

CONTENTS

	<u>PART A. INTRODUCTION</u>	1
Chapter		
1	<u>ENVIRONMENTAL QUALITY AND LAND USE: THE PROBLEM STATED</u>	5
	I. URBAN FORMS AND THE ENVIRONMENT	11
	II. THE QUALITY OF LIFE	13
	III. GEOGRAPHY AS THE STUDY OF ENVIRONMENT	14
	<u>PART B. POLLUTANT DATA SOURCES AND ENVIRONMENTAL QUALITY ASSESSMENT SYSTEMS</u>	19
2	<u>AIR QUALITY</u>	21
	I. POLLUTANT MEASUREMENT SYSTEMS	21
	1. Types of Pollutants	21
	2. Surveillance Networks	32
	a. The National Air Surveillance Network	32
	b. Continuous Air Monitoring Project	32
	c. State Reports	33
	d. Air Quality Control Region Sampling Networks	33
	e. Urban Emission Inventories	33
	II. GENERATION OF EMISSIONS	34
	1. Emission Sources and Amounts	34
	2. The Incidence of Pollution	35
	3. Statistical Models of City Characteristics Related to Pollution	36
	III. AIR QUALITY ASSESSMENT	40
	1. Clean Air Standards	40
	2. Measures of Achievement of Standards, I: Statistical Indexes	42
	a. The Mitre Air Quality Index	43
	b. The Extreme Value Index	47
	c. The Oak Ridge Air Quality Index	51
	3. Measures of Achievement of Standards, II: Indexes Incorporating Physical Processes	51
	a. Pindex	53
	IV. THE EFFECTS OF AIR POLLUTION	56
	1. Health Effects	56
	2. Welfare Effects	57
	a. Nationwide Evidence	60
	b. City-to-City Differences	60
	c. Intraurban Variations	62
	3. Rating the Pollutants by Effect	65
3	<u>WATER QUALITY</u>	71
	I. EFFLUENT MEASUREMENT SYSTEMS	71
	1. Types of Pollutants	71
	2. Composition of Surface Waters	76
	3. Surveillance Networks	85

a.	The National Water Surveillance Network	86
(i)	Federal Agencies	87
(ii)	State and Local Agencies	87
(iii)	Federal, State, and Local Conferences	91
II.	GENERATION OF THE EFFLUENTS	94
1.	Discharge Sources and Amounts	94
a.	Industrial Wastes	94
(i)	Industrial Water Use and Discharge, 1959-1968	98
(ii)	Industrial Waste Treatment, 1959-1968	99
(iii)	Public Treatment of Industrial Wastes	102
(iv)	Ground Disposal of Industrial Wastes	104
b.	Municipal Wastes	106
III.	WATER QUALITY ASSESSMENT	109
1.	Clean Water Standards	109
a.	Industrial Pollution	110
b.	Municipal Pollution	111
c.	Water Quality Standards	112
d.	Permits and Licenses	113
e.	Enforcement	114
f.	Two Approaches to Standard Setting	115
g.	Measurement Rationales	115
IV.	MEASURES OF ACHIEVEMENT OF STANDARDS	117
1.	Statistical Indexes	117
a.	Prevalence-Duration-Intensity Index	128
b.	Enviro-Control Water Quality Analysis	132
c.	The Syracuse Index	135
V.	THE EFFECTS OF WATER POLLUTION	147
1.	Important Water Supply Residuals	148
2.	Categories of Use	155
a.	Water Supplies	155
b.	Water and Municipal Health	158
c.	Food Supplies	160
d.	Other Environmental Factors	161
(i)	Infiltration and Percolation	163
(ii)	Solid Waste Decomposition Processes	163
(iii)	Gas Production and Movement	163
(iv)	Leaching and Groundwater Movement	163
(v)	Direct Runoff	163
(vi)	Physical Characteristics	164
(vii)	Biological Quality	164
(viii)	Chemical Composition	164
3.	Effects on the Resource System	165
a.	Organic Wastes and Biochemical Oxygen Demand	166
b.	Eutrophication	169
c.	Heat	169
d.	Dissolved and Suspended Solids	170
e.	Bacterial and Viral Pollutants	171
4.	Water Pollution and its Relation to the Urban Environment	171
4	<u>SOLID WASTES</u>	175
I.	RESIDUALS MEASUREMENT SYSTEMS	175
1.	Types of Refuse	175
2.	Surveillance Networks	175
a.	National	175
b.	State	181

c.	Sub-State Regions	181
II.	GENERATION FACTORS	182
1.	Sources of Solid Wastes	182
2.	Amounts by Source	182
III.	QUALITY ASSESSMENT	189
1.	Nature of Standards	189
IV.	THE EFFECTS OF SOLID WASTES	190
1.	Health Effects	190
a.	Hazardous Solid Wastes	190
b.	Disease Relationships	190
c.	Effects on Marine Life	195
2.	Welfare Effects	206
a.	Economic Considerations	206
5	<u>NOISE POLLUTION</u>	209
I.	MEASUREMENT SYSTEMS	209
1.	The Pollutant	209
2.	Surveillance Networks	210
II.	GENERATION OF NOISE	210
1.	Emmission Sources and Amounts	210
2.	The Incidence of Pollution	211
3.	Generation Factors	220
III.	QUALITY ASSESSMENT SYSTEMS	222
1.	Standards	222
2.	Achievement of Standards	223
IV.	EFFECTS OF NOISE POLLUTION	226
1.	Health Effects	226
2.	Welfare Effects	229
a.	Interference with Specific Activities	229
(i)	Sleep Disturbance	229
(ii)	Auditory Communication	230
(iii)	Effects on Learning a Task Performance	230
b.	Economic Effects	232
c.	Other Effects: Annoyance	233
6	<u>PESTICIDES</u>	237
I.	MEASUREMENT SYSTEM FOR PESTICIDE RESIDUALS	237
1.	Types of Pollutants	237
2.	Surveillance Networks	238
II.	GENERATION OF PESTICIDE POLLUTION	238
III.	QUALITY ASSESSMENT SYSTEMS	239
IV.	EFFECTS OF PESTICIDE POLLUTION	240
7	<u>RADIATION</u>	243
I.	MEASUREMENT SYSTEMS	243
1.	Types of Pollutants	243
2.	Surveillance Networks	243
II.	GENERATION OF THE EFFLUENTS	243

III.	QUALITY ASSESSMENT SYSTEM	245
IV.	EFFECTS OF RADIATION POLLUTION	245
	<u>PART C. NATIONWIDE RELATIONSHIPS OF POLLUTION TO CITY CHARACTERISTICS</u>	249
8	<u>A NATIONWIDE DATA SET</u>	251
	I. THE URBAN VARIABLES	252
	1. City Characteristics	252
	2. Urban Form Indicators	252
	II. THE POLLUTION MEASURES	257
	1. Air Quality	257
	2. Water Quality	262
	3. Solid Wastes	268
	4. Noise	270
	5. Pesticides	273
	6. Radiation	274
	III. LAND USE DATA	274
9	<u>A POLLUTION-SENSITIVE TYPOLOGY OF THE URBAN REGIONS</u>	283
	I. METHOD OF ANALYSIS	283
	II. DATA AND RESULTS	285
	III. DISCUSSION	289
10	<u>RELATIONSHIPS OF ENVIRONMENTAL POLLUTION, CITY CHARACTERIS- TICS, AND URBAN LAND USE</u>	293
	I. ENVIRONMENTAL POLLUTION, CITY CHARACTERISTICS AND URBAN FORM	295
	II. LAND USE, CITY CHARACTERISTICS AND URBAN FORM	297
	III. ENVIRONMENTAL POLLUTION AND LAND USE	300
	IV. PRINCIPAL SORTING-TABLE CONCLUSIONS	302
11	<u>EFFECTS OF AGGLOMERATION ECONOMIES AND ENVIRONMENTAL DIS- ECONOMIES ON URBAN PROPERTY VALUES</u>	303
	I. A SET OF TESTABLE HYPOTHESES	304
	II. REGRESSION RELATIONSHIPS	306
	<u>PART D. LAND USE PATTERNS, URBAN FORM AND VARIA- TIONS IN ENVIRONMENTAL QUALITY WITHIN URBAN REGIONS</u>	319
12	<u>THE LINKS BETWEEN LAND USE AND THE POLLUTION MAP</u>	321
	I. AIR POLLUTION AND THE LAND USE MAP	322
	1. Patterns of Emission Sources	322
	a. Mobility	322
	b. Time	322
	c. Spatial Units	324
	2. Generation of Emissions	324
	3. Diffusion Mechanisms	327

4.	The Air Quality Surveillance Network	326
5.	The Emissions and the Land Use Maps Related	327
II.	WATER POLLUTION AND LAND USE	329
1.	Patterns of Effluent Discharge Sources	329
2.	Generation of Effluents	329
3.	Transport of Water Pollution	333
4.	Monitoring Water-Borne Effluents	335
5.	Relationship Between Water Discharges and Land Use	336
III.	SOLID WASTES AND LAND USE	336
1.	Residual Sources	340
a.	The Sources Summarized	340
(i)	Stationary Sources	340
(ii)	Mobile Sources	340
b.	Spatial Patterns	340
(i)	Point Sources	340
(ii)	Line Sources	340
(iii)	Area Sources	340
c.	Temporal Dimensions	341
2.	Generation Factors	341
a.	Composition of Solid Wastes	341
b.	Household Wastes	341
c.	Industrial Wastes	346
d.	Recreational Wastes	349
e.	Roadside Litter	350
3.	Collection, Transportation and Monitoring	350
4.	Land Use Relationships	352
IV.	NOISE	354
1.	Patterns of Emission Sources	354
a.	Mobility Dimension	354
b.	Time Dimension	354
c.	Spatial Scale Dimension	354
2.	Generation of Emissions	356
3.	Noise Diffusion	359
4.	Monitoring Noise Levels	359
5.	Relationship between the Map of Noise Levels and the Map of Land Use	361
13	<u>URBAN FORMS AND POLLUTION PATTERNS</u>	363
I.	ELEMENTS OF URBAN FORM	363
1.	The Urban Density Gradient	364
2.	Transport Network Configurations	370
3.	Intrusive Point Sources	378
II.	SAMPLE DENSITY RELATIONS	379
III.	WATER QUALITY MEASURED AT POINTS ON A HYDROLOGIC NETWORK	383
1.	Hydrologic Setting	383
2.	History of Pollution Control	385
3.	Derivation of Water Quality Indexes	389
a.	Water Use Groupings	389
b.	Permissible Quality Levels for Use Groupings	391
c.	Data Sources and Characteristics	392
d.	Results of Data Analysis--PI Index Values	396
e.	Pollutant Sources	402
f.	Diffusion of Effluents	403
g.	Monitoring of Effluents by Receptor Network	403

h. Data Storage and Retrieval	406
IV. AIR QUALITY AND URBAN FORM: SOME COMPARISONS	406
<u>PART E. CONCLUSIONS</u>	411
14 <u>THE ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE URBAN FUTURES</u>	415
I. CONTEMPORARY URBAN DYNAMICS	415
1. The Decline of the American CBD	416
2. The Decline of Public Transportation	421
II. THE SPECTRUM OF POLICY ALTERNATIVES	424
1. Urban Form as a Basic Variable	426
2. The Policy Problem	428
<u>LITERATURE CITED</u>	431
I AIR POLLUTION	431
II WATER POLLUTION	432
III SOLID WASTES	434
IV NOISE	435
V PESTICIDES	436
VI RADIATION	437
VII OTHER	437