

SPECIAL FEATURE

The Ecology of Resource Pulses¹

Many natural systems experience resource pulses, defined as occasional and brief events of dramatically increased resource availability. When they occur, resource pulses are often perceived to be unusual events with idiosyncratic consequences in different communities and ecosystems. Although resource pulses are infrequent events for individual communities, they are also widespread phenomena in nature. Do common patterns emerge when one examines responses to resource pulses across different communities? Because the effects of resource pulses ramify through complex systems, sometimes with large and persistent consequences, investigating how and why communities respond to these events improves our ability to understand many aspects of ecosystem structure, function, and dynamics.

In recent years, ecologists have recognized some recurring patterns of behavioral, population, and community responses to pulsed resources across a wide range of ecosystems. Identifying the mechanisms that govern these common responses has been the focus of considerable emerging research aimed at integrating resource pulses into a broader, more predictive and unified view of ecology. The study of resource pulses can provide several alternative approaches to investigate general ecological questions. For example, resource pulses can serve as large-scale natural experiments for the observation of complex indirect effects in communities. Resource pulses can also provide a natural context to conduct and interpret experimental resource manipulations, while comparative studies examining how different communities respond to different pulsed perturbations can help illuminate key aspects of community structure and dynamics. To date, these approaches have shed light on behavioral and physiological responses to environmental variability, the relative roles of bottom-up and top-down effects in the regulation of populations, the topology of trophic and non-trophic interaction networks in communities, and mechanisms that influence the stability, resilience, and reactivity of ecosystems.

The five papers of this Special Feature use a range of approaches to examine key concepts and questions in the ecology of resource pulses. Yang et al. begin the feature by providing a common framework of terms and concepts that may be applied across a wide range of pulsed resource systems. This overview seeks to explore the utility of resource pulses as a tool to better understand general questions in ecology. Each of the following papers demonstrates different approaches and insights developed through the study of resource pulses.

Schmidt and Ostfeld combine a review of resource pulse-driven indirect effects in predator-prey systems with a detailed eight-year field study of mast-driven indirect effects on thrush populations. This paper emphasizes a general pattern of community response in which the “feast and famine” trajectory of resource pulses leads to diet shifts in generalist predators which redirect the indirect top-down effects of resource pulses to alternative prey.

In contrast, Nowlin et al. examine how fundamental differences in the structure and dynamics of aquatic and terrestrial communities are likely to affect their responses to resources pulses. As a case study to begin evaluating these predictions, Nowlin et al. compare the effects of massive periodical cicada carcass deposition in terrestrial and aquatic systems.

Anderson et al. consider both the spatial and temporal dimensions of resource pulses, drawing upon a series of investigations in the Gulf of California, Mexico, to develop general predictions about the relative and interactive effects of resource pulses and spatial subsidies on the composition, persistence, and dynamics of multitrophic communities, as well as the evolution of specific life history traits in plants and animals.

¹ Reprints of this 63-page Special Feature are available for \$10.00 each, either as PDFs or as hard copy. Prepayment is required. Order reprints from the Ecological Society of America, Attention: Reprint Department, 1707 H Street, N.W., Suite 400, Washington, D.C. 20006 (esaHQ@esa.org).

In the final paper of this feature, Holt provides a theoretical perspective on the ecology of resource pulses, examining models of both singular and recurrent pulsed events, as well as the equilibrium and transient effects of resource pulses. Holt links temporal and spatial variability in predicting the impact of resource pulses on ecological systems, and suggests areas for the future development of theory, observation and experimentation.

We hope that this Special Feature will provide its readers with a useful overview of this emerging field, and that it will suggest new ideas and directions for future investigations in the ecology of resource pulses.

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