as widely dispersed, rather than the concentrated projects that were the first to be funded (Kelly 2004).

Nevertheless, the Multilateral Fund is positioned to continue operating for decades to come. As more chemicals have been added to the list of those regulated by the Montreal Protocol, demand for Multilateral Fund monies has only increased (Kelly 2004). Some of the most damaging chemicals, CFCs, were initially replaced by HCFCs, compounds that posed a smaller risk to ozone levels. However, concerns over HCFCs have prompted them to be slated for phase-out from developing nations by 2030 (Secretariat 2010). With this in mind the Fund may potentially have work for the next twenty years.

Lessons From the Multilateral Fund and Applicability Towards Future Projects

It may be tempting to pronounce the achievements of the Multilateral Fund, and indeed the entire Montreal Protocol, as a sign that international treaties addressing other environmental issues need only imitate the Montreal Protocol to be successful. Mexico's ambassador to a meeting of the Montreal parties lamented that "the Multilateral Fund was the key to the Montreal Protocol's success. We're unable to create one for the Kyoto Protocol" (Leahy 2007).

Richard Benedick, the chief U.S. negotiator for the Montreal Protocol, does not seem worried about the lack of mechanisms similar to the Multilateral Fund:

“The ozone treaty has defied the efforts of a generation of academics to produce connect-the-numbers guides to successful global negotiation. Although it is useful to analyze, in retrospect, successful negotiating factors and techniques, real negotiations are both richer and more treacherous than academic models. One can offer some “lessons” [from the Montreal process ...] but there is no guarantee that things will work out. Impasses are not always destined to be resolved” (Benedick 2007).

While the Montreal Protocol has shown that successful international environmental agreements are feasible, the international community has been unable to replicate the success of the Multilateral Fund on other issues, most notably global climate change. This fact can largely be attributed to the simpler chemistry and economics of ozone depletion. Although the Multilateral Fund has shown that international environmental agreements with economic costs for some parties can be successful, it has not provided an easy roadmap to other similar mechanisms.

Aside from its role in securing the developing world’s participation in the Montreal Protocol, the legacy of the Multilateral Fund is likely to be its status as a trailblazing financial mechanism. The institutional know-how and capacity that it has established will benefit any new international environmental agreements. The Multilateral Fund is not the master key to unlocking future ecological treaties, but it has paved the way for future financial mechanisms—and played a vital role in saving the ozone layer in the meantime.

References

- Anderson, Stephen O., K. Madhava Sarma, and Kristen N. Taddonio.** 2007. *Technology Transfer for the Ozone Layer: Lessons for Climate Change*. Sterling, Virginia: Earthscan.
- Benedick, Richard Elliot.** 1991. *Ozone Diplomacy*. Cambridge, Massachusetts: Harvard University.
- _____. 2007. "Science, Diplomacy, and the Montreal Protocol." *Encyclopedia of Earth*. http://www.eoearth.org/article/Science,_diplomacy,_and_the_Montreal_Protocol (accessed March 15, 2010)
- Bove, James Andrew.** 2003. "A study of the Financial Mechanism of the Montreal Protocol on Substances that Deplete the Ozone Layer." *The Environmental Lawyer*, 9: 399+.
- Hardin, Garrett.** 1968. "The Tragedy of the Commons." *Science*, 162 (3859): 1243-1248.
- Kahn, James R.** 2005. *The Economic Approach to Environmental & Natural Resources*. Mason, Ohio: Thomson South-Western.
- Kelly, Lauren.** 2004. "The Multilateral Fund for the Implementation of the Montreal Protocol. Addressing Challenges of Globalization: An Independent Evaluation of the World Bank's Approach to Global Programs." The World Bank. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/07/15/000160016_20050715162518/Rendered/INDEX/32914a10mlf1OEDwp.txt (accessed March 15, 2010)
- Leahy, Stephen.** 2007. "Canada: International Leaders Meet to Extend Ozone Treaty." International Press Service. Sept. 18.
- Luken, Ralph and Tamas Grof.** 2004. "The Montreal Protocol's Multilateral Fund and Sustainable Development." United Nations Industrial Development Organization. http://userpage.fu-berlin.de/ffu/akumwelt/bc2004/download/luken_grof_f.pdf (accessed April 19, 2010).
- National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, World Meteorological Organization, European Commission, United Nations Environment Programme.** 1999. *Scientific Assessment of Ozone Depletion: 1998*. Nairobi, Kenya: UNEP.
- Rosen, Harvey and Ted Gayer.** 2008. *Public Finance*. New York: McGraw-Hill.

- Secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol.** 2010. Secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol. <http://www.multilateralfund.org/> (accessed March 16, 2010).
- Sims, Holly.** 1996. "The unsheltering sky: China, India, and the Montreal Protocol." *Policy Studies Journal* 24.2: 201+.
- Tietenberg, Tom.** 2000. *Environmental and Natural Resource Economics*. New York: Addison-Wesley.
- United Nations Environment Programme.** 2007. "Recognition of some of the Exemplary Projects that have been undertaken pursuant to Article 10 of the Montreal Protocol." <http://www.unep.ch/ozone/Publications/Exemplary-Projects.pdf> (accessed Feb. 16, 2010).
- United Nations Environment Programme/GRID-Arendal.** 2010. UNEP. <http://www.grida.no/publications/vg/ozone/> (accessed April 10, 2010).
- VanLoon, Gary W. and Stephen J. Duffy.** 2005. *Environmental Chemistry: A Global Perspective*. New York: Oxford University.
- Yoshida, O.** 2001. *The International Legal Regime for the Protection of the Stratospheric Ozone Layer*. Boston: Kluwer.
- Zhao, Jimin and Leonard Ortolano.** 2003. "The Chinese government's role in implementing Multilateral environmental agreements: The case of the Montreal Protocol." *The China Quarterly*, Sept (175): 708-726.