ILRI MANUAL

61

Implementation manual for launching and maintaining sentinel zones

Drought Index-insurance for Resilience in the Sahel and Horn of Africa (DIRISHA) project


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Implementation manual for launching and maintaining sentinel zones

Drought Index-insurance for Resilience in the Sahel and Horn of Africa (DIRISHA) project

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Disclaimer

Acronyms and abbreviations

DIRISHA	Drought Index-insurance for Resilience in the Sahel and Horn of Africa
DRF	Drought risk financing
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
MUAC	Mid-Upper Arm Circumference
SC	Sentinel cluster
SE Strata	Socio-environmental classes
SZ	Sentinel zone

Summary

There are several index-based drought risk financing (DRF) products available for pastoral regions, and many more new products are being proposed. These products commonly rely on indices generated from satellite-collected data as proxies for local environmental conditions, thereby avoiding costly ground-data collection for developing risk profiles, assessing local conditions, and making payments. While these index-based DRF products are promising, their accuracy and value are not guaranteed, and some ground data are required to calibrate, monitor, and assess them. Specifically, data are needed that can track the spatial and temporal dynamics between environmental conditions through household production, to household welfare, if the tools are to accurately mitigate the impacts of drought on households. Unfortunately, these data are almost entirely missing for pastoral areas in the Intergovernmental Authority on Development (IGAD) region. The sentinel zone concept was developed to meet this need by establishing a network of high-frequency and longitudinal data collection clusters specifically considering the pastoral production system and the social and environmental strata of the rangelands in the IGAD region. This manual provides guidance on how to launch and maintain a sentinel zone to those collaborating on this agenda.

Introduction

There is increasing interest and investments in drought risk financing (DRF) tools for pastoral systems. Nonetheless, existing data is insufficient for assessing the quality or improving these tools in most pastoral regions (ILRI 2021). The sentinel zone (SZ) concept aims to address this gap by maintaining a network of SZs, sampled for socio-environmental representativeness, that generate indicators specifically developed to track the impacts of drought on the productive resources and welfare of households, and at a frequency appropriate for tracking their dynamics (Fava and Jensen, 2021). Within the SZs, indicators from each of these domains—rangeland conditions, value of production, and household consumption—are quantitatively measured, to reflect the changes before, during and after droughts.

Data collection is performed weekly by a network of contributors. While there are many possible models for such arrangements, it is important to ensure that contributors are local, so that they are aware of the circumstances and conditions in the participating community, and that they can consistently collect repeated measurements in specific rangeland locations, markets, and households.[1] The longitudinal nature of the data generated by the SZ network is one of its key features, so consistency is extremely important.

Information on rangeland forage conditions is collected from specific transects of pastures identified in each sampled community. This task includes a set of images and subjective forage-condition assessments, which are then used to estimate the fraction of bare ground, the composition of vegetation, and trends in available forage. Together, these three indicators are all aimed at tracking forage available for livestock production in the region.

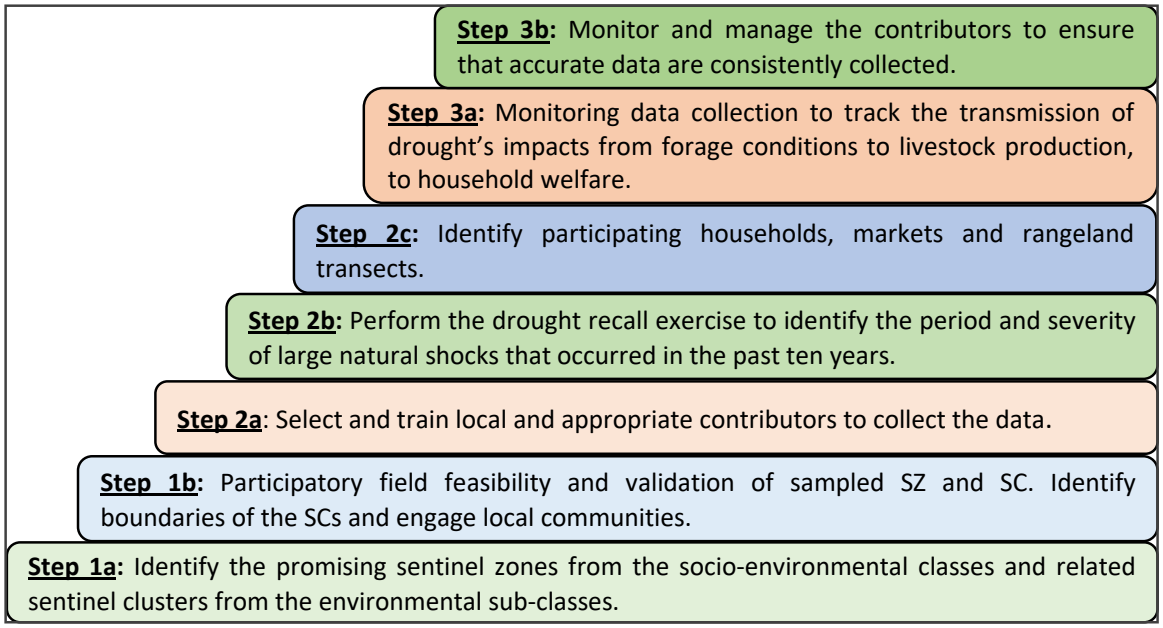
Forge conditions then impact household welfare through, among other channels, livestock productivity, which is tracked through milk production, livestock births, livestock losses, and livestock body condition within the participating households. While such production can be consumed directly through milk or livestock slaughter, the value of production is impacted by market prices, which can also be sensitive to forage conditions, so commodity and livestock prices are also tracked. Indicators of consumption and food security then provide metrics of household wellbeing. More details on motivation for the selected indicators can be found in Fava and Jensen (2021) and this report provides more details on sampling and how to collect the indicators.

The SZ network was launched in March of 2021 with two SZs, one in Ethiopia and one in Kenya. These two sites provided an opportunity to refine the sampling and data collection protocols developed in Fava and Jensen (2021), as well as develop training programs for contributors and participants. Ideally, several stakeholders in the pastoral regions will launch SZs moving forward, potentially with or without support from the current research and implementation team. This document targets an audience interested in launching an SZ in their area of operation.

This manual is a guideline on launching an SZ to integrate the data it generates into the broader SZ network database. Figure 1 summarizes the critical steps that are taken when setting up a functional SZ.

1 Recruiting local data collectors can also help to build community engagement and buy-in, both of which are not only important for sustained long-term data collection, but also for complimentary objectives related to empowerment, extension, disaster planning, and provision of information (O'Sullivan-Winks, 2020).

Figure 1: Steps for setting up and maintaining an SZ and SC.



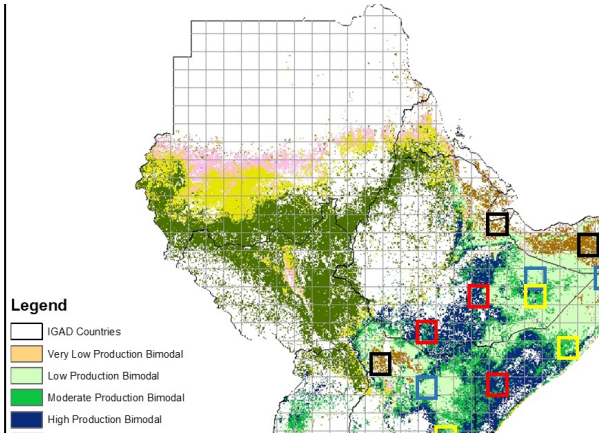
Step 1 – Setup of the sentinel zones

1.a - Selecting sentinel zones and identifying sentinel clusters

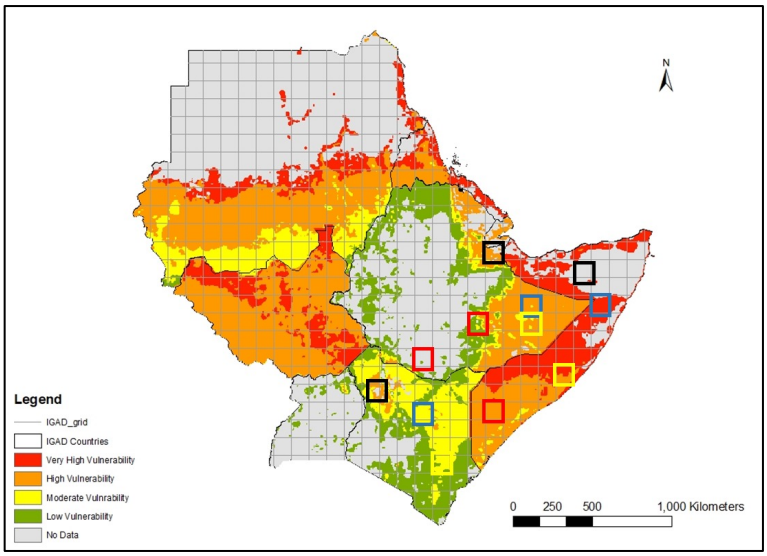
The objective of the SZ network is to provide information that can be used to track the environmental and household production and welfare conditions over time at a temporal and spatial resolution that is sufficient for assessing and improving DRF tools. In this section, general principles for selecting the SZ location within a large region and, subsequently, the specific sampling locations, are illustrated. It should be noted that this is not a rigid procedure, as it could and should be customized based on the most recent and accurate geospatial data available to characterize pastoral systems both environmentally and socio-economically.

In the framework of DIRISHA, the SZs are sampled from socio-environmental classes (SE Strata henceforth) as described by Fava and Jensen (2021) and illustrated in Figure 2. The two layers were selected for the IGAD region, and they are openly available [2]. However, alternative geospatial products can be used for the initial stratification of the region of interest based on environmental and socio-economic criteria.

Figure 2. Environmental (i.e., rangeland production) (top panel) and social (vulnerability to drought) (bottom panel) strata for SZ sampling. The squares indicate suggested locations for SZs.



2 For the drought vulnerability see Cooper et al. (2019). For the environmental classification, data can be requested at: n.kahiu@cgiar.org



Source: Fava and Jensen (2021).

As examples, the boxes in Figure 2 represent suggested locations for SZs in the IGAD region with bimodal seasonality. These suggestions are created to illustrate the concept and are not intended to be prescriptive in shape, size, or location. But there are some parameters and recommendations to follow when locating an SZ. Notably, the SZs should be located and shaped so that there is not a great deal of variability within the SZ in the SE Strata shown in Figure 2. The idea is that each SZ focuses on and represents a single SE Strata.3 As is discussed below, sub-sampling within SZ will capture heterogeneity within that SE Strata, so that the SZ network will provide information on both the variation between SE Strata (between SZs) and heterogeneity within SE Strata (within SZ). For example, the easternmost blue square in Figure 2 is mostly low rangeland production in the regions with bimodal seasonality (top panel) and with high social vulnerability (bottom panel). One should use the maps in Figure 2 to identify areas of operation where there are fairly large regions (e.g., 100 km2) dominated by a single SE Strata.

Once prospects for SZs have been located, local knowledge should be used to identify regions that are appropriate for this exercise. Recall that the intention is for the SZ to provide information on pastures and pastoralists that depend on them. Therefore, the SZs should be in regions where livestock is commonly grazed and represent a primary source of income for households; that is, populated pastoral regions.[4] In addition, while selection bias is always a concern, logistical and security considerations, such as accessibility, conflict, and national boundaries, should also be considered.[5]

Once a SZ location has been identified, sentinel clusters (SC) are selected, one from each of the main environmental sub-classes of the primary SE Strata in that SZ. This environmental sub-stratification within the primary SE Strata aims to capture environmental heterogeneity within the SE Strata. Here again, the implementor will use the local context to locate appropriate communities and related pastures for their SCs. Each SC should include pastoral households and the rangelands that the community members commonly depend on. These parameters might result in SCs that are quite misshapen as pastures are rarely spread uniformly in all directions for households. What is important, is that the households in the SC commonly depend on the rangelands within the SC.[6] With regard to the spatial or

3 In (the likely to be common) cases where there are more than one SE Strata within an SZ, focus on the dominant class.

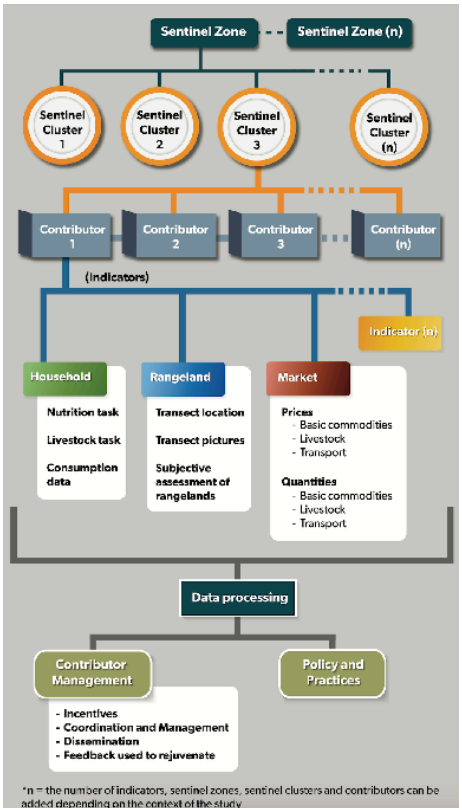
4 Populated is specified because there are many dryland areas that are not populated, for example, large regions without any dependable access to water or conservation areas that herders are not allowed to access. Such regions would generate less useful information for the network.

5 Conflict and insecurity pose an especially relevant issue in pastoral regions. Insecure regions are systematically underrepresented in data collection efforts. Because SZ management is, for the most part, remote, it is quite possible to operate SZs in conflict-prone regions and even during conflict events. But, given the extreme scarcity of these types of data from any pastoral regions, and the course sampling strata, launching SZs in conflict prone regions seems unwise and not worth any potential risk to the contributors or participants, who could be singled out merely because they are participating in a long-term program.

6 In some pastoral settings, livestock are held very far from the household or households are truly nomadic. Each of these poses a special problem, but the general idea is to track the forage conditions in pastures that are important for a typical group of pastoralists, and the household production and welfare of those pastoralists.

population size of the SC, there are no hard bounds, but the implementation plan calls for sampling 8 households within each SC that have livestock, have at least one child less than 5 years old, and commonly use the sampled rangelands. One would hope that the 8 households are drawn from a larger roster of relevant households (i.e., the SC has more than 8 households that fit the criteria). The distribution of population and rangelands will play a large role in determining the boundaries of the SC (Figure 3).

Figure 3: Technology driven high frequency indicator tracking for sentinel sones in rural settings.



*n= the number of indicators can be added depending on the context of the study

1.b - Participatory field feasibility and validating sampled SZ and SCs

The conceptual formulations and justification of the sampled SZ and SCs need to be followed by a field visit to each SC. The field visit provides an opportunity to verify that the sampling process has selected a relevant region (in respect of the project objectives), to identify SC boundaries, and to begin planning for efficient operations. The field visit requires a technical team that is familiar with the research objectives and sampling design, and a familiarity with the local context. These visits also provide the opportunity to introduce the project to the regions and to begin identifying allies within local institutions, government offices, and communities.

The suggested engagements during this initial scoping mission can be structured into the following themes.

Community entry should take place with local chiefs, relevant local ministry representatives and administrators, and pastoral associations. The first objective is to help stakeholders understand the goals of the project and to link those project goals to other stakeholders. A second objective is to create awareness and build trust in the region. The conditions necessary for the activity to be rolled out in the SC are also outlined and verified.

Collecting community details (key resources) starts with identifying landmarks in the region that are crucial in the pastoral productions – ritual sites, watering points, general assembly points or areas vital to the pastoral community. In most parts of the dryland system, localised names of rangelands or other biophysical features help collect community details. The activity also includes collecting information on the composition, spatial distribution and the

population of communities living within an SC. The intention is to have an idea of specific communities within the SC that could be targeted for data collection. For instance, urban centres are avoided since they will likely be populated by people that rely less on pastoral activities. Also, communities living close to the edge of the SZ or in transition zones are avoided as they are more likely to herd their animals outside of the SZ or in a different socio-ecological zone. The information obtained is used to identify a representative community within the SC for monitoring.

Identifying normal grazing boundaries of the main pastures commonly used by community members for each of the wet and dry seasons. These pasture resources are considered key feed reserves during dry and wet seasons where most households in the community send their animals for grazing. Therefore, the frequency of grazing and the number of households relying on the identified pasture resource is the key aspect of this exercise. It is preferred to sample from communities that graze within the original SZ and SC boundaries. If there are communities grazing much beyond the pre-defined SC boundaries during these normal periods, they are excluded from the targeted group. However, in cases where a large proportion of communities often graze outside the pre-defined zones, then the boundaries are revised to reflect the situation in the communities.

Eliciting common livestock and pasture management strategies will ensure that the communities selected are not outliers in herd composition or herd management. Ideally, the sampled communities in the SC would be reasonably similar to other communities in the SC and even the SZ. Therefore, communities with very different rangeland management policies or herd composition than most of their neighbours should be avoided. For example, if most households in most communities in a SC herd both cattle and goats, we would not want to sample from a community where most households have only camels or mostly grow crops rather than own livestock. The intention is to be consistent with a representative sample of grazers and browsers kept in the SC. All else being equal, it is better to have communities where more types of animals are herded and especially grazers, which rely on forage that is usually more sensitive to drought.

Information on general grazing patterns and pastoral resource governance is also important to obtain. It helps to understand the utilization and management of the rangelands. For example, some communities preserve specific pastures for the dry season or have individual enclosures to be used for sick or lactating animals. Information should also be collected on the types of available vegetation, and how they are distributed within the SC. Together, with information on the spatial distribution of dry and wet season pasture, the details on livestock management and distribution of forage types are used to identify the rangeland transects with community members.

Eliciting common markets, while not necessary for selecting SCs, is an activity that can be performed with the same group of individuals and at the same time, as the above verification activity. The objective is to identify the markets commonly used by communities within the SC for purchasing and selling commodities, milk, and livestock. In many cases, there will be small local markets for purchasing commodities and occasional sale of livestock. However, larger and more important livestock markets will fall outside of the SC boundaries. If these larger markets are frequently used by community members, then those markets should also be included in the data collection activities.

Step 2 – Set up data collection

2.a Contributor selection and training

Once the SCs have been identified and validated, the next step is to recruit a network of contributors who will support the project by helping to facilitate future activities and collect the weekly surveillance data. Each SC will have at least two contributors. As much as possible, the contributors should be recruited from the local communities to reduce the burden of data collection (both on the contributor and participating households), reduce the risk of missing data, and to minimize costs. Local contributors can more easily locate and travel to participants and visit local rangelands, which can minimize attrition and missing data. It also lowers the cost of field activities and puts the contributor in a position to recognize gross misreporting. There can also be advantages related to language and trust. As such, contributors should have the following traits.

- They should live and work within the target community.
- They should be trusted by the community members because the job includes engaging community members and visiting households.
- They should have knowledge and understanding of the communities and the livelihoods within the SC.
- They should have prior knowledge of the local livestock and commodity markets, an understanding of the market operations and have contacts at the market.
- They should be literate and able to use digital data collection tools.
- They should have some familiarity with smartphones so that learning to collect the smartphone-based surveys is not a large burden.

A good practice is to collect a list of potential contributors from the local stakeholder during the SZ and SC validation exercises. These stakeholders can use their understanding of the project and their local knowledge to identify promising candidates. The candidates' interest and competence should then be assessed by the technical team. In this case, the candidate must be someone the team can trust to work with. This is because these contributors will often act as liaison with the community and participants, and sometimes they can be responsible for handling payments to participants. The selected team is invited for training, but a list of other potential candidates should be held in case a replacement is needed in the future.

All the contributors within an SZ should be trained at one time in a location within the SZ if possible. A single training for all the contributors is not only cost-effective, but also helps facilitates peer-to-peer learning and builds comradery within the team, which can be important when contributors need to ask their colleagues for ICT support or to help cover each other's activities when necessary.

The training program should start by explaining the project's objectives and then outlining the expectations for the contributors and the incentive structure. At that point, trainers should check with each contributor to be sure that they are available for the project period and are still committed now that they understand what is expected of them. In our experience, there is often a risk that candidates attend training to collect per diems/stipends with little intention of participating for the duration of the project, for example, if they are a student and plan to return to a distant school in a month. While some contributors will end up resigning from their position, it is frustrating and wasteful to have one leave just after training, which would require identifying and training a new candidate. Further, high turn-over rates could negatively impact consistency and quality of the data.

Once the contributors have committed, they should be trained on how to access and use the data collection platform. All data is collected on smartphones using a mobile survey application. The survey software (application/ platform) will have some basic hardware and system capacity requirements, and some tasks require that photos and GPS points are taken, so the devices and software must be compatible with those needs. Certainly, the software should function offline. The International Livestock Research Institute (ILRI) uses the KAZNET platform to task contributors, but the survey forms could be directly launched on any Open Data Kit (ODK) service or could be migrated to another platform.[7] No matter the data collection software used, training should include hands-on training on phone maintenance: charging, how to add airtime and internet bundles, how to download and install apps, how to use location services, best practices on taking photos, and a discussion about connectivity requirements for submitting data. Once the phone maintenance issues are covered, it is time to turn to the survey application. Work with the contributors to download and install the application. Credentials for the survey software should be created logically - so that contributors can easily remember them - and documented by the project in case they are lost by contributors. It should be assumed that contributors will change phones and potentially sim cards

7 The KAZNET platform is a micro-tasking platform that was developed through a collaboration between ILRI and ONA (https://company.ona.io/). The platform allows administrators to create tasks, which are ODK survey forms that are geo-fenced (form completion is restricted by location) and can only be completed in pre-designated periods. The contributor engages with the platform through a smartphone application that provides a menu of available tasks and details on the parameters of the task (e.g., incentive, location, and period restrictions) which the contributor can select and complete. See Chelanga et al. 2021).

during the course of the project. Indeed, we have had cases of contributors sharing phones, lost phones, stolen phones, and deleted apps. This is all to say that it is useful for the contributors to know how to download, install, and sign into the programs that they are asked to use.

The survey application training should be hands-on and can take place while training on each of the tasks. Start by describing the three types of data they will be collecting: household, pasture, and market. The details of each task are described in detail in Appendix A, as are links to the paper version of the survey forms. Each of the tasks has its own set of objectives, forms, and protocols. For instance, market tasks are only performed inside markets during market days—any market tasks performed out of these parameters should be rejected. Individual survey questions should be discussed for each of the tasks in terms of the information targeted, how to frame questions in the local language, the link between questions, and quality controls embedded. In these sessions, relevant changes to the surveys can be made in response to feedback from the contributors, for example, by adjusting the acceptable domain of acceptable cattle prices to reflect local conditions or adding hints to remind contributors of the aim of a specific question. Like any data collection exercise, it is important that contributors discuss the meaning of the survey tasking and their translations into the local language.

While training on each task, be sure to highlight and discuss the time and location in which every task can be performed. Data collection is done weekly. This means a contributor should perform each of her/his rangeland transects and visit each participating household weekly. Additionally, contributors will be responsible for attending weekly market days to collect information. There is some flexibility in timing for the rangeland and household data, but most livestock markets, at least in our experience, have specific main market days. Contributors should understand their responsibilities, how they are paid, where there is flexibility, what is expected of them, and the consequences for non-participation.

Contributors are encouraged to communicate effectively and respectfully with their peers, the supervisory team, households, market stakeholders and any interested party in the community. Trainings on formal survey consent and soft skills in communication are part of the training. Use of additional communication platforms (e.g., WhatsApp groups, short message services [SMS]) can be very helpful. The intention of this session is to create avenues for continuous learning during the project period, and to minimize friction from the frequent contact with communities. Forming WhatsApp groups allow for quick and efficient sharing of problems and solutions.

Hands-on training through role playing, practice rounds with selected pre-test households and rangeland transects, and livestock markets help teach contributors about data collection protocols and requirements for quality data. This offers the trainers an opportunity to identify and address weaknesses in the contributors and issues with any task.

2.b Drought recall exercise

The objective of the drought recall exercise is to identify the period, severity and main cause of large natural shocks that occurred in the past ten years to better understand the relative importance of drought in the region and to provide a dataset that can be used to assess the accuracy of drought indices. The drought recall exercise is performed separately, in each SC. It is a participatory activity in the form of focused group discussions with stakeholders drawn from target communities in the SC. The target group of stakeholders is similar to those engaged in the feasibility and validation activity in the SC. A relatively larger number of participants is preferred (e.g., around 10) for triangulation of information; matching shocks to years and assessing their relative magnitude can be challenging. It is strategic to use the newly trained contributors as facilitators to leverage their local knowledge, interpretation of local the language and context, and continued training. It also helps to verify their position in the project to members of the communities.

The drought recall activity requires concentration and commitment by the stakeholders to avoid errors in identifying events, matching them to years and seasons, and ranking them according to severity. Be sure to motive the activity by linking it to that larger agenda.

Start the recall exercise by first developing a series of reference points in time within the recall period, especially at the beginning of the recall period. These reference points help participants place events more accurately and need only be events that took place at a time agreed upon by the group members, for example, elections, cultural ceremonies, locust invasion, football championships, and other unique events that most participants are aware of. The group also needs to agree on the cycle of seasons, when wet season(s) take place, and when dry season(s) take place.

Once the reference calendar is agreed upon, work with the participants to identify the 3 best periods for forage availability. Then begin discussing the worst seasons for livestock. There are several reasons for seasons that are especially bad for livestock and that can cause livestock losses. There are many options on how to progress through this process (e.g., focusing first on drought or first on the seasons with the highest losses, no matter their cause) but the object is the same—to identify the 3 periods with the highest losses due to drought and understand the magnitude of those losses with respect to losses caused by other shocks. A template found in Appendix B provides a structured form for recording the timing, type, and severity of shocks. Notes should also be made and collated for referencing later. These can be lively discussions that could lead to adjustments in the existing monitoring questions or the addition of extra tasks.

During the discussions, focus on the common risks to livestock. To rank the severity of shocks, use a hypothetical starting herd of 10 animals and ask how many would have been alive after the shock. Or, if livestock losses do not seem to well capture the severity of the drought, take note of key coping strategies adopted during and after the major shocks, and use them as an alternative way to rank severity.

2.c Identify rangeland transects

The drought recall exercise provides coarse information on when historic shocks took place and their severity. This is useful for assessing the relative importance of drought and verifying if the drought index accurately captures severe drought. The objectives of the monitoring data are more ambitious, to reveal and track the transmission of drought's impacts from forage conditions to livestock production, to household welfare. Illuminating such dynamics requires high-frequency and longitudinal data across several domains. This requires that we identify a set of rangelands and households to track overtime. In addition, information is collected from local markets to track the terms of trade that livestock producers face, which can exacerbate or mitigate the impacts of drought.

Building on the information obtained from stakeholders during SC feasibility and validation, households, markets, and rangelands are selected from each community. In each SC, our team has used eight households, four rangeland transects, and the 2-4 most commonly used, local, livestock markets. Participating households should be identified by community members. Target households are those with near community-median livestock holdings, have some children below five years old living at the homestead (so that Mid-Upper Arm Circumference – MUAC – measurements can be tracked), that often graze their livestock within the SC, and that have livestock herders living at the homestead (so that household members have information on both household consumption and livestock production). Once the households have been selected, the local contributor and field coordinator should visit the participant and introduce the project to them. Contributors should be made fully aware of the project's objective and timeline. The contributor should walk the participant through the type of questions that they will be asked each week, and it should be clear that participants are expected to work with the contributor to ensure that the survey is collected weekly as much as possible. The contributor should then request and record formal consent from the participant. Compensation/tokens of appreciation should also be discussed at this point, and the participants' eligibility should be verified. Finally, the participant's profile task should be collected by the contributor. This is an excellent time for the field coordinator to provide the contributors with feedback on how they interact with the participants and the data collection platform..

Rangeland transects are identified from the important local rangelands identified during the stakeholder engagements. The technical team, SC contributors, and a community guide should organize targeted visits to

commonly used dry and wet period pastures to identify and mark the potential transects.[8] It is desirable to track both dry and wet period pasture, but in situations where dry period pastures are not well defined or located too far from settlements, additional wet period pastures may be monitored. For proper identification and tracking, each transect is given a convenient and mnemonic name. Once identified, each contributor is assigned two distinct transects to monitor over the project period. The survey tools should be updated to include the transect names for contributors to select them when performing their tasks in the future.

The relevant markets for tracking index commodities, livestock prices, and livestock volumes are identified through community engagements. These could all be in a similar location or quite distinct. For example, commodities prices might be tracked at a local store in a neighbouring community while livestock prices and volumes are tracked at a livestock market in a different location. The objective is to focus on the places that community members use most often for buying and selling the good of interest.

Step 3. Network management

3.a Monitoring data collection

Once the preparatory work is completed, and the contributors have been registered, weekly data collection commences. While this process runs, several monitoring and maintenance activities are required to ensure accurate data is consistently collected and submitted.

Managers should monitor submissions for both quantity and quality. Setting up automated processes for summarizing data, flagging outliers, and highlighting missing data can save time and increase data consistency and quality. Managers should communicate with contributors and, when necessary, replacements (of either households or contributors) should be made quickly and transparently without a great deal of commotion as the project relies on the support of the community members and the team of contributors.

Contributors should be aware that tasks could be adjusted, and methods for communicating changes should be in place. We note that many survey platforms have remote update features, so as long as the contributors are appropriately trained, updating tasks can be quite simple.

3.b Monitor and manage the contributors

The contributor network must be monitored, paid, and communicated with. Communication is the most important component of maintaining the network. Be sure to have clear and simple modes of communication set up. Social platforms can encourage peer-to-peer support, and provide a venue for gamification and information dissemination.

Payments to contributors and participants should be transparent and clear. One option is to send the list of payments to all contributors and participants so that everyone is aware of how much they are receiving and why. In our implementations, contributors are not paid per task and are not paid for contributions that are deemed invalid, for example, if the verification photo cannot verify the task. Managers need to be very consistent, clear, and explicit as to why submissions are rejected. In our experience, contributors become frustrated very quickly if they do not know why their submissions are being rejected. Clear and timely communication can quickly increase and maintain data quality and consistency. Delays in payments or disputes about payments can also be a large issue, but this too can usually be addressed with communication and transparency. Where available, electronic payments systems (e.g., bank transfers, M-Pesa) to both households and contributors can reduce transaction costs and risks. [9]

8 More details on the desirable characteristics of the rangeland transect are found in Appendix A.

9 While there can be many benefits to electronic payment systems, implementors also need to weight them against potential costs related to registration and access, which can cause bias in the sample or impose limits on who in the household control the payments.

Challenges, such as application breakdown, market closures and household attrition are addressed by the system administrator. This implies that the administrator should be on standby and in close contact with the team of contributors to allow timely responses to any issues arising.

Options for long-term sustainability and cost reduction

The long-term viability of sustained data collection requires that there are sufficient funds available to support it. Here we outline the main costs for would-be implementors.

Launching an SZ requires a considerable amount of in-person fieldwork for identifying SCs, community entry, managing the drought recall exercise, identifying rangeland transects, training contributors and recruiting participants. In our experience, the process requires a minimum of 25 days in the field per SZ. For this, we suggest using two staff working together in one vehicle. The main costs for this activity are meals, incidentals and lodging (MI&L) for staff, transportation for staff, MI&L for contributors, transportation for contributors, and finally expenses related to community entry and the drought recall exercise. While the actual rate of MI&L and transportation will vary by site, what is clear is that one would, at a minimum, need to have a budget for MI&L for 50 staff days (2 staff, 25 days each), and 112 contributor days (8 contributors, 14 days each), a vehicle for at least 25 days, resources for contributor transportation (i.e., either reimbursing transportation needs or providing transport) and the budget required for community entry and the drought recall exercise (e.g., transportation for participants, meals provided, drinks, and stipend).

Once the SZ has been launched, the maintenance expenses are reasonably predictable and low. The primary direct expense is paying the contributors. While many different payment schemes are possible, we estimate about USD 15/ contributor/working day, and each contributor works about 2 days per week to cover her/his households, transect points, and market. The project should agree with contributors about who will be responsible for transportation costs and smartphone data costs related to data collection and submission. Participants should be compensated for their time at a rate that is appropriate for using 1-2 hours of their day each week. Projects should also plan to visit each of the SCs every few months after launching data collection. This allows community members and participants to raise any issues before they have festered for long and allows the research team an opportunity to follow up on any curiosities they are seeing in the data. This is also a good opportunity to run a refresher training with the contributors and to work with the community to build engagement, for example by providing summaries of the trends in the data for their region and from other SZs.

Note that the above does not include any staff salaries, which can be considerable considering the amount of time spent in the field for the initial launch, managing the network of SZs, verifying submissions and making payments to contributors and participants, and for using the data.

A rough budget is as follows.

- Initial SZ starting activities cost about USD 15,000 in direct field expenses
- Data collection plus three maintenance trips cost about USD 25,000 per year in direct field expenses
- Hardware and subscriptions: USD3,000
- Field technician: 50% FTE
- Researcher/PI: 15% FTE

The above budget would generate about 52 survey sets from each of 32 households, 52 collections from each of 16 rangeland transects, and 52 survey sets from each of 4 livestock and commodity markets. Because there are many

and varied expenses related to collecting household surveys using conventional approaches, it is not easy to provide a clear comparison between the data collection approaches described here and the more conventional household surveys. However,, as a point of reference, using the same budget our team at ILRI could collect 10-15 rounds of the same surveys from the same sample using conventional methods, rather than the 52 rounds that we will collect using the local enumerator approach.[10]

Best practices

Launching and maintaining an SZ will surely come with a host of challenges and issues. We close this manual with a list of best practices for managers and implementors. Above all, be sure to keep the objectives of the mission consistent and accurate data in mind.

Stakeholder engagement: Early and effective mobilization of stakeholders for engagement in all the participatory processes is crucial. It not only reduces costs but helps to draw a broad range of stakeholders; both those that happen to be available and those that are near the site on the day of activities, which should improve the quality of the discussion and community buy-in. These stakeholders will also provide a channel for feedback during the implementation. It is important to schedule activities around local calendar of events, such as market days or traditional ceremonies. It is also good practice to plan a feedback session with the local stakeholders and participants a few months after data collection has commenced. This is a time to show the community some of the uses for the data being collected, receive any feedback on how to better meet the SZ's objectives and identify any grievances before they have had a long time to fester.

Communication channels with contributors: Having clear and easy communication with contributors is one of the most important strategies for maintaining consistent and accurate data collection. The DIRISHA team has experience maintaining several remote teams and communication consistently surfaces as the most important management practice. Be sure to set up a number of appropriate communication groups (one for SZ contributors, one for each SC) with a member from the implementation team that is responsible for monitoring and replying to issues that arise. In our experience, poor communication is the leading cause of poor quality or missing data.

Streamlined processes for data quality monitoring: A streamlined process for monitoring data should be used to monitor and provide feedback on data quality and quantity in a timely fashion. Data submitted should be checked and validated soon after submission. This helps to identify errors, make corrections, and follow up on delayed submissions. Rejected data should be accompanied by a justification, and whenever appropriate, an individual follow-up call should be made (especially early in the implementation). This should be supported by well-built front-end (phone side) data quality controls including timestamps for ensuring data is collected during the required times, GPS locations associated with submissions, maximum and minimum rages for variables, and effective skips patterns.

The importance of having consistent, high-quality, weekly measures should be emphasized to contributors. For household data, data collection should be scheduled at the convenience of the participant. Note that the household-level data requires a period when both livestock are available, and the respondent has time.

Flexible data collection software: While most tasks should be stable by the time data collection starts, there is often a need to update tasks or even add tasks as circumstances change. The SZ should be implemented using software that allows for remote updating, and contributors should be trained on that process. In cases where changes are made, the change schedule and details should be communicated in advance. Develop a confirmation process so that contributors confirm that they have updated their tasks and have the correct version of the tool.

10 The above calculation assumes that training costs are approximately equivalent between approaches because the number of data collectors and training content is nearly identical. Further, we assume that both approaches require a field technician to provide the training and manage the data and a researcher/PI to oversee the project. Therefore, direct field expenses of data collection are where the main cost differences are. Assuming that the actual enumerator time spent collecting data is the same for each round, then the main difference is that: (1) there is no public transportation in these regions and 4x4s are needed, which cost $200/day, and (2) providing enumerators with room and board, which costs $30/enumerator/day.

Simple and transparent payment processes: The rewards for each task should be communicated and calculated in such a way that contributors can easily calculate their expected payments and dispute discrepancies. We suggest contributors to be paid per completed and verified task, but there is a threshold for contributing, under which the contributor is replaced. Participants should be paid a single flat rate each week for participating and multiple weeks without participation is the reason for replacement. Payments for both household tokens and contributor rewards should take place at agreed intervals and using previously agreed upon modes. They should be on-time, and any delays should be communicated well and early. In cases of reduced pay due to a high number of rejected tasks, the administrator should provide sufficient explanation to the contributor early enough. It is important to focus on data quality from the beginning to set the expectation high.

Ethical considerations: As with all collection of data that may contain sensitive information, there are ethical considerations to consider when implementing an SZ. There are two main concerns. First, the data collection activities themselves should not pose any risk to contributors or participants. This includes ensuring that the activities are not too large of a burden for the participants and that contributors are paid sufficiently for their efforts. As we have mentioned earlier, it is important to perform community entry activities thoroughly and well, so that community members understand and support the objectives of the project. This community entry should also reduce the risk that participating households are discriminated against by community members, but the contributors should monitor informally for such discrimination. Finally, because there is conflict in many dryland regions, it is important to be sure that the contributors can safely collect the data that they are charged with; pay attention to boundaries between groups of individuals with a history of conflict and be sure that the contributor is comfortable communicating concerns related to conflict to those managing the SZ. Second, the data should not pose any risk to contributors or participants. Anonymizing data before sharing, by dropping identifying information and adding random errors to the latitude and longitude of household locations is one step required for keeping private information safe. In addition, if the information is shared back to communities, it should be aggregated at a level that ensures anonymity for the participating households, which means aggregating to the SZ level since participating households within each SC will be commonly known. Certainly, all activities should be approved by a Research Ethics Board and meet all research requirements of the country.

A final note on collaboration: We hope that this manual has helped you think through the process of setting up an SZ. Please do reach out to the contacts listed in this manual to discuss your implementation. Not only can we provide support, but we also want to be sure to work together so that you are able to meet your objectives in joining the SZ network, and that the data collected by the SZ that your institution is launching, can be integrated into the SZ network's databases.

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Appendix A: Monitoring data collection tools

All the tools are launched in an ONA fork of ODKCollect and technicians use that mobile application to record data. The below table lists all the forms available. The paper-based (pdf) surveys are openly available at this link: https://drive.google.com/drive/folders/1-Xld6K9gtGD129_H-BoT1QEpAqJh3tRy.

The 'pdf' forms do not include all the features of the mobile based application, but they should be sufficient for the reader to examine the content of the surveys. A web-browser version of the form is also available upon request.

Field	Indicators
Contributor	Technician/contributor profile
Rangeland	Forage conditions at transect point
Market	Commodity, milk and meat prices
	Volume of livestock
	Livestock price and quality
Household	Household profile (1-time registration)
	Livestock weight and body condition
	Livestock births, deaths, sale, purchase
	Milk production
	Food security and dietary diversity
	MUAC

Contributors profile task

This task is completed by the contributor, about themselves. It captures the socio-demographic information about the contributor's such age, education, main occupation, among others. The database is useful for both administrative and analytical purposes. This is a one-time task and should be performed at the beginning of the activity with each contributor and for any new replacement contributors as they enter the program.

Household profile

This is also a one-time task that is collected by the contributor interviewing the participant and is used as a registration process. Details of children under five years old are used to build a roster of tasks targeting MUAC measurement. The data should be collected at the homesteads of the households in the sampled communities and any new or replacement household should have their profile collected.

Rangeland forage conditions

Rangeland transects should be located in dry-period and wet-period pastures commonly accessed and identified by the targeted communities. In cases where dry period pastures are practically constraining for the contributors to access (e.g., very far away or changing each season), then focus can be put on wet season pastures. A transect of 100 meters should be defined across an important grazing area in each pasture. The start and endpoints of the transect should be marked or recorded in some way with easy to identify and fixed objects, like poles or rock piles. To perform the transect path, start at one end of the transect and complete the first portion of the task, then the next portion should be repeated at each transect point, which should be spaced every 10 meters, as instructed in the tool. Each time the transect is collected, pictures and GPS should be taken at in a uniform camara position. Nadir images should be taken with arms directly out at chest height. The task includes a question for the contributor to provide an assessment of the conditions at the rangelands where the transects are drawn. Some of the questions require observation and comparison of the transect forage conditions relative to condition in the last visit—mostly a week. For example, a question on whether there was rain at the transects requires the contributors to either observe any changes in the rangelands that could indicate the occurrence of rain. Also, they could tell if it rained over the 7 days if they were present in the community over the period. Other subjective assessments of the rangelands require past knowledge of up to 5 years—so the contributors compare the current conditions to a similar period in the past.

Market prices for basic commodities.

Prices and availability of basic goods consumed in the communities in identified market location are tracked on a weekly basis. In our implementations we track sugar, milk, rice, fodder, meat, beans, and cabbage. Prices of standard measurements of commodities e.g., in kilograms or any other relevant standard applicable in the local context should be used. The task should be performed at the same market every weekly cycle of data collection. Prices should be recorded in the local currency and that currency should be recorded by the survey software. Demand and supply shocks occasioned by changes in environmental conditions are expected to impact the market prices of these commodities commonly consumed by pastoral communities.

Market prices for livestock

Market prices for all animal types traded in sampled markets are collected during the main weekly market. Specific animal categories found to be commonly traded in the market (e.g., mature, moderate, non-castrated animal types) should be selected for tracking to increase likelihood of consistent data. These decisions should be informed by initial market assessment and discussions with community members. During the market day hours, contributors approach a seller who has just completed a deal with a seller, and record the final prices paid for the animal. To increase the representativeness of the data, contributors should be encouraged to make multiple submission within each category each week. Prices should be recorded in the local currency and that currency should be recorded by the survey software.

Market livestock volumes

This task targets data on the number of livestock, per animal type, supplied to the markets for trade at a particular market day. When available and deemed reliable, contributors should acquire the total count of animals bought/sold on that market day, from the records of market management agents. If such records are not available, then the contributor could perform and record a headcount of the number of each type of animal, during the busiest part of the day. As long as the contributor uses a consistent practice, this head-count spot-check, should vary with throughput, and therefor provides an alternative when throughput itself is not available.

Household livestock milk production.

Milk production in pastoral settings is a notoriously difficult variable to track because production is not often tracked by the household. This set of tasks targets two indicators, total milk production within the household's herd and the

milk production of a specific index animal. The idea is that, while the total production is the ideal measure, those at the household may not be able to accurately estimate milk produced by portions of the herd. So, we assume that total milk recorded by the task, is a coarse approximation of total milk produced. Milk production by the index cow should be much more accurate but may not reflect the conditions that other animals in the herd face. Milk production is recorded weekly cycle, but is done so using 24-recall period. Amounts of milk should be recorded in units of measurement that are appropriate for the region, but the amount in litres should be calculated by the survey software and recorded.

Household food consumption

This task targets data on food availability and consumption of different food categories by the households to obtain a household dietary diversity score (HDDS). It also focuses on strategies applied to cope with food shortage—with is commonly referred as 'reduced coping strategy index' (rCSI). The HDD task is developed by following the protocol Kennedy et al. (2011). Household consumption choices from a list of 16 food categories is deemed to indicate access to food and a proxy to nutrient adequacy. The rCSI tasks are made up of questions adopted from Maxwell et al. (2003). The households recall how they managed scarce food times, by re-allocating different quantities across day and night mealtimes. A reference period of 7 days is targeted for both HDDS and rCSI data. The tasks should be performed at homesteads of the sampled households and the contributor should be sure to interview a household member that is well informed on the household's consumption.

Household MUAC

The MUAC measurements for the caregiver and children below five years old are measured in this task. The roster of eligible children is obtained from the household's profile task. They are populated in the MUAC task to reduce the risk of inconsistency in tracking measurements. Eligible children should be precisely identified at each measurement period. Using a tailor-made tape commonly called MUAC-tape, the measurement is taken of the mid upper left arm, while the arm is held in a relaxed position. The tape is calibrated in centimetres (CM), with arrow pointers and colour codes to guide the contributor. See UNIFEC (2020) for more information on the MAUC tapes and a video on how to measure MUAC can be found at https://www.youtube.com/watch?v=3pQUtOsjjSY. Four our project, the MUAC is measurements are taken after every 7 days. The data provides a quantitative measure of severe or moderate acute malnutrition of caregiver and child tracked.

Household livestock body condition and weight

The task entails tracking multiple dimensions of animal's body conditions and weight. Assessment of physical body condition follows standard protocol set by Kenya Bureau of standards (KEBS) of giving body score depending in the appearances of specific body parts. Contributors are trained how to assess and score body conditions of different animal types. Camels and cattle are scored into four categories: fat, moderate, thin, and emaciated. Goats and sheep are scored in three classes: fat, moderate, and emaciated. Following the protocol by Goopy et al. (2017), body weight is measured using standard hearth girth tape. The protocols for measuring cattle are widely used and thus we focused only on cattle on our SC. A specific index cow should be identified in the households for the weekly tracking. The animal body conditions are assumed to change depending in the forage conditions in the accessed rangelands.

Household livestock births, deaths, and trade

This entail recording the numbers of death and births occurrence over the previous seven days among animals herded by a household. The main cause of death is also collected for each reported loss.

Appendix B: Drought recall tools

The table below provides a template for recording the details from the drought recall exercise. These could be recorded separately for different participants or as a group.

Year	3 best seasons	Top 3 drought seasons	Losses from drought*	Worst drought season	Top 3 disease seasons	Losses from disease*	Top 3 conflict seasons	Top 3 flood seasons	Other causes of livestock losses
2010									
2011									
2012									
2013									
2014									
2015									
2016									
2017									
2018									
2019									
2020									
2021									

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