

# Analysis of the 2009/10 Maize Production Estimate from the Crop Forecast Survey



FSRP/ACF and MACO/Policy and Planning Department  
Presentation to Cooperating Partners  
ACF Conference Hall, Lusaka  
1 July 2010

# Major Issues Covered in this Presentation

---

1. Is the CFS maize production estimate for 2009/10 accurate?
2. If so, what factors account for the increased maize production in 2009/10?
3. Did overall crop output in 2009/10 increase?
  - Did the rise in maize production reflect a rise in overall agricultural production?...or
  - Did smallholders substitute area and labor out of other crops into maize?

# Question #1:

---

Is the CFS maize production estimate for 2009/10 accurate?

# CFS Data/Analysis Strengthening

---

- Past 3-5 yrs CSO/MACO has invested to improve the quality/size of the CFS survey
  - Sample size increase
  - Increased effort on data verification/consistency checks
  - Beginning with 2008/09 CFS, improved the sample weighting scheme to be more consistent with CSO rural population info
  - Closer coordination with the Stocks Committee/Private sector
- External checks of consistency of CFS data done with seed sales, FRA procurement volumes, weather and production/marketing patterns in other surveys

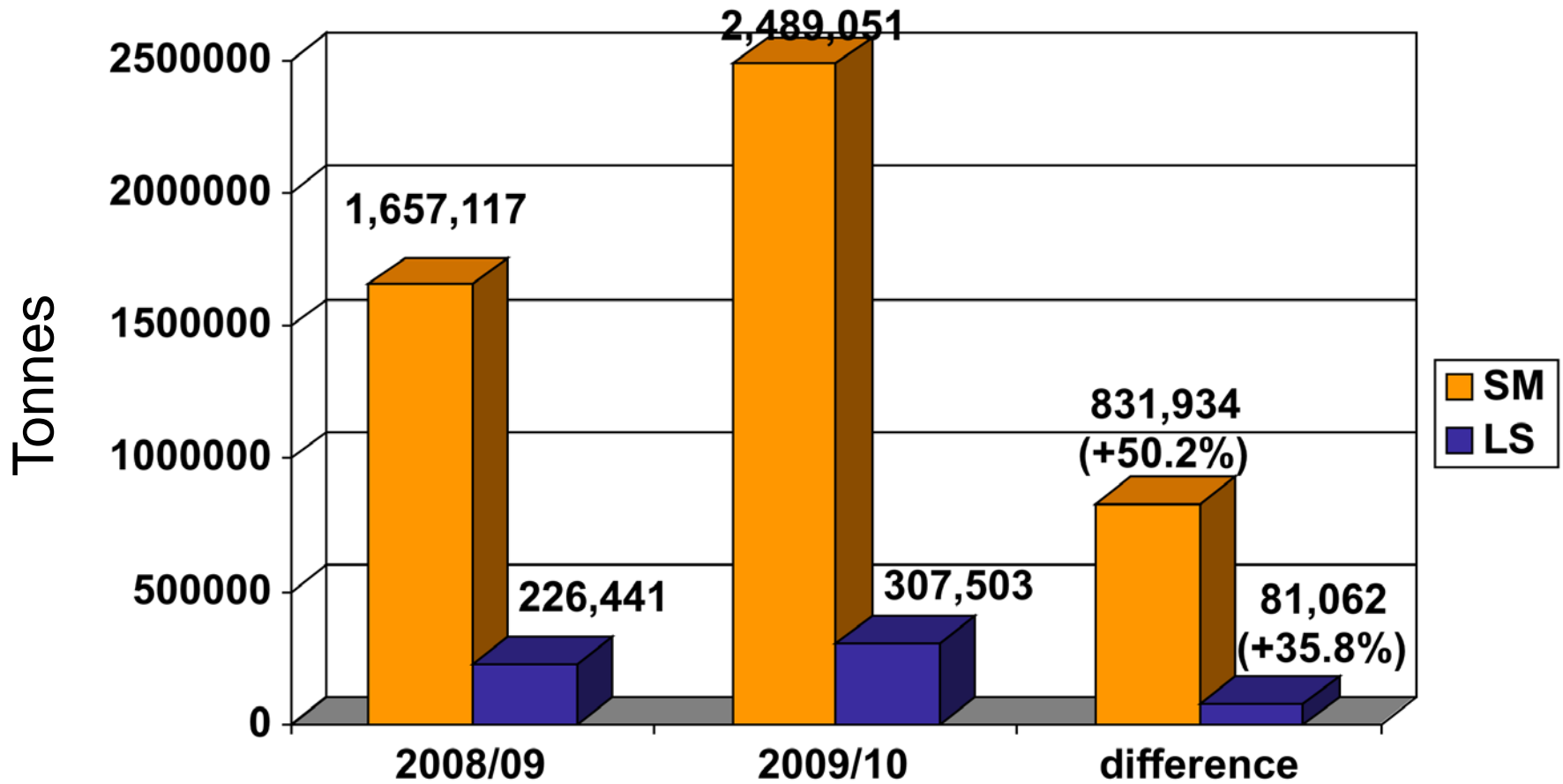
# MACO/CSO Role in the CFS

---

- CSO/MACO Hq. staff
- Master trainers and Province staff involved in data collection; master trainers also involved in data cleaning



# 2008/09 vs. 2009/10 CFS Maize Production Estimates



# Question #2:

---

What factors account for the increased maize production in 2009/10?

# Contributions to Growth

Production change = (Yield) + (Ratio of harvested area) + (Area planted)

can be attributed to

effects from

## Definitions

*prod*=production

*y*=yield

*ah*=area harvested

*ap*=area planted

$\Delta$ =change

## Mathematically

$$prod = y \cdot ah = y \cdot \frac{ah}{ap} \cdot ap$$

$$\frac{\Delta prod}{\Delta prod} = \frac{\Delta y \left( \frac{ah}{ap} \cdot ap \right)}{\Delta prod} + \frac{\Delta \frac{ah}{ap} (y \cdot ap)}{\Delta prod} + \frac{\Delta ap \left( y \cdot \frac{ah}{ap} \right)}{\Delta prod}$$

# Contributions Within Each Province to Production Growth

Province	% relative contribution to production growth between 2009-2010 harvests from changes in		
	Yield	Ratio of Harvested to Planted Land	Area Expansion
Central	45	24	31
Copperbelt	47	2	51
Eastern	102	0	-2
Luapula	59	1	40
Lusaka	51	16	32
Northern	39	1	60
Northwestern	56	7	37
Southern	45	31	24
Western	47	58	-4
All Zambia	59	18	23

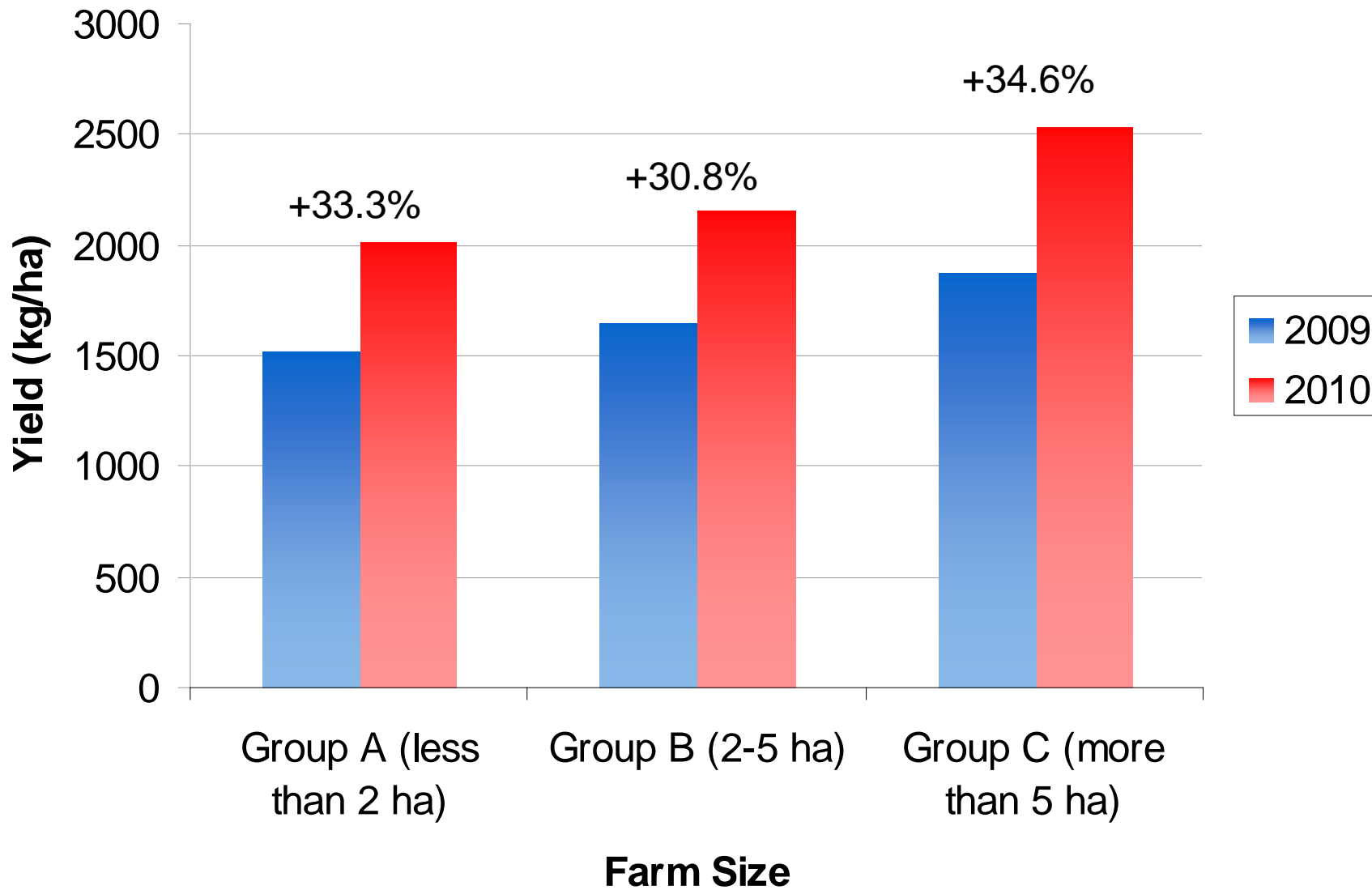
Source: Central Statistics Office Crop Forecast Survey 2008/09, 2009/10

Note: Rows sum to 100

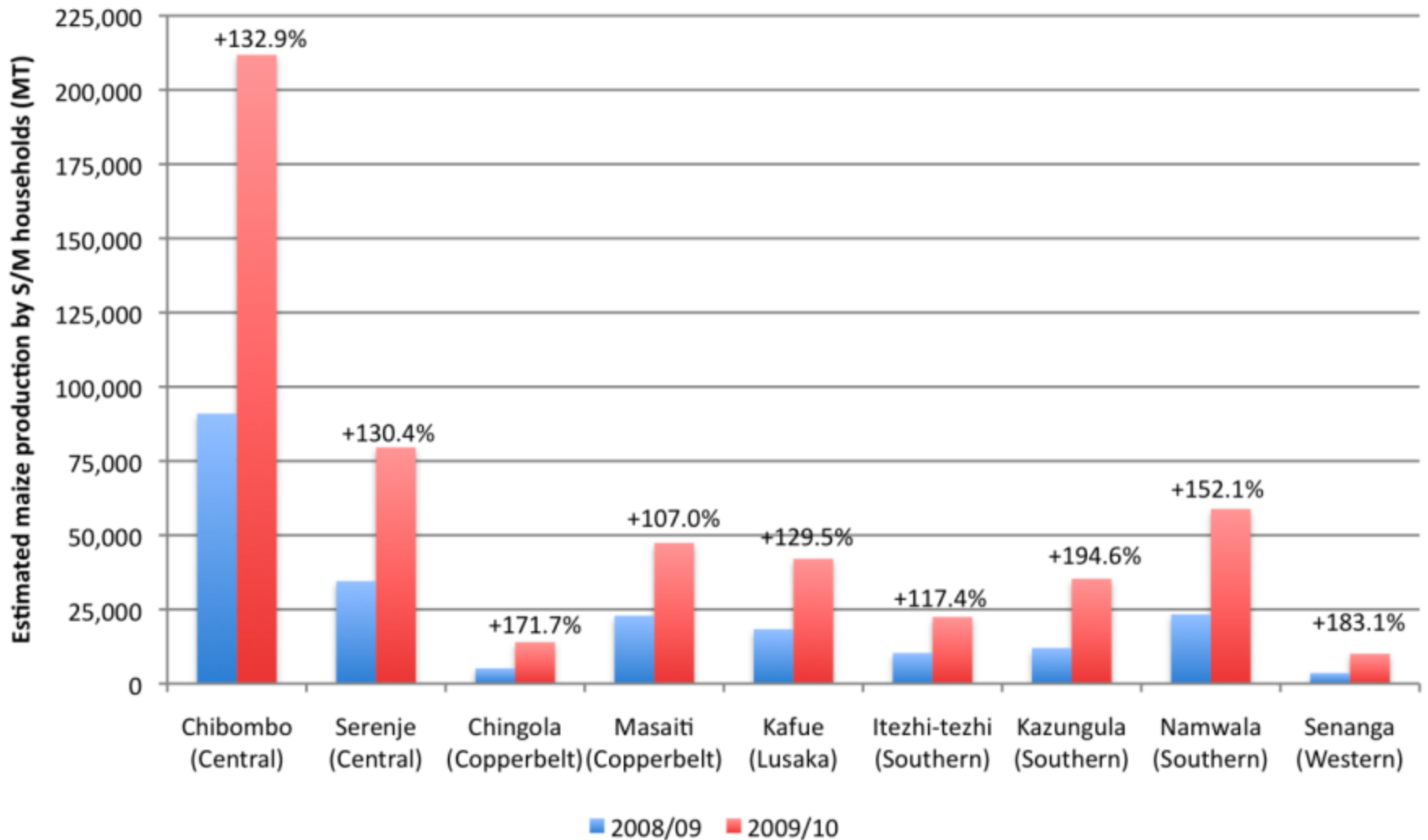
# Percent of maize area planted to be harvested, 2000/01-2009/10



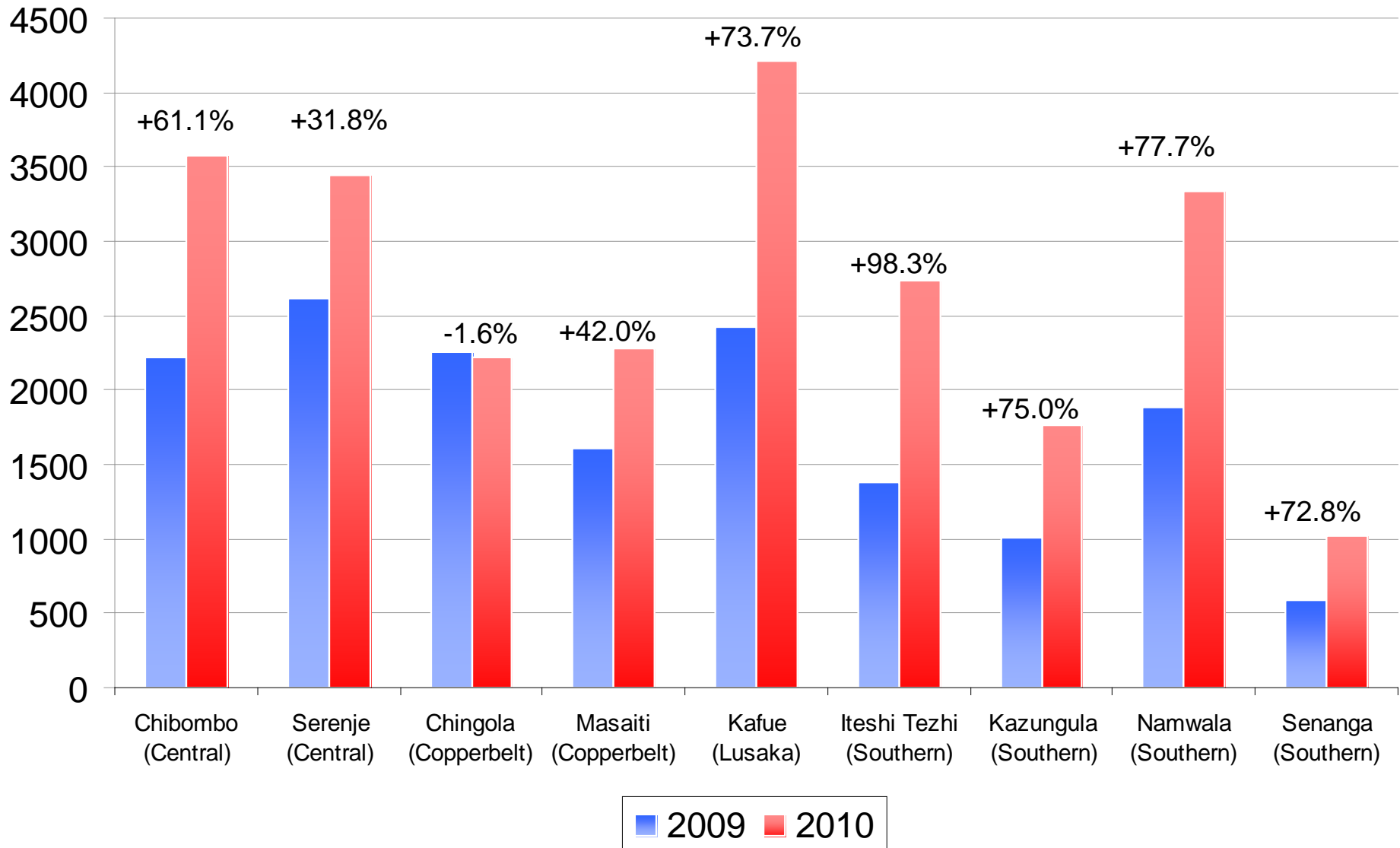
# Changes in Yield by Farm Size Category



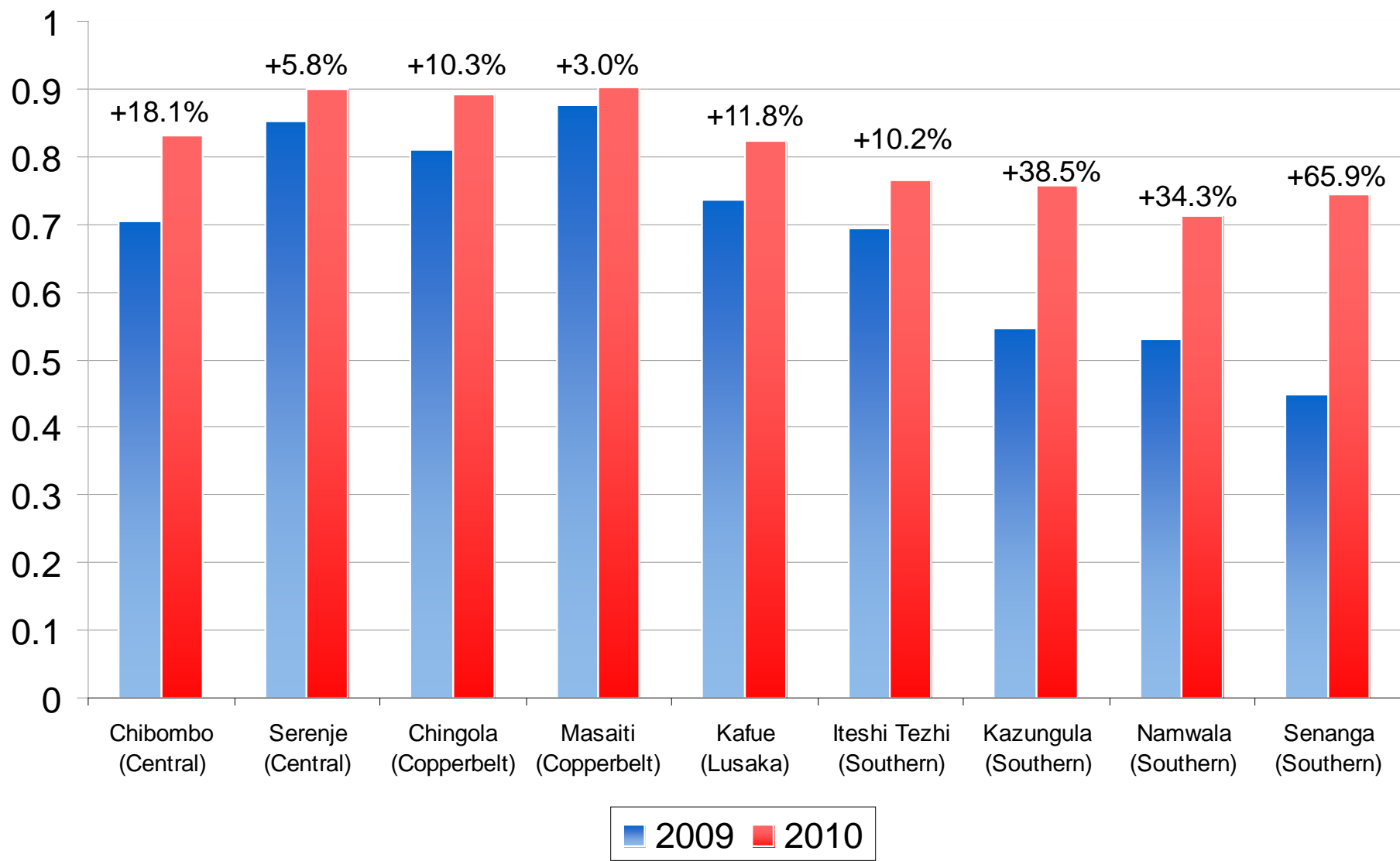
# In 9 districts, 2009/10 expected total S/M maize production more than double 2008/09 level



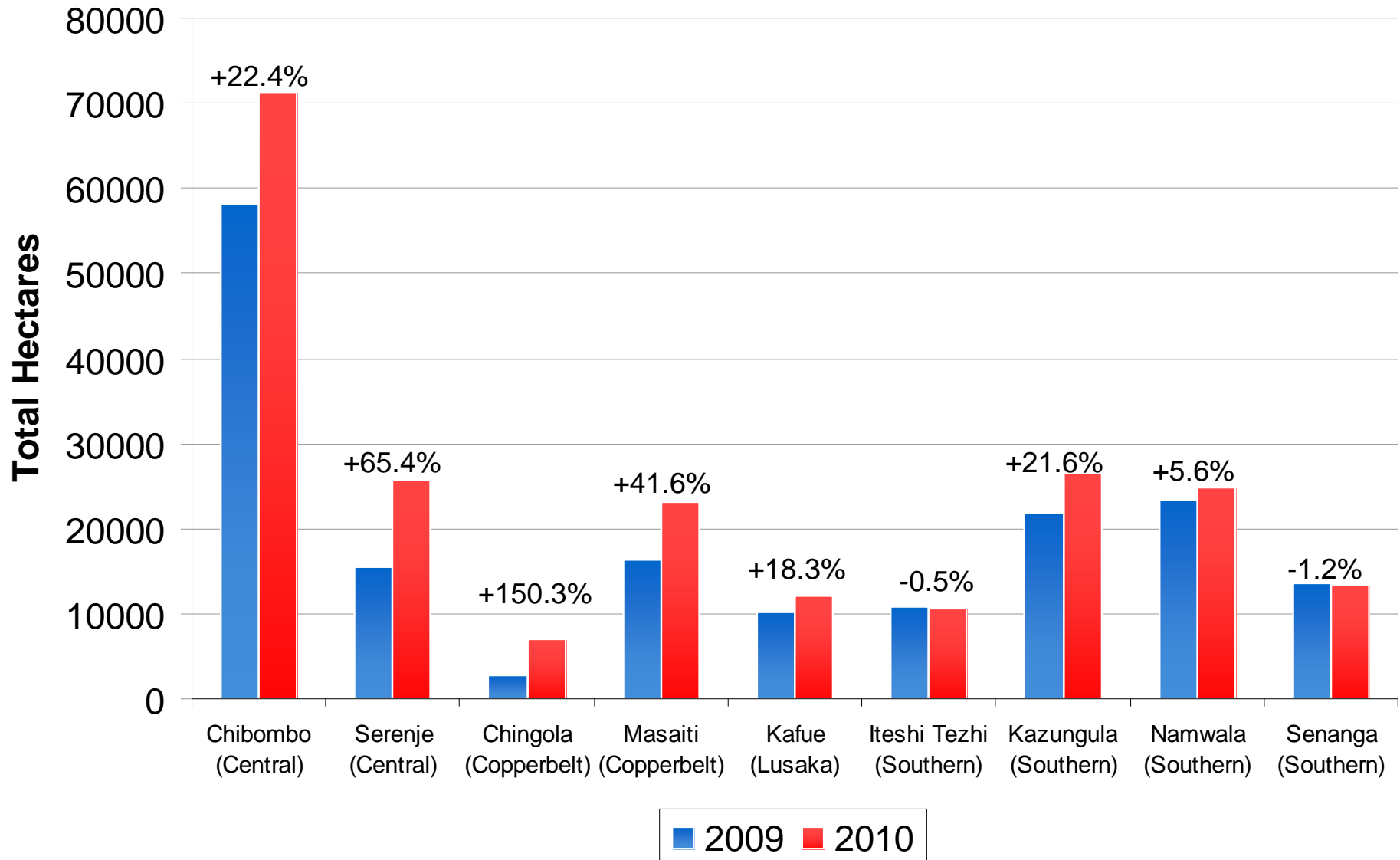
# Yield (kg/ha) changes for 9 Districts



# Ratio of Harvested to Planted Area in 9 districts



# Total area planted to maize for 9 districts



## Increase in 2009/10 maize output due to increased fertilizer use

	Fertilizer applied on maize (mt)	response rate per kg fertilizer	Incremental maize output due to fertilizer (mt)
2008/09	115,517	3.0kg mz	346,551
		4.0kg mz	462,068
		5.0kg mz	577,585
2009/10	167,200	3.0kg mz	501,600
		4.0kg mz	668,800
		5.0kg mz	836,000
difference	51,683	3.0kg mz	155,049
		4.0kg mz	206,732
		5.0kg mz	258,415

- Therefore, roughly 200,000 to 250,000 of the 831,934 tons of incremental maize production (25% to 30%) can be attributed to increased fertilizer use in 2009/10 compared to 2008/09.

## Increase in 2009/10 maize output due to expected increase in maize price:

	Price expectation based on prior year price (May-Oct): Market / FRA	% $\Delta$ Qmz / % $\Delta$ Pmz	Incremental maize output due to change in expected mz price
2008/09	943 / 1100 kw/kg		
2009/10	1205 / 1300 kw/kg		
difference	+28% / +18%	+0.3 +0.5	83,000 to 232,000 mt

- Therefore, roughly 83,000 to 232,000 of the 831,934 tons of incremental maize production (10% to 28%) can be attributed to expectation of increased maize price in 2009/10 compared to 2008/09.

## Increase in 2009/10 maize output due to increased hybrid maize seed use:

	% of maize area planted to hybrid maize seed	% yield increase in hybrid seed vs. non-hybrid	Incremental maize output due to change in use of hybrid maize seed
2008/09	39%		
2009/10	46%		
difference	7%	20% 30%	22,000 to 31,000 mt

- Therefore, roughly 22,000 mt to 31,000 mt of the 831,934 tons of incremental maize production (2.6% to 3.7%) can be attributed to increased use of hybrid maize seed in 2009/10 compared to 2008/09.

# Conservation Farming

- Highly effective
- Yield response to fertilizer is 2x greater using planting basins
- Not enough adoption to affect national production
  - CFS data not designed to sufficiently analyze the contribution of CF on maize production growth at national level.
    - Initial estimates indicate minimal contribution of CF to the growth in national production

# % of increased 2009/10 maize output (831,934 mt) attributable to:

Increased fertilizer use: (200,000 to 250,000 mt)	25% to 30%
Expectation of increased maize price: (83,000 to 232,000 mt)	10% to 28%
Increased use of hybrid maize seed (22,000 to 31,000 mt)	2.6% to 3.7%
Residual – weather effect	38% to 62%

# Regression Analysis

## Crop Variables:

Basal  
Top Dressing  
Seed type  
Nitrogen fixers  
Tillage type  
Tillage timing  
Rainfall (quadratic)  
AEZ  
Year dummy → weather

## Education:

None  
1-7 years  
8-12 years  
More than 12  
years

## Interactions:

Rainfall  
Timing  
Basal  
Top Dressing

## Later...

Tillage  
method

# Regression Analysis

Simulation	Values Used in Simulation				
	Weather	Fertilizer	All Else	Yield prediction	% change from 2009
2009 prediction	2009	2009	2009	2038	-
2010 prediction	2010	2010	2010	2565	26%
Weather effect	2010	2009	2009	2441	20%
Fertilizer effect	2009	2010	2009	2120	4%
Weather and Fertilizer effect	2010	2010	2009	2586	27%

# Regression Analysis

- Yield increase approximately 26%
- If **only** fertilizer (FISP *and* private sector) changes, increase is 4%
- If **only** weather changes, increase is 20%
- The majority of the increase in yield can be attributed to fertilizer and weather.

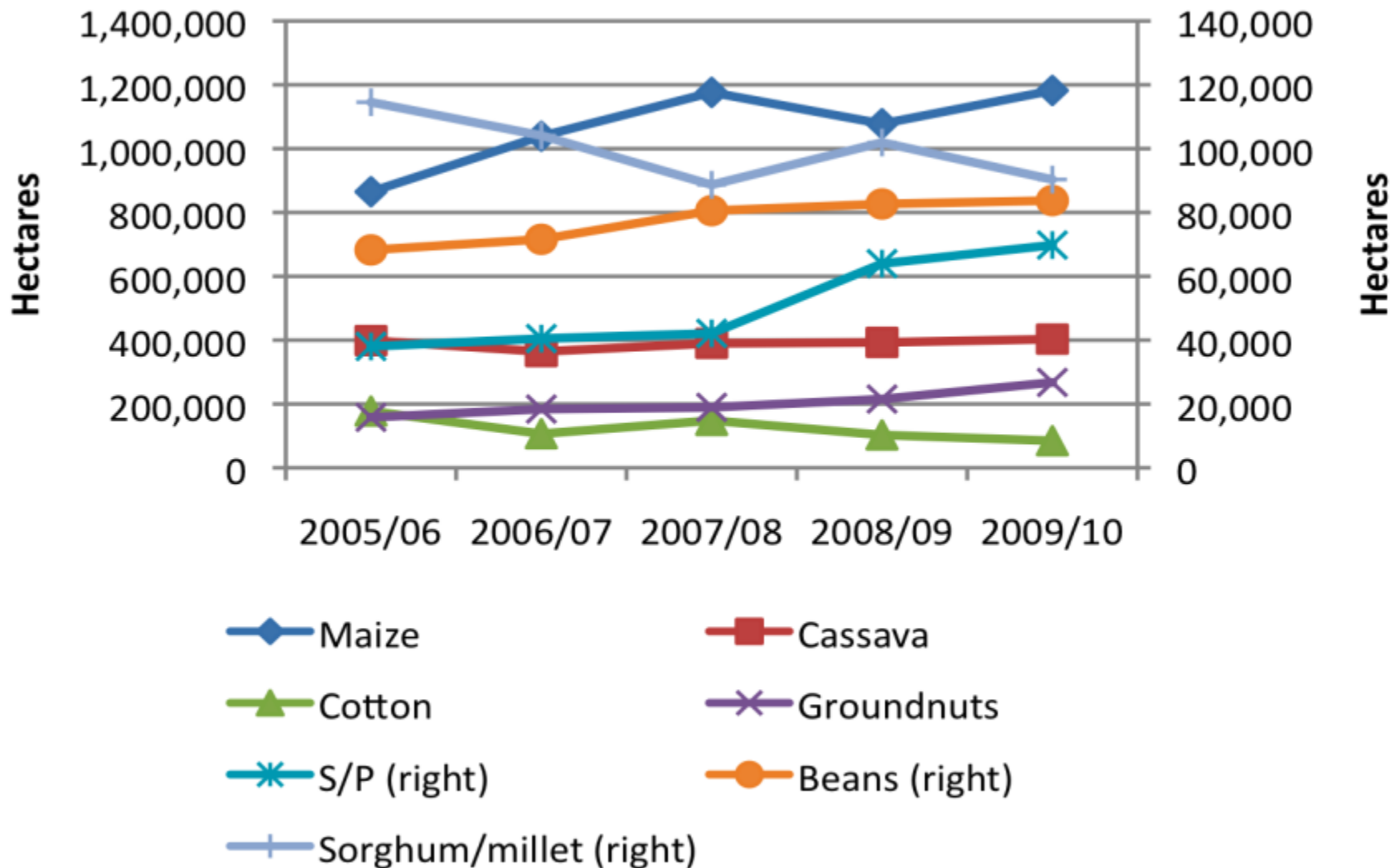
# Question #3:

---

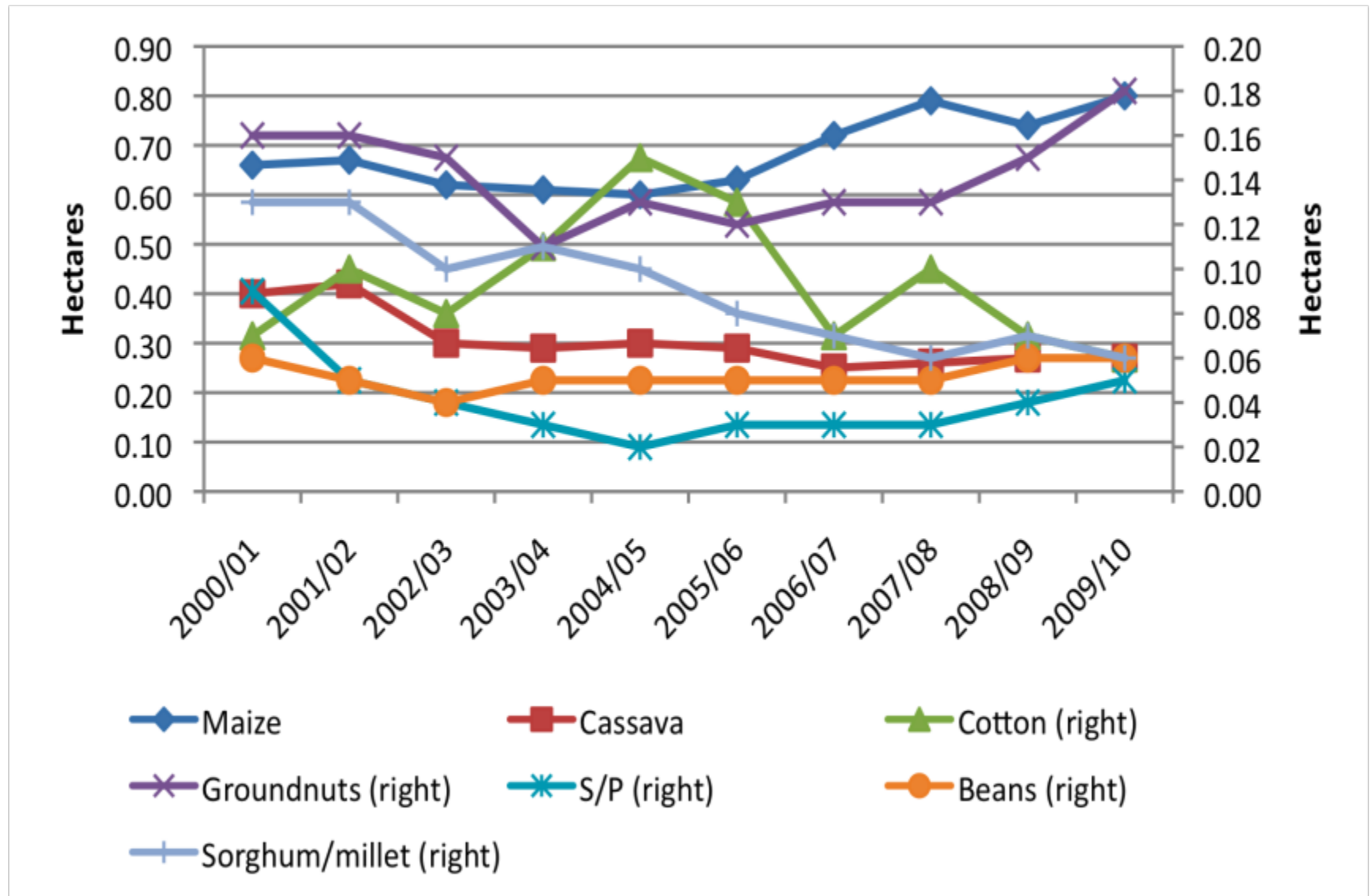
Did overall crop output in 2009/10 increase?

- Did the rise in maize production reflect a rise in overall agricultural production?...or
- Did smallholders substitute area and labor out of other crops into maize?

# Total area planted by small/medium-scale agricultural households, 2005/06-2009/10



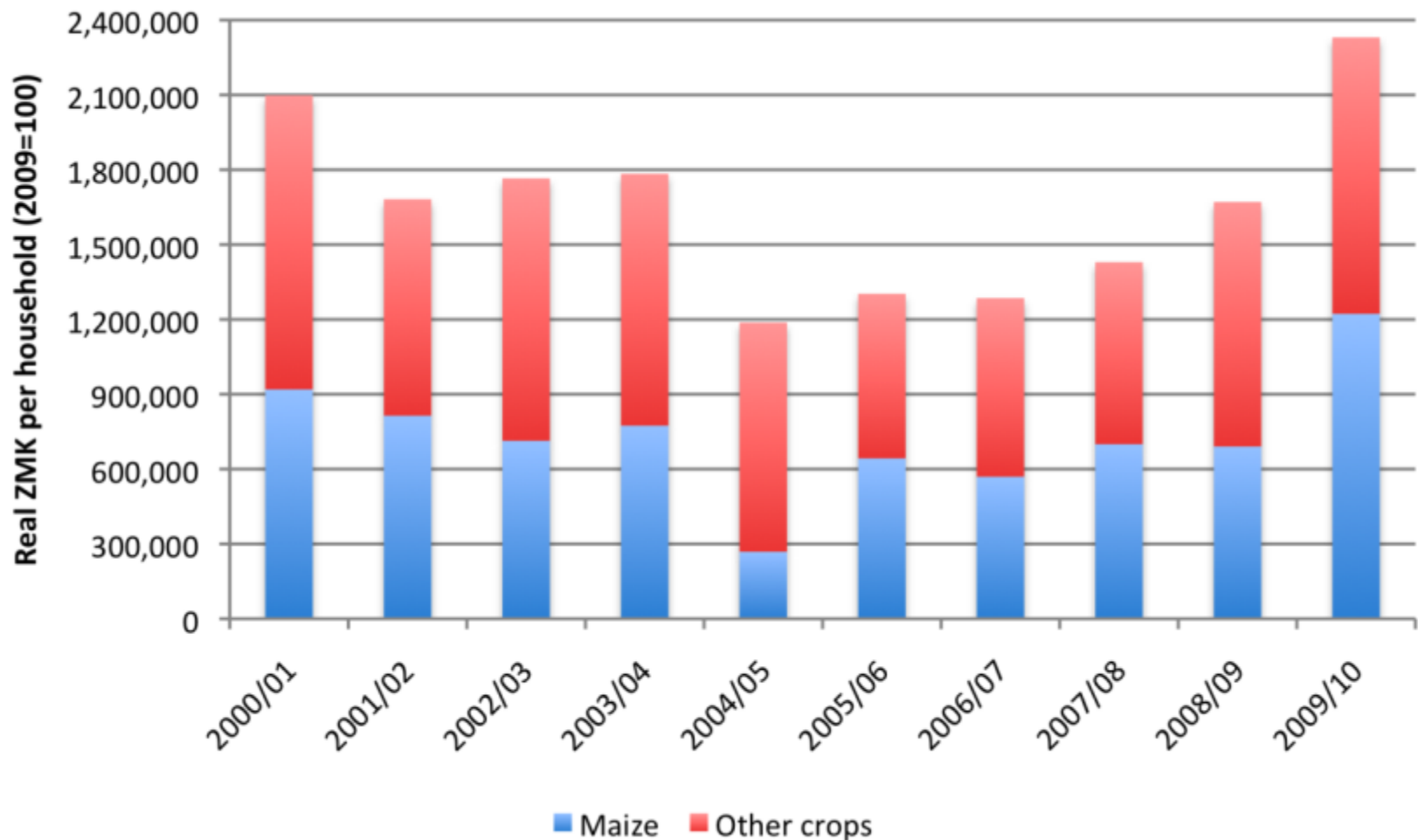
# Mean area planted per small/medium-scale agricultural household, 2000/01-2009/10



## Summary: Total Area planted by S/M agricultural households, mean area planted per S/M agricultural household and % area planted to each crop

Crop	Total area planted by s/m agricultural households (2005/06-2009/10)	Mean area planted per s/m agricultural household (2000/01-2009/10)
Maize	Increasing since 05/06 (37% higher in 09/10 compared to 05/06)	Slight decline, 00/01- 04/05; increasing since 05/06 (highest in 09/10)
Cotton	Declining since 05/06	Declining since 04/05
Cassava	Declining since 05/06	Declining over time
Groundnuts	Increasing since 05/06	-Declining until 03/04
Sweet Potato	Increasing since 05/06 (largest increase between 07/08 & 08/09)	-Increasing since 04/05 -Steepest increases between 07/08 and 09/10
Mixed Beans	Increasing since 05/06	-Stable 03/04 to 07/08 -Increasing since 08/09
Sorghum/Millet	Declining since 05/06	Declining throughout decade

# Mean value of crop production net of fertilizer costs per small/medium-scale agricultural household (billion ZMK, valued at real 2009 prices)



# Conclusions:

---

1. 2009/10 maize production estimate is in the range of plausibility
2. Factors driving the increased maize production:
  - Unusually favorable weather: 38% to 62%
  - Expectation of favorable maize prices / access to FRA: 10% to 28%
  - Increased FISP *and private sector* fertilizer use: 25% to 30%
  - Increased use of hybrid maize seed: 3% to 4%

# Conclusions:

---

4. Overall increase in net value of crop production in 2009/10 – the highest crop performance in past 10 years.
5. Some substitution out of cotton and to a lesser extent, cassava, but outweighed by huge increase in maize production
6. Trends over 2000/01 to 2009/10: mean area planted per ag household to cassava, cotton and sorghum and millet generally declines as maize area has increased.

# Conclusions:

---

7. Mean household area to sweet potato and groundnut declined during first part of decade, but has risen in recent years
8. Though Zambia had a good harvest in 2010, the country remains vulnerable to shifts in weather conditions. What can be done to further limit the contribution of weather to changes in production?

# Acknowledgements

---

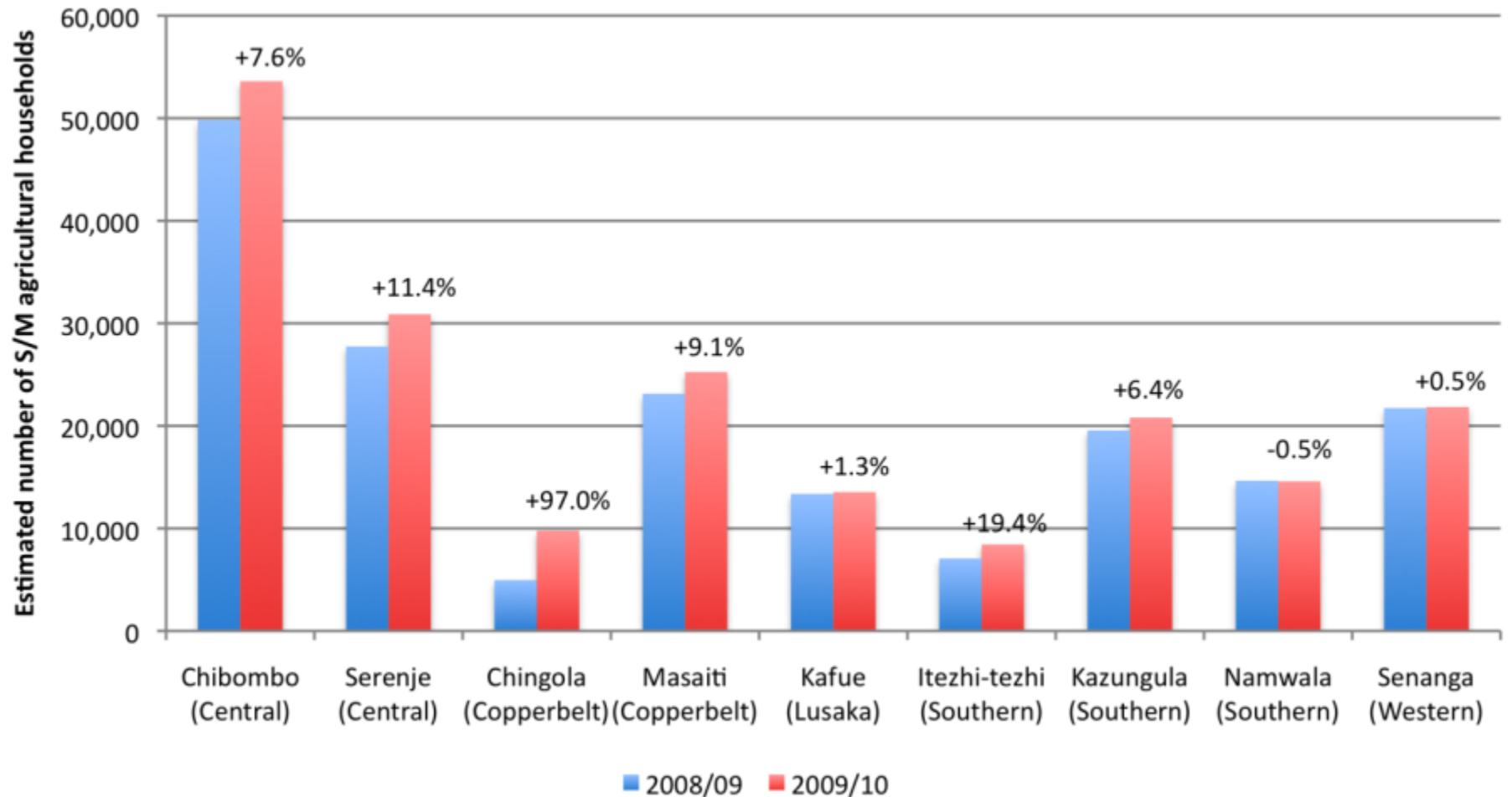
- Contributors:
  - Dingi Banda, Michael Isimwaa, Nicolas Mwale, Derrick Sikombe, Antony Chapoto, Nicole Mason, Margaret Beaver, William J. Burke, Munguzwe Hichaambwa, Thomas Jayne, Michael Weber, and Steve Longabaugh.

# Thank you

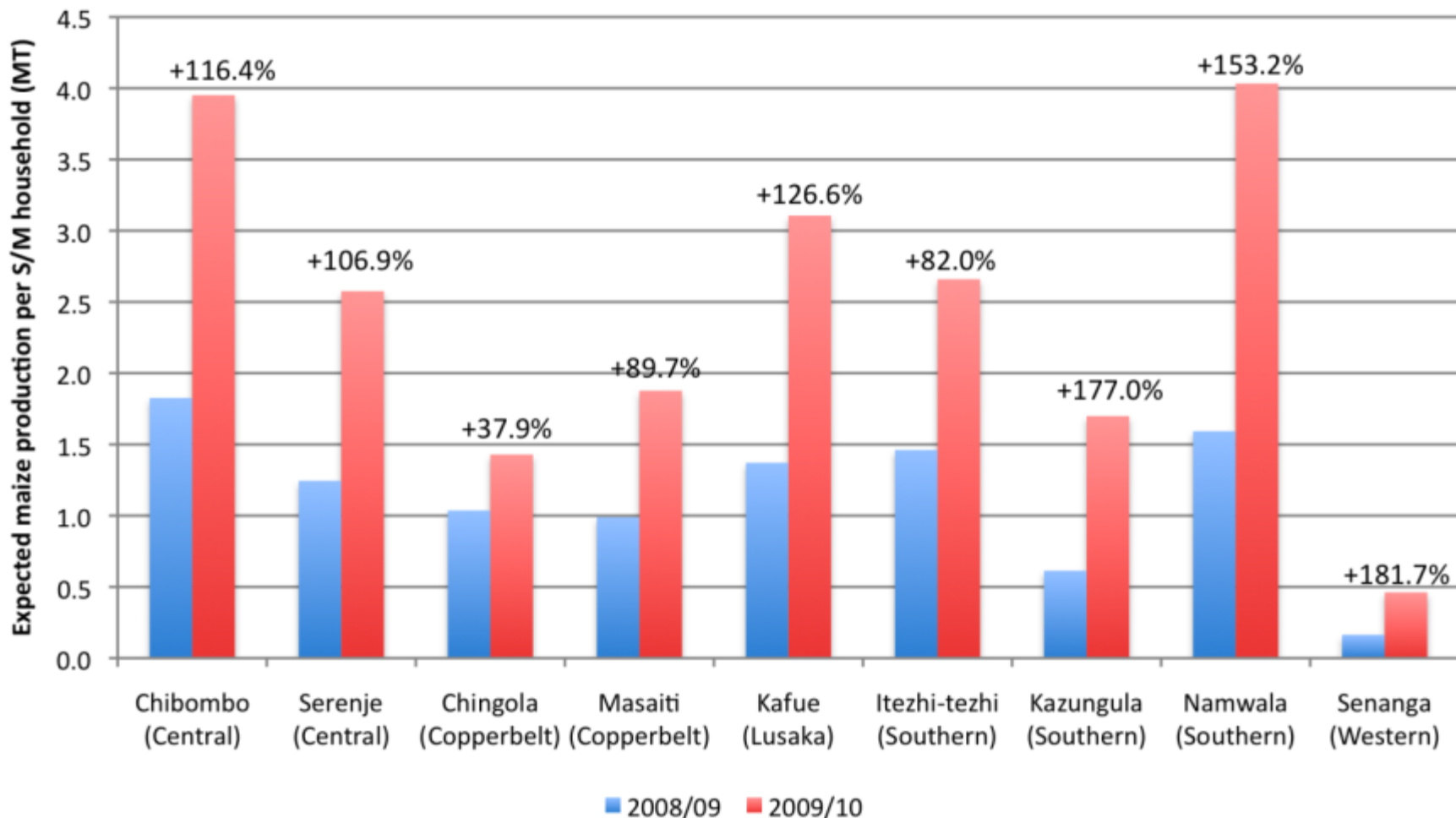


# Bonus Slides

# Number of S/M agricultural households in these 9 districts, 2008/09 and 2009/10



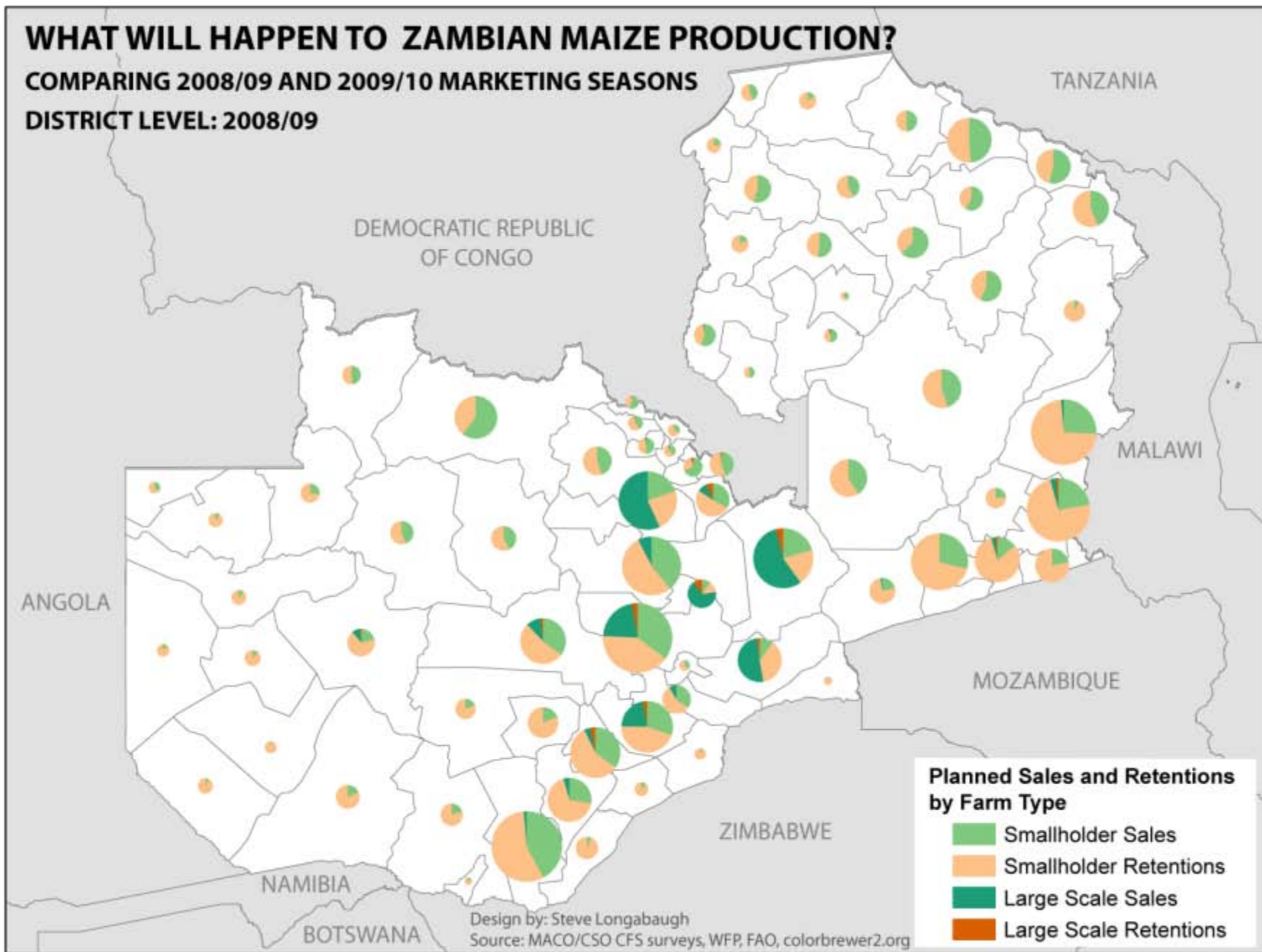
# Expected maize production per S/M agricultural household in these 9 districts, 2008/09 and 2009/10



# WHAT WILL HAPPEN TO ZAMBIAN MAIZE PRODUCTION?

COMPARING 2008/09 AND 2009/10 MARKETING SEASONS

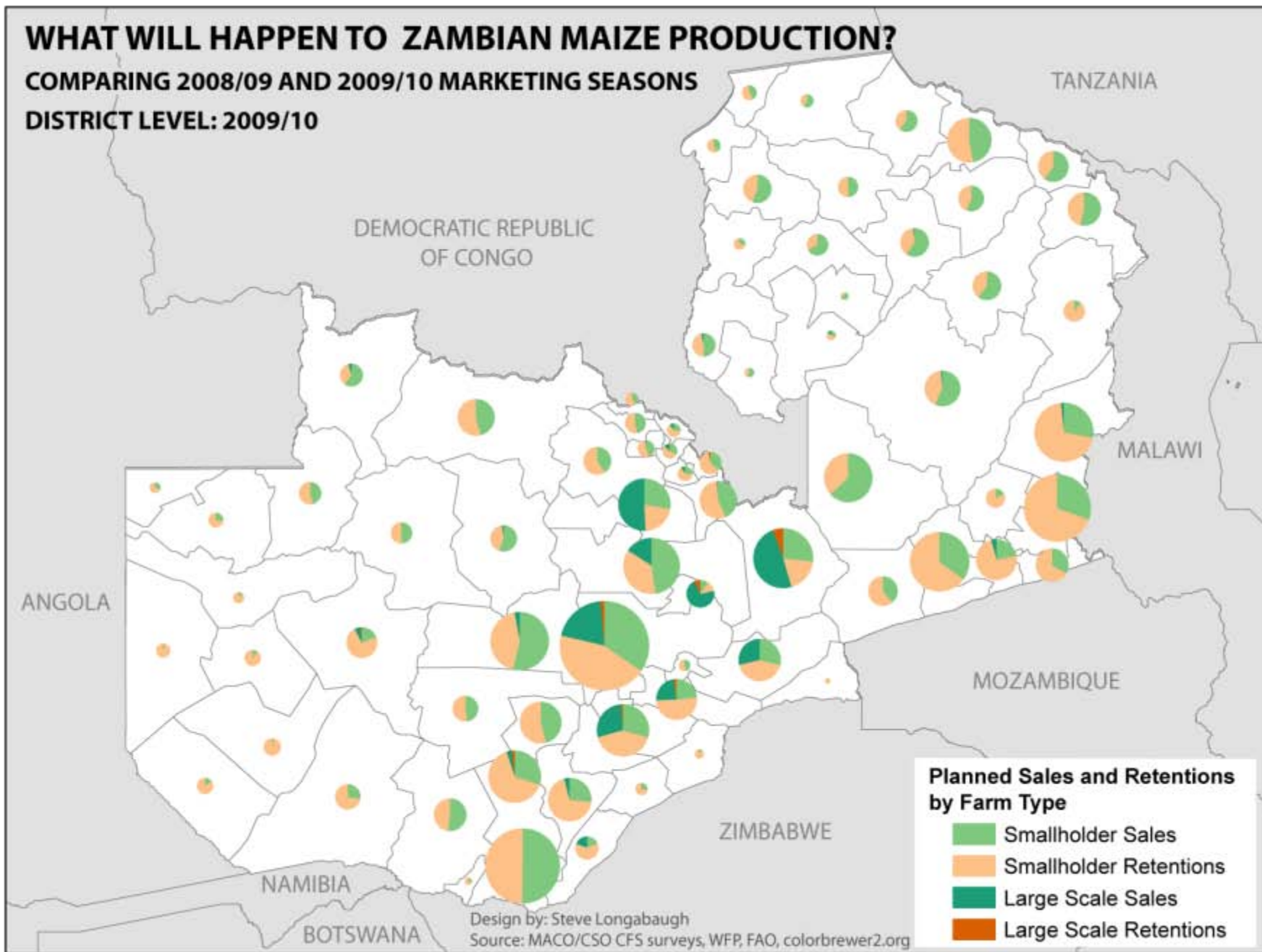
DISTRICT LEVEL: 2008/09



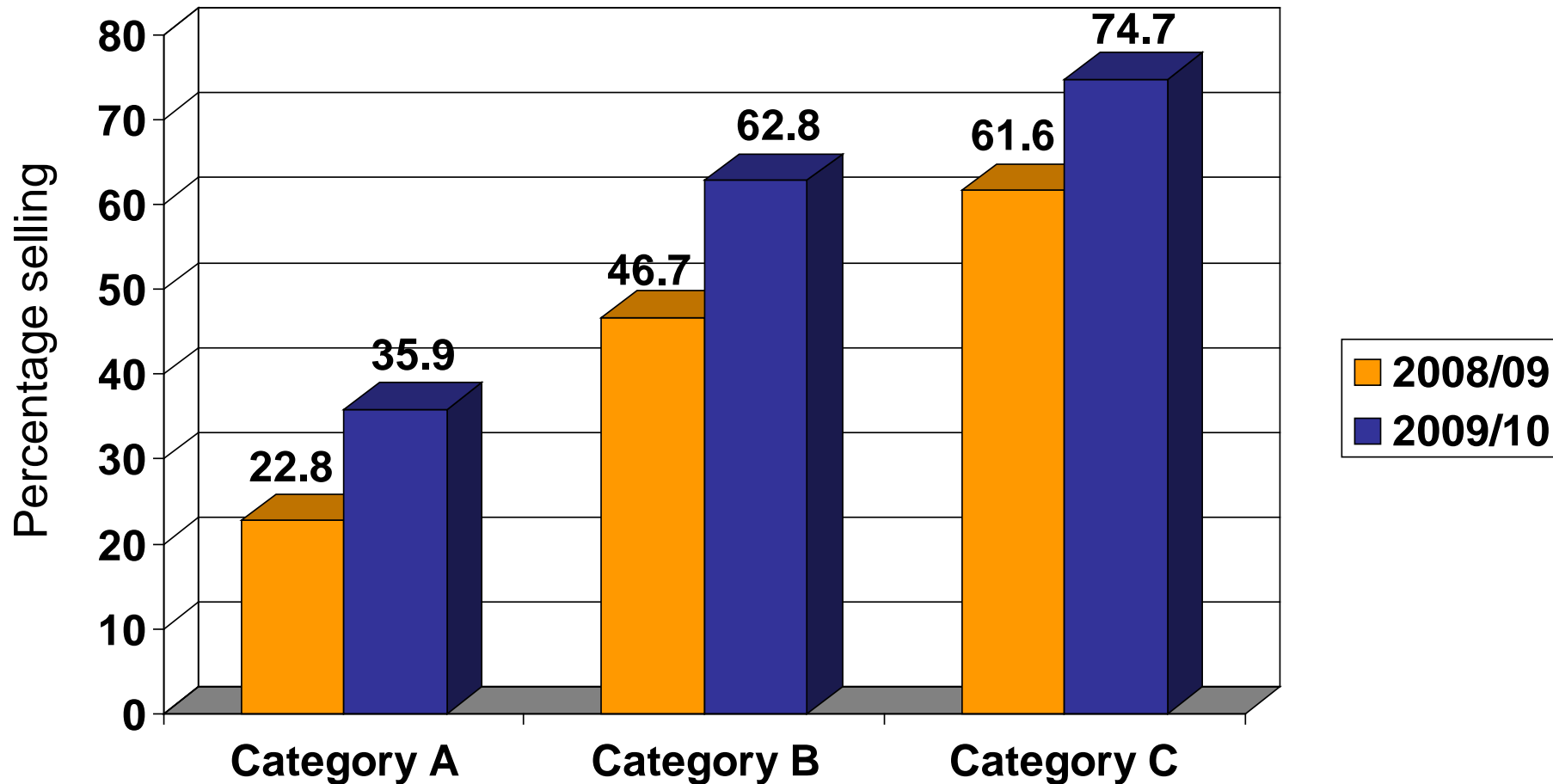
# WHAT WILL HAPPEN TO ZAMBIAN MAIZE PRODUCTION?

COMPARING 2008/09 AND 2009/10 MARKETING SEASONS

DISTRICT LEVEL: 2009/10

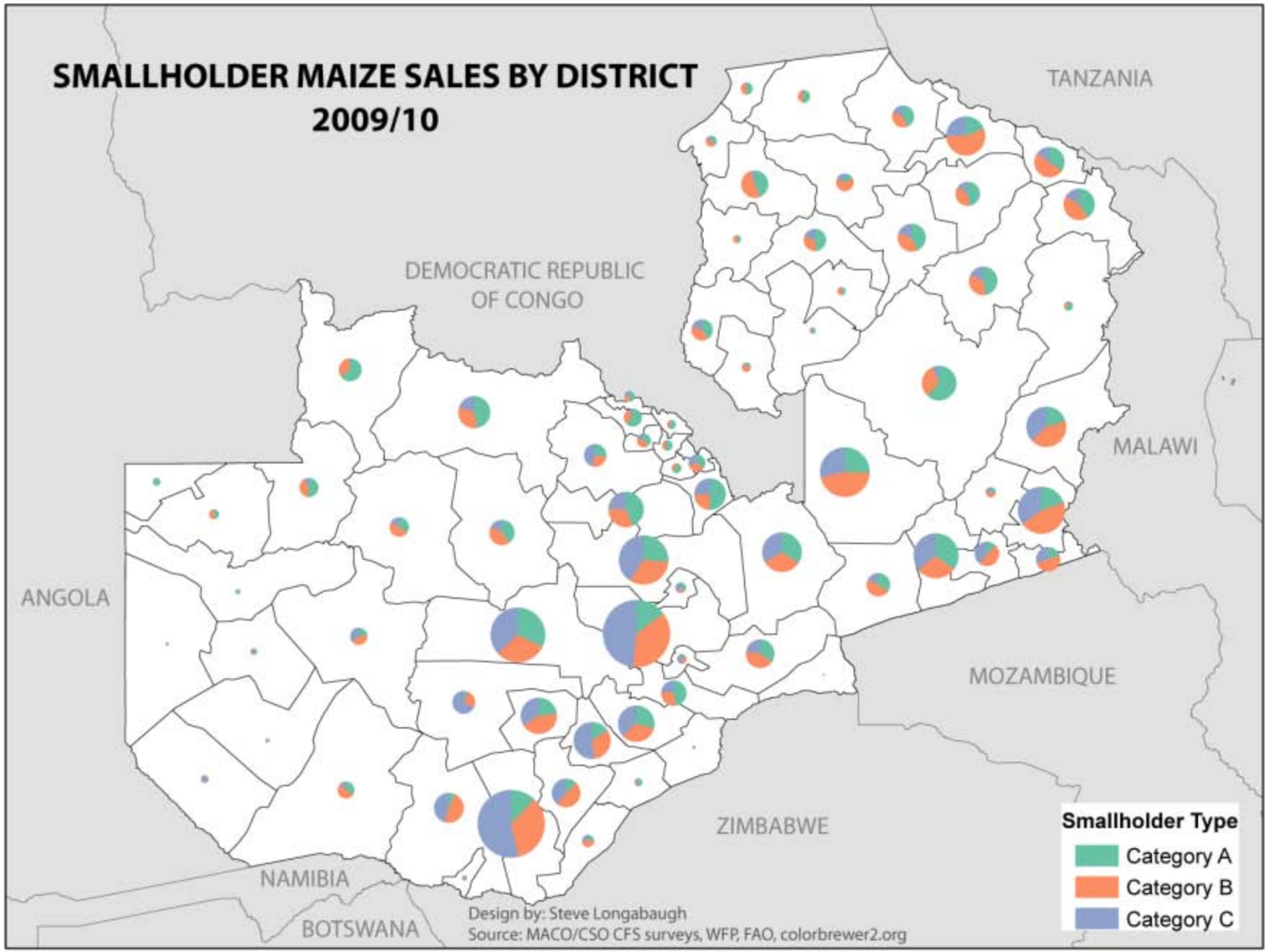


# % of smallholder maize growing households expected to sell maize, 2008/09 vs. 2009/10



# SMALLHOLDER MAIZE SALES BY DISTRICT

## 2009/10



**Smallholder Type**

- Category A
- Category B
- Category C

Design by: Steve Longabaugh  
Source: MACO/CSO CFS surveys, WFP, FAO, colorbrewer2.org

## Number of smallholder agricultural households acquiring fertilizer by source and year

Agricultural Season	FISP  (Official target)	PAM	Commercial Purchases		Gift/Free	All Sources*
			Private Traders or retailers	Other		
2008/09	192,860 <i>(200,000)</i>	3,952	199,261	59,241	10,468	427,278
2009/10	292,662 <i>(534,190)</i>	10,844	277,076	73,859	19,173	585,940

\*Some households acquired fertilizer through multiple channels so the sum of the individual source numbers slightly exceeds the “all sources” column

## Amount of fertilizer acquisition by of smallholder agricultural households by source and year

Agricultural Season	FISP  (Official target)	PAM	Commercial Purchases		Gift/Free	All Sources*
			Private Traders or retailers	Other		
2008/09	55,114 <i>(80,000)</i>	725	47,111	10,948	1,619	115,517
2009/10	69,100 <i>(106,836)</i>	1,762	78,781	15,247	2,311	167,200

# Number of smallholder agricultural households acquiring fertilizer by source and category in 2008/09 vs. 2009/10

Agricultural Season	FISP	PAM	Commercial Purchases		Gift/Free	All Sources*
			Private Traders or retailers	Other		
All Households	192,860	3,952	199,261	59,241	10,468	427,278
	<b>292,662</b>	<b>10,844</b>	<b>277,076</b>	<b>73,859</b>	<b>19,173</b>	<b>585,940</b>
Category A	105,438	2,530	128,303	41,003	8,207	271,391
	<b>166,178</b>	<b>6,655</b>	<b>165,320</b>	<b>43,633</b>	<b>14,193</b>	<b>364,209</b>
Category B	66,106	1,100	52,239	13,407	2,042	119,973
	<b>98,805</b>	<b>3,316</b>	<b>81,660</b>	<b>23,558</b>	<b>3,998</b>	<b>171,960</b>
Category C	21,316	323	18,719	4,831	220	35,913
	<b>27,679</b>	<b>872</b>	<b>30,097</b>	<b>6,670</b>	<b>982</b>	<b>49,771</b>

\*Some households acquired fertilizer through multiple channels so the sum of the individual source numbers slightly exceeds the “all sources” column

# Amount of fertilizer acquisition by of S/M agricultural households by source and category in 2008/09 vs. **2009/10** (Metric Tonnes)

Agricultural Season	FISP	PAM	Commercial Purchases		Gift/Free	All Sources
			Private Traders or retailers	Other		
All Households	55,114	725	47,111	10,948	1,619	115,517
	<b>69,100</b>	<b>1,762</b>	<b>78,781</b>	<b>15,247</b>	<b>2,311</b>	<b>167,200</b>
Category A	23,243	305	17,711	5227	784	47,269
	<b>32,611</b>	<b>733</b>	<b>26,748</b>	<b>5,765</b>	<b>1,523</b>	<b>67,379</b>
Category B	20,695	286	14,946	3,099	809	39,836
	<b>26,103</b>	<b>733</b>	<b>27,334</b>	<b>6,301</b>	<b>541</b>	<b>61,012</b>
Category C	11,176	134	14,454	2,621	26	28,412
	<b>10,387</b>	<b>297</b>	<b>24,699</b>	<b>3,181</b>	<b>246</b>	<b>38,810</b>

# Amount of fertilizer acquisition by of S/M agricultural households by source and category in 2008/09 vs. **2009/10** (% of total)

Agricultural Season	FISP	PAM	Commercial Purchases		Gift/Free	All Sources
			Private Traders or retailers	Other		
All Households	47.7%	0.6%	40.8%	9.5%	1.4%	100.0%
	<b>41.3%</b>	<b>1.1%</b>	<b>47.1%</b>	<b>9.1%</b>	<b>1.4%</b>	<b>100.0%</b>
Category A	49.2%	0.6%	37.5%	11.1%	1.7%	100%
	<b>48.4%</b>	<b>1.1%</b>	<b>39.7%</b>	<b>8.6%</b>	<b>2.3%</b>	<b>100%</b>
Category B	52.0%	0.7%	37.5%	7.8%	2.0%	100%
	<b>42.8%</b>	<b>1.2%</b>	<b>44.8%</b>	<b>10.3%</b>	<b>0.9%</b>	<b>100%</b>
Category C	39.3%	0.5%	50.9%	9.2%	0.1%	100%
	<b>26.8%</b>	<b>0.8%</b>	<b>63.6%</b>	<b>8.2%</b>	<b>0.6%</b>	<b>100%</b>

# Lessons Learned About the Ongoing CFS Quality Improvement Process

- CSO/MACO line budget needed for upkeep/upgrading of computers, software, virus protection & analysis skills
- Improved supervision in sample listing especially critical
- Use and reuse better quality enumerators in Provinces
- Getting data/insights back to Provinces for their use is critical for improving their incentives for quality data
- Important to retain experienced staff at Hq and Prov
- Use experienced data entry staff in Provinces - critical to cutting down the data verification/cleaning at Hq
- Demand for data quality upgrades come with data use