LIVELIHOOD SENSITIVITY TO CLIMATIC RISKS

Methods available for vulnerability assessment range from interviews and rapid participatory appraisal to formal modelling of resource allocation under different scenarios. This annex presents an example of a livelihood sensitivity matrix that can be used in several ways:

- To synthesis existing knowledge on climate vulnerability in a fairly rapid participatory exercise with stakeholders
- To provide a first-order vulnerability assessment based on expert judgment
- To integrate results from a variety of quantitative and qualitative methods

The matrix also illustrates some of the technical issues in the use of indicators of vulnerability to a range of climatic risks.

The analysis works best if focused on a particular region, ecosystem or resource. For instance, it might look at highland land use vulnerable to drought and floods or coastal zones susceptible to sea level rise and cyclones.

The first step is to list the livelihoods in the case study region. Then work backward to list the productive activities of these livelihoods and the ecosystem services that support those elements. Thus, the rows of the table are organised according in a hierarchy of the ecosystem services that are essential in productive activities, which are elements of common livelihoods. For example, a general relationship between climate and the soil water balance will affect a variety of crop and livestock production activities, which are the major components of some livelihoods.

More generally, the rows are the 'units of exposure'—those elements in ecosystems, populations and economies that are subject to climatic hazards and trends. Analysts may wish to organise the rows differently—for instance concern for cross-cutting sectors such as infrastructure (roads, electricity, ports, market facilities) may warrant adding a block on economic services to correspond to ecosystem services. The nature of the exposure elements should correspond to the broad framing of the vulnerable conditions.

The next step is to list the present climatic threats (or opportunities) and trends that are significant for the list of livelihoods (or exposure units). These climatic risks are the columns of the matrix. Some judgment is required to separate the continuum of weather and climate into distinct threats. For instance, drought is almost always a threat in some form for rural livelihoods. In the example below, episodes of drought over a year or more are separated from shorter dry spells during the year.

It is likely that some iteration and refinement will be warranted in rows and columns of the matrix. There are no hard and fast rules for separating

ecosystems into services, people into livelihoods, or weather into climatic risks. Indeed, one of the purposes of the matrix is to show how thresholds of vulnerabilities differ between exposure units (and over time). The definition of drought risk is quite different for subsistence farmers and pastoralists.

How sensitive is each element of exposure to each climatic risk? Fill in the matrix by ranking each cell. A rapid, scoping exercise might use high, medium or low; a five-point scale is probably sufficient for most analyses.

This is a first-cut of a rapid vulnerability assessment. What does it reveal about who is vulnerable? What are the gaps in knowledge? What indicators of vulnerability or adaptive capacity are generic to the matrix or specific for livelihoods and threats? For instance, crop-drought indicators (such as yield) are of different importance for semi-arid subsistence agriculture than for highland commercial farms. What is the range of adaptation options? Are these specific to livelihoods and threats or more generic? What institutions are relevant for implementing adaptation options for each livelihood?

Further use of the matrix might involve: exploring ratings according to outcomes; comparing different scenarios of future vulnerability and aggregating the matrix ratings into overall scores.

The rating of sensitivities depends on the outcome of exposure and hazard. For instance, sensitivity to mortality has a different pattern than exposure than loss of livelihood or well-being. In most cases, the initial ratings are related to a broad interpretation of economic assets. However, if the matrix is to be used analytically, it is necessary specify what the consequences or outcomes of the identified vulnerabilities. Most commonly, these include loss of life and loss of property (assets), but some stakeholders may be concerned with the full range of livelihood 'capitals' including social networks and psychological stress.

The matrix is relatively easy to fill in for present conditions. In order to compile a matrix for future vulnerabilities, the analysts need to describe storylines that indicate how livelihoods might change (e.g., their reliance on different ecosystem services and activities, as well as their prevalence), how climate might change (there might be new hazards or trends become significant in the future) and how the sensitivities might change (e.g., with new technology). These are the typical concerns of building scenarios. The matrix provides an easy means to compare the results.

With some caution, it may be interesting to sum the rows, columns and overall matrix into aggregated indicators. A simple sum (divided by the maximum possible score) of the rows and columns yields relative scores for exposure and impacts. An aggregate score for the total exposure and impacts might be weighted by the probability of the different hazards occurring (for the exposure scores) or the prevalence of the livelihoods (for impacts scores). Analysts may

wish to look at different scoring methods—for instance counting the number of high scores (e.g., those with a 4 or 5).

Note that aggregating matrices for different outcomes is not recommended—the justification for adding exposure to mortality to exposure to property loss raises concerns for equity that are beyond this simple technique (see guidance material on multi-criteria and benefit cost methods).

EXAMPLE OF A LIVELIHOOD-SENSIVITY MATRIX

| | **Climatic risks** | | | | | | **Exposure indices** | |
	Drought	Dry spells	Intense rain	Flood	Warm spells	... other	Exposure score	Weighted exposure index
Frequency	*20*	*40*	*10*	*5*	*10*		85	8.88
Resources and Livelihoods								
Ecosystem services								
Soil water balance	5	4	1	5	1		64	*3.59*
Water supply	5	2	2	4	1		56	*2.71*
Water quality	2	1	3	4	2		48	*1.76*
Non-farm wood fuels	3	1	1	2	1		32	*1.53*
Grazing and fodder	4	2	1	4	1		48	*2.35*
... others								
Livelihood activities								
Coarse grain production	5	4	2	3	1		60	*3.59*
Market crop production	5	3	2	2	1		52	*3.06*
Livestock production	4	3	1	3	1		48	*2.76*
Charcoal/wood fuel use	2	1	2	2	1		32	*1.41*
Craft sales	2	1	1	3	1		32	*1.35*
Rural casual labour	3	1	1	3	1		36	*1.59*
Non-farm permanent employment	2	1	1	3	1		32	*1.35*
... others								
Livelihoods *Prevalence*								
Smallholder farmers 60	5	3	1	3	1		52	*3.00*

Emerging farmers	25	3	2	1	2	1	36	*2.00*
Ranchers	10	4	2	1	2	1	40	*2.24*
Market traders ...others	5	3	1	1	4	1	40	*1.65*
Impacts score	*100*	*75*	*40*	*20*	*55*	*20*		
Weighted impacts index	**11.55**	*4.30*	*2.55*	*1.00*	*2.70*	*1.00*		**8.88**

Notes:

The example shown here is based on farming systems in southern Africa—these should not be taken as authoritative ratings, they are intended to show the technique rather than results from formal expert judgements.

Exposure score: Sum of the columns for each row divided by the total possible score (25).

Impacts score: Sum of the rows for each column divided by the total possible score (20). This is calculated only for the livelihoods—the preceding rows are elements of the livelihood scores and would result in double counting if added together.

Weighted exposure index: This takes each cell in the row and multiplies it by the frequency for the climatic risk (shown at the top of the table), the sum of these weighted values is then divided by the sum of the frequencies. Note that the frequencies may not add to 100. In Excel this is done using the sum product() function.

Weighted impact score: As above, the sum product of the cell values weighted according to the prevalence of the livelihood (shown in the left column of values). The sum of the prevalence of livelihoods should be 100, assuming they are discrete groups.

Two aggregate values are shown:
The sum of the weighted exposure scores for the livelihoods (8.88) and the sum of the weighted impact scores for the hazards (11.55) might be useful in comparing different regions or scenarios. However, these scores should be used with caution as they have no explicit meaning in and of themselves.

See lv matrix.xls for the formulas.

Source: Material prepared by SEI under the UNEP support project for the NAPA workshops organised by the LEG, UNITAR and UNDP.

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Livelihoods	*Prevalence*	Drought	Dry spells	Intense rain	Flood	Warm spells	... other	Exposure score	Weighted exposure index
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SECTOR BASED LIVELIHOOD-SENSIVITY MATRIX

Livelihood activities	Climatic risks						Total
	Drought	Dry spells	Intense rain	Flood	Warm spells	… other	%
Crop production							
Livestock production							
Fishing							
Forestry							
Total							

Ranking Scales : 5 very high 4=high 3 medium 2 =weak 1=very weak 0=none

ACTIVITY BASED LIVELIHOOD-SENSIVITY MATRIX

Activities	Climatic Vulnerability				Total	
	Floods	Drought	High Temperature	Strong Wind		
Planting						
Weeding						
Mounding						
Harvest						
Thrashing						
Storing						
Sale produce						
Total						

5=Very Strong 4=Strong 3=Medium 2=Weak 1=Very weak 0= None

ACTIVITY AND GENDER BASED LIVELIHOOD-SENSIVITY MATRIX

Livelihood activity	Drought		Floods		Raise Temp		Total		%	
	M	F	M	F	M	F	M	F	M	F
Cereal production(RF)	2	4	5	5						
Cereal production(IRRG)	4	2		01						
Cash crop production										
Casual labourers										
Firewood collection										
Water collection										
Marketing produce										
Grazing animals										
Milking animals										
Chicken rearing										
Petty business										
Fishing										
Fish processing										
Fish selling										
Charcoal burning										
Total										
%										