

CONTENTS

PREFACE	v
ACKNOWLEDGMENTS	xi
CHAPTER 1. <i>INTRODUCTION: SHRUB-STEPPE LANDS</i>	
(L.E. Rogers and W.H. Rickard)	
HISTORY	1
The Lewis and Clark Expedition	1
Trappers and Traders	3
The Oregon Trail	3
Settlement	3
THE ARID LAND ECOLOGY RESERVE: STUDY SITE FOR THIS BOOK	4
History of the Arid Land Ecology Reserve	7
Climate	8
Geology	8
Soils	9
Springs and Streams	9
Dryland Vegetation	10
Animals	10
THE ARID LAND ECOLOGY RESERVE AS A STUDY SITE	11
REFERENCES	11
CHAPTER 2. <i>CLIMATE OF THE HANFORD SITE</i>	
(W.H. Rickard)	
Section I. Meteorological Data Base	14
Section II. Climatic Patterns at the Hanford Site	14
PRECIPITATION	14
Snowfall	17
Dendrochronology and Precipitation	19
SOLAR RADIATION AND AIR TEMPERATURE	19
WIND	19
REFERENCES	21
CHAPTER 3. <i>SOILS: CARBON AND MINERAL CYCLING PROCESSES</i>	
(R.E. Wildung and T.R. Garland)	
Section I. Occurrence and Distribution of Soils	23
DISTRIBUTION OF SOILS	25
PROFILE DESCRIPTION	26
Section II. Physiochemical Properties	27
ORGANIC COMPONENTS	27
MINERAL COMPONENTS	30
Section III. Carbon Cycling: Influence of Environmental Factors	31
SOIL TYPE	32
CARBON SOURCE	32
SOIL TEMPERATURE AND WATER	35

LIVESTOCK GRAZING	38
IRRIGATION	39
HERBICIDES	42
METALS	42
Section IV. Relationships of Carbon Cycling to Mineral Weathering and Mobilization	46
MINERAL WEATHERING	46
MOBILIZATION OF TRACE ELEMENTS AND RADIONUCLIDES	49
REFERENCES	56
CHAPTER 4. <i>WATER BALANCE</i>	
(G.W. Gee, P.A. Beedlow and R.L. Skaggs)	
Section I. General Principles Applicable to Arid Sites	61
WATER BUDGET	61
PRECIPITATION	63
RUNOFF	63
EVAPOTRANSPIRATION	65
Section II. Microclimatology of the ALE Reserve: Data Bases	66
MICROCLIMATES	66
THE ROLE OF PLANTS	68
TRANSPIRATION	69
EFFECTS OF PLANTS ON MICROCLIMATE	70
EFFECTS OF PLANTS ON WATER INFILTRATION	71
COMPARISON OF WATER USE BETWEEN PLANT COMMUNITIES	71
THE ROLE OF SOILS	71
Section III. Model Simulations	72
THE MODEL	72
CRITERIA FOR DATA	73
THE MICROCLIMATE DATA	74
SOIL DATA	75
THE MOISTURE DATA	78
THE VEGETATION DATA	78
RESULTS OF THE SIMULATIONS	78
Section IV. Conclusions	80
REFERENCES	81
CHAPTER 5. <i>SPRINGS AND STREAMS</i>	
(C.E. Cushing and B.E. Vaughan)	
Section I. Physical and Chemical Characterization	85
SOURCE	85
FLOW VOLUME	86
TEMPERATURE	86
LIGHT	87
WATER CHEMISTRY	87
Section II. Biological Investigations	88
DESCRIPTIVE STUDIES	88
PRODUCTIVITY STUDIES	92
ENERGY BUDGET STUDIES	98
BIOENERGETIC STUDIES	101
DECOMPOSITION STUDIES	102
Section III. Radionuclides as Indicators of Aquatic Ecosystem Processes	103
Section IV. Summary	104
REFERENCES	104

CHAPTER 6. *PLANT COMMUNITIES: CHARACTERISTICS AND RESPONSES*

(W.H. Rickard and B.E. Vaughan)

Section I. Characteristics of Contrasting Shrub-Steppe Plant Communities	109
STANDING CROP AND SHOOT PRODUCTION IN A SAGEBRUSH-BUNCHGRASS COMMUNITY	109
STANDING CROP AND SHOOT PRODUCTION IN A CHEATGRASS COMMUNITY ..	117
PHENOLOGY OF SELECTED PLANT TAXA IN A SAGEBRUSH-BUNCHGRASS COMMUNITY	121
NITROGEN AND PHOSPHORUS	125
MINERAL ELEMENTS IN SHRUB LEAVES	136
WEIGHT LOSS OF DEAD PLANTS IN A CHEATGRASS COMMUNITY	139
INFLUENCE OF GREASEWOOD ON SOIL CHEMISTRY AND GROWTH OF CHEATGRASS	141
CATIONS IN HALOPHYTES AND GLYCOPHYTES	144
Section II. Responses of Plants and Plant Communities to Disturbances	146
EXPERIMENTAL CATTLE GRAZING	146
EXPERIMENTAL PLOWING, RECOVERY OF CHEATGRASS COMMUNITIES	151
RESPONSES TO WILDFIRE: SAGEBRUSH-BUNCHGRASS AND CHEATGRASS COMMUNITIES	153
RESPONSE TO WILDFIRE: GREASEWOOD AND SPINY HOPSAGE	158
EXPERIMENTAL MANIPULATION OF MICROCLIMATE AND THE RESPONSE OF PLANTS	160
Section III. Radionuclides as Indicators of Biological Fate and Transport of Materials	163
RADIOACTIVE STRONTIUM AND CESIUM IN THE SOIL PROFILE	163
PLUTONIUM RESUSPENSION AND FOLIAR IMPINGEMENT	167
IODINE IN DESERT PLANTS AND SOIL	169
CARBON-14 DENDROCHRONOLOGY IN SAGEBRUSH	171
Section IV. Summary	172
REFERENCES	175

CHAPTER 7. *TERRESTRIAL ANIMAL HABITATS AND POPULATION RESPONSES*

(L.E. Rogers, R.E. Fitzner, L.L. Cadwell, and B.E. Vaughan)

Section I. Mammals and Reptiles	182
LARGE MAMMALS: HABITATS AND POPULATIONS OF DEER AND ELK ON THE HANFORD SITE	184
MID-SIZED MAMMALS	186
Coyotes, Bobcats and Badgers	186
Black-Tailed Hares and Cottontails	188
SMALL MAMMALS: POPULATION RESPONSES TO DISTURBANCES	189
Relative Abundance in Undisturbed Sagebrush-Bunchgrass Communities	189
Comparative Data for Cattle-Grazed Plots	190
Response to Summer Wildfire	191
Response in a Cheatgrass Successional Community	193
Relationships to the Larger Shrub-Steppe Region	194
Conclusions	197
SNAKES AND LIZARDS ON THE HANFORD SITE	198
Section II. Birds	199
PASSERINE BIRDS IN A SAGEBRUSH-BUNCHGRASS COMMUNITY	199
LONG-BILLED CURLEW	202
RAPTORS IN SHRUB-STEPPE AND MEADOW-STEPPE REGIONS	204
Butenoid Hawks, Prairie Falcon and Golden Eagle	204
Northern Harrier Nesting	208

Nesting Owls	209
Bird Populations Associated with Surface Waters	211
Streamside Thickets	211
Columbia River	213
Artificial Ponds	216
UPLAND GAMEBIRDS	220
CARRION EATERS (MAGPIES, CROWS AND RAVENS)	221
Section III. Insects and Related Arthropods	222
BIOMASS IN A SAGEBRUSH-BUNCHGRASS COMMUNITY	222
RESPONSE TO WILDFIRE	225
RESPONSE TO CATTLE GRAZING	229
INSECTS AND RELATED ARTHROPODS IN A CHEATGRASS COMMUNITY	232
BEETLES ON THE HANFORD SITE	234
GRASSHOPPERS (ACRIDIDAE) OF THE HANFORD SITE	238
Section IV. Animals as Indicators of Radionuclide and Chemical Contamination	239
INSECTS	240
BIRDS	244
MOBILE MAMMALS	247
REFERENCES	250
 CHAPTER 8. <i>THEORETICAL PERSPECTIVE ON ECOSYSTEM DISTURBANCE AND RECOVERY</i> (P.A. Beedlow, P. Van Voris, and L.E. Rogers)	
Section I. Concepts of Response and Recovery	258
THE STABLE SYSTEM	259
THE RECOVERY PROCESS	260
Section II. Characterization of Disturbance and Stress in the Shrub-Steppe Ecosystem	262
WILDFIRE	263
LIVESTOCK GRAZING	264
FARMING	265
CONSTRUCTION	265
Section III. Future Research Needs	266
REFERENCES	268
 <i>EPILOG</i>	271
(L.E. Rogers and W.H. Rickard)	