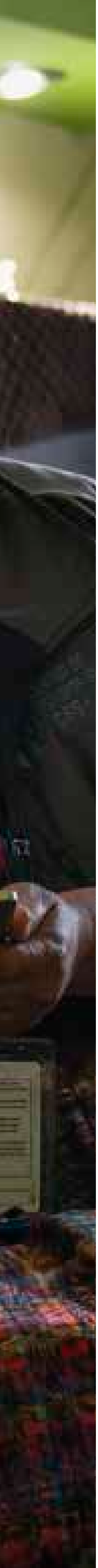


5. Sand and dust storms risk assessment framework

Chapter overview

This chapter reviews the conceptual approach to assessing SDS risk and provides two methods for assessing this risk: one using expert opinions and the second using the perceptions of those who are at risk from SDS. Each of these methods is described in a step-by-step process (including assessment forms and questionnaires) and includes samples of assessment outputs. Also discussed are how to assign confidence to results; the consideration of climate, environment and population changes; and assessing impacts in source areas.

5.1 Framing the SDS risk assessment process

The risk assessment process, as described in **chapter 4**, brings information on SDS hazards and vulnerabilities to this hazard together to define risk for different return periods for different types of SDS events. The generalized process for an SDS risk assessment is set out in **Table 5**, with specific procedures for survey and expert-based assessments covered in this chapter.

Any assessment report should include a summary of the SDS situation being assessed as part of Task 2, alongside background information on the assessment area, typical types of SDS experienced and other types of hazards or disasters that may occur. The report should note whether the assessment location is a major source area for SDS.

Table 5. Framing the sand and dust storm risk assessment process

#	Task	Notes
1	Identify and document a reason for the assessment.	If possible, the assessment should be linked to SDS risk mitigation in a specific area or location.
2	Define the spatial area of the assessment and whether the assessment focuses on a source area, an impact area or both, for combined source/impact locations.	Note that for some SDS, source and impact areas can overlap, and local sourcing may be significant (for example Type One). In general, the smaller the assessment area, the more precise the risk assessment. If the source area is some distance from the impact area, a short description of the origin and movement of the SDS should be included. Identify whether the sand and dust is expected to have any contamination or be a transmission mode for a disease.
3	Identify the SDS types from **Table 2** to be covered in the assessment.	For areas affected by more than one type of SDS, the risk assessment process treats each type of SDS separately, with comparable results.
4	Assign return periods to the SDS being assessed.	See **chapter 4.2.3** on return periods. Return periods can be defined using weather data from one or more stations in the assessment area, and the more data the better.
5	Collect data on vulnerability to SDS and other factors.	Choose whether to use the questionnaire or expert approaches to assess vulnerability (see **chapters 5.5** and **5.6**). The assessment should include the analysis of existing vulnerabilities and capacities specific to girls, women, boys and men and consider age and disability factors.
6	Repeat steps 2 to 4 for each type of SDS that can affect the spatial area covered by the assessment.	
7	Analyse results by SDS type and return period.	Results can be compared by return period across type, but most likely by type for return periods. Location, gender, age, disability, health conditions, social status and economic factors should form part of the analysis, with these factors included in the reporting of results.

8	Develop a report covering the assessment results.	The report should explain the reason for the assessment and the assessment process and should detail results and their implications for, for instance, risk reduction.
9	Validate the results.	The assessment results should be shared with, and validated by, at the least a representative group of the populations covered by the risk assessment. Comments from the validation should be incorporated into any report and used to improve the assessment process, and in particular, the vulnerability assessment.

5.2 Incorporating SDS source-area related risks

Many, but not all, locations impacted by SDS also contribute sand and dust that circulates in an SDS event. Both assessment methods described in this chapter can incorporate SDS source area risks (for example erosion associated with dust generation or movement of sand due to wind) into the assessment results.

For the survey-based assessment, source area risks are included by asking about the perceived and observed impacts of SDS events on the local environment. For instance, do SDS events remove topsoil, reducing locations where crops can be grown, or does blowing sand and dust during SDS events fill in irrigation canals? In the questionnaire in **Table 6**, questions 31 and 33 touch on source area impacts. Additional questions can be added to expand on specific source area concerns noted for where the assessment is taking place.

For the expert assessment, conditions related to source area risks can be included within the background information and location-specific questions can be posed to the experts as part of the assessment process. The extent to which source area risks are incorporated into the expert assessment will depend on the level of pre-assessment research available.

Where no sand or dust is taken up in an SDS event (for example in Barbados), the source of sand and dust would be considered only if this sand or dust had an impact on the population and locations being assessed. This would be the case, or instance, for dust containing chemical contaminates that put human health at risk.

Information on sand and dust source areas may be very useful in an assessment, and in identifying ways to reduce risk. However, tracking the source of sand and dust, and its chemical or biological characteristics, can be complicated. The costs and time involved in developing a detailed assessment of source area and sand or dust characteristics may not be feasible with the resources typically available for risk assessments. If this information is to be used, it needs to be collected before an assessment and to feed into the formulation of SDS characteristics that are used in defining the scope and questions used in the survey assessment or as input for experts in the expert assessment process. See **Box 6** for more information on assessing source areas.

Box 6. Assessing source areas

Identifying source areas can be important to determining the impact that sand or dust may have on the at-risk population. A challenge exists in that SDS source areas are quite diverse, ranging from large dry lake beds to a few square kilometres of ploughed land. As a result, the assessment design should consider both (1) the nature of the source area as a contributor of hazards (for example disease agents or radiation in dust) and (2) the extent to which some or all of the sand and dust in a storm comes from a local or distant source. Where some or all of the sand and dust in a storm comes from a source at the location being assessed, this factor should be included in the risk assessment.

A somewhat differently focused assessment would involve looking at the impact of sand or dust coming from a specific area on that area alone. In this case, either the survey or expert procedures could be used, but the focus of questions and discussions would be directed towards the impact of wind and other factors on the physical, social and economic environment where these factors are present.

For instance, if SDS events cause a loss of top soil affecting crop production, then the assessment would focus on these impacts to understand the nature of the hazard, vulnerabilities and resulting risks.

In most cases, these source area impacts would be part of the overall risk assessment. However, in some locations the source area impacts may be greater or more significant than other impacts or may be more significant in terms of overall or specific risk reduction. In these cases, a risk assessment focusing on source area impacts alone may be justified.

5.3 Comparing assessment processes

Ideally, both the survey and expert assessments discussed below are conducted for the same locations. This provides a basis for comparing results and gaining a deeper understanding of SDS risk.

Advantages of the survey approach include obtaining more direct information on impacts from those affected by SDS, a clearer understanding of how these may differ across age, gender and social groupings, and results that can be presented on a per capita basis (for example "x per cent of the total population indicated y impact").

The survey approach also identifies the most significant concerns about SDS among the surveyed populations; an important consideration when selecting risk reduction options. At the same time, surveys can be expensive, require time (weeks to months depending on their scale) and may yield variable (and possibly inconsistent) results for different locations surveyed, reflecting localized SDS impacts and risks.

Advantages of the expert approach include time (for example a two-day assessment workshop with 15 experts), cost and results that are based, in part, on research and synergized from expert opinions developed over years and across disciplines. In general, expert assessment results carry greater weight with decision makers and can consider multiple hazard and impact interactions across medium- to large-scale SDS situations.

Challenges with the expert assessment include that the results can be general in nature and not applicable to each location within an impact area. Results can also be strongly influenced by the technical expertise of experts involved, for example a preponderance of health experts participating in an assessment will skew results towards SDS health issues.

Broadly speaking:

- field survey-based assessments are most useful in identifying SDS risk issues that can be addressed at the project level
- expert assessment results focus more on policy outcomes

However, field surveys can also be used to frame policy, particularly when used to explain the impacts of SDS on at-risk individuals and as input into the expert assessment process.

Either assessment procedure, when used in the same way for different locations, can be used to compare SDS impacts and risks between assessed locations. To ensure that these comparisons are appropriate, the scale (number of persons covered by surveys, or spatial area covered by expert assessments) should be similar.

Box 7. Considering climate, environment and population changes

Risk assessments are used as inputs into future actions to reduce the risk of negative impacts. It is important to consider whether changes to the climate, the overall environment (both prime elements in the generation of SDS) or at-risk populations will change the risk.

With changes to the climate, the issue to be researched is whether the projected changes will change weather and weather patterns in such a way as to increase or decrease the likelihood or intensity of SDS events. Similarly, will changes to the environment, related to climate change, changing land use or other factors, affect the likelihood and frequency of SDS events? For at-risk populations, will the change in the number, composition (for example increased numbers of older persons) or other factors change the impact of SDS events? Unfortunately, how these factors combine and affect – or are affected by – SDS are not global or uniform.

In the case of the expert-based assessment (see **chapter 5.6**), background information collected as part of the assessment work can be used to summarize projected impacts of changes to the climate, environment and at-risk populations. These expected changes can be incorporated into the assessment process. For instance, once the rating process is complete, the experts can be asked how projected changes in the climate, environment or at-risk populations could change the results.

Incorporating possible changes to the climate, environment or at-risk populations into the survey-based assessment (see **chapter 5.5**) is problematic as a respondent's recall of long-term changes is often limited. In this case, the team conducting the assessment should add a research-based prospective analysis of how the survey results may change based on projected changes to the climate, environment or at-risk populations.

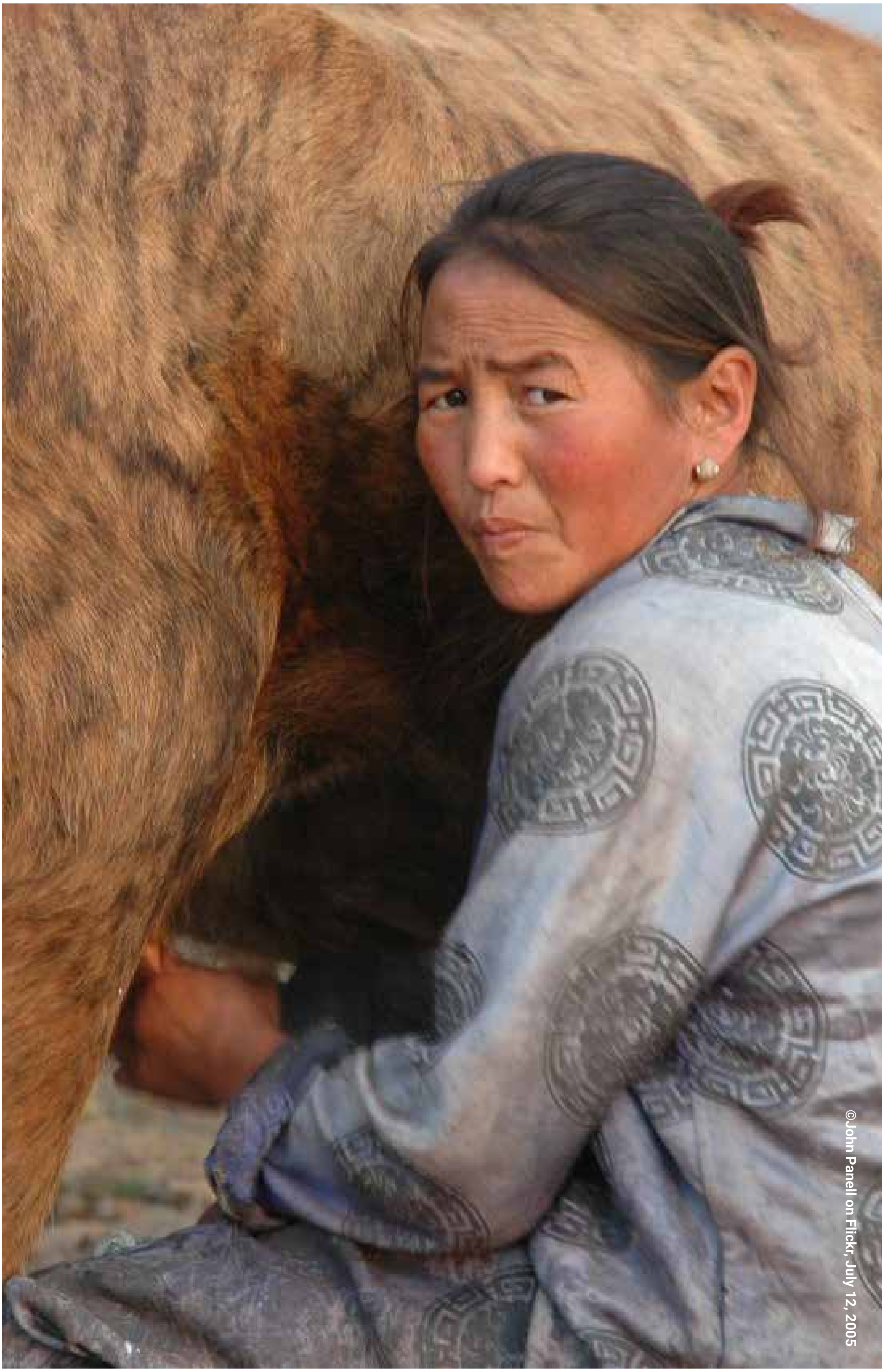
5.4 Scaling assessment results

The survey assessment process uses statistical methods to compare the data collected with the overall population in the assessment target area. This is particularly useful in determining the number of persons affected by a certain aspect of an SDS event. In turn, this scaling of impact can identify where the most severe impacts occur and identify specific target populations and impacts for risk reduction. This is why survey-based assessments are useful for project-level interventions.

The expert assessment process is more specific to the impact and risks for a spatial area affected and is less specific to affected populations, and thus, as noted, for policy-level considerations. However, because the expert assessment process considers impacts on, and risks to, specific populations (for example children and women), it is possible to broadly project the number of persons at risk from a specific aspect of an SDS event based on the general demographics of the area being assessed.

When comparing the same SDS risks for two different populations, the population with the greatest number of persons at risk is considered to be at greater overall risk. In other words, risks being equal, the more people affected, the greater the overall risk.

It is possible to use statistical methods to compare the relative significance of different SDS risks, within or between populations, for survey assessments. For the expert assessment process, the comparison of risks is possible by comparing the risk ratings. However, as the expert process does not incorporate demographic data in the same way that the survey process does, comparison between risks and populations are indicative based on the agreed judgements of the experts involved. In this case, an assessment of confidence in the results is needed (see **chapter 5.7**).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5.5 Survey-based SDS assessment process

This section describes the steps to develop, implement and analyse results from an assessment of perceptions of risk posed by SDS based on the survey process framed in **chapter 5.1** and **Table 5**, which is generally based on a questionnaire or question guide. Note that the assessment process first considers perceptions of vulnerability, before combining these perceptions with hazard information to generate a risk assessment.

This process involves a trade-off between precision on return periods (explained below) and local knowledge of vulnerabilities to SDS. The results are most appropriate for considering the risk posed by more frequent events, but they can capture vulnerability to a less frequent, but more severe event, if the assessment is conducted soon after this event.

The survey process is relatively quick and simple and can be repeated at regular intervals to develop a more detailed overall longitudinal understanding of SDS risk. As the same procedure would be used for each survey, results would be comparable over time and across locations.

Step one – Define why the assessment is needed

An assessment of SDS risk should have a clear purpose and, preferably, a role in SDS risk reduction.

Step two – Define the location for the assessment

The selected geographic location for the assessment should be well defined to avoid later confusion as to where actual surveys will take place.

Step three – Collect background data

These data should include demographic and socio-economic information that can be used to describe the assessed populations, the economy and infrastructure. Data on past SDS events and other hazards and disasters should be collected for reference.

The SDS data will provide the basis for defining SDS types and return periods (see **chapter 2**). Key informant interviews and an analysis of gender, age, disability and other factors defining the at-risk group should also be used to understand the physical, social and economic nature of the survey locations.

Step four – Design the survey

Normal procedures for using field survey questionnaires should be used to design the survey work, including the sample frame, confidence levels and survey procedures. Decide whether the survey will be conducted on an individual basis or with focus groups or key informants or using a combination of methods.

A commercial company can be hired to design and undertake the survey and conduct the analysis. It is also possible to work with NGOs or other segments of civil society to develop and conduct the SDS survey. Finally, government institutions, for instance statistics offices, may have the capacity to undertake the survey work using their own resources or they may be able to commission it.

In general, the larger a survey (larger sample size), the greater the cost. The cost–results trade-off is a core part of the design process. Surveys at the level of villages in an assessment area of 100 villages will be more expensive and time-consuming than surveys at the district level for 10 districts. The total population covered may be the same (the 100 villages are located in the 10 districts), but the results will be less specific if the scale of the assessment focuses on the 10 districts.

Assessment scale is important when comparing results across assessments. An assessment at the level of 10 districts cannot be compared to an assessment covering 100 villages within a district until the results from the latter are aggregated to the district level. This aggregation process will lead to a reduction in spatial specificity in terms of vulnerabilities and results.

Survey design should ensure that sampling covers all segments of a society and that results can be disaggregated by gender, age and physical capacities.
Deciding who will conduct the survey and how they will do so will define the organization and size of the survey team and the level of management and support required. Work on survey design would cover survey methods, team composition, logistics, etc. These details are not covered here as they are standard for questionnaire-based surveys.

Step five – Develop a questionnaire and plan the field survey

A model questionnaire for an assessment of perceived vulnerabilities to SDS is provided in **chapter 5.9**. This questionnaire would need to be adapted for each area being assessed to reflect local environmental or social issues, but the core questions and scaling of answers should remain the same to enable comparison of survey results across assessments. As a matter of normal practice, any questionnaire should be tested before general use.

The field survey work should be planned out in detail once the questionnaire has been developed. The planning builds on the survey design process and should include staffing and job descriptions, training of surveyors, written procedures for selecting those to be interviewed, printing or otherwise providing questionnaires, quality control and logistics, at a minimum. Online resources or the services of a professional field survey expert or company can be used in the planning process. As a general rule, academic standards should be incorporated into the field survey plan.

In some cases, survey data can be collected using software that uses the Internet to automatically report the data collected into a database for analysis.[1] The use of data-collection software should be integrated into the questionnaire and field survey design process.

Step six – Secure authorization to conduct the survey

Countries and organizations generally have protocols or review panels that should approve a survey or other public data collection process.

Step seven – Conduct the survey

This step involves implementing the plan developed in **Step four**.

Step eight – Analyse and report on the data

Basic analysis of the survey results should be carried out using standard statistical packages to compile and present simple results (for example frequency, number of responses) for each question. The questions on SDS experienced by those interviewed should be linked to the six types of SDS set out in **Table 2**. **Sand and dust storm hazard typology**, which should be included in the analysis process by totalling the number of each type of SDS.

Different types of analysis can then be performed. First, responses by the whole surveyed population can be presented in terms of the perceived severity of each type of SDS reported. This analysis can be presented as percentages of total number of respondents.

Second, analysis can compare the severity responses by type of SDS using disaggregated data on gender, age, occupation, economic group or other criteria collected through the questionnaire. In each case, the analysis should be done by category, for instance perceived impact on health, agriculture, travel, infrastructure, social connections, or warning, as set out in the questionnaire. The result provides an impact category-by-category analysis identifying the impacts that are perceived as most severe for each type of SDS.

1 The KoBoToolbox is a commonly used software package for the collection and analysis of data collected through questionnaires. See https://www.kobotoolbox.org/.

Results should be reported as text, with the use of charts and maps to facilitate understanding. See **Box 8** for a sample chapter of a simple report-out example.[2] Normal academic-level procedures for presenting data and reporting results should be followed, including reporting on the validity of statistical results.[3]

Step nine – Disseminate and validate results

As per Task 9 of the **Framework** (**Table 5**), results should be validated by sharing them with those affected by SDS and living in the assessment area. Dissemination products include reports, press releases, journal articles and public events.

Additional considerations

In general, perception surveys will not allow for an assessment of multiple return periods but they can cover different types of SDS. In most cases, the survey will capture perceptions based on the most recent events, which may be more severe than average events. By dating these most recent events, it is possible to link them to observed weather data and classify them in terms of statistical return periods.

Perception surveys can face difficulties in trying to align participant descriptions of an SDS event with standard names or the typology (**Table 2**). To address this challenge, pictures of different types of SDS can be prepared in advance and used by the participants to select the type of SDS most like the one that they describe. This process can improve the accuracy of the assessment process and the link between SDS recorded at weather stations and SDS reported by the survey participants.

It is also important to consider when to conduct a survey. A survey during the normal SDS season may yield perceptions skewed by an ongoing or most recent SDS event. Thus, where possible, surveys should be conducted outside normal SDS periods. The selected area should be well defined to avoid later confusion as to where actual surveys will take place.

Reporting on results should include a description of the SDS issue being assessed and other background on the assessed location.

2 The text provided is a snippet and would be longer in a real report.

3 The level of confidence in results should be based on standard statistical analysis and not on the process set out in **chapter 5.7**.

Box 8. Sample simple survey results report-out – health effects

A survey of 240 respondents (46 per cent male) was conducted in Zira Department (population 5,632; 52 per cent female) to assess the perceived impact of SDS on health. The data are presented in the chart below. The median per capita income for the district is US$ 3,760, the main occupation is semi-mechanized farming (wheat, maize) and the poverty rate is 15 per cent.

For Type Five SDS (high intensity-very small area), 83 per cent of respondents (56 per cent female) reported important or very severe health effects. Note that the survey area is subject to Type Five SDS due to the ploughing of loess-type soils during the spring windy period. For Type One SDS (high intensity-large area), 52 per cent (62 per cent female) reported important or severe effects. Few respondents indicated more than limited effects from Type Two or Six SDS (low or moderate intensity-large area and low intensity-very large area).

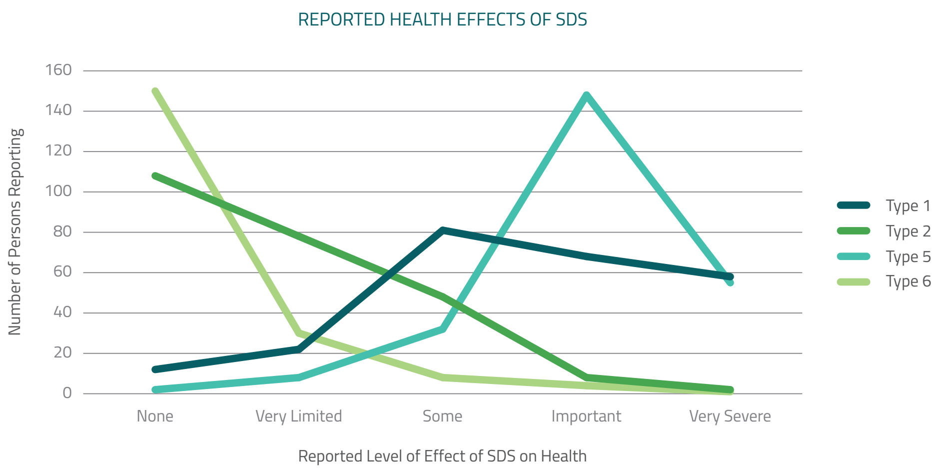
The Type Five important and severe health effects reported during the survey included:

- asthma (mentioned 46 times)
- fever following SDS events (mentioned 142 times)
- breathing problems requiring hospitalization (mentioned 74 times)
- high blood pressure and circulation problems (mentioned 73 times)
- eye irritations (mentioned 153 times)
- general difficulty in breathing, not requiring hospitalization (65 times)

Older persons and young children were reported to be the most affected. No fatalities were reported among the survey population.

Based on weather data from Zira airport, Type One storms have a return period of twice a year, Type Two events twice a year, Type Five events three times a year and Type Six events once a year. Type Three and Four events were not reported by respondents or identified based on airport data.

Figure 15. Reported health effects of sand and dust storms



Box 9. Including gender and age in the assessment

Good practice for conducting and reporting on assessments calls for gender and age to be an integral part of both processes. Including age as a factor in data collection and analysis helps with understanding the differential impact that sand and dust can have on young children and older persons. Incorporating gender assists in understanding how impacts can differ within a population where different gender groups may live and operate in different physical and social conditions.

For survey-based assessments (see **chapter 5.5**):

Gender is included by:

1. Ensuring that assessment teams and field assessment teams are gender-balanced, as far as possible
2. Collecting data on gender – of the individuals contacted, focus group meeting members and the general population – as part of the assessment process
3. Analysing data from a gender perspective to identify practical and strategic gender impacts
4. Disaggregating data analysis, results and conclusions

Age is included by:

1. Collecting information on the age of respondents. This information is usually divided into three groups: young children (younger than 60 months), older persons (at or over the local age of retirement, usually between 60 and 65) and the remaining age group (between 6 and 60 years). The 6 to 60 age group can be further segmented if justified by expected SDS impacts or other factors. The basis for segmenting people into specific age groups should be provided as part of the assessment reporting.
2. Disaggregating data analysis, results and conclusions by designated age group.

Common good practice is to also disaggregate impacts by age groups and gender, for example, SDS impacts on older women.

For the expert-based assessment (see **chapter 5.6**), gender and age are included by repeating the assessment process and asking how the assessment results would change for specific age groups, by gender, or by a combination of both (for example girls). As with the survey-based assessment:

- Expert teams should be gender-balanced as far as possible, and supported by dedicated gender expertise where available.
- Results should be disaggregated by age, gender and, where relevant, age/gender combinations.

5.6 Expert-based sand and dust storms assessment process

Box 10. Expert-based assessment process overview

The expert-based process involves:

1. Selecting an SDS type from **Table 2. Sand and dust storm hazard typology**, with reference to background materials on SDS for the locations being assessed.
2. Having the experts review **Table 4. Scaling vulnerability to sand and dust storms** and agree on a score for each type of capital that most accurately reflects the effect of the SDS event on the overall population covered in the assessment. The Insignificant, Low, Medium, High and Extreme scores can be converted into numbers (1 to 5) for ease of reference. If relevant, notations can be added to the scoring to reflect specific details that may be relevant to the overall assessment results.
3. Repeating the process for population subgroups, most often women and girls, older persons (over 64 years), children under 5 years and people with a physical disability.
4. Assigning confidence levels to each assessment. This can be done at the time of an individual assessment (preferred) or after a round of assessments for an SDS type.
5. Repeating the process for each SDS type relevant for the area being assessed.

This section describes a process for using expert understanding of SDS vulnerability, together with data collected on SDS types and frequencies, to develop a comparable understanding of SDS risk. The process uses **Table 4. Scaling vulnerability to sand and dust storms**.

Step one – Define why the assessment is needed

A clear purpose and justification for assessing SDS risk should be developed, preferably linked to SDS risk reduction.

Step two – Define the location for the assessment

A well-defined assessment area should be selected to reduce confusion over the applicability of results and facilitate the collection of background data and planning.

Step three – Design the assessment workshop

An expert-based assessment will normally take place in a workshop format, generally for one day. The design of the workshop should involve:

- Identifying between 7 and 12 experts who will participate (the number depends on their experience). They should be experts in one of the areas related to SDS or knowledgeable about the population in the assessment area. These experts can include meteorologists, geographers, sociologists, agriculturalists, community development experts, experts on gender, age and disability, health officials (doctors as well as public health specialists), engineers responsible for infrastructure at risk from SDS and government officials involved in disaster risk management.
- Identifying a location for the workshop that provides sufficient meeting space and facilities for a one-day workshop.
- Selecting one or more workshop moderators experienced in the methods used to develop consensus when dealing with diverse information and potential ambiguity. Although the moderators do not need to be knowledgeable about SDS before a workshop, they should be fully cognisant of the workshop briefing materials before the workshop. Where moderators knowledgeable on SDS are available, they should be used.
- Identifying any specific information or materials (for example maps) that should be assembled before the workshop.

- Developing an assessment workshop agenda covering the purpose of the workshop, methods, ground rules and expected results (see **Step six**)
- Defining how the workshop results will be disseminated and validated.

Step four – Collect background data

Background data should include physical, demographic (for example gender, age, disabilities), economic, social and other information that describes the population to be assessed. Specific details (for example frequency, intensity, duration) of past SDS events should be collected and compiled into a narrative summary based on the typology set out in **chapter 3** and **Table 2**. **Sand and dust storm hazard typology**.

Step five – Sharing information before the workshop

An information package should be shared with workshop participants before the event. The package should include (1) The background and reason for the workshop, (2) Information on SDS in the assessment area (for example SDS types and return times) and other background information collected in Step four, (3) Logistics arrangements, (4) Ground rules and (5) A reasonably detailed description of the process to be used in the workshop.

In general, most participants will not (or at least not fully) read the information package but any improvement in knowledge about the workshop process or SDS gained before the workshop will help the workshop process operate with fewer problems.

Step six – Conduct the workshop

The workshop should be led by one or more moderators and generally follow these agenda points:

- opening, introductions and objectives of the workshop
- background to SDS in the assessment area, including handing out of SDS typology and return period information
- review of background information on the assessment area, including handing out of background information
- review of the assessment process (see **Box 10. Expert-based assessment process overview)**
- conduct the assessment process in as many rounds as needed to cover the SDS types identified for the assessment area
- summarize results
- describe how the results will be used
- conduct a short workshop assessment covering the workshop process and facilities and services
- closing

As appropriate, there can be opening and closing speeches as well as certificates provided indicating that participants assisted in conducting the SDS assessment.

Step seven – Document, disseminate and validate results

As per Tasks 8 and 9 of the **Framework (Table 5)**, workshop results should be compiled into a report and validated by sharing with those affected by SDS and living in the assessment area. A level of confidence in the survey results should be included in the final report. See **chapter 5.7** on setting confidence levels.

An expert-group assessment report can report results for specific vulnerabilities to specific types of SDS. An example of such reporting out is provided in **Box 11. Sample simple expert assessment results report-out – SDS risk**.

A second approach is to calculate a number that indicates the relative importance (size) of the overall vulnerability assessment and to present it in a spider diagram for each group covered by the assessment, and for each SDS type. This is done by calculating the area of each triangle that makes up the spider for each group/type combination covered by an assessment.

The resulting number indicates the relative importance (size) of each of the six vulnerability factors (capitals) when compared to a scoring of "extreme" (vulnerability) and "insignificant" (vulnerability) for all six factors considered.

The resulting numbers can be used to compare vulnerability across locations and across groups. They can also be used, in an X/Y plot, to indicate comparative levels of risk, as described above.

The use of the area calculation avoids, in large measure, the issues related to attempting to compare very different characteristics of vulnerability in the absence of a standard metric for all characteristics, such as economic value or a research-based way of comparing different types of vulnerability. Procedures for calculating spider diagram area and further discussion on this approach can be found in CAMP Alatoo and UNDP Central Asia Climate Risk Management Program (2013). The calculation process can be set as a formula in Excel® or similar software, so that the results are generated automatically once vulnerability scores have been entered.

Normal (academic) good practice should be used in writing the assessment report. The procedures used should be clearly described and the results understandable so that the same process can be used elsewhere and results can be compared.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Box 11. Sample simple expert assessment results report-out – SDS risk

An expert assessment of SDS impacts on people living in Zira District was conducted by a team of experts from the fields of meteorology, geography, social sciences, agriculture, community development, health and engineering. Zira District has a population of 5,632 (52 per cent female), with a median per capita income of US$ 3,760. The main occupation is semi-mechanized farming (wheat, maize) and the poverty rate is 15 per cent.

Based on weather data from Zira airport, Type One storms have a return period of twice a year, Type Two events twice a year, Type Five events three times a year and Type Six events once a year. Type Three and Four events were not reported based on airport data.

The assessment covered the general population, women and girls and older persons. The results presented in the following graph for Type Five SDS (high intensity-very small area) indicate that this SDS has:

- a large impact on the health of older persons, with effects (albeit less severe) on women and girls and the general population
- a large impact on financial capital for women and girls, possibly due to increased costs of cleaning following SDS
- a medium impact on the financial capital of older persons, likely due to the need for medical care

EFFECTS OF TYPE FIVE SDS ON ZIRA POPULATION AND SUBGROUPS

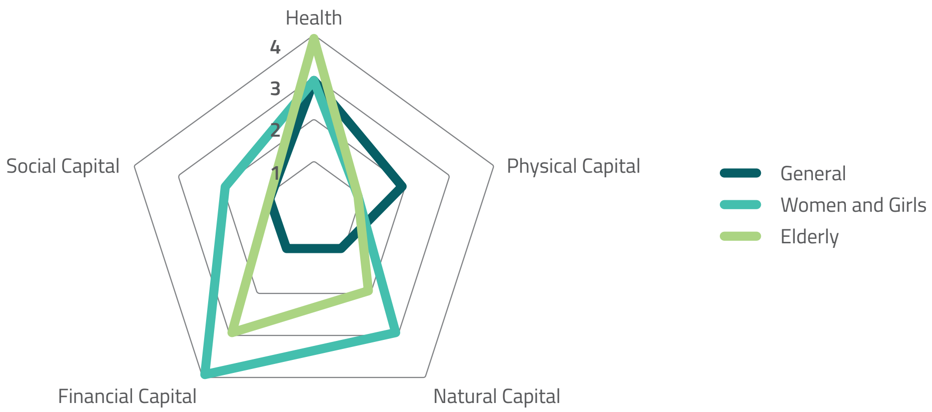

Figure 16. Effects of type five SDS on Zira population and subgroups

Note: Vulnerability effects scores where Extreme = 5; High = 4, Medium = 3, Low = 2 and Insignificant = 1.

5.7 Assigning confidence to results

There is a need to indicate the level of confidence in assessment results. The challenge is that the information used to generate results may not be uniform for all locations covered, for all relevant data sets used, or for the same data sets used in different assessments.

Clearly stating the level of confidence that assessors have in the results of their work is professionally appropriate. It also allows those using the assessment results to factor any limitations into their decision-making process.

For a questionnaire-based assessment, the statement of confidence can be developed based on the results of statistical analysis and reference to operational challenges faced in conducting a survey. These challenges will typically include no access to some of the assessment areas, large numbers of refusals to participate, confusion as to the types of SDS discussed, unwillingness to answer specific questions and difficulty in ensuring gender-balanced surveys.

For the expert-based process, one option for assessing confidence is through external reviews. This is good practice but, in the case of SDS assessments, presents three challenges. First, there may not be sufficient experts not involved in a specific assessment to conduct a robust external review, or there may be an insufficient number of experts to review numerous local or regional scale assessments.

Second, the external reviewers may disagree between themselves, and with the initial assessors, on the substance and rigour of the data used, leading to disagreements about the data even before they review the results.

Finally, there may not be agreed metrics by which to define substance and rigour for individual pieces of or groups of data, which makes understanding these parameters – as part of the initial assessment and as part of the review process – a challenge.

Another option, used in the **Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation** report (Intergovernmental Panel on Climate Change, 2012), is to establish a set of terms that define the assessors' confidence in the (1) quality of the data used, and (2) the accuracy of the results.

Adapting this approach to SDS assessments, the quality of data used can be rated as having:

- poor representation of the spatial or temporal scope of the assessment
- fair representation of the spatial or temporal scope of the assessment, or
- good representation of the spatial or temporal scope of the assessment

In each case, the definition of spatial or temporal scope would depend on the scale of the assessment. A data set may be spatially and temporally good for a specific location when assessing a specific type of SDS, but spatially and temporally poor when used as part of a continent-level assessment for all types of SDS.

Confidence in the assessment results can be assessed as being:

Low, where
- a considerable part of the data needed for the assessment is not available or
- the data used may have a weak connection to the issue of concern or
- the actual understanding of the physical or social processes involved is weak.

Medium, where
- the required data are generally available and
- there is a reasonable connection with the issue of concern and
- there is a basic understanding of the physical or social processes involved.

High, where
- all the necessary data to conduct a robust assessment are available and
- there are clear linkages between the data and the issue of concern and
- the physical and social processes involved are well understood.

To avoid overstating confidence, an assessment is rated by the lowest descriptor. For instance, where data are available but weakly connected to the issue of concern, the rating would be "low confidence".

Where the assessment of the impact on one type of capital is considered to have greater or less quality or confidence than for other information used, this should be stated as part of the overall statement of confidence. The more specific statements of confidence and data quality are for data sets under the assessment, the more transparent and credible the assessment results.

Ideally, confidence in results should be stated for each segment of the assessment process, for instance, for health and the general population; for health and women and girls; and for health and older persons. If this cannot be done, the experts involved in the assessment should set overall confidence levels for each of the major sources of vulnerability covered. In addition, confidence in the SDS typologies used should also be indicated.

All confidence statements should be consensus-based. If there is an inability to agree on specific confidence levels, then a majority and minority statement can be made, accompanied by short justifications.

5.8 Using risk assessment results

(This section should be read in conjunction with **chapters 3, 5.5, 5.6, 9, 10, 12** and **13**). The purpose of a risk assessment is to identify risks so that they can be reduced. For disaster risk reduction to be effective and efficient, the most salient risks need to be prioritized for mitigation or reduction to acceptable levels.

Both assessment methods provide results that identify risk salience and can guide risk reduction interventions. The potential uses of SDS risk assessment results for risk reduction can be summarized as follows:

- **SDS risk management policy:** Results from either assessment process can frame SDS risk reduction policy by providing evidence-based identification of the importance of risks from SDS. As the expert process can be quicker and cover larger areas than the survey process, its use in policy development (for instance a national SDS risk management strategy) can be more direct.

The survey process provides stronger evidence-based results (due to the use of statistical analysis), but can take more time and be more costly. At the policy level, these results can be used to refine strategies for more specific interventions addressing the range of risks identified as salient for the at-risk population.

- **SDS warning:** Warning of SDS events is based on research into the hazards and the identification and monitoring of triggers. The survey process can help identify which triggers are most relevant to at-risk populations (as people respond best to warnings based on triggers they know and understand), and their receptivity to specific actions that can be taken to reduce SDS impacts, depending on the type of SDS event for which warnings are provided.

- **SDS response:** In general, specific disaster relief and recovery operations are not undertaken for most SDS. The expert process can help identify and raise the profile of SDS response options by identifying where specific responses can be most effective in reducing SDS impact. An example would be linking SDS health vulnerability and risk to specific subpopulations and identifying the effectiveness of response efforts for this subpopulation. Survey-based results can also identify local SDS coping or adaptation measures that can be formalized into SDS response plans. This input is very useful in ensuring that response measures match local capacities and preferences.

- **Risk reduction:** Both assessment procedures can identify where risk reduction efforts should be targeted, with the expert process more focused on strategic interventions and the survey process more focused on on-the-ground interventions. Both procedures can be used to assess the costs-to-benefit decision points for specific SDS risk reduction interventions or for packages of interventions.

  The survey process can be used to identify the salience of specific SDS impacts for at-risk groups, which can then be used to define preferences for specific risk reduction options. As noted, survey results are likely more useful than the expert process in planning specific SDS risk reduction interventions. Initial surveys can be used to define baselines and subsequent surveys (often using reduced sampling) can be used to assess progress in reducing perceived SDS impacts and levels of risk.

  These uses of assessment results to address SDS risks need to be matched by a good understanding of the physical processes and impacts related to different types of SDS in different locations. Results from both assessments can be used, in part, to guide where research into local SDS causes and impacts should be targeted, by type of impact, location or at-risk group.

  Finally, results from both assessments of risks from specific hazards can feed into larger assessments and strategies related to the management of other hazards and risks, such as from flooding, severe weather, or drought. In this sense, SDS risk assessments further the integration of SDS into mainstream disaster risk management.

5.9 SDS survey questionnaire

5.9.1. Details of the model questionnaire

Table 6 provides a model for the field-level SDS risk assessment questionnaire which is presented in table format to include instructions and guidance. This information should be removed from the actual questionnaire but can be provided to the teams conducting surveys to assist their work. To ensure that results are comparable across surveys and assessments, the scaling of the response to questions should not be changed.

The questionnaire is designed to be administered to one person, but questions and responses are based on the assumption that it will take place in a household. The questionnaire wording should be modified if it is clearly only being administered to a single person or is being carried out with a focus group or through a key informant interview (The latter is not preferred as the scope of coverage would be limited).

Use of the questionnaire should follow normal good practice for data collection. Anyone with whom the questionnaire is used should be provided with an explanation of the purpose of the survey, how the results will be used, and particulars of the survey process and organizations involved.

5.9.2. Sample size

Questionnaire-based surveys have no defined limit regarding the maximum number of people, households or other groups that can be included in the survey. The maximum target population is generally defined through a combination of time to conduct the survey, funding and staffing. Setting the statistical confidence level and indicator for a survey can determine practical maximum and minimum limits for the sample size.[4]

5.9.3. Modifications to the questionnaire

The model questionnaire should be revised to reflect local conditions and the focus of the survey work. Additional questions can be added to the survey form, for instance to include perceptions of other hazards besides SDS. However, a field-tested survey should not take more than 30 minutes to administer, including introductions, completing the form and any other formalities.

If the survey is carried out on a one-to-one basis, gender and age information is already collected in the form. Using this information to disaggregate responses would be a normal part of the analysis and report-out process.

If the questionnaire is used to collect household responses (i.e. not one-to-one with an individual), the number of questions needs to be increased to allow for information to be collected on effects that may be different for males and females (generally men and women but also, where appropriate, boys and girls). This can be done for each of the "effect" question sets (items 27 to 41), by adding additional questions following the format of *Are these effects the same for men and women or boys and girls? If not, is there 1 - no effect, 2 – very limited effect, 3 – some effect, 4 – important effect, 5 – very severe effect*, and recording the answers separately for each group covered.

The different responses, if any, are then used in the analysis and report-out of the survey to differentiate SDS impacts by the groups covered.

Item 25 of the model questionnaire provides for collecting a statement from the person or group being interviewed describing the characteristics of an SDS event, and then estimating the reduction in visibility to match the description as closely as possible to one of the SDS types described in **Table 2**. This process could be time-consuming and the respondent may have difficulty in accurately and quickly determining visibility distance.

The alternative is to prepare pictures of each type of SDS in advance with descriptive text covering the key points from **Table 2**. These pictures would be shown to the respondents, who would choose one or more pictures as the basis for covering items 25 to 40 in the questionnaire. This use of a visual reference makes it clearer to the respondent what the survey questions are about and makes the classification of the response by SDS type clearer and more credible.

5.9.4. Information on SDS risk management

The model survey in **Table 6** is focused on collecting information on SDS impacts. Additional questions can be added to collect information on SDS preparedness, response plans, warning systems, information dissemination and ongoing mitigation activities.

The challenge with adding questions is that they can make the survey overly long, thereby reducing the number of surveys that a team can complete in a designated time, and taking excessive time from those who are being questioned. Testing of the questionnaire can assess whether its length is excessive or whether questions on SDS risk management are appropriate.

4 Confidence level and confidence indicators can be calculated at https://surveysystem.com/sscalc.htm or similar sites. (Reference to a commercial website does not indicate a recommendation or support for the company involved.)

An alternative is to use key informants to explore how SDS risks are managed, particularly as statistics on risk management options are not needed. Key informants include officials, individuals, households, businesses and academics.

A strategy of diversifying sources of information can assist with developing a broad understanding of SDS risk management practices.


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Table 6. Sand and dust storm perception survey

Sequence number	Information/question	Information to be entered	Notes
1	Date		
2	Surveyor 1	Name	One surveyor should be male and one female.
3	Surveyor 2	Name	
4	Sequence number	Number indicating the sequence of the survey, starting from 1	The sequence number can include a letter or additional number indicating the team that conducted the survey.
5	Location	Town or other location where the survey is taking place	
6	GPS reference	Global Positioning System reference for the place of the interview	
7	Gender of the respondent	Male or female	
8	Agreement to conduct survey	Yes or no	The person surveyed should agree to the survey. If not, the survey is ended.
9	Age	In years	Age can also be collected using a range of ages, for example 10 to 19, 20 to 29, etc.
10	Is the respondent the head of the household?	Yes or no	
11	If the respondent is not the head of the household, what is the gender of the head of the household?	Male or female	
12	What is the profession of the head of the household?	Select from list.	A list of typical professions should be added before the questionnaire is used.
13	How many persons are resident in the household at the time of the survey?	Number	The number should not include persons who are not currently sleeping in the household (i.e. people who are traveling or working somewhere else temporarily).
14	Of these persons, how many are female?	Number	
15	Of these persons, how many are under five years of age?	Number	
16	Of these persons, how many are over 64 years of age and what is their gender?	Number and gender	
17	Are there any persons with disabilities resident in the household and what is their gender?	Yes or no, with gender indicated	
18	If yes, list the types of disabilities.	Select from list.	Prepare the list in advance.
19	Does the household rent or own the place where they live?	Renters or owners	

Sequence number	Information/question	Information to be entered	Notes
20	Does the household have electricity?	Yes or no	
21	Does the household have running water?	Yes or no	
22	What type of sanitation facility does the household use?	Select from list.	Prepare list in advance.
23	Does the household own any of the following: car, TV, radio, computer, tractor or truck, boat?	Yes or no for each item	Update the list based on likely local ownership of assets.
24	Has the household experienced a sand or dust storm?	Yes or no	If no, end the survey.
25	If yes, ask for a description of the most recent event. Prompt for: when the SDS occurred (month, year) time of day how long it lasted how much visibility was reduced at the worst point in the storm. Use a reference point, for instance a tree or building that was not visible during the storm.	Write down the response.	After the question, estimate the distance to the structure or reference point not visible during the storm.
26	With reference to the storm described, ask how frequently per year these events take place.	Indicate per year	If less than once a year, indicate how often over a number of years, for instance, once in five years.
27	Ask whether the storm described had an effect on the health of anyone in the household.	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	
28	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Detail for each affected individual. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
29	Ask whether the storm described had any effect on buildings, roads or other infrastructure (water systems, irrigation, electrical systems, communications) where the household is located.	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	
30	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.

Sequence number	Information/question	Information to be entered	Notes
31	Ask whether the storm described had any effect on the household's fields, crops or garden production.	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	
32	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
33	Ask whether the storm caused soil loss or other erosion.	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	This question focuses on the impact of a location contributing sand or dust to an SDS event through wind erosion.
34	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
35	Ask whether the storm caused the household to lose income (i.e. someone could not work or their business could not function due to the storm).	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	
36	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
37	Ask whether the storm described had any effect on land, pasture, forests or other natural resources that are available to the household.	Answer scale: 1 – no effect 2 – very limited effect 3 – some effect 4 – important effect 5 – very severe effect	
38	For answers 2 to 5 on the scale, ask for a description of what happened.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
39	Ask whether the storm described led the household to use their social connections to deal with the effects of the storm.	Answer scale: 1 – no 2 – very limited use 3 – some use 4 – important use 5 – very significant use	Note that "social connections" can be reworded to reflect kinship ties, extended family or other social connections that are common in the location where the survey is taking place.

Sequence number	Information/question	Information to be entered	Notes
40	For answers 2 to 5 on the scale, ask for a description of which connections were used and for which purposes.	Write down the response.	Include as much detail as possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
41	Ask whether the effects of the storm had, in their opinion, been reduced by warnings or any other actions taken by the Government.	Answer scale: 5 – no 4 – very limited reduction 3 – some reduction 2 – important reduction 1 – very significant reduction	Note that the answer scale is the inverse for the other responses, making "very significant reduction" the opposite of "very severe effect".
42	For all answers, ask for a description of the actions taken.	Write down the response.	Include as much detail as possible. The impacts of warnings should be linked to one or more of the capitals if possible. Note gender, age and disability status (if appropriate) for each respondent or person discussed.
43	Ask the household whether they have experienced any other types of sand and dust storms in the past.	Yes or no	
44	If yes, repeat items 25 to 41 for this event.		After the second round with items 25 to 41, ask again if there are any other sand or dust storms that the household remembers. If yes, repeat the process until all storms mentioned by the household are covered per items 25 to 41.
45	If no other storms are reported, ask the household to rate the significance of the storms they described against the effects of floods.	Rating 1. Not significant 2. Much less significant 3. As significant 4. More significant 5. Much more significant	This item and the next should include the most significant natural hazards identified for the assessment area. Note gender, age and disability status (if appropriate) for each respondent or person discussed. Seek input from men, women, girls and boys.

Sequence number	Information/question	Information to be entered	Notes
46	If no other storms are reported, ask the household to rate the significance of the storms they described against the effects of drought.	Rating 1. Not significant 2. Much less significant 3. As significant 4. More significant 5. Much more significant	Additional items can be added to cover additional hazards. Note gender, age and disability status (if appropriate) for each respondent or person discussed. Seek input from men, women, girls and boys.
47	Close by thanking the respondent and telling them when a report based on the survey will be available.		


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5.10 Conclusions

This chapter has covered practical ways of assessing the risks posed by SDS to at-risk populations. Two approaches have been defined based on (1) expectations of data reliability and spatial consistency across all SDS-affected locations and (2) a need to deliver practical results that can help reduce SDS impacts.

One assessment approach uses questionnaire-based surveys of populations at risk of SDS to combine perceptions of SDS vulnerability with a typology of SDS events and generate results that are comparable across locations and scales. The second assessment approach uses expert knowledge and the SDS typology to define vulnerability levels and risks, which are also comparable across scales.

Either approach can be used at very local, national or regional scales. If either approach is used consistently between locations, the results from each approach can be compared and, when appropriate, aggregated to increase understanding of SDS impacts and risks.

The survey approach can be used to cover a wide geographic area and uses random or selective sampling to collect information on a wide range of affected populations. These results can then be shared as part of the expert approach to aid experts in developing a common understanding of the SDS hazard and impacts and in framing the decision-making process. This process uses the strengths of a perception-based understanding of SDS risk and the strengths of an expert understanding of the physical, economic and social consequences of SDS.

The cost of the survey process depends on the scale of the survey: the larger the at-risk population covered, the greater the expected cost for an individual survey. Surveys are likely best done at subnational scales defined by SDS source and impact locations and then aggregated to national and subglobal results. The survey approach can be implemented by commercial survey firms, non-governmental organizations, civil society groups, academic institutions or government statistical offices and can be part of larger assessments of hazards or socioeconomic or health conditions.

The cost of the expert process is considered relatively low per workshop. Each assessment workshop can cover the subnational to national level in scale, again defined by the types of SDS of concern. These workshops can be organized by governments, academic institutions or international organizations.

The two approaches set out are based on current practice for assessing disaster risk, hazards and vulnerabilities, but have not been tested or validated in the field. Validation may yield changes to both approaches and the underlying procedures and supporting materials. Where these changes are necessary, they should be applied consistently within each approach to ensure that assessment results are comparable.

To date SDS, as hazards and potential disasters, have not gained significant attention within the disaster risk management community. Providing practical assessment procedures will enable this community to better understand the threat posed by SDS and to develop effective measures to reduce these risks.

5.11 References

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