

# The Role of Protozoa in Nutrient Cycling and Energy Flow

JOHN D. STOUT

## 1. Introduction

Nutrient cycling and energy flow are centered on photosynthesis and plant growth, for plant tissue forms the greater part of the earth's biomass. But all organisms participate, and their role is determined not simply by their biomass but by their catalytic reaction in different ecosystems. The major nutrient cycles are the carbon cycle, in which the organic energy cycle is implicit, the nitrogen cycle, the sulfur cycle, and the phosphorus cycle. The major energy cycles are the solar cycle and the hydrological cycle that is not only the source of the major part of living matter but also provides the medium for all organic cycles. The geometry of nutrient cycling is determined by the nature and distribution of sources and sinks, the most important being the atmosphere, the ocean and soil, and the availability of the major, minor, and trace elements, and other growth factors.

Cycling is a function of reaction rate, and turnover is determined by pool size and residence time. The greatest difficulty lies in the identification and measurement of cycling (Payne and Wiebe, 1978). The determination of isotopic ratios has provided a valuable guide to nutrient cycling, and fortunately stable and/or radioactive isotope species of all the major nutrient elements exist.

The role of protozoa in nutrient cycling and energy flow is determined by their bionomics. The distinctive features of protozoa are their small size, their high rate of reproduction, often through a complex life history, the high conversion efficiency of nutrients to new cell tissue, and their potentially high metabolic

---

JOHN D. STOUT • Soil Bureau, New Zealand Department of Scientific and Industrial Research, Lower Hutt, New Zealand.