Notes on Sampling for SAVAC Assessments

Sampling Methods

The SAVAC approach of combining a snapshot household survey with an in-depth longitudinal survey includes two different sampling approaches: a two-stage random household and children sample as well purposive focus-group samples of district, village and household representatives. Key to both of these approaches is the selection of villages, which is normally done during assessment planning and is communicated to the provincial and district authorities well before the field work is begun.

The sampling process is highly geographic in nature; it is ultimately an expression of *where* the field teams are going to go. South Africa is well mapped and numerous data exist that are geo-reference in some kind of way, which means that geographic information systems (GIS) are necessary for the process. The author chooses to use QGIS, which is a free and open source software, with a PostreSQL an PostGIS backend (also completely free and open source). By using these software products, valuable tax payer's money is not squandered on expensive licenses. This approach is entirely inline with modern practice on secure and open data platforms, where public resources (such as money and inforamtion) are used with open source software that is not only free, but is scrutinised at source and has well known features (without any hidden "back doors").

Data Source Structure

The main data source for this work is the *Enumeration Small Areas* (ESAs), published by Statistics South Africa and actual population data are available through their Supercross Census Data Set. Some explanation is needed of ESAs, which differ from Enumeration Areas (EAs), the data set that is usually used in most countries as the base for estimating populations in predefined areas (such as livelihood zones).

EAs are geographical units that a single enumerator can theoretically cover in a single day while collecting data for the census. Theoretically at least, enumerators will each count the populations in each of their assigned EAs on the appointed day of the census (in real world practice, it takes a few days and there are many anomalies but this is a managed difficulty). There were 103,576 EAs in the South Africa for the 2011 census, with sizes ranging from a few hundred metres to ten kilometres. However, some parts of the country are extremely sparsely populated while other parts are dense. So some EAs may have very low population and other data counts. South African privacy laws forbid Statistics South Africa from releasing data to the public that can be "reverse analysed" to reveal information about individual citizens, so the census team are forced to combine some EAs with others to ensure that reported aggregate data disguises individual records adequately. After combining the lower-populated EAs, the resultant units are called *small areas* or *enumeration small areas* (ESAs) and are associated with all data collected in the census. However, it is key that many sparse areas cannot be geographically defined to populations, so these sparse areas are "missing" from the ESA data set, appearing as blank spaces on a map. There were 84,907 ESAs in South Africa after the 2011 census.

Statistics South Africa follows the administrative breakdown for the top three levels after national: *provinces*, *district municipalities (referred to as "districts")* and *local municipalities (referred to as "municipalities")*. Thereafter, they break municipalities into *main places* and *sub-places*, which are then broken down into EAs and ESAs. Because EAs and ESAs are not identifiable as places, they have no names but are referred to by their numbers, which are seven digits long for ESAs and eight digits long for EAs. Usefully, these codes themselves also contain information on their enclosing municipalities, districts and provinces.

Livelihood zone boundaries do not respect any administrative boundaries, although they do often align coincidently. An exercise has been performed that overlays the livelihood zones onto the EAs and ESAs and attributes each EA or ESA to the livelihood zone with the biggest area overlaying it. This means that each EA or ESA has the following attributes or database table columns (the database attribute name is in `Monaco font` in brackets):

- EA code or ESA code (ea_code or sa_code);
- Sub-place code (`sp_code`);
- Sub-place name (`sp_name`);
- Main place code (`mp_code`);
- Main place name (`mp_name`);
- Local municipality code (mn_code);
- Local municipality Municipal Demarcation Board code (`mn_mdb_code`);
- Local municipality name (`mn_name`);
- District municipality code (`dc_code`);
- District municipality Municipal Demarcation Board code (`dc_mdb_code`);
- District municipality name (`dc_name`);
- Provincial code (`pr_code`);
- Provincial Municipal Demarcation Board code (`pr_mdb_code`);
- Province (`pr_name`); and
- Livelihood zone code (`lz_code`).

This is in addition to the ID (gid) and geometry (the_geom) columns, as well as a few others for EAs.

Sampling involves the concept of ‘villages’ or ‘communities’ and the nearest approximation to this in the census hierarchy above is the *sub-place*. Therefore, when communities are chosen, the community’s details are obtained from the census by aggregating ESA data by sub-place.

HEA Sampling

HEA Assessments require three levels of sampling: ‘district’ (which in South Africa means local municipality), community (or village or sub-place) and households. Therefore, to get reliable results, reasonable representativeness is required at all three levels.

Usually, field teams will visit up to three local municipalities to obtain information about the general conditions of the livelihood zone they are studying: what crops are grown, livestock are kept, where the markets are, what larger towns are nearby, what other economic activities and opportunities exist and what threats or hazards prevail in the livelihood zone. This is also a chance to confirm the boundaries of the livelihood zone and to check its neighbouring zone. Municipality offices can be busy or officials difficult to locate, so usually the choice of which municipalities to visit for interviewing are made by the higher levels: the district and provincial partners. Some livelihood zones are small and only cover one or two municipalities; in this case the one or both will be visited. In an ideal world, all municipalities would be visited but this would require much extra time and funding to be practical.

The selection of villages is done on a GIS. The ESAs are loaded into view and the symbology is categorised based on the livelihood zone code (lz_code) attribute. Villages are chosen purposively, with the following guidelines: villages should not be adjacent to urban centres, nor should they be predominantly urban themselves (there is an EA attribute that indicates this but it is not found on the ESA feature set); villages should not be on a main road nor at a main road junction and villages should not be too big or atypical of the area in any other way. To see the main roads, the appropriate road or street feature set can be added and the roads categorised (The Open Street Map dataset of roads is very good and is available from WeoGeo (www.weogeo.com). Villages can often be 'seen' on the ESA map as clusters of smaller ESAs, bunched together and interspersed over the zone. By clicking any ESA within the cluster after the 'Identify Feature' control has been activated, the sub-place name and code can be retrieved and recorded. Usually, twelve villages are chosen in each zone.

Villages are added to the selection by inserting the recorded sub-place code into the village code (`village_code`) column, along with the sub-place name (`village_name` column), sampling date (`sample_date` column), livelihood zone code (`lz_code` column) and survey type ('hea', 'continuum' or 'both' into the `survey` column) of the Postgres Sampled Villages table (`zaf.tbl_sampled_villages`). There is a SQL query that does this automatically, `village_addtosample.sql`. The user must just change the sample date (all sampled villages should be selected on the same date for a single assessment exercise) and enter in the required sub-place codes. It is probably wise to do them in batches of four or six villages. Using this query, if the village does not lie in the livelihood zone (perhaps because of a mistake with the code), then it will not get added.

Erroneously added villages, or villages that are not to be visted, can be deleted using another query, `villages_deletefromsample.sql`.

Once the villages have been selected, village authorities can be informed. Normally, ward councillors and traditional authorities are contacted, along with other local functionaries and luminaries. See the section below on compiling the data and presenting it for obtaining village coordinates.

Household sampling is always done in the villages, *after the community representatives' wealth breakdown* during the actual field assessment. This is because the wealth breakdown defines the household representatives' focus groups required for household livelihood strategy interviews. It is key that household representatives are not from the wrong wealth group. Therefore, them team conducting introductions in the villages before the assessment must request the village leaders and community elders key informants to meet at an appointed time but *must not specify the household representatives* as these groups have not been defined. One method used by teams in the field is to conduct all the community-level interviews in each village first and then to revisit the villages for a round of household-level interviews.

Continuum Sampling

Continuum sampling, by its nature, is done differently, since the continuum used randomly drawn samples of individual households and children (the latter for anthropometric measurements). Instead of choosing villages purposively on a map, a list of villages and their attendant populations is put into the sampling algorithm, which carries out a random selection that is weighted for population (i.e, villages with a larger population have a higher probability of being selected, which gives an equal chance for any one household of being selected). The selected villages and their codes can be returned for presentation and to provide information to the local authorities.

Household sampling relies on a spatial sampling algorithm, combined with EA orthophotographs for the selection of dwellings. The exact coordinates of the dwellings can be recorded, along with marks on the photographs to help the enumerators find the correct selected household.

It is important to note that, once a village or household is selected, this cannot easily be changed (the entire selection algorithm should be run again to guarantee a random sample). With the purposive sampling used in HEA, minor re-selections can be made, as long as they are well motivated.

Compilation of the Sampling Data and its presentation

Once the villages have been inserted into they `zaf.tbl_sampled_villages`, they need to be linked to a map, so that users can find them. A further difficulty is that the sub-place name and the real colloquial name for the village often differ, making it impossible to find some villages. The solution is to obtain coordinates of the intended village and, since the village was actually chosen based on its geographical location and not its name, this is actually the most correct way to identify it.

To do this a Postgres view[1] is created, `zaf.vw_sampled_centroids`, that creates a list of points representing the centroids of the village ESA polygons. These points all have the attributes of the villages in `zaf.tbl_sampled_villages`, and are filtered to the most recent `sampled_date`. The resultant centroids can be plotted on a map and the coordinates used with any smart device to find the basic location of the village. They do not necessarily point to the administrative centre of the villages but that can be located easily by the field staff once they have reached the centroid.

Appendix B has a livelihood zone map example, with the selected village centroids shown as stars, coloured blue for continuum, red for HEA and yellow for both.

Appendix C shows the query used to create `zaf.vw_sampled_centroids`.

The query that creates this view is `sampled_village_centroids.sql`. The query also creates a CSV file that lists the villages, including details on their municipalities and locations. The CSV file has been be imported into MS Excel and a pivot table generated from it, which is finally presented in Appendix D.

Appendix A

SQL query: `village_addtosample.sql`

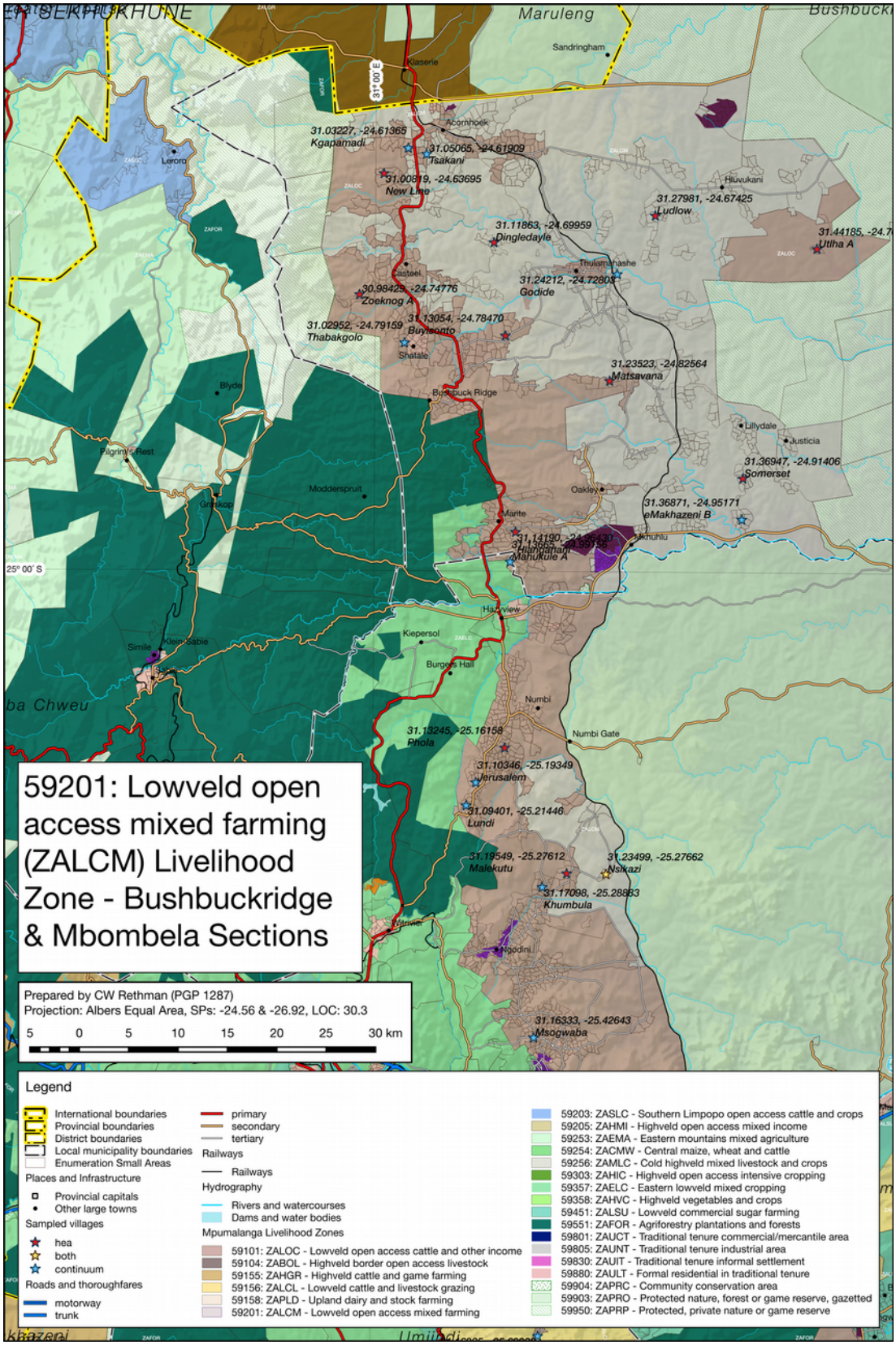
```
INSERT INTO zaf.tbl_sampled_villages (
   village_name,
   village_code,
   lz_code,
   survey,
   sampled_date
   )
   SELECT DISTINCT
      sp_name,
      sp_code,
      lz_code,
      'hea' AS survey,
-- NB: Place your required sample date in here in yyyy-mm-dd format!
      date '2016-10-04' AS sampled_date
   FROM
      zaf.demog_sas
   WHERE
         lz_code IN (
            VALUES (59101), (59104), (59201), (59205), (59303)
         )
      AND
         sp_code IN (
-- NB: Place your required sub-place (sp_code) values in here!
            VALUES (862005001), (863005003)
```

1 A view is a saved query that runs automatically when called. The view contains no actual data (it derives its data from other tables) but it makes data available to another query or to the standard output.

```
            )
;
```

Appendix B

Example of a livelihood zone map showing the selected villages.



Appendix C

SQL query that creates the selected villages centroids view, `zaf.vw_sampled centroids`.

```
DROP VIEW IF EXISTS zaf.vw_sampled_centroids;

CREATE VIEW zaf.vw_sampled_centroids AS
   SELECT
      village_code,
      the_geom,
      village_name,
      main_place_name,
      main_place_code,
      municipality_name,
      municipality_code,
      district_name,
      district_code,
      province_name,
      province_code,
      centroid,
      SUBSTRING(centroid from (POSITION('(' in centroid) + 1) for 8) || ', ' ||
            SUBSTRING(centroid from (POSITION(' ' in centroid) + 1) for 9) AS approx_coord,
      survey,
      sampled_date
   FROM (
         SELECT
            ST_Centroid(ST_Union(the_geom)) AS the_geom,
            ST_AsText(ST_Transform(ST_SetSRID(ST_Centroid(ST_Union(the_geom)),201100),4326)) AS
                  centroid,
            village_name,
            village_code,
            main_place_name,
            main_place_code,
            municipality_name,
            municipality_code,
            district_name,
            district_code,
            province_name,
            province_code,
            survey,
            sampled_date
         FROM (
            SELECT
               village_code,
               village_name,
               main_place_code,
               main_place_name,
               municipality_code,
               municipality_name,
               district_code,
               district_name,
               province_code,
               province_name,
               sampled_date,
               survey,
               ST_Centroid(the_geom) AS the_geom
            FROM
               zaf.vw_sampled_villages
         ) AS g
         GROUP BY
            village_code,
            village_name,
            main_place_name,
            main_place_code,
            municipality_name,
            municipality_code,
            district_name,
```

```
            district_code,
            province_name,
            province_code,
            survey,
            sampled_date
      ) AS h
   ORDER BY
      village_code
;

COPY
   (
      SELECT
         lz_code || ': ' || lz_name || ' (' || lz_abbrev || ')' AS lz,
         r.survey,
         r.sampled_date,
         province_name,
         province_code,
         district_name,
         district_code,
         municipality_name,
         municipality_code,
         main_place_name,
         main_place_code,
         village_name,
         r.village_code,
         pop,
         num_sas,
         SUBSTRING(coord from (POSITION(' ' in coord) + 1) for 8) || ', ' || SUBSTRING(coord from
               (POSITION('(' in coord) + 1) for 7) AS approx_coord,
         r.survey || ' - ' || village_name || ': ' || SUBSTRING(coord from (POSITION(' ' in coord) +
               1) for 8) || ', ' || SUBSTRING(coord from (POSITION('(' in coord) + 1) for 7) AS
               village_and_coord
      FROM
         (
            SELECT
               village_code,
               survey,
               sampled_date,
               COUNT(k.sa_code) AS num_sas,
               SUM(total) AS pop
            FROM
               zaf.tbl_sampled_villages AS i,
               zaf.tbl_pop_agegender_12y AS j,
               zaf.demog_sas AS k
            WHERE
                  k.sa_code = j.sa_code
               AND
                  i.village_code = k.sp_code
            GROUP BY
               village_code,
               survey,
               sampled_date
         ) AS l,
         (
            SELECT
               village_code,
               m.lz_code,
               lz_name,
               lz_abbrev,
               sampled_date
            FROM
               zaf.tbl_sampled_villages AS m,
               zaf.tbl_livezones_list AS n
            WHERE
               m.lz_code = n.lz_code
         ) AS p,
         (
```

```
            SELECT
               village_code,
               village_name,
               main_place_code,
               main_place_name,
               municipality_code,
               municipality_name,
               district_code,
               district_name,
               province_code,
               province_name,
               survey,
               sampled_date,
               ST_Centroid(ST_Union(the_geom)) AS centroid_geom,
               ST_AsText(ST_Transform(ST_SetSRID(ST_Centroid(ST_Union(the_geom)),201100),4326)) AS
                    coord
            FROM
               (
                  SELECT
                     village_code,
                     village_name,
                     main_place_code,
                     main_place_name,
                     municipality_code,
                     municipality_name,
                     district_code,
                     district_name,
                     province_code,
                     province_name,
                     sampled_date,
                     survey,
                     ST_Centroid(the_geom) AS the_geom
                  FROM
                     zaf.vw_sampled_villages
               ) AS q
            GROUP BY
               village_code,
               village_name,
               main_place_code,
               main_place_name,
               municipality_code,
               municipality_name,
               district_code,
               district_name,
               province_code,
               province_name,
               survey,
               sampled_date
         ) AS r
      WHERE
            p.village_code = l.village_code
         AND
            p.village_code = r.village_code
         AND
            p.sampled_date = r.sampled_date
      ORDER BY
         province_name,
         lz_code,
         district_name,
         municipality_name,
         main_place_name,
         village_name
   )
TO
   '/Users/Charles/Documents/hea_baselines/south_africa/baselines_surveys/2016_lp_mp/sampling/sample
d_villages_centroids.csv'
WITH
   (
```

```
        FORMAT CSV, DELIMITER ',', HEADER TRUE
    )
;
```

Appendix D

List of villages from the Mpumalanga-Limpopo assessment in October 2016.

Row Labels / Column Labels	Population by survey			No. of villages by survey			Total population	Total No. of Villages
Livelihood zone code: name (abbreviation) / Province / District / Municipality / Main place / Survey – Village: latitude, longitude	both	continuum	hea	both	continuum	hea		
59101: Lowveld open access cattle and other income (ZALOC)		61533	110433		11	12	171966	23
Limpopo		2325	25728		1	1	28053	2
Mopani		2325	25728		1	1	28053	2
Ba-Phalaborwa		2325	25728		1	1	28053	2
Ga-Mashishimale		2325			1		2325	1
continuum - Mohlabeng: -23.9324, 30.9964		2325			1		2325	1
Majeje			25728			1	25728	1
hea - Humulani: -23.8723, 31.0641			25728			1	25728	1
Mpumalanga		59208	84705		10	11	143913	21
Ehlanzeni		59208	84705		10	11	143913	21
Bushbuckridge		10962	43941		2	6	54903	8
Buyisonto			10467			1	10467	1
hea - Buyisonto SP: -24.7847, 31.1305			10467			1	10467	1
Hlanganani			21540			1	21540	1
hea - Hlanganani SP: -24.9643, 31.1419			21540			1	21540	1
Kgapamadi		5049			1		5049	1
continuum - Kgapamadi SP: -24.6136, 31.0322		5049			1		5049	1
Matsavana			5157			1	5157	1
hea - Matsavana SP: -24.8256, 31.2352			5157			1	5157	1
New Line			1836			1	1836	1
hea - New Line SP: -24.6369, 31.0081			1836			1	1836	1
Thabakgolo		5913			1		5913	1
continuum - Thabakgolo SP: -24.7915, 31.0295		5913			1		5913	1
Utlha A			876			1	876	1
hea - Utlha A SP: -24.7035, 31.4418			876			1	876	1
Zoeknog A			4065			1	4065	1
hea - Zoeknog A SP: -24.7477, 30.9842			4065			1	4065	1
Mbombela		37902	24024		5	2	61926	7
Jerusalem		8853			1		8853	1
continuum - Jerusalem SP: -25.1934, 31.1034		8853			1		8853	1
Khumbula		6729			1		6729	1
continuum - Khumbula SP: -25.2888, 31.1709		6729			1		6729	1
Lundi		4509			1		4509	1
continuum - Lundi SP: -25.2144, 31.0940		4509			1		4509	1
Mahukule A		234			1		234	1
continuum - Mahukule A SP: -24.9915, 31.1366		234			1		234	1
Malekutu			7539			1	7539	1
hea - Malekutu SP: -25.2761, 31.1954			7539			1	7539	1
Msogwaba		17577			1		17577	1
continuum - Msogwaba SP: -25.4264, 31.1633		17577			1		17577	1
Phola			16485			1	16485	1
hea - Phola SP: -25.1615, 31.1324			16485			1	16485	1
Nkomazi		8727	16740		2	3	25467	5
KwaZibukwane		5298			1		5298	1
continuum - KwaZibukwane SP: -25.6892, 31.8039		5298			1		5298	1
Madaneni			4989			1	4989	1
hea - Madaneni SP: -25.8079, 31.7903			4989			1	4989	1
Magogeni			7386			1	7386	1
hea - Magogeni SP: -25.7920, 31.6066			7386			1	7386	1
Middelplaas			4365			1	4365	1
hea - Middelplaas SP: -25.7170, 31.5531			4365			1	4365	1
Ntunda		3429			1		3429	1
continuum - Ntunda SP: -25.7315, 31.7538		3429			1		3429	1
Umjindi		1617			1		1617	1
Bonanza Gold Mine		1617			1		1617	1
continuum - Bonanza Gold Mine SP: -25.6992, 31.1693		1617			1		1617	1
59104: Highveld border open access livestock (ZABOL)	2514	588	29181	1	1	11	32283	13

Row Labels Livelihood zone code: name (abbreviation) Province District Municipality Main place Survey – Village: latitude, longitude	Population by survey			No. of villages by survey			Total population	Total No. of Villages
	both	continuum	hea	both	continuum	hea		
Mpumalanga	2514	588	29181	1	1	11	32283	13
Gert Sibande	2514	588	29181	1	1	11	32283	13
Albert Luthuli	2514	588	29181	1	1	11	32283	13
Betty's Goed			1476			1	1476	1
hea - Betty's Goed SP: -26.2533, 30.9154			1476			1	1476	1
Dundonald			4770			1	4770	1
hea - Dundonald SP: -26.2294, 30.8360			4770			1	4770	1
Embhuleni		588			1		588	1
continuum - Embhuleni SP: -26.0215, 30.7713		588			1		588	1
Enkhaba			528			1	528	1
hea - Enkhaba SP: -26.0866, 30.9038			528			1	528	1
Etjelembube			2172			1	2172	1
hea - Etjelembube SP: -26.1873, 30.9164			2172			1	2172	1
Fernie			15693			1	15693	1
hea - Fernie SP: -26.4046, 30.7862			15693			1	15693	1
Holeka	2514			1			2514	1
both - Holeka SP: -26.2314, 30.8746	2514			1			2514	1
Kalwerskraal			96			1	96	1
hea - Kalwerskraal SP: -26.1303, 30.9924			96			1	96	1
Mafumulo			1074			1	1074	1
hea - Mafumulo SP: -26.2980, 30.8418			1074			1	1074	1
Malahleka			336			1	336	1
hea - Malahleka SP: -26.0059, 30.7719			336			1	336	1
Mbejeka			384			1	384	1
hea - Mbejeka SP B: -25.9705, 30.8584			384			1	384	1
Nhlaba			786			1	786	1
hea - Nhlaba SP: -26.0800, 30.9980			786			1	786	1
Tjakastad			1866			1	1866	1
hea - Los-my-cherry: -26.0031, 30.8063			1866			1	1866	1
59201: Lowveld open access mixed farming (ZALCM)	777	81990	47031	1	19	11	129798	31
Limpopo		58203	13869		15	6	72072	21
Capricorn		657			1		657	1
Molemole		657			1		657	1
Tshitale		657			1		657	1
continuum - Tshitale SP: -23.3586, 29.9951		657			1		657	1
Mopani		23832	11157		7	4	34989	11
Ba-Phalaborwa		1821			1		1821	1
Mahale		1821			1		1821	1
continuum - Mahale SP: -23.6968, 30.9643		1821			1		1821	1
Greater Giyani		6654	6513		2	3	13167	5
Basani		2208			1		2208	1
continuum - Basani SP: -23.3520, 30.5327		2208			1		2208	1
Botshabelo			1485			1	1485	1
hea - Botshabelo SP: -23.4309, 30.5166			1485			1	1485	1
KaMakoxa		4446			1		4446	1
continuum - KaMakoxa SP: -23.2567, 30.7437		4446			1		4446	1
KaMatsotsosela			1035			1	1035	1
hea - KaMatsotsosela SP: -23.6075, 30.8303			1035			1	1035	1
KaMininginisi			3993			1	3993	1
hea - KaMininginisi SP1: -23.1498, 30.8032			3993			1	3993	1
Greater Letaba		3582			2		3582	2
Phongololo		2610			1		2610	1
continuum - Phongololo SP: -23.4104, 30.2592		2610			1		2610	1
Shamfana		972			1		972	1
continuum - Shamfana SP: -23.4578, 30.6637		972			1		972	1
Greater Tzaneen		11775	4644		2	1	16419	3
Ka-Xihoko			4644			1	4644	1
hea - Ka-Xihoko SP: -23.6638, 30.5007			4644			1	4644	1
Mavele		4824			1		4824	1
continuum - Mavele SP: -23.6757, 30.4227		4824			1		4824	1
Motupa		6951			1		6951	1
continuum - Motupa SP: -23.6810, 30.2874		6951			1		6951	1
Vhembe		33714	2712		7	2	36426	9
Makhado		21552	1665		3	1	23217	4
Bungeni		6660			1		6660	1
continuum - Bungeni SP: -23.1941, 30.1840		6660			1		6660	1
Chavani		7524			1		7524	1
continuum - Chavani SP: -23.1977, 30.1502		7524			1		7524	1
Masakona			1665			1	1665	1
hea - Sereni: -23.2714, 30.1784			1665			1	1665	1
Mpheni		7368			1		7368	1
continuum - Tshitale: -23.1405, 30.0614		7368			1		7368	1

Row Labels Livelihood zone code: name (abbreviation) Province District Municipality Main place Survey – Village: latitude, longitude	Population by survey			No. of villages by survey			Total population	Total No. of Villages
	both	continuum	hea	both	continuum	hea		
Mutale		2793	1047		1	1	3840	2
Folovhodwe		2793			1		2793	1
continuum - Folovhodwe SP: -22.5927, 30.4298		2793			1		2793	1
Tshipise			1047			1	1047	1
hea - Tshipise SP: -22.5315, 30.6698			1047			1	1047	1
Thulamela		9369			3		9369	3
Hasane		2733			1		2733	1
continuum - Hasane SP: -23.0936, 30.4783		2733			1		2733	1
Makuleke		4506			1		4506	1
continuum - Makuleke SP: -22.8695, 30.9188		4506			1		4506	1
Mtititi		2130			1		2130	1
continuum - Mtititi SP: -23.0931, 30.8984		2130			1		2130	1
Mpumalanga	777	23787	33162	1	4	5	57726	10
Ehlanzeni	777	23787	33162	1	4	5	57726	10
Bushbuckridge		21345	13086		3	3	34431	6
Dingledayle			3396			1	3396	1
hea - Dingledayle SP: -24.6995, 31.1186			3396			1	3396	1
eMakhazeni B		6126			1		6126	1
continuum - eMakhazeni B SP: -24.9517, 31.3687		6126			1		6126	1
Godide		6309			1		6309	1
continuum - Godide SP: -24.7280, 31.2421		6309			1		6309	1
Ludlow			5790			1	5790	1
hea - Ludlow SP: -24.6742, 31.2798			5790			1	5790	1
Mahlobyanini			3900			1	3900	1
hea - Somerset SP: -24.9140, 31.3694			3900			1	3900	1
Tsakani		8910			1		8910	1
continuum - Tsakani SP: -24.6190, 31.0506		8910			1		8910	1
Mbombela	777			1			777	1
Nsikazi	777			1			777	1
both - Nsikazi SP: -25.2766, 31.2349	777			1			777	1
Nkomazi		2442	20076		1	2	22518	3
Mananga		2442			1		2442	1
continuum - Mananga SP: -25.9523, 31.8442		2442			1		2442	1
Mbuzini			9951			1	9951	1
hea - Mbuzini SP: -25.9257, 31.9345			9951			1	9951	1
Mgobode			10125			1	10125	1
hea - Mgobode SP: -25.8620, 31.7039			10125			1	10125	1
59205: Highveld open access mixed income (ZAHMI)		18426	75972		4	12	94398	16
Limpopo			21006			4	21006	4
Greater Sekhukhune			21006			4	21006	4
Elias Motsoaledi			17196			3	17196	3
Mpheleng			7116			1	7116	1
hea - Mpheleng SP: -25.2017, 29.1557			7116			1	7116	1
Phukukane			4155			1	4155	1
hea - Phukukane SP: -25.2482, 29.1260			4155			1	4155	1
Thabakhubedu			5925			1	5925	1
hea - Thabakhubedu SP: -25.3431, 29.2537			5925			1	5925	1
Ephraim Mogale			3810			1	3810	1
Matlala Ramoshebo			3810			1	3810	1
hea - Matlala Ramoshebo SP: -25.0441, 29.1021			3810			1	3810	1
Mpumalanga		18426	54966		4	8	73392	12
Nkangala		18426	54966		4	8	73392	12
Dr JS Moroka		9552	33306		2	7	42858	9
Allemansdrift			7830			1	7830	1
hea - Allemansdrift C: -25.1146, 28.9089			7830			1	7830	1
Kameelpoort			1521			1	1521	1
hea - Kameelpoort SP: -25.2792, 28.8226			1521			1	1521	1
Loding			3900			1	3900	1
hea - Loding SP: -25.1114, 28.7579			3900			1	3900	1
Madubaduba		5205			1		5205	1
continuum - Madubaduba SP: -25.1359, 28.9491		5205			1		5205	1
Mmamethlake			7902			1	7902	1
hea - Mmamethlake SP: -25.1044, 28.5422			7902			1	7902	1
Phake			1578			1	1578	1
hea - Phaphamang: -25.1472, 28.4928			1578			1	1578	1
Pieterskraal			3177			1	3177	1
hea - Pieterskraal B: -25.2020, 28.9650			3177			1	3177	1
Thabana		4347			1		4347	1
continuum - Thabana SP: -25.0769, 29.0596		4347			1		4347	1
Waterval			7398			1	7398	1
hea - Waterval A: -25.1707, 29.0055			7398			1	7398	1
Thembisile		8874	21660		2	1	30534	3

Row Labels Livelihood zone code: name (abbreviation) Province District Municipality Main place Survey – Village: latitude, longitude	Population by survey			No. of villages by survey			Total population	Total No. of Villages
	both	continuum	hea	both	continuum	hea		
Kwaggafontein		3789	21660		1	1	25449	2
continuum - Kwaggafontein F: -25.3433, 28.9480		3789			1		3789	1
hea - Kwaggafontein A: -25.2959, 28.9430			21660			1	21660	1
KwaMhlanga Crossroads		5085			1		5085	1
continuum - Zakheni: -25.4054, 28.7109		5085			1		5085	1
59303: Highveld open access intensive cropping (ZAHIC)	6732	7413	74589	3	2	9	88734	14
Limpopo	4047		14445	1		4	18492	5
Greater Sekhukhune	4047		14445	1		4	18492	5
Ephraim Mogale	4047		14445	1		4	18492	5
Malebitsa	4047			1			4047	1
both - Malebitsa SP: -24.8980, 28.9280	4047			1			4047	1
Matlerekeng			4845			1	4845	1
hea - Matlerekeng SP: -24.9871, 29.0572			4845			1	4845	1
Spitspunt			2787			1	2787	1
hea - Spitspunt SP: -24.9520, 28.9186			2787			1	2787	1
Tshikanosi			1782			1	1782	1
hea - Tshikanosi SP: -24.9886, 28.9397			1782			1	1782	1
Uitvlugt			5031			1	5031	1
hea - Uitvlugt SP: -24.9348, 28.9982			5031			1	5031	1
Mpumalanga	2685	7413	60144	2	2	5	70242	9
Gert Sibande	2685		38193	2		2	40878	4
Mkhondo	999		25035	1		1	26034	2
KwaNgema	999			1			999	1
both - KwaNgema SP: -27.0205, 30.4897	999			1			999	1
Saul Mkhizeville			25035			1	25035	1
hea - Saul Mkhizeville SP: -26.9860, 30.4363			25035			1	25035	1
Pixley Ka Seme	1686		13158	1		1	14844	2
Daggakraal	1686		13158	1		1	14844	2
both - Daggakraal SP: -27.1028, 29.9961	1686			1			1686	1
hea - Vlakpoort: -27.1376, 29.9660			13158			1	13158	1
Nkangala		7413	21951		2	3	29364	5
Dr JS Moroka		3633	21951		1	3	25584	4
Koedoespoort			3390			1	3390	1
hea - Koedoespoort SP: -25.0490, 28.8583			3390			1	3390	1
Lefiso		3633			1		3633	1
continuum - Lefiso SP: -24.9379, 28.8926		3633			1		3633	1
Marapyane			10854			1	10854	1
hea - Marapyane SP: -25.0083, 28.7897			10854			1	10854	1
Seabe			7707			1	7707	1
hea - Seabe SP: -25.0257, 28.6961			7707			1	7707	1
Thembisile		3780			1		3780	1
Bhundu		3780			1		3780	1
continuum - Bhundu SP: -25.3083, 29.0680		3780			1		3780	1
Grand Total	**10023**	**169950**	**337206**	**5**	**37**	**55**	**517179**	**97**