1.5 Specified and General Resilience

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> **"Specified" resilience deals with the resilience "of what, to what" (e.g., the resilience of crop production to a drought). "General" resilience does not consider any particular kind of shock, or any particular aspect of the system that might be affected.**

Resilience to a specific disturbance or event involves identifying a particular threshold effect, where the system will not recover its earlier pattern of behaviour if this threshold is passed. Where there are known or suspected threshold effects, it is clearly necessary to address specified resilience. But in doing so it is important to ask (for example) whether it is only the resilience of crop production to drought that is of concern, or the resilience of other ecosystem services to other shocks, as well, and resilience of various parts of the social system.

The distinction between these two aspects of resilience is important because there is a danger in focusing too much on known or suspected thresholds (such as those described for the Australian catchment example). If all the attention and resources of management are channeled into managing for identified (specified) resilience and associated thresholds, the management may inadvertently be reducing resilience in other ways – resilience to completely novel 'surprises'. There is therefore a need to consider both general and specified resilience.

Key Messages

• A resilience approach calls for assessing both specified and general resilience.

• Specified resilience involves attempting to understand and identify the controlling (often slowly changing) variables that are likely to have threshold effects, leading to unwanted and perhaps irreversible regime shifts. In assessing specified resilience we ask - how will these variables respond to particular kinds of shocks and disturbances, and what attributes of the system can be enhanced to avoid exceeding particular thresholds?

• General resilience applies to the system as a whole. Given that there may be completely novel shocks, with system responses that are as yet unknown, are there parts of the system that exhibit low or declining levels of those attributes that confer general resilience? And, could actions taken to address any of the specified threshold problems lead to unintended losses of general resilience?

• General resilience involves such things as diversity (natural and social), openness (flows in and out of the system – social and biological), reserves, tightness of feedbacks, modularity, and "redundancy", eg, overlapping governance - the quotations are used to distinguish between genuine redundancies that serve no purpose, and apparent redundancies which actually reflect response diversity. The apparently wasteful redundancies removed by "just-in-time" marketing and production systems are only beneficial as long as there is no major disturbance to the supply system.

• While it is reasonably straightforward to estimate the costs of maintaining general resilience (some form of foregone extra yield or profit that it entails), it is much harder to estimate the costs of not maintaining it (since it is unspecified), and for this reason there is a tendency for general resilience to decline as management pursues goals of increased production efficiency, and even specified resilience.

Resilience Assessment

Beginning with diversity, a full list of the kinds of social, ecosystem and infrastructure diversity of any system becomes very long (e.g., diversity of skills, age structure, ethnicity, types of farming enterprises, employment, transport options, habitat diversity, species diversity, etc.). Such an effort is likely to actually hinder understanding and so, in order to gain the insights that are sought, rather than developing a long list it is better to start by considering questions such as: i) In which parts of the system is there little or no diversity, such that it might render the system vulnerable to a loss of function? ii) Are there any trends that reflect declines in diversity? (A simple example is the change from multi-cropping to mono-cropping in agriculture). Try to answer these questions in an iterative way, by referring back to the description of the system - in particular, what are the big issues? resilience of what? to what? Develop a working list of system components/areas/ where low diversity, or trends in diversity, may be of concern.

In the same way as for diversity, attempt to assess the current status and trends in other general resilience attributes (listed below) by asking similar questions. Approach the questions in an iterative way, referring back to the earlier description of the system.

Openness - There is no optimal degree of openness and either extreme can reduce resilience. What trends are occurring? Is there any evidence (social or ecological) that the system is too closed?

Reserves - In general, more reserves means greater resilience, and the trend is often a loss of reserves, both natural (such as habitat patches, seed banks) and social (memory and local knowledge). Can any critical reserves be identified? What is the current status and trends?

Tightness of feedbacks - There is often a trend of lengthening times for responses to signals, due to increasing levels of governance, and increased steps in procedural requirements. Ecosystem studies have shown that all thresholds between alternate system states are associated with a change in a critical feedback.

Modularity - There is no optimal degree of modularity, but a system that is fully connected can rapidly transmit all shocks (a disease, a bad management practice) through the whole system. In a system with tightly interacting sub-components that are loosely connected to each other (ie, a modular system), parts of the system are able to reorganize in response to changes elsewhere in the system in time to avoid disaster. Are there any trends in modularity? Is the system becoming more fully connected, or are there areas where becoming isolated, or too loosely connected, is a problem?