Measuring Up:
New Directions for Environmental Programs at the World Bank*

Piet Buys, Susmita Dasgupta, Craig Meisner, Kiran Pandey, David Wheeler
Development Research Group

Katharine Bolt, Kirk Hamilton, Limin Wang
Environment Department

World Bank

World Bank Policy Research Working Paper 3097, July 2003

* For valuable comments and suggestions, our thanks to Kristalina Georgieva, Roberto Zagha, Ede Jorge Ijjasz-Vasquez, Magda Lovei, Ken Chomitz, and the members of the World Bank's Environment Sector Board. The research summarized in this paper has been jointly supported by the World Bank's Environment Department and Development Research Group.

Executive Summary

The World Bank's new Environment Strategy focuses on environmental programs that will improve the well-being of poor people in developing countries. The strategy advocates cost-effective reduction of air and water pollutants that are most harmful to human health. In addition, it addresses threats to the livelihood of over one billion people who live on fragile lands (i.e., lands that are steeply sloped, arid, or covered by natural forests).

The new approach will require accurate information about environmental threats to health and livelihood, as well as an appropriate resource-allocation strategy. Drawing on recent research at the World Bank and elsewhere, this paper attempts to contribute in three ways. First, we develop a rule for optimal cross-country resource allocation that reflects the Bank's investment policy. Using this rule, we estimate optimal country shares of Bank environmental investments from two sets of variables: threats from outdoor air pollution, water pollution and fragile lands; and estimates of the likelihood that Bank projects will succeed. We combine the country shares with Bank investment data to estimate optimal country allocations. Finally, we aggregate our country results to allocations for the major regions in which the Bank operates.

We find that the largest share of total optimal investment goes to East Asia (44%), followed by South Asia (21%) and Sub-Saharan Africa (19%). Other regions get significantly lower shares (respectively 6%, 5% and 5% for Latin America and the Caribbean, Eastern Europe and Central Asia, and North Africa and the Middle East). Within sectors, optimal investment patterns vary significantly. Sub-Saharan Africa gets a large allocation for safe water (34%), exceeded only by East Asia (38%), while South Asia gets 15%. Africa's allocation for cleaner air is strikingly lower (6%), in the same range as the lowest-investment regions, while East Asia (largely China) commands 50% and South Asia 24%. The allocation for natural resource management is close to the overall allocation, with East Asia receiving 44%, South Asia 24%, Sub-Saharan Africa 15%, and the other regions much lower shares.

It would be lucky indeed if the Bank's current investment allocation matched the optimal allocation, for several reasons: The Bank is pursuing a new strategy; we have just developed appropriate environmental threat indices; new measures of project success likelihood have just become available; and the Bank's Environment Department has recently completed its first comprehensive accounting of the Bank's environment portfolio. In a subsequent paper, we will compare our results with the Bank's current portfolio, and explore the implications for resource allocation. Future work may also extend the optimal investment approach to indoor air pollution and biodiversity conservation.

We recognize that the optimal investment approach cannot capture the full complexity of environmental decision-making in the Bank, and we do not claim that our results will provide a comprehensive blueprint for adjustment. Nevertheless we hope that they will make a useful contribution to the discussion of new environmental priorities.

1. Introduction

The World Bank's commitment to the Millennium Development Goals and its renewed focus on poverty alleviation have had significant impacts on its environment strategy. The new strategy focuses particularly on programs for pollution control and resource conservation that will improve the health and livelihood of the poor in developing countries. Among air pollutants, the scientific consensus attributes most health damage to fine particulate matter (diameter 2.5 microns or less) produced by indoor and outdoor combustion (Holgate, et al., 1999). Among water pollutants, the consensus attributes most health damage to waterborne pathogens (WRI, 1999). Recent research has also identified the vulnerability of people on fragile lands (i.e., land that is steeply-sloped, arid, or covered by natural forest) as a major determinant of rural poverty and natural resource degradation in developing countries (WDR, 2003).

The attribution of so much damage to so few sources may have important strategic implications for the Bank's environmental portfolio. In this paper, we explore the implications by narrowing the focus of decision-making to three critical problems: outdoor fine-particulate air pollution[1], waterborne pathogens, and the vulnerability of poor people on fragile lands. We develop the analysis in several stages. First, we derive a resource-allocation rule from budget-constrained maximization of an objective function that reflects the Bank's approach to investment. In our results, optimal country investment shares depend on both the scale of environmental problems and the probability of project success.

[1] Indoor fine-particulate air pollution is clearly a major problem as well, but cross-country estimates of its severity and impact are not yet available. Current research at the World Bank is addressing this problem.

Second, we develop indices of environmental threats. For air pollution, our measure of problem scale is attributable daly's (disability-adjusted life-year losses from health damage). Our estimates come from recent collaborative research by the World Bank and the World Health Organization (Pandey, et al., 2003). For water pollution, our measure of problem scale is preventable deaths from unsafe water and poor sanitation. The country estimates have been produced by recent research at the World Bank (Wang, et al., 2003). Quantitative studies of poverty-environment links on fragile lands are less advanced, but policymakers and researchers agree that people are particularly vulnerable in such areas. For this reason, our measure of problem scale is the total rural population living on fragile lands. To estimate the affected population, we apply GIS (Geographic Information Systems) techniques to spatial overlays of demographic, topographical, climatic and natural resource information.

Third, we develop country estimates of project success probability. Our information source is a database of over 3,000 project outcome ratings maintained by the Bank's Operations Evaluation Department (OED). For each country, we use the proportion of projects judged satisfactory by OED as an estimate of success probability.

We use our environmental threat measures and success probabilities to compute optimal country investment shares on two bases: Problem scale unadjusted for project success probability, and problem scale adjusted by the OED ratings. To obtain country allocations, we multiply the investment shares by the Environment Department's most recent estimates of total investments for pollution control and natural resource conservation since 1990. We obtain overall optimal allocations by summing the optimal allocations for reducing air pollution, water pollution, and threats to fragile lands.

The remainder of the paper is organized as follows. We develop the conceptual model and implied allocation rule in Section 2. In Sections 3 and 4, we introduce the measures of problem scale and success probability that are needed to implement the model. Section 5 presents our results at the country and regional levels, while Section 6 summarizes the paper.

2. Optimal Allocation of Environmental Investments

We model the welfare impact of World Bank investments as a function of their levels and distributions across countries. Inevitably, the Bank must strike a balance between country representation and global welfare maximization in its resource allocation decisions. We cannot realistically characterize its objective function as linear (infinite elasticity of substitution across countries), because sole allocation to one country is infeasible, whatever the relative scale of its problems. Some representation for many countries is implied by the Bank's charter. At the same time, the Bank's objective function is not purely fixed-coefficient (zero elasticity of substitution across countries), because nothing forces it to maintain cross-country parity in per-capita allocation. This is a good thing for the Bank's environment program, since the distribution of environmental problems across countries does not necessarily reflect the distribution of population.

We adopt an intermediate assumption: that the Bank's objective function is characterized by unit-elastic substitution across countries. A unit-elastic (Cobb-Douglas) welfare function permits tailoring of programs to a country's circumstances, while encouraging portfolio diversification through the operation of diminishing returns. Expected welfare gains from Bank investments are related to both the scale of a country's environmental problems and the probability that projects will be successful under local

conditions. The Bank assigns the same opportunity values to human life, health and natural resource savings in all of its partner countries.

For each area of concern (outdoor air pollution, water pollution, fragile lands), we specify the Bank's objective function for damage abatement as:

$$(1)\ W = \omega_0 \prod_{i=1}^{N} A_i^{\omega_i}$$

where A_i = Environmental damage abatement in country i
ω_i = Poverty weight assigned to country i

For each country, we specify the relevant damage abatement function as:

$$(2)\ A_i = \alpha_0 B_i^{\alpha_1 D_i p_i} \quad (\alpha_1 > 0)$$

where B_i = Scale of Bank activity in country i
D_i = Scale of damage in country i
p_i = Probability of project success in country i

Equation (2) incorporates scale economies: The abatement productivity of Bank activity rises with the scale of existing environmental damage. However, productivity is also sensitive to local conditions that affect project success. To capture this effect, we multiply the base output elasticity of Bank activity ($\alpha_1 D_i$) by p_i.

For the sector (or problem area) in question, the Bank faces a fixed budget constraint and differential unit costs of operating in different countries:[2]

$$(3)\ \sum_{i=1}^{N} c_i B_i = I_T$$

where c_i = Unit cost of Bank activity in country i
I_T = Total sectoral budget

[2] In this paper, we assume that allocations for specific environmental problems are exogenous. In future work, we hope to address the cross-sectoral allocation question, both among environment sectors, and between environment and other sectors.

Substitution from (2) into (1) yields the following welfare function:

(4) $W = \omega_0 \prod_{i=1}^{N} \alpha_0 B_i^{\alpha_1 \omega_i D_i p_i}$

Maximization of W subject to the overall budget constraint yields the following ratio of optimal Bank allocations to countries i and j:

(5) $\frac{c_i B_i^*}{c_j B_j^*} = \frac{\omega_i D_i p_i}{\omega_j D_j p_j}$

Since ω is a poverty weight, we can specify it as a function of income per capita:

(6) $\omega_i = \theta_0 y_i^{\theta_1} \quad (\theta_1 < 0)$

We also allow for the possibility that project success probability is itself a function of the level of development. For the model, we use per capita income as a proxy:

(7) $p_i = \delta_0 y_i^{\delta_1} \quad (\delta_1 > 0)$

Substituting (6) and (7) into (5), we obtain:

(8) $\frac{c_i B_i^*}{c_j B_j^*} = \frac{D_i y_i^{\theta_1 + \delta_1}}{D_j y_j^{\theta_1 + \delta_1}} \quad (\theta_1 + \delta_1 \gtrless 0)$

For country i, we obtain two formulations of the optimal budget share from (5) and (8):

(5') $s_i^* = \frac{c_i B_i^*}{I_T} = \frac{\omega_i D_i p_i}{\sum_{i=1}^{N} \omega_i D_i p_i}$

(8') $s_i^* = \frac{D_i y_i^{\theta_1 + \delta_1}}{\sum_{i=1}^{N} D_i y_i^{\theta_1 + \delta_1}}$

In (5'), the country's budget share is equal to the product of its poverty weight (ω_i), environmental damage (D_i), and project success probability (p_i), divided by the sum of products for all of the Bank's partner countries. In (8'), the budget share is equal to the

product of environmental damage and the appropriate exponential of per-capita income, divided by the sum of products for all partner countries.

Equations (5') and (8') lend themselves to a variety of uses and interpretations. For example, (5') can be applied to the Bank's loan portfolio, in which case s_i* is each country's optimal investment share. It can also be applied to the Bank's policy dialogue and technical assistance activities, in which case s_i* is each country's annual budget share; B_i* is a relevant measure of Bank activity (staff time, etc.), and c_i is a country-specific cost index. Poverty weights (ω_i) can be assigned explicitly, or simply assumed to be the same across countries (implying that the Bank assigns equal value at the margin to damage abatement in any country, ceteris paribus).

In equation (8'), the optimal country share depends on environmental damage (D_i) and income per capita (y_i). If the income elasticities of the poverty weight (θ_1) and project success probability (δ_1) are equal in absolute value (while opposite in sign), then the optimal budget share in (8') is simply the country's share of total environmental damage.

3. Measures of Environmental Problems (D_i)

3.1 Health Damage from Water Pollution

Our estimates of health damage from water pollution are based on recent econometric work by Wang, et al. (2003). This approach models health outcomes (measured by the under-five mortality rate) as a function of income; social and environmental variables (female education, immunization coverage, and access to safe water); and policy variables (e.g., share of public health expenditure to GDP). To project lives lost, the econometric estimates are combined with country-level demographic data

and estimates of the proportion of the population without access to safe water. For countries where access data are not available, the model uses the population-weighted average level of access for the income groups to which the countries belong. Figure 1 displays the results, which suggest that the greatest number of preventable deaths are in Sub-Saharan Africa, South Asia and East Asia. Countries with relatively low incidence of this problem include Russia and several East European states.

3.2 Health Damage From Outdoor Air Pollution

We attribute health damage from outdoor air pollution to atmospheric contamination by fine particulates. Over time, health research has narrowed its focus from total suspended particulate matter (SPM) to small particles less than 10 microns in diameter (PM_{10}) and, most recently, to particles whose diameters are less than 2.5 microns ($PM_{2.5}$). Small particles are likely to be more dangerous because they can be inhaled deeply into the lungs, and because their constituent elements tend to be more chemically active (WHO, 2000; WRI, 1999; Holgate, 1999). At present, atmospheric monitoring in developing countries is limited to SPM and PM_{10}.

Our health damage estimates come from a recent collaborative project with WHO, which is described in Pandey, et al. (2003). Using an econometrically-estimated model of particulate pollution, we project ambient PM_{10} concentrations for 3,226 cities. We use recently-estimated "dose-response" relations to compute the associated mortality and morbidity probabilities by age-sex group for each city; multiply these probabilities by numbers of people in each group; convert the results to daly's, and sum across cities, groups and damage categories in each country to obtain our estimates of total health damage. Figure 2 displays our estimates of total daly losses by country. Health damage

is heaviest in the populous countries of South and East Asia and a few African countries. All regions display a broad pattern of variation.

3.3 Vulnerable Populations on Fragile Lands

The Bank's World Development Report 2003 has identified the vulnerability of human populations on fragile lands as a critical poverty-environment problem. Approximately 1.4 billion people live on fragile lands that are steeply-sloped, arid, or forested, and many of these people are very poor (WDR, 2003). Research on poverty-environment links in this context is not highly developed, but policymakers and researchers generally agree that people on fragile lands bear a high risk of natural resource degradation and impoverishment. For this study, we highlight the overall problem by computing total population on fragile lands using GIS techniques. Figure 3 displays the results, which indicate a particularly heavy incidence of this problem in East and South Asia. With some visible exceptions, vulnerable populations are generally smaller in Eastern Europe, Sub-Saharan Africa, and Latin America.

4. A Measure of Project Success Probability (p_i)

A country's optimal environmental investment share depends on the probability that a project or program will succeed, as well as the scale of its environmental problems. To estimate country success probabilities, we have drawn on a large database maintained by the World Bank's Operations Evaluation Department (OED). Since 1990, OED has rated the outcomes of over 3,000 World Bank projects in 146 countries. OED rates projects in eight categories: Highly satisfactory, satisfactory, moderately satisfactory, marginally satisfactory, marginally unsatisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory. We interpret the first four ratings as "successful" for our

probability calculation. Of 3,075 projects rated by OED since 1990, about 70% have achieved one of the four satisfactory ratings.[3]

Figure 4 and Table 4.1 display our estimates of project success probability. Although the estimated probabilities are generally highest in Eastern Europe/Central Asia and lowest in Sub-Saharan Africa, countries in all Bank regions except South Asia exhibit a very wide range of variation. Country estimates are presented in Appendix Table A.6.

Table 4.1: Distribution of Country Probabilities of Project Success, by Region

Region	Min	Median	Max
Sub-Saharan Africa	0	64	100
Middle East, North Africa	0	71	100
South Asia	69	71	100
East Asia, Pacific	33	76	100
Latin American, Caribbean	0	76	100
East Europe, Central Asia	0	83	100

5. Optimal Environmental Investment by Country

We develop two estimates of optimal investment for each environmental problem. In the first (case 1), optimal country investment shares are based entirely on our measures of environmental problems (D_i for outdoor air pollution, water pollution, and vulnerable populations on fragile lands). In equation (5'), this is equivalent to assuming that pollution abatement in all countries is given equal weight by the Bank (constant ω_i across countries) and future projects have the same probability of success in all countries. For

[3] For six countries with no OED project ratings, we have substituted predictions from a regression of our OED success probability estimates on the World Bank's internal rating of the countries' policy and institutional effectiveness. The regression fit is quite good (t-statistic over 7.0), so we have reasonable confidence in the six adjunct estimates. We prefer this approach to exclusion of the six countries, since the objective of this exercise is a comprehensive view of investment priorities.

convenience we assume that this probability is 1, but any constant probability will yield the same result. In equation (8'), case 1 is equivalent to assuming that the income elasticities of country poverty weights and project success probabilities are equal in magnitude but opposite in sign. This amounts to assuming that institutional and administrative difficulties in poorer countries are counterbalanced by higher weights assigned to abatement, so that only damage matters in the allocation of resources.

The second approach (case 2) uses more information, by incorporating our OED-based estimate of success probability as the measure of p_i in equation (5'). For this case, we assume that the Bank assigns equal weight to damage abatement in all partner countries (i.e. all income weights ω_i are the same).

Recently, the World Bank's Environment Department has completed a detailed accounting of the Bank's environmental projects by sector. We have used this information to estimate current Bank investments by country for air pollution control, improved water and sanitation, and natural resource management. Using our estimated optimal shares, we have distributed total Bank investments in the three problem categories across all developing countries.

Since Figures 1, 2 and 3 represent quintile ranges for the environmental problem measures across countries, they also display the relative size of optimal investment shares for case 1 (optimal shares equal to shares of environmental problems). Figures 5, 6 and 7 provide the same information by problem for case 2. Figure 8 displays the results when we sum across the three environment sectors to obtain estimates of total optimal environmental investment in case 2. Full results for both cases are reported in Appendix A.

In general, our results suggest that investment orders of magnitude and country rankings are not highly sensitive to our assumptions about p_i. For p_i = OED (the OED success rate), cross-regional variation is considerably greater than within-region variation. The consequence is general similarity in optimal investment rankings and relative magnitudes for p_i=1[4] and p_i = OED. The greatest water and sanitation investments are concentrated in Sub-Saharan Africa, South Asia and East Asia. For air pollution reduction, the greatest investments are in South Asia and China. The pattern for natural resource management is more diverse, with some large country investments indicated for all regions except Eastern Europe and Central Asia.

Differences in OED success probabilities are, however, reflected in some patterns of cross-regional allocation. Many African countries, for example, get substantially higher allocations when policy doesn't matter (p_i = 1),[5] since there is no countervailing weight for poverty in case 2. In contrast, China's allocation is significantly higher when p_i = OED.

Figure 8 summarizes the results for total optimal investment when p_i = OED. The largest indicated investments are in South and East Asia, Sub-Saharan Africa, and the two largest countries in Latin America (Brazil and Mexico). Lower levels are generally (although not always) indicated for Eastern Europe and Central Asia, Northwest Africa, Western South America, and Central America.

6. Summary and Conclusions

In this paper, we use several new datasets and a model of World Bank decision-making to estimate optimal environmental investments for the Bank across countries and

[4] We have chosen p_i = 1 for expositional clarity, but any constant probability will yield the same result.
[5] Examples are Nigeria, Congo, Somalia, Central African Republic, Congo (DR), and Cameroon.

regions. We focus on three environmental problems that have been identified as critical for poor people in developing countries: health damage from outdoor particulate air pollution; health damage from waterborne pathogens; and vulnerability of rural populations on fragile lands.

We base our optimization exercise on a welfare function that makes three basic assumptions about the Bank's decision environment: the desirability of some representation for all partner countries; the importance of relative environmental damage across countries; and equal valuation of damage abatement across countries. In the first exercise (case 1), countries' optimal investment shares are simply their shares of total environmental damage. In case 2, we maintain equal valuation of abatement across countries but drop the assumption that all countries have equal likelihood of project success. We estimate country success probabilities from thousands of actual cases reviewed by OED. In case 2, each country's optimal share of total investment is determined by the product of its environmental damage and project success probability.

Table 6.1: Optimal Investment Shares (%) by Sector (Case 2)

Region	Total	Water	Air	Fragile Lands
East Asia, Pacific	44	38	50	44
South Asia	21	15	24	24
Sub-Saharan Africa	19	34	6	15
Latin America, Caribbean	6	7	6	5
East Europe, Central Asia	5	3	9	4
North Africa, Middle East	5	3	5	7

Our overall results are summarized by region in Table 6.1. We provide a detailed presentation of our country data and results in Appendix A. We find that the largest share of total optimal investment goes to East Asia (44%), followed by South Asia (21%) and Sub-Saharan Africa (19%). Other regions get significantly lower shares (respectively

6%, 5% and 5% for Latin America and the Caribbean, Eastern Europe and Central Asia, and North Africa and the Middle East). Within sectors, optimal investment patterns vary significantly. Sub-Saharan Africa gets a large allocation for safe water (34%), exceeded only by East Asia (38%), while South Asia gets 15%. Africa's allocation for cleaner air is strikingly lower (6%), in the same range as the lowest-investment regions, while East Asia (largely China) commands 50% and South Asia 24%. The allocation for natural resource management is close to the overall allocation, with East Asia receiving 44%, South Asia 24%, Sub-Saharan Africa 15%, and the other regions much lower shares.

To illustrate the consequences of introducing project success probabilities, Table 6.2 provides the same regional breakdown for case 1 (project success probabilities assumed to be equal across countries). Table 6.3 shows the change in regional allocations induced by moving from case 1 to case 2. It is clear that the major result of introducing project success probabilities is a net shift from Sub-Saharan Africa to the East-Asia Pacific region.

Table 6.2: Optimal Investment Shares (%) by Sector (Case 1)

Region	Total	Water	Air	Fragile Lands
East Asia, Pacific	37	30	44	37
Sub-Saharan Africa	25	43	9	21
South Asia	22	15	26	25
Latin America, Caribbean	6	7	6	5
Eastern Europe, Central Asia	6	3	10	5
Middle East, North Africa	5	2	5	8

Table 6.3: Change in Regional % Shares*

Region	Total	Water	Air	Fragile Lands
Sub-Saharan Africa	-6	-9	-3	-5
Eastern Europe, Central Asia	-1	0	-1	-1
South Asia	-1	0	-2	-1
Latin America, Caribbean	0	0	0	0
Middle East, North Africa	0	0	0	0
East Asia, Pacific	7	8	6	7

* Some columns do not add to zero because of rounding

In a subsequent paper, we will compare our results with the Bank's current portfolio, and explore the implications for resource allocation. It would be lucky indeed if the Bank's current investment allocation matched the optimal allocation, for several reasons: The Bank is pursuing a new strategy; we have just developed appropriate environmental threat indices; new measures of project success likelihood have just become available; and the Bank's Environment Department has recently completed its first comprehensive accounting of the Bank's environment portfolio. We also recognize that the optimal investment approach cannot capture the full complexity of environmental decision-making in the Bank, and we do not claim that our results will provide a comprehensive blueprint for adjustment. Nevertheless we hope that they will make a useful contribution to the discussion of new environmental priorities.

8. References

Holgate, S., Samet, J., Koren, H., Maynard, R. (ed.), 1999, *Air Pollution and Health*, San Diego, California: Academic Press.

Pandey, K. D., Bolt, K., Deichmann, U., Hamilton, K., Ostro, B., Wheeler, D., 2003 (forthcoming), "The Human Cost of Air Pollution: New Estimates for Developing Countries," *World Bank Development Research Group Working Paper*, Washington, DC.

Wang, L., Bolt, K., Hamilton, K., 2003 (forthcoming), "Estimating Potential Lives Saved from Improved Environmental Infrastructure," Environment Department, The World Bank, Washington, D.C.

World Bank, 2003, *World Development Report 2003: Sustainable Development in a Dynamic World*, Washington: World Bank/Oxford University Press.

World Health Organization (WHO), 2000, *Guidelines for Air Quality*, WHO, Geneva. Available at <http://www.who.int/peh/air/Airqualitygd.htm>).

World Resources Institute (WRI), 1999, *World Resources 1998-1999: A Guide to the Global Environment: Environmental Change and Human Health*, New York, NY: Oxford University Press.

Appendix A: Data and Results Tables*

A1: Optimal Environmental Investments by Region and Country
A2: Optimal Water and Sanitation Investments by Region and Country
A3: Optimal Air Pollution-Related Investments by Region and Country
A4: Optimal Natural Resource Management Investments by Region and Country
A5: Environmental Problem Indices by Region and Country
A6: OED Success Rates by Region and Country

* Missing data have led to some missing values in the optimal investment tables; Investments below $.09 million are entered as 0.0.

Table A.1: Optimal Environmental Investment by Region and Country ($Million)

Sub-Saharan Africa	P_i		Latin America, Caribbean	Pi		East Europe, Central Asia	Pi	
	OED	1		OED	1		OED	1
Ethiopia	758.5	810.5	Mexico	361.2	318.0	Turkey	256.5	295.8
Nigeria	688.5	1,083.4	Brazil	296.9	282.6	Ukraine	172.9	153.6
Tanzania	287.7	254.0	Argentina	183.2	182.1	Russia	163.9	238.5
Uganda	203.0	207.6	Peru	122.0	108.5	Poland	80.3	77.2
Sudan	164.9	206.2	Colombia	56.9	64.9	Uzbekistan	70.6	103.8
South Africa	163.5	151.1	Ecuador	52.1	44.3	Romania	52.9	48.0
Congo (DR)	157.9	555.7	Chile	51.0	43.6	Georgia	48.6	37.0
Angola	145.7	164.4	Bolivia	49.8	42.5	Bulgaria	45.7	45.7
Mozambique	135.3	117.9	Guatemala	29.0	33.2	Kazakhstan	45.6	40.0
Kenya	129.0	226.9	Haiti	28.9	56.8	Azerbaijan	35.3	39.3
Madagascar	123.7	126.3	El Salvador	26.4	21.9	Armenia	30.1	25.0
Chad	108.0	103.1	Dom. Rep.	23.8	25.6	Kyrgyz Republic	27.7	22.0
Burkina Faso	99.6	86.9	Venezuela	19.3	35.0	Tajikistan	27.5	27.9
Niger	98.9	120.5	Uruguay	19.2	14.8	Yugoslavia	19.4	19.3
Ghana	94.5	93.4	Nicaragua	17.9	15.5	Hungary	14.5	12.4
Mali	85.6	93.1	Honduras	17.0	17.6	Bosnia-Herz.	13.8	10.6
Zimbabwe	75.4	65.0	Paraguay	13.4	19.3	Lithuania	10.3	8.9
Cote d'Ivoire	72.4	88.0	Costa Rica	11.9	8.9	Albania	10.2	8.5
Senegal	71.3	66.7	Panama	10.5	7.6	Czech Republic	9.2	6.6
Eritrea	64.6	46.0	Jamaica	8.7	10.4	Moldova	7.6	8.7
Guinea	62.0	74.1	Guyana	2.0	2.1	Slovakia	6.1	4.5
Zambia	55.1	73.5	Trin., Tobago	1.9	2.1	Croatia	5.5	6.1
Malawi	54.8	72.1	Belize	1.0	0.9	Latvia	4.8	3.6
Benin	45.5	41.7	St. Vinc., Gren.	0.4	0.3	Cyprus	4.2	3.7
Rwanda	37.9	82.9	Bahamas	0.3	0.5	Estonia	3.3	2.4
Sierra Leone	37.0	64.7	Grenada	0.3	0.2	FYR Macedonia	3.0	3.3
Cameroon	36.3	114.3	St. Lucia	0.2	0.2	Slovenia	2.9	2.6
Mauritania	32.0	34.2	Dominica	0.0	0.0	Belarus	0.7	0.8
Burundi	23.3	30.2	Barbados	0.0	0.0	Turkmenistan	0.0	30.1
Somalia	19.3	68.9	St. Kitts, Nevis	0.0	0.0	**Total**	**1,173.1**	**1,286.9**
Togo	17.7	33.7	**Total**	**1,405.2**	**1,360.4**			
Guinea Bissau	11.2	11.5						
Namibia	10.1	10.2						
Gambia	7.7	10.1						
Swaziland	7.3	5.2						
Lesotho	7.1	9.0						
Cen. Afr. Rep.	7.0	24.9						
Botswana	4.9	5.2						
Congo	3.5	38.3						
Gabon	2.8	4.8						
Cape Verde	1.7	1.2						
Equatorial Guinea	1.5	4.1						
Comoros	0.8	1.7						
Djibouti	0.5	0.5						
Sao Tome, Principe	0.4	0.6						
Seychelles	0.1	0.1						
Liberia	0.0	16.0						
Mauritius	0.0	0.0						
Total	**4,215.5**	**5,501.4**						

Table A.1: Optimal Environmental Investment by Region and Country ($Million)

East Asia, Pacific	P_i		South Asia	Pi		North Africa, Middle East	Pi	
	OED	1		OED	1		OED	1
China	7,344.9	5,993.5	India	3,568.6	3,740.5	Egypt	371.1	394.2
Indonesia	903.1	864.2	Pakistan	708.9	741.3	Iran	260.4	227.5
Vietnam	532.2	379.8	Bangladesh	175.5	170.5	Yemen	140.6	149.0
Thailand	195.8	156.5	Nepal	82.0	84.1	Morocco	99.9	114.7
Myanmar	193.7	216.0	Sri Lanka	46.0	48.3	Algeria	73.9	117.2
Philippines	170.8	171.3	Bhutan	9.3	6.6	Tunisia	36.5	33.3
Korea	148.2	124.9	Maldives	0.3	0.3	Oman	27.2	19.3
Cambodia	114.0	99.0	**Total**	**4,590.6**	**4,792.6**	Jordan	19.6	16.3
Malaysia	67.3	51.9				West Bank, Gaza	10.4	7.1
Papua New Guinea	27.9	41.6				Lebanon	0.0	7.3
Lao PDR	19.2	20.3				Western Sahara	0.0	0.0
Mongolia	12.6	10.3				**Total**	**1,039.6**	**1,086.9**
Fiji	5.1	3.5						
Solomon Islands	1.7	2.5						
Kiribati	0.4	0.4						
Vanuatu	0.3	0.7						
Samoa	0.0	0.0						
East Timor	0.0	0.0						
Micronesia	0.0	0.0						
Marshall Islands	0.0	0.0						
Tonga	0.0	0.0						
Total	**9,737.2**	**8,137.4**						

Table A.2: Optimal Water and Sanitation Investment by Region and Country ($Million)

Sub-Saharan Africa	P_i		Latin America, Caribbean	Pi		East Europe, Central Asia	Pi	
	OED	1		OED	1		OED	1
Ethiopia	613.6	644.0	Brazil	142.9	128.7	Turkey	65.3	69.1
Nigeria	423.1	639.6	Mexico	135.9	111.9	Ukraine	38.3	31.0
Tanzania	212.4	183.1	Peru	51.2	42.8	Romania	32.8	28.6
Uganda	151.9	152.3	Argentina	47.2	42.7	Uzbekistan	19.8	27.1
Congo (DR)	110.0	376.6	Ecuador	32.5	26.7	Poland	17.2	15.0
Angola	104.2	114.1	Colombia	24.9	27.0	Kyrgyz Republic	9.9	7.5
Madagascar	99.5	99.8	Haiti	21.0	40.2	Tajikistan	9.9	9.5
Mozambique	99.2	84.1	Bolivia	20.7	16.6	Azerbaijan	9.1	9.4
Kenya	90.3	154.5	El Salvador	16.3	13.0	Yugoslavia	8.2	7.7
Chad	79.2	73.6	Venezuela	14.9	26.6	Kazakhstan	7.2	5.8
Sudan	68.0	80.4	Dom. Rep.	12.1	12.4	Georgia	5.2	3.6
Ghana	65.4	62.9	Nicaragua	11.8	9.9	Czech Republic	4.9	3.4
Niger	57.2	67.1	Guatemala	8.5	9.1	Albania	4.7	3.7
South Africa	54.2	47.2	Paraguay	7.5	10.2	Bulgaria	4.4	4.0
Mali	49.7	52.0	Honduras	6.3	6.2	Armenia	4.2	3.2
Malawi	46.6	60.4	Chile	6.2	4.8	Bosnia-Herz.	4.2	3.0
Burkina Faso	43.0	35.6	Jamaica	4.4	5.0	Russia	2.8	3.7
Guinea	39.5	45.5	Panama	3.5	2.4	Lithuania	2.7	2.2
Eritrea	36.7	25.1	Trin., Tobago	0.8	0.8	Latvia	1.6	1.1
Cote d'Ivoire	34.6	39.9	Costa Rica	0.7	0.5	Croatia	0.7	0.7
Zambia	34.4	44.0	Belize	0.6	0.5	Estonia	0.7	0.4
Benin	30.8	27.4	Uruguay	0.5	0.3	Hungary	0.4	0.3
Rwanda	30.1	64.8	Guyana	0.3	0.3	FYR Macedonia	0.1	0.1
Sierra Leone	28.0	47.9	St. Vinc., Gren.	0.1	0.0	Turkmenistan	0.0	14.6
Senegal	26.8	23.5	Grenada	0.1	0.0	Belarus	0.0	0.0
Zimbabwe	21.4	17.2	St. Lucia	0.0	0.0	Moldova	0.0	0.0
Cameroon	21.0	63.2	St. Kitts, Nevis	0.0	0.0	Slovakia	0.0	0.0
Mauritania	20.3	20.8	Barbados	0.0	0.0	Cyprus		
Burundi	16.1	20.3	Bahamas			Slovenia		
Togo	12.9	23.9	Dominica			**Total**	**254.3**	**255.7**
Somalia	9.4	32.1	**Total**	**570.9**	**539.6**			
Guinea Bissau	7.8	7.7						
Gambia	4.7	6.0						
Cen. Afr. Rep.	4.6	15.9						
Namibia	4.4	4.2						
Swaziland	3.3	2.2						
Gabon	2.3	3.9						
Botswana	1.9	2.0						
Congo	1.8	18.8						
Cape Verde	1.7	1.2						
Lesotho	1.6	1.8						
Equatorial Guinea	1.1	3.1						
Sao Tome, Principe	0.3	0.4						
Comoros	0.1	0.2						
Seychelles	0.1	0.1						
Liberia	0.0	10.0						
Djibouti	0.0	0.0						
Mauritius	0.0	0.0						
Total	**2,765.2**	**3,501.4**						

Table A.2: Optimal Water and Sanitation Investment by Region and Country ($Million)

East Asia, Pacific	P_i		South Asia	Pi		North Africa, Middle East	Pi	
	OED	1		OED	1		OED	1
China	1,958.2	1,476.7	India	974.1	946.2	Yemen	63.3	63.9
Indonesia	376.9	339.6	Pakistan	177.1	171.0	Morocco	35.0	38.0
Vietnam	307.1	210.2	Nepal	44.0	43.4	Iran	26.1	20.8
Myanmar	109.3	116.3	Bangladesh	36.3	32.2	Egypt	25.1	24.2
Cambodia	95.2	81.5	Sri Lanka	17.5	17.2	Oman	19.0	13.0
Philippines	84.9	80.4	Bhutan	5.0	3.4	Tunisia	11.9	10.2
Thailand	80.7	60.6	Maldives	0.0	0.0	West Bank, Gaza	10.4	7.1
Malaysia	29.7	21.8	**Total**	**1,254.0**	**1,214.4**	Algeria	9.5	13.8
Korea	20.0	15.3				Jordan	2.3	1.8
Papua New Guinea	19.3	28.1				Lebanon	0.0	0.0
Mongolia	7.8	6.1				Western Sahara		
Lao PDR	5.9	5.9				**Total**	**202.6**	**193.8**
Fiji	4.4	3.0						
Solomon Islands	1.1	1.5						
Kiribati	0.4	0.4						
Vanuatu	0.1	0.2						
Samoa	0.0	0.0						
Tonga	0.0	0.0						
East Timor								
Micronesia								
Marshall Islands								
Total	**3,101.0**	**2,448.6**						

Table A.3: Optimal Air Pollution-Related Investment by Region and Country ($Million)

Sub-Saharan Africa	P_i		Latin America, Caribbean	P_i		East Europe, Central Asia	P_i	
	OED	1		OED	1		OED	1
Nigeria	129.2	221.2	Argentina	129.9	133.3	Turkey	148.5	177.9
Ethiopia	36.6	43.6	Mexico	129.4	120.7	Russia	123.5	181.9
Sudan	32.6	43.7	Brazil	83.7	85.4	Ukraine	117.1	107.3
Senegal	22.9	22.7	Chile	38.7	33.7	Poland	61.0	60.2
South Africa	22.4	22.1	Peru	38.0	36.0	Bulgaria	38.7	39.2
Angola	20.2	25.0	Uruguay	18.5	14.3	Georgia	37.0	28.7
Cote d'Ivoire	18.4	24.0	Bolivia	15.6	14.2	Uzbekistan	21.7	33.6
Zimbabwe	17.4	15.9	Colombia	7.7	9.5	Armenia	20.3	17.3
Tanzania	17.1	16.7	Guatemala	4.4	5.4	Azerbaijan	16.1	18.8
Mozambique	16.3	15.6	Ecuador	4.2	3.9	Kazakhstan	13.4	12.3
Burkina Faso	14.0	13.1	Dom. Rep.	3.9	4.5	Romania	10.5	10.3
Zambia	13.4	19.3	Paraguay	3.3	5.2	Hungary	9.7	8.4
Chad	12.1	12.8	Costa Rica	3.1	2.4	Lithuania	5.7	5.2
Congo (DR)	11.5	44.7	El Salvador	2.7	2.5	Bosnia-Herz.	4.0	3.3
Mali	9.6	11.4	Panama	2.6	2.0	Yugoslavia	4.0	4.2
Niger	8.2	10.9	Honduras	2.6	2.9	Moldova	3.9	4.6
Guinea	7.9	10.3	Haiti	1.9	4.1	Tajikistan	3.0	3.2
Kenya	7.4	14.3	Nicaragua	1.6	1.5	Czech Republic	3.0	2.3
Mauritania	7.3	8.5	Jamaica	1.4	1.8	Kyrgyz Republic	2.6	2.2
Cameroon	7.0	23.9	Venezuela	0.4	0.7	Latvia	2.3	1.8
Madagascar	6.6	7.5	Bahamas	0.3	0.4	Cyprus	2.3	2.0
Ghana	6.3	6.8	Guyana	0.3	0.3	Croatia	2.2	2.6
Eritrea	5.7	4.4	St. Lucia	0.1	0.1	Slovakia	1.4	1.1
Benin	4.4	4.4	St. Vinc., Gren.	0.0	0.0	FYR Macedonia	1.4	1.5
Malawi	2.5	3.7	Grenada	0.0	0.0	Estonia	0.8	0.6
Sierra Leone	2.2	4.3	Trin., Tobago	0.0	0.0	Slovenia	0.7	0.7
Guinea Bissau	2.1	2.4	Belize	0.0	0.0	Albania	0.6	0.5
Gambia	1.5	2.1	Barbados	0.0	0.0	Turkmenistan	0.0	4.0
Lesotho	1.4	1.9	Dominica	0.0	0.0	Belarus	0.0	0.0
Congo	1.4	16.5	St. Kitts, Nevis	0.0	0.0	**Total**	**655.4**	**736.7**
Togo	1.2	2.6	**Total**	**494.3**	**485.8**			
Namibia	0.9	1.0						
Cen. Afr. Rep.	0.8	3.3						
Somalia	0.8	3.1						
Burundi	0.6	0.9						
Rwanda	0.3	0.8						
Swaziland	0.3	0.2						
Gabon	0.2	0.4						
Sao Tome, Principe	0.1	0.1						
Uganda	0.1	0.1						
Comoros	0.1	0.2						
Liberia	0.0	1.5						
Botswana								
Cape Verde								
Djibouti								
Equatorial Guinea								
Mauritius								
Seychelles								
Total	**471.0**	**688.9**						

Table A.3: Optimal Air Pollution-Related Investment by Region and Country ($Million)

East Asia, Pacific	P_i		South Asia	P_i		Middle East, North Africa	P_i	
	OED	**1**		**OED**	**1**		**OED**	**1**
China	3,206.8	2,739.2	India	1,388.7	1,527.9	Egypt	183.9	200.9
Indonesia	256.9	262.2	Pakistan	303.7	332.2	Iran	105.2	95.2
Korea	99.2	85.7	Bangladesh	98.1	98.7	Algeria	28.6	47.2
Vietnam	84.0	65.2	Sri Lanka	12.3	13.8	Yemen	16.5	18.9
Thailand	62.9	53.5	Nepal	3.0	3.3	Morocco	12.1	14.9
Philippines	58.0	62.3	Maldives	0.3	0.3	Jordan	9.8	8.4
Myanmar	44.2	53.3	Bhutan	0.2	0.1	Tunisia	6.8	6.6
Malaysia	4.2	3.5	**Total**	**1,806.3**	**1,977.3**	Oman	6.0	4.7
Cambodia	3.0	2.9				Lebanon	0.0	5.7
Mongolia	2.8	2.5				West Bank, Gaza		
Lao PDR	1.7	1.9				Western Sahara		
Fiji	0.3	0.3				**Total**	**368.9**	**403.5**
Papua New Guinea	0.2	0.3						
Solomon Islands	0.0	0.1						
Vanuatu	0.0	0.0						
East Timor								
Micronesia								
Kiribati								
Marshall Islands								
Samoa								
Tonga								
Total	**3,824.2**	**3,333.9**						

Table A.4: Optimal Natural Resource Management Investment by Region and Country ($Million)

Sub-Saharan Africa	P_i		Latin America, Caribbean	Pi		East Europe, Central Asia	Pi	
	OED	1		OED	1		OED	1
Nigeria	136.2	222.6	Mexico	95.9	85.4	Turkey	42.7	48.8
Ethiopia	108.2	122.8	Brazil	70.3	68.5	Russia	37.6	52.9
South Africa	86.9	81.8	Peru	32.8	29.7	Uzbekistan	29.2	43.2
Sudan	64.2	82.1	Colombia	24.2	28.4	Kazakhstan	25.0	21.9
Tanzania	58.2	54.3	Guatemala	16.1	18.7	Ukraine	17.4	15.2
Uganda	51.0	55.3	Ecuador	15.4	13.7	Kyrgyz Republic	15.1	12.3
Burkina Faso	42.6	38.2	Bolivia	13.5	11.7	Tajikistan	14.6	15.1
Zimbabwe	36.6	31.9	Honduras	8.1	8.6	Azerbaijan	10.0	11.1
Congo (DR)	36.3	134.4	Costa Rica	8.1	6.0	Romania	9.7	9.1
Niger	33.5	42.5	Dom. Rep.	7.9	8.7	Yugoslavia	7.2	7.3
Kenya	31.4	58.1	El Salvador	7.4	6.4	Georgia	6.4	4.7
Mali	26.3	29.8	Argentina	6.2	6.0	Bosnia-Herz.	5.6	4.4
Ghana	22.8	23.7	Chile	6.1	5.1	Armenia	5.6	4.6
Eritrea	22.3	16.5	Haiti	6.0	12.5	Albania	5.0	4.3
Senegal	21.6	20.5	Nicaragua	4.5	4.1	Slovakia	4.7	3.5
Angola	21.3	25.2	Panama	4.3	3.2	Hungary	4.5	3.7
Mozambique	19.9	18.2	Venezuela	4.0	7.7	Moldova	3.7	4.1
Cote d'Ivoire	19.4	24.1	Jamaica	2.9	3.6	Bulgaria	2.6	2.5
Madagascar	17.6	19.1	Paraguay	2.6	3.8	Croatia	2.6	2.8
Chad	16.7	16.7	Guyana	1.4	1.5	Slovenia	2.1	1.9
Guinea	14.6	18.3	Trin., Tobago	1.2	1.3	Poland	2.1	1.9
Benin	10.3	9.9	Belize	0.4	0.4	Cyprus	1.9	1.6
Somalia	9.1	33.7	St. Vinc., Gren.	0.3	0.2	Lithuania	1.8	1.6
Cameroon	8.3	27.2	Grenada	0.2	0.1	Estonia	1.8	1.3
Rwanda	7.4	17.3	Uruguay	0.2	0.1	FYR Macedonia	1.5	1.6
Zambia	7.4	10.2	St. Lucia	0.1	0.1	Czech Republic	1.3	1.0
Sierra Leone	6.7	12.4	Bahamas	0.1	0.1	Latvia	0.9	0.7
Burundi	6.5	8.9	Dominica	0.0	0.0	Belarus	0.7	0.8
Malawi	5.7	8.0	St. Kitts, Nevis	0.0	0.0	Turkmenistan	0.0	11.6
Namibia	4.8	5.0	Barbados	0.0	0.0	**Total**	**263.3**	**296.5**
Mauritania	4.4	4.9	**Total**	**340.2**	**336.6**			
Lesotho	4.1	5.2						
Swaziland	3.8	2.8						
Togo	3.6	7.2						
Botswana	2.9	3.2						
Cen. Afr. Rep.	1.5	5.7						
Gambia	1.5	2.0						
Guinea Bissau	1.3	1.4						
Comoros	0.6	1.3						
Djibouti	0.5	0.5						
Equatorial Guinea	0.3	1.0						
Gabon	0.3	0.5						
Congo	0.3	3.0						
Sao Tome, Principe	0.1	0.1						
Liberia	0.0	4.5						
Cape Verde								
Mauritius								
Seychelles								
Total	**979.0**	**1,313.0**						

Table A.4: Optimal Natural Resource Management Investment

by Region and Country ($Million)

East Asia, Pacific	P_i		South Asia	Pi		North Africa, Middle East	Pi	
	OED	1		OED	1		OED	1
China	2,180.0	1,777.5	India	1,205.8	1,266.4	Egypt	162.1	169.1
Indonesia	269.3	262.4	Pakistan	228.0	238.1	Iran	129.1	111.5
Vietnam	141.1	104.5	Bangladesh	41.1	39.5	Yemen	60.7	66.2
Thailand	52.3	42.4	Nepal	35.0	37.3	Morocco	52.8	61.8
Myanmar	40.2	46.3	Sri Lanka	16.2	17.3	Algeria	35.8	56.3
Malaysia	33.5	26.6	Bhutan	4.1	3.1	Tunisia	17.7	16.4
Korea	29.1	24.0	Maldives			Jordan	7.5	6.2
Philippines	27.9	28.6	**Total**	**1,530.2**	**1,602.7**	Oman	2.1	1.6
Cambodia	15.8	14.6				Lebanon	0.0	1.6
Lao PDR	11.5	12.4				West Bank, Gaza		
Papua New Guinea	8.4	13.3				Western Sahara		
Mongolia	2.0	1.7				**Total**	**467.8**	**491.7**
Solomon Islands	0.6	0.9						
Fiji	0.3	0.2						
Vanuatu	0.2	0.5						
East Timor								
Micronesia								
Kiribati								
Marshall Islands								
Samoa								
Tonga								
Total	**2,812.2**	**2,356.9**						

Table A.5: OED Project Success Rates by Region and Country

Sub-Saharan Africa	OED Rate	Latin America, Caribbean	OED Rate	East Europe, Central Asia	OED Rate
Cape Verde	100.0	Costa Rica	100.0	Estonia	100.0
Eritrea	100.0	St. Vinc., Gren.	100.0	Czech Republic	100.0
Swaziland	100.0	Uruguay	100.0	Latvia	100.0
Zimbabwe	85.0	Grenada	100.0	Slovakia	100.0
Burkina Faso	82.6	Panama	100.0	Georgia	100.0
Mozambique	80.8	Dominica	100.0	Bosnia-Herz.	95.7
Tanzania	79.4	Chile	88.9	Armenia	90.9
South Africa	78.6	El Salvador	85.7	Kyrgyz Republic	90.9
Senegal	78.1	Bolivia	85.3	Hungary	89.2
Benin	76.9	Belize	83.3	Cyprus	87.5
Djibouti	75.0	Ecuador	83.3	Albania	86.4
Chad	73.7	Mexico	83.1	Lithuania	85.7
Ghana	71.2	Peru	81.8	Ukraine	84.6
Namibia	70.7	Nicaragua	81.8	Kazakhstan	84.6
Guinea Bissau	68.8	Brazil	76.0	Slovenia	83.3
Uganda	68.3	Argentina	75.5	Poland	78.6
Madagascar	68.3	Honduras	70.0	Romania	78.6
Botswana	66.7	Guyana	70.0	Bulgaria	76.5
Mauritania	66.7	Trin., Tobago	66.7	Yugoslavia	72.7
Seychelles	66.7	St. Lucia	66.7	Tajikistan	71.4
Mali	65.4	Barbados	66.7	FYR Macedonia	70.0
Ethiopia	65.2	Dom. Rep.	66.7	Croatia	66.7
Mauritius	63.6	Guatemala	63.6	Moldova	66.7
Angola	62.5	Colombia	63.2	Azerbaijan	66.7
Cote d'Ivoire	59.4	Jamaica	60.0	Turkey	64.7
Guinea	59.4	Paraguay	50.0	Belarus	60.0
Lesotho	58.3	Bahamas	50.0	Russia	52.6
Niger	58.3	Venezuela	38.5	Uzbekistan	50.0
Sudan	57.9	Haiti	35.7	Turkmenistan	0.0
Burundi	54.2	St. Kitts, Nevis	0.0	**Average**	**77.7**
Gambia	53.8	Cuba			
Zambia	53.6	Suriname			
Malawi	52.8	Ant., Barbuda			
Sao Tome, Principe	50.0	Aruba			
Nigeria	45.3	Anguilla			
Kenya	40.0	Neth. Antilles			
Sierra Leone	40.0	Bermuda			
Gabon	40.0	Cayman Islands			
Togo	36.8	Falkland Is.			
Comoros	33.3	Guadeloupe			
Rwanda	31.8	French Guiana			
Equatorial Guinea	25.0	Montserrat			
Cameroon	22.7	Martinique			
Congo (DR)	20.0	Puerto Rico			
Cen. Afr. Rep.	20.0	US Virgin Is.			
Somalia	20.0	**Average**	**73.1**		
Congo	6.7				
Liberia	0.0				
Mayotte					
Réunion					
Saint Helena					
Average	**57.4**				

Table A.5: OED Project Success Rates by Region and Country

East Asia, Pacific	OED Rate	South Asia	OED Rate	Middle East, North Africa	OED Rate
East Timor	100.0	Bhutan	100.0	Oman	100.0
Samoa	100.0	Maldives	100.0	W. Bank, Gaza	100.0
Vietnam	100.0	Bangladesh	77.0	Jordan	90.3
Fiji	100.0	Pakistan	70.9	Iran	85.7
Malaysia	93.1	India	70.5	Tunisia	80.0
Thailand	91.2	Sri Lanka	69.4	Egypt	71.0
China	90.8	Nepal	69.4	Yemen	67.9
Korea, Republic of	89.7	Afghanistan		Western Sahara	66.7
Mongolia	87.5	**Average**	**79.6**	Morocco	63.2
Cambodia	80.0			Algeria	47.1
Indonesia	76.0			Lebanon	0.0
Philippines	72.2			Iraq	
Lao PDR	68.8			Saudi Arabia	
Myanmar	64.3			Syria	
Marshall Islands	59.1			Unit. Arab Emir.	
Micronesia	58.6			Israel	
Kiribati	57.2			Kuwait	
Tonga	50.0			Qatar	
Solomon Islands	50.0			Bahrain	
Papua New Guinea	47.1			Libya	
Vanuatu	33.3			Malta	
Korea (DR)				Holy See	
Singapore				**Average**	**70.2**
Brunei Darussalam					
Hong Kong					
American Samoa					
Australia					
Cook Islands					
Guam					
Japan					
Macau					
Midway Islands					
N. Mariana Islands					
New Caledonia					
Nauru					
New Zealand					
Pitcairn					
Palau					
French Polynesia					
Taiwan, China					
Average	**74.7**				

Table A.6: Environmental Problem Index by Region and Country

Sub-Saharan Africa	D_i			Latin America, Caribbean	D_i			East Europe, Central Asia	D_i		
	Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)
Nigeria	170,493	145,893	43.82	Argentina	102,771	9,749	1.19	Russia	140,164	844	10.42
Congo (DR)	34,448	85,899	26.47	Mexico	93,018	25,526	16.82	Turkey	137,105	15,758	9.61
Sudan	33,685	18,337	16.17	Brazil	65,786	29,360	13.48	Ukraine	82,725	7,070	3.00
Ethiopia	33,578	146,897	24.19	Peru	27,732	9,770	5.84	Poland	46,414	3,427	0.38
Angola	19,299	26,023	4.97	Chile	26,011	1,088	1.00	Bulgaria	30,250	907	0.49
Cote d'Ivoire	18,502	9,101	4.75	Uruguay	11,046	75	0.03	Uzbekistan	25,898	6,174	8.50
Cameroon	18,427	14,419	5.35	Bolivia	10,936	3,782	2.31	Georgia	22,110	814	0.93
Senegal	17,510	5,365	4.03	Colombia	7,331	6,147	5.59	Azerbaijan	14,460	2,141	2.19
South Africa	17,066	10,768	16.10	Guatemala	4,174	2,081	3.68	Armenia	13,318	722	0.90
Zambia	14,899	10,031	2.00	Paraguay	3,995	2,336	0.76	Kazakhstan	9,455	1,330	4.31
Tanzania	12,853	41,752	10.69	Dom. Rep.	3,487	2,825	1.72	Romania	7,968	6,520	1.79
Congo	12,748	4,280	0.59	Haiti	3,143	9,179	2.45	Hungary	6,470	66	0.73
Zimbabwe	12,235	3,929	6.28	Ecuador	3,040	6,085	2.70	Lithuania	3,973	495	0.31
Mozambique	12,026	19,183	3.58	Cuba	2,632	490	1.10	Moldova	3,512	0	0.81
Kenya	11,042	35,229	11.44	Honduras	2,213	1,407	1.69	Yugoslavia	3,249	1,767	1.44
Burkina Faso	10,104	8,126	7.52	El Salvador	1,895	2,970	1.25	Turkmenistan	3,066	3,326	2.28
Chad	9,851	16,790	3.29	Costa Rica	1,850	112	1.18	Bosnia-Herz.	2,517	678	0.86
Mali	8,758	11,864	5.86	Panama	1,557	549	0.63	Tajikistan	2,480	2,168	2.98
Niger	8,401	15,297	8.37	Jamaica	1,349	1,144	0.71	Croatia	1,992	158	0.56
Guinea	7,918	10,385	3.59	Nicaragua	1,182	2,252	0.80	Czech Republic	1,763	769	0.19
Mauritania	6,555	4,755	0.96	Venezuela	551	6,057	1.52	Kyrgyz Republic	1,701	1,707	2.43
Madagascar	5,745	22,755	3.75	Suriname	369	33	0.07	Cyprus	1,561		0.32
Ghana	5,275	14,352	4.66	Bahamas	307		0.02	Latvia	1,390	252	0.13
Benin	3,402	6,256	1.95	Guyana	218	71	0.29	FYR Macedonia	1,194	20	0.32
Eritrea	3,381	5,729	3.25	St. Lucia	77	4	0.02	Slovakia	841	0	0.68
Sierra Leone	3,352	10,934	2.44	Trin., Tobago	23	176	0.25	Slovenia	535		0.37
Malawi	2,862	13,775	1.58	St. Vinc., Gren.	20	11	0.04	Estonia	490	102	0.26
Cen. Afr. Rep.	2,519	3,629	1.13	Grenada	19	9	0.03	Albania	397	848	0.84
Somalia	2,378	7,312	6.64	Barbados	19	0	0.00	Belarus	0	0	0.17
Togo	2,024	5,451	1.42	Belize	16	108	0.08				
Guinea Bissau	1,868	1,765	0.27	Dominica	12		0.00				
Gambia	1,630	1,367	0.40	St. Kitts, Nevis	5	1	0.00				
Lesotho	1,457	418	1.03	Ant., Barbuda	1	8	0.00				
Liberia	1,136	2,289	0.89	Aruba			0.50				
Namibia	747	962	0.99	Anguilla			0.06				
Burundi	703	4,641	1.76	Neth. Antilles			0.00				
Rwanda	621	14,787	3.40	Bermuda							
Gabon	325	881	0.10	Cayman Islands							
Swaziland	155	511	0.55	Falkland Islands							
Comoros	119	51	0.26	Guadeloupe							

Sub-Saharan Africa	D_i			Latin America, Caribbean	D_i			East Europe, Central Asia	D_i		
	Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)
Sao Tome, Principe	109	80	0.02	French Guiana							
Uganda	69	34,731	10.88	Montserrat							
Botswana		453	0.64	Martinique							
Cape Verde		269	0.19	Puerto Rico		532					
Djibouti		0	0.10	US Virgin Is.			0.00				
Equatorial Guinea		709									
Mauritius		0									
Mayotte											
Réunion											
Saint Helena											
Seychelles		13									

Table A.6: Environmental Problem Index by Region and Country

East Asia, Pacific	D_i			South Asia	D_i			North Africa, Middle East	D_i		
	Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)		Air	Water	Pop. On Fragile Lands (million)
China	2,111,123	336,819	349.98	India	1,177,555	215,815	249.35	Egypt	154,843	5,526	33.29
Indonesia	202,063	77,461	51.66	Pakistan	256,046	39,012	46.87	Iraq	100,533	7,574	4.04
Korea, Republic	66,040	3,480	4.72	Bangladesh	76,067	7,355	7.78	Iran	73,354	4,752	21.95
Korea (DR)	54,338	6,702	5.26	Sri Lanka	10,611	3,933	3.40	Saudi Arabia	37,658	2,341	2.11
Vietnam	50,219	47,939	20.57	Afghanistan	9,058	73,257	14.94	Algeria	36,345	3,148	11.08
Philippines	48,001	18,343	5.63	Nepal	2,559	9,900	7.35	Syria	22,534	6,365	6.66
Thailand	41,197	13,820	8.35	Maldives	208	0		Yemen	14,572	14,569	13.04
Myanmar	41,107	26,536	9.12	Bhutan	101	785	0.60	Morocco	11,485	8,660	12.18
Malaysia	2,669	4,974	5.25					Unit.Arab Emi.	11,470		0.37
Singapore	2,506		0.00					Israel	8,253		0.52
Cambodia	2,207	18,587	2.88					Kuwait	7,281		0.04
Mongolia	1,896	1,385	0.34					Jordan	6,457	404	1.22
Lao PDR	1,490	1,345	2.45					Tunisia	5,110	2,331	3.23
Papua New Guinea	205	6,401	2.61					Lebanon	4,405	0	0.32
Fiji	195	690	0.05					Oman	3,612	2,970	0.31
Solomon Islands	48	336	0.18					Qatar	1,675		0.04
Brunei Darussalam	41		0.05					Bahrain	591	126	0.04
Vanuatu	15	50	0.09					Western Sahara			
Hong Kong	0		0.00					Libya		2,620	0.53
American Samoa								Malta		0	0.03
Australia			1.53					Holy See			
Cook Islands								W. Bank, Gaza		1,628	
Micronesia											
Guam											
Japan			19.50								
Kiribati		99									
Macau			0.00								
Marshall Islands											
Midway Islands											
N. Mariana Islands											
New Caledonia			0.02								
Nauru											
New Zealand			0.11								
Pitcairn											
Palau											
French Polynesia											
East Timor											
Tonga		0									
Taiwan, China											
Samoa		3									

Text Figures

Figures 1 - 3: Environmental Problem Indices

1: Mortality From Waterborne Disease
2: DALY's From Outdoor Air Pollution
3: Fragile Lands: Population at Risk

white: Lower Impact
light gray: Intermediate Impact
dark gray: Higher Impact

Figure 4: OED Ratings: Probability of Project Success

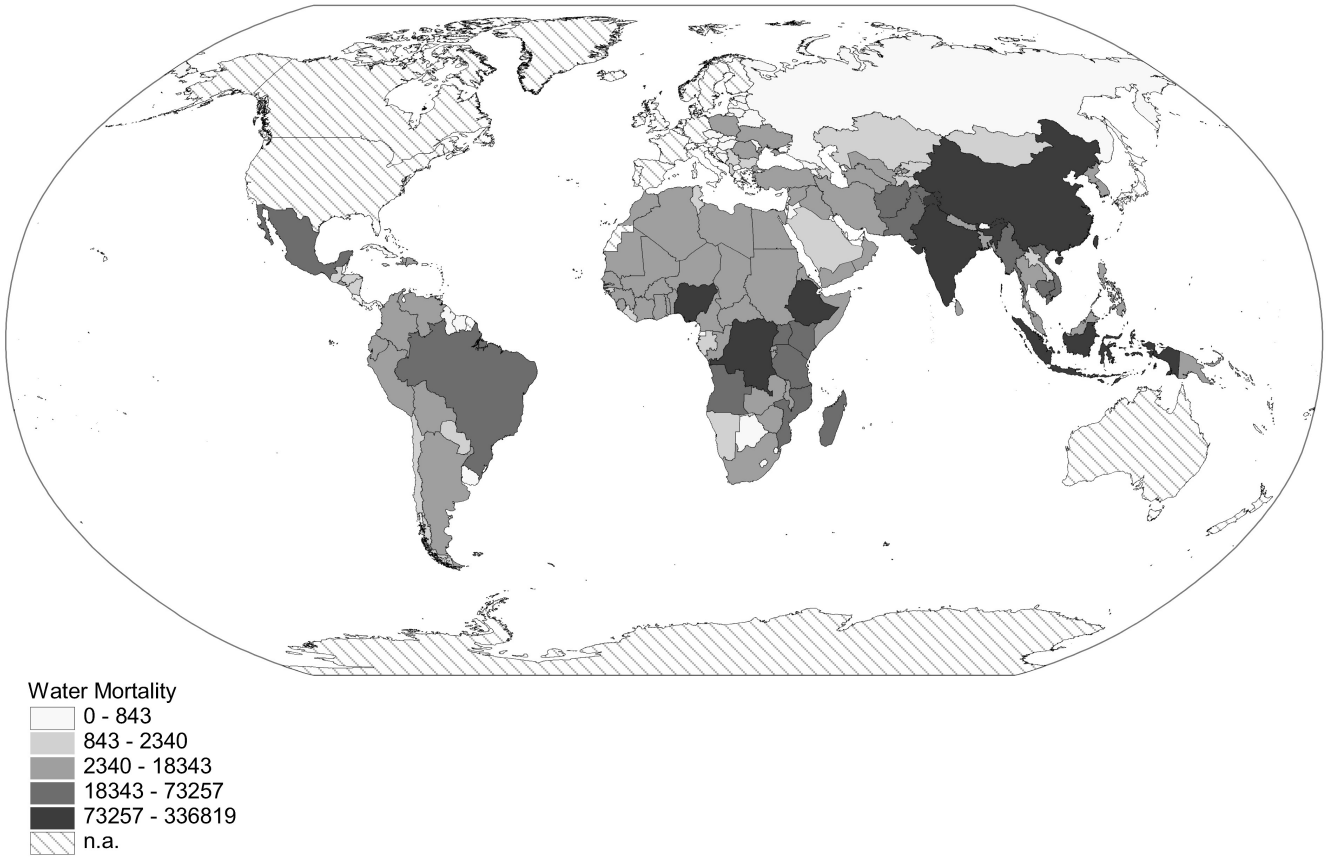
white: Low Probability
light gray: Intermediate Probability
dark gray: High Probability

Figures 5 - 8: Optimal Investment Levels

5: Water and Sanitation
6: Air Pollution-Related
7: Natural Resource Management
8: Total

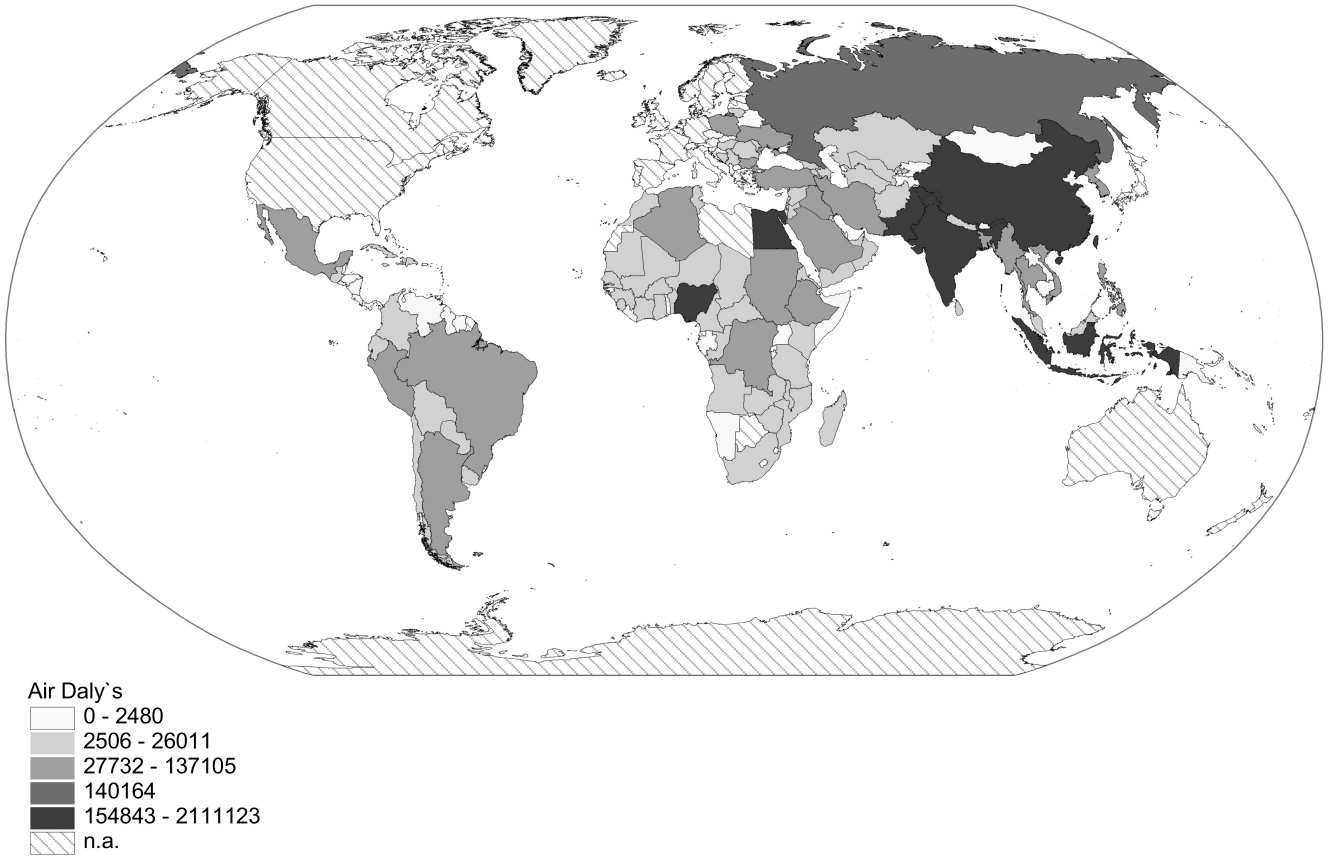
white: Lower Investment Level
light gray: Intermediate Investment Level
dark gray: Higher Investment Level

Figure 1: Mortality From Waterborne Disease



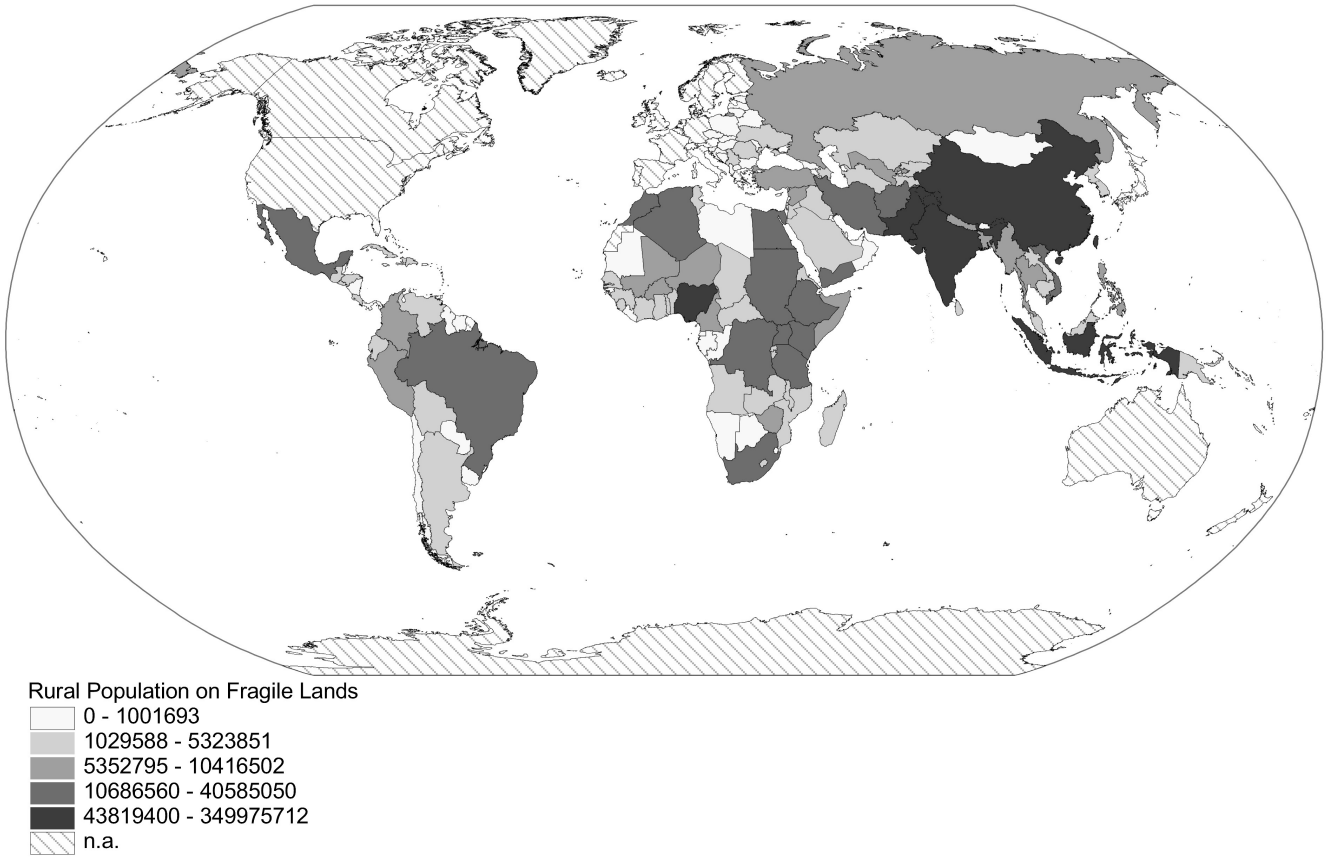
Source: Wang, et al. (2003)

Figure 2: DALY's From Outdoor Air Pollution



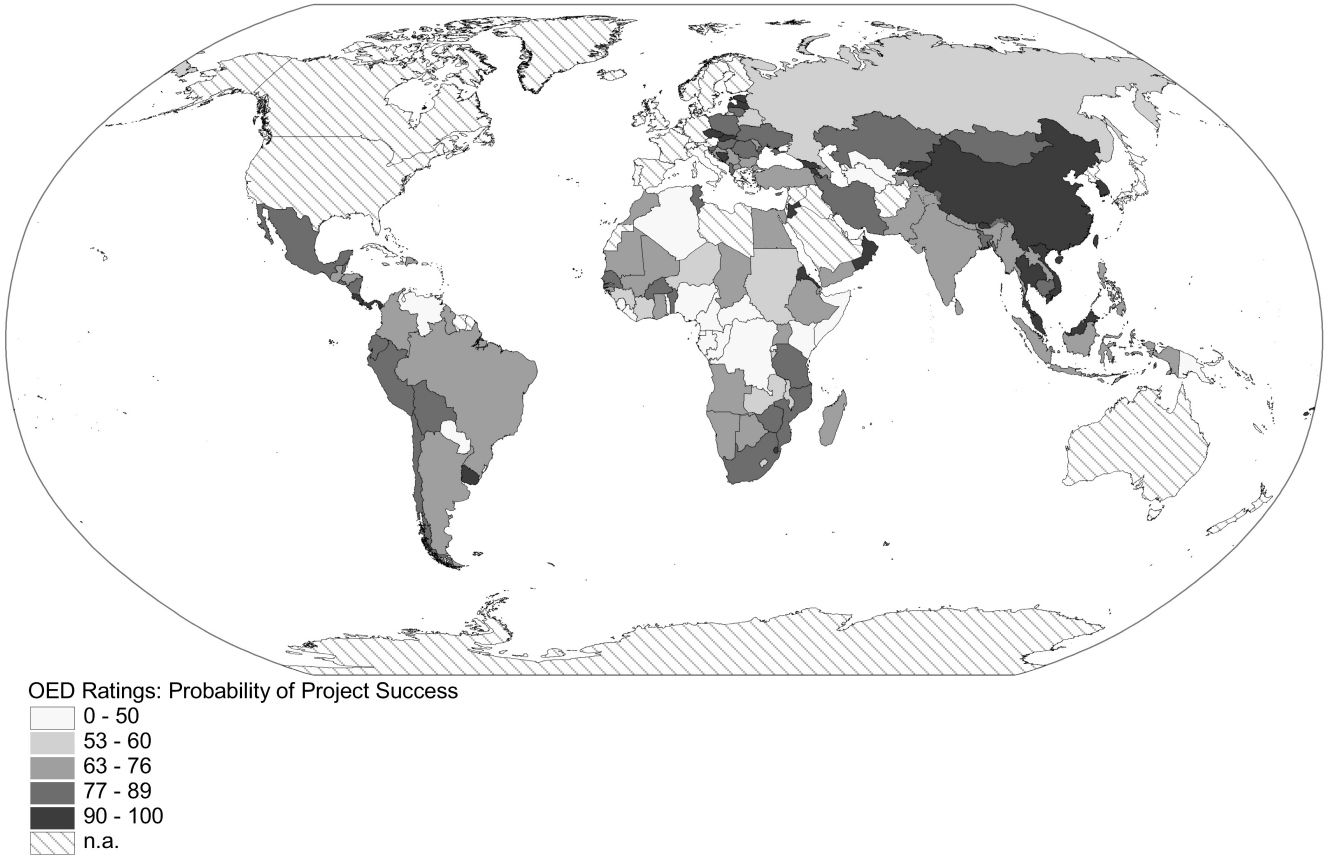
Source: Pandey, et al. (2003)

Figure 3: Fragile Lands: Population at Risk



Source: World Development Report (2003)

Figure 4: OED Ratings: Probability of Project Success



Source: World Bank, OED

Figure 5: Optimal Water and Sanitation Investment

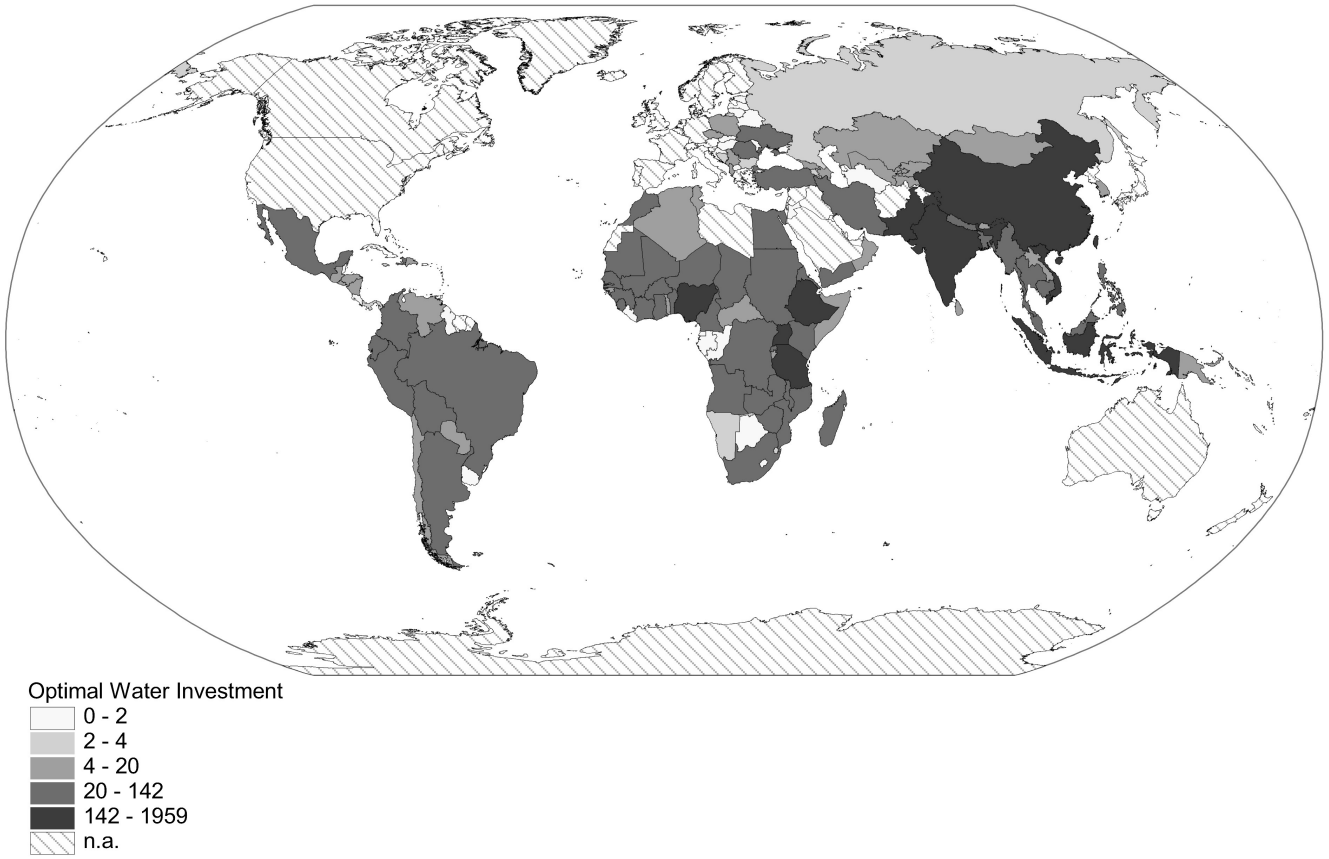


Figure 6: Optimal Air Pollution-Related Investment

Figure 7: Optimal Natural Resource Management Investment

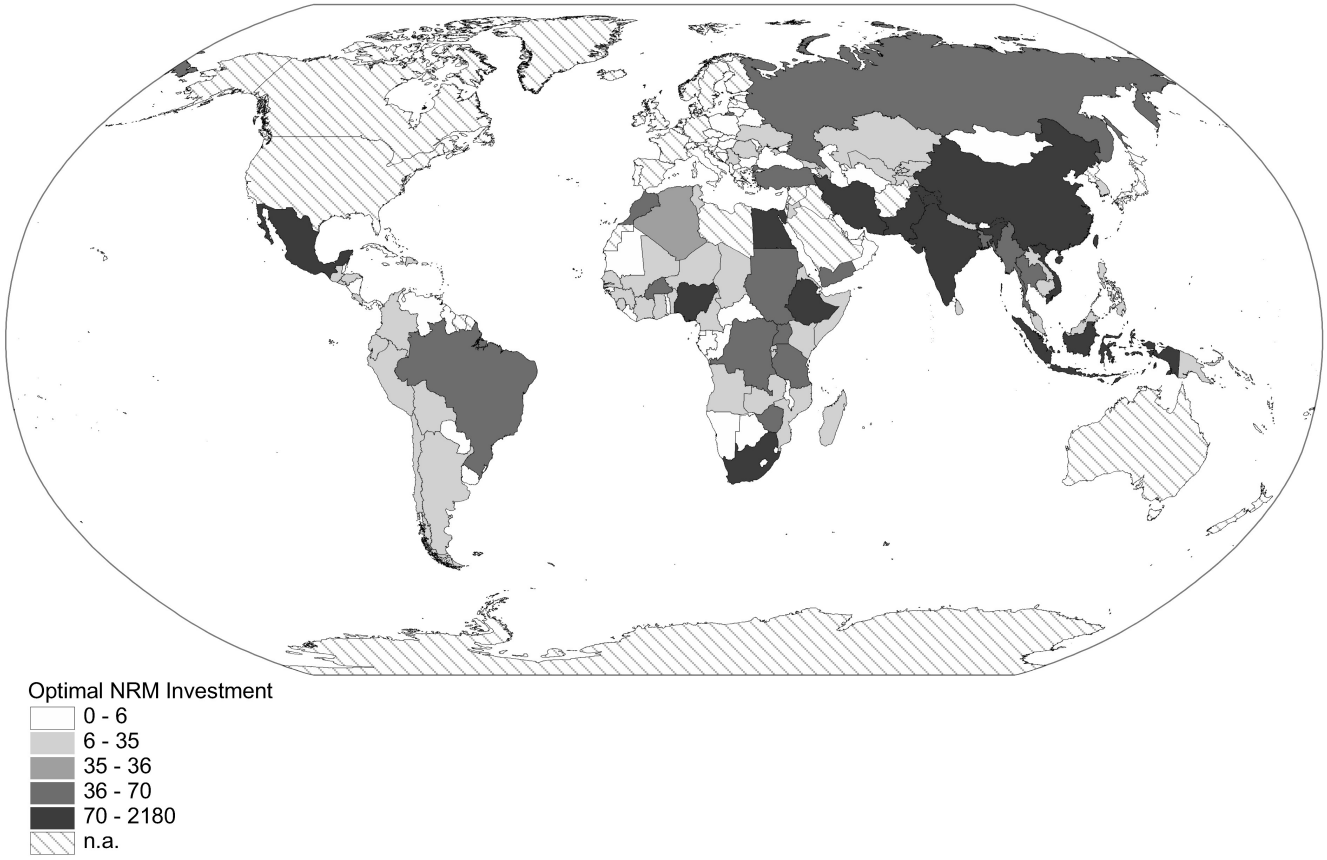


Figure 8: Total Environmental Investment