



**APHLIS - AFRICAN POSTHARVEST LOSSES INFORMATION SYSTEM**

**- A TRANSNATIONAL NETWORK OF CEREAL GRAIN EXPERTS**

# UNDERSTANDING APHLIS - The African Postharvest Losses Information System

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May 2014

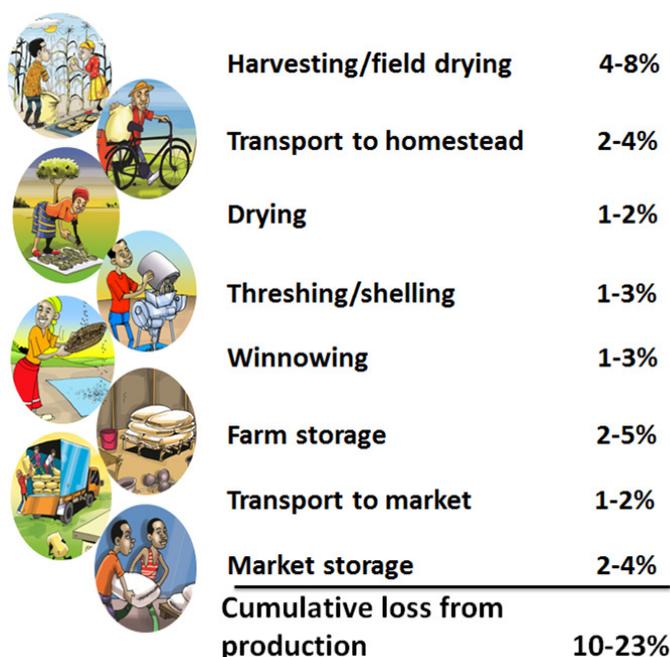
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**Disclaimer – The European Commission and its agents accept no responsibility for the accuracy or otherwise of data or estimates obtained from the PHL Information System and these are provided entirely at the users' risk.**

## 1. Introduction

This manual describes the use and operation of the African Postharvest Losses Information System (APHLIS), a unique resource providing postharvest specialists in Sub-Saharan Africa (SSA) with estimates of weight losses from the postharvest chain (Fig. 1). These losses are expressed as cumulative loss from the production at the level of the primary administrative unit (province). APHLIS also provides a means to estimate losses at finer geographical scale using user-preferred loss values.



**Figure 1: Links in the postharvest chain for cereal grains in Sub-Saharan Africa, showing a typical range of weight loss**

The first link of the postharvest chain is harvesting itself (Fig. 1), since at this point cereal grains have reached physiological maturity and grain production is complete. The postharvest chain has at least eight links (Fig. 1). At each link there are usually some dry matter weight losses. These are due to grain becoming scattered or spilt, or alternatively grain may become rotten through the action of moulds or consumed by pests, especially insects and sometimes rodents. The typical magnitudes of such losses are shown in Figure 1.

Before the introduction of APHLIS, the origin and justification of weight losses values for cereal grains were not well founded. APHLIS generates loss estimates that are -

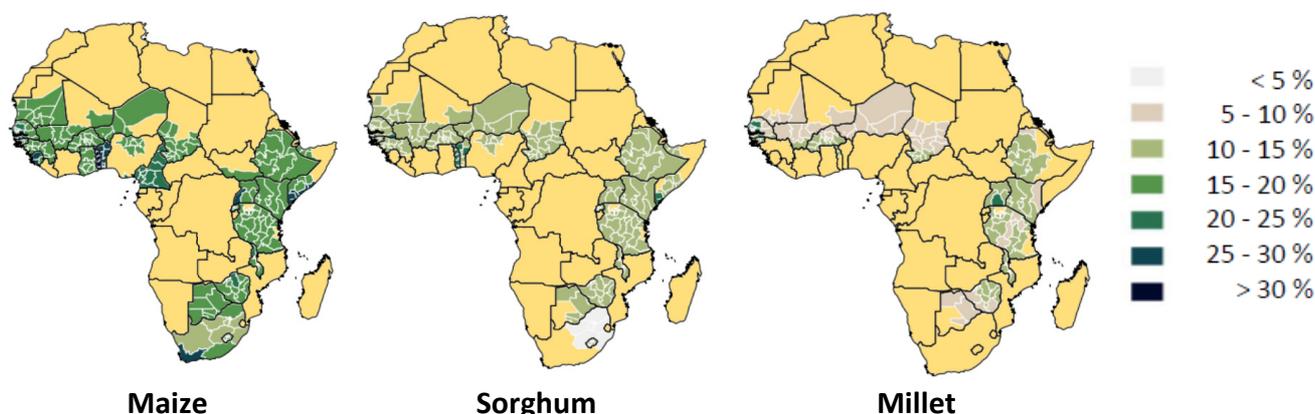
- Transparent in the way they are calculated
- Contributed (in part) and verified by local experts
- Adjustable year by year depending on circumstances
- Based on the primary national unit (i.e. province not just country level)
- Upgradeable as more (reliable) data become available

## 2. What does APHLIS do?

APHLIS provides postharvest weight loss estimates for seven of the cereal crops of Sub-Saharan Africa. It is available at the following address -

<http://www.aphlis.net/>

The postharvest losses (PHLs) displayed by APHLIS are cumulative % weight losses (see Section 7) of provinces and are presented at by province, but also aggregated to country and to region. These loss estimates can be seen on the website as tables or maps and are calculated using established default values together with seasonal data submitted by APHLIS network members. The website shows a rating of the reliability of each of the loss figures used in the loss estimation, indicates how such figures were derived, and gives their bibliographical references.



**Cereal % weight losses in Sub-Saharan Africa in 2012**

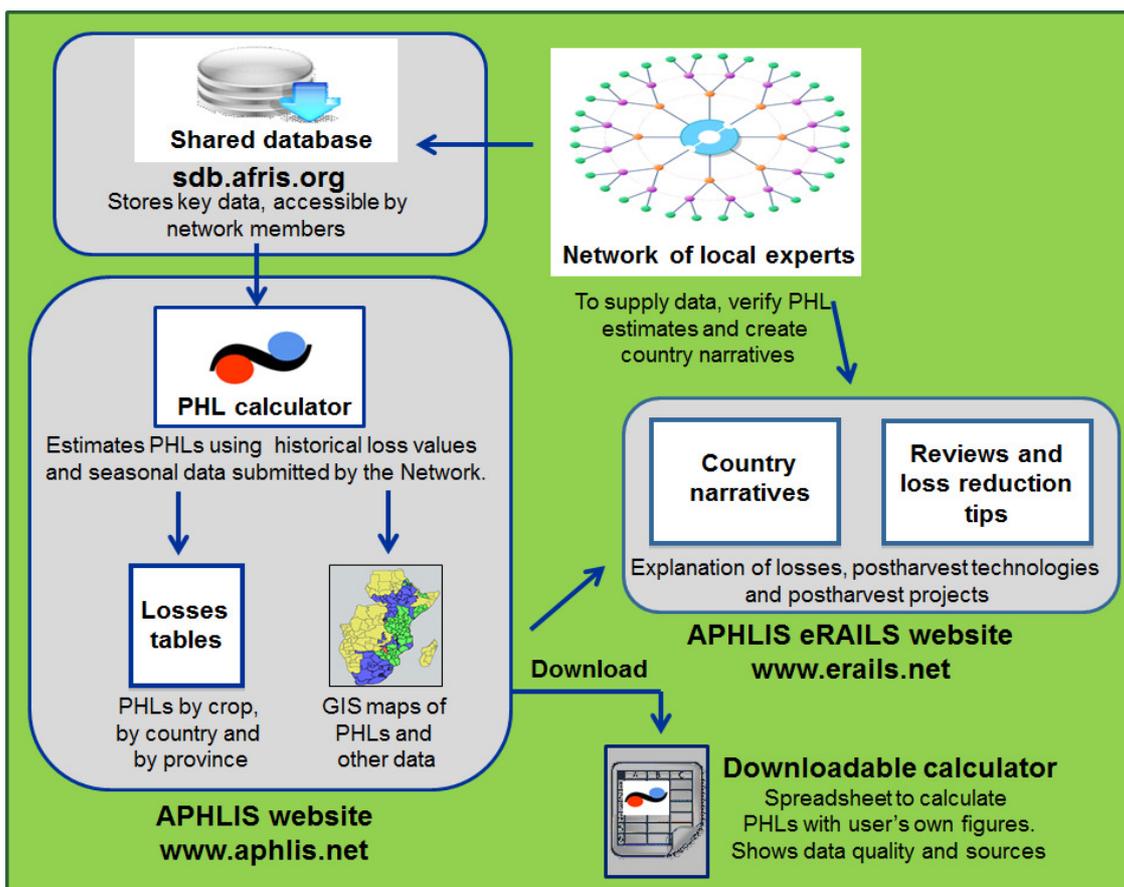
Another important feature of APHLIS is that it gives postharvest practitioners the opportunity to calculate their own loss figures. This is done using a downloadable spreadsheet version of the PHL calculator where default values can be replaced with user-preferred figures (see Section 14).

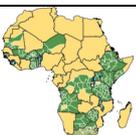
The downloadable PHL calculator offers several advantages. Users can work with the most up-to-date or most relevant data. This is important when the subject of investigation is a district, farmer's group or even an individual farming household. It is also important when the political boundaries of provinces do not match natural agro-climatic boundaries. In this case, the estimates presented on the website may hide considerable heterogeneity and so better estimates could be obtained by and at a smaller geographical scale that includes only areas within the same zones. Like the web-based version of the calculator, the downloadable version also indicates the bibliographical references and gives a rating of the reliability of the data in much the same way as the website, so that users can determine the suitability of the PHL estimates for their purposes.

## 3. Why do we need APHLIS?

APHLIS has been created to provide weight loss data in support of agricultural policy formulation, the identification of opportunities to improve the efficiency of value chains, to improve food security planning by facilitating more accurate cereal supply calculations, and to provide a means to monitor and evaluate project performance. Recently, Country Narratives (see Section 12) have been added to the system that put the estimated loss values into the context of the postharvest systems of each focus country. The narratives also give details of current and recent projects that could contribute to postharvest loss reduction. In the longer term it is intended that the Country Narratives will become a means of articulating the opportunities for postharvest loss reduction.

#### 4. Key components of APHLIS



System feature		Menu buttons
	The PHL Network of local experts who provide data and verify loss estimates.	APHLIS network
	The shared database for entering and storing key data related to PHL estimation. The database can be updated by PHL Network members.	Login
	The PHL Calculator estimates a cumulative % weight loss from production using the information in the database and a PHL profile (the typical PHLs figures for each step in the postharvest chain) for the specific conditions in question. The Calculator estimates a PHL for each cereal crop by both country and by province.	Losses tables
	A GIS mapping facility to display the distribution of PHLs and other key factors in Sub-Saharan Africa.	Interactive losses maps
	Links to narratives presenting the postharvest systems, the loss values and on-going postharvest projects, and reviews of key subject including tips for loss reduction.	Country narratives, Postharvest reviews
	A downloadable PHL Calculator in Excel. Defaults can be changed to user preferences and estimates made at preferred geographical scales. Data quality ratings and bibliographical references are displayed.	Downloadable calculator

## 5. Website home page

The APHLIS website home page looks like this.

**APHLIS AFRICAN POSTHARVEST LOSSES INFORMATION SYSTEM**  
A TRANSNATIONAL NETWORK OF CEREAL GRAIN EXPERTS

English French

**Home**  
Losses tables  
Interactive losses maps  
Larger grain borer  
Downloadable calculator  
Postharvest reviews  
Understanding APHLIS  
Collecting new data  
Country narratives  
Literature  
APHLIS Network  
About us Contacts Links  
Information materials  
Login

**Overview**  
The APHLIS website displays postharvest loss estimates (PHLs) for the cereal crops of Sub-Saharan Africa, for individual countries and for their provinces. The **PHL calculator** that makes these estimates can also be downloaded as an Excel spreadsheet where the default values can be changed to users' preferences. To learn about all the facilities of APHLIS and how losses are calculated click here to see the guide to **Understanding APHLIS**.

Estimates of postharvest losses are important data for policy makers, for food security staff making cereal supply estimates and for agricultural practitioners proposing, or actually managing, interventions to reduce postharvest losses. Before the introduction of APHLIS, the origin and justification of PHLs figures were not well founded. APLHIS was established to generate figures for the PHLs of cereal crops in a fully transparent manner and in a way that can enable the updating of PHL estimates as new data become available. The postharvest losses are presented as maps and as tables, to see the tables click on 'Losses tables'. There are three different types of tables which show -

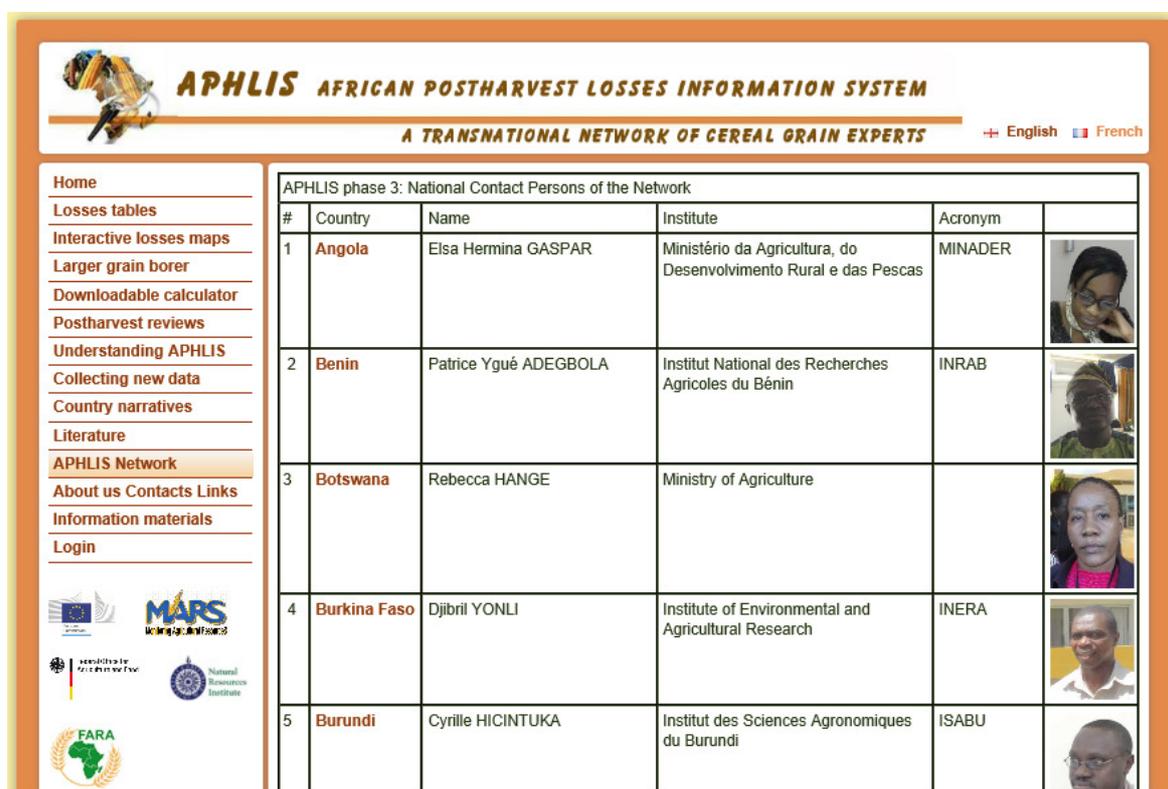
- % cumulative weight loss from production,
- the actual weight of grain lost from production, and

The menu bar on the left hand side offer access to -

<b>Losses tables</b>	Tables of PHL estimates by crop for country and province
<b>Interactive Losses Maps</b>	Maps showing distribution of losses, loss densities and other factors
<b>Larger grain Borer</b>	Summary information showing incidence of this important storage pest
<b>Downloadable calculator</b>	PHL calculator available for download as an Excel spreadsheet
<b>Postharvest reviews</b>	A review of postharvest weight losses, quality losses and fully illustrated tips for farmers on postharvest loss reduction
<b>Understanding APHLIS</b>	Downloadable guide to understanding and using APHLIS
<b>Collecting new data</b>	Downloadable guide to collecting new loss data and data on seasonal factors that affect losses
<b>Country narratives</b>	Links to narratives presenting the postharvest systems, the loss values and on-going postharvest projects in several countries
<b>Literature</b>	Key bibliographical references to postharvest literature
<b>APHLIS network</b>	A listing of APLHIS country representatives with photos
<b>About us, Contacts Links</b>	Details about the APLHIS development team. Contact details for information and for submitting new PHL data. Links to websites concerned with APLHIS
<b>Information materials</b>	Downloadable leaflet, PowerPoint presentation about APLHIS, and advice on how to refer to APLHIS
<b>Login</b>	Login gives APLHIS network members access to data entry

## 6. APHLIS Network Members

APHLIS network members represent those countries that are included within APHLIS. The members are typically professionals working in the area of agricultural information or postharvest development and are given the opportunity to attend one or more APHLIS workshop to become familiar with the system. The member for each country is shown on the 'APHLIS Network' tab.



APHLIS phase 3: National Contact Persons of the Network					
#	Country	Name	Institute	Acronym	
1	Angola	Elsa Hermina GASPAR	Ministério da Agricultura, do Desenvolvimento Rural e das Pescas	MINADER	
2	Benin	Patrice Ygué ADEGBOLA	Institut National des Recherches Agricoles du Bénin	INRAB	
3	Botswana	Rebecca HANGE	Ministry of Agriculture		
4	Burkina Faso	Djibril YONLI	Institute of Environmental and Agricultural Research	INERA	
5	Burundi	Cyrille HICINTUKA	Institut des Sciences Agronomiques du Burundi	ISABU	

Members have access to the data submission tables in APHLIS. The data for each country is kept separately and only accessible by the members and the system administrator. Members are asked to submit new data annually, this includes information on cereal production and on a several factors that affect postharvest loss values and that vary on seasonally/annually (these factors are mentioned in Sub-section 8.2).

In case you need to contact a member this can be done through the APHLIS administrator (aphlis3@gmail.com).

## 7. What PHL figures mean

The PHLs estimated by APHLIS are the cumulative % loss in weight from production of ready to consume grain incurred during harvesting, drying, handling operations, farm storage, transport and market storage.

The PHLs estimated by APHLIS -

1. Reflect losses of quantity (weight loss); quality change is only relevant if food is no longer fit for human consumption (and therefore considered a 100% weight loss).
2. Include grain spilt and scattered during handling.
3. Are from one year's production, i.e. do not include carryover stocks from the previous season.
4. Are reported for national and sub-national units (provinces) which follow political rather than agro-climatic boundaries; loss estimates for any particular area may therefore hide wide internal variations.
5. Do not take into account any cereal processing losses.

An example of a postharvest chain for maize with production of 1000 MT is given below. The % weight losses and the actual amount of grain lost from production (the loss increment) for each link of the chain are shown. For example the 5% loss at harvesting amounts to 50 MT (1000x 0.05) of lost grain leaving 950 MT of the original production.

		Weight loss	
	%	increment (MT)	Production remaining (MT)
 <b>Harvesting/field drying</b>	5%	50.0	950.0
 <b>Drying</b>	1%	9.5	940.5
 <b>Threshing/shelling</b>	3%	28.3	912.3
 <b>Winnowing</b>	2%	18.3	894.0
 <b>Transport to homestead</b>	2%	17.9	876.2
 <b>Farm storage</b>	5%	43.8	832.4
 <b>Transport to market</b>	1%	8.3	824.0
 <b>Market storage</b>	2%	16.5	807.5
	<b>19.26%</b>	<b>192.6</b>	

At each link in the chain the loss of weight diminishes the original 1000 MT of production. Consequently, although the loss in farm storage is also 5% the loss increment is lower than that at harvest (only 43.8 MT not 50 MT) because only 876.2 MT entered farm storage due to earlier losses. This type of calculation is described as 'cumulative' and in this case the cumulative weight loss from production is 19.26% rather than 21% which is the figure you would get if you simply add up the individual % loss values in the figure above.

There is a certain irony in loss calculation. If for example some new technology improved harvesting so the loss at this stage was reduced from 5% down to 0% instead of saving the expected 50MT the saving would be only 42.5 MT. This is because the % loss remains fixed at the other links in the chain, at these link the loss would increase because more grain is entering them.

## 8. How APHLIS makes loss estimates

To make loss estimates APHLIS relies on two distinct sources of data. The first is a set of figures that quantifies the expected loss at each link in the postharvest chain. This set of figures is derived from the scientific literature and called a postharvest loss profile. The second source of data relates to factors that may affect losses on a seasonal or annual basis. These are referred to as seasonal data and are submitted by the APHLIS network.

### 8.1. PHL Profiles

When APHLIS estimates the % weight loss for a particular crop, in a particular province, a pre-determined set of PHL values for each step in the chain, called the PHL profile is inserted into the PHL Calculator (see Table 1 for examples).

**Table 1: Examples of PHL profiles for different cereals in different climates and at different scales of farming**

<b>Climate cluster</b>	A*	C	B	B	A
<b>Crop</b>	Maize	Maize	Sorghum	Millet	Rice
<b>Scale of farming</b>	Small	Large	Small	Small	Small
Harvesting/field drying	6.4	2	4.9	3.5	4.3
Drying	4	3.5	-	-	-
Shelling/threshing	1.2	2.3	4	2.5	2.6
Winnowing	-	-	-	-	2.5
Transport to store	2.3	1.9	2.1	2.5	1.3
Storage	5.3	2.1	2.2	1.1	1.2
Transport to market	1	1	1	1	1
Market storage	4	4	4	4	4
Cumulative % weight loss	17.9	11.3	12.6	9.3	11.4

\* Climate codes – A – tropical savannah, B – arid/desert and C – warm temperate

One problem faced in seeking to provide PH profiles is that PHL data have only been collected in a few parts of Sub-Saharan Africa. It is therefore inevitable that in the creation of the PHL profiles many different provinces will have to share the same data. This sharing was achieved by clustering together the data from provinces of various countries that are basically similar with respect to climate. The climates of Sub-Saharan Africa have been classified according to the Köppen system, and for the purposes of APHLIS are of three types, tropical savannah, arid/desert or warm temperate. For each crop there is a PHL profile for each climate, so with seven crops (maize, sorghum, millet, wheat, barley, rice and teff) there is a total of 21 (3x7) profiles. Except for maize, the profiles are specific to the technologies associated with smallholder farming. For maize there are both smallholder and a large scale farming profiles.

In the creation of PHL profiles, it is necessary to create a generalised loss figure for each step in the PH chain. The basic data on which these are based come from the scientific literature and figures supplied by the PHL Network. These figures were refined by 1) removing outliers, 2) avoiding the use of 'questionnaire/guesstimate' data where there is sufficient measured loss

estimates, and 3) averaging what data remained. In the case of storage loss figures, these were standardised to a 9 month storage period and an even pattern of consumption by the household over this 9 month period. It is very important to take into account this consumption as without doing so losses would be overstated, in just the same way as losses are overstated if they are not calculated on a cumulative basis (see Section 7).

## **8.2 Seasonal data**

PHL profile is not the only factor than will determine the magnitude of the cumulative loss.

Several other 'seasonal' factors are taken into account and these have a very significant bearing on the actual loss estimate. These include the following -

- 1) whether or not there is damp weather at time of any of the harvests which would make drying difficult,
- 2) the proportion of grain that is marketed within the first three months, so will not enter farm storage for any significant time,
- 3) the length of the farm storage period
- 4) in the case of maize, whether or not LGB (*Prostephanus truncatus*) is expected to be a significant pest.

Data on these seasonal factors is contributed by the APHLIS network members or supplied by individual users for the downloadable calculator.

## 9. Displaying the APHLIS loss estimates

The APHLIS website can be consulted for information about the PHLs of provinces, crops, seasons and the scale of farming. The results are displayed in a series of loss tables accessible from the 'Losses Tables' button on the left hand column of the web page. The estimated PHLs also take account of seasonal factors that may vary seasonally/annually (see Sub-section 8.2). The first loss table, show below, gives a regional weighted average of % weight loss by year followed by a breakdown of these losses by cereal name. On the website, just below this you can find a table giving the associated absolute losses (i.e. in tonnes rather than as a % weight loss), for brevity this has been omitted here.

Weighted average according to reported figures



Regional total PHL for cereals [% of total annual production]										
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
14.3	14.7	14.3	14.5	15.8	15.6	14.9	15.3	14.9	15.1	15.1

Regional PHL by cereal [% of total annual production]											
Cereal	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<b>Wheat</b>	5.6	5.5	13.1	9.9	12.8	12.7	15.1	14	13.1	12.9	22.9
<b>Maize</b>	16.8	17.3	17.1	17.9	18.9	20	17.9	19	18	18.2	17.8
<b>Rice</b>	11.8	11.8	11.7	11.8	11.8	12.1	12	12.6	12	13.9	12.1
<b>Sorghum</b>	12.3	11.9	12.1	12.3	12.3	12.8	12.5	12.6	12.4	12.4	12.3
<b>Barley</b>	9.8	4.9	9.4	9.4	9.4	9.5	10.9	10.1	9.7	9.7	24
Rye	-	-	-	-	-	-	-	-	-	-	-
<b>Oats</b>	-	-	2.1	2.1	2	2.1	2.1	2.1	2.1	2.1	-
<b>Millets</b>	9.6	9.8	9.7	9.9	10.1	10	9.7	9.4	9.8	9.6	9.4
<b>Fonio</b>	11.7	11.7	11.7	11.7	11.7	12	12.4	12.2	11.7	11.8	11.7
<b>Teff</b>	11.7	11.7	12.4	12.4	12.1	12.4	12.5	12.5	12.5	12.4	-

By clicking on a cereal name, show in the table above, you can retrieve a table of the % weight loss losses by country for that cereal (see below) and again a table of the associated absolute losses.



<a href="#">Back</a>											
Maize											
Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<a href="#">Angola</a>	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	-	-
<a href="#">Benin</a>	-	-	-	-	-	24.3	24.7	25.4	25.3	25.3	-
<a href="#">Botswana</a>	-	16.8	16.3	17.1	16.7	20.1	17.1	18.3	17.1	16.4	-
<a href="#">Burkina Faso</a>	-	-	-	-	-	21.5	26.6	26	19.4	17.6	19.4
<a href="#">Burundi</a>	18	-	18	18	18	18	18	18	18	-	-
<a href="#">Cameroon</a>	17.7	17.7	17.7	17.7	17.7	22	22	22	22	22	22
<a href="#">Chad</a>	-	-	-	-	-	-	-	-	-	17.5	-
<a href="#">Cote d'Ivoire</a>	18	18	18	18	18	-	-	-	-	-	-
<a href="#">Democratic Republic of Congo</a>	-	-	-	-	-	17.2	17.2	17.2	17.2	-	-
<a href="#">Eritrea</a>	17.2	17.2	17.2	17.2	17.2	-	-	-	-	-	-
<a href="#">Ethiopia</a>	-	-	17.8	17.8	17.9	17.8	17.8	17.8	17.8	17.8	-
<a href="#">Gambia</a>	-	-	-	-	-	-	-	-	18	-	-
<a href="#">Ghana</a>	18	18	18	18	18	18	18	18	18	18	-
<a href="#">Guinea</a>	-	-	-	-	-	16	16	16	16	16	16
<a href="#">Guinea-Bissau</a>	18	18	18	18	18	18	18	18	18	18	-
<a href="#">Kenya</a>	-	-	-	-	22.2	18.3	19.3	25.7	18	18.1	25.5
<a href="#">Lesotho</a>	-	17.4	17.4	17.4	17.4	16.7	16.1	17.2	16.4	15.5	17.1
<a href="#">Liberia</a>	-	-	-	-	-	-	-	-	-	-	-
<a href="#">Madagascar</a>	-	-	-	-	-	-	-	-	-	-	-
<a href="#">Malawi</a>	-	20.2	20.2	20.4	20.2	21.4	20.3	20.8	21	19.7	-
<a href="#">Mali</a>	17.7	17.8	17.7	17.8	17.8	22	21.9	21.8	21.6	22.1	-

Click on a country name in the table above and the % weight loss (and absolute loss) of the provinces of that country will be displayed. The example below shows the three provinces of Malawi.

## for Maize in : Malawi Provinces of Malawi



**Click on a loss figure** in the table below to see in detail how the figure was derived. Send us **your comments** if you have the feeling that the underlying data and assumptions could be improved.

Please sent your comments to [info\(at\)phlosses.net](mailto:info(at)phlosses.net).

Province	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Back
Central	-	19.5	19.3	19.7	19.4	20.7	20.1	20.2	20.8	19.5	-	
Northern	-	20.5	20.5	20.9	20.2	21.2	21	21	21.2	20.3	-	
Southern	-	19.6	19.7	19.7	21.6	22.5	20.3	22.2	21.5	19.6	-	Back

## Estimated Postharvest Losses (t) 2003 - 2013

Province	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Back
Central	-	210739	171142	262904	365508	313792	393851	423331	470653	360817	-	
Northern	-	56539	46119	109244	100668	81950	116472	103845	120748	93704	-	
Southern	-	116224	70940	183514	255017	206815	267156	194942	240464	244718	-	

Click on a loss figure for one of the three provinces and a long table is revealed that displays details of the loss calculation and data sources. For example by clicking on 19.5 in the table above, which is the % weight loss for maize in Central Province in 2012, a breakdown of the loss estimation is displayed. The first part of this table is as follows.

### Weighted average

- Country : Malawi
- Province : Central
- Climate : Humid subtropical climate dry winter (Cwa)
- Year : 2012
- Crop : Maize

Annual production and losses		
	tonne	%
Production	1846011	100
Grain remaining	1485194	80.5
Lost grain	360817	19.5

Seasonal production and losses							
Season	Farm Type	Production (t)	Remaining (t)	Losses (t)	Production (%)	Remaining (%)	Losses (%)
1	small	1522185	1216585	305600	99.0	79.1	19.9
1	large	15804	13485	2319	1.0	0.9	0.2
Seasonal:		1537989	1230070	307919	100.0	80.0	20.1
2	small	308022	255124	52898	100.0	82.8	17.2
2	large						
Seasonal:		308022	255124	52898	100.0	82.8	17.2
Annual:		1846011	1485194	360817	100.0	80.5	19.5

### PHL (%) Calculation

*NB Annual averages are a weighted average of the seasons*

In this particular case there are two seasons of maize cultivation. In the first season there are both smallholder and larger scale farming activities. In the second season there are only smallholders. The loss estimate for the first season is 20.1%, the second season 17.2%. The annual weighted average of the two loss estimates is 19.5%.

By scrolling down this table more details of the loss estimation process are revealed. First details of the seasonal factors for smallholders in Season 1 are given, then the PHL profiles used to calculate the loss, the losses expected for the grain that remains in store on-farm and the losses from grain that is marketed in the first three months. There follow similar tables for large-scale farmers in Season 1, and smallholders in Season 2 (but not shown here). If you would like to see them then go to the website (<http://www.aphlis.net>).

PHL (%) Calculation: Season: 1 Farm Type: <u>small</u>					
Grain marketed within the first three months after harvest (%)	30	<p><i>If data is missing (no data) it is assumed that for subsistence farmers all grain is stored whereas for commercial farmers all grain is marketed.</i></p> <p><i>Note: Figures in this table are farm type specific (small or large farms). The value Grain marketed within the first three months after harvest (%) is used to determine the percentage of total production that is stored and marketed by this type of farm in this particular season (Season 1, Season 2 etc). The calculation only considers the portion that is produced by this type of farm. Consequently, the figures below for Stored (%) and Marketed (%) will only add up to 100% if all grain in a particular season is produced on this farm type. Otherwise the corresponding percent figures for the other farm type, in the same season, must be included to arrive at a sum of 100%.</i></p>			
Rain at harvest	no	<p><i>If weather is damp at harvest, leading to exceptional mould damage to the crop, then the value is yes and the Harvesting/field drying losses figure in the PHL profile is replaced by 16.3%.</i></p>			
Storage duration (months)	12	<p><b>Effect of storage duration:</b></p> <ol style="list-style-type: none"> <li>0-3 months % figure for storage is 0 (zero)</li> <li>3-6 months the % figure of the PHL profile is divided by 2</li> <li>More than 6 months or in case of missing data (no data) the % figure in the general profile is used</li> </ol>			
Larger Grain Borer	yes	<p><i>If the crop is maize and the value is yes then the Farm storage loss figure in the PHL profile is multiplied by 2.</i></p>			
		Stored (%)		Marketed (%)	
		69.3		29.7	
Stages	PHL profile (adjusted)	Remaining grain	Loss Increment	Remaining grain	Loss Increment
Harvesting/field drying	6.4	64.8	4.4	27.8	1.9
Platform drying	4	62.2	2.6	26.7	1.1
Threshing and Shelling	1.3	61.4	0.8	26.3	0.4
Winnowing	0	61.4	0	26.3	0
Transport to farm	2.4	59.9	1.5	25.7	0.6
Farm storage	9.1	54.5	5.4	25.7	0
Transport to market	1.7	54.5	0	25.3	0.4
Market storage	2.7	54.5	0	24.6	0.7
<b>Total</b>		<b>54.5</b>	<b>14.8</b>	<b>24.6</b>	<b>5.1</b>

Following the loss tables, for each scale of farming there is an assessment of the quality of the data that has been used to create the PHL profile. The individual loss estimates that have been used to derive each loss profile figure are rated for their specificity to the situation in which they

### PHL profile: Data quality display and references to sources

PHL profiles are used to calculate losses, each profile consists of a series of values, one for each link in the postharvest chain. Each value in the PHL profile is formed from the average of several figures drawn from the available literature. All these figures are shown individually in the tables below. Separate PHL profiles are given for small farms and large (commercial) farms. The reliability of each datum contributing to the calculation of each PHL profile value is displayed in the table below. The assessment is based on how specific the figure is to the situation in which it is being used. To do this, each figure is assessed according to whether it is from the same **Cereal** type (maize, rice etc), same **Climate** type (is from same Koeppen code), same **Farm type** (from a small farm or large commercial farm), and if the **Method** of loss assessment was an actual measurement of loss or was a questionnaire survey or guesstimate. The result of the assessment is indicated using the **red/0** and **green/1** system as follows - 0 A datum used in the calculation of a PHL profile value is not specific to this situation or is from a questionnaire survey or a guesstimate, i.e. is not measured.

1 A datum used in the calculation of a PHL profile value is specific to this situation or is measured.

PHL profile figures based on more 'green/1' data are considered to be more reliable than those based on more 'red/0' data. Against each PHL profile value the number of 'red/0' and 'green/1' assessments is averaged, and displayed in bold, to give a general assessment of the value. Frequently some parts of the profile are more reliable than others, especially those where more loss data are available from the literature.

References and individual loss figures % for small farms						
Stages	Loss figure	Reference	Origin of figure			
			Cereal	Climate	Farm type	Method
Harvesting/field drying	5.5	Egyir I.S. - 2011	1	0	1	0
	2.0	Boxall R.A. - 1998	0	0	1	0
	5.0	Vervroegen D. - 1990	0	1	1	0
	3.2	Singano C. - 2008	1	1	1	0
	6.5	Singano C. - 2008	1	1	1	0
	6.9	Singano C. - 2008	1	1	1	0
	9.9	Singano C. - 2008	1	1	1	0
	9.9	Grolleaud M. - 1997	1	0	1	0
	5.8	Mvumi B.M. - 1995	1	1	1	0
	9.5	Odogola W.R. - 1991	1	1	1	0
Platform drying	6.4		1	1	1	0
	3.5	Lars-Ove Jonsson - 1987	1	1	1	0
	4.5	Odogola W.R. - 1991	1	1	1	0
Threshing and Shelling	4.0		1	1	1	0
	1.0	Odogola W.R. - 1991	1	1	1	0
	1.8	Egyir I.S. - 2011	1	0	1	0
	1.0	Boxall R.A. - 1998	0	0	1	0
	0.3	Grolleaud M. - 1997	1	0	1	0
Transport to farm	2.5	Mvumi B.M. - 1995	1	1	1	0
	1.3		1	0	1	0
	1.0	Odogola W.R. - 1991	1	1	1	0
	3.0	Vervroegen D. - 1990	0	1	1	0
	2.0	Singano C. - 2008	1	1	1	0
	2.3	Singano C. - 2008	1	1	1	0
	4.0	Singano C. - 2008	1	1	1	0
	2.2	Egyir I.S. - 2011	1	0	1	0
Farm storage	2.4		1	1	1	0
	5.4	Adams J.M. - 1977	1	1	1	1
	4.3	Binder K.F. - 1994	1	1	1	1
	4.4	Binder K.F. - 1994	1	1	1	1
	4.6	Binder K.F. - 1994	1	1	1	1
	4.1	Adams J.M. - 1977	1	1	1	1
	4.4	De Lima C.P.F. - 1982	1	1	1	1
Transport to market	4.5		1	1	1	1
	1.0	Odogola W.R. - 1991	1	1	1	0
	2.3	Egyir I.S. - 2011	1	0	1	0
Market storage	1.7		1	1	1	0
	1.3	Egyir I.S. - 2011	1	0	1	0
	4.0	Boxall R.A. - 1998	0	0	1	0
	2.7		1	0	1	0

**Title:**  
The maize (Zea mays L.) post-production practices of smallholder farmers in Zimbabwe: findings from surveys.

**Source:**  
Journal of Applied Science in Southern Africa 1 (2), 115-130.

**Author:**  
Mvumi B.M., Giga D.P. and Chiuswa D.V.

**Year of publication:** 1995

**Geo focus:** Zimbabwe

**Bibliographical reference**

are being used (by crop type, by climate type, by scale of farming, and by whether the estimate was derived from a measurement of loss or by a questionnaire survey). Where estimates are specific or measured then they are marked green/ given a '1' rating, where they are not specific or are questionnaire data they are marked red/ given a '0' rating. The average rating is then given in bold against each PHL profile figure. The same table shows the author for each loss estimate used to calculate the PHL profile figures. By hovering the cursor over these author names, the full bibliographical details are revealed.

## 10. Warnings about APHLIS estimates

As far as possible, PHL profiles are specific to the crops and region for which they were developed. The PHL calculator should not be used for the estimation of losses for other crops, farming systems or regions.

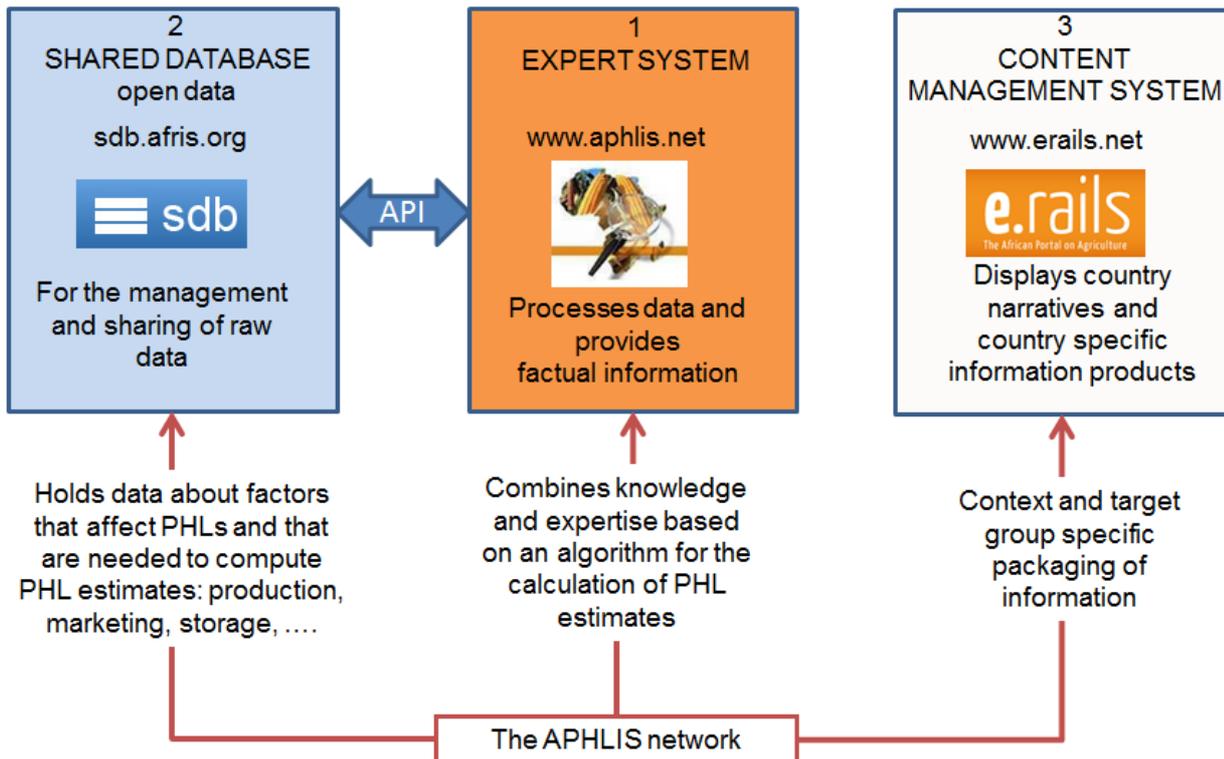
PHL estimates are based on the best data available, but this is not necessarily very accurate. In many cases the PHL profiles are very generalised, i.e. do not contain loss figures from the same cereal or from the same climatic area for all steps of the PH chain. This is indicated in both the web-based 'Losses Tables' and in the downloadable PHL calculator by scoring each individual figure that makes up a generalised value in the PHL profiles. These are marked as 1 if they are specific or 'measured' or marked '0' if not specific ('other') or 'questionnaire/guesstimate'. If this scoring gives an average of below 0.5 then the individual PHL profile value is rated as 'other' or 'questionnaire/guesstimate' and such values would generally be expected to be less reliable than when specific or measured values are used.

If you possess more up-to-date, specific data then these could be used by downloading the spreadsheet version of the PHL calculator and altering the default values of the PHL profile. However, note that PHL profiles can't be altered permanently on the spreadsheet. The APHLIS network is always looking for new, well documented PHL figures which can be added to the web-based calculator to make the PHL profiles more specific and more robust. If you have such figures then make contact with PHL network using the 'Contact us' feature on the home page).

## 11. APHLIS database



APHLIS was developed in the frame of 3 successive projects and was continuously improved as new knowledge became available. The process of improvement will continue and is achievable because the APHLIS information system has a modular structure that provides the flexibility required for up-grading and extending the system at low cost.



### The three modules of APHLIS

The central module is the APHLIS website that can be found at [www.aphlis.net](http://www.aphlis.net). It is used for processing data and for displaying factual data and results in tabular format and as maps. The second module is the Shared database. This is used for decentralized management of seasonal data by the national teams. The SDB is a novel GIS enabled database system that allows for the management of numerical data for an unlimited number of variables and objects. Data is managed in data-matrices (shown below) that assure the referencing and description of data according to international standards. Each national team has a set of data-matrices for the management of their own seasonal data. The export and import features of the SDB allow for off-line data management in Excel (an example is shown below).

Variable: Production (mass) - 1st season - smallholder farms metric tonnes [MT] - Min: 0, Max: 10000000

Location	Date	Barley, other #040001010502 Barley, other	Maize (corn), other #040001010202 Maize (corn), other	Millet, other #040001010802 Millet, other	Oats, other #040001010702 Oats, other	Rice paddy, other (not husked) #040001010302 Rice paddy, other (not husked)	Sorghum, other #040001010402 Sorghum, other	Teff, other #04000101080204 Teff, other	Wheat, other #040001010102 Wheat, other
Gambella	2008								
	2009	0	13841.7	0	0	0	9770.96	0	0
	2010	0	9712.49	0	0	0	9257.85	0	0
	2011	0	10245.9	0	0	0	8214.64	0	0
	2012	5.448	10687.4	0	0	0	5497.36	27.087	2.97
	2013	17.3	11972.5	0	0	6	8232.2	0	0
Dire Dawa	2008								
	2009	0	317.406	0	0	0	9733.18	0	0
	2010	0	623.245	0	0	0	8821.94	0	0
	2011	2.811	505.268	0	0	0	15282.9	0	0

Example of a data matrix in the SDB, in this case for cereal production in Ethiopia

Zwischenablage		Schriftart		Ausrichtung		Zahl				
B1		Ethiopia - Cereal production 1st season small farms 2008 to 2015								
A	B	C	D	E	F	G	H	I	J	
1	Datatablename	Ethiopia - Cereal p	Variable	Crop production > Harvest > Production (mass) - 1st season - smallholder farms(#22) (metric						
			Maize (corn), other (#39)	Millet, other (#40)	Oats, other (#41)	Rice paddy, other (not husked) (#42)	Rice paddy, other (not husked)	Sorghum, other (#43)	Teff, other (#44)	Wheat, other (#45)
2	Location	Interval	Barley, other (#38)	Maize (corn), other	Millet, other	Oats, other	Sorghum, other (#43)	Teff, other (#44)	Wheat, other	
3	Gambella (#86)	2008 (#209)								
4	Gambella (#86)	2009 (#210)	0	13841.782	0	0	0	9770.963	0	0
5	Gambella (#86)	2010 (#211)	0	9712.493	0	0	0	9257.859	0	0
6	Gambella (#86)	2011 (#212)	0	10245.94	0	0	0	8214.646	0	0
7	Gambella (#86)	2012 (#213)	5.448	10687.412	0	0	0	5497.36	27.087	2.97
8	Gambella (#86)	2013 (#214)	17.3	11972.5	0	0	6	8232.2	0	0
9	Gambella (#86)	2014 (#215)								
10	Gambella (#86)	2015 (#216)								
11	Dire Dawa (#87)	2008 (#209)								
12	Dire Dawa (#87)	2009 (#210)	0	317.406	0	0	0	9733.185	0	0
13	Dire Dawa (#87)	2010 (#211)	0	623.245	0	0	0	8821.948	0	0
14	Dire Dawa (#87)	2011 (#212)	2.811	505.268	0	0	0	15282.958	0	0

The same data-matrix in Excel for off-line data management

An Application Programming Interface (API) is used to filter and transfer the required data to the APHLIS website for the calculation of losses estimates and production of factual information. New data can easily be integrated at low cost by the definition of additional data-matrices and the adjustment of the filter of the API.

The third module of APHLIS is the regional information system of FARA [www.erails.net](http://www.erails.net). It is an easy-to-use decentralized content management system. APHLIS network members use it to publish and share information in various formats such as manuals, loss reduction tips and Country

Narratives. APHLIS network members use it to provide location specific background information and to contextualize results in order customize information products and to increase the relevance of the information for their target audience.

## 12. APHLIS Country narratives

Some APHLIS network members have prepared narratives to explain their loss figures in the context of their postharvest situations. They also offer some information and links to current or recent postharvest projects.

The country narratives are posted on the eRAILs website of the Forum for Agricultural Research in Africa (FARA) but are conveniently accessed via the left hand menu of APHLIS. There are currently only four countries listed but the intention is to increase the number of participating countries.

The screenshot shows the APHLIS website interface. On the left is a navigation menu with the following items: Home, Losses tables, Interactive losses maps, Larger grain borer, Downloadable calculator, Postharvest reviews, Understanding APHLIS, Collecting new data, Country narratives (highlighted), Literature, APHLIS Network, and About us Contacts Links. The main content area is titled 'Country Narratives' and contains a sub-header 'Country Narratives' followed by a paragraph: 'Some APHLIS network members have made information available on the cereal postharvest situation in their country and where possible have sought to explain the loss figures that appear in APHLIS and compare them with recent loss assessment exercises. They also offer some information on postharvest project that are either current or in the recent past.' Below this paragraph is a list of countries: Malawi, Rwanda, Senegal, Uganda, and Zimbabwe.

Clicking on one of the country links leads to a summary of cereal postharvest losses. There is a further menu to take you to an explanation of the loss figures which includes a detailed account of the postharvest situation, details of postharvest projects and weight loss estimates which is a link back to the losses tables on the APHLIS site.

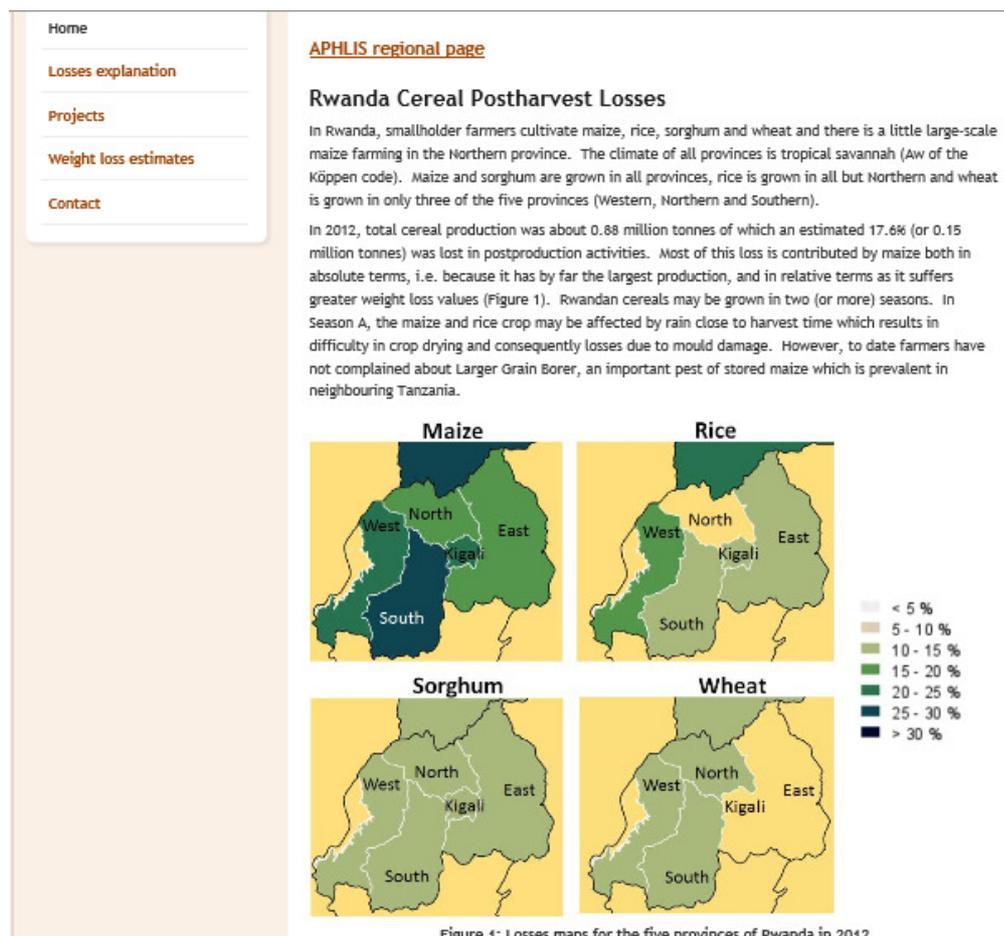


Figure 1: Losses maps for the five provinces of Rwanda in 2012

## 13. APHLIS maps



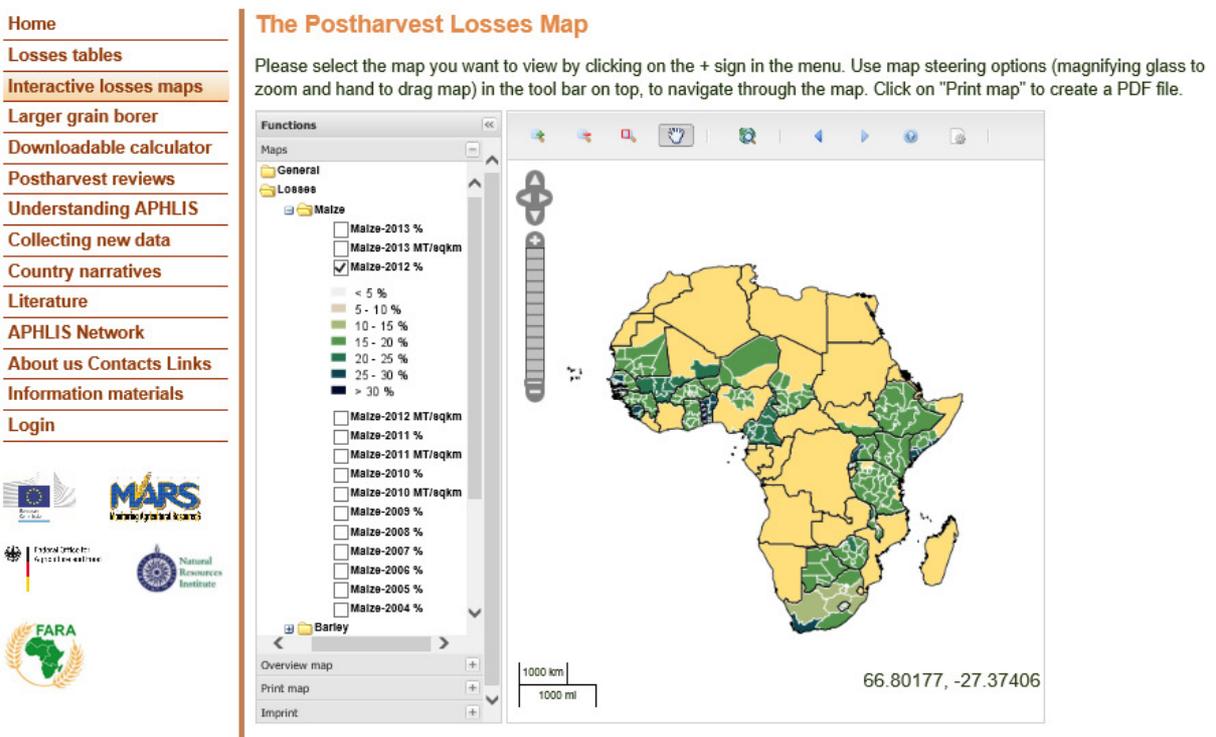
The mapping facility displays maps of losses and other key data. To access the map click the 'Interactive losses maps' button in the home page menu (see Section 5).

### 13.1 Displaying different maps

Once the map page is open select the map you want to view in the Maps menu. This offers the following –

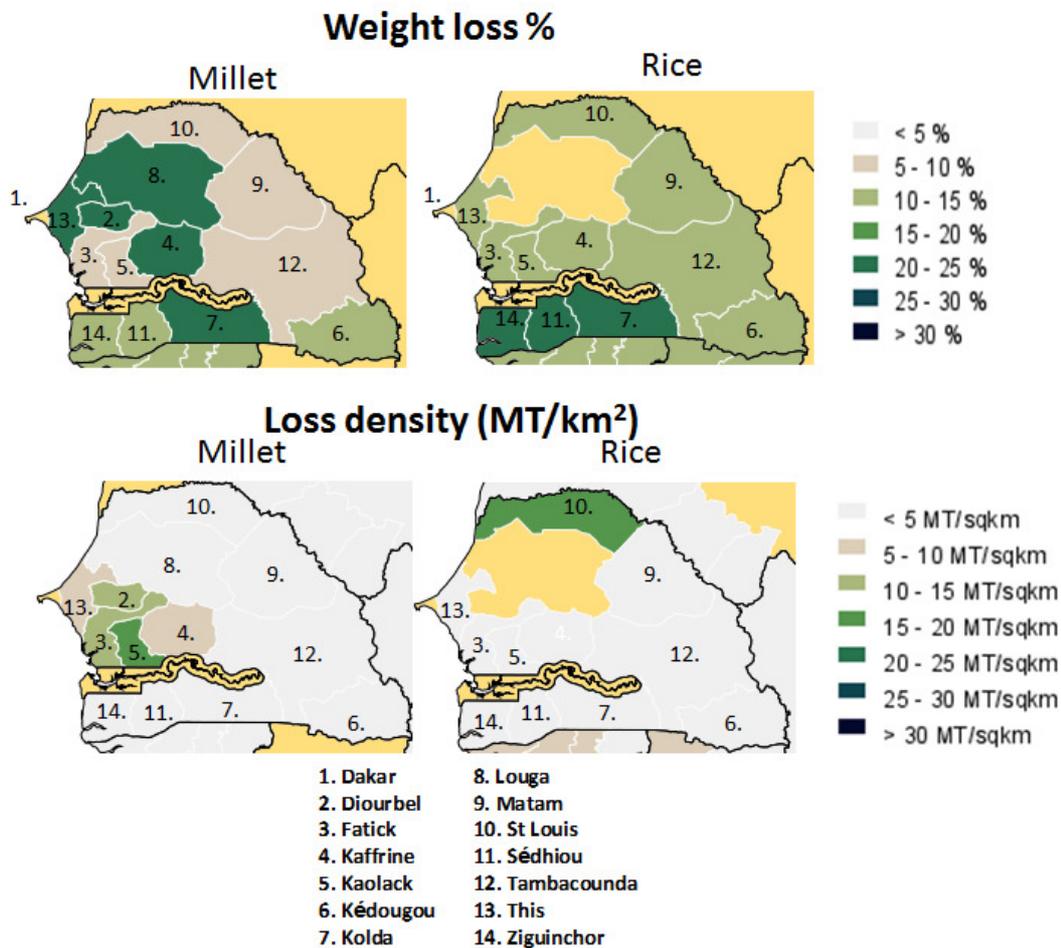
- 'General' (shows province boundaries and the Köppen climate for each province as coloured shading),
- 'Losses' (shows % losses by year for each of seven cereals and loss density maps),
- Pests and diseases (shows annual incidence of when larger grain borer has been reported as a problem) and
- Names and 'Borders' (shows country borders, province names, country names and Köppen codes a symbols).

Each map is accessed by opening the directories (+ and -) then ticking the relevant box. Use map steering options (magnifying glass to zoom and hand to drag map) to navigate through the map. The figure below shows % weight loss values for maize in 2012 for the provinces of many countries.



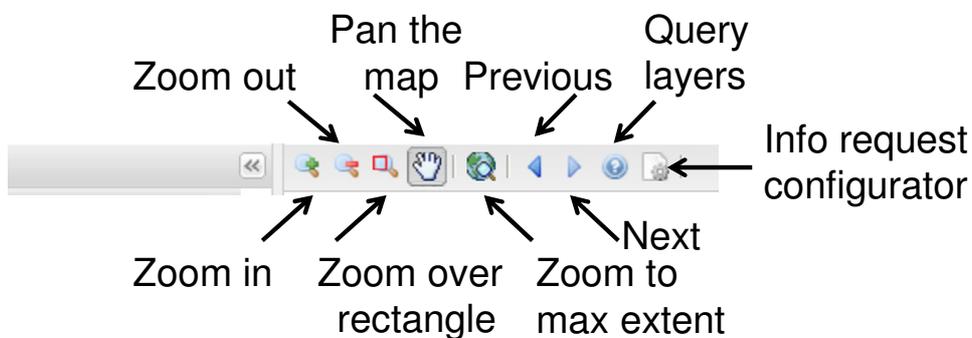
Loss density may be displayed by unticking the Maize-2012% box and then ticking, for example, Maize-2012 MT/sqkm. This highlights the places where the absolute loss values are especially severe. For example, the % weight loss values for millet and rice in Senegal are compared with the loss density values in the figure below. The provinces with greater % weight losses do not necessarily have greater absolute losses (tonnes of loss). In the case of millet, Kaolack province

(#5) has amongst the lowest % weight loss (5-10%), not least because there was no rain at harvest, whereas it has the highest loss density (15-20 MT/km<sup>2</sup>) because for its land area it produces an exceptionally large millet crop. This suggests that it may be a good target for loss reduction measures. Similarly for rice, Saint Louis province (#10) is among the lowest for % weight loss (10-15%) but is the highest for loss density (15-20 MT/km<sup>2</sup>).



### 13.2 Controlling the map settings

Above the map is a control panel with a set of buttons like this –



These button descriptions are self-explanatory in some case. The less obvious ones are

**Queries layers** – by pressing this button and then clicking on a particular province, the specific loss value of that province is displayed. This is especially useful when there is difficulty in

distinguishing which colours of the legend correspond to which loss values or when you want to know the precise loss figure not just the range offered by the legend.

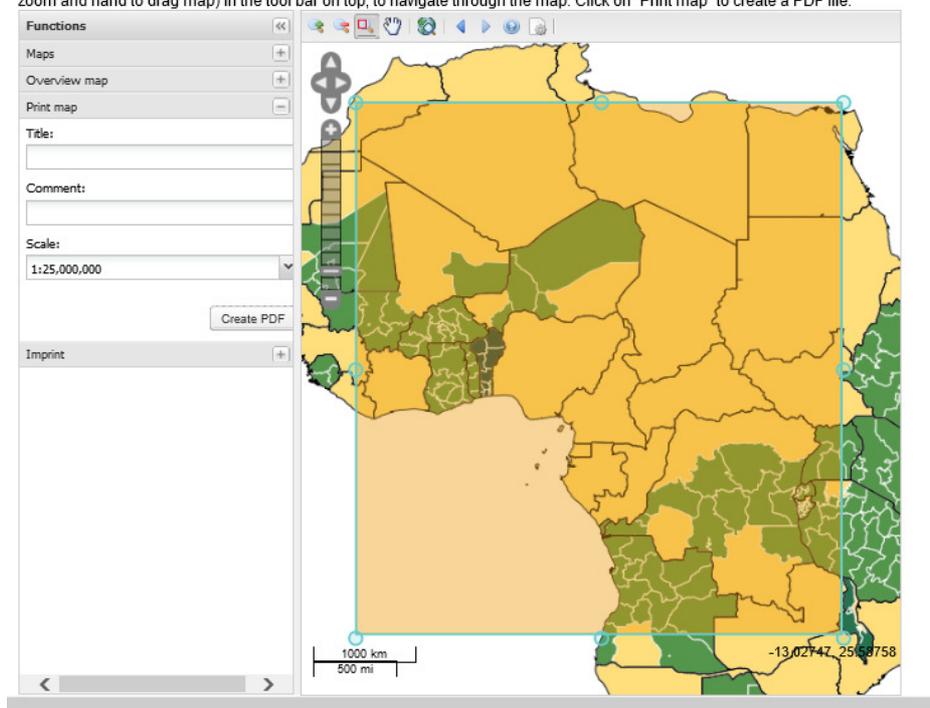
**Info request configurator** – by pressing this button you can see a listing of all the map layers that have been activated. It is then possible to deselect layers that are no longer required.

### 13.3 Printing maps

A further menu option on the map is **'Print Map'**. This allows you to download a selected area of the map as PDF file, which can be very useful for preparing reports. On opening the 'Print map' function a large rectangle appear over the map as shown below. Press the 'Zoom over rectangle' button in the map control panel to move or resize this rectangle so that it includes precisely the area of interest. When this is completed press the 'Create PDF' button to download a PDF.

#### The Postharvest Losses Map

Please select the map you want to view by clicking on the + sign in the menu. Use map steering options (magnifying glass to zoom and hand to drag map) in the tool bar on top, to navigate through the map. Click on "Print map" to create a PDF file.



## 14. How to estimate losses using the downloadable APHLIS calculator



You can download the APHLIS Calculator as an Excel spreadsheet from the menu on the left hand column of the Homepage.

This spreadsheet allows the user to substitute their own preferred values for defaults and to make estimates at whatever geographical scale is appropriate (not just region, country or province). If production data for cereals are not available then it also allows an estimate of the production if the quantities entered into storage are known. Finally, the PHL estimates can be saved in a section at the end of the spreadsheet so that a series of PHL values can be built up to give a total loss for a crop, or range of crops, across seasons, years or diverse geographical units.

### 14.1. Home page of spreadsheet

You can download a copy of the calculator from the website (<http://www.aphlis.net>), simply click the 'Download button' and you will be offered the various files that can be downloaded from APHLIS.

<ul style="list-style-type: none"><li>Home</li><li>Losses tables</li><li>Interactive losses maps</li><li>Larger grain borer</li><li><b>Downloadable calculator</b></li><li>Postharvest reviews</li><li>Understanding APHLIS</li><li>Collecting new data</li><li>Country narratives</li><li>Literature</li><li>APHLIS Network</li><li>About us Contacts Links</li><li>Information materials</li><li>Login</li></ul>	<h3>Downloadable calculator</h3> <p>The APHLIS calculator can be downloaded as an Excel spreadsheet. This allows users to -</p> <ul style="list-style-type: none"><li>• Substitute their preferred values in place of the APHLIS defaults, in this way loss estimates can be customised for specific locations or geographical scale (not just region, country or province)</li><li>• Estimate the production of a particular cereal if the quantities entered into storage are known (it does this by back calculation which adds back the losses expected prior to storage).</li><li>• Save the results of several calculations in a section at the end of the spreadsheet that will then display a weighted average loss. In this way PHL values can be built up to give a total loss for a crop, or range of crops, across seasons, years or diverse geographical units.</li></ul> <p>Details about the use of the downloadable calculator are presented in the 'Understanding APHLIS' manual (Section 10) and suggestions of how the calculator can be used in losses assessment studies of the APHLIS loss assessment manual (Part 3).</p> <ul style="list-style-type: none"><li>Loss calculator Version 2.7 (xls file format - Excel 97)</li><li>Loss calculator Version 2.7 (xlsx file format - Excel 2010)</li></ul> <p>Find the calculator in the download section here</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Open the file and you will see the front page (below). Choose your language by entering the appropriate number, then 'click' to enter the calculator.

Choose language

Enter calculator

Once you have entered the calculator you will be presented with a series of boxes, where the red figures can be altered by the user (all other elements of the calculation are automatic). The first box allows the user to set geographical data, crop type and climate type relevant to the study. If you are unsure about the climate type, consult the Köppen map on the APHLIS website (from the menu - Losses maps, General, Köppen).

Country and year

Crop type

Climate type

In the next box you should enter the seasonally relevant data for the situation for which you are making the loss estimate. There is an option to enter data for one, two or three seasons. Note that in the case of cereal production data, if there is no data for a particular season then you should enter a zero '0'. You should not leave the cell blank, if you do then a warning message will be displayed.

Enter the SEASONAL DATA by replacing the red figures							
Farm type	1st season		2nd season		3rd season		
	small	large	small	large	small	large	
Production	1500 tonnes	345 tonnes	300 tonnes	100 tonnes	0 tonnes	0 tonnes	
Marketed at harvest	50 % (0-100)	100 % (0-100)	20 % (0-100)	0 % (0-100)	0 % (0-100)	0 % (0-100)	
Rain at harvest	1 1=yes	1=yes	1=yes	1=yes	1=yes	1=yes	
Storage duration	7 months	0 months	4 months	7 months	0 months	0 months	
Larger Grain Borer	1=yes	1=yes	1=yes	1=yes	1=yes	1=yes	

You must enter data on

- Crop production – an estimate of the tonnage of grain produced in the season(s) with which you are concerned (if you have no production estimate then it may be possible to create one, see Sub-section 14.5),

The following data are not essential but if added will improve the loss estimate -

- Marketed at harvest – this is the % of grain marketed in the 1<sup>st</sup> three months after harvest,
- Rain at harvest - if there has been wet/damp cloudy weather at harvest time that makes it difficult to dry the grain then enter '1' into the 'rain at harvest' box.
- Storage duration - the number of months grain will be held in farm storage (**BUT** if you are going to change the default storage loss in the PHL profile to a specific figure that you have measured (see Sub-section 14.2), then you **should always** enter here a period of 9 months storage, even if it wasn't, this ensures that APHLIS will not make further adjustments to your storage loss figure)
- Larger Grain Borer – if LGB is a problem during storage of maize then enter '1' into the 'Larger Grain Borer' box (**BUT** if you are going to change the default storage loss in the PHL profile to a specific figure that you have measured then leave this unchecked as any losses due to Larger Grain Borer will already be included in your own storage loss measurement).

Once you have entered this data then PHL profiles are offered for smallholder and/or larger-scale commercial farming. These profiles include a % weight loss figure for each link in the postharvest chain (except winnowing as this is not relevant to maize).

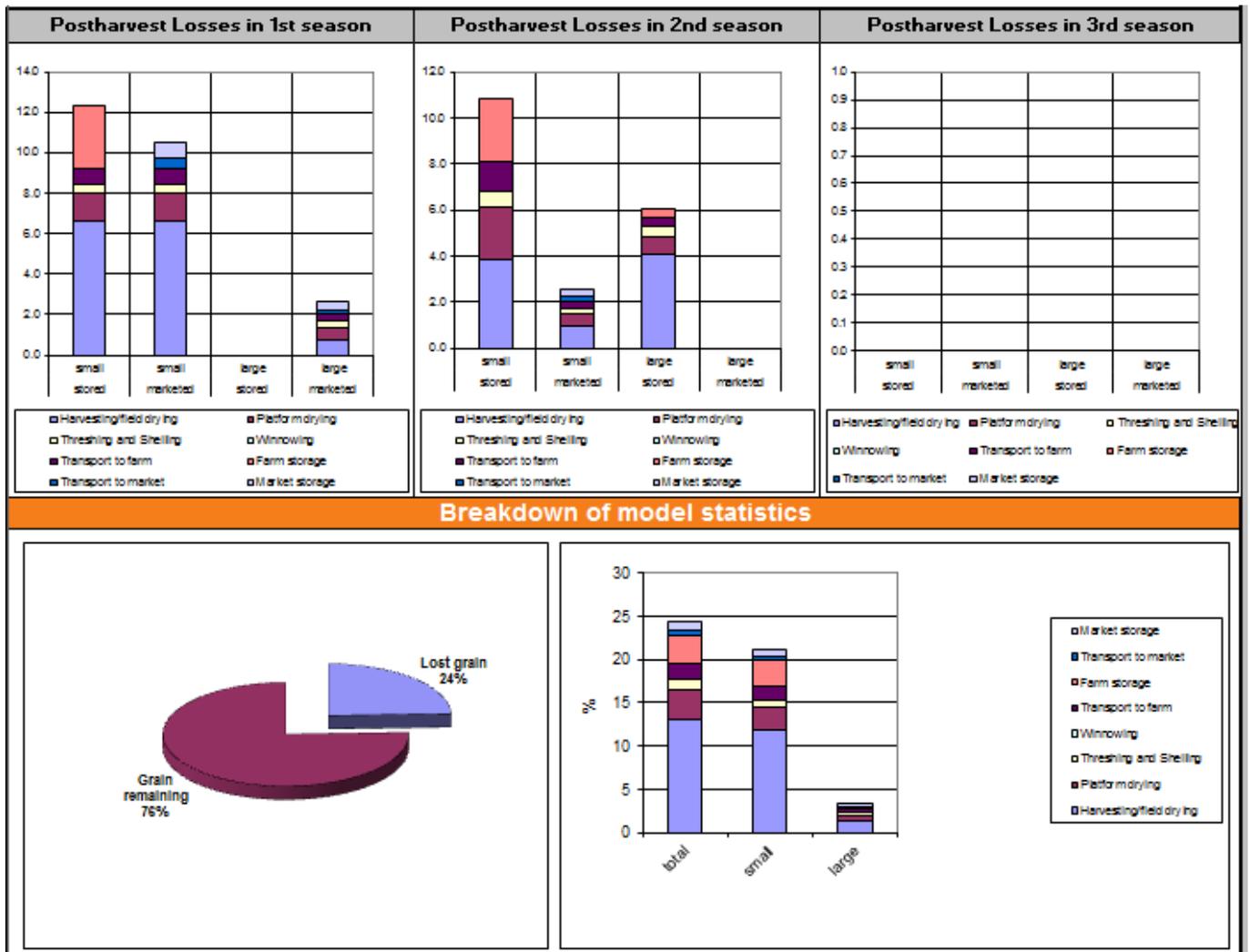
		PHL (%) Calculation: Maize - Kenya - 2012															
Farm type		1st season						2nd season						3rd season			
		small			large			small			large			small		large	
Share of production		9			91			75			25						
Destination		store		market	store		market	store		market	store		market	store		market	
Share		5		4.5	80.9		60		15.0	25							
		adjusted PHL profile		adjusted PHL profile	adjusted PHL profile		adjusted PHL profile	adjusted PHL profile		adjusted PHL profile	adjusted PHL profile		adjusted PHL profile	adjusted PHL profile		adjusted PHL profile	
		remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment	remaining grain	loss increment
<b>Steps</b>																	
Harvesting/field drying	16.3	4	0.7	4	0.7	3.8		87	3.4	6.4	56	3.9	14	1.0	16.3	21	4.1
Platform drying	4.0	4	0.2	4	0.2	3.5		84	3.1	4.0	54	2.2	13	0.6	3.5	20	0.7
Threshing and Shelling	1.3	4	0.0	4	0.0	2.3		83	1.9	1.3	53	0.7	13	0.2	2.3	20	0.5
Winnowing	-																
Transport to farm	2.4	4	0.1	4	0.1	1.9		81	1.6	2.4	52	1.3	13	0.3	1.9	19	0.4
Farm storage	5.3	3	0.2					5.3	4.9	2.7					2.3	19	0.4
Transport to market	1.7			3	0.1	1.0		80	0.8	1.7					1.0		
Market storage	2.7			3	0.1	2.7		78	2.1	2.7					2.7		
<b>Total</b>		3	1.2	3	1.2			78	12.9		49	10.8	12	2.6	19	6.1	

Smallholder farmer PHL profile for the Season 1 harvest. Note farm storage loss is 5.3%.

### 14.2. Changing the default values of the PHL profile

An important feature of the downloadable calculator is that it is possible to change the default values. At the far right of the spreadsheet there are boxes where your new values can be entered to replace the defaults according to season and by scale of farming (small/large). Enter the postharvest loss values that are relevant to your study or loss figures that you wish to use to generate a 'what if' scenario. In the example below, a 10% loss figure was determined by a project and so this figure has been entered to replace the default value of 5.3% (which you saw in the previous figure).





### 14.3. Tracing Loss Values and their quality

The next section of the spreadsheet presents the quality (reliability) of the data sources used to generate each of the figures used in the PHL profile (see Sub-section 8.1). It is from here that you can see whether the loss estimate used for each step in the PHL profile is specific to the crop, climate and scale of farming or is 'other' meaning that the closest applicable figures, but not specific ones, are being used. There is also a record of how the figures were derived under the 'Method' column. Figures are either 'measured' in which case objective techniques have been used to estimate a loss value or they are 'questionnaire/guesstimate' meaning that they are less objective (but not necessarily less accurate). It would be anticipated that where specific and 'measured' figures are being used then the estimate is more reliable than when figures are from 'other' or 'questionnaire/guesstimate'.

In this system, those values contributing to the general PHL profile figures for each link in the chain are scored as 1 if they are specific or 'measured' or scored 0 if 'other' or 'questionnaire/guesstimate'. If average values are below 0.5 then the value is rated as 'other' or 'questionnaire/guesstimate'. You will see in the table below that for subsistence farming, farm storage is specific and measured while for large scale farming it is not measured or specific to cereal or climate.

Finally there is a table which gives the loss profile figures used for subsistence or for commercial farmers against which there are numbers. The first figure (highlighted) has no reference number against it, this is the PHL profile figure derived from the other estimates in the same row. These other estimates are those taken from the literature or submitted to the PHL database, each has a reference number above it that refers to a listing of bibliographical source found at 'References' tab in the top left hand corner of the spreadsheet.

Tracing Loss Values Area										
Default PHL profile as defined by this crop and climate										
Farm type	Small farms					Large farms				
Steps	%	Origin of figure				%	Origin of figure			
		Cereal	Climate	Farm type	Method		Cereal	Climate	Farm type	Method
Harvesting/field drying	6.4	other	other	small	questionnaire/guesstimate	3.8	other	other	large	questionnaire/guesstimate
Platform drying	4.0	other	other	small	questionnaire/guesstimate	3.5	other	other	large	questionnaire/guesstimate
Threshing and Shelling	1.3	other	other	small	questionnaire/guesstimate	2.3	other	other	large	questionnaire/guesstimate
Winnowing	-	-	-	-	-	-	-	-	-	-
Transport to farm	2.4	other	other	small	questionnaire/guesstimate	1.9	other	other	large	questionnaire/guesstimate
Farm storage	5.3	Maize	Aw	small	measured estimate	2.3	other	other	large	questionnaire/guesstimate
Transport to market	1.7	Maize	Aw	small	questionnaire/guesstimate	1.0	other	other	other	questionnaire/guesstimate
Market storage	2.7	Maize	Aw	small	questionnaire/guesstimate	2.7	Maize	Aw	large	questionnaire/guesstimate

References and individual loss figures %																						
Data and references for the PHL profile of small farms																						
Steps	Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Harvesting/field drying	reference n°	13	33	51	53	71	73	73	73	75	-	-	-	-	-	-	-	-	-	-	-	
	figure	6.4	2	9.9	5.8	9.5	5	3.2	6.5	6.9	9.9	5.5	-	-	-	-	-	-	-	-	-	
Platform drying	reference n°	45	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	4.0	3.5	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Threshing and Shelling	reference n°	13	33	51	53	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	1.3	1	0.3	2.5	1	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Winnowing	reference n°	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transport to farm	reference n°	13	53	71	73	73	73	75	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	2.4	2	1	3	2	2.3	4	2.2	-	-	-	-	-	-	-	-	-	-	-	-	
Farm storage	reference n°	18	18	18	18	26	27	52	67	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	5.3	4.6	5.2	6.2	7.3	3.1	6.1	4.6	5	-	-	-	-	-	-	-	-	-	-	-	
Transport to market	reference n°	53	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	1.7	1	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Market storage	reference n°	13	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	2.7	4	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Please note that the loss figures of this general profile are adjusted in the loss calculation matrix above (adjusted profile) for 'rain at harvest', 'storage duration' and problems with the 'larger grain borer' according to the data you enter.

Data and references for the PHL profile of large farms																						
Steps	Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Harvesting/field drying	reference n°	13	73	73	73	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	3.8	2	2.1	4.1	4.8	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Platform drying	reference n°	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	3.5	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Threshing and Shelling	reference n°	13	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	2.3	1	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Winnowing	reference n°	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transport to farm	reference n°	13	73	73	73	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	1.9	2	0.5	2	2.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Farm storage	reference n°	73	73	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	2.3	1.7	2.5	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transport to market	reference n°	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Market storage	reference n°	13	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	figure	2.7	4	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Please note that the loss figures of this general profile are adjusted in the loss calculation matrix above (adjusted profile) for 'rain at harvest', 'storage duration' and problems with the 'larger grain borer' according to the data you enter.

#### 14.4. Calculation of postharvest losses for a country

The last facility of the spreadsheet is a table into which the user can record the PHL estimates made for one or more crops in any particular area (region, sub-region, country, province, sub-province etc.). The values entered can be saved each time the Calculator is used and so eventually the table will display the final total loss estimate for the crop (s) and geographical area.



To use the Production Calculator-

1. Set the PHL calculator to the correct crop type and climate type (see Sub-section 14.1)
2. In the production box add in the weight (tonnes) of grain in store and the weight of grain already marketed and/or consumed. There are separate entries for either smallholder or larger commercial farmers.
3. The production in each farm type is displayed. Now that you have a production estimate, this can be entered into the PHL calculator (under 'Seasonal' data) to help obtain a cumulative weight loss estimate.

#### 14.6. Resetting the calculator to model losses

The calculator can be used to model different scenarios, in Sub-section 14.2 you saw how to change default values of the PHL profile. You can also change the value for 'seasonal' data to observe their effect on loss estimation. So for example, if it would be of interest to model loss without grain marketing by smallholders then the marketed crop can be removed from the calculation by setting 'Marketed at harvest' to zero, as show below.

##### Marketed at harvest set to zero

Farm type	1st season		2nd season		3rd season	
	small	large	small	large	small	large
Production	34.5 tonnes	345 tonnes	300 tonnes	100 tonnes	0 tonnes	0 tonnes
Marketed at harvest	0 % (0-100)	0 % (0-100)	20 % (0-100)	0 % (0-100)	0 % (0-100)	0 % (0-100)
Rain at harvest	1 1=yes	1=yes	1=yes	1=yes	1=yes	1=yes
Storage duration	7 months	0 months	4 months	7 months	0 months	0 months
Larger Grain Borer	1=yes	1=yes	1=yes	1=yes	1=yes	1=yes

This results in no losses accruing due to transport to market or due to market storage.

Farm type	small				large			
	store		market		store		market	
Share of production	9				91			
Destination	9				90.9			
Share	9				90.9			
Steps	adjusted PHL profile	remaining grain	loss increment	remaining grain	loss increment	adjusted PHL profile	remaining grain	loss increment
Harvesting/field drying	16.3	8	1.5			3.8	87	3.4
Platform drying	4.0	7	0.3			3.5	84	3.1
Threshing and Shelling	1.3	7	0.1			2.3	83	1.9
Winnowing	-							
Transport to farm	2.4	7	0.2			1.9	81	1.6
Farm storage	10.0	6	0.7					
Transport to market	1.7					1.0	80	0.8
Market storage	2.7					2.7	78	2.1
<b>Total</b>		<b>6</b>	<b>2.8</b>				<b>78</b>	<b>12.9</b>

No transport to market or market storage losses are registered

The loss value returned has now increased to 26% and 582 tonnes (see below), since farm storage at 10% is much more severe than the losses due to transport and market storage that would have affected the 50% of grain sent to market.

Farm type	small	large	small	large	small	large
Grain remaining	56.7	16.0	61.6	18.9		
Lost grain	24.7	2.7	13.4	6.1		
	1st season		2nd season		3rd season	
Grain remaining	72.7		80.5			
Lost grain	27.3		19.5			
Total remaining			74 %			
<b>Annual loss</b>	<b>26 %</b>					
<b>PHL (tonnes) Calculation: Maize - Kenya - 2012</b>						
Farm type	1st season		2nd season		3rd season	
	small	large	small	large	small	large
Production	1,500	345	300	100		
Grain remaining	1,045	295	247	76		
Lost grain	455	49	53	24		
Production	1,845		400			
Grain remaining	1,341		322			
Lost grain	504		78			
Annual production			2,245 tonnes			
Total remaining			1,663 tonnes			
<b>Annual loss</b>	<b>582 tonnes</b>					

**In this case a higher loss is estimated if no grain is marketed**

However, although the % loss is correct the tonnage includes grain that previously was marketed. This may be satisfactory for some purposes but if it should be excluded from the estimate then this can be done by reducing the maize production estimate by 50% (which is the amount of grain that was marketed).

#### 14.7. Using APHLIS as a component of loss assessment studies

Projects on loss assessment are designed to collect loss data in order to -

- i) justify/plan the implementation of loss reduction measures, and/or
- ii) to document the impact of loss reduction measures as a component of project monitoring and evaluation (M&E). Such projects typically deliver postharvest training, introduce new postharvest techniques (better stores, drying methods, mechanisation etc.), and/or connect farmers to more quality conscious markets.

In either case APHLIS is an invaluable tool. General loss estimates for provinces can be obtained from the APHLIS website (they are either displayed or will require data input for them to be displayed). Such figures are a useful benchmark against which to compare the progress of projects that are working at a smaller geographical scale. Most postharvest practitioners work on projects that address losses at a relatively small geographical scale (i.e. not the whole country or a whole province) and generate loss data specifically for this situation. Such practitioners need to use the downloadable PHL calculator to obtain a cumulative estimate of postharvest losses. It is very unlikely that a project could collect loss data for all links in the postharvest chain but APHLIS can provide these whilst the practitioner can enter into the calculator the figures relating to those links in the postharvest chain that are relevant to the project. The impact of the new data on the postharvest system as a whole can be seen when the calculator returns an estimate of the cumulative loss of the whole chain. So for example, if losses during storage have been reduced from 10% to 1%, it will now be possible to see what effect this has on the cumulative losses (which would not be a 9% reduction). It will be possible to estimate how much more grain is available and, if farm gate prices are available, then to calculate how much better off farmers might be if they can sell this grain.

In cases where projects have investigated adopters and non-adopters of a technological improvement then for purposes of comparison the groups should be as similar as possible in all respects except for the adoption of the improvement. In the real world they may not be very

similar because where an intervention is now well embedded it may have altered the behaviour of the adopters (e.g. they may market more or less grain, store grain for longer or shorter periods or apply or not apply insecticides). In this situation the calculator maybe used to generate different scenarios, such as the losses of these two groups as actually observed, or their losses modelled by inserting the different weight loss values that result from adoption on non-adoption into each other's loss profiles.

**Warning – when defaults are changed the spreadsheet will take some seconds to recalculate. You must give it time to make the changes, the 'Calculating Cells' display in the bottom left hand corner monitors progress.**

## 15. Collecting new data for APHLIS

To provide loss estimates APHLIS requires two types of data. It needs estimates of the -

- values of losses for each link in the postharvest chain, and
- seasonal factors that affect losses.

<ul style="list-style-type: none"> <li><a href="#">Home</a></li> <li><a href="#">Losses tables</a></li> <li><a href="#">Interactive losses maps</a></li> <li><a href="#">Larger grain borer</a></li> <li><a href="#">Downloadable calculator</a></li> <li><a href="#">Postharvest reviews</a></li> <li><a href="#">Understanding APHLIS</a></li> <li style="background-color: #f4a460;"><a href="#">Collecting new data</a></li> <li><a href="#">Country narratives</a></li> <li><a href="#">Literature</a></li> <li><a href="#">APHLIS Network</a></li> <li><a href="#">About us Contacts Links</a></li> <li><a href="#">Information materials</a></li> <li><a href="#">Login</a></li> </ul>	<h3>Collecting new data</h3> <p>To make loss estimations APHLIS needs three types of data, these are -</p> <ol style="list-style-type: none"> <li>1) Cereal production by province, by season and where possible by smallholder or larger-scale producer - these can usually be obtained on request from Ministries of Agriculture</li> <li>2) Losses that occur at each link in the postharvest chain - obtain by costly and time consuming field survey work (this is why APHLIS has to rely mostly on loss data from the scientific literature), and</li> <li>3) Factors that affect the severity of losses, between seasons and between years - obtained by field survey interviews or interviews with experienced extension workers.</li> </ol> <p>To help facilitate the collection of new loss data, APHLIS has prepared a <b>loss assessment manual</b> that gives details of rapid survey methods for loss assessment, in particular the combined use of visual scales and questionnaire surveys. There is also a <b>form</b> that can be used for face to face or telephone interviews to gather seasonal data from experienced extension workers.</p>
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### 15.1. New data on weight losses

The loss values for each link in the chain are already set as defaults in the PHL calculator (on the website and the downloadable Excel spreadsheet). However, these defaults are based on a relatively small set of data from published studies and the 'grey' literature. The numbers involved are shown on the figure below.

### Number of individual loss estimates available

	Number of loss figures	
	Harvesting/field drying	38
	Transport to homestead	19
	Drying	2
	Threshing/shelling	23
	Winnowing	7
	Farm storage	83
	Transport to market	2
	Market storage	3

Much of this data is shared between different crops, different climates and scales of farming (smallholder and larger scale) so that within the calculator the PHL Profiles (see Sub-section 8.1) are not entirely specific to the situation or are only partially specific. Consequently, there is still a need for more postharvest weight loss data that could be used refine the loss estimates. To help

gather more data APHLIS has prepared a manual entitled 'How to assess postharvest cereal losses and their impact on grain supply'. This manual can be downloaded from the APHLIS website. It puts emphasis on rapid techniques for loss estimation.

### **15.2. New data on seasonal factors**

The collection of data on seasonal factors is also very important, since on the APHLIS system it is this data that creates the difference in losses between seasons and between years. The seasonal factors considered are -

- 1) whether or not there is damp weather at time of any of the harvests that affects the ability of farmers to dry grain well. If at least 50% of farmers questioned in an area have had problems in grain drying due to rain and/or damp cloudy weather at harvest then APHLIS is set so that losses are increased due to 'rain at harvest.
- 2) the proportion of grain that is marketed within the first three months, so will not enter storage for any significant time,
- 3) the length of the farm storage period, and
- 4) in the case of maize, whether or not LGB is expected to be a significant pest.

The collection of data on seasonal factors is potentially very time consuming if this is obtained by interviewing individual farmers. However, this could be made much easier if knowledgeable extension workers are interviewed by mobile phone. A suggestion for an interview form that can be used to collect these 'seasonal' data is given in Annex 1.

## 16. How to submit new data to APHLIS

When new data on PHLs and on seasonal factors are available then they can be submitted to APHLIS as described below.

### 16.1. Postharvest weight loss data

These data are required for improving the PHL profile figures (see Sub-section 8.1). New data together with details of how they were gathered should be e-mailed to [Aphlis3@gmail.com](mailto:Aphlis3@gmail.com). The data will be assessed and if suitable will be added to the database and will be drawn upon for the calculation of PH Loss Profile figures.

### 16.2. Data on 'seasonal factors'

APHLIS network members with a login and password can submit this data directly into the APHLIS database.

Data on seasonal factors (described in more detail in Sub-section 8.2) may be assembled in the form of a simple table. An example of the 2012 data for maize collected in Malawi using the questionnaire form shown in Annex 1, is presented in Table 2.

**Table 2: Seasonal factors data for maize in 2012 for the three provinces of Malawi**

<b>Maize, Smallholder, Season 1</b>	<b>North</b>	<b>Central</b>	<b>South</b>
% marketed in 1st 3 months	66.5	39.3	44.7
Length of farm storage	6.5	6.3	6
Rain at harvest	No	No	No
Problems with LGB	Yes	Yes	Yes
<b>Maize, Smallholder, Season 2</b>			
% marketed in 1st 3 months	65	36.3	16.7
Length of farm storage	4	3.7	3.7
Rain at harvest	No	No	No
Problems with LGB	Yes	Yes	Yes
<b>Maize, Large scale, Season 1</b>			
% marketed in 1st 3 months	91	10	-
Length of farm storage	7	-	-
Rain at harvest	No	No	-
Problems with LGB	Yes	Yes	-

### 16.3 Other observations

Any other useful observations on losses, postharvest practice or postharvest projects can be submitted to the country member for posting in the Country Narratives described in Section 11. Country members are listed under 'APHLIS network' in the menu of the APHLIS web page but their e-mail addresses are not disclosed. To make contact send a message to [Aphlis3@gmail.com](mailto:Aphlis3@gmail.com) and mention which country and person you wish to contact.

## Contact details and acknowledgements

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## **Annex 1 - Interview form for the collection of APHLIS seasonal data**

This form is the basis for an interview with experienced individuals to gather data about agricultural factors that vary from season to season. These factors affect the weight losses calculations of APHLIS.

The interview is expected to last about 40 minutes and may either be 'face to face' or done over the phone. Before proceeding with the interview, the interviewer should establish that the interviewee has sufficient experience to be able to answer the questions with a reasonable degree of accuracy. If not an alternative interviewee should be sought.

### **A. Interviewee details**

**Name:** .....

**Length of time working in this area:** .....

**Description of position in organisation:** .....

**Main area of expertise:** .....

**Name of interviewer:** .....

**Date of interview**    ...../...../.....



5. Are there large scale and smallholder farmers in your area? ('Y' or 'N')

Crop	Smallholder	Large scale
Maize		
Rice		
Sorghum		
Millet		
Wheat		
Barley		
Teff		
Other		

### C. Seasonal factors

#### Rain at harvest

1) Do farmers experience rainfall or damp cloudy conditions at harvest? (mark 'Y' or 'N')

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

1b) Was this year (season) different from previous years (seasons) and if so what was the difference? Record any details.

- 2) If there was rainfall or damp cloudy conditions at harvest then did farmers experience problems in drying their grain? (mark 'Y' or 'N')

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

- 3) If farmers did have drying problems at this or other harvests then what % of farmers are believed to have experienced this problem? (mark %)

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

Grain marketed

1) **How much grain do farmers produce?** (record number of bags, stating bag size, or tonnes)

<b>Crop/harvest number</b>	<b>Smallholder/ season</b>			<b>Large scale/ season</b>		
	1	2	3	1	2	3
<b>Maize</b> Bag size						
<b>Rice</b> Bag size						
<b>Sorghum</b> Bag size						
<b>Millet</b> Bag size						
<b>Wheat</b> Bag size						
<b>Barley</b> Bag size						
<b>Teff</b> Bag size						
<b>Other</b> Bag size						

2) Do farmers sell any of their grain? (mark 'Y' or 'N')

Crop/ harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

3) If yes, then how many bags/tonnes of their harvest do they sell? (mark bags/tonnes)

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

- 4) How many bags/tonnes of their grain do they sell within the first three months after harvest? (mark bags/tonnes)

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

Length of farm storage period

- 1) In which month do farmers finish consuming all the grain from the first (or only) harvest, 2<sup>nd</sup> harvest, 3<sup>rd</sup> harvest? (record month)

Crop/harvest number	Smallholder/ season			Large scale/ season		
	1	2	3	1	2	3
Maize						
Rice						
Sorghum						
Millet						
Wheat						
Barley						
Teff						
Other						

Larger grain borer infestation

1) **Do you know LGB? If yes then describe it?** (indicate 'Y'/'N' below, if yes proceed to 2)

Y / N

2) **Does LGB occur on maize grain in your province?** (If yes, then indicate where and which years).

Y / N

Where	Years

3) **Did farmers complain about LGB on maize in your area this season?** (indicate 'Y' or 'N' and provide any additional details)

Y / N