



Compendium Introduction
**“Environmental Finance:
Value and Risk in an Age of Ecology”**

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Education.*



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ENVIRONMENTAL FINANCE: VALUE AND RISK IN AN AGE OF ECOLOGY



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Environmental issues are restructuring markets and redirecting capital flows throughout the world. An outline is provided of concerns facing the development of an environmentally responsible or 'environmental finance' perspective. It reviews the major ways in which organizations are responding to environmental threats and opportunities in the three major branches of finance – corporate finance, investments and financial institutions – highlighting in particular novel programs and initiatives. In the past, financial concerns have exacerbated the degradation of the natural environment; in the future, they probably hold the key to their preservation.

Only after the last tree has been cut down, only after the last river has been poisoned, only after the last fish has been caught, only then will you discover that money cannot be eaten. (Cree Indian Prophecy)

INTRODUCTION

Recent years have seen an explosion of concern by individuals, businesses and governments regarding the use of the natural environment. The 'greening' of business is underway as environmental issues impact and change managerial practices throughout the world. Global integration of the world's financial markets is progressing at a breathless pace and, in some instances, has fostered and/or accelerated the degradation of natural environments. In others, the free flow of capital has facilitated a redirection of financial resources towards investment opportunities, promising overall increases in both human and environmental welfare.

This paper seeks to achieve two objectives. Firstly, it attempts to define the structure of the financial system with respect to the natural environment. Secondly, it outlines ways in which environmental concerns are impacting financial decision-making by corporations, investors and financial institutions, briefly describing the current responses to these challenges. The financial system facilitates the exchange of financial resources among economic agents. The exchange of resources is generally not an end in itself; rather, decision-makers engage in such activity to further their own designs. Understanding the relationship between finance and the environment requires an examination of the goals of human activity and the role of financial markets in achieving those goals.

THE FIELD OF FINANCE

Traditionally, the role of the financial system has been to facilitate the transformation of savings into investment. Financial institutions (banks, brokerage



houses, insurance companies) accomplish this by creating financial instruments (deposits, mutual funds, insurance policies) which are traded on financial markets. By this means savings, i.e. income remaining after current-period consumption, are redirected into various forms of productive capital.

The field of finance is often divided into three branches: (i) managerial or corporate finance, primarily concerned with the investment and financing decisions of corporations and other business organizations; (ii) investments, which seek to achieve the greatest return for a given level of risk; and (iii) financial institutions and markets, dealing with issues specific to the management of financial institutions and/or the operation of financial markets. As a discipline, finance works towards maximizing value while managing risk. Because risk and value are two sides of the same coin (decreasing risk increases value and vice versa), it is impossible to entreat one without invoking the other. Uncertainty in estimating both risk and value, particularly with regard to environmental amenities, is the source of much friction between economists and environmentalists.

Finance is often defined as a form of applied economics relying heavily on information collected in accounting. It comes as no surprise, then, that many of the tools and analyses used in finance are rooted in these fields. The majority of environmental amenities are not traded in markets, either because property rights are not well defined (fisheries, biodiversity) or because the services in question are public goods (clean air and water, beautiful views, etc.). The discipline of economics offers numerous methods for dealing with both problems and also provides techniques for valuing non-marketed environmental assets, a first step in financial decision-making.

New accounting techniques are expanding the measurement of environmental costs and benefits to include regulatory costs, auditing costs, voluntary costs, contingent costs and image/relationship costs. Recognition of the myriad and subtle ways environmental issues impact companies' cost and revenue streams is often the first step in developing a proactive environmental management program. Similar efforts are taking place on the macroeconomic level. Projects to ascertain the contribution of natural and human or social capital in the national income accounts have been undertaken by national governments, the United Nations, the World Bank and others (cf. Ahmad *et al.*, 1989; Peskin, 1991; IBRD, 1995). The results are informative '... identifying dozens of countries like Kenya, Libya, Nigeria and Venezuela that are, in effect, eating their seed corn countries where the accumulation of capital has been offset by the depletion of raw materials and fertile land'.

The link between finance and the environment ultimately rests on one's definition of capital, or endowments used in the generation of income. Classical economists recognized two forms of capital: land and labor. Recent scholars in ecological economics have identified three broad types of capital (Costanza and Daly, 1992): (i) natural capital – natural resources used to generate income, i.e. farmland, forests, and fisheries; (ii) manufactured capital – factories, buildings, tools and other artifacts; and (iii) human capital – the stock of education, skills, culture and knowledge stored in human beings themselves (see also Becker, 1975).

The key in understanding the role of finance in either exacerbating or alleviating environmental damage is to recognize that, for the most part, the above forms of capital are substitutes for one another and that transforming one to the other generally involves a fourth kind: financial capital. Financial capital, or money, enjoys a special place in this taxonomy, for it alone is truly fungible. It serves as a unit of account (numeraire), as a store of wealth and as the means to acquire additional welfare. Some kinds of capital, e.g. unspoiled wilderness, factories, education, etc., provide welfare in and of themselves. Financial capital is valued for its liquidity, i.e. the ease with which it can be exchanged for the other three kinds of capital.

More capital, be it natural, manufactured, human or financial, is preferable to less. Moreover, an individual's welfare is most likely maximized by the acquisition of some combination of these four types. For example, a farmer may choose to exchange the products of his or her land and labor for a new tractor, for education, or simply for money (which is then either consumed or invested). Individual choices concerning the types of capital to hold and how much to consume and how much to save are ultimately responsible for the depletion or preservation of natural resources.

ENVIRONMENTAL FINANCE

Environmental finance concerns itself with the impact of environmental issues on financial decision-making, which is essentially a three-step process. The first step is to identify sources of risk and/or opportunities to create value. This requires a better understanding of the interconnections between ecology and economics, which is a good thing. 'Knowledge on the whole is an environmentally neutral asset that we can contribute to the future', remarks economist and Nobel laureate Robert Solow (Solow, 1991). Environmental auditing, ecobalance analysis and technology forecasting are useful tools in this process. The second step is to



analyze various alternatives for increasing value or laying off risk. Various valuation techniques (including contingent valuation), cost-benefit analysis and full-cost accounting are used to monetize trade-offs between different resource allocations. Finally, a decision must be made, based on a thorough analysis of all costs, benefits and uncertainties.

The Financial System: Earth's Friend or Foe?

There is nothing inherent in the structure of the financial system which necessarily leads to environmental destruction. If economic agents desire greater amounts of current consumption (for whatever reason), a well-functioning financial system facilitates the achievement of these goals in an efficient manner. In some cases the availability of financial capital may lead to the degradation of environmental amenities which would not otherwise have taken place. For instance, a fisherman might borrow money from a bank to buy a boat, which he then employs to harvest fish at rates well above maximum sustainable yield, ultimately leading to the demise of the fishery. The problem lies not with the financial system, but with the disparity between private and social objectives. Environmental economics publications are replete with examples on how best to realign these interests (cf. Cropper and Oates, 1992).

The financial system can also work to preserve natural capital. The Nature Conservancy (TNC), an international conservation organization, provides an excellent example of this approach. Its tactics are deceptively simple: to protect rare plants and animals, TNC buys the places they need to survive. Funded by individuals, businesses and government subsidies, this organization directly transforms financial and other kinds of capital into natural capital, increasing the welfare of its donors. Schmidheiny *et al.* (1996) provide numerous other examples of how financial institutions and financial markets are working to advance the cause of sustainable development and sustainability.

Value and Risk

Financial markets exist to transfer value and to transfer risk. Transferring value is akin to the transformation of different kinds of capital into one another. Transferring risk essentially refers to the laying off of risk from hedgers to speculators. Individuals and businesses have different appetites for risk, just as they have preferences for different kinds of capital. Well-functioning financial markets provide opportunities to insure against adverse scenarios. For example, under the 1990 Clean Air Act, certain electric utilities in the USA must hold

permits allowing them the right to emit sulfur dioxide, a pollutant responsible for the formation of acid rain. Because these permits are tradable (and, in fact, are also available as pollution futures), the utilities can choose how best to achieve predefined policy goals by decreasing emissions or purchasing sufficient permits forward to meet their expected needs, i.e. hedging.

Certain agents may demonstrate preferences for particular kinds of capital, or increased current consumption, which may come at the expense of natural capital, but, again, this is a problem with preferences, not the system as a whole. 'How much is enough?' asks Durning (1992). Individuals have different satiation levels for different kinds of capital. With regard to natural capital, the majority of humanity lies somewhere between Ronald Reagan ('A tree is a tree: how many more do you need to look at?') and John Muir ('In God's wildness lies the hope of the world'). Other business disciplines face similar dilemmas with regard to environmental issues. A central goal of marketing, for instance, is to increase the consumption of a firm's goods and services. But consumption seems to be the problem, not the solution!

The remainder of this paper provides examples concerning the impact of environmental issues on financial decision-making by corporations, investors and financial institutions. For corporations, failure to manage environmental risks is likely to increase financing costs and/or decrease investment returns. For investors, a major task is in forecasting the effects of increased environmental concern on investment returns (value) to determine which companies are likely to profit from increased attention to environmental issues (e.g. recycling, waste management firms) and which will be impacted in a negative fashion (e.g. older manufacturing firms faced with expensive remodeling or compliance expenses, firms with significant liability for the remediation of toxic wastes). Banks and other financial institutions are addressing increased credit risks arising from a borrower's environmental exposure (including the possibility of lender liability in the event of loan default) and weighing the advantages of 'eco-banking'. In each of these areas, the principles of value maximization and risk management provide guidance in determining the likely outcome of financial decision-making with regard to environmental issues.

CORPORATE FINANCE AND THE ENVIRONMENT

Attempts to integrate environmental concerns into the corporate finance function immediately come



up against a central doctrine of finance: the alleged goal of the financial manager is to maximize shareholder wealth. In a capitalistic system, those who contribute capital to an economic enterprise are entitled to special treatment by virtue of their ownership position (Friedman, 1970; Malkiel and Quandt, 1971). A corporation, though a legal entity in its own right, is nonetheless owned by its shareholders, who work their collective will through the firm's board of directors and management team. Firms engaging in behaviors not providing direct pecuniary benefits to shareholders, e.g. employing more environmentally sound but higher cost production processes or donating a portion of profits to environmental organizations, should earn investment returns inferior to businesses pursuing less lofty goals. Although some shareholders prefer these sorts of firms (the so-called 'ethical investors'), the majority of the investment community does not appear to, and share prices are likely to fall, decreasing shareholder wealth.

Today, very few firms are apt to admit that they pursue the hard-line maximization of shareholder wealth. Managers are much more likely to espouse some variant of the stakeholder paradigm, in which business is considered as a system of agreements or contracts between many parties (Freeman, 1984; Cornell and Shapiro, 1987). Management's response to the firm's stakeholders – an amorphous group comprising customers, employees, suppliers, shareholders, competitors and others – depends on the relative importance of a particular stakeholder group to the company's overall strategy. If the natural environment is granted stakeholder status, as some scholars argue (Hart, 1995; Shrivastava, 1995a, 1995b), corporate decision-making becomes much more difficult and a rather large ethical can of worms is opened.

Adjusting for Environmental Risks

Even without wholly embracing the stakeholder concept, certain modifications to 'business as usual' make sense within the traditional paradigm of shareholder wealth maximization. Most of these relate to a firm's investment policies. The financing function is impacted indirectly to the extent that a failure to manage environmental risks increases the company's cost of capital. Some of the risks faced by companies with regard to environmental issues are described in the following sections.

Consumer Backlash

Immediately following the *Exxon Valdez* oil spill, returns to Exxon shareholders and shareholders in unrelated 'environmentally irresponsible' companies

dropped precipitously (White, 1995c). Consumer boycotts against Exxon (*Exxon Valdez* oil spill), Bumblebee tuna (dolphin-tuna controversy), General Electric (nuclear power), Royal Dutch Shell (Brent Spar) and other companies have engendered significant losses in public goodwill and company value.

Functionality

Process modifications to achieve better environmental performance create new risks. For instance, Esprit's new clothing line made with naturally colored cotton required the development of new ginning and weaving techniques due to the cotton's shorter fibers. Recycled materials contain impurities and contaminants not present in virgin feedstocks, the removal of which often outweighs their lower initial costs.

Liability

Liability for environmental incidents is a growing concern for businesses in the developed nations of the world. The 'Superfund' law in the USA is perhaps the most draconian example of legislation designed to prevent environmental mishaps. Designed to facilitate the identification and cleanup of hazardous substance disposal sites, this law imposes strict, joint and several liability for cleanup costs on owners and operators of contaminated sites, and transporters and generators of hazardous substances. Moreover, it is retroactive, requiring companies to remediate disposal sites which at one time were in full compliance with the law. The fear of environmental liability, and a general inability to insure against it, is driving more and more businesses to practice pollution prevention. In essence, firms which do not create waste or pollution in the first place need not be concerned with cleaning it up.

Discounting the Future

In general, risks and uncertainties about future costs or benefits are best handled by adjusting the stream of expected future cash flows, not the discount rate. However, the practice of discounting has itself come under criticism on the grounds that it negatively discriminates against future generations. Moreover, the higher the discount rate, the faster resources are likely to be depleted, i.e. discounting appears to be inconsistent with sustainability. Several rationales are offered for discounting, including the observations that humans exhibit positive time preference and that the productivity of capital implies current resources diverted to production yield higher levels of future consumption. Critics, however, respond that individual



impatience is not necessarily consistent with maximizing lifetime welfare, and that what individuals want should not necessarily influence public policy. The number of publications on discounting the future is vast and generally slanted according to the authors' personal beliefs (Markandya and Pearce, 1991; Partridge, 1981; Norgaard, 1992; Summers, 1992; Brennan, 1995). Although there may be valid arguments against discounting from society's point of view, these do not appear to extend to the case of individual or corporate decision-makers. It may be more appropriate, for instance, to incorporate a sustainability constraint, i.e. irrespective of the benefits and costs, the stock of natural capital must remain constant (Costanza, 1994; Daly, 1994). This is essentially the point of mitigation banking, discussed in a later section of this paper.

GREEN INVESTING

Environmental protection spending in the USA has grown three times faster than the GDP since the late 1960s. In 1992, the total expenditure for environmental goods and services was approximately \$170 billion, or 2.8% of the GDP. By the year 2000, this figure is estimated to increase to \$250 billion (3.1% of the GDP), an amount approximately equal to the anticipated defense budget at that time (Bezdek, 1993). The worldwide market for environmental goods and services is expected to grow rapidly from \$300 billion to \$600 billion by 2000, with annual growth rates ranging from 5 to 25% (IBRD, 1991). Areas for investment growth in industrial nations include waste management and pollution control, energy efficient technologies, alternative energy sources and environmental consulting (White, 1992). In developing nations, game ranching, plantation forestry, specialty products, genetic material and ecotourism are expected to increase in importance. Smaller firms may distinguish themselves by providing environmentally desirable alternatives to current consumer products, e.g., The Body Shop, Cultural Survival, Shaman Enterprises, dkk Scharfenstein.

Green Mutual Funds

Environmentally oriented mutual funds are a subset of the general phenomenon of socially responsible investment or ethical investing. In the USA, ethical investment funds date back to the late 1920s, when many religious institutions eschewed investments in 'sin stocks,' i.e. firms connected with alcohol, tobacco or gambling activities. The Pax World and Dreyfus Third Century funds were established in the late 1970s

focusing on investments in firms with exemplary records in employee relations, equal opportunity practices, community development, the advancement of women and minorities, product safety and environmental responsibility. During the late 1980s, interest in 'environmentally friendly' investing grew until at one time more than three dozen funds worldwide were dedicated exclusively to environmental concerns. Although there is no consensus on what, exactly, constitutes an 'environmental' fund, the term is generally taken to mean funds investing in companies involved in the environmental services and hazardous waste disposal industries, e.g. Waste Management and Browning-Ferris Industries and/or firms screened for superior environmental performance in recycling, pollution control, alternative energy and production processes and voluntarily information disclosure.

Investor interest in these funds has waxed and waned with their performance (or lack thereof). The majority of funds are offered to investors in the USA, Great Britain and Germany. Numerous advisory services exist to assist investors in evaluating potential investment candidates. Reports of environmental mutual fund performance are mixed, varying by performance appraisal method and the time period under investigation. White's (1995a) analysis of environmental mutual funds in the USA and Germany appears to be the most comprehensive treatment of this issue to date; see Hamilton *et al.* (1993) for a review of socially responsible mutual funds. Excepting one fund in Germany, White (1995a) reports that funds in both countries significantly underperformed market indices on a risk-adjusted basis during 1991–1993. Several reasons are offered for their poor showing, including investment set restrictions and/or inept management. The former argument, however, is weakened by the contemporaneously strong performance of the Domini Social Index, a benchmark portfolio of companies screened using socially responsible investment criteria.

Corporate Codes of Environmental Conduct

Many firms have adopted corporate codes of environmental conduct, partly to disseminate environmental commitments throughout the firm and partly to achieve better relations with investors and the public (Nash and Ehrenfeld, 1996). The chemical industry's Responsible Care initiative, the International Chamber of Commerce's Business Charter for Sustainable Development and the CERES, previously the Valdez, Principles are some of the better known codes to which a corporation might pledge itself. To the extent that



the adoption of these codes reflects an organization's genuine intent to tread more lightly on the earth, they serve a useful purpose by signaling the possibility of reduced future liability, cost savings and better scanning for environmental opportunities.

Environmental Performance and Firm Financial Performance

More recent research on the investment performance of individual firms has been more encouraging. Johnson (1995) has conducted the most thorough investigation of the relationship between corporate environmental performance and several measures of economic performance to date. He reports mixed results, though '... for most cases in which a statistically significant relationship was observed, poorer environmental performance translates to poorer economic performance ...' (Johnson, 1995: 201).

White (1995b) used environmental reputation data from the Council on Economic Priorities and an event study analysis of firms' signing the CERES Principles to show that a positive reputation for environmental responsibility is associated with superior risk-adjusted investment returns. Hart and Ahuja (1996) examined the relationship between pollution prevention and firm performance using data from the EPA's Toxic Release Inventory. They report evidence of a positive link between emissions reductions (pollution prevention) and financial performance. Cohen *et al.* (1995) also find significantly lower risk-adjusted returns for 'high emissions' portfolios versus 'low emissions' portfolios using TRI data.

Although these findings are encouraging, it is important to bear in mind that in efficient financial markets, investors will earn returns commensurate with the level of expected risk taken on. Evidence that 'green' companies earn superior risk-adjusted returns prompts investors to purchase shares in these firms, driving up stock prices and decreasing returns. If markets are efficient, 'green' firms are unlikely to earn risk-adjusted returns either greater or lower than is appropriate for their level of risk once equilibrium is reached.

FINANCIAL INSTITUTIONS AND THE ENVIRONMENT

The Chinese word for 'crisis' consists of two characters: 'danger' and 'opportunity'. Banks, insurance companies and other financial institutions are responding to our present environmental crisis on both fronts. In a recent international survey on environmental policies and practices of

the financial services sector, 70% of the respondents believed environmental issues have a material impact on their business (UNEP, 1995). Liability for past environmental transgressions or unanticipated future incidents was the primary environmental concern facing most financial intermediaries. The vast majority (80%) of institutions perform some kind of environmental risk management, generally before committing funds to a transaction.

Lender Liability

Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or 'Superfund'), lenders can become liable for environmental cleanup costs as owners if they hold title to contaminated property seized as collateral in loan foreclosures. Because liability is joint and several, if one party is unable to pay its share of the cleanup costs, the EPA looks to other parties with deeper pockets. Cleanup costs can easily exceed the value of the property, such that lenders stand to lose more than just the value of the loan. The cost of investigating and cleaning up a site on the National Priorities List (NPL) averages \$50 million (Plewa, pers. comm., 1994).

The Superfund Amendment and Reauthorization Act (SARA) of 1986 provided two defenses under which lending institutions might be exempted from liability under the Superfund statutes. The innocent landowner defense provides an exemption for potentially responsible parties unaware of existing contamination before becoming owners of the property and who exercised due diligence in determining whether such contamination in fact existed. A lender must show it did not know and had no reason to know about the presence of any hazardous substances disposed at the site. Due diligence presumes all appropriate inquiries were made concerning the previous and current ownership and uses of the site were made and that there was no reason to know the property was contaminated.

The security interest exemption addresses the problem of lender liability more directly. Specifically, it clarifies the meaning of an 'owner or operator', explaining that it does not include '... a person who without participating in the management of the facility, holds indicia [a form] of ownership primarily to protect his security interest in the vessel or facility'. The exemption was designed to protect lenders who held title solely for the purpose of securing a loan. Unfortunately, significant confusion exists concerning the interpretation of this passage. A 1992 rule issued by the EPA was supposed to have clarified the agency's



position; however, it was vacated by a 1994 court decision and lenders are once more faced with uncertainties at the Federal and state level (Prager and Witte, 1994).

Eco-Banking

Mutual funds are not the only financial intermediary seeking to satisfy the needs of more environmentally conscious consumers. Brokerage firms, commercial banks, insurance companies and credit card companies have increased their offerings of environmental products and services (Schierenbeck and Seidel, 1992; White and Molinaro, 1992). In May 1988, the world's first 'ecobank' opened in Germany, dedicated to the provision of environmentally sound banking services. Loan requests are screened for social benefits and depositors are encouraged to direct their funds towards investments in the areas of environment, social justice, education and equal opportunity (GeMUT, 1989; Stüdemann, 1993). In the USA, South Shore Bank established a similar subsidiary in the Pacific Northwest. Its goal is to facilitate conservation-based development and improve the economy while preserving the last stands of temperate rain forest in existence. By allowing depositors to 'invest their principal with principles', both institutions are differentiating themselves in a highly competitive market. On a related note, financial services firm Working Assets offers a credit card promising donations to various environmental causes each time the card is used.

Though few commercial banks are going as far as Germany's Okobank or South Shore Bank, many others have pledged themselves to pursue principles of sustainable development. The United Nations Environment Program first presented 'A Statement by Banks on the Environment and Sustainable Development' at the 1992 UN Conference on Environment and Development (the Earth Summit). It acknowledges that 'environmental risks should be part of the normal checklist of risk assessment and management' and pledge the banks to proactive policies to minimize environmental impacts. As of January 1995, 65 financial institutions (including many large European and Canadian banks, but few from the USA or Japan) were signatories to this statement (Vaughn, UNEP, pers. comm., 1995).

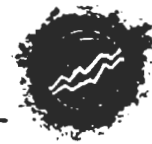
Debt for Nature Swaps and Conservation Banking

Debt for nature swaps were first proposed in 1984 as a means of protecting the earth's biodiversity while realizing a return on hitherto unproductive banking assets. They entail the acquisition of debt

(at a discount) by conservation organizations and its subsequent redemption in local currency with the proceeds used for conservation purposes. White (1994) discusses several reasons why a bank or financial institution might choose to participate in this process, including tax breaks, the removal of non-performing loans and the chance to improve its public image. Since 1987, approximately \$500 million worth of Latin American debt has been retired in these agreements (Anonymous, 1994). Unique environmental habitats in Costa Rica, Brazil, Madagascar and more than two dozen other countries have been preserved as a result of these novel financing schemes. Although not a panacea for the developing world's debt and environmental crises, debt for nature swaps do exemplify one method of harnessing the marketplace to serve environmental ends.

Conservation or mitigation banking is another means by which financial institutions are taking an active role in balancing environmental and economic concerns. A conservation bank is a parcel or series of parcels of habitat owned by a private party or public agency and managed for its natural resource values. In exchange for permanent guarantees to restore and/or enhance natural habitats and wetlands within the 'bank', developers receive credits which can be used to offset unavoidable habitat or wetland losses at more desirable locations. Spurred by President Clinton's wetlands reform package in 1993, conservation banks are rapidly becoming a favored means for moving the development process forward while protecting environmentally sensitive habitats in a more rational and coordinated manner (Marsh *et al.*, in press).

In April 1995, Bank of America created the nation's first multi-species conservation bank (Lawrence, 1996). Two years earlier, the bank foreclosed on Carlsbad Highlands, a 263 acre property in northern San Diego County. The parcel appraised at a very low value, in part because it was home to the California gnatcatcher, a songbird classified as 'threatened' under the US's Endangered Species Act. After Bank of America sold a portion of this land to the California transportation authority as mitigation land for a highway project running through gnatcatcher habitat, it set up a full-fledged conservation bank to sell the remaining 180 acres to others in need of similar offsets. Developers are expected to benefit from an increased opportunity set, environmentalists are pleased with a more integrated approach to habitat planning (versus the former piecemeal practices), and financial institutions/investors are able to realize higher prices for environmentally sensitive land assets.



Insurance Companies

Insurance companies are perhaps the most concerned group of financial institutions. Environmental risks can be extremely expensive and difficult to predict. Changing scientific reports and, worse, changing liability rules, have created an unusually hostile climate for insurers. During the latter part of the 1980s, commercial property insurers virtually abandoned the pollution liability market, fearing catastrophic losses as potentially responsible persons under the Superfund laws. A few have since returned, though with very expensive coverage.

Changing climate patterns are another problem for property and casualty companies. A recent report by the UN-sponsored Intergovernmental Panel on Climate Change (IPCC) confirms a global temperature rise. This could have seriously unfortunate effects, submerging entire coastal population centers, altering agricultural growth patterns across the world and increasing the severity of droughts, floods and storms (IPCC, 1995). In the USA, natural disasters already appear to have increased in number and intensity:

From 1966 to 1987, no single natural catastrophe generated claim payments of over \$1 billion (in 1992 dollars), whereas between 1987 and April 1993, no less than 11 catastrophes topped the \$1 billion mark. From 1989 to 1992, US insurers paid out \$39.5 billion in catastrophe losses, exceeding all catastrophe payments for the prior 26 years (Sabar, 1994).

Faced with evidence suggesting a link between global warming and increased insurance claims, property and casualty insurers (and particularly property and casualty re-insurers) are sponsoring scientific symposia and hiring in-house climate experts to re-evaluate their risk exposures (Leggett, 1992, 1996; Sabar, 1994).

CONCLUSIONS

Awareness of and concern for the preservation of our natural environment has dramatically increased over the last quarter century or so. Consumers are demanding expanded environmental responsibilities from businesses, regulators are imposing ever stricter environmental performance standards and competitors are maneuvering for competitive advantage by reducing waste, preventing pollution and targeting strategic environmental markets. Dangers and opportunities lurk within

this terrain, posing threats and rewards to managers in all branches of finance. This paper has attempted to review the structure of the financial system and its relationship with the natural environment. Additional information was provided highlighting the ways in which the financial markets are currently working to address environmental problems, always centered on the twin objectives of value maximization and risk management.

Numerous questions, however, remain unanswered. For instance, what additional environmental costs are appropriate for the firm to include in its investment decision-making? How does a firm's environmental reputation affect its cost of capital? What is driving recent findings of a positive relationship between corporate environmental performance and firm financial performance? Are eco-banking services cost-competitive with ordinary offerings? 'Avoiding environmental incidents remains the single greatest imperative facing industry today', notes Edgar Woolard, chief executive officer of the DuPont Corporation. Further research into the vitally important field of environmental finance would seem to be in order.

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