

Assessing a farm's sustainability: insights from resilience thinking

Ika Darnhofer^{1*}, John Fairweather² and Henrik Moller³

¹ BOKU, University of Natural Resources and Applied Life Sciences, Vienna, Austria

² AERU, Lincoln University, Christchurch, New Zealand

³ CSAFE, University of Otago, Dunedin, New Zealand

Research on sustainability in agriculture often focuses on reducing the environmental impacts of production systems. However, environmentally friendly production methods may not be sufficient to ensure the long-term economic and social sustainability of a farm. Taking a systems approach to sustainable farming, we turn to resilience thinking with its focus on the interdependence of social and ecological systems. We apply this approach to farming by conceptualizing a farm as being part of a set of systems spanning several spatial scales and including agro-ecological, economic and political-social domains. These subsystems interact and are subjected to their own complex dynamics. Within such a complex adaptive system, farm sustainability can only be achieved through adaptability and change. To be ready for the inevitable periods of turbulent change, a farmer needs to retain diversity and redundancy to ensure adaptability. Resilience is thus more likely to emerge when farmers hone the capacity to transform the farm, when farm production is attuned to the local ecological carrying capacity, and when learning and innovation are targeted outcomes. This article shows how resilience theory applied to farming may provide a more comprehensive route to achieving sustainability and offers rules of thumb as guides to building farm resilience.

Keywords: adaptive management; agriculture; complex adaptive systems; farming systems; social-ecological resilience; sustainability

Introduction

Producing food while maintaining biodiversity and ecosystem services is one of the greatest challenges facing the Earth's population (Millennium Ecosystem Assessment, 2005; Ehrlich, 2008). With more than 40 per cent of the Earth's land surface being used for agriculture (FAO, 2007), farmers and herders manage vast tracts of land and the natural resources found on them, shaping ecosystems, habitats and landscapes (OECD, 2008). Farms are vital in securing the survival of humans, both directly by producing food and fibre, and indirectly by producing amenities. However, many farming practices negatively affect not only the ecosystems on-farm but also those off-farm, sometimes over large distances, by importing ecological subsidies (Moller *et al.*, 2008) and exporting pollution (Gordon *et al.*, 2008).

Many studies address the challenge of identifying more environmentally friendly production methods. This focus on agronomic aspects should not come at the expense of studying the farm or farming system as a whole, essential components of which are the social and economic domains. However, despite calls for interdisciplinary approaches to address the sustainability challenge in a holistic way, there is still a dearth of conceptual models integrating ecological, social and economic sustainability over various temporal and spatial scales. In this paper we want to explore one approach that integrates these dimensions: resilience thinking. This approach is based on an understanding of the world as a system that is both complex and adaptive, that is, where subsystems co-evolve, and where change is the only constant (Rammel *et al.*, 2007). Studies on resilience have shown that the persistence of a social-ecological

*Corresponding author. Email: ika.darnhofer@boku.ac.at