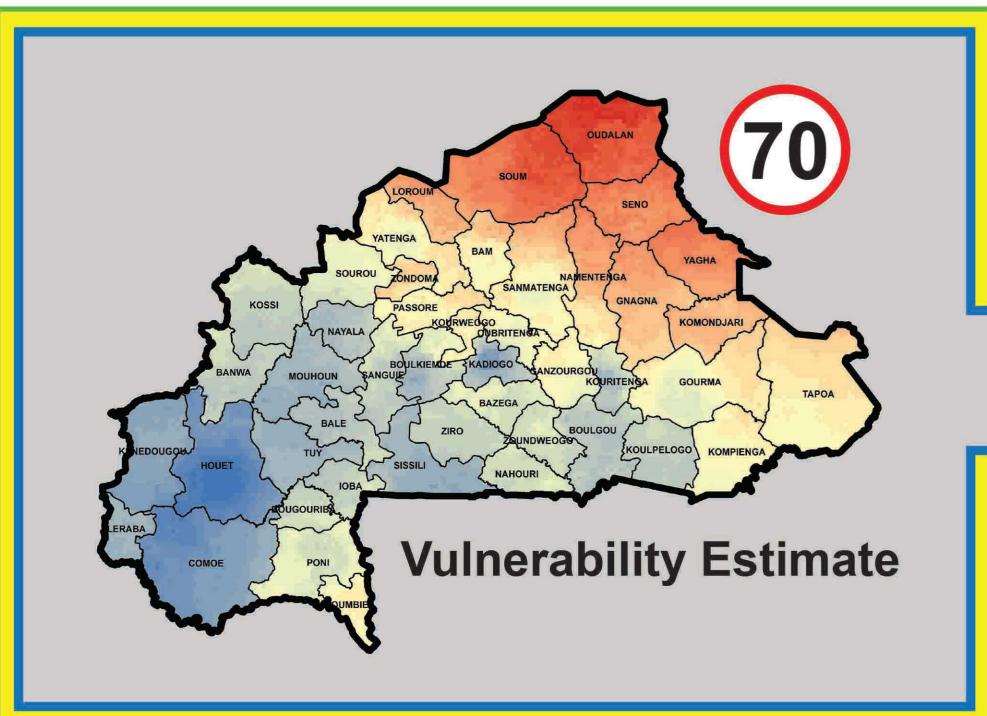
# Structural Vulnerability Map of Burkina Faso - Feb. 2015

#### **Definition of Structural Vulnerability:**

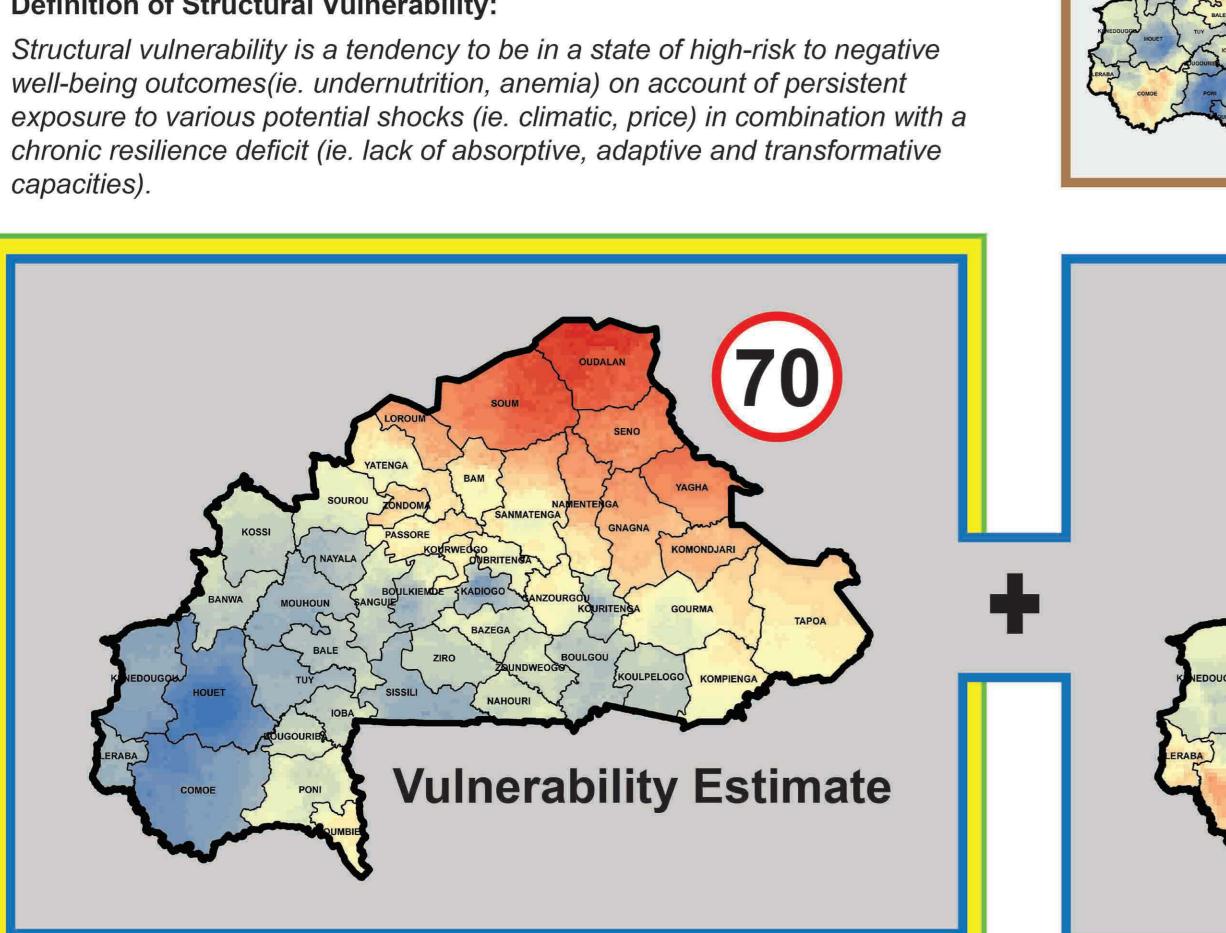
well-being outcomes(ie. undernutrition, anemia) on account of persistent chronic resilience deficit (ie. lack of absorptive, adaptive and transformative capacities).



#### **Linear Regression Analysis:**

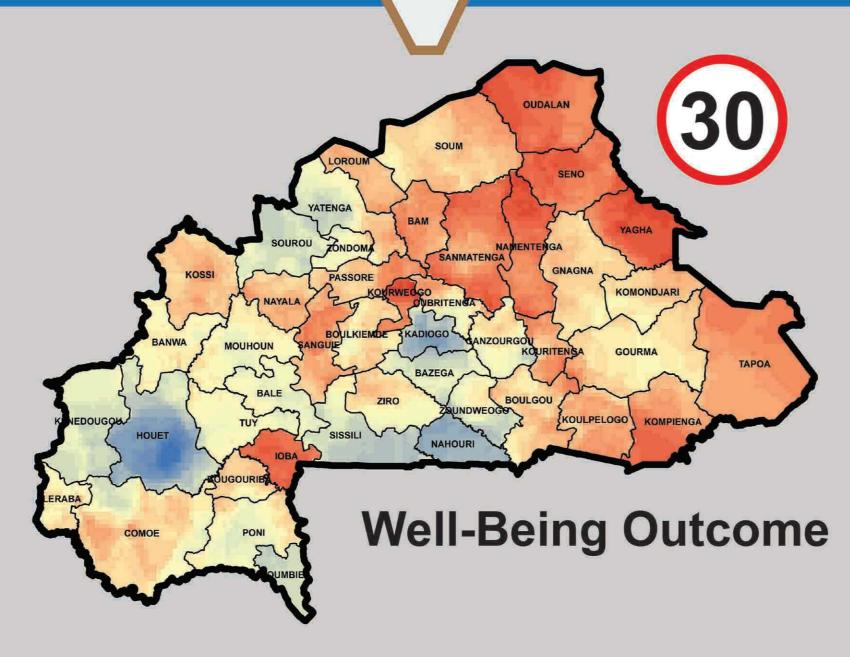
A linear regression was run to determine how well the Vulnerability Estimate composite model predicts (correlates to) the Well-Being Outcome composite. The assumption is that if Resilience Capacities and Exposure to Shocks and Stresses are combined to form a Vulnerability Estimate, the vulnerable zones identified therein should correlate to geographic zones of negative well-being outcomes (ie. undernutrition). Modeled grid cell values from both geographic models were used for the regression analysis.

R-Squared = 0.39



Scatterplot shows grouping

Undernutrition



Vulnerability Estimate (left) gets "corrected" here by averaging it with real well-being outcome measurements through the well-being composite above. The result of this correction is the Final Vulnerability Map to the right.

Exposure

(Shocks and Stresses)

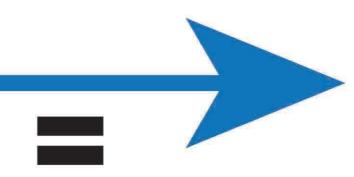
### Purpose of Map:

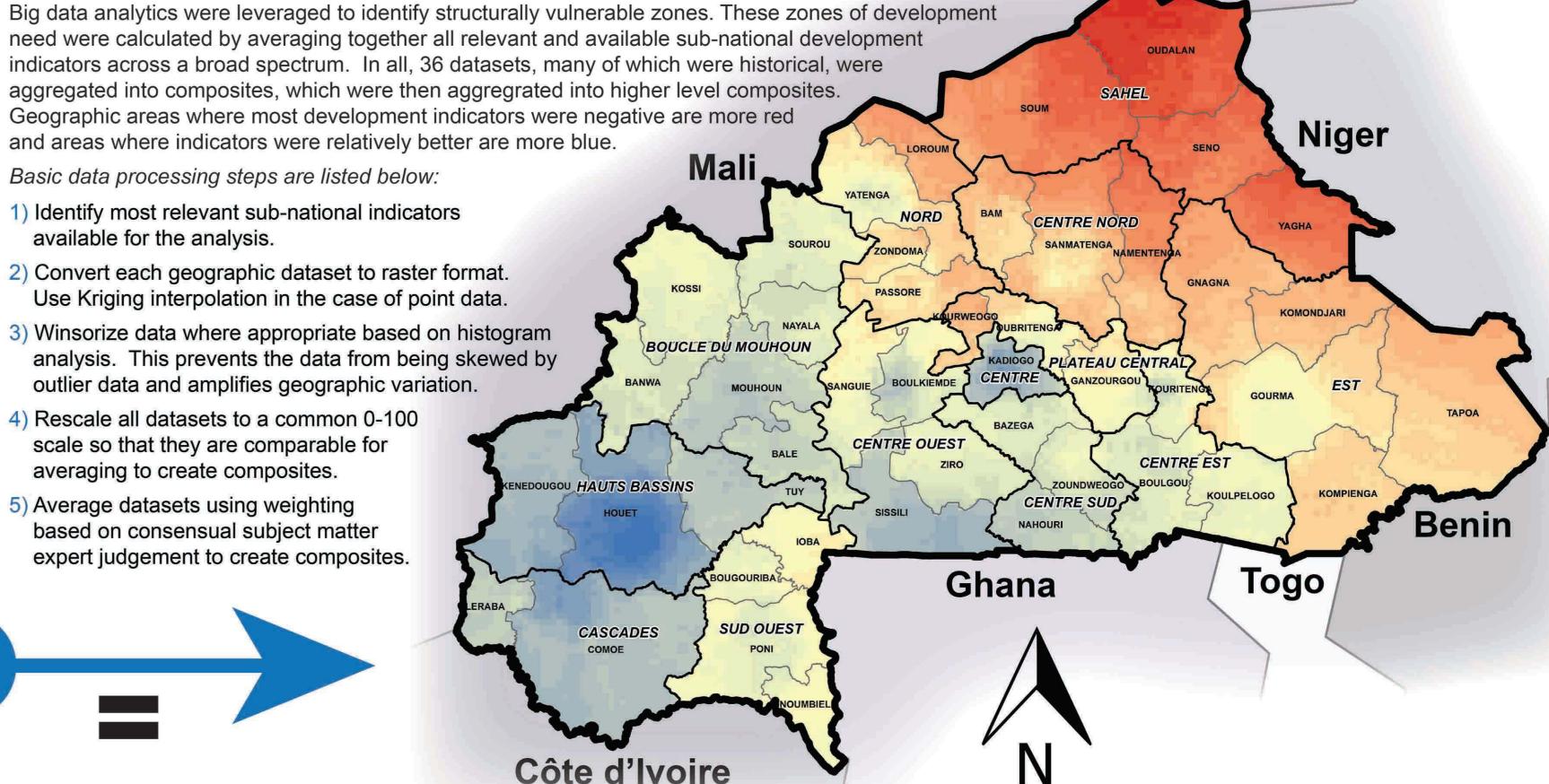
The purpose of the final vulnerability map is to better identify "hotspots" of structural vulnerability in order to better geographically target longer term resilience investments (development adapted to vulnerable contexts) where the need is greatest. Improved geographic targetting of the most vulnerable is critical to decision making regarding strategic investments for resilience and redressal of social justice related grievances which may lead to conflict.

### **Basic Methodology:**

aggregated into composites, which were then aggregated into higher level composites Geographic areas where most development indicators were negative are more red and areas where indicators were relatively better are more blue. Basic data processing steps are listed below:

- 1) Identify most relevant sub-national indicators available for the analysis.
- 2) Convert each geographic dataset to raster format. Use Kriging interpolation in the case of point data.
- 3) Winsorize data where appropriate based on histogram analysis. This prevents the data from being skewed by outlier data and amplifies geographic variation.
- 4) Rescale all datasets to a common 0-100 scale so that they are comparable for averaging to create composites.
- 5) Average datasets using weighting based on consensual subject matter expert judgement to create composites.



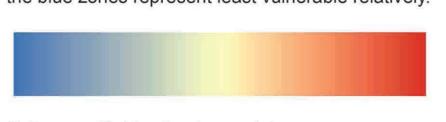


# Final Vulnerability Map

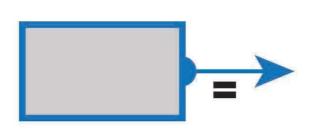
## Legend:

#### how to read this infographic

1) Red Zones on all maps are most vulnerable and the blue zones represent least vulnerable relatively.



2) Boxes with blue border contain composite index maps. The + sign between composite maps signifies that they are averaged together to form yet another composite map. Follow the arrow symbol with = sign to see which composite they create when averaged together.



3) Boxes with brown border contain sub-composite index maps. All subcomposite maps in brown bordered boxes are averaged together to form the composite maps they feed into (see the tip of brown box with = sign in it). It should be noted here that subcomposite maps in this infographic are based on other component maps not visualized on this infographic. The table at right gives the specifics about datasets used and the nature of the components maps that were aggregated using a weighted average to produce the subcomposite maps you see in this infographic.

Rank	Department	Province	Region	Vulnerability Score	POP (2006 Census)	
1	TIN-AKOFF	Oudalan	SAHEL	96.3	21,013	
2	DEOU	Oudalan	SAHEL	95.5	25,321	
3	OURSI	Oudalan	SAHEL	91.9	15,806	
4	GOROM-GOROM	Oudalan	SAHEL	88.8	106,346	
5	MARKOYE	Oudalan	SAHEL	88.5	27,478	
6	KOUTOUGOU	Soum	SAHEL	88.4	18,655	
7	TITABE	Yagha	SAHEL	87.5	20,639	
8	FALAGOUNTOU	Seno	SAHEL	85.5	18,180	
9	TANKOUGOUNADIE	Yagha	SAHEL	85.2	16,453	
10	ARBINDA	Soum	SAHEL	84.5	91,020	
11	SEBBA	Yagha	SAHEL	84.1	32,374	
12	BOUNDORE	Yagha	SAHEL	83.9	22,773	
13	GORGADJI	Seno	SAHEL	83.7	29,913	
14	DORI	Seno	SAHEL	82.6	106,808	
15	SEYTENGA	Seno	SAHEL	82.2	31,585	
16	BOUROUM	Namentenga	CENTRE NORD	81.6	46,232	
17	SOLHAN	Yagha	SAHEL	81.1	25,108	
18	NAGBINGOU	Namentenga	CENTRE NORD	80.9	16,004	
19	SAMPELGA	Seno	SAHEL	80.6	19,227	
20	TONGOMAYEL	Soum	SAHEL	80.2	70,372	
21	NASSOUMBOU	Soum	SAHEL	80.1	20,165	
22	BANI	Seno	SAHEL	79.6	59,278	
23	YALGO	Namentenga	CENTRE NORD	78.7	31,641	
24	KELBO	Soum	SAHEL	78.3	24,157	
25	MANSILA	Yagha	SAHEL	78.2	42,805	
26	PENSA	Sanmatenga	CENTRE NORD	77.3	36,158	
27	DJIBO	Soum	SAHEL	76.3	60,042	
28	DABLO	Sanmatenga	CENTRE NORD	76.2	20,707	
29	DIGUEL	Soum	SAHEL	75.0	8,989	
30	TOUGOURI	Namentenga	CENTRE NORD	74.4	76,824	
31	SOLLE	Loroum	NORD	72.8	17,526	
32	BARABOULE	Soum	SAHEL	72.0	29,883	
33	BANH	Loroum	NORD	70.8	30,332	
34	COALLA	Gnagna	EST	70.8	42,652	
35	MANI	Gnagna	EST	70.7	68,448	
36	BOURZANGA	Bam	CENTRE NORD	69.8	47,751	
37	BARSALOGHO	Sanmatenga	CENTRE NORD	69.7	78,919	
38	OUINDIGUI	Loroum	NORD	69.4	28,278	
39	POBE-MENGAO	Soum	SAHEL	69.3	24,052	
40	TITAO	Loroum	NORD	69.2	66,717	
41	NAMISSIGUIMA	Sanmatenga	CENTRE NORD	69.0	9,752	
42	THION	Gnagna	EST	68.3	23,025	
43	вотои	Тароа	EST	68.0	46,959	
44	FOUTOURI	Komandjari	EST	67.7	14,683	
45	BARTIEBOUGOU	Komandjari	EST	67.5	16,067	
46	TOEGHIN	Kourweogo	PLATEAU CENTRAL	67.4	16,500	
47	BOGANDE	Gnagna	EST	66.7	84,838	
48	LIPTOUGOU	Gnagna	EST	66.5	41,823	
49	NIOU	Kourweogo	PLATEAU CENTRAL	66.2	26,998	
50	ZEGUEDEGUIN	Namentenga	CENTRE NORD	66.0	21,904	

**Top 50 Most Vulnerable Communes** 

#### datasets averaged based on weightings listed \* historical datasets used when available in order to map structural vulnerability vs. conjunctural

All datasets used for composites (datasets averaged based on weightings listed):

Title	Source	Date Range	Admin Level	Methodology notes	SubCom posite Weight	SubComposite Title	Final Weight	Composite Title	Composite Weight	Top Index Composite
FEWSNET	FEWSNET food security outlook data	2008-2014	Province/ Livelihood zone	Averaged IPC score per zone over entire time period.	50%					
SAP	Système d'Alerte Précoce (SAP) vulnerable communes	2009-2014	Commune	Commune score generated by totalling number of times communes identified as vulnerable during time period.	50%	Food Security	50%	Food		
% of non-self sufficient farm households	Ministry of Agriculture - Burkina Faso	2008-2009	Region	Averaged % per region over both years.	43%			Security/Ag.	31%	
Soil Organic Carbon Density	International Soil Reference and Information Centre - World Soil Information	2013	Raster	The soil organic carbon predicted mean for the 1st standard depth (0–5cm), 2nd standard depth (5–15cm) and 3rd standard depth (5–15cm) depth (15–30cm) were summed for an approximation of the soil organic carbon in top soil, which is 0–20cm.	57%	Agricultural Productivity	50%	Productivity		
Educational Level	Annuaire Statistique de l'education nationale	2010-2013	Province	The passing rates for grades 1 thru 5 were averaged and then these averages were averaged over the 4 years.			40%	Literacy Rates	23%	
Literacy Rates	Census Data	2006	Commune	During the 2006 census, everyone over the age of 3 were asked whether or not the respondent could read and write in any language.			60%	anciacy naces	2570	
Poverty	Burkinabè Household Living Conditions Survey (ECBVM)	2003, 2009	Region	Averaged poverty rates per region to approximate general tendency.	67% Poverty (adjusted)		25%			
Remittances	Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO)	2011	Region	A per capital amount was calculated for remittances per region.			25%			
Wealth Index	Demographic and Health Surveys (DHS)	2003, 2010	Cluster	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)			33%			Resilience
Lack of Access to Health Services on Account of Financial Constraints	Demographic and Health Surveys (DHS)	2003, 2010	Cluster Points	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)			8%	Poverty	31%	Capacity
Tropical Livestock Units	Ministry of Livestock - Burkina Faso	2012	Province	Projected Livestock figures converted to TLU	1	Ì	17%			
Immigration Rates	Census Data	2006	Commune	During the 2006 census, every family was asked if they had moved in the last year, and if so, from where to where. Immigration Rates were used as a proxy for vulnerability based on the assumption that generally zones that are less vulnerable are more attractive (offer more opportunities) and thus have higher rates of immigration.						
Lack of Access to Health Services on Account of Distance	Demographic and Health Surveys (DHS)	2003, 2010	Cluster Points	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)	40%	Distance to	20%			
Distance to Health Center	Ministry of Health - Burkina Faso	2013	Province	Yearly report from the Ministry of Health that calculates how many people in each province are 10 km or more away from a health center	60%	Health Services	20%			
# of People per Unit Area	AFRIPOP	2014 estimate	Raster	Areas of lower population are considered as a proxy to lack of access to services (remoteness)			27%	Service Access	15%	
Access to Improved Sanitation	Demographic and Health Surveys (DHS)	2003, 2010	Cluster	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)			20%	The second of th		
Access to Improved Drinking Water Source	Demographic and Health Surveys (DHS)	2003, 2010	Cluster	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)	1		13%			
> 30 minutes walk to nearest drinking water source	Demographic and Health Surveys (DHS)	2003, 2010	Cluster	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)			20%			
Average Rainfall Variability	CHIRPS dataset, C. Funk et al.	Jan, 1981 - Sept. 2014	Raster	Coefficient of Variation of rainfall data was calculated across entire time period for the month of May (planting time) and the month of October (harvest). The variation in rainfall during these two months is considered critical. The two rasters were then averaged to highlight the most vulnerable zones in regards to rainfall variability and its affect on agproduction.			29%			
Average Temperature during Rainy Season	University of East Anglia's Climatic Research Unit (UEA/CRU)	2000-2011 (JJAS- rainy season)	Raster	Average temperature during each rainy season (JJAS) over entire time period was averaged to get a general rainy season average temperature. Hotter average temperature during rainy season can be considered a proxy to plant stress at higher temperatures.			14%	Recurrent Climate Shock	44%	
Average Length of Rainy Season	Famine Early Warning Systems Network (FEWSNET)	2001-2010	Raster	Zones with shorter rainy seasons are considered more vulnerable.			29%			
Average Total Annual Precipitation	CHIRPS dataset, C. Funk et al.	Jan, 1981 - Sept. 2014	Raster	Calculated over entire time period. Zones of lower average total precipitation are considered more vulnerable.			29%			
Historical Conflict	Armed Conflict Location & Event Data (ACLED) database	1/1/1997 to 7/16/2014	Point Data	# of incidents per location plus number of fatalities multiplied by two was used to generate a "conflict score" per point location. All types of conflict from database were included (ie. protests, armed groups, police, ethnic milities, etc.).			67%	Historic Sites of Conflict	11%	Exposure (Shocks & Stresses)
Refugees	World Food Programme (WFP)	2014	Point Data	Total refugee count was used per location as a proxy to conflict because of population and resource pressures created by refugee presence.			33%			23,23,23
Malaria Prevalence	Demographic and Health Surveys (DHS)	2010	Point Data	Points interpolated to Raster using Kriging Method (both rasters for each year averaged)			100%	Health Shock	11%	
Average millet price during lean season	SIM/SONAGESS	2004-2014	Point Data	Point data represents all markets surveyed monthly for prices. Average market prices were calculated for all markets overtime during lean season. Lean season is when high prices have the biggest negative impact on household food security. Point data was interpolated to Raster using Kriging Method (both rasters for each year averaged). Relative weighting for each commodities production level.			27%	Recurrent Price	33%	
Average yellow corn price during lean season	SIM/SONAGESS	2004-2014	Point Data	SAME METHODOLOGY NOTES FOR ALL PRICE DATA IN COMPOSITE (SEE NOTES FOR MILLET PRICES)	50%		5-5-24-24-	SHOURS		
Average white corn price during lean season	SIM/SONAGESS	2004-2014	Point Data	SAME METHODOLOGY NOTES FOR ALL PRICE DATA IN COMPOSITE (SEE NOTES FOR MILLET PRICES)	50%	Corn Prices	29%			
Average white sorghum price	***************************************	2004 2014	Point Data	SAME METHODOLOGY NOTES FOR ALL PRICE DATA IN			33%			
during lean season	SIM/SONAGESS	2004-2014	PUITE Data	COMPOSITE (SEE NOTES FOR MILLET PRICES)	1		3370			

67% Anemia
Prevalence

SIM/SONAGESS 2004-2014 Point Data

2003, 2010 Cluster Points Interpolated to hatch a veraged)

Demographic and Health 2003, 2010

Surveys (DHS)



**Malaria Prevalence** 

**Price Shocks** 

**Historic Sites** of Conflict Recurrent **Climate Shocks** 

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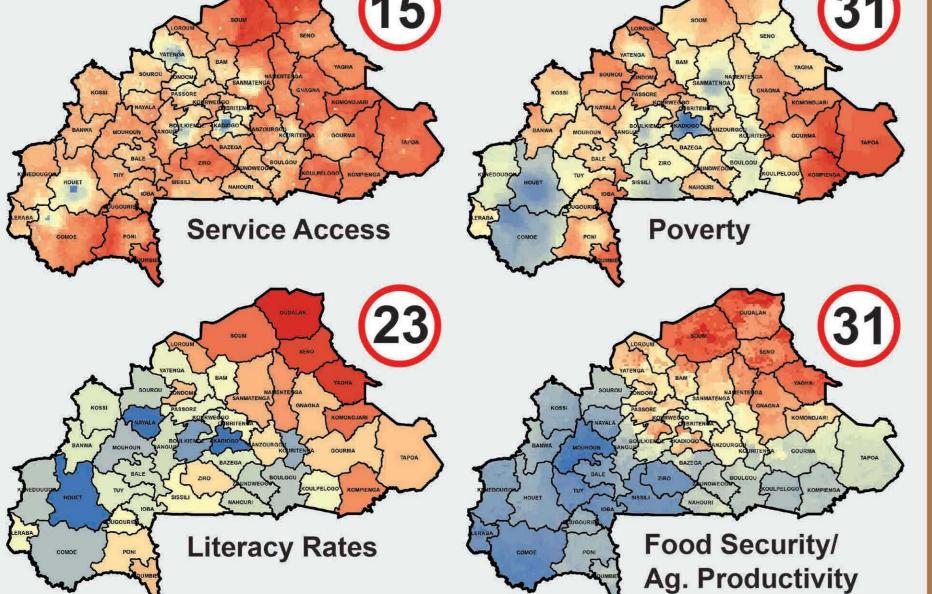
6) Numbers in red circles represent relative weighting of each composite or subcomposite as it contributes to the average. Weightings are represented as a percentage out of 100%. The reason that some of the weightings are odd numbers is because they were derived from an initial intuitive weighting

based on double-weighting, half-weighting, one and a half weighting etc., based on a group consensus of subject matter experts. These informal weightings were then converted to a percentage of 100 to calculating weighted averages to form composites.

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**Resilience Capacity** 

Absorptive, Adaptive, &

**Transformative Capacities**