

## Chapter 3

# Resilience, Self-Organization, Complexity and Pattern Formation

Florian Jeltsch, Laura Turnbull, Stefania Scarsoglio, Concepcion L. Alados, Francesc Gallart, Eva Nora Mueller, Nicolas Barbier, James D.A. Millington, John Wainwright, Mareike Wiczorek, and Volker Grimm

**Abstract** Clarity of definitions is fundamental to the successful completion of any interdisciplinary project. In this chapter, we focus on defining a number of key terms that recur throughout the volume, and thus it acts as both a foundation and glossary for understanding the material covered. Ideas of resilience, self-organization and complexity are widely used across in constituent disciplines discussed in Chap. 1, but their use varies and we attempt to define this variation and thus the context of use in the book. There is also a strong emphasis on pattern, so we provide here an initial definition, to be followed up in more detail in Chaps. 7 and 8. We then move onto the specific nature of drylands and the need to understand land

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F. Jeltsch

Plant Ecology and Nature Conservation, University of Potsdam, 14469 Potsdam, Germany  
e-mail: [jeltsch@uni-potsdam.de](mailto:jeltsch@uni-potsdam.de)

L. Turnbull

Institute of Hazards, Risk and Resilience, Department of Geography, Durham University,  
Science Laboratories, South Road, Durham DH1 3LE, UK  
e-mail: [laura.turnbull@durham.ac.uk](mailto:laura.turnbull@durham.ac.uk)

S. Scarsoglio

Dipartimento di Idraulica, Trasporti ed Infrastrutture Civili, University of Turin,  
10129 Torino, Italy  
e-mail: [stefania.scarsoglio@polito.it](mailto:stefania.scarsoglio@polito.it)

C.L. Alados

Pyrenean Institute of Ecology, 50080 Zaragoza, Spain  
e-mail: [alados@ipe.csic.es](mailto:alados@ipe.csic.es)

F. Gallart

Institute of Earth Sciences, Jaume Almera (CSIC), 08028 Barcelona, Spain  
e-mail: [francesc.gallart@idaea.csic.es](mailto:francesc.gallart@idaea.csic.es)

E.N. Mueller (✉)

Institute of Earth and Environmental Science, University of Potsdam, 14476 Potsdam, Germany  
e-mail: [eva.mueller@uni-potsdam.de](mailto:eva.mueller@uni-potsdam.de)

degradation within them and through them. How the mode of study affects our understanding is the next theme, in particular how case studies based in different places can be generalized, given the variations in landscape and vegetation type within them. Following an initial summary of the preceding material to evaluate why self-organization and complexity are useful frameworks for understanding patterns and processes in drylands, the chapter concludes with an overview of the deterministic and stochastic frameworks for understanding pattern.

### 3.1 Introduction

One issue that arose in Chaps. 1 and 2 is that of terminology and the ways in which researchers working from different disciplinary perspectives can often use the same or similar terms to mean quite different ideas or things. These differences in language can therefore have significant effects on both the ways research is carried out (e.g. Wu and Hobbs 2002), interpreted, and in the ways in which research results are communicated to stakeholders (e.g. Webb and Raffaelli 2008). These difficulties are prevalent in land-degradation studies, which involve researchers from a wide range of disciplines working on an applied topic; it was certainly a topic that cropped up on numerous occasions during the workshop from which this book was developed. These difficulties are compounded by the need to apply the results of rapidly developing research topics across a number of fields, and thus, this chapter starts off by defining what we mean by a number of key terms such as resilience, self-organization, complexity and pattern. It will become clear in doing so that there are nuances in the definitions of all of these terms, and so appreciating these nuances will be critical for understanding the rest of the book.

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N. Barbier

IRD/UMR AMAP, Botany and Computational Plant Architecture, 34398 Montpellier, France  
e-mail: [nicolas.barbier@ird.fr](mailto:nicolas.barbier@ird.fr)

J.D.A. Millington

Department of Geography, King's College London, Strand, WC2R 2LS London, UK  
e-mail: [james.millington@kcl.ac.uk](mailto:james.millington@kcl.ac.uk)

J. Wainwright

Department of Geography, University of Durham, Durham DH1 3LE, UK  
e-mail: [john.wainwright@durham.ac.uk](mailto:john.wainwright@durham.ac.uk)

M. Wiczorek

Department of Geosciences, Alfred Wegener Institute for Polar and Marine Research,  
14473 Potsdam, Germany  
e-mail: [mareike.wiczorek@awi.de](mailto:mareike.wiczorek@awi.de)

V. Grimm

Department of Ecological Modelling, Helmholtz Center for Environmental Research UFZ,  
04318 Leipzig, Germany  
e-mail: [volker.grimm@ufz.de](mailto:volker.grimm@ufz.de)