Preface

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PREFACE

Arthur Wallace

Disturbed lands in desert ecosystems may require decades or centuries for natural return to their original condition. The fragile nature of deserts due to hostile climate partially explains this reclamation problem that investigators and developers are now faced with because of new governmental regulations.

This series of 30 papers relates to efforts to develop information which can be used either to prevent needless destruction of desert systems or to help restore disturbed lands to their original condition.

The studies involved cover a period of several years. Included were those years during which the International Biological Program, through the National Science Foundation, participated in desert ecosystems studies. The goals of that program included those of preservation, use, and restoration of deserts. The Nevada Operations Office of the Department of Energy (formerly Atomic Energy Commission and Energy Research and Development Administration) for the past decade has been vitally concerned about problems related to cleanup of some soils contaminated with radionuclides. Any cleanup operation would drastically alter natural ecosystems, possibly resulting in problems more difficult to solve than the original ones. Ongoing environmental and ecological studies at the Nevada Test Site have been made by members of our group since 1960.

The present 30 papers resulting from those studies can be divided into six groupings. The first group consists of a single paper that describes the amazing amount of variability encountered from year to year in the phenological events of the perennial plant species at the Nevada Test Site. This variability is of concern to those who would attempt to plant or manipulate any native desert species.

The second group of 11 papers describes how the plant communities are put together and explains some of their attributes. An understanding of plant sociological relationships in any ecosystem is prerequisite to any subsequent management. These papers concern...
distribution, interactions, turnover, habitat preferences, longevity, and other topics.

The third group of five papers relates to the carbon cycle under desert conditions. More specifically, the papers are concerned with below-ground aspects of plant communities in the desert areas studied. The below-ground contributions to biomass under desert conditions are poorly understood, and these studies, made with the help of the $^{14}$carbon isotope, provide some answers. Information of the type contained in these five papers is particularly useful in land-cleanup procedures where soil is only partially removed.

The fourth group, consisting of six papers, relates to soil-plant relationships of desert vegetation and mineral composition of plants. Knowledge of soil preferences for plants is of prime importance for any attempt at revegetation and land reclamation. Almost as important is knowledge concerning the reasons for soil preferences for plants. These six papers provide some needed information in these areas. The introductory paper discusses the subject of how plants modify desert soils and redistribute mineral nutrients in them. This, without question, points out one of the most important problems associated with restoration of vegetation on disturbed desert land, that is, the destruction of the fertile spots in the desert created by long-time plant activity.

The fifth group, with four papers, concerns photosynthesis and transpiration processes. The first paper touches on the subject of $C_3$ and $C_4$ plants in regard to mechanisms of photosynthesis and shows relationships with water-use efficiency, which itself concerns transpiration. Attempts of man to manipulate and regulate deserts to achieve restoration or revegetation must consider the important aspects of adaptive and survival characteristics imparted by photosynthetic mechanisms, which in turn can be influenced by soil moisture conditions. These phenomena induce competitive effects among plant species. These studies contribute to understanding of deserts and will lead to more efficient management of them.

The sixth and last group (three papers) relates to practical aspects of desert revegetation. The first two papers of this group discuss the all-important interaction of native animals with new vegetation obtained either by natural reinvansion or by transplanting specimens onto disturbed lands. The problems caused by native animals and the one associated with "fertile islands" discussed in the fourth grouping of papers constitute formidable obstacles to certain types of desert land restoration. The final paper of the group and of the series is a summary chapter of the challenges involved in being able to comply with governmental regulations involved with southwestern deserts. Some synthesis of the total project is attempted in the final chapter.

Some important omissions from this series of 30 papers relate to soil characteristics, the nitrogen cycle, and water relationships. These were not purposely overlooked, and some publications on these topics have been made elsewhere as follows:


A recent suggestion that desert sands catalyze photochemical formation of ammonia (Chem. Eng. News, 13 Nov. 1978) at rates of from 2 to 25 kg/ha per year could provide new insight into the desert nitrogen cycle.

A more complete listing of environmental