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Resilience as a guiding principle for implementing practices and policies for climate variability and climate change in Africa

Global Science Conference on Climate-Smart Agriculture,
20-22 March 2013, University of California, Davis; 20.3.2012

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Outline

1. Introduction
2. Resilience principle for addressing climatic risks
3. Applying resilience to farmer practices
4. Applying resilience to policy objectives and practice
5. Conclusions and Outlook



Introduction
Agricultural Production Context in Africa

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- Widespread dependency on rainfed agriculture
- Large population dependent on agriculture
- Increasing land degradation (Koninga and Smaling 2005)
- Agricultural production deficit (IAASTD 2008)
- High vulnerability and low adaptive capacity

→ **Agriculture highly sensitive to climatic risks**



Introduction:
Climate change is one of many drivers

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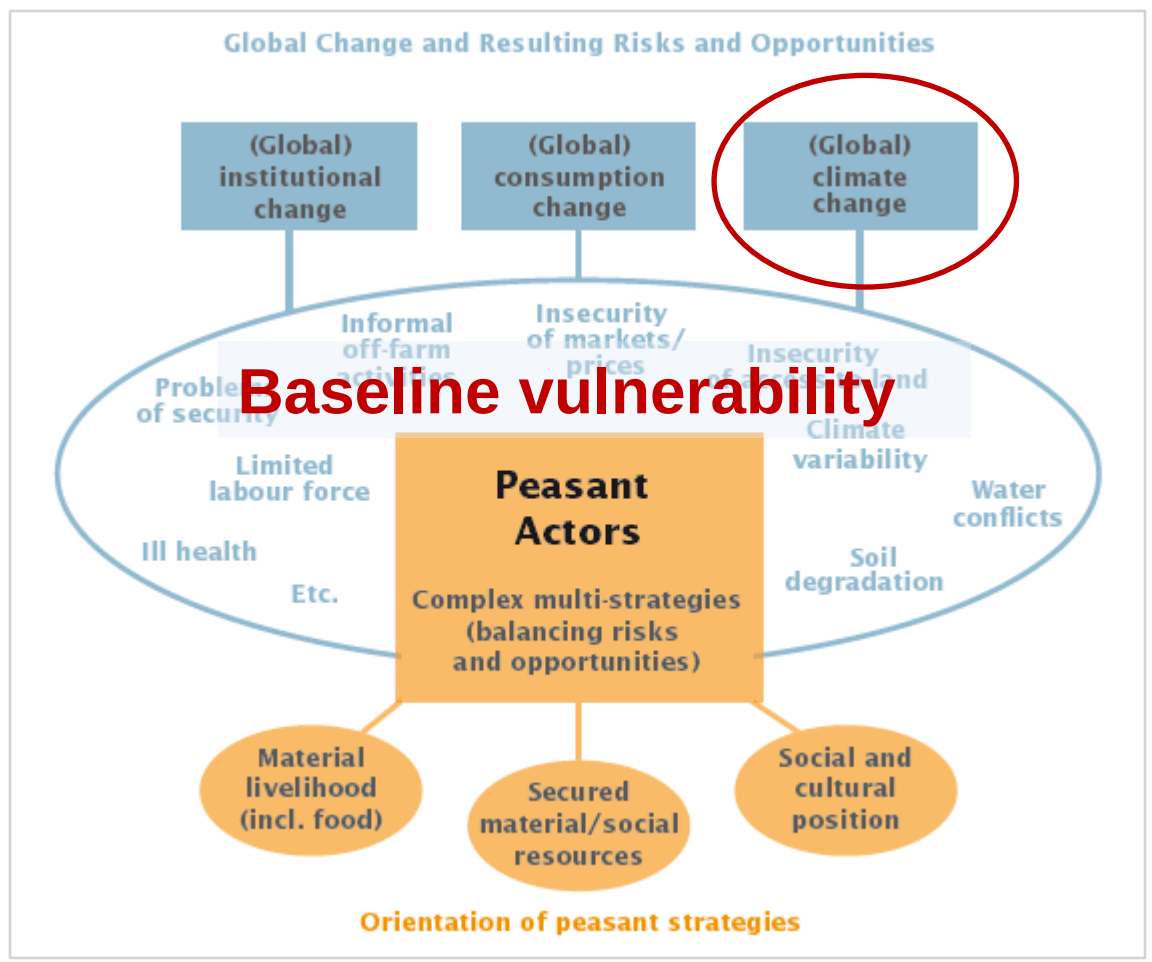

Wiesmann et al. 2011

Introduction
High Rainfall Variability in many Areas

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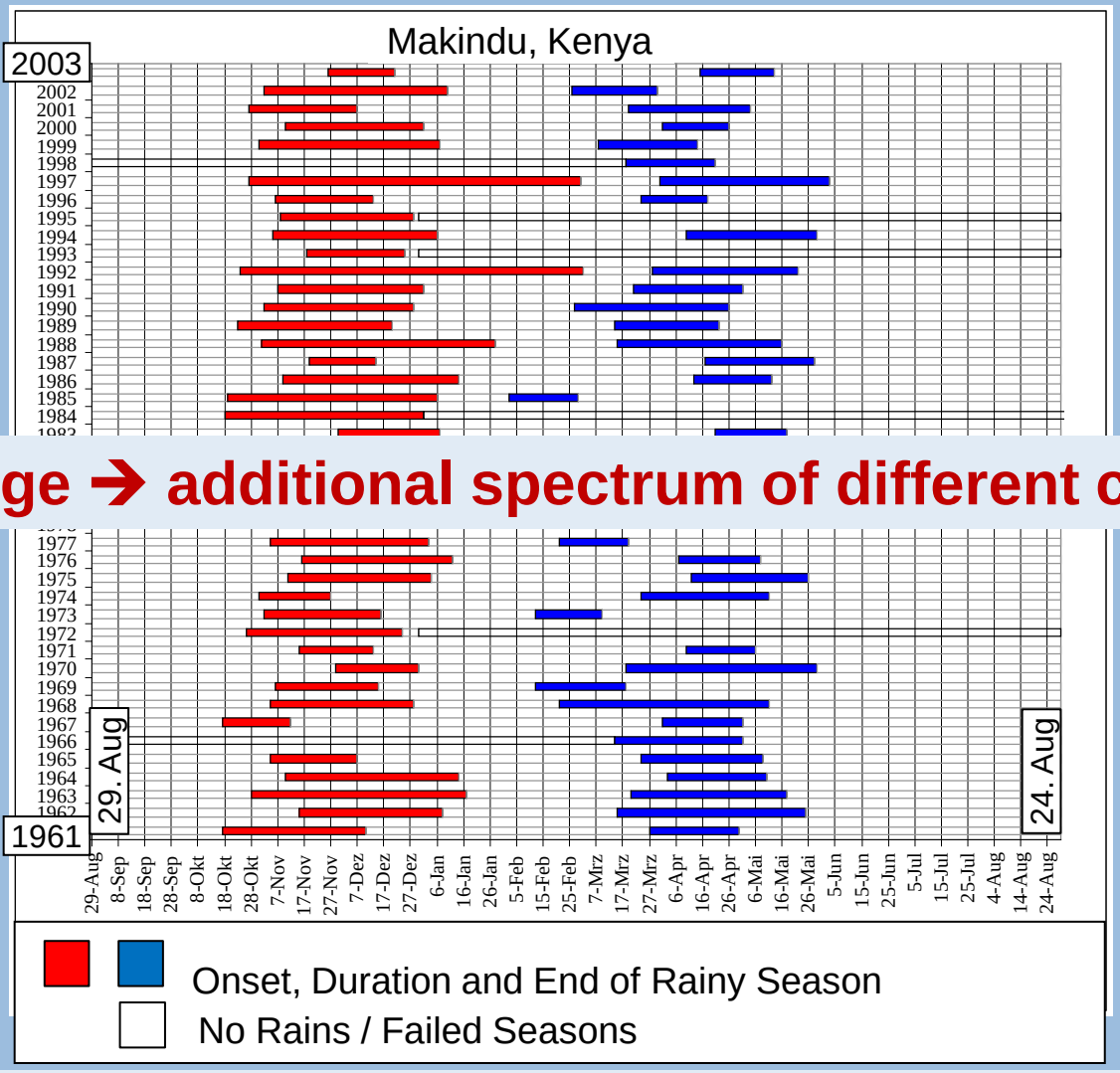
1st Rains



2nd Rains

Climate change → additional spectrum of different climatic risks

Source: Rainfall data Makindu 1961-2003, Ifejika Speranza 2006

Implications of Spectrum of Different Climatic Risks for African Agriculture

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How to accommodate climatic disturbances and their impacts, use opportunities, and continue functioning despite multiple pressures?

Using resilience as a guiding principle helps us to address these challenges

Resilience

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> the capacity to tolerate disturbance, undergo change, and retain the same essential functions, structure, identity and feedbacks (Carpenter et al., 2001; Holling, 1973, 2001; Walker et al., 2002, 2004)

Benefits of resilience as a guiding principle

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Resilience directs focus on

> factors than enable functioning despite adverse conditions; dealing successfully with change (Carpenter et al. 2001; Obrist et al 2010; Cumming 2011)

It provides

> a useful **framework** for understanding the dynamic relationships between humans and the environment (social-ecological systems, SESs) (Cabell and Oelofse 2012)

> **models** for increasing society's capacity to manage change (Cabell and Oelofse 2012)

> **a key** to progressing towards sustainability of SES (Walker and Salt 2006, Turner 2010)

> and is **critical** for achieving climate-smart agriculture

Desirable and Undesirable Resilience

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Aim to maintain or achieve desirable system states

Social and Ecological Resilience – Links

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- **Note:** Different perspectives to resilience; in this presentation - an integrative Human Geography and Ecology perspective
- **Social resilience** - the ability of groups or communities to cope with external stresses and disturbances from social, political and environmental change[1]
- Link to ecological resilience - e.g. groups or communities that are dependent on natural resources for their livelihoods[1]
- Sometimes resilient ecosystems enable resilient communities or vice versa[1]; other times ↓↑

[1] Adger 2000

Measuring Resilience

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- **Generally 3 ways** (Carpenter et al. 2001, Holling 2001, Gunderson and Holling 2002, Folke 2006, and Folke et al.2010)
- Amount of change a system can undergo and still maintain the same controls on structure and function
- Degree to which the system is capable of self-organization
- Ability to build and increase the capacity for learning and adaptation

Measuring Resilience – A Challenge

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Resilience

- a normative concept
- a scientific construct to be inferred; cannot be directly observed or measured (Obrist et al. 2010)

Various measurement alternatives

- Conceptual models (Resilience Alliance 2010)
- Surrogates/indicators (Bennett et al. 2005; Carpenter et al. 2006)
- Models (Peterson 2002; Fletcher et al. 2006)
- Identifying “rules of the thumb” for complex & dynamic systems, e.g. agroecosystems (Darnhofer et al. 2010; Milestad & Darnhofer 2003); behaviour-based indicators (Cabell & Oelofse 2012; Ifejika Speranza 2012a/b)

Applying to Social Resilience - Three general features

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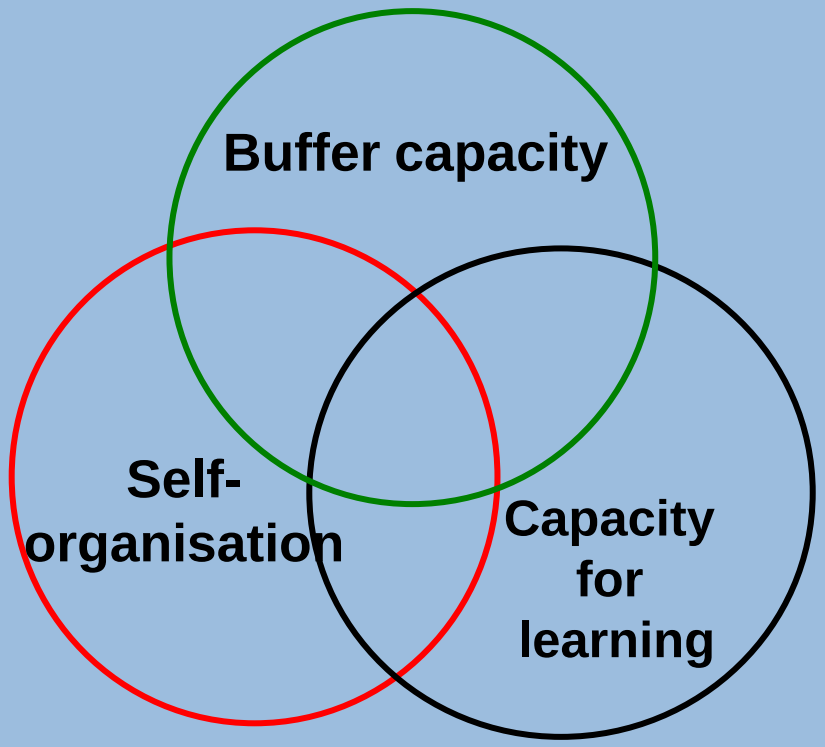

Ifejika Speranza 2010

- **Buffer capacity** - capacity to cushion change, to maintain or increase assets, to use opportunities to achieve better livelihood outcomes such as reducing poverty - **the ability to cope and adjust**.
- **Self-organisation** – the degree to which people can direct their own actions and outcomes.
- **Capacity for learning** – experimenting, innovating

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Resilience is about maintaining or enhancing farmer livelihood functions

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- **Livelihood function:** the benefits that livelihoods provide (consumption, income, insurance and poverty reduction) (Chambers and Conway 1992; Dorwald et al. 2001)
- **Landscape function:** the goods and services that landscapes provide (food, fibre, biomass, water, soil erosion control, carbon sequestration, etc.) (Mannsfeld 1979)
  → **ecosystem services** (Millennium Ecosystem Assessment 2005)
- **How to maintain functions despite climate variability & - change?**



Farmer Livelihood Resilience - Indicators

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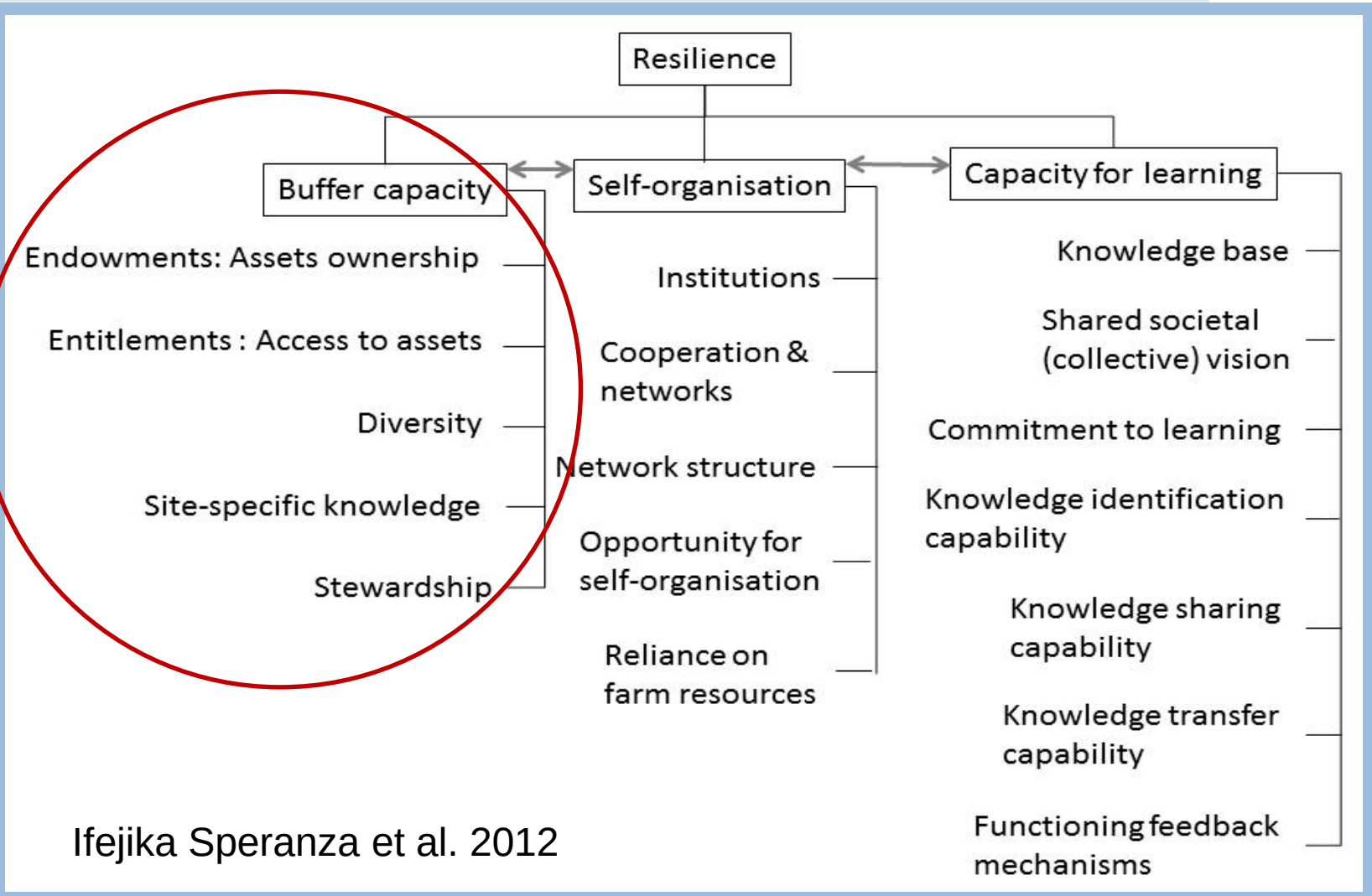

Ifejika Speranza et al. 2012

Contributions to Resilience:
- Conservation Agriculture (CA)

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- How do farmer CA practices contribute to buffer capacity?
- How do CA practices allow farmers to continue crop production despite droughts?
- What better livelihood outcomes have been achieved through CA in economic, social and ecological dimensions?

Ifejika Speranza 2012



Conservation Agriculture Practices - Contributions to economic buffer capacity

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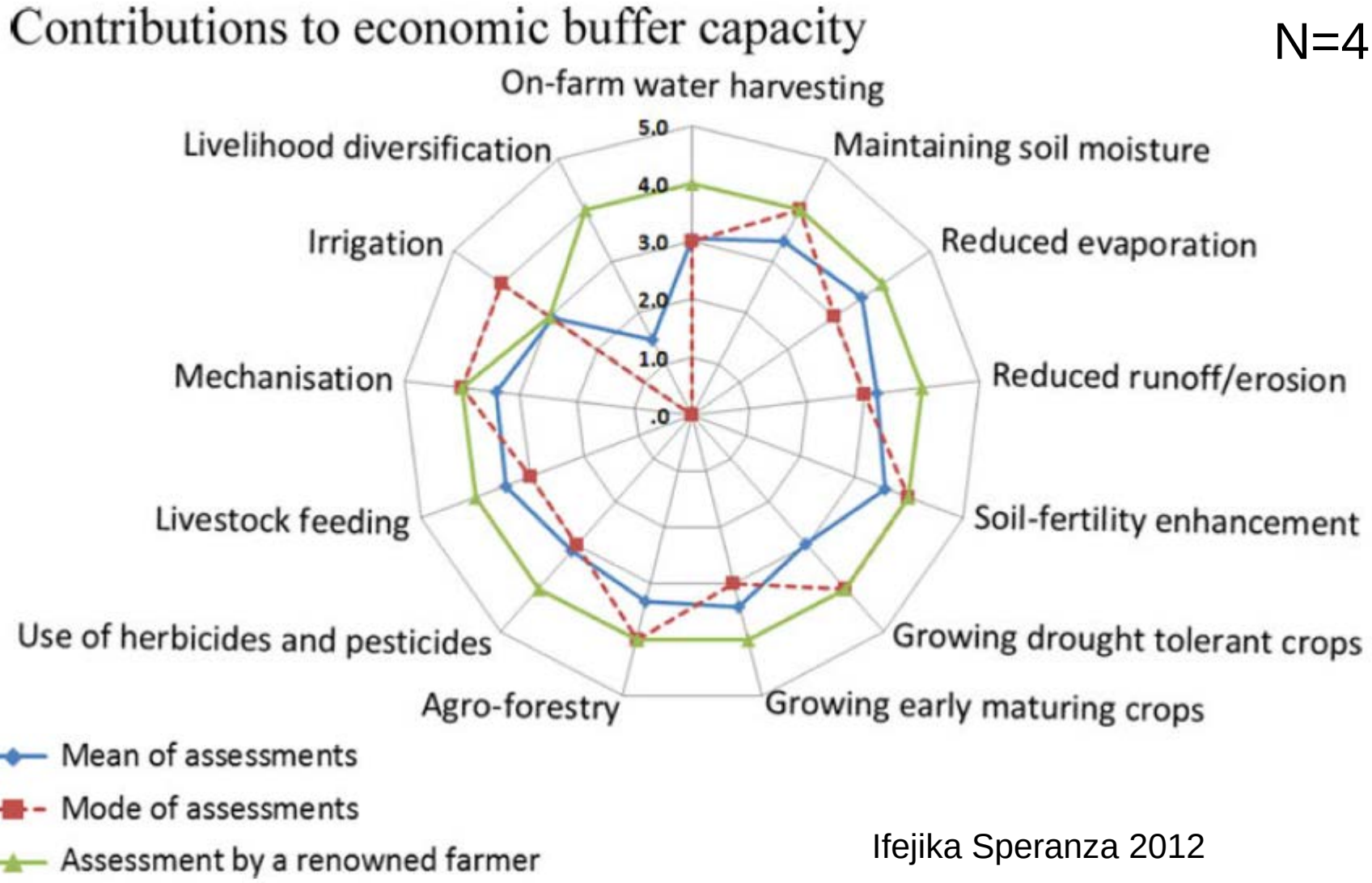

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Conservation Agriculture Practices - Contributions to social buffer capacity

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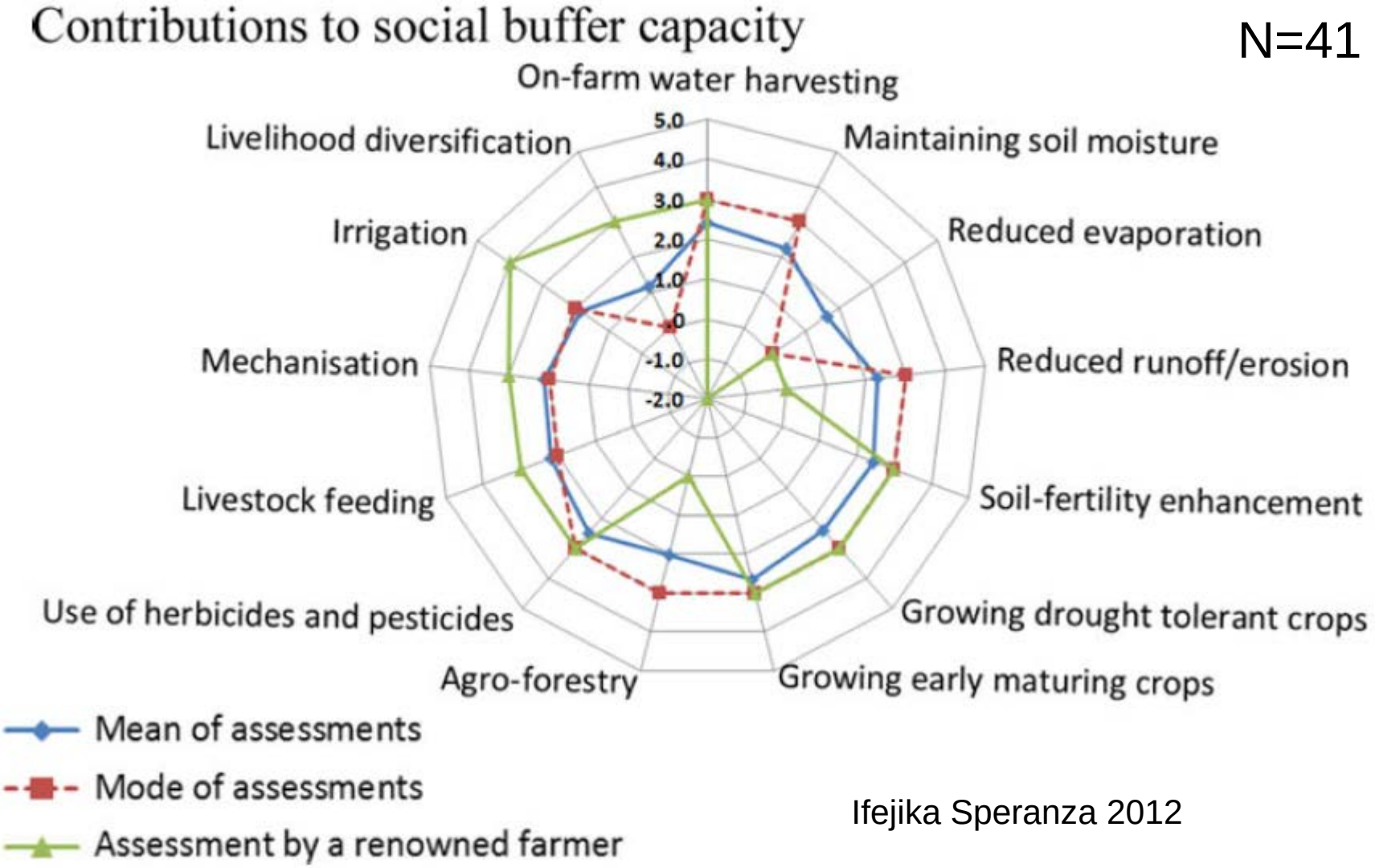

Ifejika Speranza 2012

Conservation Agriculture Practices - Contributions to ecological buffer capacity

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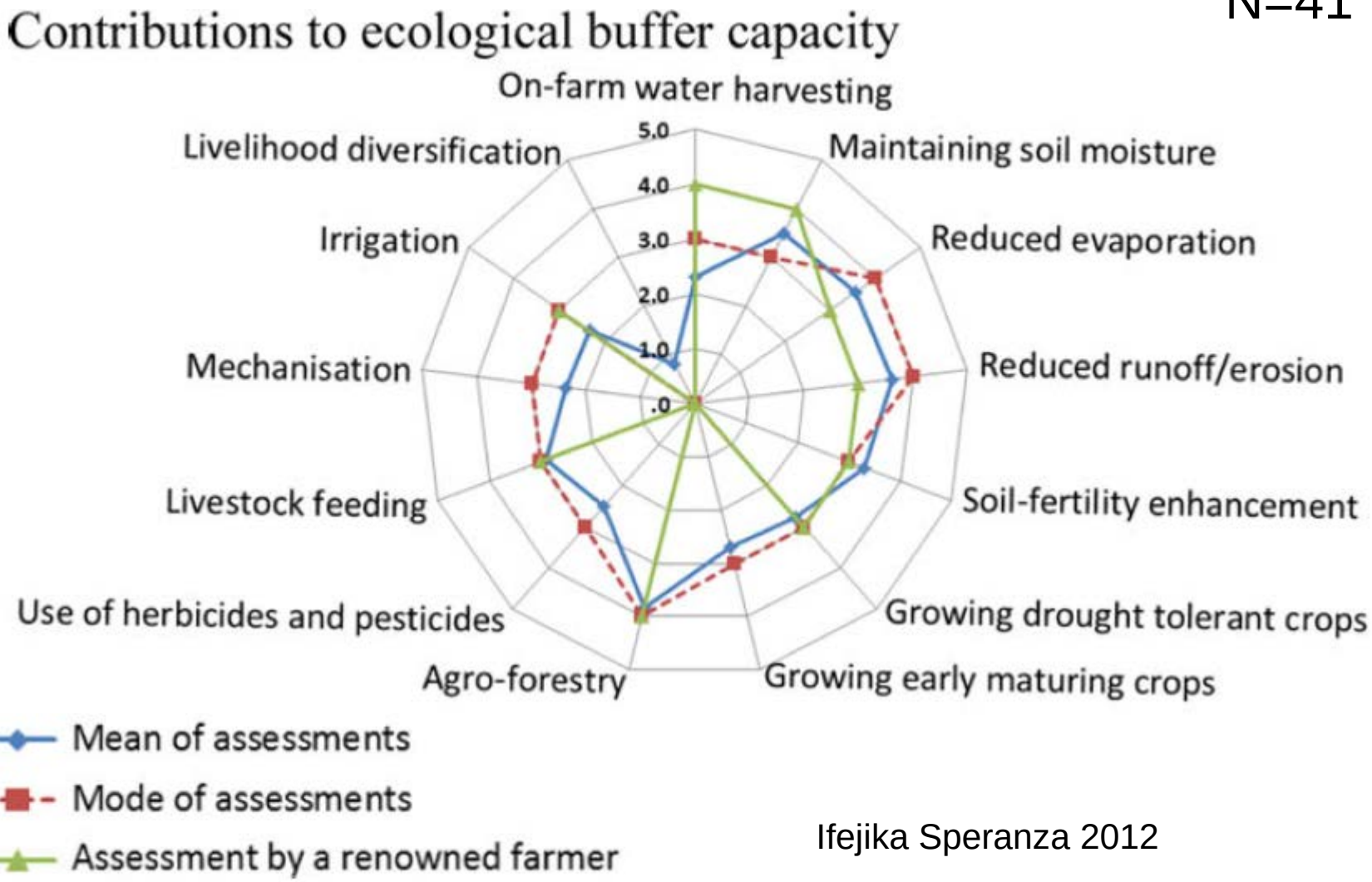

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Resilience Principle for Implementing Policies

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- In what ways and how much do agriculture related policies and actual government practices support (enable or constrain) land users' in adopting practices that enhance resilience to climate change?

Policies, Climate Change & Resilience

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- **Policy objectives**
  Most policies (e.g. Kenya; Nigeria) propose measures to address climatic risks and reduce vulnerability
- **Policy implementation – governance failures**
  - drought triggered food crisis (e.g. Kenya)
- Resilience not yet explicitly addressed in policies
- **Challenge** – to implement policies in ways that build resilience

Policy Practice - e.g. Public Agric. Extension Services (PAES) & Resilience

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Mainly on Learning

- Awareness creating, trainings & advice
- Pilot conservation efforts - afforestation and agro-forestry
- Motivating farmers' to adapt
- Introducing new farming techniques/new technologies

Policy Practice
E.g. public agric. extension services (PAES)

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CC undermines PAES ability to provide services

- Generally PAES top-down – limits field officers' flexibility
- Frequent droughts & crop failures - discourage & impoverish farmers
- Migration of men - changing extension clientele - women
- PAES work plans cannot be implemented due to changes in seasons
- Timely and relevant training more difficult
- Climatic risks question relevance and validity of extension advise
- **Need to adjust extension services to the dynamic (climatic) conditions**

Factors Influencing the Contributions of PAES to Farm Resilience

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- Highly hierarchical system but with high horizontal interactions
- High donor dominance / dependency / agenda setting?
- Inventive / adaptable field extension agents
- Policy encompasses adaptive principles but resources limit implementation

Need to

- increase use of complementary tools, e.g. media
- Engage local extension agents
- Address the question of what PAES is desirable? PAES vision under a changing climate?

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Conclusions and Outlook

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- Land-users already implement practices that build resilience
- Applying the resilience principle – highlights limits to farmers' adaptive capacity & potential entry points to improve farm resilience
- Crucial to address multi-level perspectives and trade-offs
- Agricultural policy objectives generally support practices that build/enhance resilience
- Additional to governance challenges, climate change undermines policy practice (e.g. extension services) – needs to be addressed to ensure that policy practice supports farmers in building resilient livelihoods and agricultural landscapes.


Thank you for your attention!

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Extra Slides



Dynamics in Livelihood Resilience

The adaptive cycle (Gunderson and Holling, 2002)

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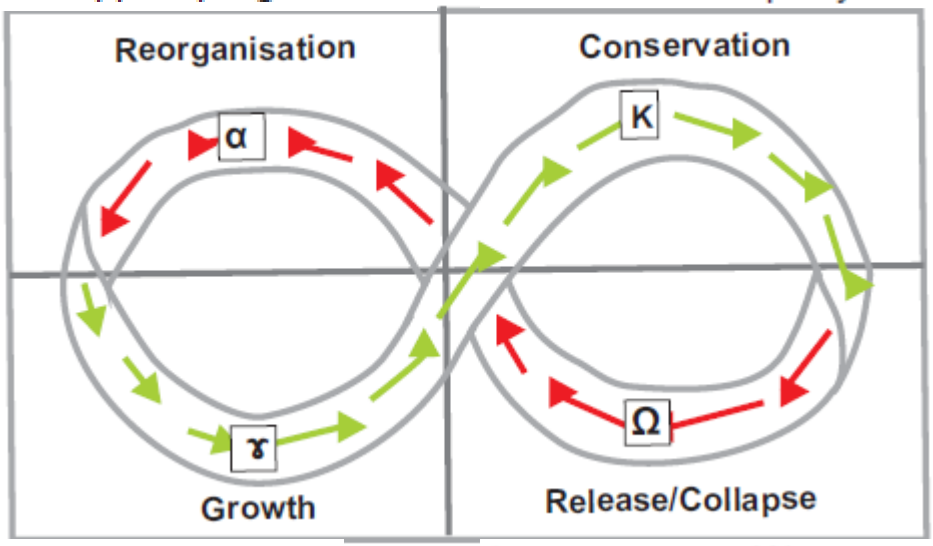
Reorganisation phase (α) indicators, e.g.:
- Policy reform and institutional framework
- Re-stocking of livestock and re-planting
- Dominance of government support programmes

Conservation (K) phase indicators, e.g.:
- Stagnation/loss in production, productivity and incomes
- Intensification, less flexibility and diversification and more specialisation
- Increased frequency of exposure to stresses and shocks
- Less favourable policy and institutional framework



E.g. Recurrent droughts

Growth phase (r) indicators, e.g.:
- Increasing production, increasing income, expansion of crop lands; exploitation of natural resources
- Positive framing conditions due to policy, institutions and socio-economic processes
- Shocks and seasonality do not lead to significant production decline.

Collapse phase (Ω) indicators, e.g.:
- Declining production, productivity and incomes
- Non favourable policy and institutional framework
- Increased frequency and intensity of stresses and shocks
- Complete production and income loss
- High proportion dependent on external support

Frequent Drought Occurrences (Makindu 1961 – 2003; 43 years)

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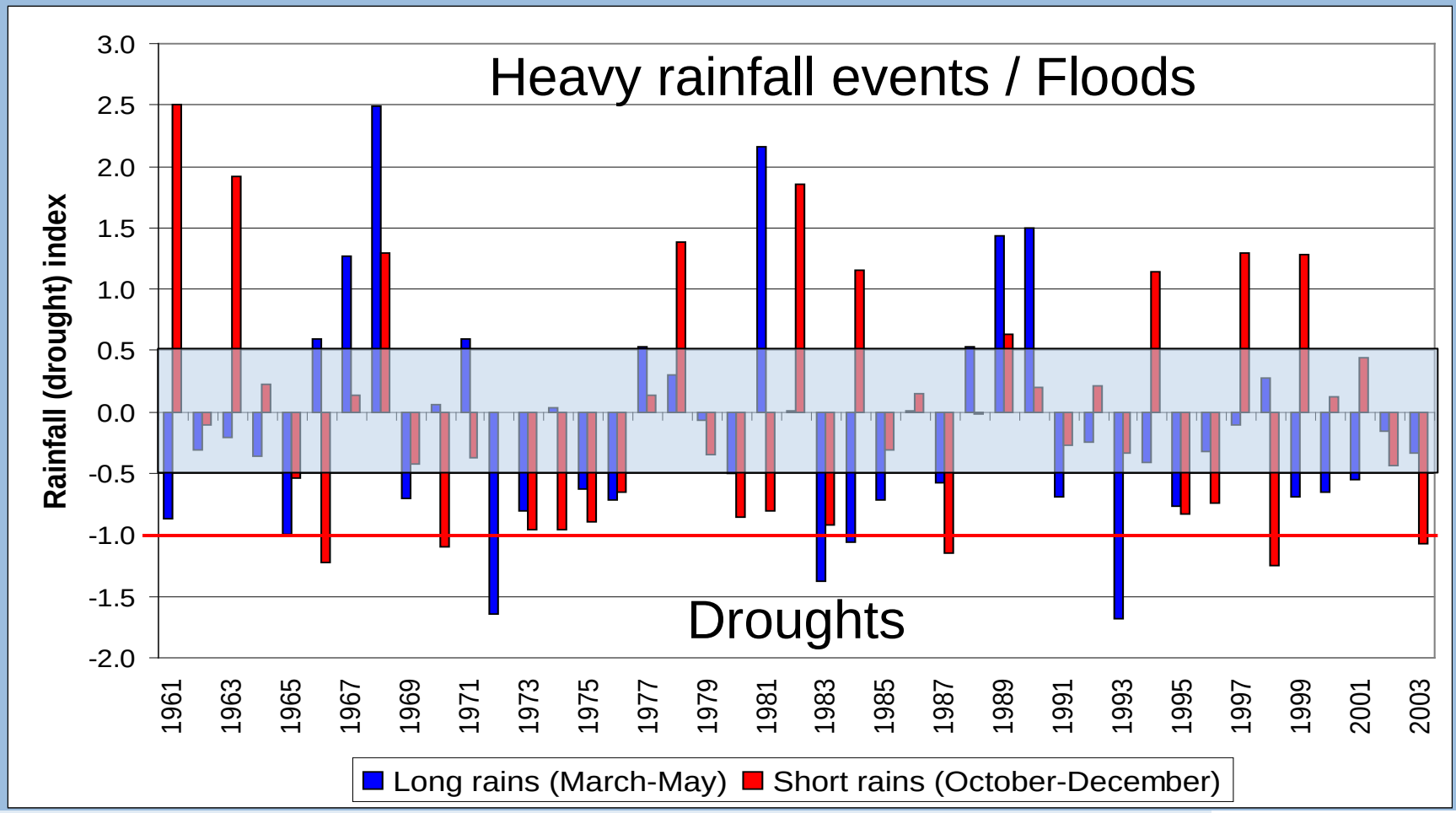
Droughts at seasonal scales (Ifejika Speranza 2006)



Applying Resilience to Farmers and Agricultural Landscapes

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- **A farmer livelihood is resilient if** it can maintain its key functions, absorb the impacts of disturbances without causing major declines in production and well-being.

- **A landscape is resilient if** it can continue to provide key ecosystem services and avoid disruptive dynamics when subject to natural variability, extreme events and climatic change processes (adapted from Moench 2005).

Managing agricultural landscapes for resilience

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- What is the desired state of the landscape?
- Capacity to provide ecosystem services?
- Capacity to tolerate drought?
- What factor constellations are likely to make the landscape persist in or transform to a desired state despite shocks and surprises?
- From a landscape perspective – where are areas of low resilience?

Agricultural Landscapes - Criteria & Indicators

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How much are the following attributes present in a landscape?

- Conditions of resources (water/soil/biomass)
- Biological memory
- Modularity
- Disturbance experience
- Connectedness
- Diversity (functional & response)
- Heterogeneity (spatial & temporal)
- Provisioning services (food, fuel, fibre production)
- Regulating services (water-, disease- and air quality regulation)
- Supporting services (soil formation, nutrient cycling)
- Cultural services (recreation and cultural history)

Agricultural Landscapes & Resilience

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- Identify the desired state(s) of an agricultural landscape in the context of climatic risks
- Generic identification of biotic and spatial indicators of resilience in agricultural landscapes
- Assess landscape – presence of indicators contributing to resilience suggest a resilient agricultural landscape
- Further evaluation (expert/farmer assessment; field measurements/index) – in what ways and to what extent do Land users' practices contribute to resilience?

Livelihood- and Landscape resilience Data Collection and Analysis Methods

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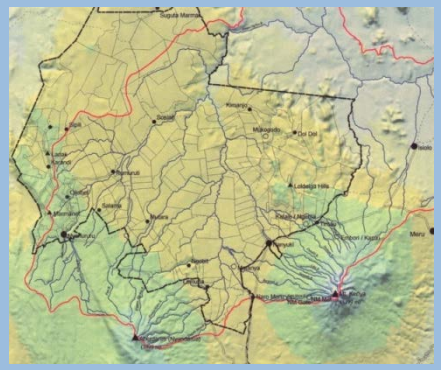
Household surveys; interviews, focus group discussions



Biomass index

NDVI = (NIR — VIS)/(NIR + VIS)

The Directional Leakiness Index (DLI)

$$\mathrm{DLI} = 1 - \text{resource retention}$$
$$= 1 - \left(\frac{L_{\max} - L_{\mathrm{obs}}}{L_{\max} - L_{\min}}\right)^{k}$$

Revised Universal Soil Loss Equation (RUSLE):
A = LS R K C P

Buffer capacity
The capacity to cushion change

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- Depends on what farmers have – social, financial, human «capitals» etc. (Sen 1976-1987, Bourdieu 1983, Chambers 1989, Putnam 1993,1995)
- what they can do*
- what they actually do - actions & reactions

(*Sen 1976-1999, Bourdieu 1977,1983, Chambers1989, Bourdieu & Wacquant 1992, Giddens 1984,1997, Wiesmann et al 2011)

Agency & an actor-oriented perspective is important.

Farmer Livelihoods and Resilience

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- Identify the desired state(s) of farmer livelihoods in the context of climatic risks
- Generic identification of practices contributing to resilience
- Capture farmers' practices – presence of practices contributing to resilience suggest a resilient agriculture-based livelihood
- Further evaluation (expert/farmer assessment; field measurements/index) – in what ways and to what extent do farmers' practices contribute to resilience?

Land-users' Capacity to Act and Land-users' Strategies

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88% local maize
6% hybrid
6% hybrid + local

N = 129

Drought

- Lack of water
- **Crop loss** → **Crop loss Why?**
- High commodity prices
- Increase in charcoal production
- Increase in livestock sale

Crop loss Why?

- Lack of water Why?
  - Climate (drought)
  - No irrigation
- Poor crop selection Why?
  - Preference
  - Other seeds are expensive
  - No drought warning

Ifejika Speranza 2006