BASIC LESSONS

• Vernacular definitions of vulnerability are inadequate to express the full complexity of the degree of vulnerability of a complex system under multiple stresses, one of which may be climate variations.

• A full assessment of the degree of vulnerability of a system can only be done by a full integrated assessment of the response of that system to multiple stresses.
VERNACULAR DEFINITIONS:

**Vulnerable:** Susceptible to physical damage (American Century Dictionary)

**Resilient:** Marked by the ability to recover readily (American Century Dictionary)

**Cope:** To contend with difficulties and act to overcome them (American Century Dictionary)

**Adapt:** To make suitable to or fit for a specific use or situation (American Century Dictionary)
Adaptation has the implication of planning while coping does not. The element of time scales enter when considering whether or not resilient systems are vulnerable in the long term. General issues of space and time scales.

Can a resilient system be vulnerable?

Is an adaptable system vulnerable?

Does adequate coping imply invulnerability?

What is the relationship between coping, adaptation, resilience and vulnerability?
MORE COMPLEX DEFINITIONS

We use the word “vulnerability” to describe inherent characteristics of a system that creates the potential of harm but are independent of the probabilistic “risk” of the occurrence of any particular hazard or extreme event. (Sarawitz Pielke, Jr., and Keykhah, 2003)

[Are the characteristics of the system independent of the stresses on that system? What is the time scale of dependence or independence]
A major conceptual advance occurred in moving from impact assessment based on climate model scenarios to analyses based on understanding of vulnerability. The lack of consensus about how climate may change at the regional level, and the recognition that changes in social systems may be more important than changes in natural systems in determining the impacts of drought and other climatic shifts, reoriented the WG2 of the IPCC second assessment to pay more attention to vulnerability assessment. For example, rapid increases in water demand have increased drought vulnerability, and the spread of urban settlements into coastal and flood-prone regions has increased vulnerability to sea level rise and severe storms. (NRC, 1999b, Pathways)
Working Group II decided to focus on assessing the sensitivity and vulnerability of systems to a range of climatic change, and only then, having identified response functions and/or potential thresholds, on evaluating the plausible impacts that would result from a particular regional climate scenario. The approach first sought to clarify what was known and unknown about three distinct issues before applying regional climate scenarios to estimate potential impacts. These issues were:
• How sensitive is a particular system to climate change—that is, how will a system respond to given changes in climate?
• How adaptable is a particular system to climate change—that is, to what degree are adjustments possible in practices, processes, or structures of systems in response to projected or actual changes in climate?
• Finally, how vulnerable is a system to climate change—that is, how susceptible is it to damage or harm?
(IPCC, SAR 1995, WG2)
Natural hazard “vulnerability” is broadly defined as the characteristics of places or people that are likely to be harmed by meteorological and geophysical events. To be vulnerable to drought is to lack environmental, technological, economic or political defenses against its impacts.
(Liverman, 1990)
The sensitivity of human well-being to climatic variation is the extent to which important outcomes change as a function of that variation. We use the term “vulnerable” to refer to human groups or activities that face the risk of extreme negative outcomes as a result of climatic events that overwhelm the adaptations they have in place. (NRC, 1999)

[Can damage be done even when the adaptations are effective?]
Vulnerability in the human sciences is typically identified in terms of three elements:

- system exposure to crises, stresses, and shocks;
- inadequate system capacities to cope;

and

- severe consequences and attendant risks of slow (or poor) system recovery.

(Harvard Research and Assessment Systems for Sustainability Program 2001, Report 2001-17)

[What determines the vulnerability or resilience of the nature-society system in particular kinds]
of places and for particular types of ecosystems and human livelihoods? (One of the core sustainability questions--e.g. Kates, *Ann. Rev.*, *Environ. Sci.*, 2001 (Queries on the Human Use of the Earth) or http://sustsci.harvard.edu/questions.htm)
Research demonstrates that vulnerability is registered not by exposure to hazards (perturbations and stresses) alone but also resides in the sensitivity and resilience of the system experiencing such hazards. This recognition requires revisions and enlargements in the basic design of vulnerability assessments, including the capacity to treat coupled human–environment systems and those linkages within and without the systems that affect their vulnerability (Turner et al, 2003).
Figure 1: Eight-Step Methodology for Vulnerability Research

From Harvard University Report 2003-05
Vulnerability framework.
Details of the exposure, sensitivity, and resilience components of the vulnerability framework.
Figure 3: Airlie House vulnerability framework


Sarawitz, D., R. Pielke Jr., and M. Keykhah, 2003: Vulnerability and risk: some thoughts from a political and policy perspective. Soc. for Risk Analysis,


**WEBSITES:**

[http://ksgnotes1.harvard.edu/bcsia/sust.nsf/publications](http://ksgnotes1.harvard.edu/bcsia/sust.nsf/publications)

[http://sustsci.harvard.edu/](http://sustsci.harvard.edu/)
http://www.sei.se/risk/overview.html

http://www.pik-potsdam.de/~dagmar/vulnerability.html