UN WOMEN

WOMEN COUNT

Sampling methods and survey operations:

Measuring the nexus between gender and the environment

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Abbreviations and acronyms

CAPI	Computer assisted personal interview
CI	Confidence interval
CV	Coefficient of variation
NSO	National statistical office
PSU	Primary sampling unit
e	Relative error
SDGs	Sustainable Development Goals
SE	Standard error
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women

Executive summary

Implementing the "Model Questionnaire: Measuring the nexus between Gender and Environment" requires a three-stage sampling method. As the modules refer to multiple economic and non-economic areas encompassing agriculture, fisheries, garbage management and many more, sampling strategies must include women and men engaged in these environment-specific sectors for pay, profit or leisure. Equal numbers of women and men interviewers should be recruited, trained and deployed to carry out the field work. It is recommended that all eligible women and men ages 15 and over in a household are interviewed. In the event of budget limitations, a minimum of one man and one woman per household should be interviewed. This is essential to capture gender differences and avoid using proxy respondents, a practice demonstrated to return unreliable gender estimates. The two respondents must be selected at random, and thus may or may not include the household head. Where interviewing minors poses legal or operational difficulties, the sample can be adjusted to those ages 18 and over.

1. Introduction and background

Women and men, in all their diversities, interact with the environment differently. From their differentiated access to natural resources to their different levels of vulnerability to the effects of climate change and distinct challenges for participation in environmental decision-making, their experiences are diverse. Data that reflect these experiences, however, are rarely available. To fill these gaps and support national data collection efforts on this topic, the Model Questionnaire: Measuring the nexus between Gender and Environment was developed by the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) in collaboration with the Food and Agriculture Organization of the United Nations, the International Labour Organization, the International Union for Conservation of Nature, the Pacific Community, the United Nations Environment Programme, the Economic and Social Commission for Asia and the Pacific and the United Nations Office for Disaster Risk Reduction. The questionnaire includes 10 modules and follows international statistical standards, classifications and practices to the extent possible.

This chapter examines sampling needs to compile statistics on gender and environment through the implementation of national surveys utilizing the Model Questionnaire, and it provides recommendations to ensure the quality of the data produced.

The survey and recommended sampling strategy were designed to provide representative estimates for approximately 100 gender-environment indicators at the national level, with disaggregation by sex, and to the extent possible additional variables such as location, age group, disability status, engagement in select economic and environmental activities, type of household-level land tenure, exposure to environmental hazards and many more variables.

1.1 Objectives

The overall goal of the gender-environment survey is to collect data to assess the connections between environmental issues and gender equality and women's empowerment. This includes issues around environmental decision-making, ownership of environmental assets, engagement in environmental livelihoods, roles played in environmental conservation and degradation, natural resource management, and risks and vulnerabilities to disasters and climate change. The survey aims to capture how women and men interact with the environment in a holistic manner. As such, the scope of the survey goes beyond economic activities to also capture relationships that take place in the context of the household or during leisure time.

1.2 Basic sampling principles for gender-environment surveys

Scientific sample surveys use statistical techniques to obtain accurate population-level data on gender and environment. A number of general principles govern the sampling processes in the gender-environment survey to achieve comparability, consistency and the highest quality in survey results. Country-specific adaptations may be required, however this document provides general sampling guidelines.

The basic sampling principles for undertaking a gender-environment survey are summarized below:

- Make use of a sampling frame that already exists, such as a census. Note that samples from labour force surveys or agricultural surveys will not be adequate, as the gender-environment survey aims at collecting data from all individuals engaged in environmental activities, regardless of whether it is for employment, pay, profit or leisure.
- Ensure complete coverage of the target population.
- Conduct three stages of selection: primary sampling units (PSUs), households and individuals.
- Apply probability sampling, as it offers the best opportunity to produce a sample that is representative of the population. The most important prerequisite for probability sampling is that each member of a population has an equal chance of being selected. For example, if there were 10,000 households in the population of a country, each household would have one chance in 10,000 of being chosen for the survey.
- Choose an appropriate sample size, that is, the minimum number of persons that achieves the desired survey precision for core indicators at the domain level (sampling domain and analysis domain). If the budget for a survey is limited, then the sample size is the maximum number of persons that the limited budget can cover (see section 3.7).
- Employ the simplest design feasible, validate how well the design meets requirements (e.g. produces accurate estimates) through a quick assessment process or an in-depth study that samples a section of the design.
- Conduct household listing and household pre-selection (see section 4.2.2 and Appendix 3), providing good documentation of the sampling.
- Make a roster of all individuals per household, to proceed with selection at the individual level.
- Administer survey modules 1 and 2 at the household level. Only one individual per household responds to these two modules for the whole household. Select the respondent at random among all household members (refrain from assigning the head of household by default). You can use the UN Women survey script to select this individual at random.
- Administer survey modules 3–10 at the individual level, as the use of proxy respondent is highly discouraged. Sample a minimum of one man and one woman per household (age 15 and over). In households with several possible respondents, the selection of the respondents can be done using either the UN Women CS-Pro survey script (available at https://data.unwomen.org/) or the Kish grid method.
- Implement the sample exactly as designed.

1.3 Confidentiality

Confidentiality is critical, especially when dealing with sensitive issues, such as gender differences and intrahousehold inequalities. In view of this fundamental challenge, gender-environment surveys must be anonymous, and no specific household or individual can be identified in the data set. The final component and stage in achieving adequate sampling precision is to protect respondents' identity and confidentiality.

1.4 Considerations prior to data collection

For this survey, face-to-face data collection is preferred over computer assisted telephone interviewing. This is because of the survey length and level of detail, which would return interviews too long and tedious for phone or online implementation. The recommended period of the field data collection to implement the survey in full is approximately two and half months.

Where possible, the use of computer assisted personal interviews (CAPI) is recommended, as it provides advantages for data recording, including in the context of geo-tagging households. Recording the geographical coordinates of each household is of relevance for environmental analysis. For instance, some gender outcomes are affected by climate related variables, the availability of water, energy, roads and other infrastructure, and other geographical information. Therefore, integrating gender-environment surveys with geospatial information is recommended to assess these correlations.

A team with a minimum of three interviewers, one supervisor and a driver is generally recommended for each enumeration area. This is because, given the length of the questionnaire, visits will be long in households with many eligible individuals. Furthermore, where possible, the team should include women and men enumerators, to attempt sex matching with the respondents. This is particularly relevant in countries where cultural practices prevent one-on-one interviews with opposite sex. Evidence also shows that sex matching of enumerators and respondents contributes to more reliable responses and better quality data overall.

To ensure that field data collection instruments are well-understood and appreciated, a minimum of two days should be devoted to field practice, prior to survey implementation. In addition, a statistical review should be undertaken in preparation for the survey by adhering to the following steps:

1. Read these guidelines in full. They have been prepared taking into consideration international statistical standards and classifications, where relevant, to ensure the quality and comparability of the data.
2. Ensure the legal and institutional framework in the country of implementation allows for generating quality gender and environment statistics.
3. Examine existing statistical practices in the country of implementation for similar surveys.
4. Identify gaps and information needs, taking into account national strategies and priorities, research, laws, policies, programmes and projects.
5. Engage a variety of stakeholders in the identification of information needs, including through dialogues across government sectors and with civil society, media and academia.
6. Review available gender statistics, and ascertain gender-environment data gaps in the information needs assessment.
7. Draft a list of key indicators to produce with the gender-environment survey. The key indicators can draw from the list of 100 gender-environment indicators suggested for gender-environment surveys (available from https://data.unwomen.org/). Many of these are relevant to reporting on progress towards achieving the Sustainable Development Goals (SDGs) and indicators on climate change and disasters, such as those in the Sendai Framework for Disaster Risk Reduction 2015–2030.
8. Certify that the norms governing the functioning of the data collection organization (the national statistical office (NSO) or otherwise), its operations and culture adequately support the generation of quality gender statistics. This includes respecting the Fundamental Principles of Official Statistics as well as international recommendations on the collection of quality gender statistics.
9. Review the logistics plan, and technical and other equipment to ensure they adequately support the generation and dissemination of gender-environment statistics.
10. Make a plan, prior to data collection, for technical issues, such as data processing, storage, archiving, dissemination, advocacy, publication and data user engagement. The plan should include detailed timelines.

2. Producing gender-environment statistics

2.1 Gender considerations for data collection

Gender statistics must accurately measure the participation of women and men in, and their contribution to, society (Hedman et al., 1996). Gender statistics refer not only to social issues but have a cross-cutting nature. For instance, gender statistics are relevant to measure progress across each of the SDGs. As such, gender statistics are produced across the entire national statistical system and include data from a variety of sources and statistical disciplines (Hedman, Francesca and Pehr, 1996). Producing gender statistics requires gender mainstreaming through all stages of the data value chain, including design, collection, analysis, dissemination, communication and use.

Environment statistics have traditionally focused on the measurement of natural resources and phenomena, and only recently expanded to reflect human-environment interactions. It is in this context that a gender angle can be most adequately captured. Survey instruments provide important opportunities to measure this nexus, but it is important to utilize gender-sensitive survey designs (e.g. sampling that allows for disaggregation at multiple levels, does not use proxy respondent practices and sensitizing enumerators to identify and avoid gender bias). Furthermore, as human interactions with the environment often take place beyond the world of work, the information collected must refer to all aspects of life, and not just economic production.

2.2 Scope and coverage

To ensure that a gender-environment survey is comprehensive and reliable, sampling for the survey should reach 100 per cent of the country's target population (e.g. all households and women and men ages 15 and over should be considered for sampling). In select cases the exclusion of specific locations may be required, for instance, due to violence or insecurity that may put the safety of the enumerators or respondents at risk, but these concerns must be addressed before the sample is drawn. Given the topic of the survey, the exclusion of select geographical areas, including remote areas or environmentally hazardous areas, is strongly discouraged. Capturing information from all environmental areas within a country is essential to obtain an accurate overall picture of gender-environment issues.

2.3 Workplan

A workplan is important to specify roles and responsibilities, share workloads, and manage resources and budgets. It will assist in achieving goals, targets, milestones and timelines. An example workplan for a gender-environment survey is showcased in table 2.1.

Table 2.1: Draft detailed workplan for a gender-environment survey

NO.	ACTIVITY	DAYS	RESPONSIBILITY
1	Questionnaire adaptation to national needs, including translation	5	Survey coordinator, in partnership with key data users (policy makers) and UN Women
2	Recruitment of field officers	15	Survey coordinator
3	Training field officers (including CAPI practice)	10	Training coordinator
4	Training report to UN Women or funding entity	2	Survey coordinator
5	Cognitive testing or pilot implementation using a small sample	2	Survey coordinator and survey project implementation team
6	Fieldwork	70*	Survey project implementation team
7	Debriefing of field work to Management	71*	Survey project implementation team
8	Debriefing of field work TAC	1	Survey project implementation team
9	Data validation and cleaning	10	Data quality monitor
10	Data processing and tabulation	15	Data quality monitor
11	Draft data analysis, generation of 100 gender-environment indicators, estimation and report writing	15	Data quality team/ report writer
12	Submission of final report to copy edit and design	7	Survey coordinator

Abbreviations: CAPI, computer assisted personal interview; TAC, technical advisory committee.
Note: Activities marked with an * are expected to occur simultaneously.

2.4 Duration of the fieldwork

The duration will vary across countries depending on a variety of factors, such as population size, number of enumeration areas, ease of travel across and within provinces, distance, environmental conditions, and social norms about greetings and pace of interviews. Importantly, the duration of interviews may also vary substantially across geographical areas, based on the number of environmental hazards that each respondent may have experienced. In most cases, interviews will range between one and three hours. To help calculate a timeline for implementation of the survey, an example is provided in Box 1, although adjustments should be made to reflect relevant factors.

Box 1. Calculating a survey timeline

Imagine implementing a gender-environment survey with the aim of sampling 10,000 people across 20 provinces.

To draw timelines, it is important to consider the travel time required between enumeration areas, both in urban and rural locations, as rural locations are likely to be farther apart. The design of timelines in each country must consider environmental conditions enabling or limiting access to select areas, and social norms around blackout hours, rest days, conducting interviews and human interaction. If sex matching between enumerators and respondents is carried out, this might affect timelines if an insufficient number of women or men enumerators is recruited. If information is available on the number of environmental hazards that affected different areas, additional enumerators should be deployed to areas that have experienced more hazards to limit the overall duration of the fieldwork.

With these considerations, the timeline can be calculated as follows:

In each province, an estimated 25 teams will each cover 20 enumeration areas. They will have one travel day and two enumeration days for each of the 20 enumeration areas. This will come to 60 days for data collection. Assuming six work days and one day off per week, a total of 70 days or 2.5 months will be needed for enumeration. If the provinces are not of equal size, then the allocation of enumeration areas should be proportional to the province size.

2.5 Maps and geospatial information

A detailed map with marked boundaries for the enumeration area helps avoid omission and duplication of households. It should be prepared prior to enumeration to enable the interviewers to locate the selected enumeration area accurately.

The use of geospatial coordinates is highly encouraged if the survey is conducted using tablets. This will be useful for enumerators to locate the households, as well as later on for data analysis. As geospatial information is well suited to capture select climate phenomena, it is recommended to integrate gender-environment surveys with geospatial information for survey analysis.

An interactive map can be used to access the selected area, if available. Hard copies of maps with descriptions of study area boundaries should be used when Internet connections and geo-coordinates are unavailable.

3. Technical approach and methodology

A key feature of gender-environment surveys is that they measure human interactions with the environment, within and beyond economic production, including in the context of leisure. Modules 7 and 8 look at engagement in agriculture, fisheries, mining, lodging and other environmental livelihoods. Therefore, information from labour force surveys, and agricultural surveys can be helpful for identifying the approximate size of the target population; but data from these surveys will underestimate the total eligible population and cannot be considered as a sampling frame for gender-environment surveys.

3.1 Survey instrument

The Model Questionnaire should be used to implement national surveys with as little modification of the sequence and phrasing of the questions as possible. This is because the Model Questionnaire is aligned with international standards and classifications. Refraining from substantial modification will also promote international comparability of the data. Where necessary, adjustments can be made to reflect national specificities if these are not reflected in the questionnaire. The Model Questionnaire covers 10 modules, as described below. Only one member of each household should be selected to respond to questions in module 1 and 2. For modules 3–10, a minimum of one man and one woman age 15 and over per household should answer the questions, avoiding the use of proxy respondents.

Module 1: Household roster

This module helps register data on the age, sex and gender of all household members, including the relationship between them and whether they operate any land or raise any livestock, including fish farming (for identification of agricultural households).

Module 2: Housing characteristics

This module collects data on the characteristics of the dwelling, including condition of walls, roof, floor, land or plot, number of sleeping rooms, and location near environmentally hazardous triggers. Furthermore, it helps gather information on energy-related matters, such as source of electricity, type of cooking fuel or energy source, factors affecting indoor air quality, and person in charge of cooking and gathering cooking fuels, type of heating and cooling systems, and household appliances (including type of cooking stove). Water and sanitation variables in this module include information on source of drinking water and its location, travel time to water source, availability and quality of water, type, location and disposal system of toilet facility, hand-washing information and safety-related questions associated with the use of sanitation facilities, such as illumination, locks and sharing practices.

Module 3: Individual characteristics

Under this module, respondents answer questions concerning marital status, age at first marriage, nationality, educational attainment, ethnicity, disability status and other variables.

Module 4: Disaster and hazard exposure, preparedness and consequences

The focus of this module is on disaster/hazard exposure, early warning, preparedness, experience of consequences and impacts, and environmental decision making associated with post-disaster needs assessment and planning. Each respondent will be given a list of hazards (in line International Hazard Definition and Classification standards) and asked whether or not these were experienced in the past. For each of the hazards experienced, the respondent must provide answers to the full suite of questions in the module. As such, the number of responses recorded must equal the total number of questions in the module, by the total number of hazards experienced. It is important for enumerators to perform this quality check when implementing the survey.

Module 5: Exposure to, and preparedness for, climate related effects

The module includes questions collecting information on the various effects of climate change on each individual and their livelihoods, including information on exposure, preparedness, source of information, mitigation techniques, effects on livelihoods, changes in safety and participation on environmental decision making for climate change mitigation. Like module 4, each respondent is given a list of slow-onset effects and asked whether or not she or he has witnessed them in a reference period. For each of the effects experienced, the respondent must provide answers to the full suite of questions in the module. As such, enumerators must make sure that the number of responses recorded equals the total number of questions in the module, by the total number of effects experienced by each individual.

Module 6: Employment in the green economy

In this module, respondents are asked to provide information on current employment and related work practices to determine whether or not they engage in green jobs. For instance, questions are asked around their engagement in different types of jobs, type of industrial processes, main function at the workplace, production of environmental goods and services and use of environmental technologies and practices in production processes and at work. Many of the questions in this module are only asked to individuals currently in employment.

Module 7: Agriculture and land use

Questions in this module relate to various agricultural and land use practices, including whether each household member operates land, the type of farming they engage in, their income or gain, soil degradation and aggravating practices, irrigation techniques, quality and allocation, type of fertilizer, use of pesticides, environmental risks of agricultural practices, environmental practices for land conservation, organic certification, decision-making around agricultural practices, natural resources and biodiversity in the context of land and agriculture. It is important to note that, contrary to agricultural surveys and censuses, the unit of analysis for this module is the individual and not the agricultural plot. In this regard, the data collected from this survey will differ from estimates generated from agricultural censuses and surveys. The gender-environment survey will capture the practices of all people who interact with land and agriculture, regardless of whether they live in an agricultural household, and whether they grow produce for profit, subsistence or leisure. It is thus discouraged to attach this module to agricultural surveys or censuses, as the reference population used for these instruments will be different.

Module 8: Environment-related livelihoods

This module compiles specific information from populations engaged in fishing, aquaculture, collecting plants, gathering firewood/timber, hunting, use of wild forests, mining, oil pumping, water collection, food and beverage processing/ preservation and storage and garbage picking/

sorting/recycling. It gathers data on engagement in these environment-related livelihoods, harvesting practices, changes in the availability of natural resources over time (due to climate change, environmental degradation or other factors), biodiversity loss, environmentally detrimental practices related to these livelihoods, recycling and reusing of gear and participation in natural resource management and decision-making. As in module 7, information is gathered from all individuals engaging in these practices, regardless of whether they engage for pay or profit, and thus this information will not be comparable with some statistics derived from labour force surveys or agricultural surveys. Furthermore, depending on the prevalence of environment-related livelihoods in each country, the survey sampling strategy may need to make use of oversampling or small area estimation to obtain reliable estimates.

Module 9: Asset ownership

This module includes a sequence of questions to assess ownership of agricultural land at the individual level, including questions on available documentation of land owned, type of document, name listed on the document, right to sell land and right to bequeath land. It also asks the respondent to indicate the size of the land they own, and similar questions around other productive assets, such as whether they own large land or fishing equipment, multiple questions about ownership of dwelling, and questions to ascertain whether they have access to bank account and financial assets. These questions are important in the context of the gender-environment nexus as they help ascertain an individual's capacity to cope with sudden environmental hazards that may have repercussions on their livelihoods.

Module 10: Decision-making and mobility

The module includes questions around the individual's agency to use money, mobility and garbage management practices at home. It also includes multiple questions around means of transportation to ascertain the individual's dependence on public transportation, private vehicles and the frequency of their use, which can help assess their environmental footprint in the context of daily commutes.

3.2 Sample design

All women and men age 15 and over who live in sampled households are eligible to be interviewed. In cases when interviewing all eligible household members is too costly, interviews can be carried out with one randomly selected man and one woman per household (guidance on sample selection is provided in section 3.9).

For finite population inference, probability sampling is considered the gold standard in survey statistics (Yang and Kim, 2020). Probability samples must be chosen using well-known sampling designs to ensure they are representative of the target population. It is worthy of note that, once the selection probability is known, subsequent inference and estimation can be made from the data collected (Cochran, 1977; Fuller, 2009; Sarnda, Swensson and Wretman, 2003).

3.3 Unit of analysis

The unit of analysis in the Model Questionnaire is the individual, apart from modules 1 and 2, in which the unit of analysis is the household. To produce the 100 gender-environment indicators, survey results must be disaggregated at various levels, such as urban-rural location, sex, age, occupation, engagement with different environmental resources, exposure to hazards and different educational levels of respondents (see 3.6 for additional details).

3.4 Target population

The overall purpose of gender-environment surveys is to gather data on all interactions between humans and the environment and the differentiated experiences of women and men in all their diversity. Thus, the target population for gender-environment surveys is defined as all women and men age 15 and over (or age 18 and over in countries where there are legal or operational obstacles to interviewing minors) in a given country. The main disaggregation variables to generate the 100 gender-environment indicators include sex, age, disability status, type of land tenure, location of dwelling, type of water source, educational attainment, type of hazard experienced, type of climate change effect experienced, type of environmental livelihood and ethnicity.

3.5 Sampling frame

A sampling frame, which is a complete list of statistical units encompassing the target population, should be used to create a probability sample for the survey. In lieu of building a new sampling frame, gender-environment surveys may rely on a suitable, officially acknowledged pre-existing sampling frame, such as a population/housing census. During the formulation of the survey design, the quality, accessibility and suitability of the sampling frame to capture the population groups of interest should be assessed.

Sampling methods for gender-environment surveys require a three-stage process. Firstly, primary sampling units (PSUs) will be identified; secondly, households will be selected within each PSU; and finally, individuals will be sampled within each household. Thus, the sampling frame should include information on PSUs as well as on households.

3.5.1 Primary sampling frame of units

The PSUs will be obtained with the help of the survey methods and geographic information systems (GIS) divisions of the NSO, which can provide all the necessary information for selected PSUs, including maps and descriptions. In addition, the information should be uploaded onto the global positioning system (GPS) and the computer assisted personal interview (CAPI) application, where applicable.

3.5.2 Secondary sampling frame of households

Where census data (or other data used for sampling frame) is outdated, field teams must carry out a listing exercise to create a current list of households in each of the selected PSUs. This will serve as the secondary frame for the selection of sample households. After specific households are selected, individuals in the household will be listed and individual respondents sampled.

3.6 Stratification

Stratified sampling is a statistical approach to ensure that each subgroup of interest is adequately represented in the sample. This methodology provides greater precision reduces costs, and it can ensure the sample units are sufficient to support a separate analysis of all subgroups. The actual sorting and separation of the units into designated strata is known as explicit stratification. The sample should be designed and chosen independently for each stratum. To achieve the effect of stratification, units must be systematically sampled from an ordered list, with a defined sampling interval between selected units.

The main goal of stratification is to minimize sampling errors. The sampling mistakes in a stratified sample are determined by the population variance that exists within the strata, but not between the strata. Another important reason for stratification is that it enables a flexible sample design that can be different for each subgroup when there are significant disparities between subgroups, such as in urban and rural locations.

Stratification should only be used at the beginning of the sampling process. For simplicity, systematic sampling would be employed during the dwelling/household selection stage. Note that no attempt should be made to rank the dwelling/household list prior to selection in the hopes of improving the implicit stratification impact. Single-level or multi-level stratification is possible.

In the gender-environment survey, the sampling process must consider the information needed for to generate the 100 gender-environment indicators. To achieve this, two domains should be employed: statistical design and analysis. A design domain is a subpopulation that can be identified in the sampling frame and treated separately in terms of sample size and sampling processes, while an analytical domain is a subpopulation defined by individual characteristics and thus identifiable only at the analysis stage.

For instance, gender-environment surveys typically use separate design domains for urban and rural locations. However, some subpopulations, such as people who witnessed the effects of climate change, cannot be identified in the sampling frame (design domain), and so they are identified in the analytical domain. It is important to ensure that the number of instances (households or individuals, depending on the module) in each survey domain is sufficient for estimates to be trustworthy and meet the desired degree of precision for ecological zones or population groups.

The sample size for a design domain is obtained by partitioning the target population into needed design domains and then calculating the sample size for each domain while accounting for the precision required. It can be difficult to manage the sample size during the design stage to guarantee precision during the analysis. This is more feasible if prior estimations of the average number of target individuals are given. For instance, if statistics on the proportion of people that utilize sustainable marine harvesting practices are to be produced and estimates of the total number of people engaging in marine harvesting are available, then it is possible to calculate the sample size needed to achieve the required precision. It is important to note, however, that for this particular example it is very unlikely that estimates will be available, as the scope of the gender-environment survey goes beyond economic activities, which labour force or other survey data would typically cover.

The set of 100 gender-environment indicators includes indicators for second level domains such as coverage of the marine harvesting population within a hazard prone area (where a hazard prone area is the first level domain, and the marine harvesting population is the second level domain). The second level domain includes smaller subpopulations, thus attention should be paid to the precision required. If many domains are included in the survey, a very large sample size will be needed. Remember that the total sample size needed is the sum of sample sizes required in all first level domains.

To generate the 100 gender-environment indicators, information such as the distribution of people engaging in different forms of environment-related livelihoods (e.g. fisheries, agriculture, logging, garbage management) should be considered, as well as the distribution of people experiencing exposure to environmental hazards. However, when data on these population groups is not readily available to use for sampling, the stratification method should classify the population into the main domains of interest found in the sampling frame. For example, for a gender-environment survey in Thailand, ecological zones and urban-rural locations could be considered key domains of interest (as they can be found directly in the sampling frame and are necessary to calculate many of the 100 gender-environment indicators). The frame would be stratified first into nine ecological zones,[1] and each zone would be split into urban and rural locations to form two strata, yielding a total of 18 strata. If geospatial information on locations exposed to frequent environmental hazards is readily available, it may be used for stratification. Note that all the variables representing the domains of interest must be matched with the indicators that will be produced.

Box 2: Designing the sample for a gender-environment survey, in the event no data on specific variables of interest is available

The recent gender-environment survey conducted in Tonga was the first of its kind in the country. As such, there was a lack of prior data on population groups of interest (e.g. people affected by hazards, people engaging in environmental livelihoods beyond economic purposes, etc.) to produce the 100 gender-environment indicators and design the sample. Thus, the Government performed the sampling as follows:

- Census blocks (PSUs) were used in first stage sampling.
- Stratification included six geographical domains, used in the country for many other surveys and representing all environmental/ecological areas in the country (Tongatapu urban, Tongatapu rural, Vava'u, Ha'apai, Eua and Niuas).
- The first sampling stage for the random selection of census blocks (PSUs) was carried out with probability proportional to size (P1), thus the larger the block, the higher the probability of selection:
  - P(i)=nb*n(i)/N
    Where:
  - P(i)=probability of selection of the PSU
  - nb=number of PSUs to select within the strata
  - n(i)=total number of households in block i
  - N=total number of households in strata

1 Kayah-Karen Montane Rainforests, Northern Indochina Subtropical Forests, Tenasserim-South Thailand Semi-Evergreen Rainforests, Cardamom Mountains Moist Forests, Peninsular Malaysian Lowland and Mountain Forests, Central Indochina Dry Forests, Mekong River, Salween River and Andaman Sea.

- The second sampling stage for the random selection of households was carried out so all households from the same strata have the same probability of selection:

  — P(j)=m/n(i)
  Where:
  — P(j)=probability of selection of household j in block i
  — m=cluster size (e.g. number of households per block)
  — n(i)=total number of households in block i

- The final probability of selection per household was:

  — P=P(i)*P(j).
  This meant:
  — P=nb/N*m
  — Meaning that all households from the same strata had the same probability of selection, but households from different strata have different probability of selection.

- The third stage of sampling was completed using the computer assisted personal interview (CAPI) script, developed by UN Women, which provides automatic random selection of respondents within households. In the case of Tonga, one adult man and one adult woman were selected from each sampled household.

- For sample size computation, given the lack of prior data on the variables of interest, 50 per cent was used as a prevalence behaviour that the survey attempted to measure (the most conservative way to design a sample that leads to the largest sample size). As no variable of interest could be used to design the sample, the sample was built on a 1.5 design effect (explained in section 3.7).

3.7 Sample size

The overall sample size for gender-environment surveys should be determined by the desired precision, number of domains, capabilities of the implementing organization, data quality concerns and available budget. A sufficient sample size is critical to ensure data quality.

It is well known that, in most cases, the larger the sample size, the better the survey precision. To minimize sampling errors, the sample size should be large and groups (strata) representative of the population characteristics. To minimize non-sampling errors (e.g. data collection errors, non-response errors, etc.), which grow with survey scale and sample size, it is important to strike a balance between the need for precision, and the capabilities of the implementing organization.

In a gender-environment survey, at a minimum the sample should include women and men to allow for the generation of sex-disaggregated estimates. In order to generate estimates disaggregated by other variables, the sample size must be expanded to cover each of these domains (location, exposure to hazards, etc). The sum of the minimum sample sizes for each of the domains will return a desirable sample size for the whole survey.

Factors that should be considered to determine the sample size include the following:

1. Minimum number of individuals and households needed for the production of the selected indicators;
2. Prevalence rate of an occurrence, if known from other sources (e.g. how common is the occurrence of women and men engaged in marine harvesting, exposed to disasters, etc.);
3. Expected level of precision or coefficient of variation (CV);
4. Design effect;
5. Non-response rate;
6. Confidence interval (CI);
7. Average household size;
8. Average number of households in an enumeration area;
9. Available human and financial resources.

3.7.1 Sample size computation

Calculating the sample size can be achieved by using the mathematical formula below, which requires that some of the values are taken from existing surveys or the population census.

n=[z²*p(1-p)*d*(1+nse)]/[((e*p)2)*h*r]

Where:

- n=Minimum number of households selected to interview individuals for the production of the desired indicators
- e=Relative error
- p=Prevalence rate of the population of interest
- d=Design effect
- nse=Non-response rate (for households)
- h=Average household size (people per household)
- r=Average size of enumeration area (households per enumeration area)

For example, to fill out this formula, sampling errors generated by existing surveys need to be added. Similarly, the values for the design effect, non-response rate, average number of households per enumeration area and average household size can all be extracted from previous surveys or censuses. If we continue with the Thailand example set out earlier, after inserting all these values into the formula (see below), it returns a minimum number of households per domain of 500. This indicates that, in the sample, the number of households in each of the nine ecological zones should be at least 500. Thus, to get the required sample size for the entire survey, the minimum sample size is multiplied by the number of ecological zones (500*9=4,500).

Therefore, if, according to existing data:

- e=5.3 per cent
- p=0.0791
- d=1.8
- nse=7.8 per cent
- h=3.6 people
- r=140 households

We assume a confidence level of 95 per cent (in a normal distribution 95 per cent of the area under a normal curve lies within approximately 1.96 standard deviations of the mean. Thus z=1.96). Then: n=500

$$n= \frac{(z^2 * p(1-p) * d * (1+nse)}{(e * p)^2 * h * r}$$

$$n_h= \frac{[(1.96 * 1.96 * 0.0791(1-0.0791) * 1.8(1+7.800)]}{[(0.053 * 0.0791)^2 * 3.6 * 140)]} =500$$

Box 3: Exercise: Sample size calculation for a gender-environment survey

This box provides an example using figures for a dummy country to illustrate the calculation of the sample size for a gender-environment survey where a key goal is to compute the indicator "Proportion of fishing/marine harvesting population whose catch (relative to resources) decreased over time, by sex". In any given country, this information may be extracted from an existing survey or census that captures the total number of people that engage in fishing (that is, all those that engage for pay, profit, subsistence or leisure). For this sample, enumeration areas that lack households with people engaging in fishing/marine harvesting have been excluded.

Table 3.1 provides information on the distribution of population that engages in fishing/marine harvesting, by ecological zone, in a dummy country. Table 3.2 shows the distribution of households where at least one person engages in fishing/marine harvesting. Table 3.3 shows the estimates for the proportion of the fishing/marine harvesting population whose catch decreased over time in the dummy country. These are the results that would be obtained after calculating the sample size, implementing the survey and computing the estimates.

Table 3.1: Distribution of fishing/marine harvesting population, by ecological zone

ECOLOGICAL ZONE	FISHING/MARINE HARVESTING POPULATION	HOUSEHOLDS WITH FISHING/MARINE HARVESTING POPULATION	NUMBER OF ENUMERATION AREAS	AVERAGE FISHING/ MARINE HARVESTING HOUSEHOLD SIZE*	AVERAGE NUMBER OF FISHING HOUSEHOLDS PER ENUMERATION AREA
Southern belt	21 569	6 163	205	3.5	30
Middle belt	15 870	4 959	136	3.2	36
Northern belt	11 623	3 874	95	3.0	41
National aggregate	**49 062**	**14 996**	**436**	**3.3**	**34**

* Household size is measured as the number of people per household.
Source: Dummy country population census sampling frame.

Table 3.2: Distribution of fishing or marine harvesting population by ecological zone and sex

ECOLOGICAL ZONE	FISHING/MARINE HARVESTING POPULATION	FISHING/MARINE HARVESTING WOMEN	FISHING/MARINE HARVESTING MEN
Southern belt	21 569	235	21 334
Middle belt	15 870	261	15 609
Northern belt	11 623	136	11 487
National aggregate	**49 062**	**632**	**48 430**

Source: Dummy country population census sampling frame.

Table 3.3: Proportion of fishing/marine harvesting population whose catch (relative to resources) decreased over time, by ecological zone and sex

				95 PER CENT CONFIDENCE INTERVAL		
ECOLOGICAL ZONE	PROPORTION OF FISHING/ MARINE HARVESTING POPULATION WHOSE CATCH DECREASED	STANDARD ERROR (SE)	RELATIVE ERROR OR CV(E)	R-2SE	R+2SE	DESIGN EFFECT
Southern belt	0.670	0.045	0.068	0.563	0.763	1.311
Middle belt	0.614	0.060	0.098	0.474	0.737	3.448
Northern belt	0.374	0.048	0.130	0.273	0.486	1.200
Sex						
Women	0.444	0.034	0.075	0.374	0.523	1.872
Men	0.718	0.036	0.050	0.631	0.791	2.321
National aggregate	**0.29**	**0.053**	**0.050**	**0.270**	**0.500**	**2.000**

Source: Dummy data on sampling errors for an indicator generated from a previous survey.

Scenario 1

Using this method, the sample size is determined using the formula provided in section 3.7.1, with values extracted from tables 3.1–3.3, as follows:

- p= prevalence rate of fishing or marine harvesting population=0.717[2]
- d= design effect=2.000[3]
- nse= nonresponse rate for fishing/marine harvesting households=2.9[4]
- CI= confidence interval 95 per cent[5]
- e= relative error 5 per cent[6]

2 Prevalence rate of fishing or marine harvesting population is obtained from previous surveys.
3 The value of design effect is obtained from Table 3.3, national aggregate of design effect (2.000).
4 Nonresponse rate for fishing/marine harvesting households is obtained from previous surveys.
5 For this exercise, confidence interval is set as 95 per cent.
6 The relative error is obtained from Table 3.3, national aggregate of relative error (0.05 or 5 per cent).

- h= average fishing/marine harvesting household size=3.3[7]
- r=average number of fishing/marine harvesting households in an enumeration area=34[8]
- Number of domains (ecological zones)=3
- Z=1.96 (confidence level of 95 per cent)

As a result, the minimum number of fishing/marine harvesting households to be interviewed during the survey in each of the ecological zones=42. The total sample size will thus amount to 126 households (42*3=126), with two people interviewed in each.

$$n = \frac{(z^2 * p(1 - p) * d * (1 + nse)}{(e * p)^2 * h * r}$$

$$n_h = \frac{[(1.96 * 1.96 * 0.717(1 - 0.717) * 2.000(1 + 2.9)]}{[(0.05 * 0.717)^2 * 3.3 * 34)]} = 42$$

Scenario 2

Using this method, separate sample sizes are calculated for women and men. Thus, this method is preferred for the generation of gender estimates.

First, to calculate the sample size for women, the following values should be used:

- p=0.44
- d=1.872
- nse=2.9
- CI=95 per cent
- e=7.5 per cent
- h=3.3
- r=34
- Number of domains (ecological zones)=3

The result of inserting these numbers into the formula returns a minimum of 57 fishing/marine women to be interviewed for the indicator. As such, the total sample size for women's fishing/marine harvesting households would be 171 (57*3=171).

A similar procedure would be followed for men, utilizing the following values from the tables:

- p=0.718
- d=2.321
- nse=2.9
- CI=95 per cent
- e=5 per cent
- h=3.3
- r=34
- Number of domains (ecological zones)=3

This will return 49 as the minimum number of fishing/marine harvesting men to be interviewed. Thus, the total sample size is 147 (49*3=147).

7 The value is obtained from Table 3.1, national aggregate of average fishing or marine harvest household size (3.3).
8 The value is obtained from Table 3.1, national aggregate number of fishing or marine harvesting households in an enumeration area (34).

3.8 Sample allocation

Assigning different domains may be necessary when there are strata within a domain. This improves sampling efficiency and reduces sampling errors. If there is considerable variation in the size of the domains/strata, the smaller domains/strata may only receive a limited sample size. In this case, a power allocation (Bankier, 1988) can be used.

A power value of 1 corresponds to proportional allocation; a power value of 0 corresponds to equal size allocation; and a power value between 0 and 1 corresponds to a mix of proportional and equal size allocation. Equal size allocation is useful for comparison across domains but may compromise accuracy at the national level. On the other hand, proportional allocation is appropriate for computing national level indicators but may not meet precision requirements at subnational and domain levels. A trade-off allocation is thus recommended for gender-environment surveys.

For these surveys, small domains may be grouped together (for instance, two sparsely populated (contiguous) ecological zones can be grouped together). Similarly, for producing the indicator "proportion of population exposed to hazards whose livelihoods were affected, by sex and type of hazard", it is possible that only a few people have been exposed to a specific environmental hazard (e.g. sinkholes). To avoid oversampling those who experienced sinkholes to the extent this biases the overall sample substantially, different types of hazards may be grouped (e.g. sinkholes, landslides and flooding).

Tables 3.4 to 3.6 are examples of household distribution by province (for a dummy country that has 20 provinces) and location (urban/rural). Note that the household distribution often differs from the population distribution because the average urban household size is typically smaller than the average rural household size. Box 4 (further below) explains how to calculate the sample size using a power allocation.

To generate estimates for most of the 100 gender-environment indicators, several domains need to be paired (each indicator must be paired with any number of domains of interest). Thus, it is important to draw a sample that ensures precision at the domain level. Existing survey data can indicate the number of people needed in the sample to calculate an indicator.

3.9 Sample selection

In each country, the heterogeneity of the population in terms of their environmental, social and economic background requires a sampling frame that is fully representative of their experiences interacting with the environment. For gender-environment surveys, a probability sampling methodology should be used, as this is the only technique that will provide unbiased estimates and allow for the assessment of sampling errors. A probability sample is one in which the units are chosen at random but the probabilities are known and non-zero.

A gender-environment survey should have a stratified sample selected in three stages (first PSUs, then households, then individuals). This will produce a relatively representative sample in the absence of a list of all target individuals to measure indicators of interest (e.g. all population engaged in fishing, affected by disasters, etc.).

Before the sample can be stratified, it is important to consider all domains of interest, which will depend on the indicators to be produced. For instance, if it is important to produce indicators disaggregated by ecological zone, location (urban/rural) and sex, stratification will separate the data from each ecological zone into urban and rural locations and into women and men. The total number of urban and rural locations per ecological zone will determine the sampling strata. Similarly, the total number of women and men per ecological zone will determine the sampling strata (and will be found in the sampling frame). Samples will then be selected independently in each sampling stratum, as follows:

1. In the first stage, enumeration areas are selected from each primary sampling unit, with probability proportional to size (e.g. enumeration areas with a larger number of residential households are more likely to be selected), according to a given sample allocation usually given by a census (such as that in table 3.9).
2. Where this information is not up-to-date, a household listing must be carried out in all selected enumeration areas (this entails visiting each area to draw a location map, record geo-coordinates and identify which residential households are occupied).[9]

9 Some of the selected enumeration areas may have many more households than others. Those with more than 200 households can be segmented before the household listing. Only one segment will be selected for the survey with probability proportional to the segment size.

3. From the household listing, a fixed number of households (such as 20)[10] will be selected in every enumeration area, using equal probability systematic sampling.
4. A household roster (module 1 of the Model Questionnaire) should be completed in each selected household to identify all individuals age 15 and over.
5. Every one of these individuals can be interviewed for the remaining modules in the Model Questionnaire. In countries where, due to limited resources, not all household members age 15 and over can be interviewed, two adults of different sex should be interviewed per household. To select the interviewees from each selected household, either UN Women's script for gender-environment survey implementation in CAPI or the Kish grid method can be used during the listing exercise (see 3.9.4). If the household is a single adult household, only that person will be interviewed.
6. At the data collection stage, interviewers must only gather information from the pre-selected households and individuals. No replacements should be allowed to prevent bias.

Box 4: **Exercise: Using power allocation and conducting sample selection in a gender-environment survey**

This box provides an example of power allocation for a dummy country with a population of 892,649 in its sampling frame. We assume a sample size of 300 PSUs. These have been selected based on the ecological zones for a study with requirements of a minimum sample size of 24 PSUs per domain. Power allocation has been adopted to allocate the PSUs into the 10 ecological zones. Note that values under the power of zero (0), one (1) and between 0 and 1 show the results of the equal allocation, proportional allocation and power allocation respectively. Powers of 0, 0.1 and 1 have been used in the table 3.11. (see table 3.11 and Appendix 4).

Tables 3.4 to 3.6 provide an overview of the population distribution by provinces. These have been added for information only. Tables 3.7 onwards are to be used for the completion of this exercise.

Table 3.4: **Distribution of households by province and location**

PROVINCE	HOUSEHOLD DISTRIBUTION			SHARE OF TOTAL POPULATION (PERCENTAGE)	URBAN POPULATION (PERCENTAGE)
	URBAN	RURAL	TOTAL		
1	328 507	292 842	621 349	7.4	52.9
2	494 127	344 366	838 493	10.0	58.9
3	1 578 935	123 225	1 702 160	20.3	92.8
...					
20	60 975	129 218	190 193	2.3	32.1
National aggregate	**5 075 408**	**3 289 766**	**8 365 174**	**100.0**	**60.7**

Source: Dummy country population census sampling frame.

Household listing will be conducted only in the selected segment.
10 Note that 20 is a dummy number. The number can be 10 or 15 or 25 depending on the total sample size targeted and availability of funds.

Table 3.5: Distribution of population by province and location

PROVINCE	POPULATION DISTRIBUTION URBAN	RURAL	TOTAL	SHARE OF TOTAL POPULATION (PERCENTAGE)	URBAN POPULATION (PERCENTAGE)
1	1 030 916	991 900	2 022 816	6.7	51.0
2	1 589 075	1 182 411	2 771 486	9.2	57.3
3	4 933 620	450 648	5 384 268	17.9	91.6
...					
20	219 501	655 973	875 474	2.9	25.1
National aggregate	**16 849 556**	**13 230 246**	**30 079 802**	**100.0**	**56.0**

Source: Dummy country population census sampling frame.

Table 3.6: Distribution of enumeration areas and average household and size of the enumeration area

PROVINCE	ENUMERATION AREAS URBAN	RURAL	TOTAL	AVERAGE HOUSEHOLD SIZE*	AVERAGE NUMBER OF HOUSEHOLDS PER ENUMERATION AREA
1	1 603	1 555	3 158	3.3	197
2	2 256	2 022	4 278	3.3	196
3	6 352	597	6 949	3.2	245
...					
20	409	1 436	1 845	4.6	103
National aggregate	**26 295**	**25 622**	**51 917**	**3.6**	**140**

* Household size is measured as the number of people per household.
Source: Dummy country population census sampling frame.

Tables 3.7 and 3.8 are similar to table 3.3. but provide information on several domains at once (in this case province and sex). The number of domains must correspond to the indicator that is being estimated.

Table 3.7: Expected survey precision for coastal area, by province and by sex

PROVINCE	PREVALENCE (P)	STANDARD ERROR (SE)	RELATIVE ERROR (E)	95 PER CENT CONFIDENCE INTERVAL E-2SE	E+2SE
1	0.172	0.008	0.049	0.154	0.192
2	0.150	0.004	0.025	0.142	0.159
3	0.199	0..10	0.049	0.178	0.221
...					
20	0.161	0.008	0.049	0.144	0.179
Sex					
Women	0.172	0.010	0.058	0.151	0.195
Men	0.149	0.012	0.080	0.124	0.177
Total	**0.161**	**0.006**	**0.040**	**0.147**	**0.176**

Source: Dummy disaster-prone area prevalence generated from previous.

Table 3.8: Expected survey precision for disaster-prone area, by province and by sex

				95 PER CENT CONFIDENCE INTERVAL	
PROVINCE	PREVALENCE (P)	STANDARD ERROR (SE)	RELATIVE ERROR (E)	R-2SE	R+2SE
1	0.633	0.105	0.166	0.387	0.825
2	0.594	0.078	0.131	0.416	0.749
3	0.791	0.031	0.039	0.714	0.851
...					
20	0.380	0.083	0.218	0.219	0.574
Sex					
Women	0.369	0.018	0.048	0.331	0.409
Men	0.289	0.035	0.122	0.217	0.373
Total	**0.590**	**0.053**	**0.089**	**0.470**	**0.700**

Source: Dummy disaster-prone area prevalence came from previous.

Table 3.9 shows an example of a sample allocation. Table 3.10 provides the sample allocation of enumeration areas and households by ecological zone and by location (urban/rural). These were calculated using the expected number of women and men interviewed in each ecological zone and location (table 3.9). The allocation of women and men features a power allocation with a small adjustment (typically used when a proportional allocation does not meet the minimum number of women and men to be interviewed per domain).

Table 3.9: Sample allocation with number of women and men age 15 and over, by ecological zone and location

	WOMEN			MEN			TOTAL
ECOLOGICAL ZONE	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL	
1	420	180	600	420	180	600	1 200
2	360	300	660	360	300	660	1 320
3	600	120	720	600	120	720	1 440
...							
10	200	320	560	200	320	560	1 120
Total	**6 360**	**3640**	**10 000**	**6 360**	**3 640**	**10 000**	**20 000**

Source: Dummy country population census sampling frame.

Table 3.10: Sample allocation of enumeration areas and households, by ecological zone and location

	ENUMERATION AREAS			HOUSEHOLDS		
ECOLOGICAL ZONE	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL
1	21	9	30	420	180	600
2	18	15	33	360	300	660
3	30	6	36	600	120	720
...						
10	10	16	28	200	320	560
Total	**318**	**182**	**500**	**6 360**	**3 640**	**10 000**

Source: Dummy country population census sampling frame.
Note: Numbers are calculated using the proportions obtained from Table 3.9. For example, when looking at women in ecological zone 1, 70% of women in the sample are from urban area (420/600*100), whereas that of rural area is 30%. Thus, in Table 3.10, the number of urban enumeration areas in ecological zone 1 in the sample is calculated as: 30*70%=21, whereas that of rural areas is 30*30%=9; same applies to the calculation of households.

Table 3.11: Distribution of primary sampling units for equal, proportional and power allocation by ecological zone

ECOLOGICAL ZONE	EQUAL ALLOCATION	PROPORTIONAL ALLOCATION	POWER ALLOCATION (0.1)*
1	30	27	30
2	30	35	31
3	30	91	34
4	30	26	30
5	30	22	30
6	30	19	29
7	30	40	32
8	30	23	30
9	30	11	28
10	30	5	26
Total	**300**	**300**	**300**

Source: Dummy figures from unknown country sampling frame.
*: As mentioned earlier, previous study suggested a minimum of 24 PSUs per ecological zone. In the power allocation, the power of 0.1 is selected as it is the only power in which each ecological zone has a minimum of 24 PSUs.
Note: Detail calculation please refer to Appendix 4.

As a result of this exercise, during the first sampling stage, 500 PSUs were selected using probability proportional to size (see table 3.10). During the second stage, 10,000 households were systematically selected from the listed households (set at 20 households per PSU in this example) to form the secondary sampling unit. This information is useful to compute the second stage probability of selection, which must be considered for the computation weights.

As one adult woman and one adult man are expected to be interviewed in each selected household, and the examples shown in tables 3.9–3.11 assume 10,000 households will be selected for the survey, a rough total of 20,000 individuals will be interviewed in this example, although after accounting for single adult households, this total will differ.

3.9.1 Selecting two adults within the household

When implementing gender-environment surveys without the use of the UN Women CAPI script, which automates random selection (available for download at the UN Women's Data Hub), the two adults could be chosen for interview manually, either by systematic selection or, preferably, by using the Kish grid method. This technique prevents the enumerator from influencing the selection. Module 1 from the Model Questionnaire is used to construct household rosters (questions 1.1–1.5), and the selection is then made from the roster of household members.

Kish grid approach

Each column of the Kish grid represents the number of eligible people in a building or enumeration area, while its rows represent the number of households within the building. The steps to use the Kish grid method are as follows:

1. Determine the size of each household (only individuals age 15 and over should be listed).
2. Count separately the number of listed women and men in the household.
3. Find the column and row of the Kish grid that apply to the household. For instance, using table 3.12 and 3.13, if the enumerator is visiting the sixth household in a building and there are four eligible adult women and six men, then it means that, the second eligible woman as well as the sixth eligible man would be selected to be interviewed (see highlighted sections in tables 3.12 and 3.13).

Procedure to identify the respondent for modules 1 and 2

In gender-environment surveys, modules 1 and 2 are meant to be implemented at the household level only. To select the household member that will respond to these questions manually (without using UN Women's CAPI script), the following steps must be followed:

1. Enter the household and first explain the purpose of the survey to the person opening the door.
2. Identify any household member age 15 and over able to respond to modules 1 and 2. This could be the person who opened the door if aged 15 and older. Alternatively, any other person age 15 and over who resides in the household. You may not ask to speak with the household head specifically.
3. Before beginning the interview, explain that the survey includes two household-level modules and several individual-level modules. Explain that both respondents are selected at random, and thus do not necessarily need to be the household head.

Procedure to identify the respondents for modules 3 to 10

For the selection of two respondents at random, where UN Women's CAPI script is not used, the following steps must be followed:

1. In line with the eligibility criteria (age and sex) identify individuals eligible to respond to the modules of the questionnaire.
2. If more than one woman and one man age 15 and over reside in the household, select the respondents by using the Kish grid.

Table 3.12: Kish grid template for selection of women

NUMBER OF THE HOUSEHOLD WITHIN THE BUILDING	NUMBER OF ELIGIBLE WOMEN AGE 15 AND OVER WITHIN THE HOUSEHOLD									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
1st	1	1	1	1	1	1	1	1	1	1
2nd	1	2	2	2	2	2	2	2	2	2
3rd	1	1	3	3	3	3	3	3	3	3
4th	1	2	1	4	4	4	4	4	4	4
5th	1	1	2	1	5	5	5	5	5	5
6th	1	2	3	**2**	1	6	6	6	6	6
7th	1	1	1	3	2	1	7	7	7	7
8th	1	2	2	4	3	2	1	8	8	8
9th	1	1	3	1	4	3	2	1	9	9
10th+	1	2	1	2	5	4	3	2	1	10

Note: To build a Kish gird table, the number of eligible adults will be used to fill out the values per column. For instance, column 4 (4 eligible in a household) is numbered 1, 2, 3 and 4 downwards, and then repeats. Column 2 (2 eligible adults) is numbered 1, 2 downwards, and then repeats.

Table 3.13: Kish grid template for selection of men

NUMBER OF THE HOUSEHOLD WITHIN THE STRUCTURE	NUMBER OF ELIGIBLE MEN AGE 15 AND OVER WITHIN THE HOUSEHOLD									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
1st	1	1	1	1	1	1	1	1	1	1
2nd	1	2	2	2	2	2	2	2	2	2
3rd	1	1	3	3	3	3	3	3	3	3
4th	1	2	1	4	4	4	4	4	4	4
5th	1	1	2	1	5	5	5	5	5	5
6th	1	2	3	2	1	**6**	6	6	6	6
7th	1	1	1	3	2	1	7	7	7	7
8th	1	2	2	4	3	2	1	8	8	8
9th	1	1	3	1	4	3	2	1	9	9
10th+	1	2	1	2	5	4	3	2	1	10

If the selected household member is not available to be interviewed, it is important to find out when she/he would be available and try again. Under no circumstances should enumerators randomly select another respondent from the same household. After three unsuccessful tries, the interview should be abandoned as a casualty (Kapur, 2010; Kish, 1949; Lewis-Beck, Bryman and Liao, 2003), to avoid selection bias.

To ensure the sampling procedures are accurately followed, it is important to train enumerators thoroughly. Training should be conducted for not less than two weeks, and it should include separate sections for each of the modules of the gender-environment survey. This is because different sampling and interviewing procedures may apply to some of the modules (such as those addressing land ownership, engagement in agriculture and other environmental livelihoods).

4. Survey implementation

4.1 Recruitment

The selected enumerators should meet a minimum set of qualifications, including holding a degree, having fluency in local languages and knowledge of the culture and traditions of the area, and having experience in data collection and computer/tablet literacy. In addition, people that have experience with environment and/or gender data collection would be well suited to participate as enumerators or supervisors. For gender-environment surveys, both women and men enumerators must be recruited. Evidence shows that some women are more likely to reveal confidential information to women enumerators when asked about sensitive issues. To ensure that sufficient field officers are available for survey implementation and to compensate for any unforeseen circumstances, additional (standby) interviewers should be recruited.

4.2 Training

Training of field staff is essential prior to collecting gender-environment data. In particular, targeted technical training on environmental issues and on avoiding gender bias is key to ensuring the quality of data and proper procedures during field operations, while training on listing exercises is important to ensure the sampling process is carried out accurately and only those who are sampled are interviewed. Both types of training are crucial for the generation of gender-environment data, and the training should be conducted in sequence.

4.2.1 Technical training on environmental issues and avoiding gender bias

Targeted technical training on topics such as environmental hazards and gender social norms are essential to ensure the quality of the data and prevent bias. For instance, enumerators must be familiar with international hazard definitions, and receive training on basic gender data collection principles prior to going to the field. Targeted training to provide basic knowledge on the SDGs, the Sendai Framework and other indicator frameworks to which the gender-environment survey may contribute to, will also be key to promoting accurate data interpretation and use. A minimum of one day should be allocated for general training, including on the basics of collecting survey data (e.g. turning refusals into responses, utilizing revisits rather than replacements, etc). This should be followed by technical training covering each of the modules. A minimum of 4 days should be allocated for module-by-module training, where technical definitions are shared with the enumerators, along with cues to help respondents understand each of the questions, per the enumerator's manual (refer to enumerator's manual for further details).

The timing of the training is key to ensuring the quality of the data collection. Training should be organized two weeks prior to survey administration. It should be followed by a week of testing and practicing by the enumerators.

4.2.2 Listing training (where listing is needed)

Additional training on household listing is necessary when the sampling frame (population census) is not recent or hasn't been updated in recent years. It typically lasts one full day. The target participants are listers, which may or may not differ from enumerators. A draft listing form appears in Appendix 2. The listing training should focus on teaching enumerators how to complete the form without errors. Information on the steps, rules and data collection principles involved in listing must be provided during the training. For example, buildings may be hard to find if they are behind trees or hills, or they may be hard to identify if they are under construction. To find residences, listers may need to follow paths heading away from rural centres, examine riverbeds and other water bodies for potential dwellings on boats and above-water structures, and speak with locals or community members.

Listing trainings should cover the issue of segmenting large enumeration areas if needed. In the event of an unusually large enumeration area, one of its smaller segments may be selected for inclusion and listing as long as its characteristics are representative from an environmental point of view (e.g. the climate, topography, population density are similar across segments). This decision should not be made by the lister alone, but rather in consultation with survey coordinators. If segmentation of an enumeration area is needed, the lister must attempt to divide it into the fewest possible parts, so the segments have 150–200 households each. Unless absolutely necessary, splitting an enumeration area into many segments (more than three) should be avoided in order to reduce errors. Ideally, segments should be of equal size, demarcated by boundaries that are visible. Listers must draw a location map of the entire enumeration area during the first visit and divide the area using observable boundaries like roads, waterways, and electricity lines.

Box 5: Exercise: Segmenting an enumeration area prior to listing

An enumeration area of 650 dwellings has been divided into three segments based on topography and urbanization characteristics (see table 4.1). Remember that, for gender-environment surveys, each segment must have environmental characteristics that are representative of the enumeration area.

A number between 0 and 100 will be chosen at random by the head office and assigned to the file for each sizable enumeration area that has to be segmented. For segment selection, listers must compare the cumulative size of each segment to this random number and choose the first segment where the total length exceeds or is equal to the random integer. For instance, if the random number 67 is generated, segment number 3 would be chosen, and the household listing procedure would be carried out in segment number 3. Listers then make a thorough sketch map of segment 3 and list all the households in it.

Table 4.1: A summary of segmentation calculation

SEGMENT NUMBER	NUMBER OF DWELLINGS	PERCENTAGE	CUMULATIVE PERCENTAGE
1	230	35	35
2	200	31	66
3	220	34	100

Listers must report the total number of households accurately, as these will be used for household selection. For sample segmentation, listers must report the proportion of the total population of the enumeration area that is included in the segment, as this is needed for the calculation of population weights. To provide this information, the household selection template must be accurately filled out (an example of household selection template is provided in Appendix 3). In particular, the following steps are necessary for filling the form:

1. Populate the listed households (N).
2. Determine the sample size (n).
3. Find the sample interval by dividing N by n.
4. Generate the random number.
5. Fix the random number to avoid changes of figures.
6. Determine the random start by multiplying the sample interval by the random number.
7. Add the random start to the sample interval by fixing it, and determine the second number
8. Repeat until the sample size is 20.

The steps for systematic selection of households within enumeration areas should start from a random beginning point and will continue until the requisite sample size is reached. This achieves a pre-determined sample of households while avoiding any potential bias that interviewers may introduce if they were to choose households to interview in the field. It is important that interviews are only conducted with the pre-determined households. The selected buildings and dwellings can be marked on the maps given to the enumerators to facilitate survey implementation.

4.2.3 Cascade training and trial fieldwork

In many contexts, it will be impractical to train all enumerators and field supervisors at once, as proper interaction is difficult with large numbers of participants, and there may be limitations associated with language/need for interpretation. As a result, training is often given to supervisors and permanent NSO staff, who will train enumerators and field staff afterwards. Adequate time needs to be allocated to allow for proper cascade training.

The training should include both classroom instruction and trial fieldwork. Allowing interviewers to role-play asking the survey questions and recording the answers is a particularly effective approach. In gender-environment surveys, it is likely that respondents will ask questions around definitions of specific hazards (e.g. the meaning of a "persistent pollutant contamination episode"), exact agricultural practices (e.g. what qualifies as organic farming) or livelihood-related practices (e.g. what qualifies as by-catch). Furthermore, it is important that respondents understand the difference between natural hazards, disasters and the effects of climate change. Trial fieldwork will provide opportunities to identify the level of knowledge of the general population on these issues so that enumerators can prepare adequately for actual data collection. Purposive field practice, whereby some households recently exposed to environmental hazards are identified in advance, is desirable though logistically more complicated.

4.3 Team composition

In addition to good training of enumerators, quality supervision on the field is key. Typically, supervisors are selected from trainees based on performance during trial, leadership ability/engagement during training classes, and good understanding of all concepts and definitions. The latter can be tested with a final training quiz. Supervisors will undergo extensive training in all aspects of the gender-environment survey before overseeing data collection.

Examples of a team composition and team workload are showed in tables 4.2 and 4.3.

Table 4.2: Example of number of field officers by category

S/N	TYPE OF FIELD OFFICER	NUMBER REQUIRED	NUMBER TRAINED	STANDBY
1	Field enumerator	75	80	5
2	Supervisor	25	26	1
3	Driver	25		
	Total	**125**	**106**	**6**

Table 4.3: Example distribution of enumeration areas and households by team

TEAM	ENUMERATION AREAS			HOUSEHOLDS		
	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL
1	12	8	20	240	160	400
2	9	11	20	180	220	400
3	16	4	20	320	80	400
...						
25	4	16	20	80	320	400
Total	**318**	**182**	**500**	**6 360**	**3 640**	**10 000**

4.4 Fieldwork

Once training is complete, teams of interviewers are assigned a list of enumeration areas and deployed to the field. A team leader or supervisor is assigned for each interviewing team. She or he will distribute the sampled households among the interviewers. After locating a selected household, the interviewer will begin with module 1 of the Model Questionnaire, to complete the household roster and enable the selection of eligible women and men members of the household.

In the event of failure to contact a household or an eligible person in the first visit, the interviewer is required to make at least two repeat visits, or call backs, on different days and at different times of the day before the interview is abandoned. The process of making call backs requires the teams to stay in a cluster for a whole day. Some countries propose large interviewing teams in order to try to cover an entire enumeration area in one day. This process is not acceptable for a gender-environment survey, because non-response will bias the survey results (e.g. households where members are more likely to be out at sea, working in the fields or absent all day due to engagement in other environment-related livelihoods may return non-response but it is essential to reach them. Similarly, households damaged or affected by hazards may also return non-response, but these need to be reached). Efforts to record responses from difficult units are important to remove bias.

Box 6: Illustrative example for field operations, timelines and staff

In the example in tables 4.2 and 4.3, data collection for the 10 modules of the Model Questionnaire will be carried out by 125 field officers (25 teams) from 20 July to 29 September. Each team is assigned 20 enumeration areas, and a team is expected to complete enumeration in each area in three days' time. The survey will be administered to 20 households in each of the 500 enumeration areas to yield a total sample of 10,000 households. The total number of days allocated for fieldwork will therefore be 70 days, including one rest day per week. Senior officers will monitor the fieldwork. If cultural practices permit, it will be important that the resting day does not overlap with the resting day of people performing environment-related livelihoods among the target population (e.g. if most people in agriculture, fisheries, logging, etc. rest on Saturdays, survey enumerators should rest on a different day to ensure they are able to reach he target population).

In this example, tablets will be used for data collection, although Internet coverage is not available in remote areas. During the interviews, enumerators will enter the data using tablets, and at the end of the day data entry personnel will transfer it to a computer or centralized database if an Internet connection is available. A server will be set up at the head office and the data will be transferred through secured Internet file transmission during this time period.

4.4.1 Pretest

Given the nature of gender-environment surveys (with long questionnaires, technical language around environmental issues, a target population not necessarily aware of environmental risks, and the need for sensitivity to gender-related issues), pretests must be conducted for all modules prior to survey implementation. The pretests will help to determine whether the questionnaire is easily understood in all local languages and whether all concepts are known by interviewees. They will also provide an indication of the expected survey duration, which can help Survey Managers estimate the total survey time and resources needed. It is important that all modules are pretested, with special emphasis on modules 4, 5, 7 and 8, given their technical nature. A key concept for enumerators to test has to do with respondents recognizing their engagement on a variety of environmental activities. This is particularly important in communities where one type of environmental livelihood prevails (e.g. coastal communities where marine harvesting is performed by most), as the survey must capture all interactions of individuals with the environment (i.e. enumerators must make sure that respondents understand they also need to provide answers about other environmental livelihoods, such as gardening, foraging or food processing, even if this is not their main economic activity or even if this is only performed for leisure).

4.4.2 Monitoring, evaluation and reporting

To ensure full coverage and high-quality data, supervisors and field monitors should be deployed. They must assess compliance with the sampling strategy as well as concepts, definitions and classifications of gender-environment data. For instance, monitors will ensure that field data collection instructions are followed, and that both enumerators and supervisors collect and edit information adequately, in line with these guidelines and international hazard definition and classifications.

In addition, it is advisable that field data collection officers, supervisors and monitors write a daily field progress report. This will ensure transparency and accountability.

4.5 Communications strategy

Putting in place a targeted communication strategy is key to ensuring data use and avoiding data waste. An effective communication strategy will help increase awareness on the gender-environment nexus and give visibility to the data, once it is available. The communication strategy should include activities that take place before and after publishing the data. Prior to data collection, advocacy on the importance of the data will ensure the buy-in from decision-makers, civil society organizations and academics, all of which are target data users for this survey. In addition, a communications strategy should help to establish the trustworthiness of the data among the public.

Communications should be targeted to each of the survey thematic areas, depending on the target population groups. For instance, if a government is in the process of reviewing its natural disaster management strategy, policymakers in that area should receive targeted communications about the data on modules 4 and 5, including what the information means, possible uses and new findings. If a government is revising its development strategy or if it needs data to report progress across the SDGs, then a broader advocacy strategy would be needed for the sustainable development coordination body, covering all survey modules. In addition, targeted communication strategies should also be put in place for specific interest groups (including groups beyond government), such as fisher unions or forest management bodies.

Communication strategies should go beyond simply planning the release of a survey report and a launch event, and should envisage the preparation of targeted products, communication to targeted groups and separate dialogues with different stakeholders to promote data use.

5. Data analysis and report writing

5.1 Data processing, storage and archiving

The usual data processing practices may be followed for gender-environment surveys. Notably, the following, among others, may be key steps:

1. Ensure the data quality monitoring strategy has been implemented adequately.
2. Examine data quality by performing supervisor re-interviews.
3. Assess data quality using server and error reports.
4. Confirm that data documentation is thorough and, if not, edit and revise the data as needed.
5. Design and implement a tabulation plan.
6. Implement the data cleaning process comprehensively.
7. Evaluate data estimation within urban/rural and national domains, as well as any other domains identified as relevant during the design of the tabulation plan and identification of research questions.
8. If new compound variables are calculated and added to the data set (e.g. population that experienced a natural hazard, population working in green jobs, etc.), ensure all classifications align with international standards and calculations are error-free.
9. Ensure no errors are introduced into the data set during preparation prior to storage.
10. If data on gender-environment indicators is available from previous surveys, run comparisons of estimates to see if trends make sense or if large discrepancies can be observed.

A full guideline on data management and cleaning for gender-environment surveys can be found at data.unwomen.org.

5.2 Report writing and dissemination

Since different questions within gender-environment surveys are asked of different population groups, appropriate sample documentation is required. A sample design document and a list of PSUs should be included in the sample documentation. The methodology, sampling procedure, sample size, sample allocation, survey domains and stratification should all be detailed in the sample project plan. This should serve as the basis for a sample design appendix to the final survey report. The identification information for all selected sample points as well as their likelihood of selection should be included in the sample list.

The survey report must include all key findings from the survey without overwhelming the reader with too much background information. In particular, to identify the key statistics to highlight in the report, writers must look at the research questions identified in dialogues with data users prior to conducting the survey. Separate publications can be produced targeting different sets of potential data users, to maximize impact and increase the chances of data use.

Although survey reports usually mirror the structure of survey questionnaires (e.g. one report chapter per questionnaire module), gender-environment survey reports must take into consideration cross-module information. For instance, to calculate the proportion of people with ownership and tenure of agricultural land disaggregated by sex, information from modules 1 and 9 is necessary. Statistics on this indicator would be best placed in the survey report under a chapter on asset ownership, but the indicator can also be used as an important disaggregation variable for modules 4 and 5 on disasters and climate change. It may be relevant to calculate the proportion of people who saw their livelihoods affected as a result of environmental hazards, with disaggregation by sex and by whether or not they own land, as land is an important asset to enable people to access loans and other forms of financing that may increase their capacity to cope with disasters.

Given the wide variety of topics covered in gender-environment surveys, and the limited space available in survey reports, it will be important that access to microdata is provided to researchers and a wide range of data users free of charge, so useful analysis can be performed to respond to many research questions. Besides survey reports, it is also recommended to produce other communication materials, such as videos, social media posts, info graphics and events, to enhance the reach to various population groups.

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Appendix 1: Computation of weights

A1.1 Why weighting

A gender-environment survey sample is a representative sample randomly selected from the target population. Each interviewed unit (household and individual) represents a certain number of similar units in the target population. In order for any statistical inferences drawn from the survey data to be valid, this representativeness of the sample must be taken into account. Sampling weights are used to make adjustments to the sample so it looks more like the target population.

Due to the complexity and variety of topics and target population groups included in gender-environment surveys, nationwide self-weighting samples are not feasible for these surveys, and sampling weights are always necessary. Even when a survey is designed to be nationally self- weighting, it is necessary to correct for the different response patterns across domains/strata.

Since the gender-environment survey sample is a two-stage stratified cluster sample (followed by individual sampling from each selected household), sampling weights will be calculated based on sampling probabilities separately for each sampling stage and for each cluster. In particular, weights will be calculated as follows:

- P_{1hi}: first-stage sampling probability of the i^{th} PSU in stratum *h* from the sampling frame
- P_{2hi}: second-stage sampling probability within the i^{th} PSU (household selection)
- n_h: number of PSUs selected in stratum *h*
- M_{hi}: measure of size (number of residential households) according to the sampling frame in the i^{th} PSU
- ΣM_{hi}: total measure of size (total number of residential households) in the stratum *h*

The probability of selecting the i^{th} PSU in stratum h from the sampling frame is calculated as follows:

$$P1hi = \frac{n_h M_{hi}}{\Sigma M_{hi}}$$

- S_{hi}: proportion of households in the selected segment compared to the total number of households in PSU *i* in stratum *h* if the PSU is segmented, otherwise S_{hi} =1
- L_{hi}: number of households listed in the household listing operation in cluster *i* in stratum *h*
- m_{hi}: 20 (number of households selected in the cluster)

The second stage selection probability for each household in the cluster is calculated as follows:

$$P_{2hi} = \frac{m_{hi}}{L_{hi}} * S_{hi}$$

The overall selection probability of each household in cluster *i* of stratum *h* is therefore the production of the selection probabilities:

$$P_{hi} = P_{1hi} * P_{2hi} = \frac{n_h M_{hi}}{\Sigma M_{hi}} * \frac{m_{hi}}{L_{hi}}$$

The design weight for each household in cluster *i* of stratum *h* is the inverse of its overall selection probability:

$$W_{hi} = \frac{1}{P_{hi}} = \frac{\Sigma M_{hi}}{n_h M_{hi}} * \frac{L_{hi}}{m_{hi}}$$

Design weights should be adjusted for household non-response and for individual non-response for women and men. The differences of the household sampling weights and the individual sampling weights are introduced by individual non-response.

The final sampling weights must be normalized to ensure the total number of unweighted cases are equal to the total number of weighted cases at the national level, for both household weights and individual weights. The normalized weights are relative weights which are valid for estimating means, proportions and ratios, but not valid for estimating population totals and for pooled data.

The sampling weights for the various indicators would be calculated in a similar way for women and men at the national level so that the combined prevalence for women and men is valid.

Sampling errors would be calculated for selected indicators for the national sample, as well as for each domain of interest, such as urban and rural locations and ecological zones.

A1.2 Design weight (base weight)

Since the probability proportional to size (PPS) selection is not self-weighting, the sample data has to be weighted. These weights, generally called sample weights or design/base weights, are the inverse of the inclusion probability.

Therefore, the weighting factor (or expansion factor), W_{hi}, for a household in the i^{th} selected PSU in the h^{th} stratum is the reciprocal (inverse) of the overall probability of selecting that household.

That is,

A1.3 Non-response adjustment

To adjust to non-response the number of households successfully interviewed in each PSU is used in the computation.

The final weight for the sample households in the j^{th} cluster within the i^{th} sample PSU in stratum h is:

$$W_{hi} = W_{hi} * \frac{b'}{b''}$$

b'= Number of interviews plus the number of no interviews in the sample cluster

- b''= Number of interviewed sample households selected in the j^{th} sample PSU within the i^{th} sample stratum h

A1.4 Post stratified adjustment

Finally, the estimated totals and subgroups of the population must be compared with current statistics. Should there be marked differences, another adjustment factor can be applied to the non-response adjusted weights so that the subgroup totals from census data are reconciled with those of the survey. In countries where no previous rounds of the gender-environment survey exist, comparisons over time will not be possible. Nevertheless, rough comparisons with employment statistics, agriculture statistics and other forms of environment statistics can be attempted, always keeping in mind that gender-environment surveys will return different results as they capture human interaction with the environment beyond the production boundary.

A1.5 Estimates of sampling errors

Many of the available statistical software packages can support the estimation of sampling errors. Therefore, for instance, the statistical package for social sciences (SPSS) Software Complex Samples (CSPlan) module can be used for estimating the sampling errors, the relative error (e), coefficient of variation (CV), confidence limits, design effect and square root of the design effect. Similarly, package *svy survey* in Stata, package *survey* in R and package *proc surveymeans* in Statistical Analysis System (SAS) will achieve these calculations. Remember that a CV exceeding 20 per cent is considered very low and signifies that the sample size is too small (see table A1.1).

Table A1.1: Interpretation of the reliability co-coefficients

NO.	RELATIVE ERROR (E) (PERCENTAGE)	INDICATOR
1	1–<5	Highly precise
2	5–<10	Good precision
3	10–<15	Acceptable if close to 10 per cent
4	15–<20	Less precise and cannot be used for policy matters
5	20 or more	Very low precision, must be used with caution (sample size is too small)

Sampling errors, coefficient of variation (CV), confidence limits, design effect and square root of the design effect should be computed for all selected key indicators (see table A1.2). Note that draft sampling errors will be different for each key indicator. Refer to the list of 100 gender-environment indicators to see the full list of reference populations and inform your calculation of sampling errors.

Table A1.2: Expected survey precision for prevalence by ecological zone and by adult women and adult men together

ECOLOGICAL ZONE	PREVALENCE (P)	STANDARD ERROR (SE)	RELATIVE ERROR (E)	95 PER CENT CONFIDENCE INTERVAL	
				R-2SE	R+2SE
1	0.988	0.002	0.002	0.983	0.992
2	0.980	0.001	0.001	0.977	0.983
3	0.971	0.004	0.004	0.961	0.978
...					
10	0.978	0.004	0.004	0.967	0.985
Total	**0.979**	**0.002**	**0.002**	**0.973**	**0.984**

Appendix 2: Draft gender-environment survey listing form

Page I___I___I of I___I___I

Gender-environment survey 2022
Listing form

GES serial No.:I___I___I___I   Urban-rural: ...I___I   Locality name:..
......
Enumeration area number: ... I__I__I__I   State/district: .... I__I__I   Province: .... I__I__I
Mapper: .... I__I__I   Lister:...........................I__I__I

LEAVE BLANK										
SELECTED HOUSEHOLD NUMBER	SERIAL NUMBER OF HOUSEHOLD	SERIAL NUMBER OF STRUCTURE (1)	ADDRESS / DESCRIPTION OF STRUCTURE (2)	RESIDENCE Y/N (3)	SERIAL NUMBER OF HOUSEHOLD IN THE STRUCTURE (4)	NAME OF HOUSEHOLD MEMBER (5)	SEX (6)	AGE (7)	HOUSEHOLD SIZE (8)	OBSERVATION/ OCCUPANCY STATUS (9)

Appendix 3: Household selection template using systematic selection approach

	Number of households																							
EA	Listed (N)	Selected (N)	Selected intervals (N/N=SI)	Random (0–1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	138	20	6.9	0.03800	1	8	15	21	28	35	42	49	56	63	70	77	84	90	97	104	111	118	125	132
2	151	20	7.6	0.65268	5	13	21	28	36	43	51	58	66	73	81	88	96	104	111	119	126	134	141	149
3	182	20	9.1	0.97489	9	18	28	37	46	55	64	73	82	91	100	109	119	128	137	146	155	164	173	182
4	129	20	6.5	0.41931	3	10	16	23	29	35	42	48	55	61	68	74	81	87	94	100	106	113	119	126
5	180	20	9.0	0.53756	5	14	23	32	41	50	59	68	77	86	95	104	113	122	131	140	149	158	167	176
6	173	20	8.7	0.70405	7	15	24	33	41	50	58	67	76	84	93	102	110	119	128	136	145	154	162	171
7	140	20	7.0	0.51868	4	11	18	25	32	39	46	53	60	67	74	81	88	95	102	109	116	123	130	137
8	69	20	3.5	0.25579	1	5	8	12	15	19	22	26	29	32	36	39	43	46	50	53	57	60	63	67
9	176	20	8.8	0.96775	9	18	27	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	167	176
10	90	20	4.5	0.40192	2	7	11	16	20	25	29	34	38	43	47	52	56	61	65	70	74	79	83	88
11	131	20	6.6	0.32702	3	9	16	22	29	35	42	48	55	62	68	75	81	88	94	101	107	114	121	127
12	92	20	4.6	0.76363	4	9	13	18	22	27	32	36	41	45	50	55	59	64	68	73	78	82	87	91
13	126	20	6.3	0.41681	3	9	16	22	28	35	41	47	54	60	66	72	79	85	91	98	104	110	117	123
14	199	20	10.0	0.84599	9	19	29	39	49	59	69	79	89	98	108	118	128	138	148	158	168	178	188	198
15	225	20	11.3	0.91906	1	22	33	45	56	67	78	90	101	112	123	135	146	157	168	180	191	202	213	225
16	205	20	10.3	0.12089	2	12	22	32	43	53	63	73	84	94	104	114	125	135	145	155	166	176	186	196
17	148	20	7.4	0.88941	7	14	22	29	37	44	51	59	66	74	81	88	96	103	111	118	125	133	140	148
18	146	20	7.3	0.25095	2	10	17	24	32	39	46	53	61	68	75	83	90	97	105	112	119	126	134	141
19	139	20	7.0	0.14534	2	8	15	22	29	36	43	50	57	64	71	78	85	92	99	106	113	120	127	134
20	201	20	10.1	0.84172	9	19	29	39	49	59	69	79	89	99	109	120	130	140	150	160	170	180	190	200

Appendix 4: Allocation of primary sampling units using power allocation

ECOLOGICAL ZONE	POPULATION	0	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
1	79 269	1	3.089657	9.545983	16.77938	29.49382	91.1258	281.5475	869.8854	2687.648	8303.911	25656.24	79269
2	105 099	1	3.178044	10.09996	18.00527	32.09812	102.0092	324.1898	1030.289	3274.304	10405.88	33070.34	105099
3	270 436	1	3.493063	12.20149	22.80427	42.62058	148.8764	520.0346	1816.514	6345.198	22164.18	77420.87	270436
4	76 189	1	3.077437	9.470621	16.61396	29.14524	89.69266	276.0235	849.4452	2614.114	8044.773	24757.29	76189
5	66 430	1	3.035543	9.214523	16.05429	27.97108	84.90743	257.7402	782.3815	2374.953	7209.272	21884.06	66430
6	56 632	1	2.987488	8.925085	15.42643	26.66359	79.65715	237.9748	710.9469	2123.945	6345.261	18956.39	56632
7	120 453	1	3.221675	10.37919	18.62964	33.43838	107.7276	347.0634	1118.126	3602.237	11605.24	37388.31	120453
8	69 858	1	3.050855	9.307718	16.25751	28.3965	86.63362	264.3066	806.3613	2460.092	7505.384	22897.84	69858
9	32 323	1	2.824562	7.978152	13.40843	22.53479	63.65092	179.786	507.8167	1434.36	4051.439	11443.54	32323
10	15 960	1	2.632105	6.927979	11.23979	18.23517	47.9969	126.3329	332.5215	875.2317	2303.702	6063.587	15960
Total	**892 649**	**10**	**30.59043**	**94.05071**	**165.219**	**290.5973**	**902.2777**	**2814.999**	**8824.287**	**27792.08**	**87939.04**	**279538.5**	**892649**

SAMPLE OF 300

		EQUAL[1]	POWER ALLOCATION[3]										PROPORTIONAL ALLOCATION[2]
ECOLOGICAL ZONE	**POPULATION**	**0**	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1**
1	79 269	30	30.30023	30.44948	30.46753	30.44814	30.29859	30.00507	29.57356	29.01166	28.32841	27.53422	26.64059
2	105 099	30	31.16704	32.21654	32.69347	33.1367	33.91724	34.54954	35.02683	35.34428	35.49919	35.49101	35.3215
3	270 436	30	34.25643	38.91993	41.40736	43.99963	49.50019	55.42111	61.75617	68.49286	75.61207	83.08789	90.88768
4	76 189	30	30.18039	30.20909	30.16716	30.08828	29.82208	29.41637	28.87866	28.2179	27.44438	26.56946	25.60547
5	66 430	30	29.76954	29.3922	29.15093	28.87613	28.23103	27.46788	26.59869	25.63629	24.5941	23.48592	22.32568
6	56 632	30	29.29826	28.46896	28.01089	27.52633	26.48535	25.36144	24.17012	22.9268	21.64657	20.34395	19.03279
7	120 453	30	31.59493	33.10722	33.82718	34.52033	35.81856	36.98723	38.01301	38.88414	39.59074	40.12504	40.48165
8	69 858	30	29.9197	29.68947	29.51994	29.31531	28.80497	28.16768	27.41393	26.55532	25.60427	24.57391	23.47776
9	32 323	30	27.70045	25.44846	24.34665	23.26394	21.16341	19.16015	17.26429	15.48311	13.8213	12.28118	10.86306
10	15 960	30	25.81303	22.09865	20.4089	18.8252	15.95858	13.46354	11.30476	9.447637	7.858974	6.507426	5.36381
Total	**892 649**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**	**300**
MINIMUM			**24**										

1. *Equal allocation*: $\frac{\textit{Total PSUs required}}{\textit{Number of ecological zone}} = \frac{300}{10}$ = 30 PSUs per zone

2. *Number of PSUs in $zone_x$ under proportional allocation*:300* $\frac{\textit{Population of zone}_x}{\textit{Total population}}$

   For example, number of PSUs in $zone_1$ is = 300* $\frac{79269}{892649}$ = 26.64

3. The calculation of power allocation involves 3 steps:

   Number of PSUs in $zone_1$ using power (0.1) = *Population of* $zone_1^{\text{power selected}}$ = $79269^{0.1}$ = 3.09........(step 1)

   Sum of all PSUs needed in $zone_1$ to $zone_{10}$ = 3.09+3.18+3.49+3.08+3.04+2.99+3.22+3.05+2.82+2.63=30.59........(step 2)

   Number of PSUs in $zone_1$ using power (0.1) and a sample of 300 PSUs= 300* $\frac{\textit{Answer from step 1}}{\textit{Answer from step 2}}$ = 300* $\frac{3.09}{30.59}$ = 30.3........(step 3)

   Repeat step 1 to step 3 to obtain the number of PSUs required in each zone.