

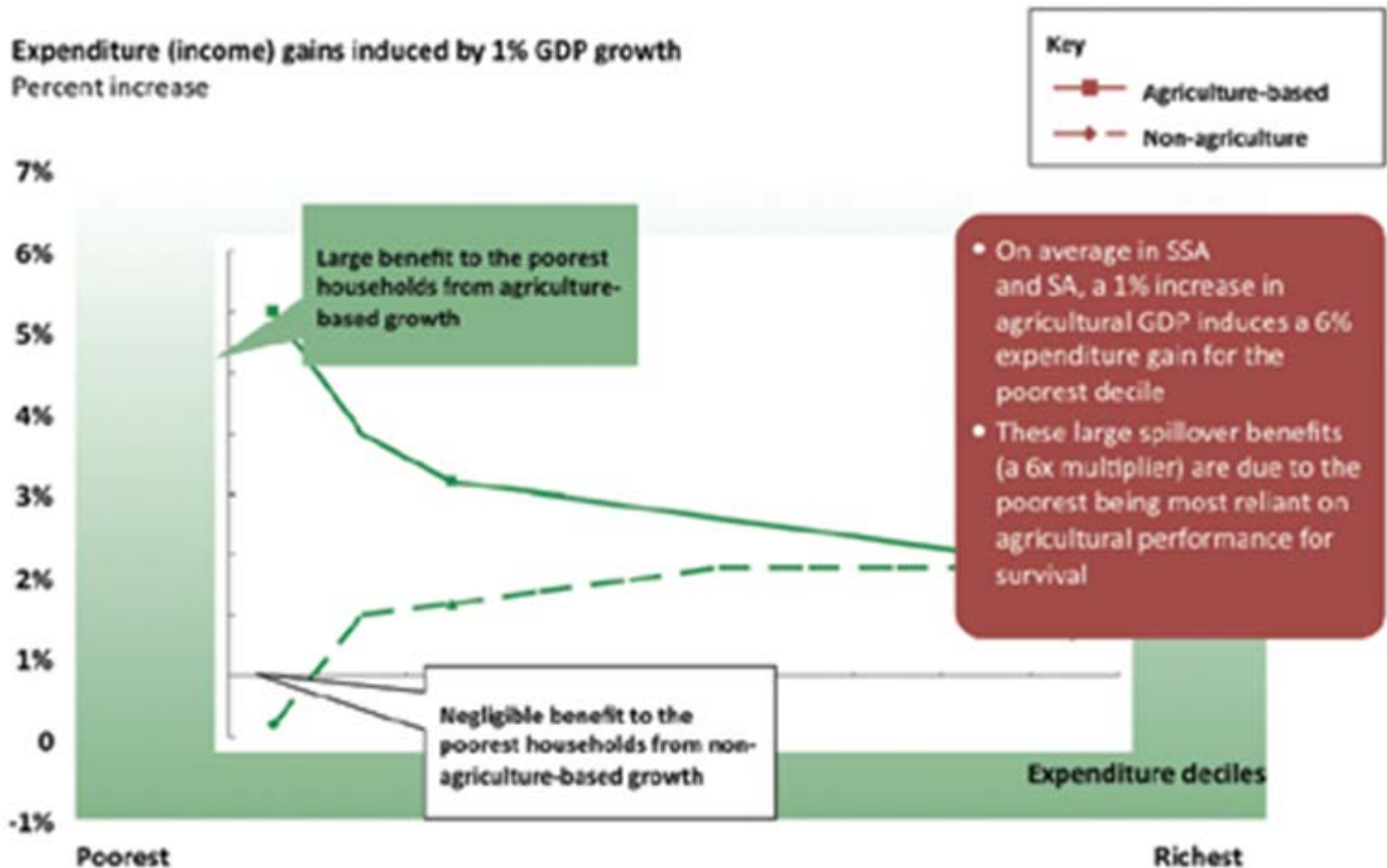
Building Agricultural Resilience to Climate Change in Africa

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Mellon Symposium-Changing Environments, Changing Societies: Community
Responses to Environmental Uncertainties
Bowdoin College, Maine, U.S.A
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Agricultural Based Growth Benefits Africa's Poor



Source: Ugo and Sadolet 2007 "Estimating the Effects of Aggregate Agricultural Growth on the Distribution of Expenditures." Background paper for World Development Report 2008

Alliance for a Green Revolution in Africa (AGRA)

African Agriculture:

- Close to 80% of Africans depend on Agriculture
- Most cultivate less than 2 ha
- Low productivity fuels cycle of hunger/poverty
- High potential to increase productivity, transform agriculture/economies

AGRA Goals:

To catalyze a uniquely Green Revolution (increase incomes; protect environment; advance equity) by:

- Reducing Food insecurity by 50% in at least 20 countries
- Doubling the incomes of 20 million smallholder farmers
- Putting at least 30 countries on track for attaining and sustaining a uniquely African Green Revolution

Alliance for a Green Revolution in Africa (AGRA)

AGRA's Strategic Objectives:

- **Develop/disseminate technologies to increase agricultural productivity**
- **Promote evidence-based policies enabling research, institutional environment, incentive system to promote up-take of technology by poor**
- **Provide a platform that enables effective alliances of diverse constituents to address agricultural productivity**
- **Demonstrate options to catalyze a green revolution /influence smallholder farmers, governments, partners and development practitioners /deliver effective programs**
- **Identify and fill critical financing and human resource gaps-- mobilizing national and international resources in support of an African green revolution**

Focus of this Presentation

What we know ...

... and what we do not know

What smallholder farming societies/communities in Africa are responding/adapting to

What constraints and vulnerabilities smallholder farming societies/communities in Africa are battling with

What resilient-building/ adaptation mechanisms AGRA programs will/could develop

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The Average Temperature Will Increase ...

1.1 °C

Temperature Increase Prediction Range from
IPCC Fourth Assessment Report

6.4 °C

Parallel Climate Model (PCM)
Temperature Increase Prediction = 2 °C

- Climate change prediction model supported by the US Department of Energy
- Climate change components include: atmosphere, land surface, ocean
- Predicts mild temperature increases and marginal gains in precipitation during summer and winter months
- Presents results from a 300 year present-day coupled climate control simulation

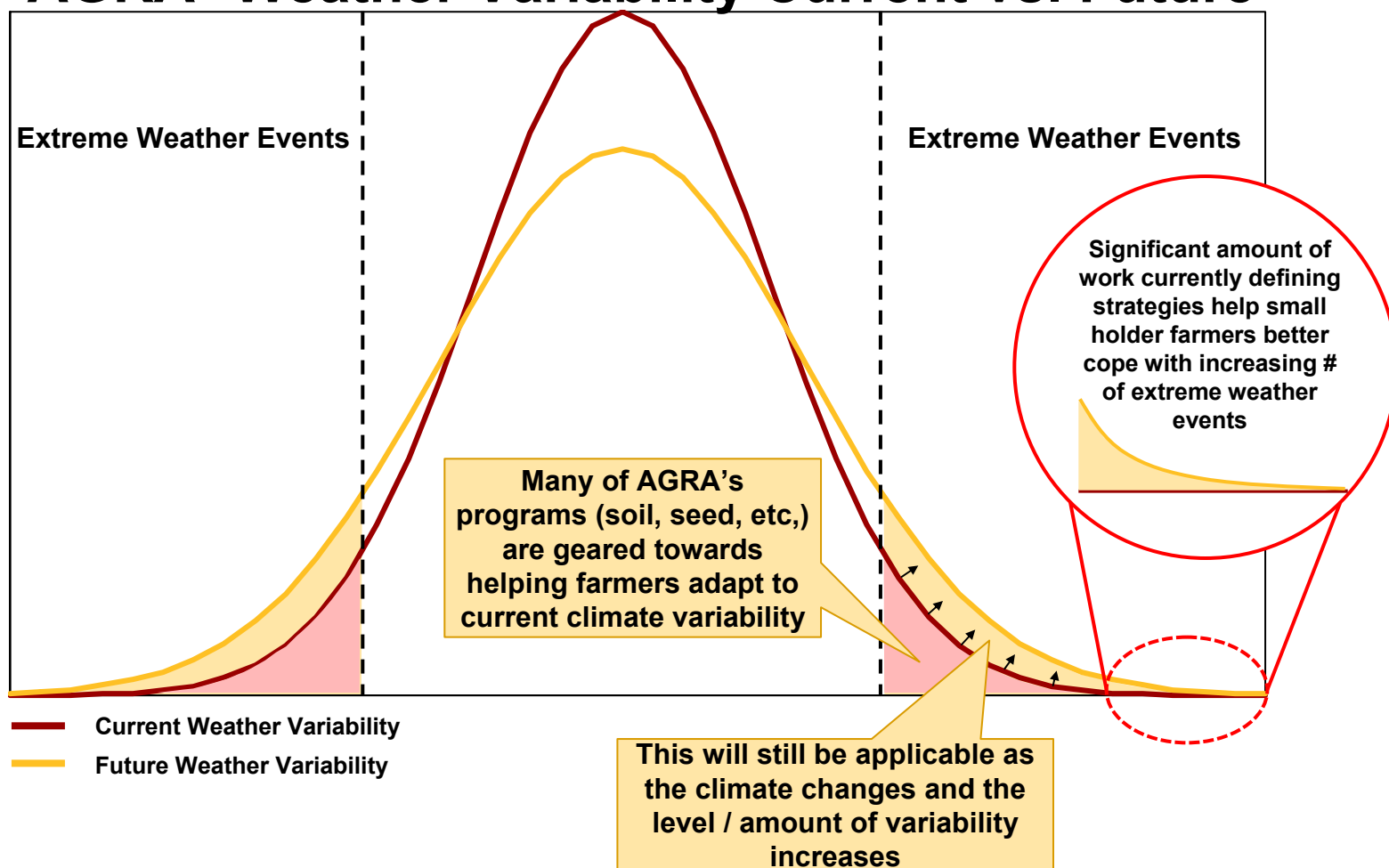
Canadian Climate Change Model (CCC)
Temperature Increase Prediction > 5.4 °C

- Climate change prediction model that simulates the potential climatic consequences of increasing greenhouse gas concentrations and sulfate aerosol
- Climate change components: atmosphere, land surface, ocean
- Predicts more severe warming with drier summers and wetter winters
- Projected climate change simulations extend to year 2100

These predictions span the range of likely outcomes predicted by the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

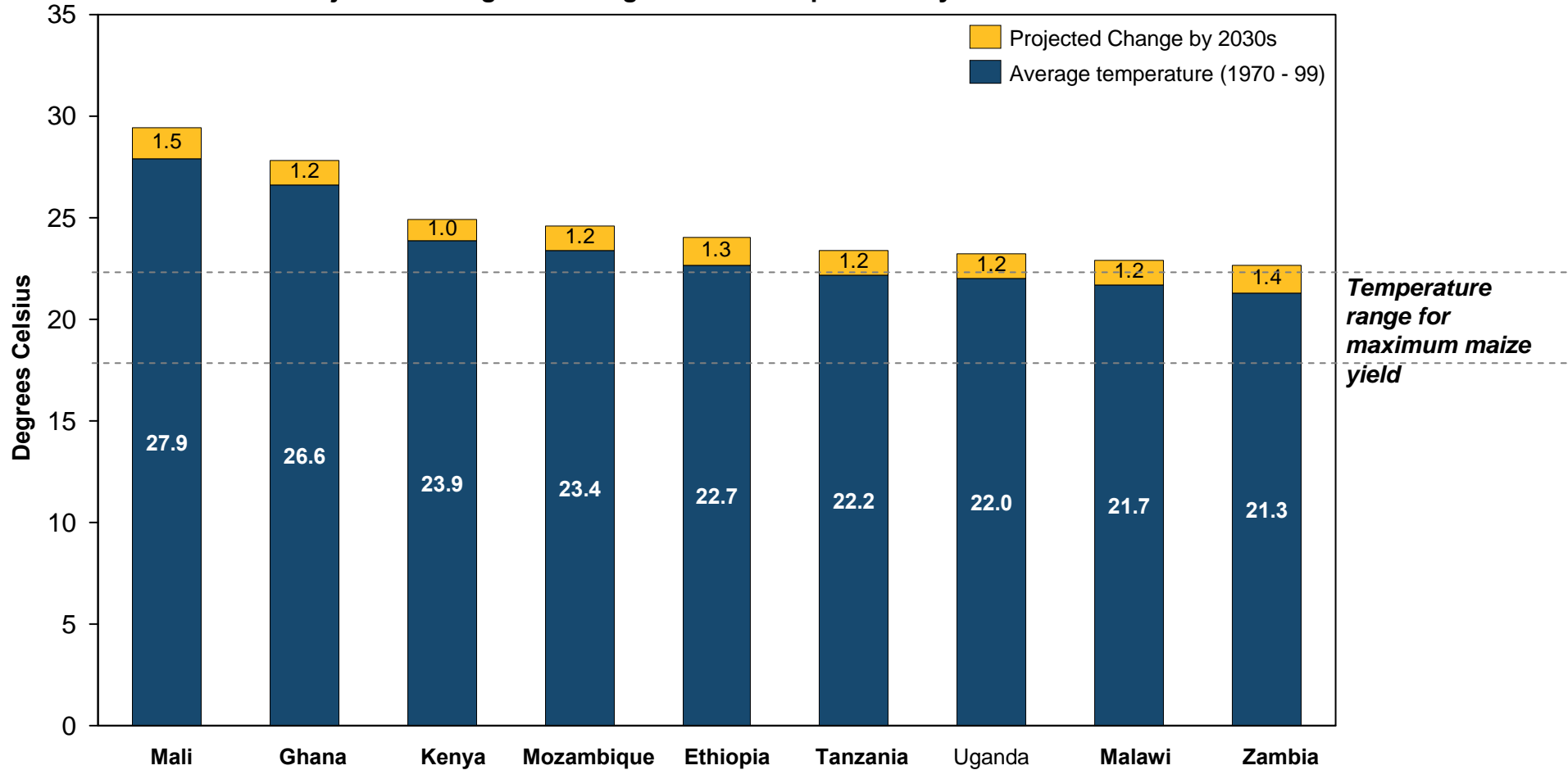
... and Extreme Weather Events Will Become More Likely

AGRA--Weather Variability Current vs. Future



Many Crops Near Maximum Temperature/ Tolerance & Yields Likely to Fall in Future

Projected Change in Average Annual Temperature by 2030s



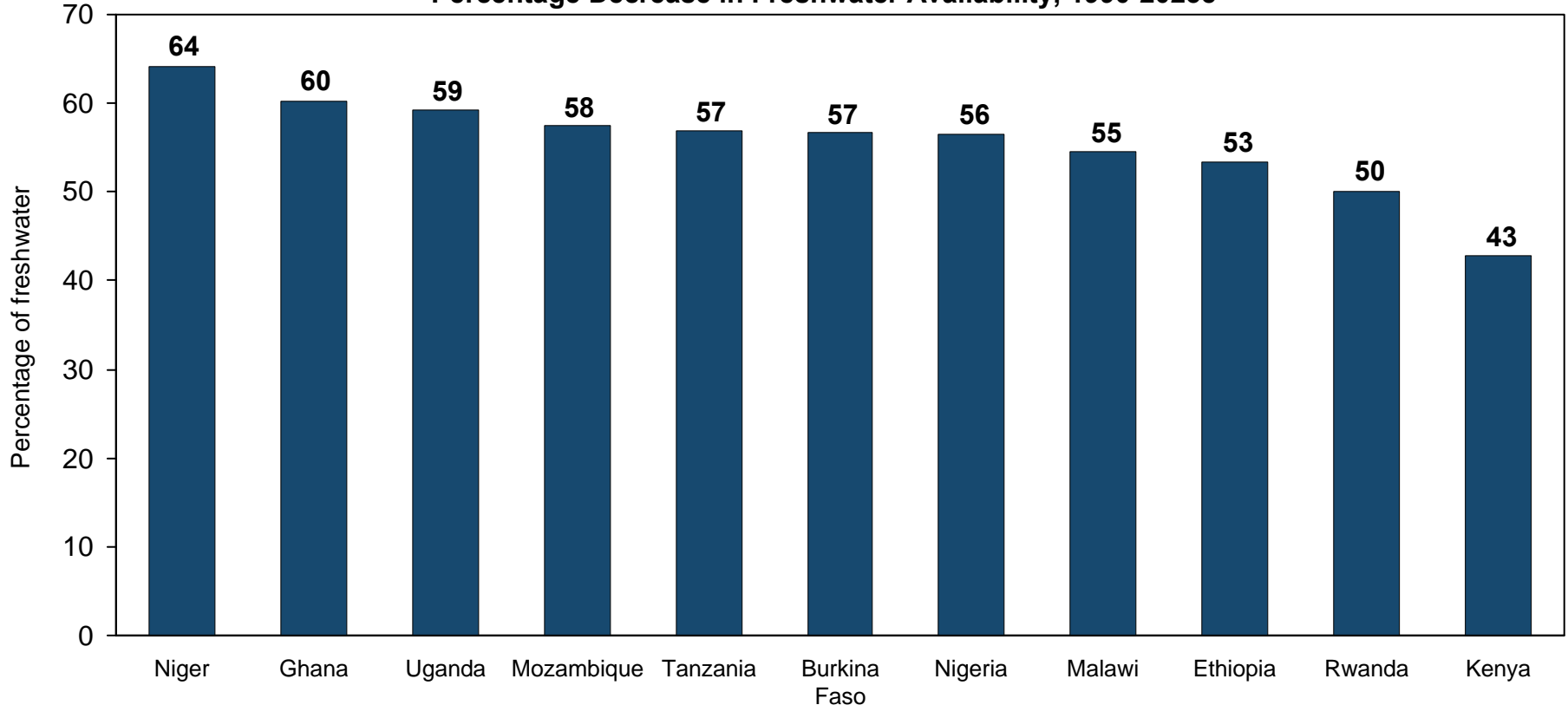
Note: Climate Change data for Burkina Faso, Niger, Nigeria and Rwanda was not available from the source below

Source: UNDP Climate Change Country Profiles (<http://country-profiles.geog.ox.ac.uk>); "Hotter Fields, Lower Yields: How Global Warming Could Hurt America's Farms"; Monitor Analysis

Freshwater availability will further decrease in many African countries

Despite moderate increases in precipitation, rapid population growth, expanding urbanisation and increased economic development are leading to increased water stress in Africa

Percentage Decrease in Freshwater Availability, 1990-2025e



	Niger	Ghana	Uganda	Mozambique	Tanzania	Burkina Faso	Nigeria	Malawi	Ethiopia	Rwanda	Kenya
1990 (m³)	5,450	3,400	3,550	4,000	2,900	3,000	3,100	1,100	2,250	1,000	700
2025 (m³)	1,950	1,350	1,450	1,700	1,250	1,300	1,350	500	1,050	500	400

Source: "Mapping Climate Vulnerability and Poverty in Africa", The International Livestock Research Institute (2006); Monitor Analysis

But, we do not Know ...

How the already fragile rural smallholder farming communities' structures and systems will adapt to a changing climate?

Which parts of these fragile systems are most exposed/ which specific geographies will be most affected by climate change

What can be done to strengthen the adaptation capabilities of smallholder farmers in a sustainable manner?

Where governments, development and donor organizations should focus in their own adaptation strategies for Africa?

Focus of this Presentation

What we know ...

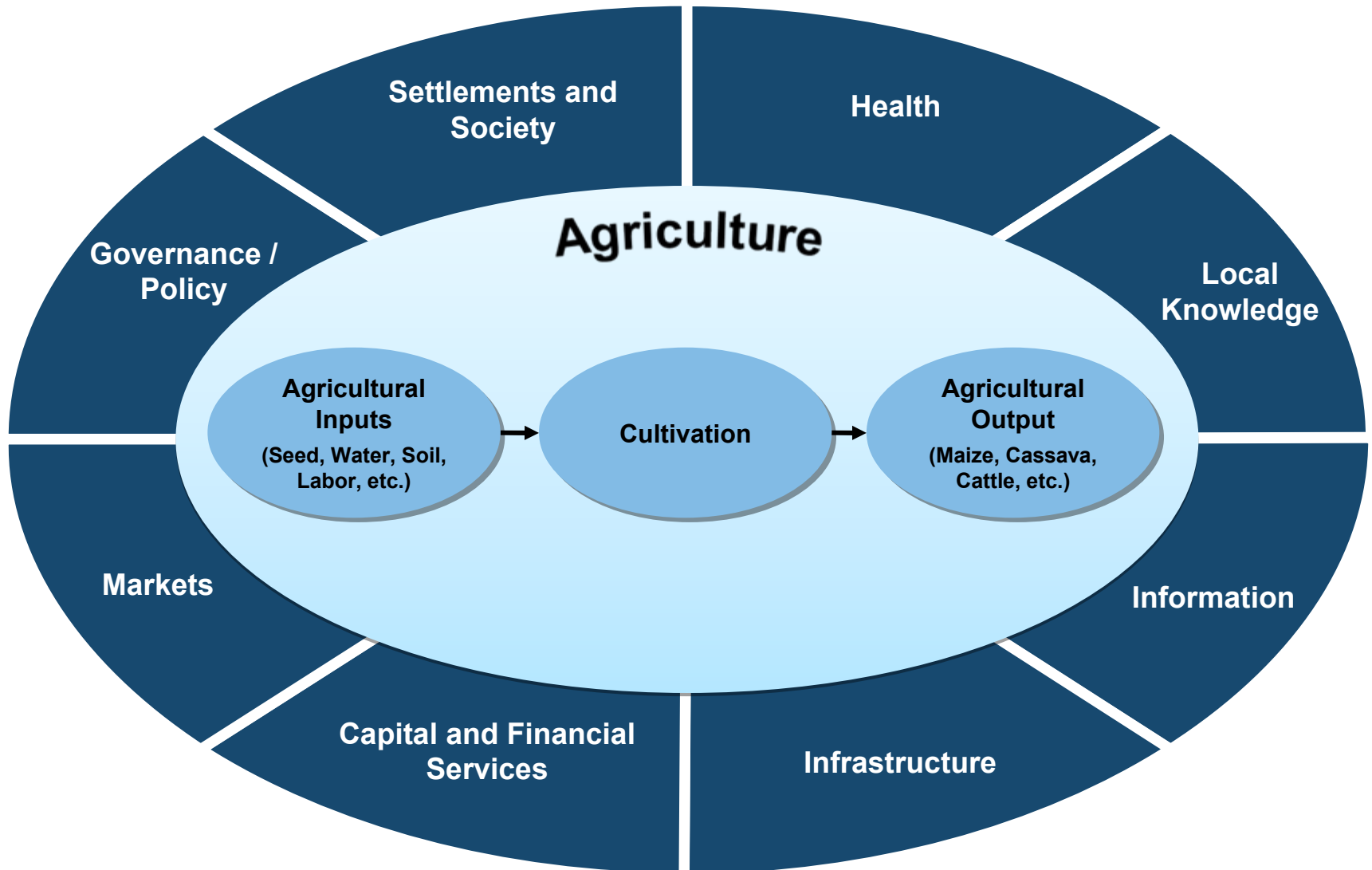
... and what we do not know

What smallholder farming societies/communities in Africa are responding/adapting to

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Agricultural system within which smallholders operate

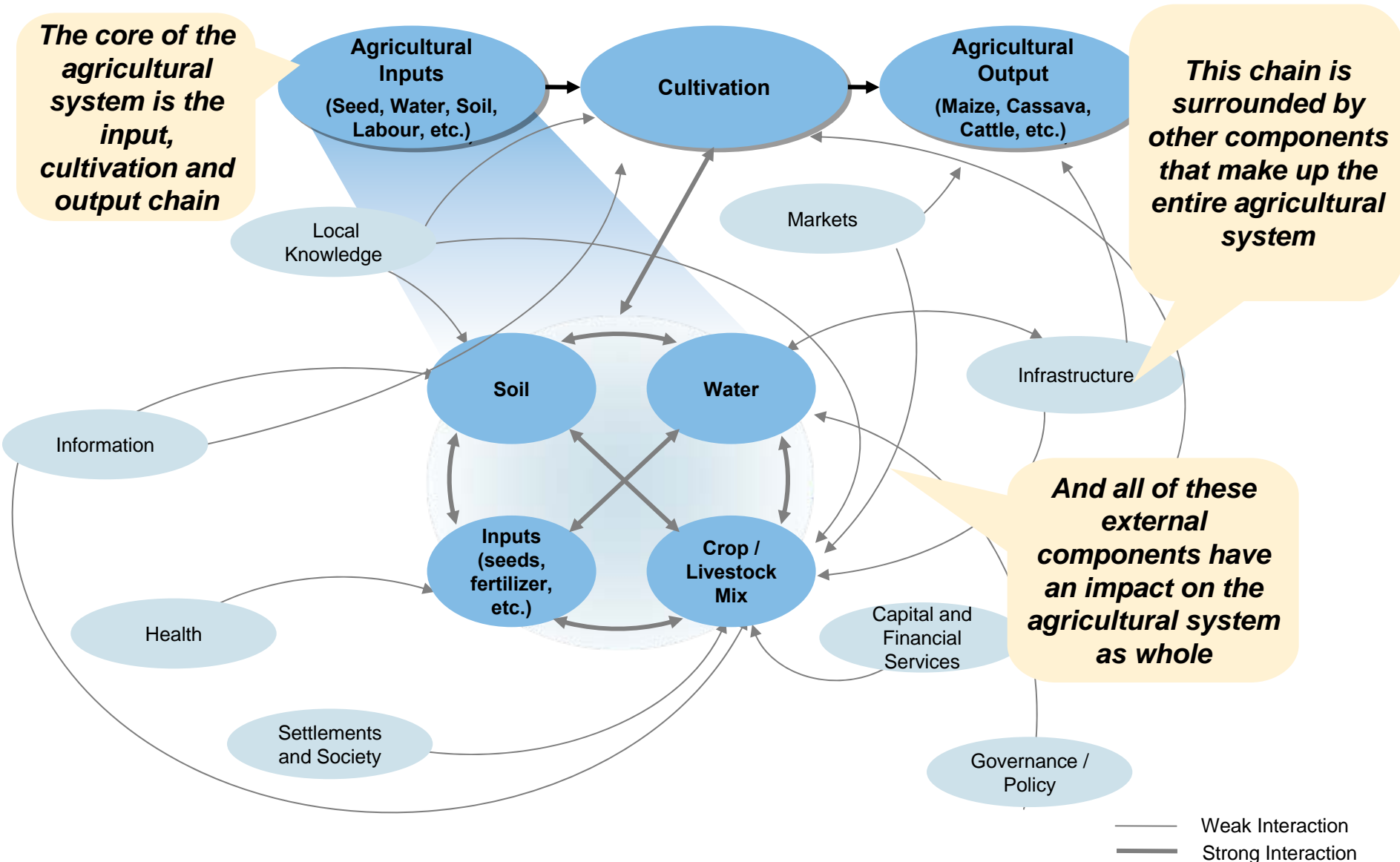


A disturbance in any component affects the rest of the system...

The core of the agricultural system is the input, cultivation and output chain

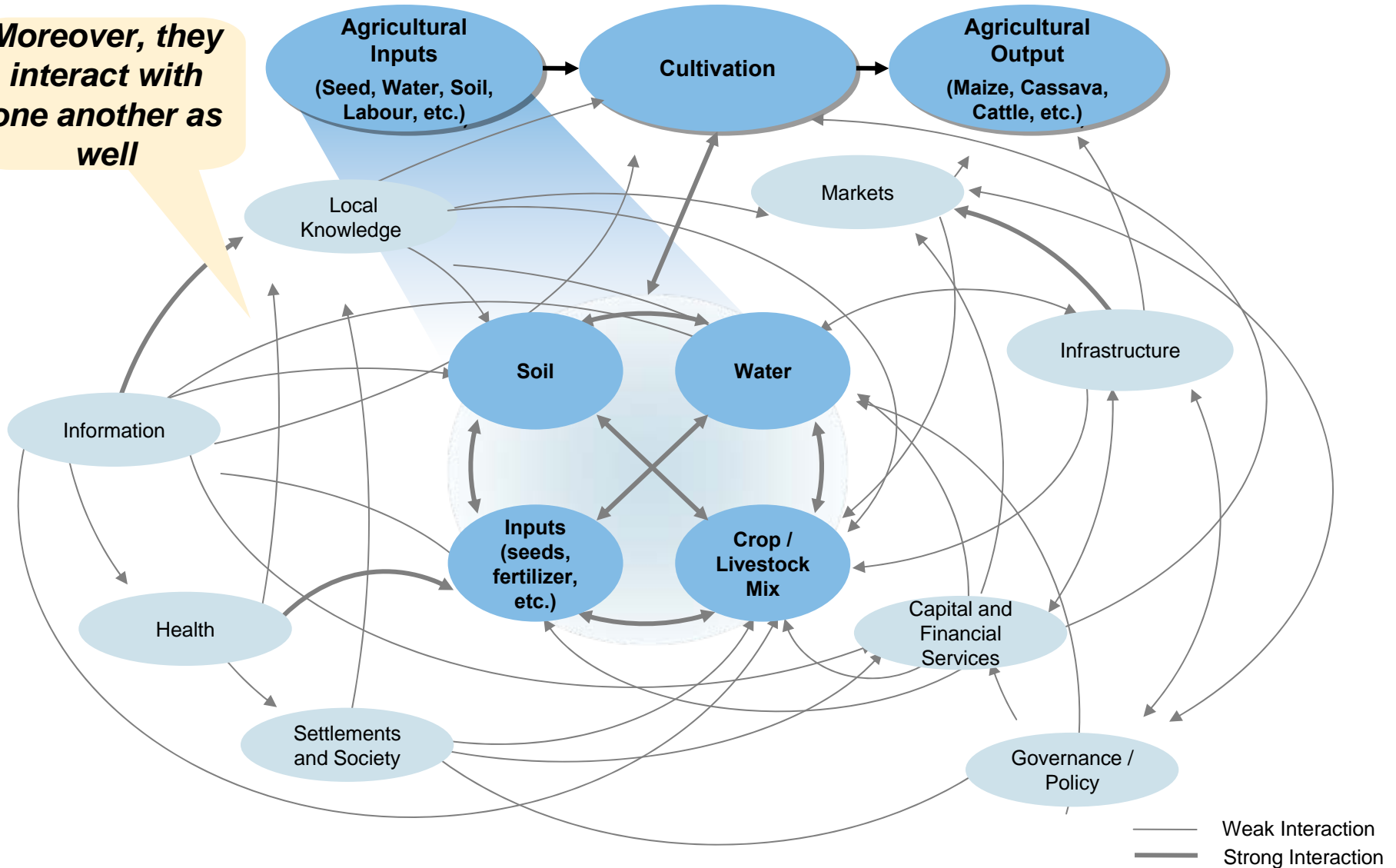
This chain is surrounded by other components that make up the entire agricultural system

And all of these external components have an impact on the agricultural system as whole

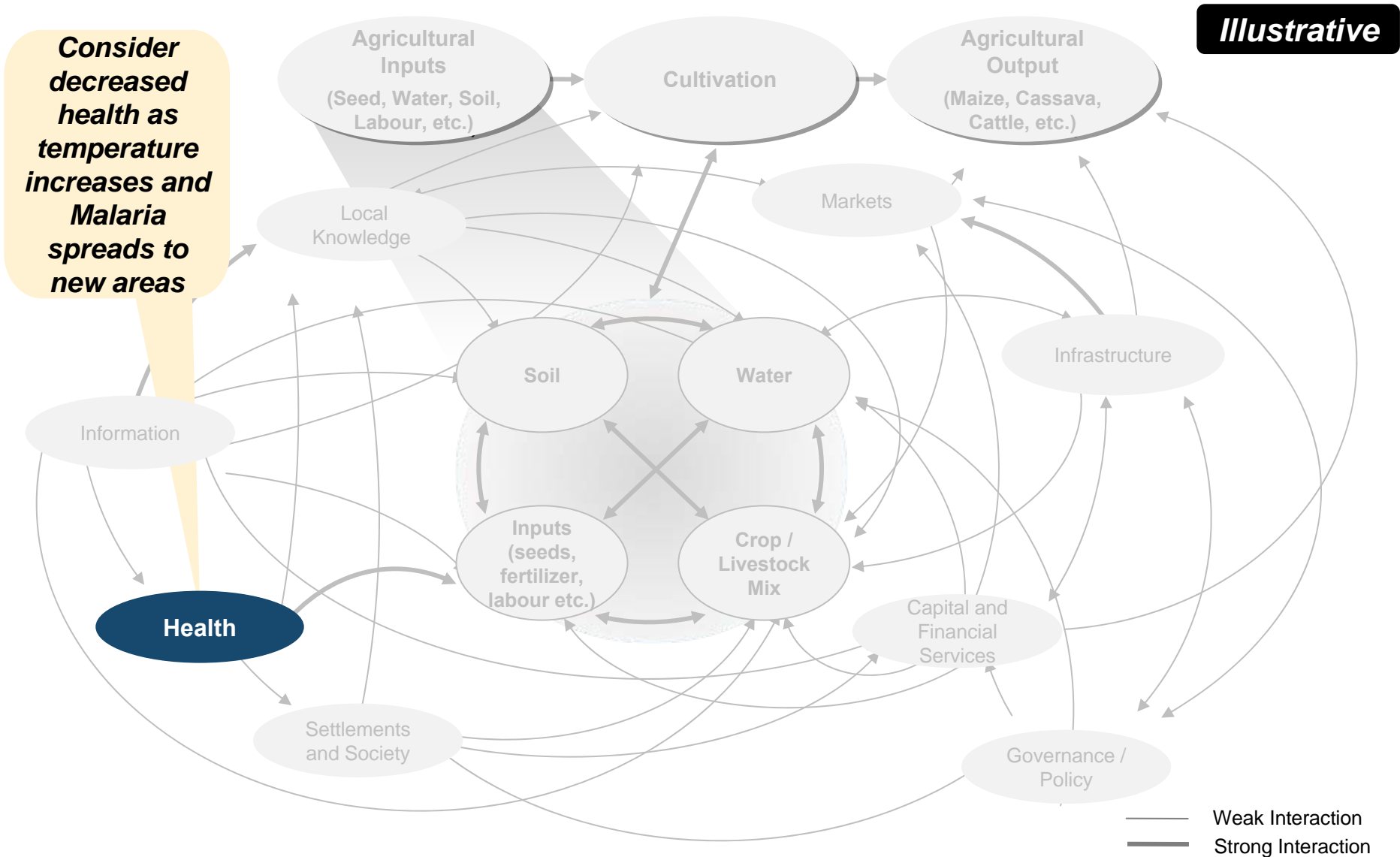


A disturbance in any component affects the rest of the system...

Moreover, they interact with one another as well



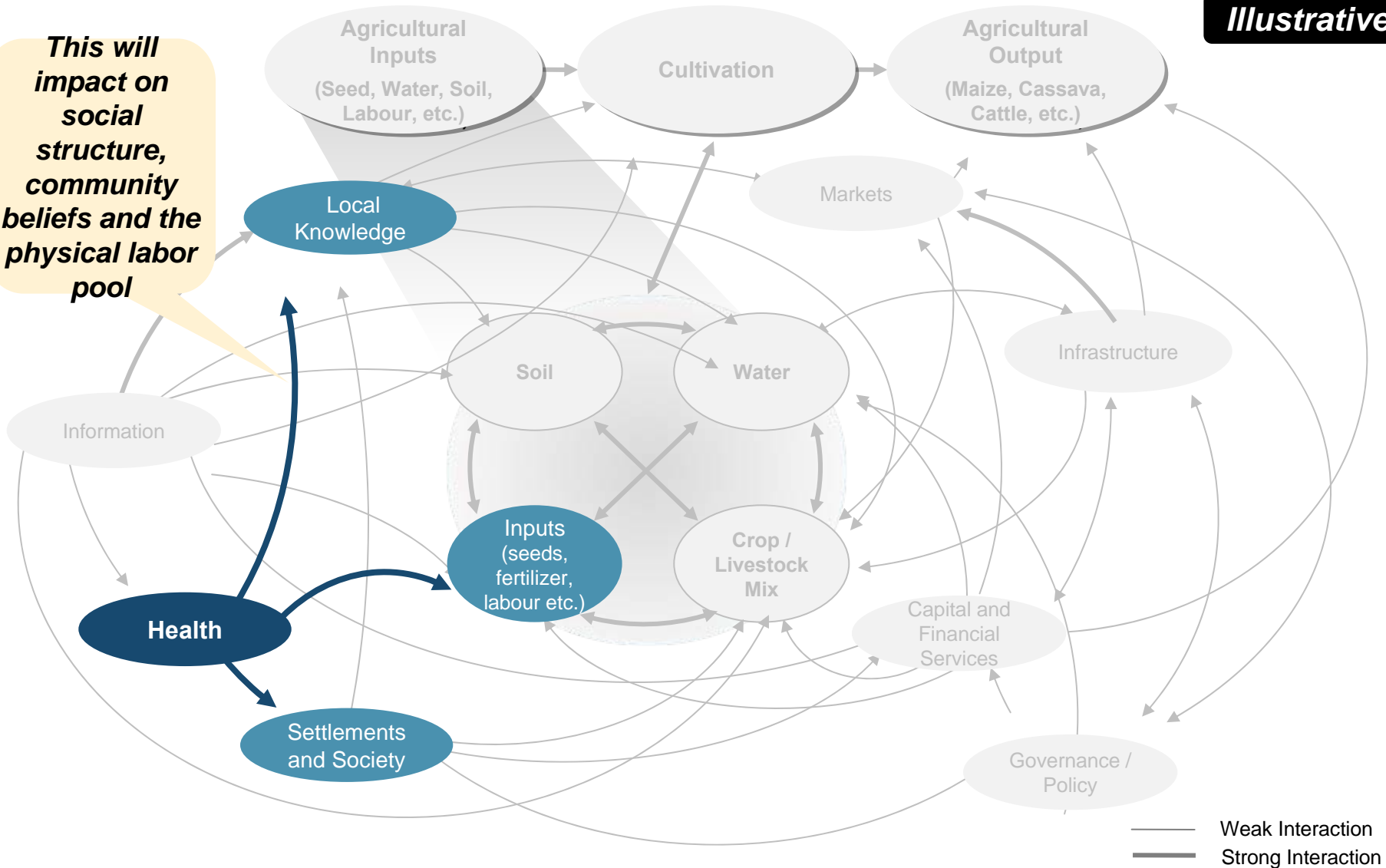
Impact of climate change...



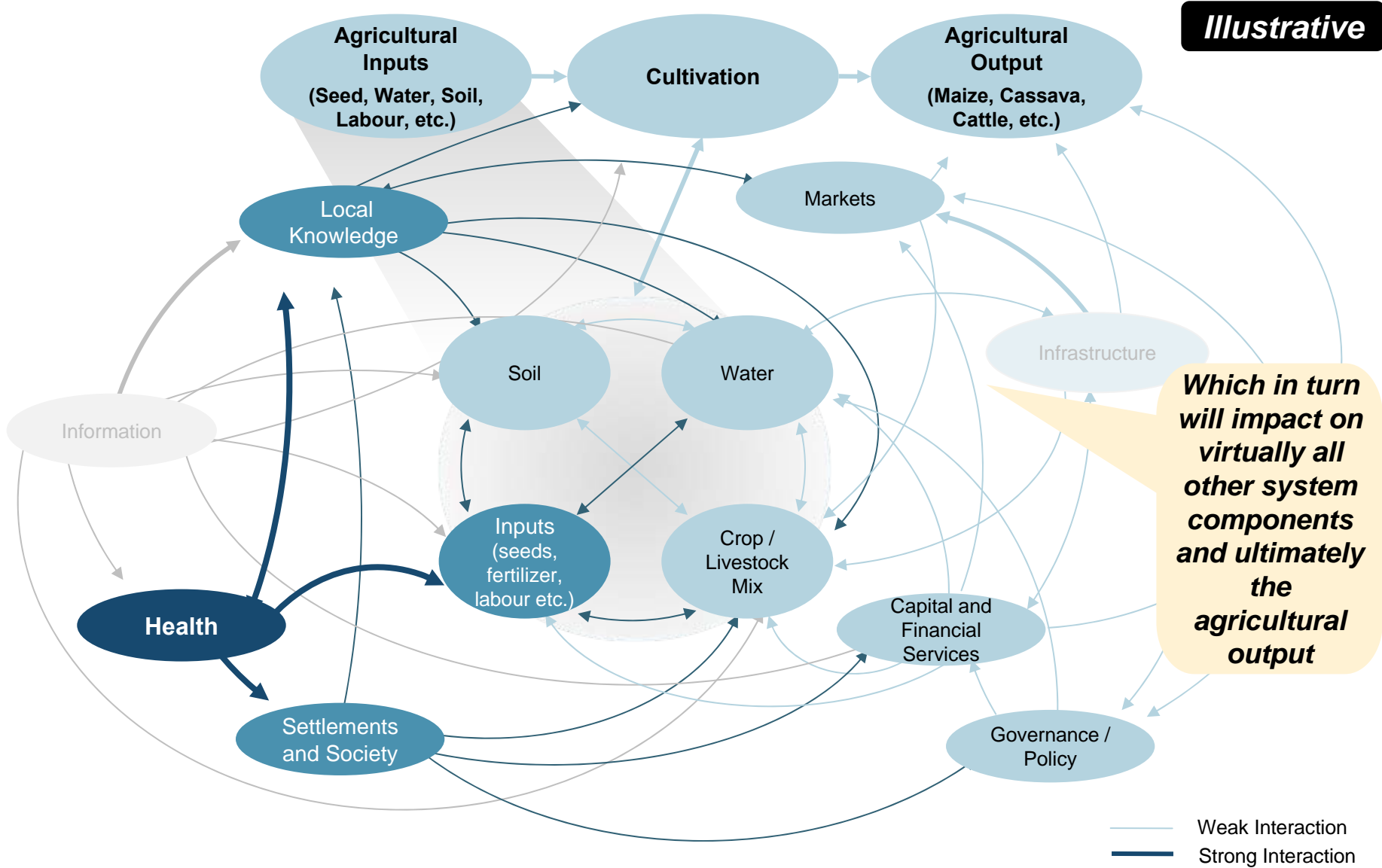
Impact of climate change...

Illustrative

This will impact on social structure, community beliefs and the physical labor pool



Impact of Climate Change



Focus of this Presentation

What we know ...

... and what we do not know

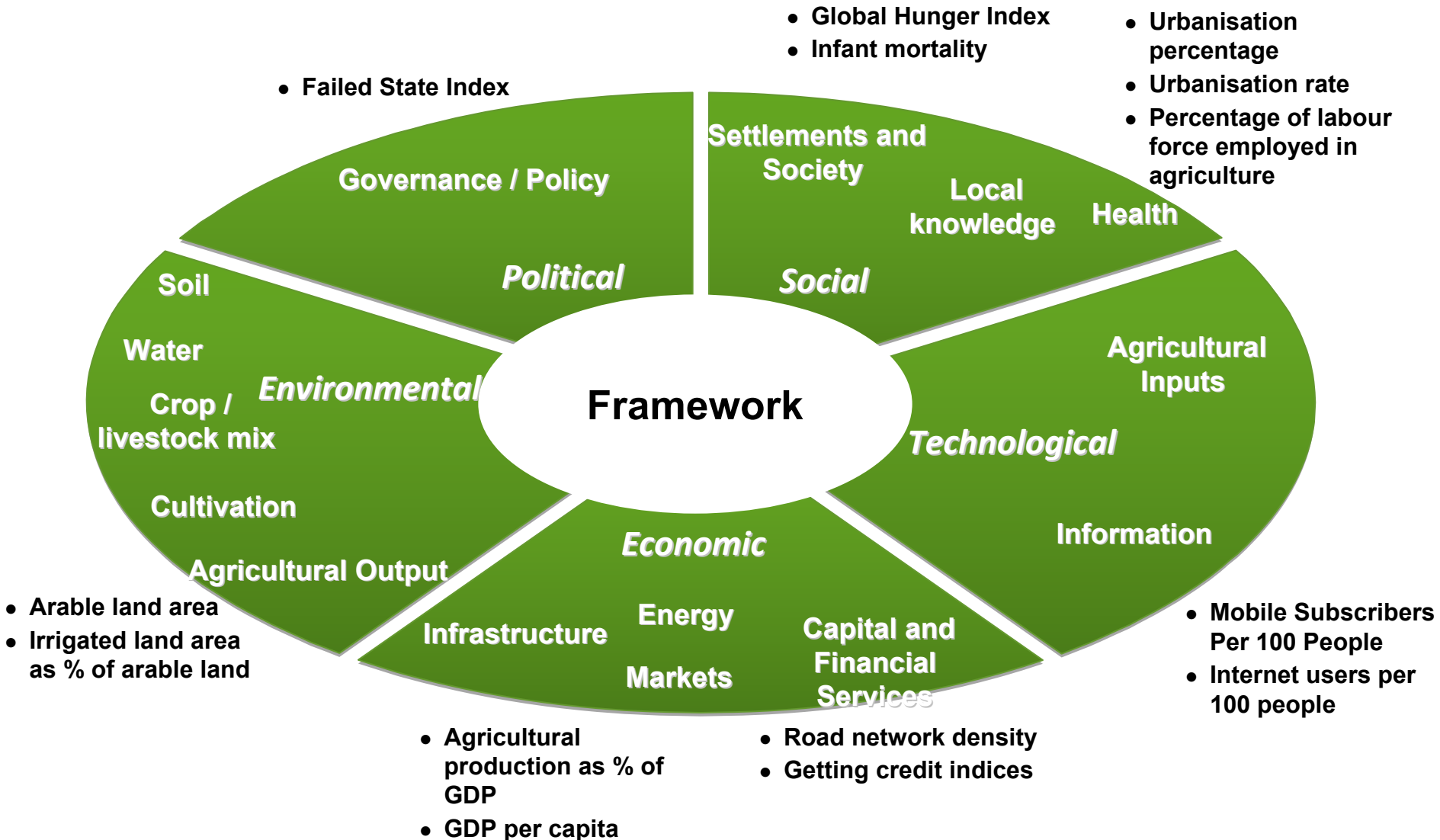
What smallholder farming societies/communities in Africa are responding/adapting to

What constraints and vulnerabilities smallholder farming societies/communities in Africa are battling with

What resilient-building/ adaptation mechanisms AGRA programs will/could develop

A broad perspective of constraints/ vulnerabilities

Agricultural systems in most African countries are highly vulnerable to climate change



Example: Kenya

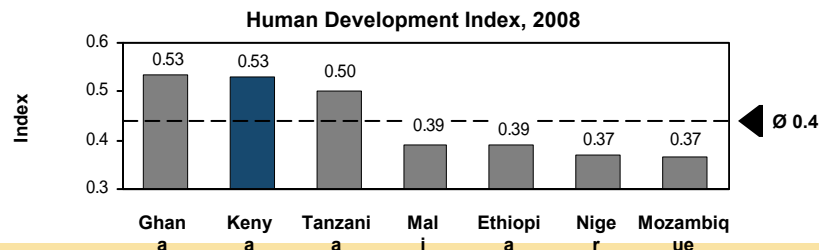


Country Vulnerability Assessment: Kenya (1/4)



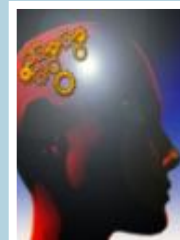
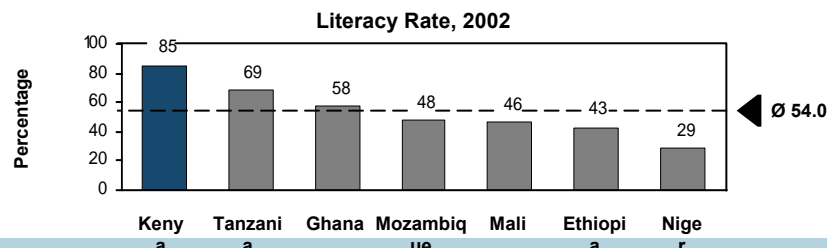
Settlements and Society

- Among the best Human Development Index scores of the countries under consideration
- 2008 unemployment rate of >40% is very high
- Nearly 300K asylum seekers have taken residence in Kenya



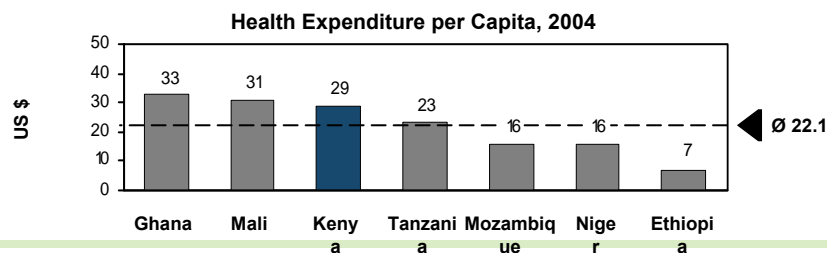
Local Knowledge

- Highest literacy rate of countries under consideration
- Highest primary school completion and school life expectancy
- Highest government spend on education



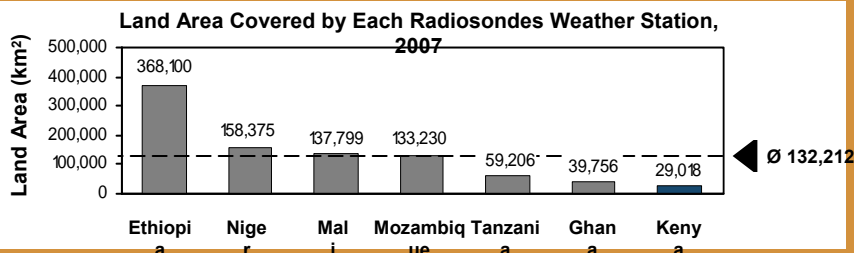
Health

- Although Kenya has one of the highest HIV/AIDS rates in Africa, its healthy life expectancy (48 years) is in-line with other African countries
- Kenya is rated “alarming” on the global hunger index and 30% of the population is under-nourished
- Per capita health expenditure spend is above average



Information

- Best weather station coverage
- High mobile phone and Internet penetration, average land-line penetration
- Average radio and television penetration

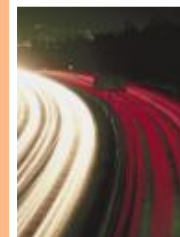
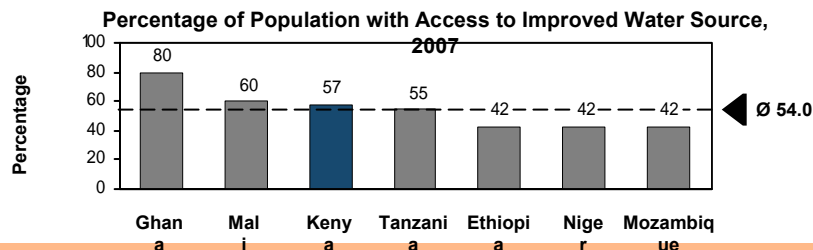


Country Vulnerability Assessment: Kenya (2/4)



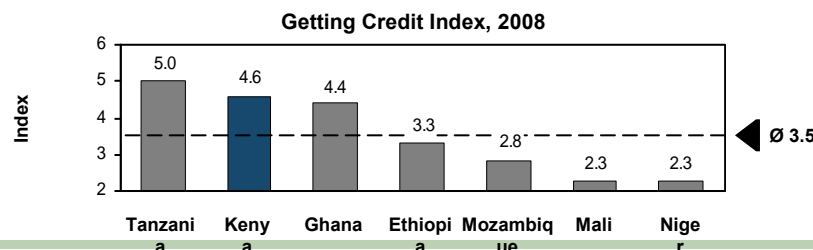
Infrastructure

- Road network infrastructure is modestly above average for SSA, although still generally poor, constraining the movement of food from surplus areas to deficit areas
- The country's water storage capacity is extremely limited
- Extensive grain storage network
- Kenya attracts significant infrastructure investment



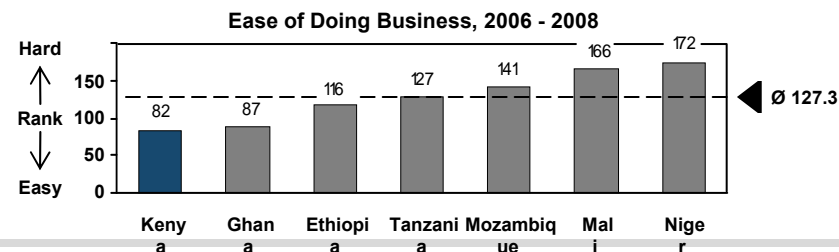
Capital and Financial Services

- High Getting Credit Index score
- Above average GDP per capita and GDP growth, but more than 50% of the population lives below the poverty line
- Although only 20% of GDP from agriculture, it employs 75% of the labour force



Markets

- Best trade facilitation index of the countries under consideration
- Better than average trade policy
- Best Ease of Doing Business rank
- High proportion of maize is commercialised

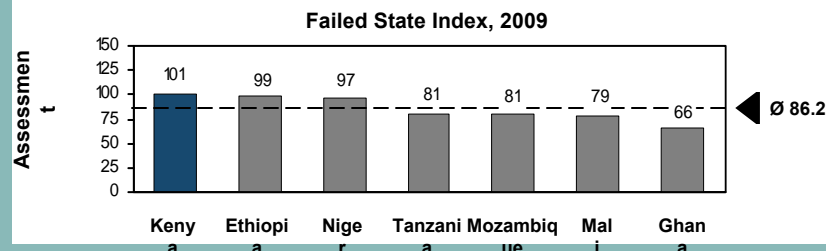


Country Vulnerability Assessment: Kenya (3/4)



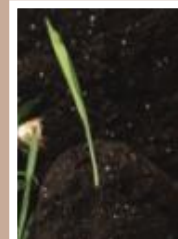
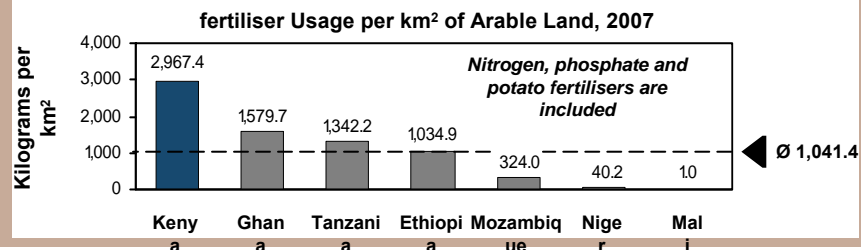
Governance / Policy

- Worst Failed States Index rating
- Below average property rights score
- Lowest dependency on foreign aid
- Lacks institutional capacity to source food externally and distribute through the government system¹



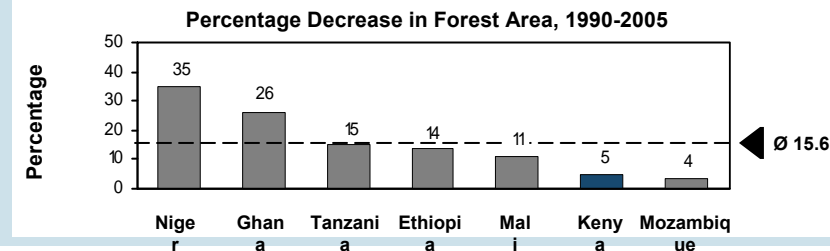
Agricultural Inputs

- 75% of the Kenyan labour force works in the agricultural sector, which is a particularly high degree of dependence
- Much of this labour is not employed for long periods of the year, due to the current drought
- Farmers are regular users of certified seeds and fertiliser, however this is primarily in cash crops



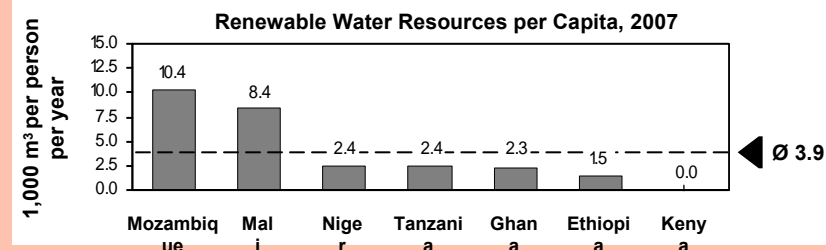
Soil

- The rate of soil nutrient depletion is significantly above average
- Although the extent of deforestation is lower than the other Sub-Saharan countries, UNEP has warned that Kenya may already be beyond the tipping point in terms of impacts on river flows



Water

- Kenya has one of the lowest renewable water resources per capita
- Low dam water capacity per capita

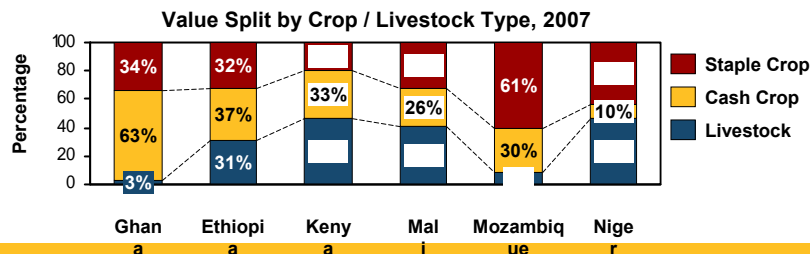


Country Vulnerability Assessment: Kenya (4/4)



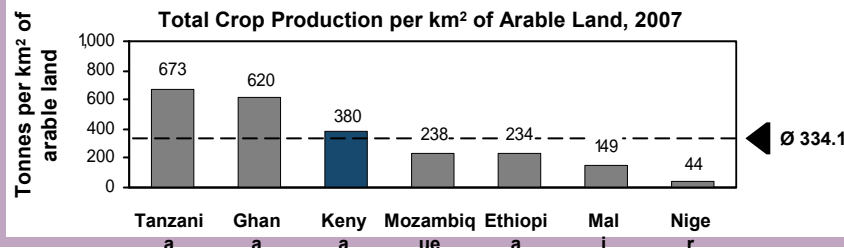
Crop / Livestock Mix

- Livestock accounts for almost half of agricultural production by value. This is a potentially advantage as livestock are less susceptible than crops to short term drought impacts.
- Maize is the largest staple crop by production volume, this is a vulnerability due to the water dependent nature of the crop and its sensitivity to high temperatures



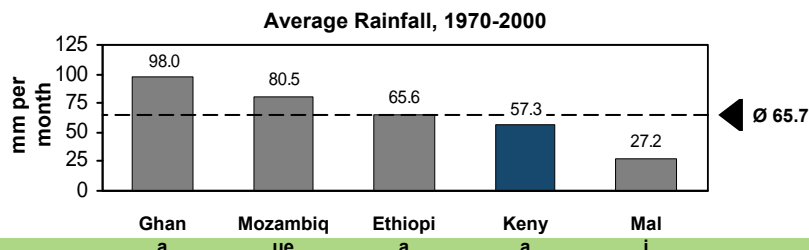
Agricultural Outputs

- Low per capita output in both value and volume
- High incidence of drought frequently impacts production
- High malnourishment rate
- Kenya's agriculture sector contributes < 20% to GDP, lowest of countries under consideration



Cultivation

- High frequency of hot days, stifles agricultural potential
- 42% of total rainfall falls in heavy events, which means that much of the moisture is not retained. This has also contributed to an alarmingly high incidence of floods
- The growing period length is fairly short, which magnifies the threat of climate change



Focus of this Presentation

What we know ...

... and what we do not know

What are smallholder farming societies/communities in Africa really responding and adapting to?

Which types of constraints and vulnerabilities are smallholder farming societies/communities in Africa battling with?

How is AGRA thinking about introducing adaptation mechanisms and solutions into its strategic programs?

Smallholder farmers ultimately care about four issues as climate changes

AGRA is exploring the 'right' approach to help smallholder farmers--it is crucial to understand their needs in the face of a changing climate

Information

- What changes are coming my way?

Extension

- What can / should I do to adapt?

Enablers

- How will I acquire the things I need?

Inputs

- What do I physically need to survive and thrive?



Information

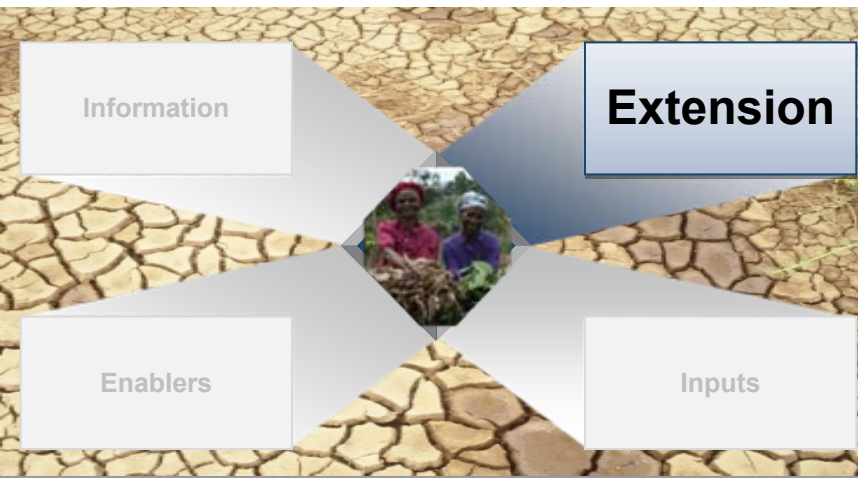
Each need is reinforced by a number of potential adaptations that strengthen the system and make it more resilient to climate change



Viabale Adaptation Methods

- **Comprehensive weather station for reliable weather forecast data**
 - Data to develop more climate models on a regional scale, to improve short-term weather forecasts/long term climate change scenarios
- **Inform farmers, through both independent organizations and agro-dealers, about the expected changes in climate and the likely impacts thereof**
- **Provide farmers with market information in export and urban markets as supply, and therefore price, fluctuates due to more variable output caused by climate change**

Extension



Viability Adaptation Methods

- **Demonstration plots to illustrate resilient farming methods:**
 - Diverse crop varieties (early/ late maturing)
 - Low water demand crops as opposed to climate sensitive crops (e.g., maize vs. cassava)
 - Farming techniques such as multi-cropping and crop rotation, agro-forestry
- **Compile/disseminate localised best practices that build climate change resilience**
- **Promote farming techniques that result in soil conservation, including water retention e.g., increased weeding, no-till farming, and fertilizer application**
- **Promote agro-forestry to provide ground cover, soil nutrients and alternative income source**
- **Promote crop-livestock agricultural systems as an alternative source of income and soil**

fertility

Inputs



Viability Adaptation Methods

- Improve input systems
- Develop improved water management techniques such as:
 - Small scale water storage --wells, weirs, tanks; reduce reliance on rainfall
 - Water conservation and water use efficiency--water harvesting; store run-off water
 - Small scale irrigation (e.g. treadle and small power pumps; drip/ spray irrigation kits)
- Provide ground cover to reduce evapotranspiration
- Develop drought resistant/early maturing seeds

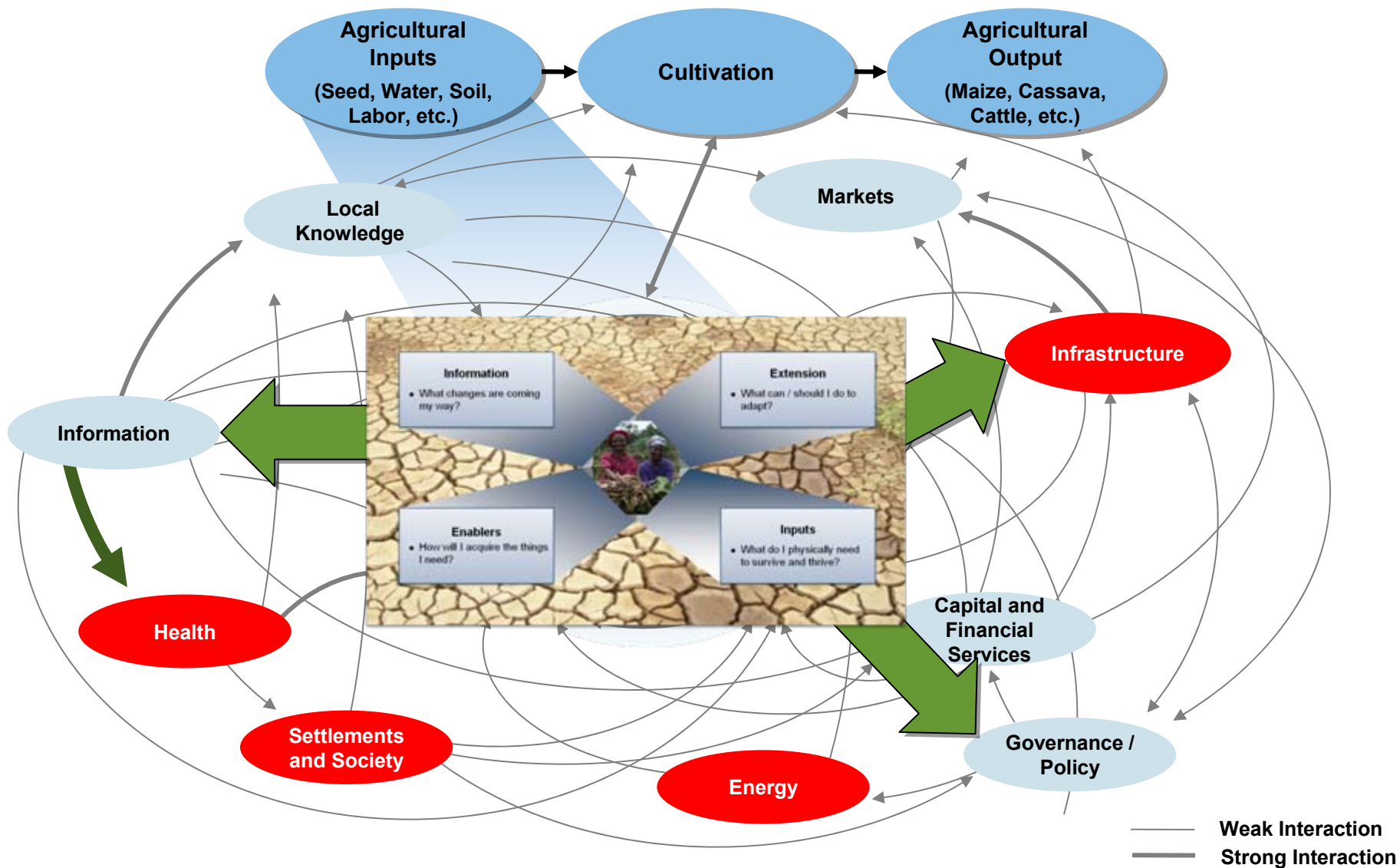
Enablers



Viable Adaptation Methods

- Partner with financial institutions to provide micro financing to farmers, capital --access to adaptation technologies
- Insurance products across the value chain to protect farmers and agro-dealers against failed crops and keep them solvent
- Improve the business and trade environment -- transfer of produce from surplus to deficit areas
- Provide for informed policy choices--science based policy (e.g. predicted decreased rainfall could force government to invest in dams); land rights to improve land management
- Farmer association-----conduit for communication
 - Inform farmers of impending climate change
 - Provide guidance for adapting
 - Economies of scale in input/output markets
 - Policy Advocacy

Building Partnerships for Resilient Smallholder Farming Systems



— Weak Interaction
 — Strong Interaction



**THANK YOU
ASANTE SANA!**