APPENDIX A

ADMINISTRATIVE BOUNDARIES

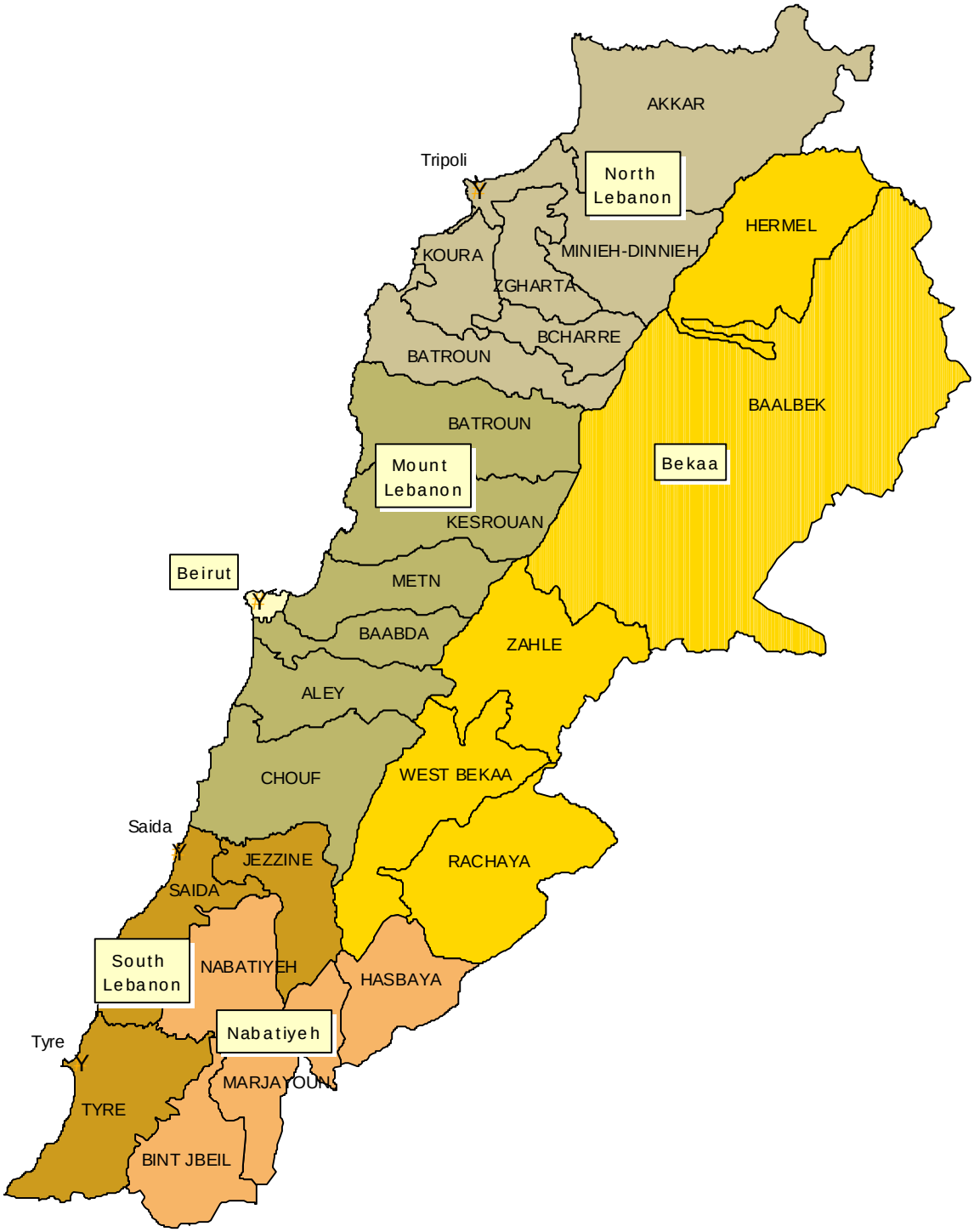
Lebanon is divided into six Mohafazas, 25 Cazas (excluding Beirut), and 1,492 cadastral zones (see Table A-1). The surface areas in Table A-1 are approximations. Map A-1 depicts the Mohafazas and the Cazas.

TABLE A-1
MOHAFAZAS, CAZAS AND CADASTRAL ZONES

Mohafaza	*Caza*	*Number of Cadastral Zones*	*Surface Area (km^2)*
Beirut	**Beirut**	**12**	**19.6**
Mount Lebanon		**495**	**1,968.3**
	ALEY	72	263.7
	BAABDA	58	194.3
	CHOUF	96	481.2
	EL METN	100	263.2
	JBAIL	94	430.2
	KESROUAN	75	335.7
North		**387**	**2,024.8**
	AKKAR	133	788.4
	MINIEH-DINNIEH	46	409.1
	BATROUN	72	287.3
	BCHARRE	25	158.2
	KOURA	42	172.6
	ZGHARTA	52	181.9
	TRIPOLI	17	27.3
South		**227**	**929.6**
	JEZZINE	76	241.8
	SAIDA	76	273.7
	SOUR	75	414.1
Nabatiyeh		**147**	**1,098.0**
	BENT JBAIL	38	263.7
	MARJAAYOUN	35	265.3
	NABATIYE	52	304.0
	HASBAYA	22	265.0
Bekaa		**224**	**4,160.9**
	WEST BEKAA	41	425.4
	RACHAYA	28	485.0
	HERMEL	11	505.9
	ZAHLE	61	425.4
	BAALBEK	83	2319.2
TOTAL		**1,492**	**10,201.2**

MAP A-1

ADMINISTRATIVE BOUNDARIES (MOHAFAZAS AND CAZAS)



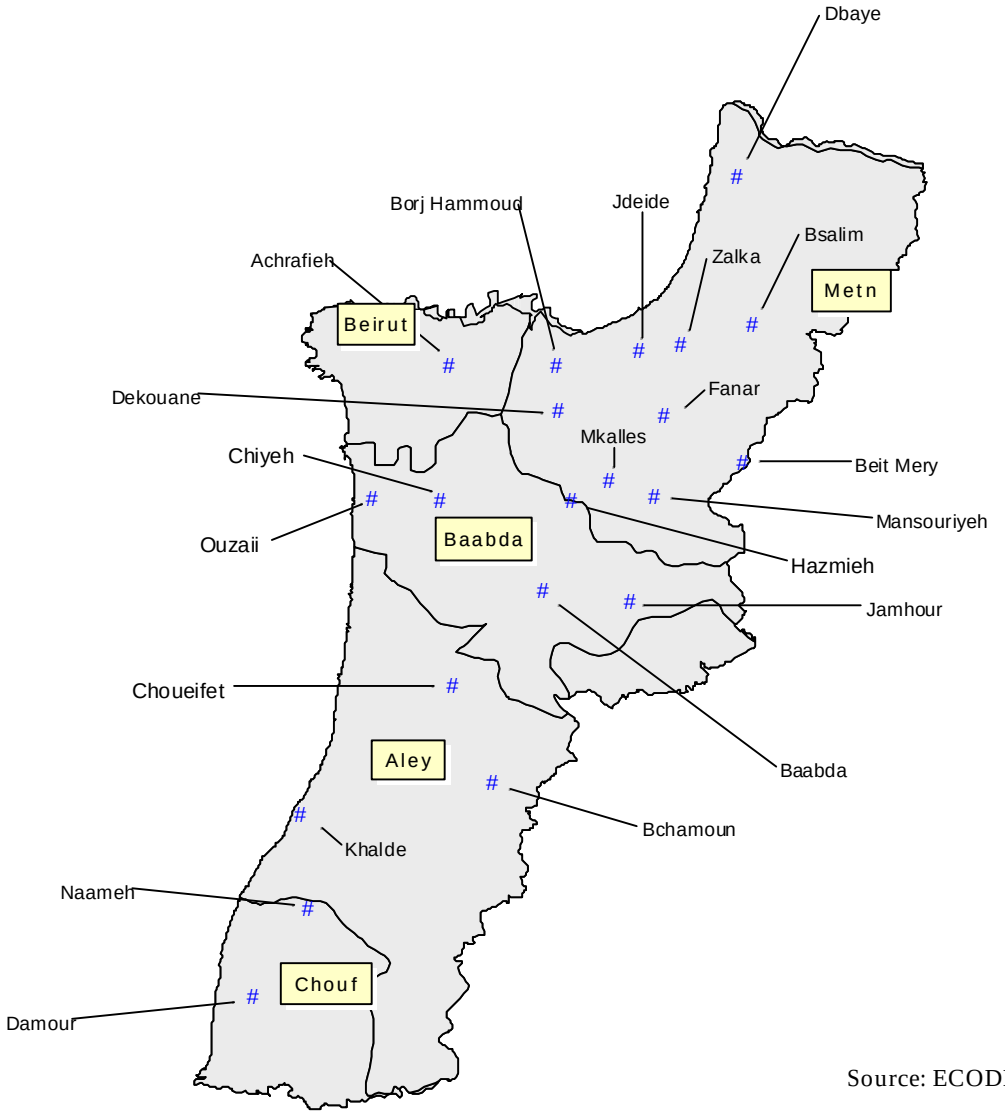
APPENDIX B

LEGAL AND GEOGRAPHIC EXTENSION OF GBA (BEIRUT AND SUBURBS)

The Greater Beirut Area (GBA) is an ill-defined geographic extension that roughly includes the lower parts of the Cazas of Metn, Baabda, Aley and Chouf (see Map B-1). The GBA includes at least 63 cadastral zones and has a surface area of 233 km^2, and hosts

suburbs fall within Mount Lebanon, it is important to differentiate the suburbs from the rest of Mount Lebanon while assessing economic activities and environmental pressures. CAS Study No.9 (1998) lists all cadastral zones and villages included in the GBA.

MAP B-1
GEOGRAPHIC LIMITS OF GBA



Source: ECODIT, 2001

APPENDIX C

PESTICIDES BANNED IN LEBANON (MOA DECISION 1/94, DATED 20/5/1998)

1. 1,2 dibromo-ethane
2. 1, 2 dichloro-ethane
3. 2,3,4,5- Bis (2-butylene) tetrahydro-2-furaldehide [*Repellent-11*]
4. 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)
5. Acrolein
6. Acrylonitrile
7. Aldicarb
8. Adrin
9. All compounds containing arsenic salts.
10. Aminocarb
11. Aramite
12. Arsenious oxide
13. BHC Technical (not Gamma HCH-Lindane)
14. Binapacryl
15. Butocarboxium
16. Butoxycarboxium
17. Cadminate
18. Cadmium Calcium Copper Zinc Chromate Complex
19. Cadmium compounds
20. Calcium Arsenate
21. Calcium Arsenite
22. Calcium cyanide
23. Captafol
24. Carbon tetrachloride
25. Carbonphenothion
26. Chloranil
27. Chlordane
28. Chlordecone
29. Chlordimefon
30. Chlorinated camphene [*Toxaphene*]
31. Chlormephos
32. Chloromethoxyproylmercuric acetate (CMPA)
33. Chlorthiophos
34. Copper Acetoarsenite
35. Copper Arsenate
36. Copper Arsenite
37. Crimidine
38. Crotoxyphos
39. Cyanothoate
40. Cycloheximide
41. DBCP (Dibromo chloro propane)

42. DDT
43. *Decachlorooctahydro 1,3,4 methoxy 2H cyclobuta (cd) pentalen-2-one [Chlordecone].*
44. Dechlorane
45. Demephion-O
46. Demephion-S
47. Diamidafos
48. Dibromochloropropane
49. Dicrotophos
50. Dieldrin
51. Dimefox
52. Dimetilan
53. Dinoterb salts
54. Dinoseb salts
55. Dioxathion
56. Edifenphos
57. Endothion
58. Endrin
59. EPN (Ethyl (p-nitrophenyl) thio benzene phosphonate)
60. Erbon
61. Ethylan
62. Ethyl Parathion
63. Ethylene Dibromide
64. Ethylene oxide
65. Fensulfothion
66. Fluoroacetamide
67. Fosthietan
68. HCH containing less than 99.0% of gamma isomer
69. Heptachlore
70. IFSP = Aphidan
71. Isazophos
72. Isobenzane
73. Isodrin
74. Isothioate
75. Isoxathion
76. Kepon
77. Lead arsenate
78. Leptophos
79. Maleic hydrazine and its salts, other than salts of choline, potassium and sodium.
80. Medinoterb acetate
81. Mercuric chloride
82. Mercuric Compounds (Organic and Inorganic)
83. Mirex
84. Nitrofen
85. OMPA [*Schradan*]
86. Oxydeprofos
    - *Parathion ethyl*
87. Phenazine
88. Phenylmercuric oleate (PMO)

89. Phenylmercury acetate (PMA)
90. Phospholan
91. Potassium 2,3,5 trichlorophenate (2,4,5,-TCP)
92. Pyriminil [*Vacor*]
    - *Repellent-11*
93. Safrole
94. Salithion
    - *Schradan*
95. Silvex
96. Sodium arsenate
97. Sodium arsenite
98. Sodium Cyanide
99. Sodium fluoroacetate
100. Sodium pentachloro-phenoxide (Sodium pentachlorophenate)
    - *Strobane*
101. TDE (1,1- Dichloro-2,2-bis (p-chlorophenyl) Ethane
102. TEPP (Tetra ethyl diphosphate or Tetra ethyl pyrophosphate or Ethyl pyrophosphate)
103. Terpene polychlorinates [*strobane*]
104. Thallium sulfate
105. Thionazin
    - *Toxaphene*
106. Triamiphos
107. Trichloronate
108. Trysben
    - *Vacor*
109. Vinyl chloride
110. Wipeout

Compounds listed in italics have been already cited under different names.

APPENDIX D

LEGAL STATUS OF CURRENT INDUSTRIAL ZONES

As of January 1999, there were 72 industrial zones in Lebanon: 23 zones were decreed, eight were approved by the Council of Ministers but had not been decreed yet; 13 zones were approved by the DGUP and await approval by the Council of Ministers; and at least 28 zones existed *de facto*, without any form of government approval.

Zones Decreed	*Zones approved by council of ministers*	*Zones approved by the GDUP*	*Others (Informal)*
1. Aajaltoun 2. Aley 3. Baabda 4. Bauchrieh 5. Dbaye 6. Fanar-roumieh 7. Ghazir* 8. Hosrayel 9. Majdel-anjar 10. Mkalles* 11. Nabatiye 12. Taanayel * 13. Bablieh 14. Ain anoub 15. Insariye 16. Bablieh 17. Mina 18. Makse 19. Nahr Ibrahim* 20. Chekka - Enfe* 21. Mazraat Yachoua* 22. Choueifat 23. Bchamoun	1. Baalbeck 2. Halba 3. Qalamoun 4. Sibline 5. Sin el fil 6. Taalabaya- 7. Saadnayel 8. Zouq*	1. El hirre * 2. Amchit* 3. Bahsas 4. Beit Mery 5. Broumana 6. Dekwaneh 7. Ghazieh 8. Hadeth-Baalbek 9. Kfarchima 10. Choueifat 11. Baabdate-Sfeila 12. Hsoun (Jbeil) 13. Al Safra (Kab-Elias)	1. Naameh - Damour 2. Haouch Sneid 3. El Mansourieh 4. Halat 5. Qraiaa 6. Toul (Nabatiye) 7. Deir Nbouh (Zghorta) 8. Hermel (al mansoura) 9. Qleiaat (Al Roumoul) 10. Mazraat Bsafour 11. El Qaa (ras baalbeck) 12. Semqaniye 13. Majdel (amioun zonet) 14. Jouar (Metn) 15. Choueir (Metn) 16. Hammana (Metn) 17. Selaata 18. Edde (Jbeil) 19. Sarba (Jounieh) 20. Ain Akrine (Batroun) 21. Basbina (Chouman) 22. Baaourta (Aley) 23. Baaqline 24. Beddawi 25. Bouj Hammoud 26. Saida 27. Tyr 28. Zahleh

Source: Data was compiled by URBI (January 1999) * The limits of those coastal zones were modified

APPENDIX E

LOSS OF CULTURAL HERITAGE IN BEIRUT

Based on essay supplied to ECODIT by Ms. Mona Hallaq, APSAD

Heritage buildings embody distinctive architectural characteristics of different styles and periods. In Beirut Pericentral district, besides individually exceptional buildings of inherent artistic value, a 1997 study, commissioned by the DGUP, highlighted four clusters representing coherent groups of urban homogeneity that reflect the rich historic architectural character of Beirut. These clusters still enjoy a beautiful sense of scale, street alignment, interesting details and lots of lavish green spaces:

1. Qantari, Spears, Ain el Mreisseh;
2. Zokak el Blatt, Bachoura, Basta Tahta;
3. Jemmaizeh, Sursock, Mar Maroun; and
4. Achrafieh, Furn el Hayek, Yassonieh.

These four clusters include a total of 520 buildings, representing less than three percent of the total number of buildings in Beirut. The study stressed the logic of clusters rather than individual buildings, and proposed to suspend any demolition works until new urban planning regulations were developed, and new legal and financial incentives were formulated to support preservation efforts with the approval of and in coordination with the property owners.

In October 1997, the GDUP released 78 buildings from the list, reducing the number to 469.

In July 1998, the CDR presented a new study that reevaluated the buildings into five ranks (A, B, C, D, E, and F). The study proposed to release group D (161 buildings) and E (89 buildings) as not possessing high artistic values, thus allowing their demolition, causing an irrevocable damage to the four coherent clusters.

In March 1999, the cabinet approved the CDR report. Since then, at least 24 buildings (ranks D and E) have been demolished, all of which were important typological examples of Lebanese architecture as well as integral parts of their respective clusters. In the absence of specific urban regulations to protect these areas, new buildings and urban development projects will invariably damage the character of the cluster.

Leading factors leading to the loss of heritage buildings include:

- High lot coverage and floor area ratio escalate the value of real estate;
- Lack of incentives for owners to preserve their properties and develop the areas surrounding the clusters to become sources of attraction (i.e., Rue Monot in Achrafieh, and Foch & Allenby streets in the Beirut Central District); and
- An outdated rental law which provides no economic incentive to preserve old houses.

As a first step towards conserving heritage buildings, the GOL should issue a national cultural heritage law (or update existing legislation which date back to the French mandate). This law should establish a Higher Council for National Heritage and possibly exempt property owners who restore heritage buildings from municipal and income taxes. The law could also impose a new tax on properties overlooking heritage buildings. Generated income could then support / subsidize restoration efforts. Under strict urban planning regulations, property owners of heritage buildings could also benefit from the transfer of exploitation rights; they can sell unexploited floor area to other lots in specific areas where higher buildings cause no harm to the urban landscape.

APPENDIX F

ECOTOURISM PROVIDERS (2001)

Ecotourism is gaining popularity in Lebanon. The number of ecotourism providers (businesses and non-profit organizations) has increased from only one in 1971 to eight in 2001. Ecotourism involves a wide rangy of nature-based activities that normally generate significantly less environmental pressures than traditional tourism. Table E-1 provides relevant contact information for all known ecotourism providers in Lebanon.

TABLE F-1
BACKGROUND AND CONTACT INFORMATION
FOR ECOTOURISM PROVIDERS

Name	***Legal Status***	***Year of Establishment***	***Types of Activities***	***Phone Number Email and Website***
Club des Vieux Santiers	NGO	1971	Hiking	01-873 865
Green Line Association	NGO	1991	Nature, agricultural and cultural tourism	01-746 215 grline@sodetel.net.lb www.greenline.org.lb
The Lebanese British Club	Sarl	1996	Adventure travel and extended trips to Syria and Jordan	04-419 848 dan@tlb.com.lb
Wild Expeditions	Sarl	1997	Adventure travel and nature sports	01-615 381 widlex@cyberia.net.lb
Horizon Vert	NGO	1997	Hiking excursions	01-335 406
Liban Trek	Sarl	1997	Trekking	01-390 790 info@libantrek.com www.libantrek.com
Lebanese Adventure	Sarl	1999	Rafting, hiking caving, cycling, sailing, rappelling, star gazing and camping	01-427 076 01- 398 982 infos@lebanese-adventure.com
Ibex Eco Tourism	Sarl	2000	Mountain biking, trekking, cross-country skiing	01-216 299 ibex_sarl@hotmail.com
Sport Nature	Sarl	1996	Rafting, canoeing, kayaking	03-678 398 flck@flck.org www.flck.org

Source: ECODIT survey, 2001

APPENDIX G

OPPORTUNITIES FOR WASTE-TO-ENERGY IN LEBANON

Lebanon is plagued with at least eight large uncontrolled landfills and countless more village level open dumps. The largest uncontrolled landfills are situated on the shoreline (Saida, Normandy, Borj Hammoud, and Tripoli). Major, sizeable inland-uncontrolled landfills include Zahle, Tyre, Nabatiyeh and Baalbeck. Table G-1 provides

Table G-1
Distribution and Status of Most Significant Dumpsites in Lebanon

Area	*Current status*	*Remarks*
❑ Saida	Still operational	Plans underway to close it down
❑ Normandy	Closed since 1994. Remediation and reclamation works underway. USD 53 million contract signed between US-based Radian and Solidere.	Rehabilitation works expected to be completed by 2003
❑ Borj Hammoud	Closed July 1997. Feasibility for gas extraction completed (see Box G-1)	700-m long (seashore). 60 meters high. Volume of 4 million m^3 (3.7 million above sea level)
❑ Tripoli	Still operational but nearing full capacity. A sea wall was erected to contain the site. Operation of site was contracted to the private sector, at an annual cost of US$1.2 million, financed by the Federation.	Floating debris still drift away, polluting the shoreline north of Tripoli.
❑ Zahle	Still used, until nearby landfill becomes fully operational. New facility also includes a sorting plant and a leachate evaporation pond.	Existing dump may be landfilled in nearby landfill facility. Social cost incurred including the presence of small communities / settlements living on top of the existing dump
❑ Baalbeck	Still used. Emits fumes and smoke most of the year.	No immediate plans to close it
❑ Nabatiyeh	Still operational	No immediate plans to close it
❑ Tyre	Still operational	No immediate plans to close it

Unlike controlled landfills, which are usually engineered to control landfill gas, there are no provisions for the control of landfill gas from large-scale open dumps. The rehabilitation of open dumps involves several measures including the control of landfill gas. In recent years, it has been suggested that Lebanon could recover landfill gas to generate electricity. While so called *waste-to-energy* technologies are available and have been successfully implemented in select countries (Europe and US), several applied research studies have explored the feasibility of recovering landfill gas in Lebanon. For example, Box G-1 summarizes the findings of a feasibility study commissioned by MoE -

for the recovery of landfill gas from the Borj Hammoud dumpsite and according to which a gas recovery program would be economically justified.

Box G-1
Gas Extraction and Rehabilitation of Borj Hammoud Dumpsite

The Swedish International Development Agency (SIDA) financed a feasibility study for gas extraction and rehabilitation of the Borj Hammoud dumpsite. The FS estimated that about 170 million Nm^3 of landfill gas (LFG) can be collected over the course of the first 15 years of operation, with a methane content of 45-55 percent. This will require about 70 wells, in addition to auxiliary equipment such as pumping and regulation stations, motor units and connection lines. Using an energy value of 5kWh/Nm^3 LFG, the total energy content in the collected gas was further estimated at around 850 GWh (CDR/SWECO, 2000). The project would cost approximately USD 9 million while environmental benefits include primarily the recovery of 1.6 million ton-equivalent of CO_2 (2001-2015).

Source: CDR/SWECO, 2000

Meanwhile, ongoing work on landfill gas emission levels at the Borj Hammoud dumpsite suggests that waste-to-energy forecasts at this site are unreliable. [1] Landfill gas emission levels are lower than initially measured/estimated (1999). This is potentially attributed to the waste composition in Lebanon (high fraction of food waste is readily biodegradable). In this context, leachate quality data at the Naameh landfill are very indicative of the fast biodegradation occurring in such wastes. At the Naameh landfill site, BOD levels dropped from a high of 50,000 mg/L to a low of 1,000 within a period of two years after disposal at the site started. Similarly and within the same period, COD levels dropped from a high of 100,000 mg/l to a low of 3,000 mg/L. Concurrently, the pH started at 5.5 and increased to around 8 within less than 2 years after the start of operations at the site. The end values of BOD and COD as well as the alkaline pH (>7) are typical of landfills 10 to 15 years old.

The relatively low BOD and COD values can be attributed to the high initial organic and moisture contents leading to significant biological activity and oxygen demand at this stage. The quick depletion of readily biodegradable matter and the drainage of excess moisture contribute to the sharp reduction in biological activity and hence the observed decrease in COD and BOD levels. Such data are a clear indication of premature landfill stability because the onset of the methanogenic phase appears to have been very rapid. Parameters correlated to the "age" of the landfill exhibit a shift towards methanogenic activity characteristics within a relatively short period after waste deposition. Around 14 months after the start of the operations, the pH had risen above 7 indicating a decline of acetogenic activity and the BOD/COD ratio has fallen below 0.3 further confirming that the waste is well into the "moderately stable" (El-Fadel *et al.*, 2001b). Assuming a similar behavior at the 15-year old Bourj Hammoud site would suggest that opportunities for energy recovery at this site are diminishing rapidly.[1]

[1] *Pers comm* El-Fadel M, AUB

APPENDIX H

ECONOMIC HEALTH IMPACTS OF WATER POLLUTION

Health impacts due to poor water quality are a major concern in Lebanon. In general, waterborne diseases, especially diarrheal diseases, are one of the leading causes of mortality and morbidity among children less than five years old. In addition, health problems resulting from exposure to water pollutants often result in health care expenditures and absence from work. In addition to health impacts, poor water quality encourages or forces people to buy more bottled water than they would normally buy if they had access to good quality drinking water.

This appendix estimates the incremental costs of water pollution impacts on public health at about US$7.3 million per year, and bottled water consumption at about US$ 7.5 million. The methodology used to estimate these costs always relies on very conservative estimates --i.e., the actual costs are likely to be much higher than what is presented in this chapter. In addition, water pollution results in many other costs that are more difficult to quantify (e.g., treatment of water for drinking purposes, contamination of aquatic life, reduction in fish catch, contamination of well water used for irrigation, chemical contamination from various industrial sources). *Therefore, the costs presented in this chapter tend to underestimate the actual costs of water pollution.*

H.1 Excess mortality and morbidity damages due to water pollution

To estimate excess mortality and morbidity damages due to water pollution, this chapter relies on an approach similar to the approach used to estimate the costs of air pollution in Greater Beirut (Djoundourian et al., 1999).

H.1.1 Excess mortality damages due to water pollution

The methodology used to estimate excess mortality damages consists of three steps:

- Estimate mortality due to diarrheal diseases;
- Estimate excess mortality due to unsafe water supply and contamination; and
- Estimate costs of excess mortality due to unsafe water supply and contamination.

Mortality due to diarrheal diseases

Acute and chronic diarrheal diseases are an important cause of child mortality. To estimate the number of deaths of children less than five due to diarrheal diseases, we have estimated:

- Mortality of children less than five years old; and
- Mortality of children less than five due to diarrheal diseases.

Mortality of children less than five years old: 33 per 1,000 births; [2] since there were 85,955 births in 1999 (see Table H-1), the total number of deaths of children less than five years old is 85,955 x 0.033 = 2,837.

Table H-1
Births by Mohafaza (1999)

Mohafaza	*Number of births in 1999*		
	Male	Female	Total
Beirut	4,307	4,366	8,673
Mount Lebanon	7,753	7,474	15,227
North	11,467	11,469	22,936
South	5,706	5,447	11,153
Nabatiyeh	6,068	5,968	12,036
Bekaa	7,988	7,942	15,930
Total	43,289	42,666	85,955

Source: Tableau 4, Bulletin Statistique, Octobre 2000, No.10/2000, Administration Centrale

Mortality of children less than five years old due to diarrheal diseases: the 1990 national EPI/IMR/CDD survey estimated that 3.75% of these deaths, i.e., 106, are due to diarrheal diseases. Results from studies and sentinel surveillance centers have found significant geographic disparities in the incidence of diarrheal diseases --the rural regions of the Beqaa, North, and South are severely affected.[3]

Excess mortality due to unsafe water supply and sanitation

We define excess mortality as the increase of deaths resulting from increased water contamination due to unsafe water supply and contamination. A review of 144 studies published in the Bulletin of the World Health Organization (WHO) in 1991 concluded that improved water supply and sanitation produced a median reduction in morbidity and mortality in the order of 25 percent and 65 percent, respectively.[4] If the provision of safe water and sanitation is accompanied by improved hygiene and health education, the reductions could be even larger.

As mentioned above, waterborne diseases, especially diarrheal diseases, are one of the leading causes of mortality and morbidity among Lebanese children less than five years old. According to the WHO study, improved water supply and sanitation could reduce mortality by 65 percent, thus saving 69 lives (106 x 65%).

[2] LEDO, Under five mortality rate indicator, Ministry of Environment, Lebanon

[3] Situation Analysis and Surveys on Child Health in Lebanon, UNICEF, Lebanon, 1993

[4] Middle East and North Africa Environmental Strategy Towards Sustainable Development, February 17, 1995, Report No. 13601-MNA, World Bank, page 9

Costs of excess mortality due to unsafe water supply and sanitation

The air pollution study referenced earlier estimated an average excess mortality cost of US$88,573 per person (see Box H-1). Therefore, the costs of excess mortality due to unsafe water supply and sanitation are US$6,111,537 (US$88,573 x 69).

H.1.2 Excess morbidity damages due to water pollution

This section estimates the costs of hospitalization for illnesses that are aggravated by water pollution and the lost earnings resulting from absenteeism due to hospitalization. The cost estimates in this section are not comprehensive, but provide an order of magnitude of the effects.

This section estimates:

- The number of hospital admissions due to diarrheal diseases and associated cost of treatment;
- Emergency room visits and cost per visit; and
- The value of restricted activity days.

Morbidity due to diarrheal diseases

Hospital admissions: the MoPH (Directorate of Preventive Medicine) has compiled statistics on the incidence of 21 infectious diseases from around the country since 1995. These diseases include the three major waterborne diseases that we have selected for this case study: dysentery, hepatitis A, and typhoid (see Figure H-1). It is widely believed that the numbers significantly underestimate the true incidence of the selected diseases because they are only based on the information submitted by the respective hospitals and public health centers in the country. This reporting system is flawed on two counts:

1. many hospitals do not systematically inventory and compile diagnoses (and most certainly did not in the early-to-mid 1990s) and often lack basic computerized logging systems; and
2. many hospitals and health care clinics do not live up to their reporting obligation a communication gap that compels the MoPH to play a pro-active role in compiling the information.

Box H-1
Value of a Statistical Life in Lebanon

One of the less controversial approaches to valuing human life is based on the concept of the "Value of a Statistical Life" (VOSL). VOSL values the monetary benefits of reducing mortality risks. When assessing the benefits of risk reduction using VOSL, what matters is the risk bearing individual's own willingness to pay for a reduction in the probability of

reduction. VOSL

Several techniques, such as surveys, contingent valuation, and labor market behavior,

mor

that pose higher risks. Alternatively, workers demand higher compensations to accept more risky occupations. Therefore, the employment choices that individuals make carry with them an implicit valuation of life.

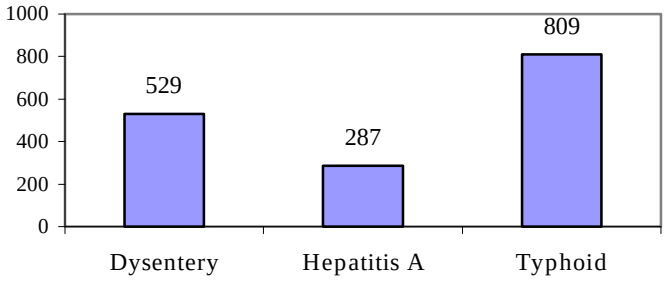
Since Lebanon lacks micro level information on the risk-taking behavior of individual workers, it is not possible to empirically estimate the VOSL of a Lebanese worker. An implicit value of life has to be derived from an empirical literature survey of labor market studies. After reviewing VOSL estimates in 24 labor market studies, Viscussi (1993) reported values between US$600,000 and US$16 million per life, with the majority of the values in the US$3 million to US$7 million range.

The VOSL reflects to a large extent income and wage levels in the country of study. Most of the studies are conducted in the United States and hence need to be adjusted for the income differentials between Lebanon and the United States 1999 per capita GDP in Lebanon is US$4,705, while in the United States it is US$31,872, according to UNDP's Human Development Indicators 2000. *Considering the lowest possible value of life estimate of US$600,000 per person in the United States, and adjusting it for the income differentials between the two countries, the result would be a very conservative Lebanese VOSL of US$88,573 per person.*

The VOSL of US$88,573 is an estimate of average excess mortality cost. Viscussi (1993) suggested US$800,000 as a value of life estimate for workers in high risk jobs and workers in countries outside the United States. Our choice of US$600,000 can be viewed as being overly conservative. Note that the VOSL varies with income, age, sex, education and / or occupation. However, the study assumes that all individuals are valued the same. Note also that a VOSL of US$88,573 is higher than the amount a judge would offer as a compensation for victims of accidents in Lebanon. The average compensation to the families of victims ranges from US$20,000 to US$50,000 depending on various socioeconomic factors.

Source: Human Development Indicators, UNDP
The Social and Economic Impacts of Mobile Source Pollution on Public Health in Greater Beirut, Lebanon, Final Report, Harvard Institute for International Development, Beirut, Lebanon, March 1999, pages 47-48.

Figure H -1
Number of Reported Cases per Year
(Annual Average for Years 1995-2000)



Source: Compilation of Lebanese Epidemiological Newsletter (EpiNews), MoPH, 1995-2000

Emergency room visits: the air pollution study referenced earlier estimated that the number of emergency room visits in Beirut is 140,000 per year. The same air pollution study also estimated that there are 455,000 hospital admissions annually in Lebanon and that a third of them are for hospitals in Beirut. If we assume that emergency room visits in Beirut also represent a third of emergency room visits in Lebanon, the number of emergency room visits in Lebanon is 420,000 per year.

The total number of hospital admissions for diarrheal diseases is 1,627 per year (annual average of compilation of 1995-2000 statistics), which results in a ratio of 0.0036 admissions for diarrheal diseases to total admissions. If we assume that this ratio also applies to emergency room visits, the number of emergency room visits due to diarrheal diseases is 1,512 (420,000 x 0.0036).

Restricted activity days:

For the three waterborne diseases identified previously, the number of restricted activity days (RADs) for patients admitted to hospitals is almost 10,000 per year (see Table H-2).

Table H-2
Number of Restricted Activity Days (RAD) for Patients Admitted to Hospitals

Disease	*Number of Admissions (average per year)*	*Average Length of Stay (RAD)*	*Number of RAD per Year*
Dysentery	529	3	1,587
Hepatitis A	287	5	1,435
Typhoid	809	7	5,663
TOTAL	1,625		8,685

Source: Figure 1 and *Pers. Comm.* with AUH staff

According to a UNICEF study[5], only 1.3% of children under five with diarrhea are referred to hospitals for treatment. Therefore, the number of children under five with diarrhea is substantially larger than the number of children admitted to hospitals (see Table 3). Even when children are not admitted to hospitals, they incur restricted activity days; school days are lost and an adult, who either takes a leave from work or cannot perform household duties, usually keeps company to the child. We have assumed that the number of RADs per child will be half of the number for children admitted to hospitals because we can assume that when children stay at home, the disease is usually less serious and the adult has to spend less time with the kid. The total number of RADs (adults keeping company to children) is above 40,000 per year (see Table H-3).

The total number of RADs for the three waterborne diseases is almost 50,000 (see Table H-3).

Table H-3
Number of Restricted Activity Days (RAD) for Adults Keeping Company to Children

Disease	*Number of Admissions for Children under 5*	*Total Number of Children under 5 with Disease*	*Number of Children under 5 with Disease who Stay at Home (*0.987)*	*Number of Restricted Activity Days (adults keeping company to children)*
Dysentery	106	8,154	8,048	12,072
Hepatitis A	33	2,538	2,505	6,263
Typhoid	96	7,385	7,289	25,512
TOTAL	235	18,077	17,842	43,847

Table H-4
Number of Restricted Activity Days (RAD) per Year by Disease

Disease	*Number of RADs per year*
Dysentery	13,659
Hepatitis A	7,698
Typhoid	31,175
TOTAL	52,532

Source: Tables H-2 and H-3

Excess morbidity due to unsafe water supply and sanitation

We define excess morbidity as the increase of hospital admissions, emergency room visits, and restricted activity days resulting from increased water contamination. As explained in Section 8.1.2, improved water supply and sanitation produced a median reduction in morbidity in the order of 25 percent. If the provision of safe water and

[5] Report on the National Survey about Health Indicators of Children in Lebanon, Part Two, Control of Diarrheal Diseases, Ministry of Public Health, UNICEF, July 1996.

sanitation is accompanied by improved hygiene and health education, the reductions could be even larger.

As shown in Table H-5, the provision of safe water and sanitation could save annually:

- 406 hospital admissions;
- 378 emergency room visits; and
- 13,133 restricted activity days.

Table H-5
Excess Morbidity

Category	*Cases*	*Excess Cases (25%)*
Hospital Admissions	1,625	406
Emergency room visits	1,512	378
Restricted Activity Days	52,532	13,133

Costs of excess morbidity due to unsafe water supply and sanitation

To estimate the cost of hospital admissions, we have used estimates of the average duration of stay by disease and the average daily cost by disease. The cost of hospital admissions is close to US$1 million (see Table H-6).

Table H-6
Cost of Hospital Admissions

Disease	*Average duration of stay (days)*	*Average Daily Cost (USUS$)*	*Total Cost per Stay (USUS$)*	*Excess hospital admissions*	*Annual cost (US$)*
Dysentery	3	300	900	132	118,800
Hepatitis A	5	350	1,750	72	126,000
Typhoid	7	400	2,800	202	565,600
TOTAL				406	810,400

To estimate the cost of emergency room visits, we have used an average cost of US$76.04 same as air pollution study. The cost of emergency room visits remains below US$30,000 (see Table H-7).

Table H-7
Cost of Emergency Room Visits

Number of Emergency Room Visits	*Average Cost (USUS$) per Emergency Room*	*Total Cost of Emergency Room Visits (USUS$)*
378	76.04	28,743

Source: Table H-5, Djoundourian et al., 1999

We have assumed that the value of a restricted activity day is equivalent to the daily wage of an average income earner. According to the 1997 household survey[6], the average per capita income is 327,700 Lebanese pounds (LBP) per month or US$10 per day, assuming 22 working days per month. According to the same household survey, only 34% of the population works; therefore, the daily wage of the average income earner is US$29.4.

The annual costs of excess mortality and morbidity due to water pollution in Lebanon are US$7,336,790 (see Table H-8).

Table H-8
Estimated Annual Costs of Excess Mortality and Morbidity Due to Water Pollution in Lebanon

Cost Category	*Number of persons or cases*	*Cost per person (US$)*	*Total cost (US$)*
Premature mortality	69	88,573	6,111,537
Hospital admissions due to diarrheal diseases --Dysentery --Hepatitis A --Typhoid	406 132 72 202	 900 1,750 2,800	 118,800 126,000 565,600
Emergency room visits	378	76.04	28,743
Restricted activity days	13,133	29.4	386,110
TOTAL			7,336,790

H.2 Cost of Excess Consumption of Bottled Water

Poor water quality increases the costs of water treatment and encourages people to buy more bottled water than they would normally buy if they had access to good quality drinking water. According to the survey on household budgets,[7] annual average expenses are 6,697,000 Lebanese pounds (LBP) per capita and bottled water represents 0.6 percent of these expenses i.e., LBP 40,182. Given that the average price for bottled water

[6] CAS Study / No.9, 1998

[7] CAS Study / No.9, 1998

is approximately LBP 350 per liter,[8] the average per capita consumption of bottled water in Lebanon is 115 liters per year.

Other Mediterranean countries such as France and Spain have a lower consumption of mineral water (89 liters per capita per year in France and 78.2 liters in [9] The average for these three countries is 107.4 li
due to water pollution is the difference between 115 (average consumption in Lebanon) and 107.4 (average of Italy, France, and Spain), which is 7.6 liters per capita per year.[10] With an average price of 350 LBP (USUS$0.233) per liter and a population of 4.26 million, the cost of excess consumption of bottled water is therefore about *US$7,543,000*.

[8] Average is based on the price of bottled water and water gallons of various sizes.

[9] Website www.mineralwaters.org

[10] op by 7% if the consumption is likely to be higher. Most Lebanese people drink bottled water because they do not have a choice whereas Europeans can choose between bottled water and public water.

APPENDIX I

MOST COMMON TREES IN LEBANON

Latin Name	*Elevation Zone (meters)*	*Common Name (English)*	*Common Name (Arabic)*
1. *Abies cilica*	1300 - 2000	Cilician Fir	
2. *Acer syriacum*	0 - 800	Syrian Maple	
3. *Acer tauriculum*	0 - 800	Taurus Maple	
4. *Arbustus andrachne*	500 - 1500	Oriental Strawberry Tree	
5. *Arbustus unedo*		Common Strawberry Tree	
6. *Cedrus libani*	1200 - 2000	Cedar of Lebanon	
7. *Celtis australis*	200 1400	European Nettle-Tree	
8. *Ceratonia ciliqua*	Sea 800	Carob	
9. *Ceris siliquastrum*	Sea- 800	Judas Tree	
10. *Cupressus sempervirens*	Sea 1700	Cypress	
11. *Fraxinus ornus*	500 2000	Flowering Ash	
12. *Fraxinus syriaca*		Syrian Ash	
13. *Juglans regia*	400 1800	Walnut	
14. *Juniperus drupacea*	1000 2000	Juniper	
15. *Juniperus excelsa*	1500 2800	Grecian Juniper	
16. *Juniperus foetidissima*		Fetid Juniper	
17. *Juniperus oxycedrus*	500 - 1500	Prickly Juniper	
18. *Laurus nobilis*	Sea - 1200	Laurel	
19. *Myrtus communis*	Sea - 800	Myrtle	
20. *Ostrya carpinifolia*	500 - 1500	Flowering Ash	
21. *Pinus brutia*	500 - 1700	Calibrian Pine	
22. *Pinus halepensis*	0 500	Aleppo Pine	
23. *Pinus pinea*	500 1600	Stone Pine	
24. *Pistacia lentiscus*	0 400	Mastic Tree	
25. *Pistacia palaestina*	500 1000	Palestine Pistachio	
26. *Platanus orientalis*	Sea 1800	Oriental Plane	
27. *Populus alba*	500 1500	White Poplar	
28. *Populus nigra*	500 1500	Black Poplar	
29. *Populus tremula*	1000 2000	Trembling Poplar	
30. *Quercus brantii*	1400 1800		
31. *Quercus calliprinos*	Sea 1500	Kermes Oak	
32. *Quercus cedrorum*		Cedar Oak	
33. *Quercus cerris*	1400 1800	Turkey Oak	
34. *Quercus infectoria*	500 1500	Cyprus Oak	
35. *Quercus libani*		Lebanese Oak	
36. *Quercus pinnatifida*		Pennatiforme Oak	
37. *Salix alba*	500 1800	White Willow	
38. *Sorbus torminalis*	1000 2000	Wild Service-Tree	
39. *Styrax officinalis*	500 1700	Storax	

Source: MOA / ONF, 1999 (Common names in English and Arabic are based on Nehme, 2000).

APPENDIX J

FRESHWATER HOTSPOTS: THREATS, POLICIES AND ON-GOING ACTIONS

Hot Spot	*Description*	*Threat*	*Policies and Actions*
Lake Qaroun	Largest lake in Lebanon, manmade. Altitude 850m, storage capacity 240 MCM. Major reservoir for planned irrigation schemes in south Lebanon	Direct discharge of domestic and industrial waste effluents upstream. Early signs of accelerated eutrophication observed. Contamination from pesticides run-off and fertilizers seepage	An *Environmental Master Plan for the Litani River and Lake Qaroun Catchment Area* has been completed.[11] This is the first step towards implementing a comprehensive rescue and management plan. Within the Litani watershed area, at least four wastewater treatment plants are under preparation (Qaroun, Jib Jannine, Aanjar and Zahleh), and one is under execution (Baalbeck)
Lake Yammouneh	Highest surface water system in Lebanon (1450 m). Former lake has been reduced to several small ponds by drainage	Drainage started in the early 1940s. Endemic freshwater fish (*Phoxinellus libani*) possibly extinct. Water is diverted by gravity to agricultural schemes. Drained lands are cultivated (mostly converted to apple orchards)	Area surrounding flat highland proclaimed legal nature reserve (February, 1999). The possibility of grant funding (WB / GEF) for a medium sized conservation and management project is being examined. Preparations underway for restoring the lake (CDR) measuring about 25 hectares (expandable to 60 ha.) and with a storage capacity of 1.5 Mm^3
Aamiq marshes	Formerly an extensive wetland system stretching to Zahle. Important habitat for migratory and resident bird species	Construction of new road system. Drainage for agricultural production. Grazing, hunting and human settlements	EIA for proposed road section conducted. Drainage canals closed to restore water regime. Protected Areas Framework Law (pending) could provide a mechanism for enforcing conservation on private lands. With grant funding from FFEM, Ammiq marshes became one of two beneficiaries for a wetland conservation project (2001)

[11] MOE-CDR / MVM, 2000

APPENDIX K

KNOWN MINEFIELDS AND SUSPECTED MINEFIELDS (1999)

District	*Number*	*Sample of Minefield Locations*
1. Beirut Area	8	Ras el Nabeh, Ras el Nabeh Cementeries, Mathaf Olivetti, Sahat Al Abd, Syoufi Garden, and Sharshabouh District
2. Baabda Area	47	Near the Faculty of sciences of Lebanese University, Kfarshima, Salima, Arbaniyya
3. Northern Metn	38	Wadi Jamajem, Shamoun Buildings, Ayroun, and Dawwar
4. Chouf	58	Deir El Kamar, Barouk Cedars, Ikleem Al Kharoub, KfarMatta, Ain Ksour, Ain Zhalta, Ain El Hawtr, Mtoulleh, Bakkifa, Hasrout, Shourit
5. Aley	115	Souk El Gharb, Kayfoun, Aytat, Maaroufieh, Aley Ras El Jabal, Bmakkin, Ain Ksour, Binnay, Abey, Baysour, Btater, Ain Drafeil
6. Kesserwan	33	Ouyoun El Siman, Geita, Sakiat El Meftiey, Klayaat, Deir Aafes, and Bakaata (?)
7. Jbeil	65	Jouroud Al Akoura, Barbara, the Old Tripoli Road, Bejjeh, Shmout, Fghal, Afqa
8. Koura	10	Matawleh, Shanata, Wata Fares, Kateh Fares, Majdal
9. Batroun	78	Shabteen, Sourat, Harbouna, Zan, Toula, Douk, Dahr Abi Yaghi, Tannourine, Sghar,Masrah, Artez, Niha, Koura
10. Bsharre	15	Mazraat Bani Assaf, Mazraat Bani Saab, and Metrit.
11. Akkar	1	Klayat Airbase
12. Saida	5	Tanbourit, Barti, Zeghdraya, Kfarhatta, Maghdoushi, Jabal Hemedeh
13. Jezzine (before the withdrawal)	6	Mrah Hbas, Ain El Mir, Wadi Maksabi
14. Nabatieh	3	Wadi Jhannam, the Nabatieh Fortress
15. West Bekaa	13	Falouj, Bireh, Kilya, Zallaya, Maydoum, Ain Tina, Rawda, Yohmor, Kamed El Lawz
16. Baalbeck	1	Baalbeck Fortress
17. Rashayaa	6	Yanta, Jabal Mzaybleh, Bakka, Jabal Al Dawaweer
18. Hasbayya	6	Dallafa, Fakha, Mazraat Ain Al Hajal, Shebaa, Al Kakour

Source: Data was presented by the Lebanese Army at the Arab Regional Seminar on Landmines in Cairo (9-11 Aril 2000). Three hundred minefields are confirmed and another 218 are suspected to exist. In addition, 303 minefields have already been cleared.

APPENDIX L

LIST OF CITED LEGISLATION RELATED TO ENVIRONMENTAL PROTECTION

Legal Instrument	*Date*	*Description*
Agriculture		
Decision 94/1, MoA	20/5/98	Bans the import of 110 pesticides
Industry		
Decree 4917	24/4/94	Divides establishments into three classes upon their environmental threat
Decree 5243	5/4/01	Amends Decree 4917 introducing five industrial classes
Decision 44, CoM	-/-/99	Requires Class 1 and 2 industries to be located inside industrial zones
Decision 23, CoM	11/12/99	Exempts Class 2 and 3 industries from being located inside an industrial zone
Decision 5/1, MoE	25/1/01	Provides environmental guidelines for establishing gas stations
Decision 16/1, MoE	5/4/01	Provides environmental guidelines for establishing farms
Decision 75/1, MoE	2/9/01	Provides environmental guidelines for establishing or tanneries
Decision 4/1, MoE	12/1/01	Provides environmental guidelines for establishing slaughterhouses
Decision 3/1, MoE	25/1/01	Provides environmental guidelines for establishing rendering plants
Decision 29/1, MoE	31/5/01	Provides environmental guidelines for establishing dairy production
Decision 5/1, MoE	4/1/01	Provides environmental guidelines for establishing fruit and vegetable processing plants
Decision 60/1, MoE	20/9/01	Provides environmental guidelines for establishing stone cutting plants
Decision 61/1, MoE	20/9/01	Provides environmental guidelines for establishing plastics manufacturing plants
Construction		
Decree 10490	21/6/97	Reorganizes the DGUP and redefines its role and responsibilities
Decree 3361	7/7/00	Exempts new industrial establishments in South Lebanon from income taxes during the first 6 years of operation
Decision 90/1, MoE	19/11/00	Provides environmental guidelines for construction in river basins and sensitive ecosystems
Transport		
Law 368	1/8/94	Allows the import and use of diesel-engine pick-ups, trucks and buses

Law 384	4/11/94	Permits the MoIM to sell up to 24,000 licenses for shared-taxis, trucks, minibuses and buses
Decree 6603	4/4/95	Defines the standards for operating diesel trucks and buses
Law 432	15/5/95	Amends law 368. Removes age restriction on imported diesel vehicles if shipped before promulgation of Law 368
Decision 138, MoPWT	13/10/99	Establishes the Transport Regulatory Unit at the MoPWT
Decision 9, CoM	5/4/00	Calls for reducing the number of public transport vehicles to about 27,000
Law 341	6/8/01	Aims to reduce air pollution by transport sector through the implementation of a series of regulatory measures
Tourism		
Decree 15598	21/09/70	Establishes general standards for the creation and operation of tourist establishments
Decree 4221	10/10/00	Amends Decree 15598 and provides a new/updated classification system for tourist establishments
Decision 37	26/2/00	Forms a national committee to support the skiing sector (resorts and associated facilities)
Water		
Law 221	29/5/00	water authorities
Law 241	7/8/00	Amends Law 221 by reorganizing the water boards into *four* regional water authorities
Decree 1039, MoI	2/8/99	Sets permissible standards for drinking water parameters
Air		
Decision 52/1, MoE	29/7/96	Establishes National Air Quality Standards
Decision 8/1, MoE	1/3/01	Updates/replaces Decision 1/52 by developing National Standards for Environmental Quality (NSEQ)
Decision 191/1, MoE	-/9/97	Defines environmental guidelines to improve the environmental performance of Portland cement plants
Biodiversity		
Decision 92/1, MoA	27/2/96	Prohibits the export of all medicinal and aromatic plants
Decision 340/1, MoA	1/8/96	Permits the export of processed thyme and sage
Decision 108/1, MoA	12/9/95	Bans the import and introduction of all cedar seeds and plants
Decision 2/B, MoE	21/5/93	Bans the use and import of bird sound devices.
Decision 102/1, MoE-MoA	28/4/93	Divides game birds and animals into three categories
Decision 110/1, MoE-MoA	18/5/95	Restricts hunting to certain animals and birds only
Decision 11, CoM	30/8/95	Declares a ban on hunting (for three years) over the entire Republic of Lebanon
Decision 15, CoM	12/9/95	Reopens the season of hunting for four months starting from 15/9/95 and re-declares a ban on hunting from 15/1/96 till the end of 1997

Decision 35, CoM	27/5/97	Renews the ban on hunting over the entire Republic of Lebanon till further notice
Decision 37, CoM	23/12/97	Reasserts the application of the national ban on hunting until the hunting law of 18/6/1952 is revised and promulgated
Decision 55, CoM	8/11/01	Approves the MoE draft law to update the hunting law of 1952
Decision 92/1, MoE	27/2/96	Prohibits the export of all medicinal and aromatic plants, including thyme, myrtle, and chamomile.
Decision 108/1, MoE	12/9/95	Bans the import and introduction of all cedar seeds and plants
Soils and Land		
Decree 144	-/-/1925	Declares the sea including the sea bed and the sea floor and the coast as public domain
Decree 4810	24/6/96	Provides for the right of public access to the maritime public domain
Law 21 (Art. 1)	3/29/66	States that the establishment and management of public beaches falls under the responsibility of the Ministry of Tourism
Decree 8861	25/7/96	Regulates the licensing of billboards and other advertisements and defines minimum setback distances from roads and natural sites
Institutional		
Law 216	02/5/93	Establishes the Ministry of Environment and defines its mandate
Decree 5591	30/8/94	Organizes the MoE into divisions and sections and defines the responsibility of each administrative unit
Law 667	29/12/97	Amends Law 216 and reorganizes the ministry into 5 departments and redefines its functions into 17 areas of intervention
Land Management		
Law 121	9/3/92	Declares the Horsh Ehden and Palm Islands Nature Reserves
Law 532	24/7/96	Declares the Al Shouf Cedars Nature Reserve
Law 708	5/11/98	Declares the Tyre Coast Nature Reserve
Law 9	20/2/99	Declares the Tannourine Reserve Nature
Law 10	20/2/99	Declares the Yammouneh Nature Reserve
Law 11	20/2/99	
Decision 14/1, MoE	6/10/95	Declares the Karm Chbat Nature Reserve
Law 558	24/7/96	Amends the Forest Code (Law 85 dated 12/9/91) and declares all cedar, fir, cypress, and juniper forests as protected
Decision 499/1, MoA	14/10/96	Declares the forests of Tannourine, Hadath el Jebbeh, Jaij and Arz protected
Decision 587/1, MoA	30/12/96	Declares the forest of Sawyse protected
Decision 588/1, MoA	30/12/96	Declares the forest of Ammouah protected

Decision 589 / 1, MoA	30 / 12 / 96	Declares the forest of Karm Chbat protected
Decision 591 / 1, MoA	30 / 12 / 96	Declares the forest of Bazbina protected
Decision 592 / 1, MoA	30 / 12 / 96	Declares the forest of Knat protected
Decision 10 / 1, MoA	17 / 1 / 97	Declares the forest of Qaryet el Sfina protected
Decision 11 / 1, MoA	17 / 1 / 97	Declares the forest of Merbine protected
Decision 8 / 1, MoA	17 / 1 / 97	Declares the forest of Ain el Houkaylat protected
Decision 9 / 1, MoA	17 / 1 / 97	Declares the forest of Jurd el Njas protected
Decision 174 / 1, MoA	25 / 3 / 97	Declares the forest of Chbaa protected
Decision 3 / 1, MoA	8 / 12 / 97	Declares the forest of Bkassine protected
Decision 97 / 1, MoE	2 / 7 / 98	Declares Nahr el Kalb protected
Decision 130 / 1, MoE	1 / 9 / 98	Declares Beirut River protected
Decision 189 / 1, MoE	19 / 11 / 98	Declares El Aassi river protected
Decision 188 / 1, MoE	19 / 11 / 98	Declares Aarkah river protected
Decision 187 / 1, MoE	17 / 11 / 98	Declares the Makmel summit (also known as Qornet el Sawda) protected
Decision 131 / 1, MoE	1 / 9 / 98	Declares the Awali river protected
Decision 129 / 1, MoE	1 / 9 / 98	Declares the valley of Damour protected
Decision 122 / 1, MoE	1 / 9 / 98	Declares several sites in the Chouf region protected
Decision 71 / 1, MoA	- / - / 92	Declares a site in Kfarzebid protected
Decision 152 / 1, MoA	- / - / 92	Declares a site in Hbaline (Caza of Byblos) protected
Solid Waste Management		
Law 504	6 / 9 / 95	Approves a loan agreement between the GoL and the WB for implementing SWEMP
Decision 58, CoM	2 / 1 / 97	Adopts the Emergency Plan for SWM in GBA
Decision 22 / 1, MoE	24 / 10 / 96	Bans all waste imports destined for final disposal or energy recovery (incineration), as well as hazardous waste imports bound for recycling

APPENDIX M

INTERNATIONAL CONVENTIONS AND TREATIES (2001)

Name of Convention	*Convention Date*	*Accession/Ratification Date*
On Protecting Natural Resources		
United Nations Convention to Combat Desertification. PARIS	1994	8/12/1995 by Law No. 469/95
Convention on Biological Diversity. RIO DE JANERO	1992	1/8/1994 by Law No. 360/94
Protocol Concerning Mediterranean Specially Protected Areas. GENEVA	1982	22/2/1994 By Law No. 292/94
International Convention for the Protection of World Cultural and Natural Heritage PARIS	1972	30/10/1990 by Law No. 19/90
Convention on Wetlands of International Importance especially as Waterfowl Habitat. RAMSAR. IRAN	1971	23/2/1999 by Law No. 23/99
On Climate Change		
Amendment to the Montreal Protocol on Substances that deplete the Ozone Layer. COPENHAGEN	1992	25/10/1999 by Law No. 120/99
United Nations Framework Convention on Climate Change. RIO DE JANERO	1992	1/8/1994 by Law No. 359/94
Amendment to the Montreal Protocol on Substances that deplete Ozone Layer. LONDON	1990	22/7/1993 by Law No. 253/93
Montreal Protocol on Substances that deplete the Ozone Layer. MONTREAL	1987	22/7/1993 by Law No. 253/93
Vienna Convention for the Protection of the Ozone Layer. VIENNA	1985	22/7/1993 by Law No. 253/93
On Pollution Prevention		
Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources. ATHENS	1980	22/2/1994 by Law No. 292/94
Protocol regarding the International Convention for the Prevention of Pollution from Ships. LONDON	1978	28/5/1983 by Law No. 13/83
Protocol Concerning Co-operation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency. BARCELONA	1976	30/6/1977 by Decree-Law No. 126/77
Convention for the Protection of the Mediterranean Sea against Pollution. BARCELONA	1976	30/6/1977 by Decree-Law No. 126/77

Name of Convention	*Convention Date*	*Accession/Ratification Date*
Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft. BARCELONA	1976	30 / 6 / 1977 by Decree-Law No. 126 / 77
International Convention for the Prevention of Pollution from Ships. LONDON	1973	28 / 5 / 1983 by Law No. 13 / 83
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. LONDON-MEXICO CITY-MOSCOW-WASHINGTON.	1972	
International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties. BRUSSELS	1969	12 / 10 / 1974 by Decree No. 9226
International Convention on Civil Liability for Oil Pollution Damage. BRUSSELS	1969	10 / 12 / 1973 by Law No. 28 / 73
International Convention relating to the responsibility of nuclear ships BRUSSELS	1962	12 / 10 / 1974 by Decree No. 9228
International Convention for the Prevention of Pollution of the Sea by Oil. LONDON	1954	26 / 11 / 1966 by Law No. 68 / 66
On Toxic/Hazardous Waste		
Convention on Persistent Organic pollutants for adoption by the conference of Plenipotentiaries. STOCKHOLM	2001	Signature: 22 / 5 / 2001
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. BASEL.	1989	21 / 12 / 1994 by Law No. 387 / 94
Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and the Ocean floor and in the Subsoil. LONDON-MOSCOW-WASHINGTON.	1971	12 / 10 / 1974 by Decree No. 9223

Source: based on http: / / www / moe.gov.lb / agreements

APPENDIX N

RECENT AND ON-GOING ENVIRONMENTAL PROJECTS (1994-2001)

THEME	*PROJECT TITLE*	*DURATION*	*Donor (EXEC. AG.)*	*BUDGET*
INSTITUTIONAL STRENGTHENING	Preparation of Lebanon State of the Environment Report	95-96	METAP (MoE)	400
	Introduction of formal and operational environmental management in reconstruction and rehabilitation (Capacity 21, Phase I)	94-00	UNDP UNEP (MoE)	565 60
	Identification of Environmental Projects	93-00	FRA / MAE-FRA (MoE)	466
	Unit of Planning and Programming (UPP)	96-01	METAP (MoE)	350
	Sustainable Development Networking Program (SDNP)	96-98	UNDP (MoE)	256
	National Program for Promoting Sustainable Development at Institutional Level (Capacity 21, Phase II)	97-99	UNDP (MoE)	[12]400
	Strengthening the Permitting and auditing system for industries.	99-01	EU (MoE)	365.5
	Establishment of a Lebanese Environment and development observatory.	99-01	EU (MoE)	371.5
	EIA Training and Public Awareness Campaigns	00-01	METAP (MoE)	100
LAND RESOURCES	Resource management in KARSTIC areas of the coastal regions of the Mediterranean.	97-00	EU (CREDCO)	82
	Reprinting of the geological maps of Lebanon	99-01	EU (NCRS)	96
	Desertification / ACSAD	99-00	GFR / GTZ (ACSAD)	547
	National action programme to combat desertification in Lebanon	00-03	UNDP LEB / MOA* UNSO (MoA)	5 200 80
WATER RESOURCES	Isotope study of underground water resources	95-00	IAEA (IAEA)	91
	Control of bacterial growth in water supply distribution	97-00	EU (UNT)	125
	Drainage Basin	98-99	ACSAD (ACSAD)	100

[12] Commitment includes residual budget from Capacity 21 Phase I

THEME	*PROJECT TITLE*	*DURATION*	*Donor (EXEC. AG.)*	*BUDGET*
cont.	Environmental master plan for LITANI river and the lake QARAOUN LATCHMENT area	98-00	SIDA (MoE-LRA)	753
FORESTS	Combating forest fires	97-00	FRA / MOF-FRA (MoA)	1,767
	Assistance a la Protection de la	97-00	EU (MoA)	1,896
	Equipment for combating forest fires incidence	99-00	MOF-FRA (CDR)	1,096
CLIMATE CHANGE	Phasing out CFC	95-00	MP (UNIDO)	2,073
	Enabling activity (Building capacity for the GHG inventory in response to UFCCC communications obligations)	96-00	GEF / UNDP (MoE)	293
	Institutional strengthening for the implementation of MONTREAL PROTOCOL in Lebanon. (Phase I)	98-00	MP / UNDP (MoE)	179
	Methyl Bromide Alternatives Project	99-01	MLF (MoE / UNDP)	328
	Conversion of CFC-11 to HCFC-141b and from CFC-12 to HFC-134a in the manufacture commercial refrigeration equipment.	00-03	MP / UNDP (UNOPS)	200
	Conversion of CFC-Free technology in the manufacture of aerosol at SOCIETE NOUGEAIM P.M.O S.A.L	00-03	MP / UNDP (UNOPS)	159
	Conversion of CFC-Free technology in the manufacture of aerosol at ZTME, SNCI, SOLF	00-03	MP / UNDP (UNOPS)	314
	Conversion of CFC-Free technology in the manufacture of aerosol at INCOMA S.A.L	00-03	MP / UNDP (UNOPS)	171
	Ozone Office: Institutional Strengthening for the Implementation of Montreal Protocol (Phase II)	01-03	MP / UNDP (MoE)	119
	Expedited Financing of Climate Change Enabling Activities (Phase II)	01-02	GEF / UNDP (MoE)	100
	Methyl Bromide Alternatives Investment Project	01-06	MLF / UNDP UNIDO (MoE)	2,600 1,500
BIODIVERSITY	Strengthening of National Capacity and Grassroots In-situ Conservation for Sustainable Biodiversity Protection	96-01	GEF / UNDP (MoE)	2,500

THEME	*PROJECT TITLE*	*DURATION*	*Donor (EXEC. AG.)*	*BUDGET*
	National Biodiversity Strategy and Action Plan (NBSAP)	97-99	GEF / UNDP (MoE)	155
	Conservation & Sustainable Use of Dryland Agro biodiversity of the Near East.	99-04	GEF / UNDP (MoA)	1,500
	Coastal vegetation survey and conservation.	99-02	UKM / BE (---)	229
	Conservation of wetlands and coastal zones in the Mediterranean	01-05	FFEM (MoE)	404
	Assessment of Capacity Building Needs and Country Specific Priorities in Biodiversity (Top-up proposal)	01-02	GEF / UNDP (MoE)	100
ENERGY	Lebanon Cross-Sectoral Energy Efficiency and Removal of Barriers to ESO Operations (Energy Centre project)	01-06	GEF / UNDP (MoE)	3,400
	Capacity Building for the Adoption & Application of Energy Standards for Buildings	01-03	GEF / UNDP (MoPWT)	494
WASTE MANAGEMENT	Solid waste management programme-The Green Park project.	98-99	FIN / FINNIDA (UNIFIL)	503
		98-99	FAO (FAO)	101
	Feasibility study for Gas Extraction and Rehabilitation of BOURJ HAMMOUD Landfill	99-00	SWE / SIDA (CDR)	106
	NORMANDY landfill reclamation.	99-99	USA / ATDA (CMU)	220
	Integrated Management of Olive Oil Production Waste in Lebanon / Syria / Jordan	01-03	EU-SMAP (MoE)	[13]1,495
	Implementation of Hazardous Waste Program	01-02	METAP (MoE)	180
COASTAL MANAGEMENT	Coastal Area Management Program (CAMP)	01-03	UNEP-MAP (EC Life-LEDO)	380 18
	Integrated Coastal Management between Jbail and Latakia	01-03	EU-SMAP (MoE)	1,000

[13] Commitment covers Lebanon, Syria and Jordan (project is hosted in Lebanon)

APPENDIX O

CURRENT RESEARCH CENTERS AND LABORATORIES

Research Center and Laboratory	*Activity Type*	*Location*	*Staffing*	*Affiliation*	*Selection of equipment*	*Comments*	*Analysis Type*
National Center for Marine Sciences	Marine research	Batroun	18	NCSR	AA spectrophotometer with Zeeman effect Gas chromatography, IR spectrophotometer, microbiology equipment for bacteriological analysis	Would benefit from more research projects	Heavy metals, hydrocarbons, chlorinated pollutants, microorganisms, biodiversity
Industrial Research Institute	Quality control: chemical and physical measures, chemistry and petroleum analysis	Beirut	6	MoI	IR spectrophotometer UV spectrophotometer AA spectrophotometer Total carbon analyzer	Personnel could benefit from targeted training workshop. Work on demand	Petroleum pollutants, heavy metals
Environmental Engineering Research Center	Public health, environmental research and air quality monitoring	Beirut	3	AUB	AA spectrophotometer Gas chromatograph Digital flame photometer Total carbon analyzer Colorimeters	Tests conform with USEPA	Bacteriology, physio-chemical
Core Environmental Laboratory	Water and sediments analysis	Beirut	4	AUB	Gas chromatography / mass spectrometer Gas chromatography / Electron capture detector HPLC UV spectrophotometer	Operational Good equipment Price lists available	Pesticides, hydrocarbons and physio-chemical
Faculty of Sciences	Chemical, biology and marine biology	Hadath	15	Lebanese University	AA spectrophotometer Gas chromatography Flame photometer Total carbon analyzer HPLC, UV spectrophotometer	Labs are designed for students and research only	Chemical pollutants

Faculty of Public Health	Chemical, microbiological water research	Tripoli Beirut Saida	4 2 2	Lebanese University	Flame photometer UV spectrophotometer, colorimeters, all microbiology equipment for bacteriological analysis	Competent human resources	Bacteriological and chemical analysis
Central Laboratory of MoPH	Public health, medical	Beirut	15	MoPH	Flame photometer, UV spectrophotometer, colorimeters, all microbiology equipment for bacteriology and medical analysis	Lack of human resources and equipment	Bacteriological and chemical analysis
Agronomic Research Institute	Fish quality	Al Fanar	12	MoA	Flame photometer, UV spectrophotometer, colorimeters, HPLC, microbiology equipment for bacteriology equipment	Good equipment	Chlorinated pollutants and heavy metals in living organisms, microbiology
Water Authorities	Water quality	Beirut Tripoli Saida	8 2 2	MoEW	AA spectrophotometer, gas chromatography, IR spectrophotometer, flame photometer, UV spectrophotometer, colorimeters, microbiology equipment for bacteriological analysis	Reorganization of 22 water boards into four authorities	Bacteriological and chemical analysis
National Atomic Energy Center	Research center	Beirut	5	NCSR	AA spectrophotometer, fluorescence X spectrophotometer	New center	Isotope analysis
Tripoli Observatory for Environment & Development	Air quality monitoring	Tripoli	4	Federation of Municipalities of Al Fayhaa	NA	Continuous monitoring, Frequent interruptions, monthly reports	Air quality parameters (e.g., pm, SO_2, dust density, hydrocarbons)
Meteorological Institute	Air quality monitoring	Beirut	NA	Beirut International Airport (MoT)	NA	Continuous monitoring, frequent interruption, monthly reports	Air quality parameters (e.g., dust, SO_2, NO_x, ozone, CO)

Source: Based on CDR/LACECO-SAFEGE, 2000, except for Tripoli Observatory and Meteorological Institute

APPENDIX P

SEVEN NATURE RESERVES DECLARED BY LAW

1. Horsh Ehden Nature Reserve: Established in 1992, Horsh Ehden boasts the highest number of documented species (726), including plants, mammals, invertebrates and birds. Perched across three Cazas (Ehden, Bsharre, and El Dinnieh), this reserve includes a core forested area measuring 6km^2, as well as sparse grassland and barren rocks. The Horsh Ehden Nature Reserve was one of three beneficiaries of a five-year GEF Protected Areas Project (1996-2001). A management team of 6 is in place to enforce protected areas regulations (hunting and grazing are prohibited) and guide and assist visitors. The reserve is open to the public all year round, except when snow blocks access to the reserve (usually 2-3 months a year).

2. Palm Island Nature Reserve consists of 3 main islands, several small islets as well as the marine environment within 500 meters from them. The combined land area is approximately 26 ha. It was listed as a Ramsar Site of International Significance in 2001. The islands are host to at least 42 migratory birds. Karstic outcrops and sandy beaches present important habitats for breeding colonies of seabirds (yellow-legged gull, etc.) and turtles, respectively. Layers of invading domestic waste washed ashore remain a serious problem. Palm Island hosts ancient salt beds while an old lighthouse is characteristic of the island of Ramkine. The islands are public and currently managed by a Government Appointed Committee under the tutelage of the MoE and were one of tree beneficiaries of the GEF Protected Areas Project.

3. Al Shouf Cedars Nature Reserve is the largest nature reserve in Lebanon. It measures approximately 160 km^2 covering a 5 km-wide corridor stretching from Dahr el Baidar in the North to Niha in the South. The Al Shouf Cedars Nature Re

   of over 1000 hectares: Ain Zhalta, El Barouk, El Maasser, and Bmohray (allegedly the southern most limit of the *Cedrus libani* in the northern hemisphere). The reserve also hosts a number of mammals such as wolves, hyenas, wild boar and jackals. The local management team consists of 10 people and is currently exploring the possibility of reintroducing the wild ibex or the mountain gazelle to the area. The Reserve is the third beneficiaries of the GEF Protected Areas Project.

4. Tyre Coastal Nature Reserve is a marine coastal nature reserve declared protected in 1998. The site is intricately complex extending across a narrow coastal ribbon between 200-500 meters wide and approximately 4 km long. The reserve is truncated into two sections by the Rachidieh settlement. The reserve offers ideal nesting sites for sea turtles. However, during the summer, more than 150 licensed booths operate on the beach, luring thousands of guests and threatening the fragile ecosystem (sand dunes have been scraped aside to provide parking space). In June 2001, a grant protocol was signed between the GoL and the FFEM to fund a conservation and management program in Tyre Coastal Nature Reserve. The Aamiq Marshes are also included in this agreement.

5. Bentel Nature Reserve was protected by local villagers and private endeavours as early as 1981. It represents a typical Mediterranean pine forest ecosystem, intermixed with oak stands. The reserve extends over 108 hectares of municipal land and is located on very steep terrain overlooking the Bental stream. In an effort to control soil erosion, villagers have constructed a series of terraces which are today abandoned but are still in good condition. The reserve offers rich floral associations and superb stands of *Pinus pinea* which are harvested for their edible pine seeds each year, as well as scenic trails, cliff formations and caves. Bental is the only reserve not to benefit from any donor project. It is managed by a Government Appointed Committee under the tutelage of the MoE. The Committee includes representatives from local municipalities, MoA, MoIM, NGOs and scientists.

6. Yammouneh Nature Reserve is a partially degraded mountain ecosystem on the eastern slopes of Mount Lebanon. It includes two sections, East and West of the Yammouneh plain. The reserve includes relic juniper stands, a high level of endemism, and several archaeological sites. Several conflicts over water and land between Yammouneh and neighbouring villages have rendered the site inhospitable to many. At 1,400 meters above sea level, the Yammouneh lake was undisputedly

   agricultural areas downstream, and much of the recovered area has since been transformed into orchards. The CDR is currently assessing the feasibility of restoring the lake and the WB is funding a study (through a Project Development Facility grant) to design and implement an integrated conservation project in the area. Based on the findings of this study, the Yammouneh Nature Reserve could be eligible for GEF funding and benefit from a GEF/WB medium sized project (MSP) worth up to US$ 600,000.

7. Tannourine Cedars Nature Reserve is an integral part of a much larger area of wilderness and cedar landscape extending North to Hadath el Jebbe and Bsharre, and East to Qnat and Niha. The Tannourine cedars extend over 1.5 km^2 and have for at least 10 years been plagued by an endemic pest, C*ephalcia tannourinensis*, which has caused extensive infestations and damage leading to the removal of about 200 century-old trees. The forest has been the subject of an intensive yet controversial conservation management project funded by the GoL and executed by a group of scientists with technical support from France and the Lebanese Army. Pursuant to the recommendations of the MoE-MoA workshop on the cedars of Tannourine, three aerial spraying applications were conducted between 1999-2001 to combat the pest. Tannourine Cedars is also benefiting from a PDF grant that could lead to the implementation of GEF/UNEP medium sized project (up to US$600,000) on forest conservation and management, executed by the MoE.

APPENDIX Q

ERITAGE SITES: CRITERIA FOR INCLUSION

Sites are listed based on a set of cultural and / or natural selection criteria. Four of in 1994 based on cultural criteria as follows: Tyre (criteria iii and iv), Byblos (iii, iv, vi), Anjar (iii, iv) and Baalbeck (i, iv). The Qadisha valley was listed in 1998 based on several cultural (iii, iv) as well as natural (ii, iii, iv) heritage criteria. The selection criteria are complex. Table Q-1 lists only criteria

Table Q-1

Cultural Criteria	
(i)	nte un chef-
(iii)	ou une civilisation vivante ou disparue
(iv)	tural ou
(vi)	signification universelle exceptionnelle
Natural Criteria	
(ii)	ts
(iii)	
(iv)	plus importants pour la de la conservation