Investigating the role of waterbirds in the ecological resilience of freshwater systems

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Abstract

Organisms that actively move around the landscape and connect habitat at various spatio-temporal scales are essential for ecosystem functioning and dynamics. They are a source of ecological resilience, buffering systems against perturbation and offering the opportunity for reorganization through inputs of genetic material, resources and support of necessary processes. In this paper we explore the effect of highly mobile waterbirds on ecological resilience within South African wetland ecosystems through the interspatial exchange of aquatic organisms. We are largely unaware of the influence waterbirds exert on wetland functioning, particularly in the southern hemisphere. Current anthropogenically altered waterbird movement and distribution patterns may severely affect organism-mediated connectivity, consequently eroding resilience in freshwater systems.

Droughts are part of the natural disturbance regime of wetland systems. Following such a disturbance, plant and animal assemblages outside the disturbed area may act as a source for re-colonization and are important features which determine the capacity of a system to regain former functioning. We propose that waterbirds enhance ecological resilience in these systems by acting as vectors of seeds, eggs and larvae and in this way contribute to both the genetic and species diversity of wetlands. This ecological resilience is generated through diverse and overlapping dispersal functions performed by a variety of waterbird species operating at different scales.

We assess the contribution of waterbirds to resilience in wetland systems by examining factors influencing the dispersal of aquatic organisms. A total of 411 individual waterbirds of five species were captured from three wetland sites in South Africa. We investigated the numbers, types and viability of invertebrate and plant propagules within freshly collected faecal samples and feather brushings. The dispersal potential of a variety of these propagules was investigated by integrating the movement data of two waterbird species (Alopochen aegyptiacus and Anas erythrorhyncha) monitored by satellite telemetry with gut retention times of various seeds and eggs. Our preliminary results suggest that approximately 9% of birds are carrying at least one viable propagule of a variety of different taxa. Satellite tracking data reveals that these are likely dispersed over a range of spatial scales with birds capable of moving from a few kilometers to over 1000 kilometers in one day.

Freshwater systems, despite their importance for human well-being, are one of the most
endangered and poorly understood ecosystems globally. These findings represent a first step towards understanding how mobile dispersers may enhance resilience in freshwater ecosystems. However, we also argue that there exist potential tradeoffs between the ecosystem services and disservices provided by highly mobile species. Global environmental change recognizes ecosystems becoming increasingly susceptible to invasions. Waterbirds carrying seeds and eggs may also act as vectors for invasive species and disease thus eroding resilience in freshwater systems. We conclude that knowledge of animal movement patterns and interspatial exchange of propagules must be incorporated into management plans in order to maintain ecosystem resilience and secure the capacity of wetlands to supply services essential to society.

**Keywords:** Waterbirds, Resilience, Dispersal, Ecosystem Services, Water Management