Shock Impact Simulation Model (SISMod)

Case Study - Nepal

October 2013

WFP
wfp.org

Overall Food Security Context of Nepal

- Nepal, with population of approximately 27 million, is one of the world's least developed countries.

- It ranks 157 out of 187 countries in the Human Development Index 2012 and 60 out of 79 in the Global Hunger Index 2012.

- The impaired economic development combined with political instability, high food price inflation and series of droughts and floods have compounded food insecurity in the past.

- In general, the food insecurity is most serious in the hills and mountains of the mid- and far-western regions.
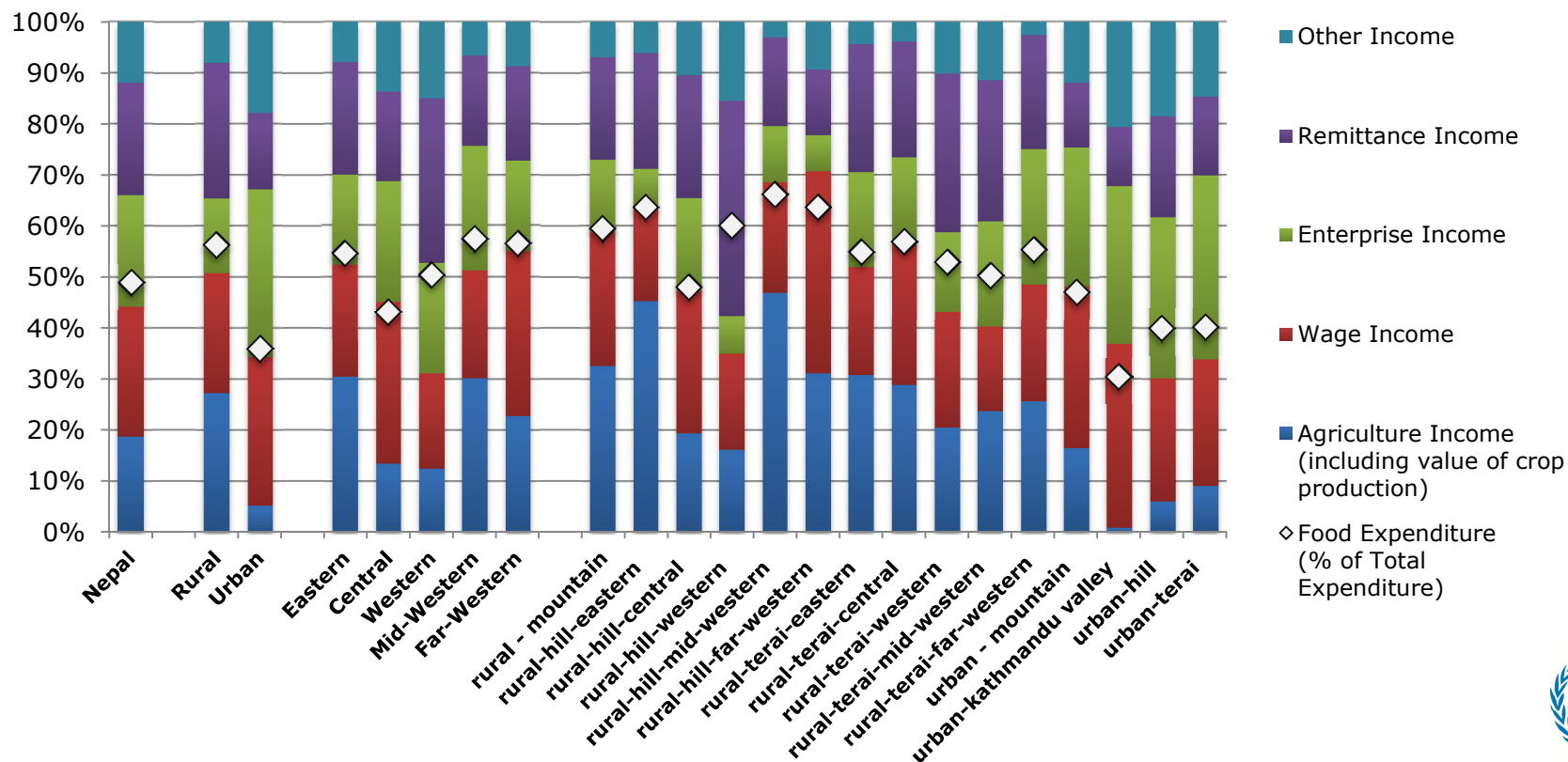
HH profile of the baseline year (NLSS 2010)
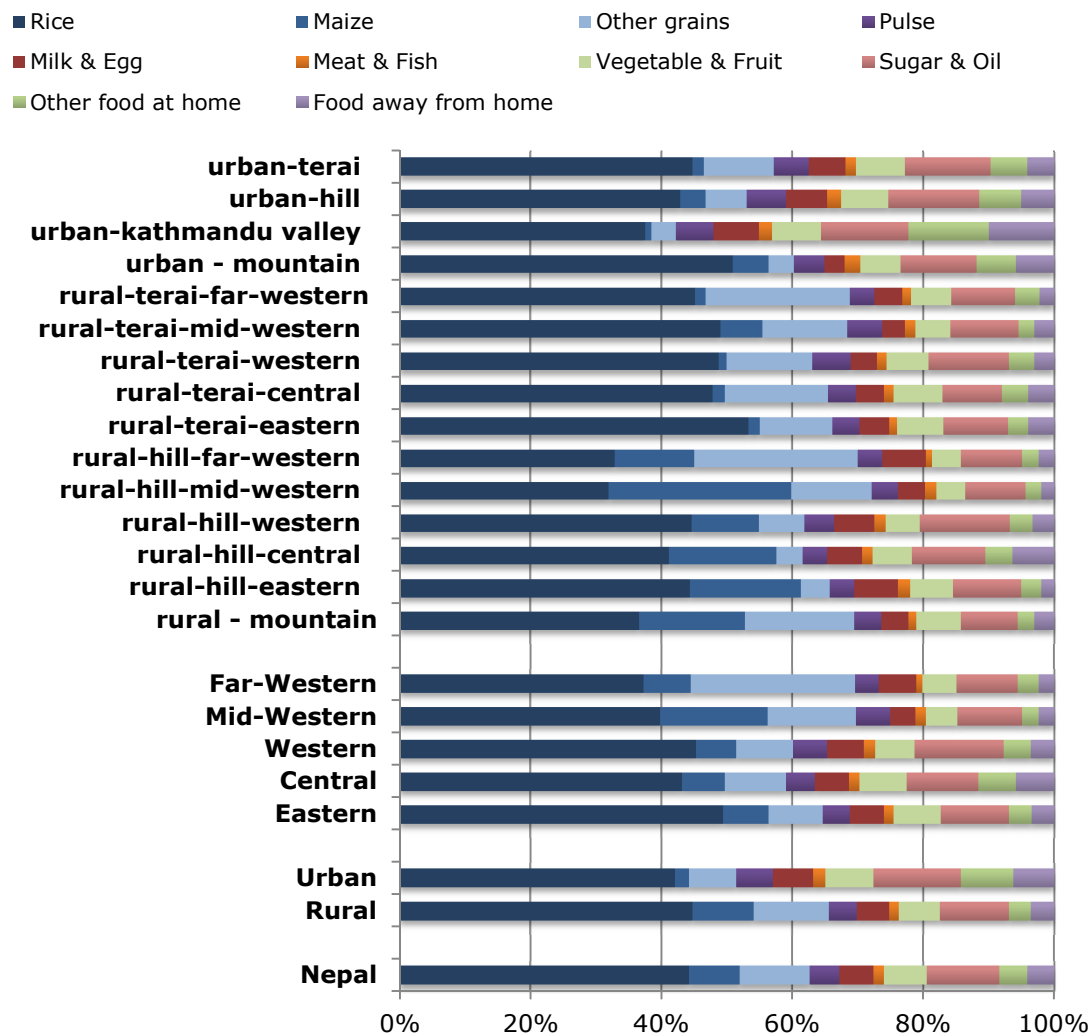## Share of Household Income Sources and Expenditure on Food

▪ Agriculture production, wage and remittance are the major income sources of HH in rural area. HH in urban area depended more on wage and enterprise income.

▪ Food expenditure accounted for 49% of the total HH's expenditure. HH in rural area had a higher share of food expenditure than HH in urban area (56% and 36%, respectively).
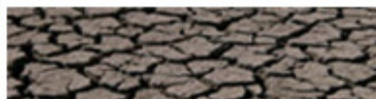

Legend:
- Other Income
- Remittance Income
- Enterprise Income
- Wage Income
- Agriculture Income (including value of crop production)
- ◇ Food Expenditure (% of Total Expenditure)

WFP
wfp.org

HH profile of the baseline year (NLSS 2010)
Per Capita Share of Calories Consumption of Food Items

Legend:
- ■ Rice
- ■ Maize
- ■ Other grains
- ■ Pulse
- ■ Milk & Egg
- ■ Meat & Fish
- ■ Vegetable & Fruit
- ■ Sugar & Oil
- ■ Other food at home
- ■ Food away from home

Chart categories (top to bottom):
- urban-terai
- urban-hill
- urban-kathmandu valley
- urban - mountain
- rural-terai-far-western
- rural-terai-mid-western
- rural-terai-western
- rural-terai-central
- rural-terai-eastern
- rural-hill-far-western
- rural-hill-mid-western
- rural-hill-western
- rural-hill-central
- rural-hill-eastern
- rural - mountain

- Far-Western
- Mid-Western
- Western
- Central
- Eastern

- Urban
- Rural
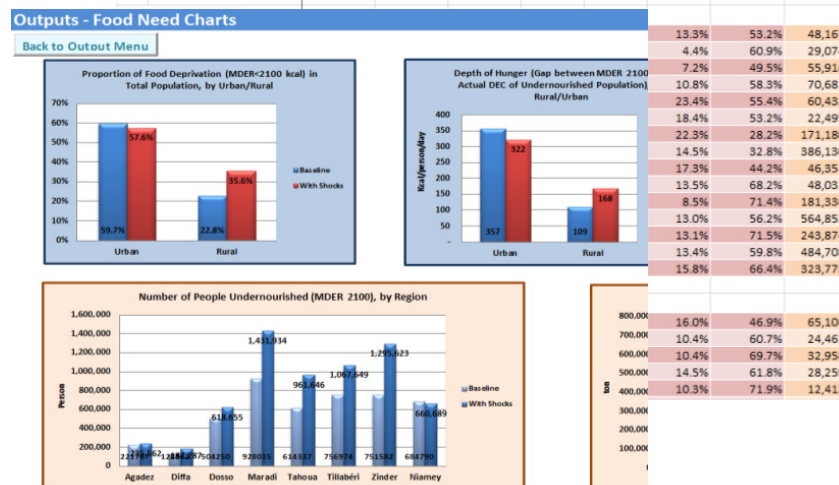
- Nepal

X-axis: 0% 20% 40% 60% 80% 100%

- Of the total calories consumption, the proportion of rice(44%), maize(8%) and other grains(11%) brought the proportion of total grains to the highest share, 63%. In mid-western and far-western region, it even reached 70%.

- HH in urban area had a more diverse diet than the HH in rural area, with 51% of caloric contribution from grains (vs. 66% in rural area).

4

Key Outputs of SISMod

- **Proportion of food energy deficient population** *(below the minimum dietary energy consumption (MDEC) thresholds)*

- **Number of food energy deficient people**

- **Depth of hunger (kcal/person/day)**
  (Deficit in absolute terms between the average DEC of the food energy deficient population and the MDEC)

- **Gap of food needs (kg of cereal /person/year)**
  (Cereal equivalent of the depth of hunger)

- **Total food assistance needed to meet the needs (tonnes/year)**

- **All outputs can be viewed with :**
  - Different population groupings *(Gender, Smallholders, Income, Livelihoods Zone, Region, Province, Urban/Rural)*
  - MDEC threshold breakdowns
  - Table and chart formats

Simulation of the Proportion of Food Energy Deficient Population (<MEDC 1810 kcal)
All Shock Factors Included

- Increases observed in 2005, 2008 and 2013, reflects the impacts of flood (2005) which affected 800,000 people, high food prices crisis (2008) and crop failure due to late and weak monsoon (2013).
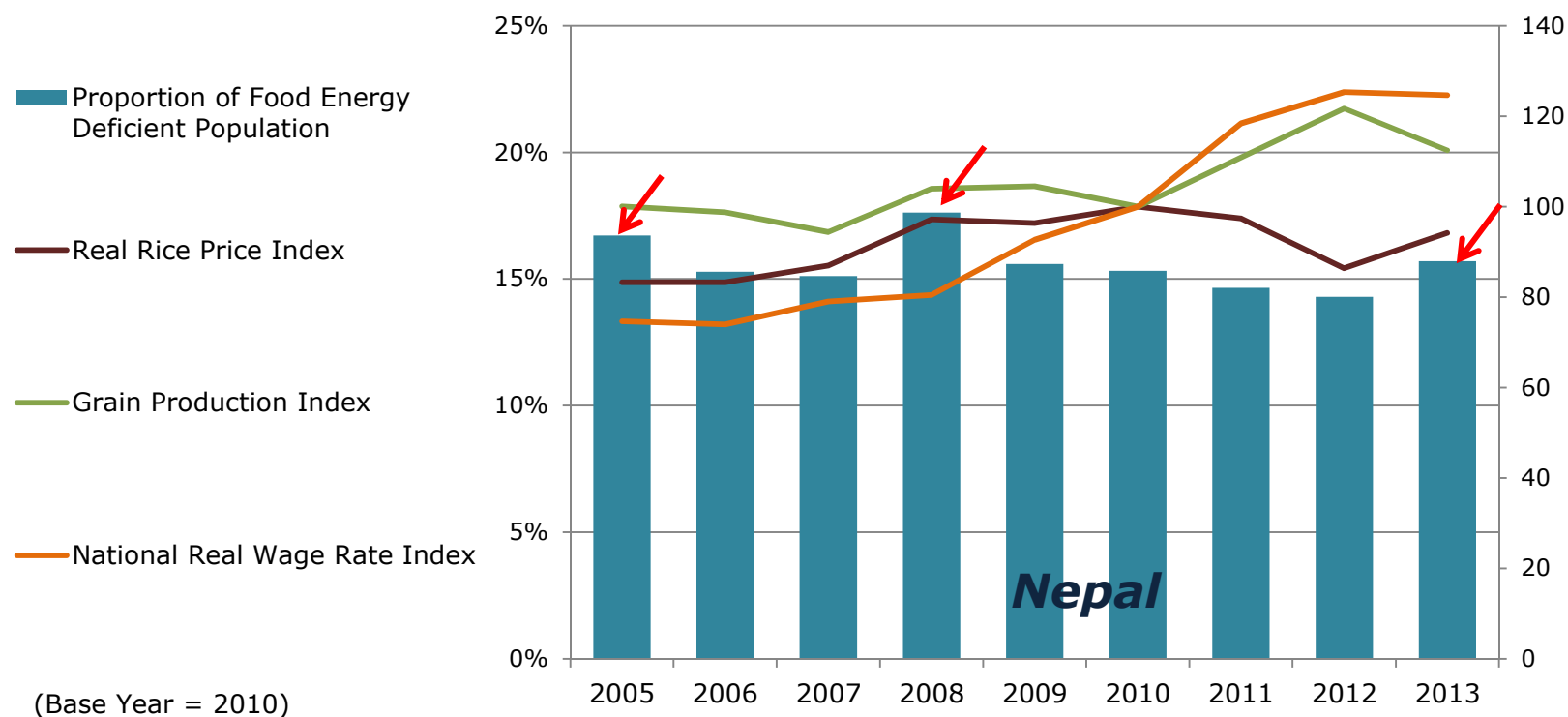
Proportion of Food Energy Deficient Population

Real Rice Price Index

Grain Production Index

National Real Wage Rate Index

(Base Year = 2010)

Nepal

Simulation of the Proportion of Food Energy Deficient Population (<MEDC 1810 kcal)
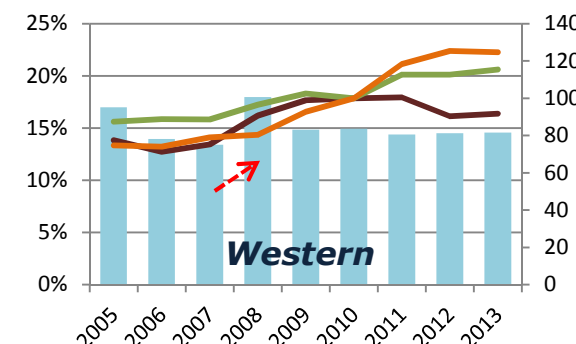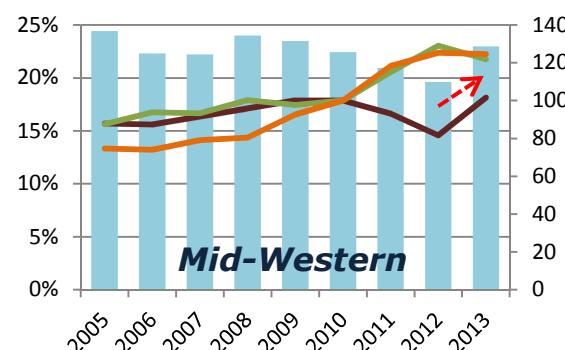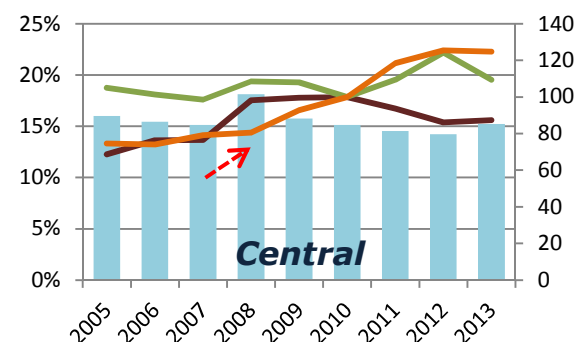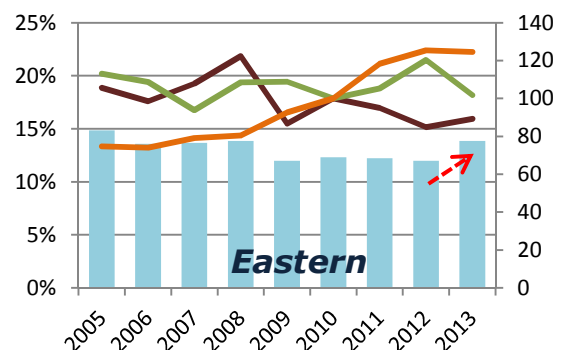## All Shock Factors Included

Legend:
- Proportion of Food Energy Deficient Population
- Real Rice Price Index
- Grain Production Index
- National Agri. Labour Real Wage Rate Index

(Base Year = 2010)

Charts for regions: Eastern, Central, Far-Western, Mid-Western, Western (2005–2013)
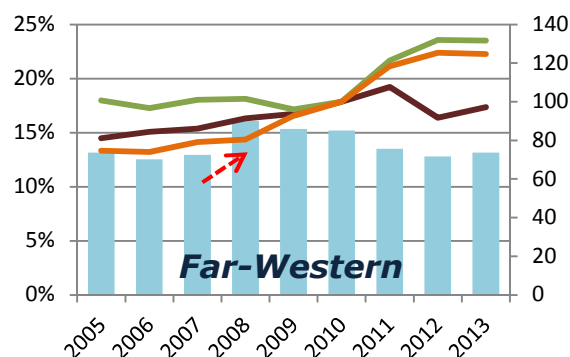
- Mid-Western region has higher proportion of food energy deficient people in general.

- Impact of shocks varies among regions. During the high food price crisis in 2008, Central region had the highest increase in real rice price (+28%), but its increase of proportion of food energy deficient people (+20%) was less than Far-Western region (+24%) where the real rice price increase was only (6%) because grain production index did not increase there.

- Impact of 2013 crop failure is more visible in Mid-Western (+17%) and Eastern (+16%) regions.
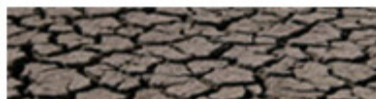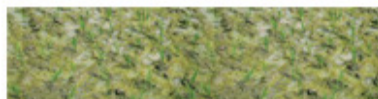
Simulation of the Proportion of Food Energy Deficient Population (<MEDC 1810 kcal)

by rural/urban

Legend:
- Rural
- Urban

by rural/urban & gender of HH's head

Legend:
- Rural - Male headed
- Rural - Female headed
- Urban - Male headed
- Urban - Female headed
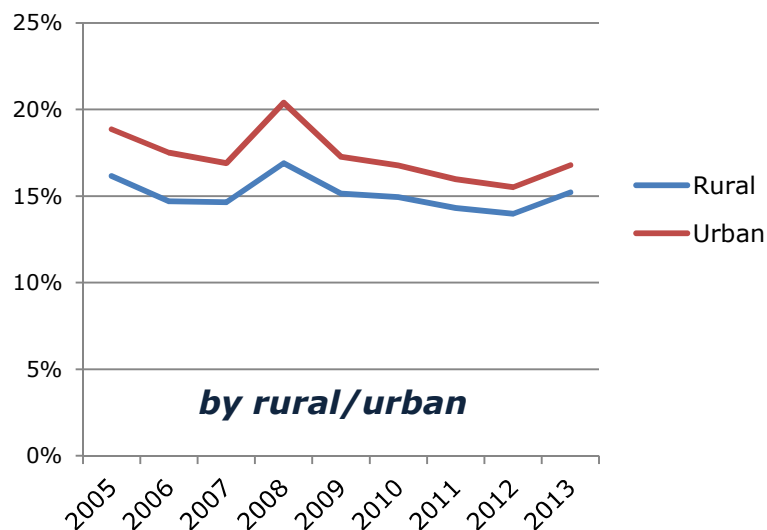
By rural/urban:

- HHs in rural areas are generally more resilient to shocks. The increases of proportion of food deficient population in rural areas were less than in urban areas (compared to the year before, rural +16% vs. urban +19% in 2008; rural +8% vs. urban +9% in 2013).
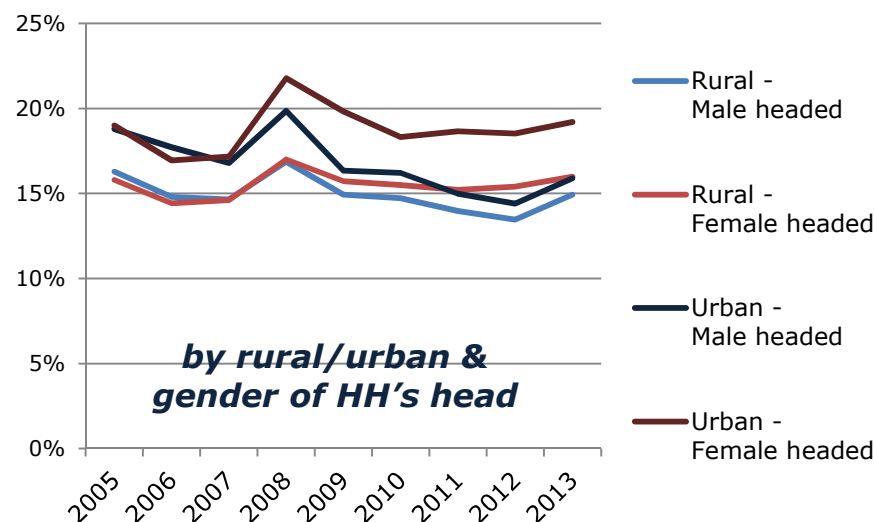
By rural/urban & gender of HH's head

- Female headed HHs were more exposed to shocks in both rural and urban areas and recovered more slowly. The improvement on their food security situation was not as much as the national average (compared 2012 to 2008, national avg. -19%, female-headed in rural area -9%, female-headed in urban area -15%).

Simulation of the Proportion of Food Energy Deficient Population (<MEDC 1810 kcal)

Chart 1 — by rural/urban & size of arable land
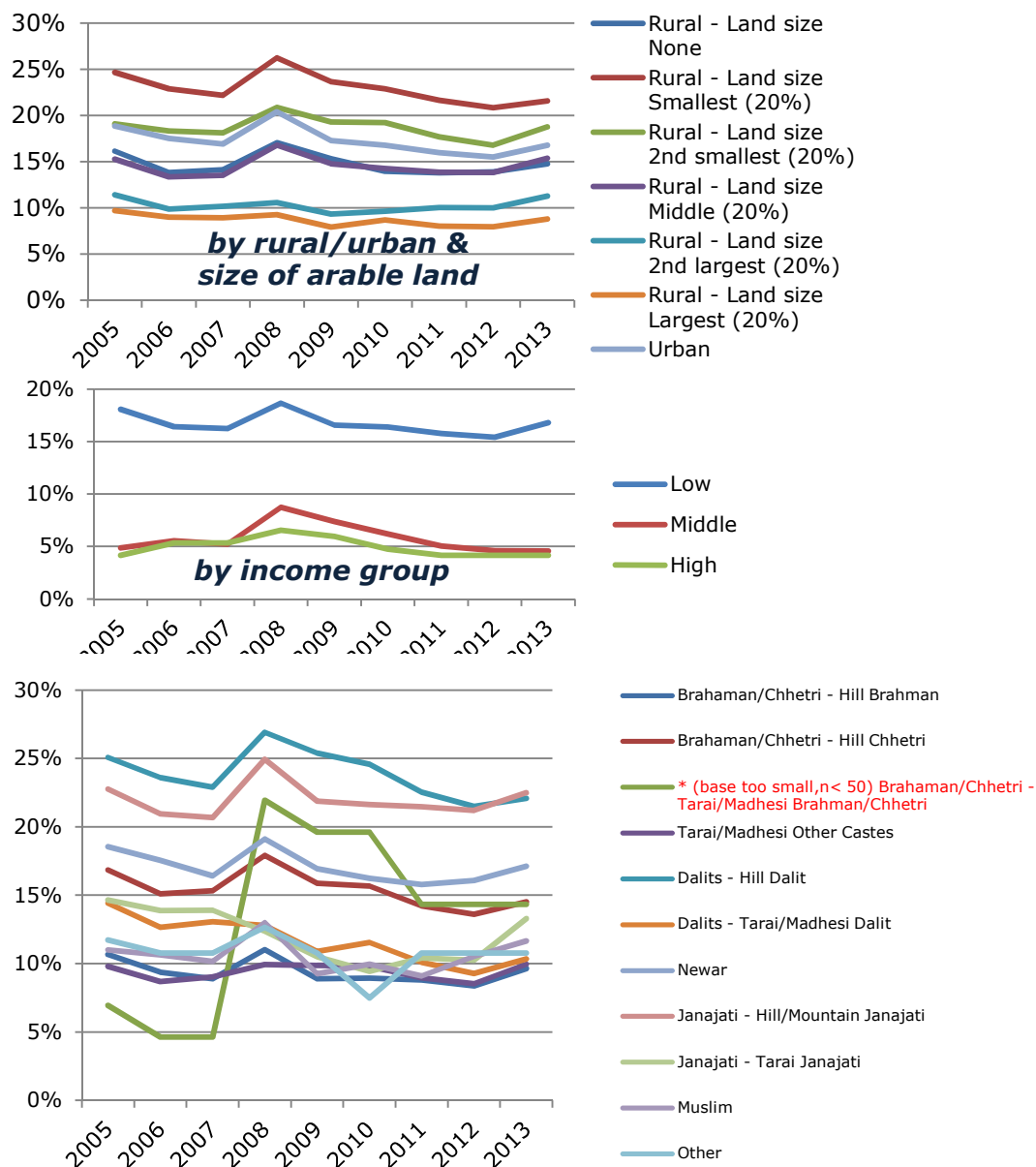
Legend:
- Rural - Land size None
- Rural - Land size Smallest (20%)
- Rural - Land size 2nd smallest (20%)
- Rural - Land size Middle (20%)
- Rural - Land size 2nd largest (20%)
- Rural - Land size Largest (20%)
- Urban

Chart 2 — by income group

Legend:
- Low
- Middle
- High

Chart 3 — by caste/ethnic group

Legend:
- Brahaman/Chhetri - Hill Brahman
- Brahaman/Chhetri - Hill Chhetri
- * (base too small,n< 50) Brahaman/Chhetri - Tarai/Madhesi Brahman/Chhetri
- Tarai/Madhesi Other Castes
- Dalits - Hill Dalit
- Dalits - Tarai/Madhesi Dalit
- Newar
- Janajati - Hill/Mountain Janajati
- Janajati - Tarai Janajati
- Muslim
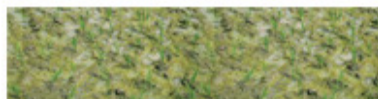- Other

By rural/ urban & size of arable land:

- In rural areas, for HHs which operate a land, the smaller the land size, the more likely they were affected by shocks. The proportion of food deficient population of the rural areas with the smallest land size stood the highest, while those with the largest land stood the lowest.

By income group:

- Although the proportion of food deficient population of the low income group stood high, the impact of the 2008 high food price crisis was lower than the middle income group (low +15 %, mid +68%, high +23%).
- The impact of crop failure in 2013 was significant in the low income group(low +9%, mid & high 0%).

By caste/ethnic group:

- Within the same caste and ethnic group, wide variation in food security exists between the subgroups, e.g. Dalits (Hill) vs. Dalits (Tarai/Madhesi).
- The poverty rate of Dalits (hill) is the highest (44%) (CBS, 2011), and its proportion of food deficient population is always the highest too. However, during the 2008 price shock the most affected group was Muslim, +28% compared to 2007, while Dalits (hill) increased by +18%.

Simulation of Total Food Assistance Needed to Meet the Needs at MDEC 1810 kcal
(in tonnes/year)

- Overall food tonnage requirement increased by 34% in 2008 and 35% in 2013 compared to the year before.

- In 2013, most increases are in Eastern(+95%) , Mid-Western(+48%) and to a lesser extent in Central region (+21%), because of the losses of crop production (~30% of HH total income in Eastern & Mid-W. , ~13% in Central) and price hikes brought by the monsoon.
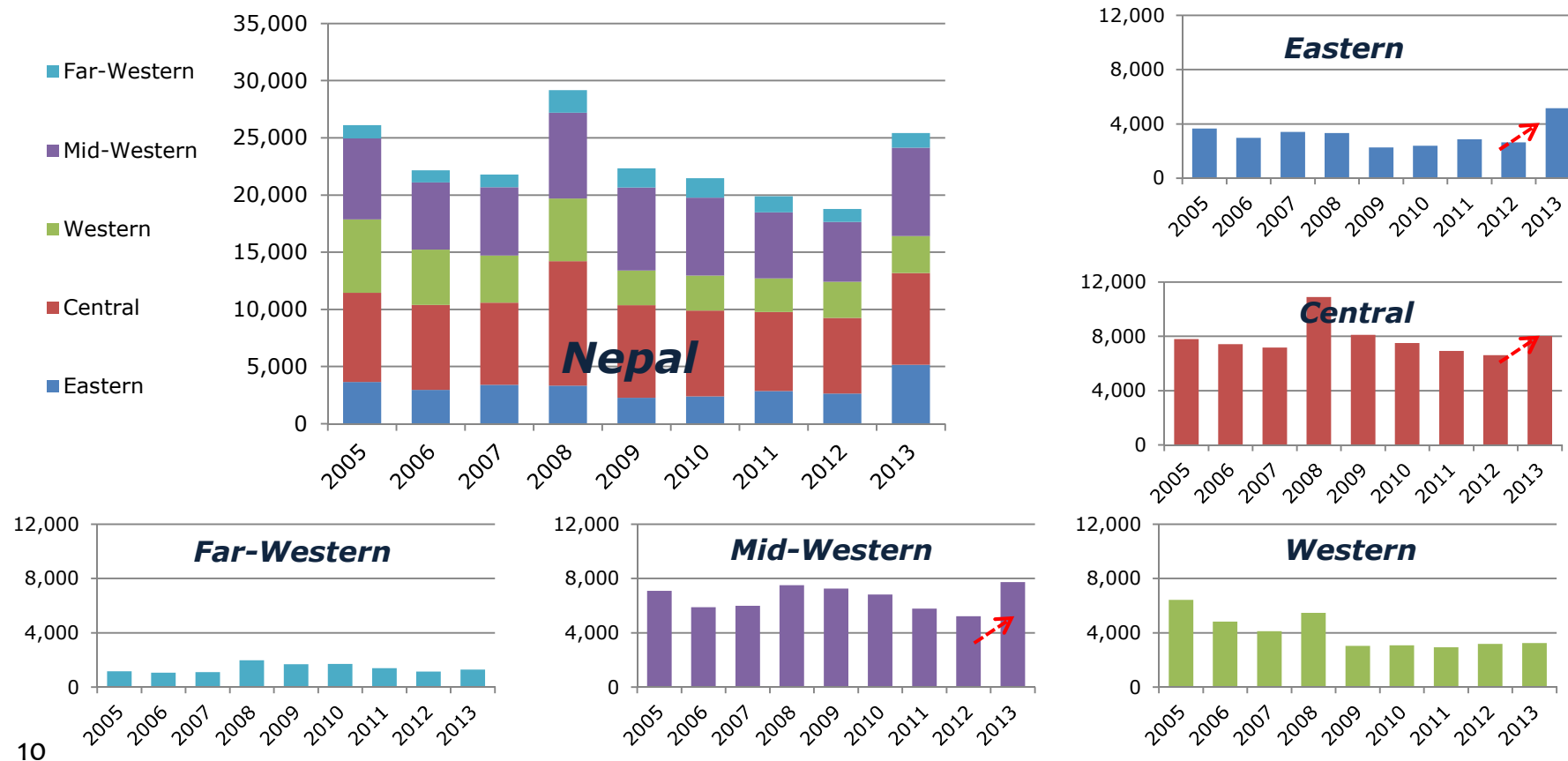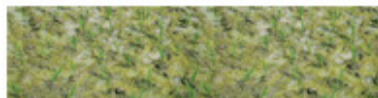
Simulation of 2008/2009 Winter Drought Impact
in Mid- & Far- Western Regions
(corresponding to year 2009 in SISMod)

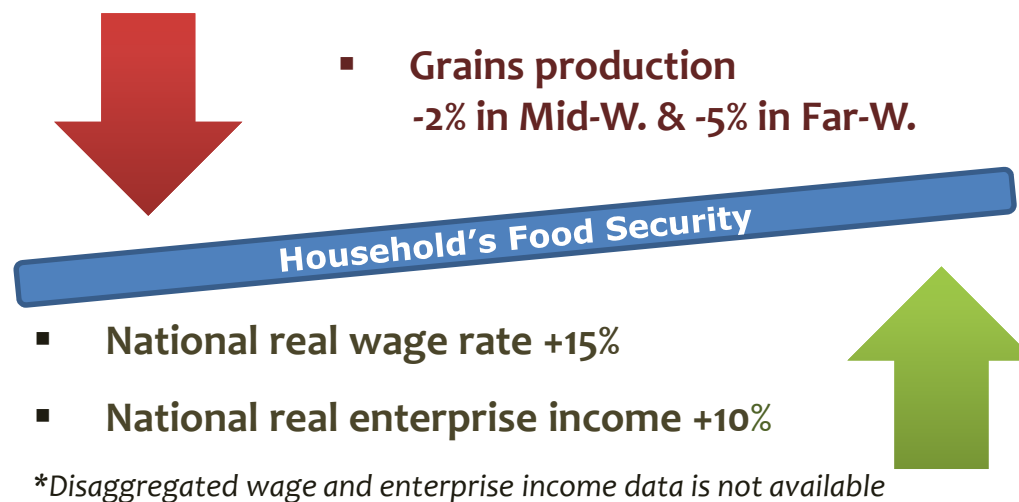| % Change of Proportion of Food Energy Deficient Population (2009 vs. 2008)	
Nepal	-12%
Eastern	-14%
Central	-13%
Western	-17%
Mid-Western	-2%
Far-Western	-5%

- After the global food price crisis in 2008, there was a record-setting summer harvest, the paddy production reached 4.5 million MT (+5% vs. the year before), and an increase in real wage rate (+15%) in 2009.

- However, improvement on HH food security was hindered by a localized shock – the 2009 winter drought, especially in Mid- & Far-Western regions.

- Losses of the main winter crops (wheat and barley) were 20% in Mid-W. and 23% in Far-W.

- Increase of production of summer crops (paddy, maize and millet) had off set the winter crop failure.

- Total grains losses in Mid-W. and Far-W. were 2% and 5 % respectively.

% Change of Grains Production (2009 vs. 2008)	Mid-W.	Far-W.
Total Grains	-2%	-5%
Paddy	+7%	+1%
Maize	-1%	0%
Millet	-1%	+12%
Wheat	-20%	-24%
Barley	-20%	-21%

WFP
wfp.org

Simulation of 2008/2009 Winter Drought Impact in Mid- & Far- Western Regions

- **Grains production**
  -2% in Mid-W. & -5% in Far-W.

Household's Food Security

- **National real wage rate +15%**

- **National real enterprise income +10%**

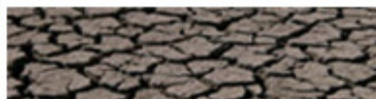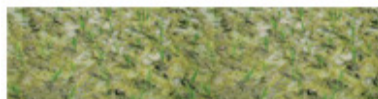**Disaggregated wage and enterprise income data is not available*

- **Scenario A**

  If wage rate in Mid- & Far- W. did not increase as the national rate, i.e. same as 2008 level

- **Scenario B**

  If both wage rate and enterprise income in Mid- & Far- W. were same as 2008 level

WFP
wfp.org

Simulation of 2008/2009 Winter Drought Impact in Mid- & Far- Western Regions

Proportion of Food Energy Deficient Population	2008 (All shock factors)	2009 (All shock factors)	2009 Scenario A ('08 wage)	2009 Scenario B ('08 wage & ent. inc.)
Mid-Western	24.0%	23.5%	24.2%	24.3%
Far-Western	16.1%	15.3%	16.1%	16.3%

- Impact of the winter drought in Mid- & Far-W. was off set by good summer harvest, increase of wage and enterprises income.

- By controlling for wage and enterprise income factors, the situation in 2009 became worse than in 2008 global food crisis.

Noteworthy that the annual average (since the HH data is on annual average) smoothes out the short term impact of the drought.

Can SISMod. simulate the current situation, but not only annual situation?
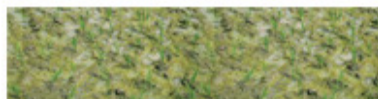
WFP
wfp.org

Assumption on 2008/2009 Winter Drought Impact in Mid- & Far- Western Regions in April 2009

- Imagine it is now **2009 April,** the information we know about the winter drought is, as per VAM sources:

  - Estimated winter crop losses are between 30% to 70 % *(VAM Emergency Alert April 2009)*

  - Real Rice prices +11% in Mid-W. and +27% in Far-W.*(VAM Food Prices Database)*

  - Real Wheat prices +3% in Mid-W. and +17% in Far-W. *(VAM Food Prices Database)*

Scenario C Assumptions are made on top of the already known 2008 situation to create scenario of Q1 2009

- Quantity of crops production -50% (apply to all crop types in order to treat the income from crop production as a whole, regardless of the share of crop type in total "annual" crop production)

  ➡ This will affect income from crop production (own-consumption is income and expenditure in the model)

- Wage and enterprise income from agri. sector -36% in Mid-W. and -44% in Far-W. as per the combined impact of crop loss and crop price increase

  ➡ This will affect other income sources and agri. Input cost (casual labor) in the model.

- Real retail and wholesale price of rice +11% in Mid-W. and +27% in Far-W.(Q1 2009 vs. Q1 2008)

- Real retail and wholesale price of wheat +3% in Mid-W. and +17% in Far-W. (Q1 2009 vs. Q1 2008)

  ➡ These will affect income from crop production and expenditure in the model
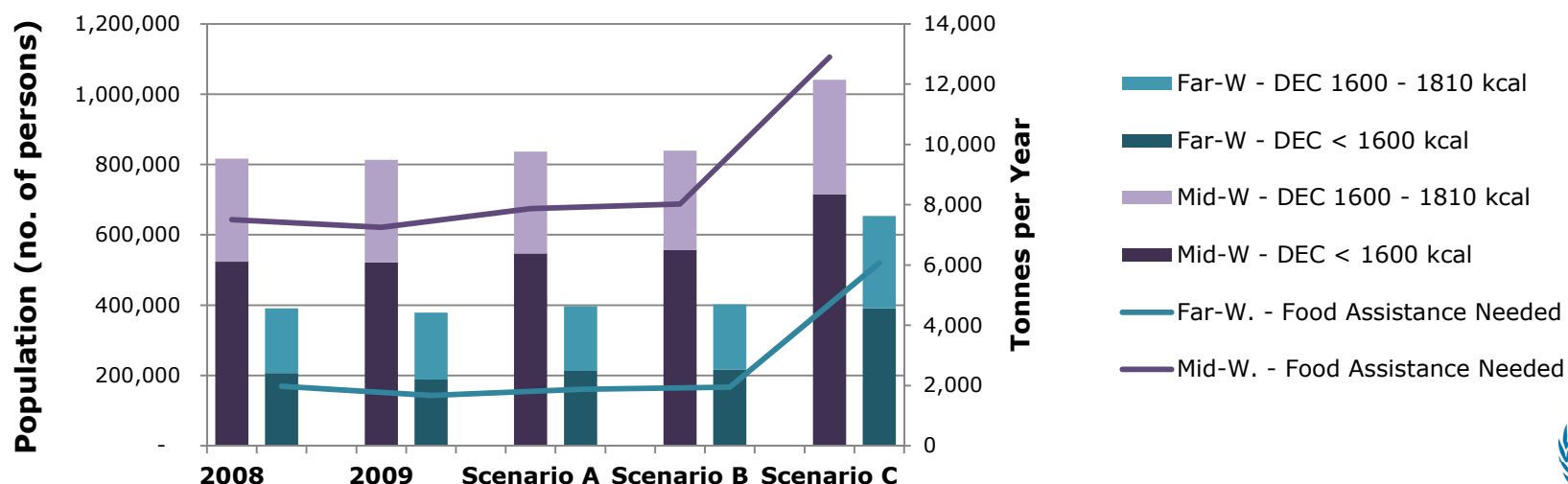
Simulation of 2008/2009 Winter Drought Impact in Mid- & Far- Western Regions

- Food security situation in Q1 2009 (scenario C) in Mid- and Far-Western regions was significantly aggravated, compared to the 2008 annual average.

Proportion of Food Energy Deficient Population	2008 (All shock factors)	2009 (All shock factors)	2009 Scenario A ('08 wage)	2009 Scenario B ('08 wage & ent. inc.)	2009 Scenario C Q1
Mid-Western	24.0%	23.5%	24.2%	24.3%	30.1%
Far-Western	16.1%	15.3%	16.1%	16.3%	26.5%

Breakdown of Food Energy Deficient Population and Total Food Assistance Needed to Meet MDEC 1810 kcal

Legend:
- Far-W - DEC 1600 - 1810 kcal
- Far-W - DEC < 1600 kcal
- Mid-W - DEC 1600 - 1810 kcal
- Mid-W - DEC < 1600 kcal
- Far-W. - Food Assistance Needed
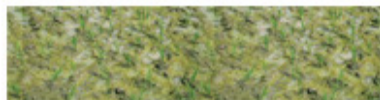- Mid-W. - Food Assistance Needed

15

WFP
wfp.org

Lessons Learnt

- Outputs are consistent with expected impacts of past shocks.

- Adequate outputs at sub-national level require a set of more disaggregated shock factors which reflects the sub-national changes.

- Impact of shocks would be off-set by the other factors such as increases in other incomes (wage, enterprise income), wholesale prices, etc.

- The more knowledge of changes in shock factors, the more shock scenarios refined to derive impacts (e.g. Mid- and Far-W. crop failure in 2009).

- Keeping in mind that the baseline data is on annual basis, the short term impact of a shock would be smoothed-out by the annual average.

- When creating scenario with different time-reference (e.g. quarterly, not annually), seasonal data is needed but not always available for shock impact simulation.

- It is very important to validate the shock factors and the results with local experts who have good understanding of the local changes.

- SISMod results should be interpreted with caution when considering different sub-groups: representativeness could be lost.

wfp.org
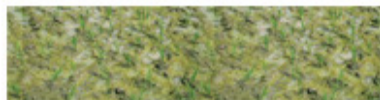
Implications of SISMod.

- **Monitoring**
  - track and measure impact of actual or anticipated shocks (e.g. price, drought, flood...) on household food security

- **Assessment**
  - provide early quantitative estimations of the impact of shocks prior to ground-truthing assessment using baseline data
  - Identify household group more or less affected or resilient to shocks

- **Program & Policy**
  - Identify vulnerable groups (geographical location, community, livelihood and gender-based) for initial programme design phases, preparedness or contingency planning

Thank You