

**1st Arab-American Frontiers of Sciences,  
Engineering, and Medicine Symposium**  
*Climate Change, Extreme Weather  
Events, and Agriculture*

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**Addressing climate change impacts in the context  
of multiple stresses in North Africa Region**

By  
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# **Presentation outline**

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**Key climate change terms**

**North Africa under a changing climate**

**Adaptation options**

**Micro Dams A Case study from Morocco**

**Ecosystem management- Case study from Sudan**

## Key climate change terms

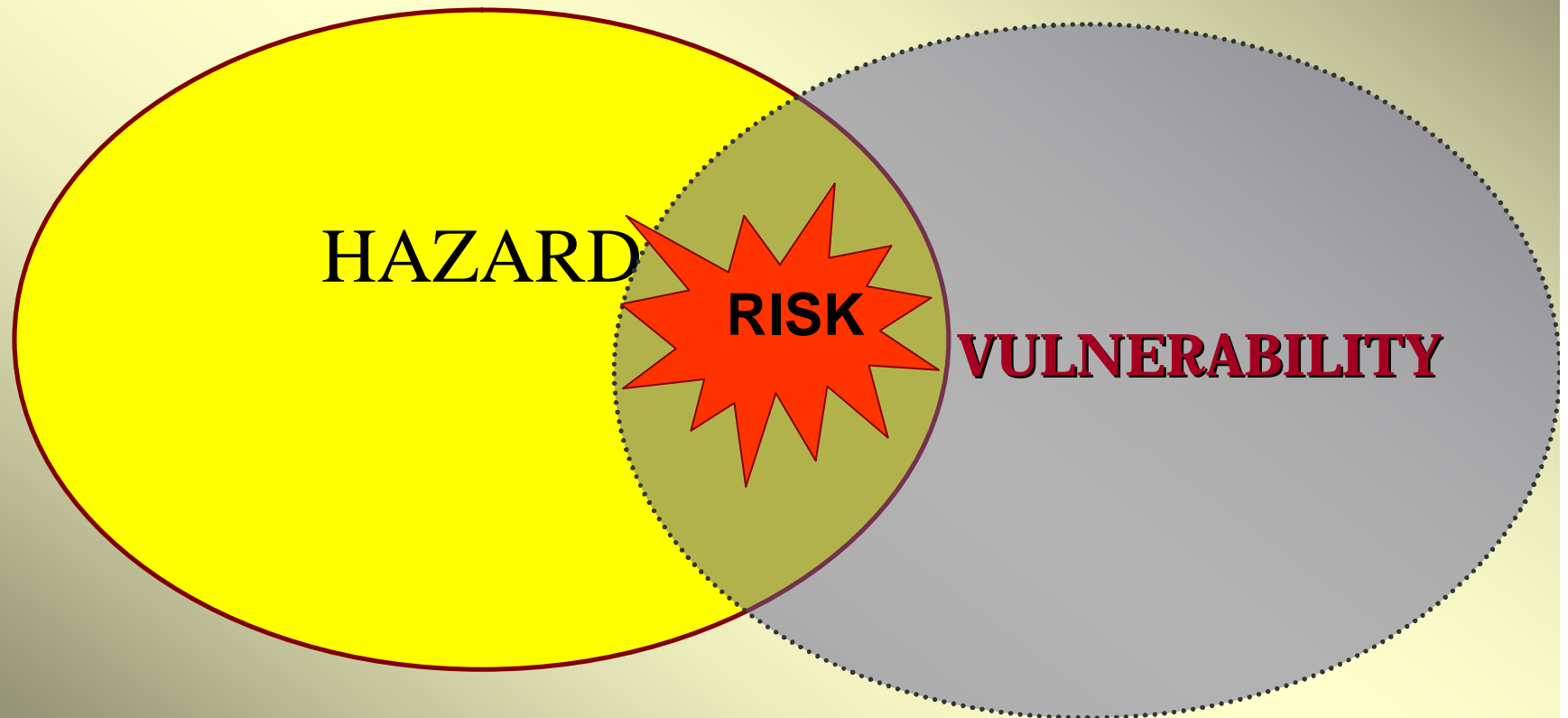
### **Vulnerability (IPCC definition)**

- The degree to which a system is susceptible to, or unable to cope with, adverse effects of CC including climate variability & extremes.
- It is a function of **the magnitude, and rate of change** to which a system is **exposed**, its **sensitivity**, and its adaptive capacity.

**Risk:** is the overlay of hazard & vulnerability

**Disasters** : are the realisation of risk

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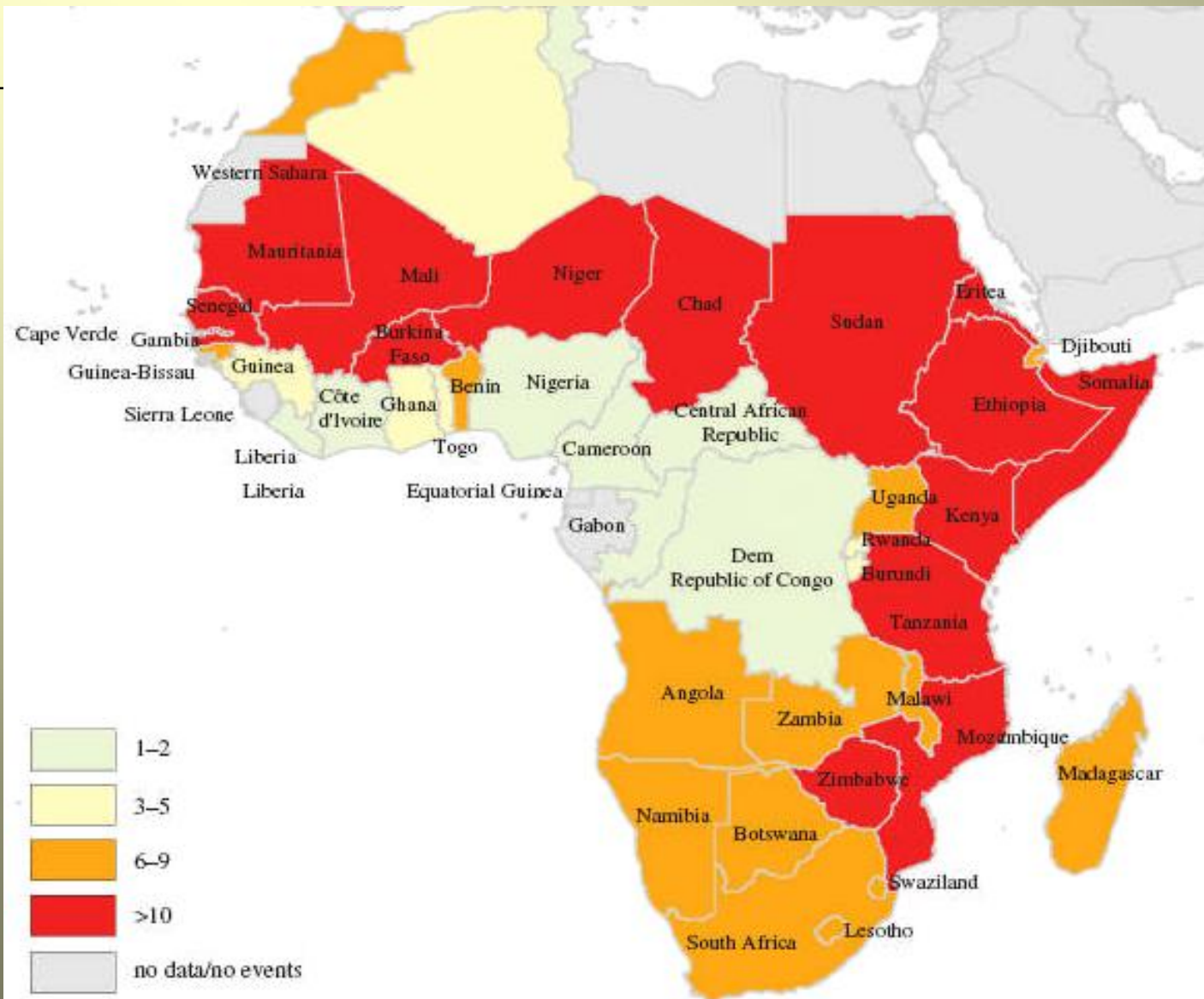


# Key terms

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- **Adaptation** - *Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC TAR, 2001 a)*

# Drought events per country from 1970 to 2004





# Multiple stresses chronic problems, poverty & conflicts

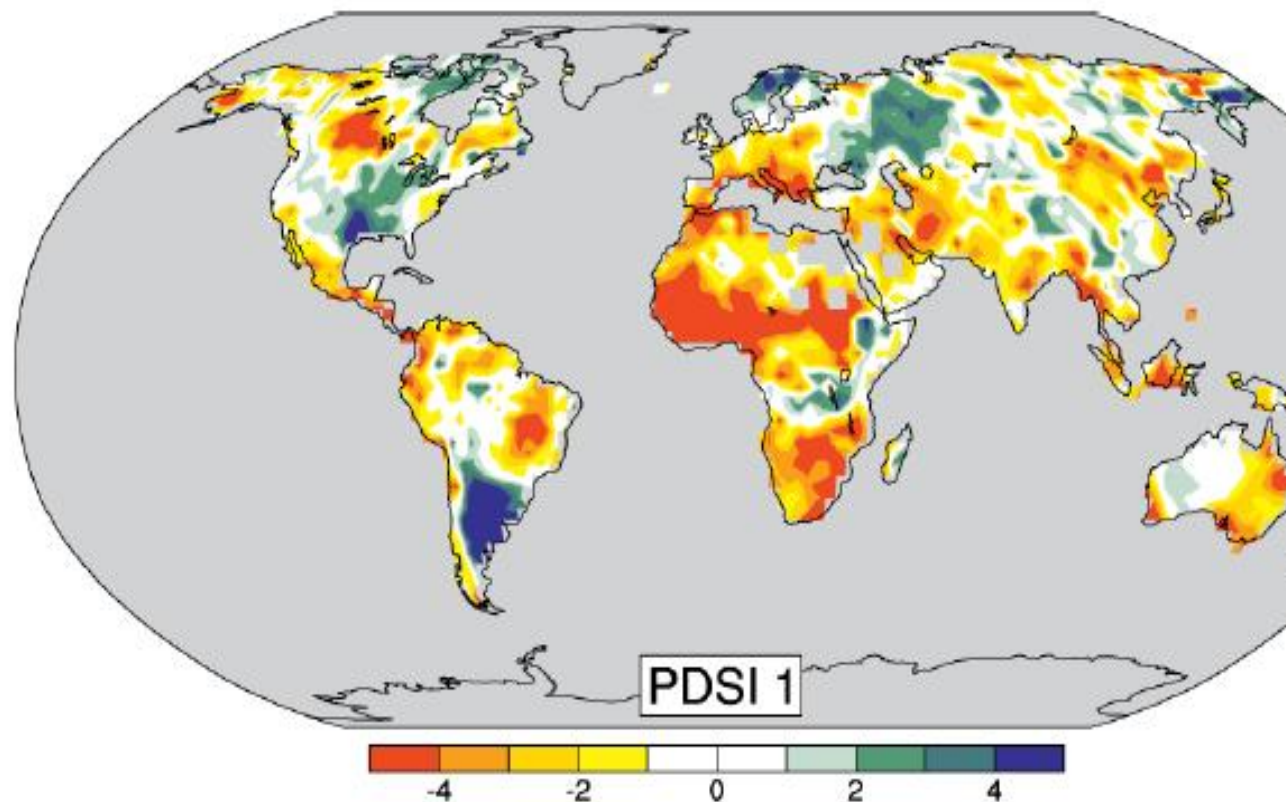
## HUNGER AND CONFLICTS IN AFRICA



Sources: Map originally created by Sylvie Brunel and Cécile Marin. *Human Development Report*, UNDP, 1996; Ramsès 1994, Dunod; *Total Call of the HCR Examination of the Programs*, HCR, 2001; *The State of Food Insecurity in the World*, FAO, Rome, 1999; *Populations en danger*, Médecins sans frontières - Lepac, La Découverte, 1995; *Interventions*, Action internationale contre la faim, 1994; *Le Monde peut-il nourrir le monde?*, Les Clés de la planète, hors-série no.1, Croissance, Paris, 1998.

## Drought frequency is already increasing in MENA

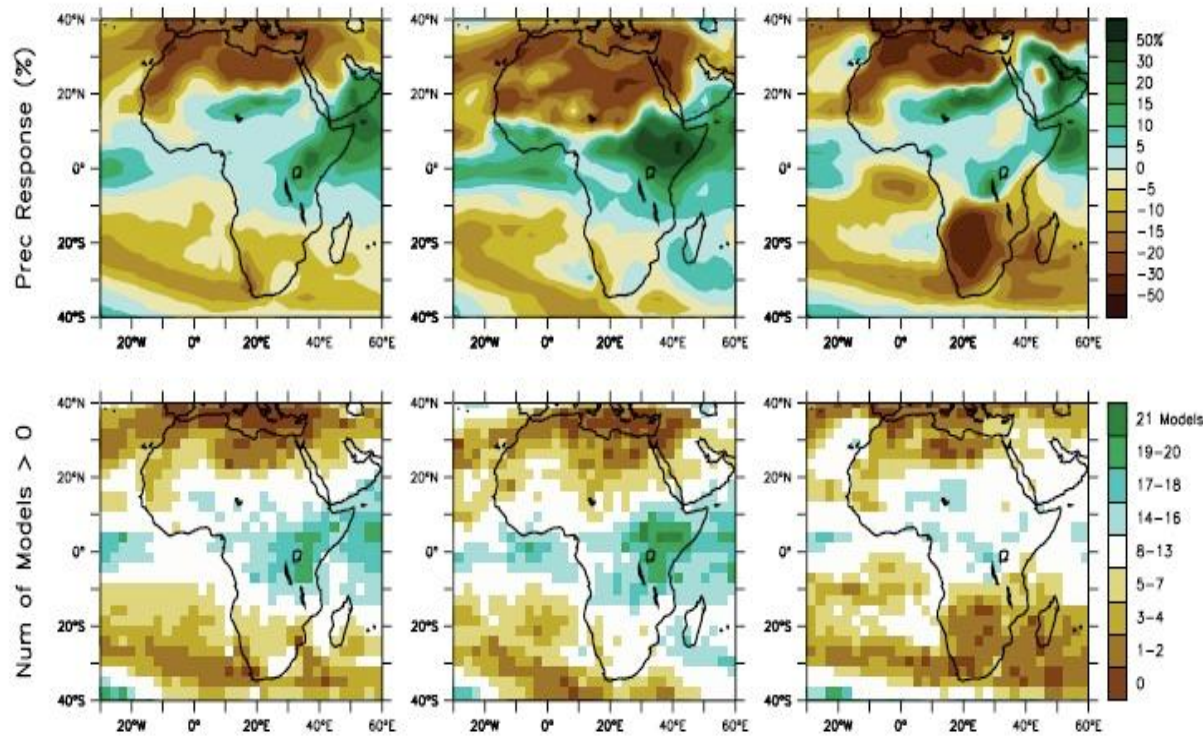
Palmer Drought Severity Index (PDSI) for 1990 to 2002.



Source: IPCC Fourth Assessment Report, 2007



# Climate change projections

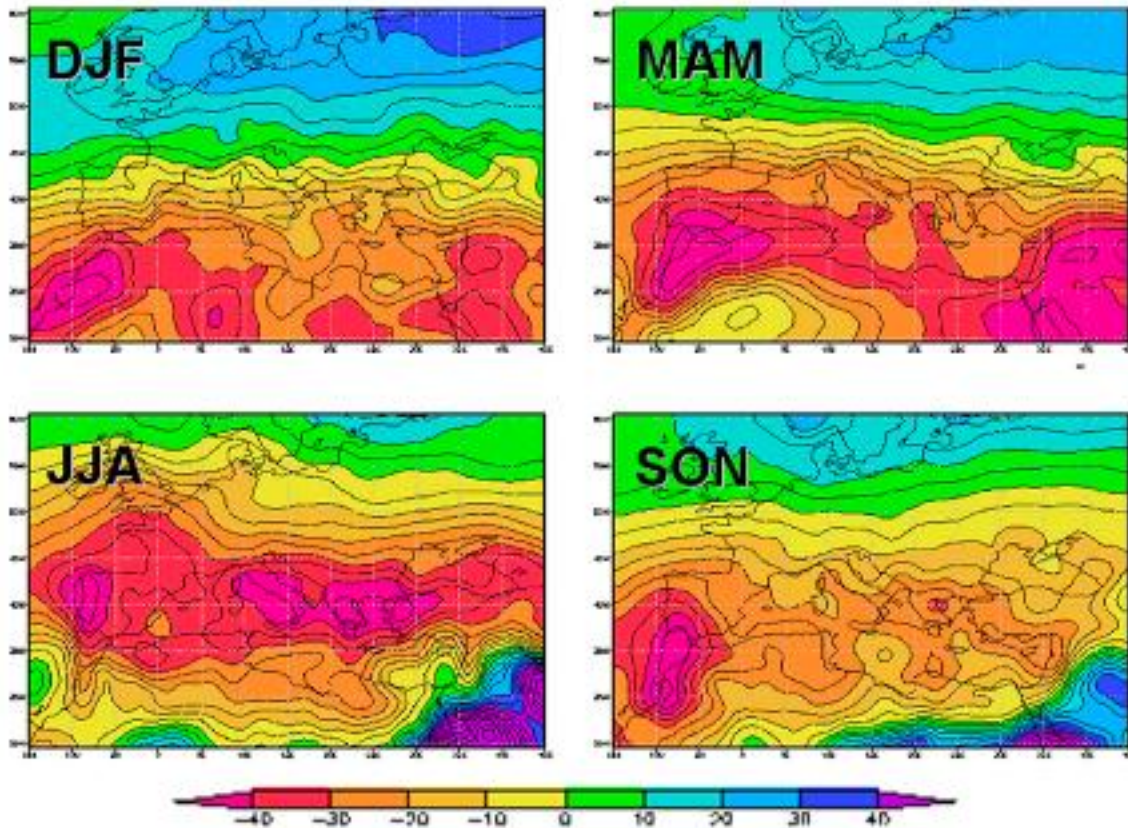


IPCC projected large reductions in rainfall in N. Africa and Mediterranean

Annual precipitation changes over Africa between 1980-1999 & 2080-2099 from MMD-A1B simulations, mean for 21 models

# North Africa

Precipitation change (% , 2071-2100 minus 1961-1990),  
MGME ensemble average, A2 scenario



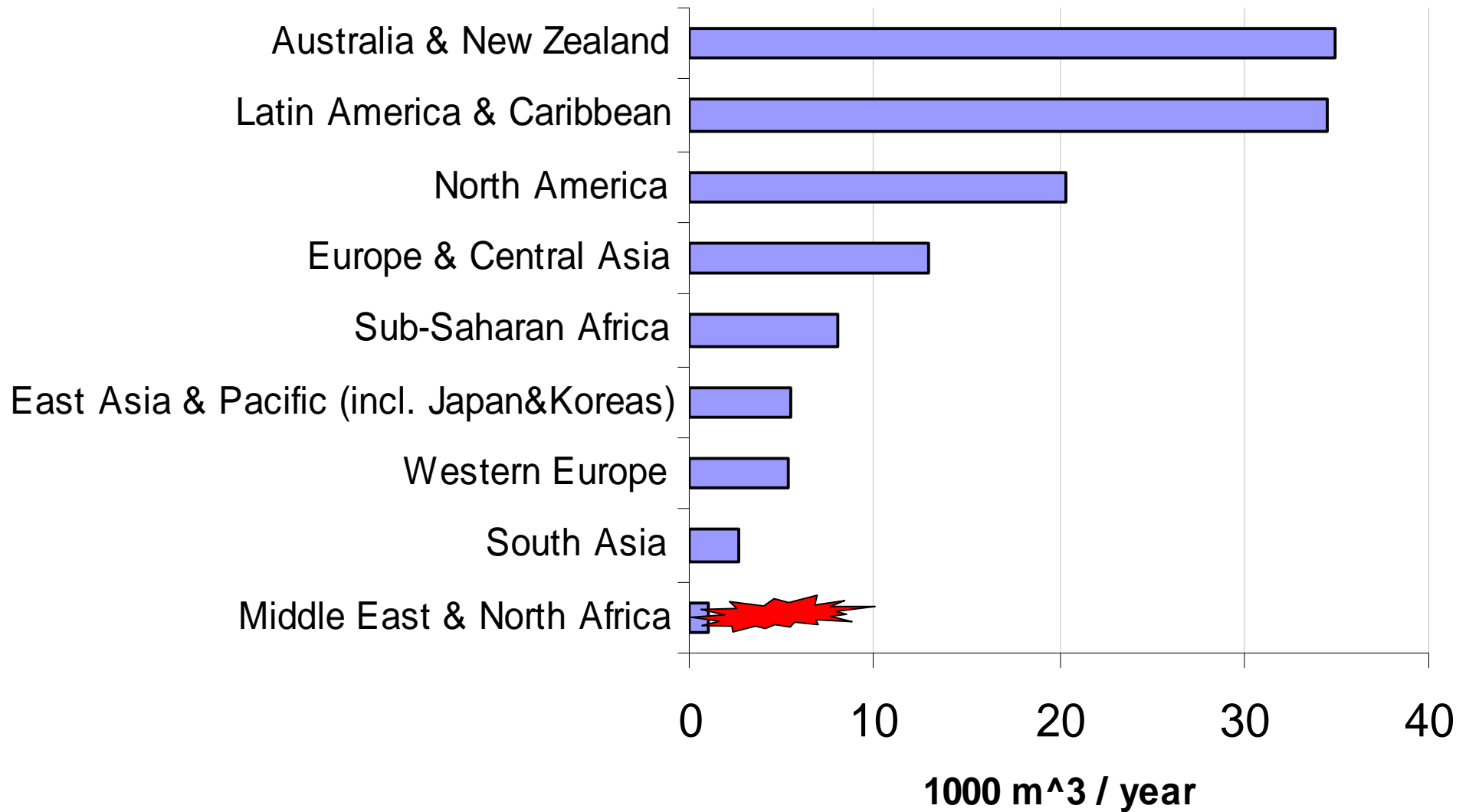
Graphic reproduced from Giorgi & Lionello (2008: 97)

Giorgi, F. and Lionello, P. 2008. Climate change projections for the Mediterranean region. *Global and Planetary Change* 63: 94-104.

Warming of  $0.8-1.1^{\circ}\text{C}$  in  
2020s;  $3.2-5.0^{\circ}\text{C}$  in  
2080s

- Drier across the Mediterranean & Atlantic coasts
- large Warming & drying over Maghreb
- Greater impacts on water resources
- Uncertainty over Sahara (few data)
- Adaptation focus on water retention, efficiency, etc

## Annual renewable water resources per capita





**Annual renewable water resources per capita is getting less and less**



# Morocco case study

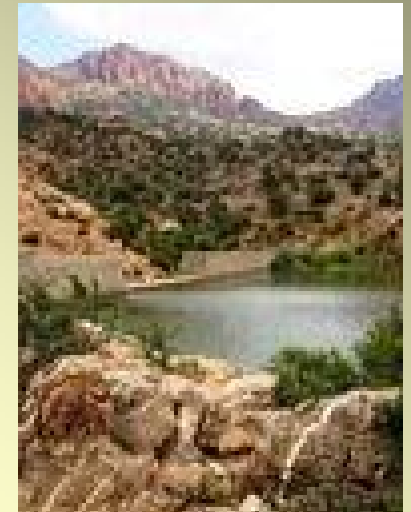




# Integrated eco-systemic approach for optimization of small dams

## Project objective

- The purpose of the project is to analyse the vulnerability and adaptive capabilities of rural communities in southern Morocco with focus on water resources, ecosystem, economy & health and to contribute to the development of their adaptive capacity through raising awareness & improve water management using micro dams.



## Development of Micro Dams

- The project is implemented mainly in Souss-Massa-Draa (SMD), southern Morocco, an area surrounded by mountains which are subjected to severe droughts.
- Rural population of the SMD region is among the poorest and most vulnerable.
- 3 micro dams are developed:
  - n **1- Asgherkiss** located in the rural community of Aougounz (province of Chtouka Ait Baha);
  - n **2-Adghir and Imgoune** in the rural community of Askaoun (province of Taroudant); and
  - n **3-Imi Lhad** in the rural community of Smimou (province of Essaouira). The three sites selected feed rural communities of different sizes and for different purposes.

## Project Partners



- The research is funded Jointly by **IDRC&DFID** under the Climate Change Adaptation for Africa (CCAA)- implemented by a research team from **Agadir Regional Agronomical Research Centre** in cooperation with several partners (researchers, NGOs, local authorities, institutions and the private sector, etc.)

## Participatory Action Research (PAR)

- Participatory action research (PAR), seeks to understand and improve the community's livelihood by initiating the change.





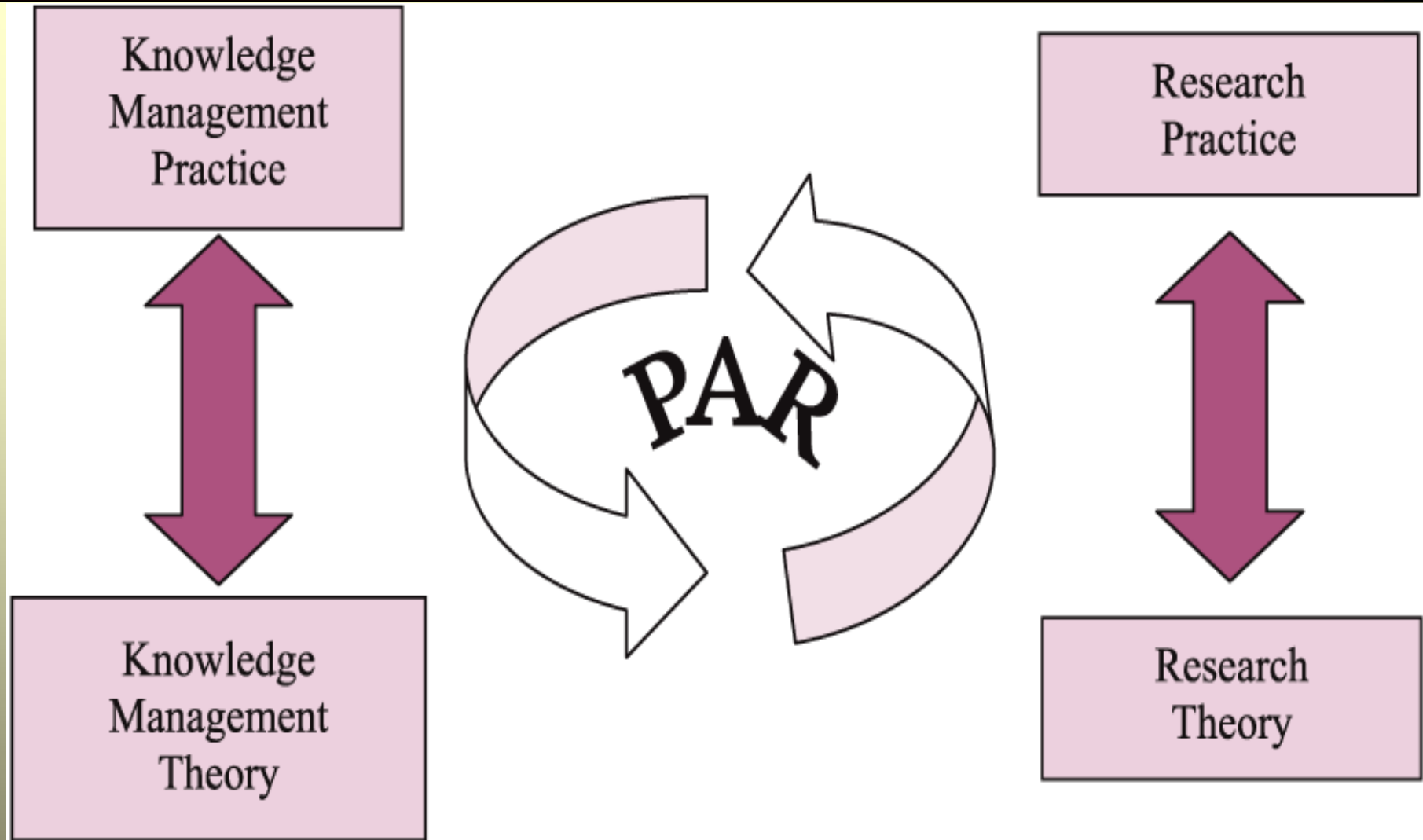
## Participatory-Action Research versus conventional research

PAR differs from conventional research in three ways:

- **Firstly**, it focuses on research whose purpose is to enable action;
- **Secondly**, PAR pays careful attention to power relationships, advocating for power to be deliberately shared between the researcher and the researched
- **Thirdly**, PAR contrasts with less dynamic approaches that remove data and information from their contexts. PAR advocates that those being researched should be involved in the process actively







**Gillian Ragsdell, (2009) "Participatory action research: a winning strategy for KM", Journal of Knowledge Management, Vol. 13 Iss: 6, pp.564 - 576**

# Asgherkiss Dam to improve irrigation





## **Micro-Dams provide a year- round water**



**Increase of surface water availability through the use establishment of small Dams**

**Health and hygiene**

**Farming system and agricultural**

**Social change**

**Ecosystem sustainabilit**

**Sustain better health & hygiene conditions**

**Improved agriculture production**

**Better water management of water hv women**

**Improved biodiversity  
It reduced flooding impact down stream**

**Potential risks**

**Health risks related to low water quality**

**It has may create additional workload for women in irrigated**

**Growing wildlife around the community dam may increase risk of zoonotic diseases**

# PAR Strengths

- Helps develop and strengthen **community networks**
- **Empowering** communities (develop their negotiation capabilities)
- Takes issues to **public debate** (CC, Water scarcity...)
- Provides **evidence** and facilitates enlighten policy
- Help develop **new research questions** (more local related) (waste water in the watershed)
- It evolve to a **learning process** that help to make better use of what is available at community level (capacities, knowledge, experience, practice...)
- Strengthen and help develop **team work**



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- For information on the Micro Dam project please contact: Aitlhaj Abderrahmane  
[aitlhaj\\_ab@yahoo.fr](mailto:aitlhaj_ab@yahoo.fr)

## 2. Sudan Case study

AIACC Project “Environmental Strategies for Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East Africa”

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### Goal:

- To prove that certain Livelihoods/Environmental Management Measures (SL/EM) increase the resilience of communities to climate related shocks;
- **Establish that these measures are effective and should be considered as climate change adaptation options that could be included in the planning of national adaptation strategies; and**
- Explore what *enables* them to be effective – i.e., what factors\* made it possible for the measures to be successful**

## What types of measures are we considering?

**SL/EM: like natural resources management and soil conservation, etc., each of which involves an array of specific measures (e.g., water harvesting, intercropping, livestock diversification, and establishment of shelter belts**





## Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity- Gereigikh Project (Kordofan State)



## Research approach

- The research activities aimed at: understanding the local context of the communities in which the particular SL/EM strategy has been implemented and related local responses . It involved collection of information on the local and national factors.





## Engagement of community members in the management of rangeland



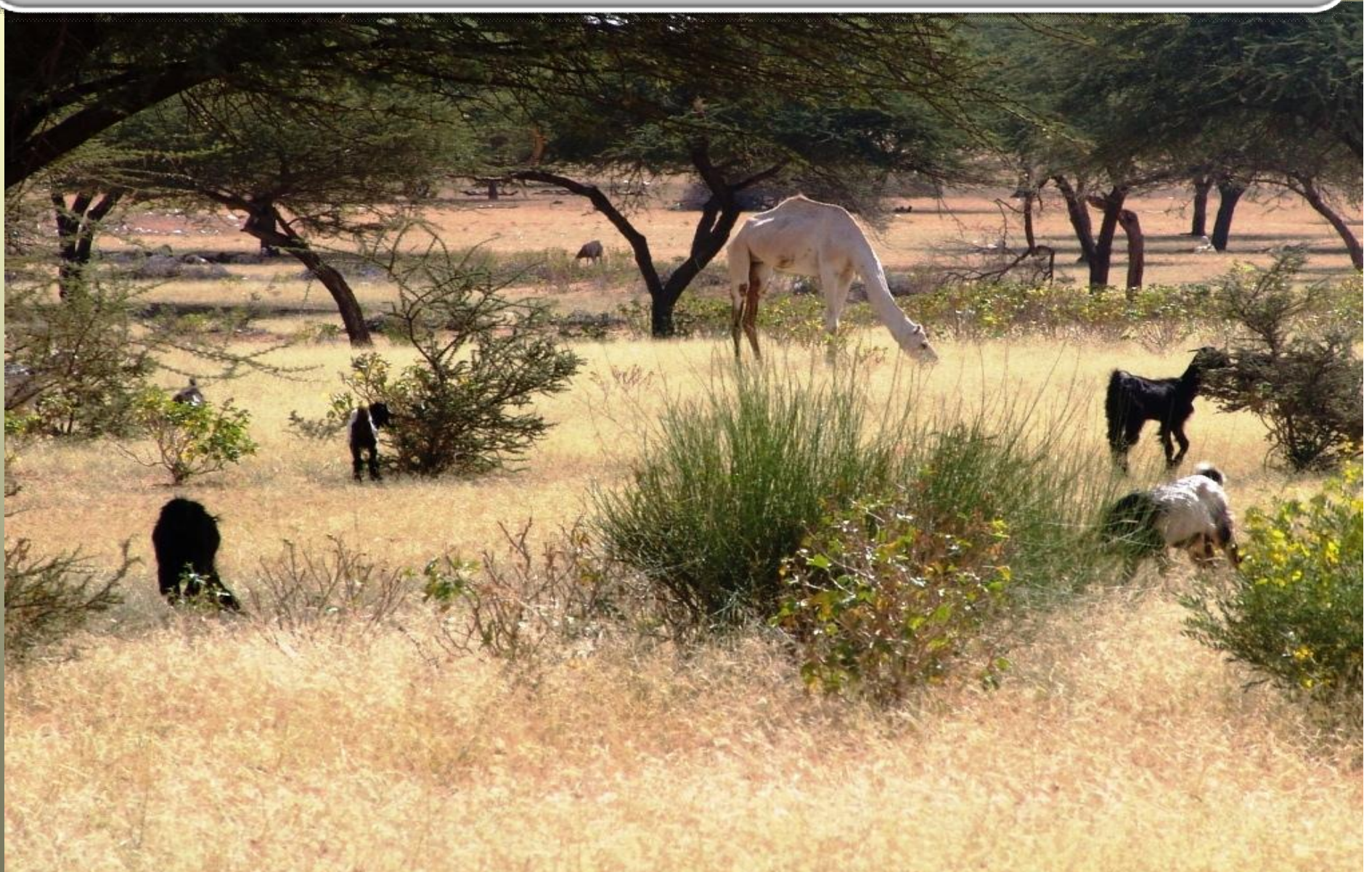


## Tree conservation and use of mud walled buildings





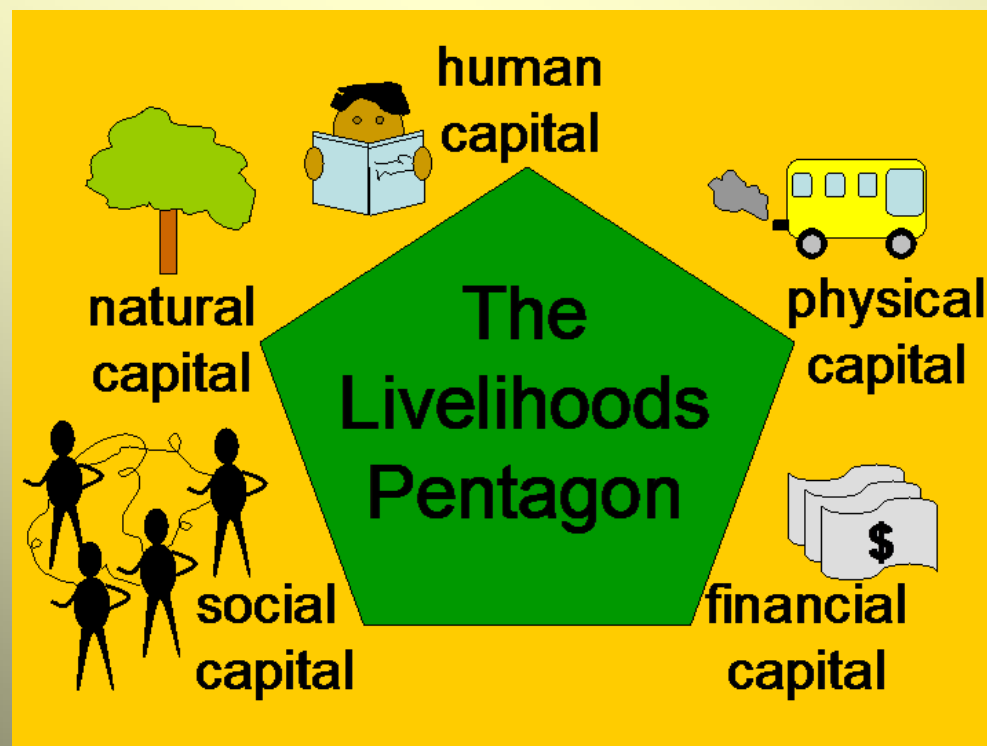
## Controlled Grazing in the allotments





## Primary Assessment tool-Sustainable Livelihood Approach

- The primary tool employed is the sustainable livelihood impact assessment methods for assessing project impacts on target communities.



## **Sustainable livelihood approach**

- Within the SL framework the project employed the Livelihood Assets Tracking (LATs) system to measure changes in coping and adaptive capacity.**
- Use of word pictures by household to assess their own vulnerability and coping capacity to a climate-related impact.**
- Consultation with communities to develop indicators of community resilience and construct word pictures.**

## Word pictures

- are description of HH circumstances developed in a participatory manner with the community in question.
- “Best case”
- “worse case” snapshot.





## Development of criteria and indicators around the livelihood capitals

### Natural Capital

- Rangeland productivity
- Rangeland carrying capacity
- Plant species composition
- Water sources,
- quality and use
- Access to Natural resources by marginal community groups ( women, minority tribes, poor)



## **Financial Capital**

- **Income generating activities**
- **Income levels and stability**
- **Revolving funds /amount of credit granted to individuals**
- **Savings**
- **Accessibility of vulnerable groups to credit (women, poor and minority groups)**



## **Physical capital**

- **Water pumps, wells**
- **Agric inputs**
- **Grain stores (capacity and accessibility)**
- **Grain mills (capacity and accessibility)**
- **Energy conservation techniques (improved stoves)**
- **Availability of spare parts**

**Harvesting machines**

**Market facilities**

**Roads**





## **Human capital**

- **Ownership of assets**
- **Skilled labors**
- **Housing type**
- **Access of marginal groups to education, training and extension services**

## **Social Capital**

- **Organizational set-up**
- **Role of Village Dev. Committees in the decision making process.**
- **Membership to organizations**
- **Sharing of responsibilities**



## Other issues covered by the assessment

### **Government policies related to: Potential risks**

- Taxes
- Market prices
- Incentives
- Land tenure

### **Access to services**

- Extension & education
- Health & veterinary services
- Training

- Changing government policies
- Out-migration by skilled people
- Encroachment by other tribes into the project area
- Pressures on rangelands by intruding nomads



## Tabulation of criteria and indicators

### Development of criteria and indicators around the capital assets:

Around each capital asset a set of criteria and indicators are developed as tabulated below :

Capital assets	Dimension	Criteria	Indicators
Natural capital	Productivity	1.Rangeland productivity 2.Carrying capacity 3.Forage production	Area of improved / rehabilitated rangeland -Animal units per average ha  -Average ton of dry matter /ha per year -
	Equity	Access of marginal groups to grazing allotments	% of minorities (Kawahla) tribes with access to grazing allotments
	Sustainability	-Rangeland management -Sustainability of range land -Rangeland quality	-Effectiveness of management practices -% of agric. land been transferred into rangeland, Abundance of desirable plant species
	Risks	-Pressures on rangeland	Frequency of nomads from other areas encroachment into the project RL.

## Preparation of a livelihood assets status framework matrix

### CASE STUDY ASSESSMENT SHEET: Natural Capital

Criteria	Indicators	Worst case		Moderate		Best case
<b>Productivity: Rangelands productivity</b>	<b>Area of improved/ rehabilitated rangelands</b>	<b>90% Degraded</b>				<b>Excellent &gt;90% rehabilitated</b>
<b>Carrying capacity</b>	<b>5AU/ha/year</b>	<b>5to 10 AU/ha/year</b>	<b>10to 15 AU/ha/year</b>	<b>15to 20 AU/ha/year</b>		<b>20AU/ha/year</b>

## Resulting Word Pictures

### Hypothetical word picture of household's access to natural resources (natural capital)

Pre-SL Activity	Post-SL Activity
<ul style="list-style-type: none"><li>• Little or no land; one or two month's food; quality of land is poor, some have given away land as collateral; no source of irrigation; no fodder for livestock; no milk produced; low access to forest produce;</li></ul>	Fertile land with more moisture retention power; more produce from land; grows and sells cash crops; grows vegetables; access to forest produce; has many fruit trees; availability of home grown food throughout the year; many livestock, high returns from livestock;

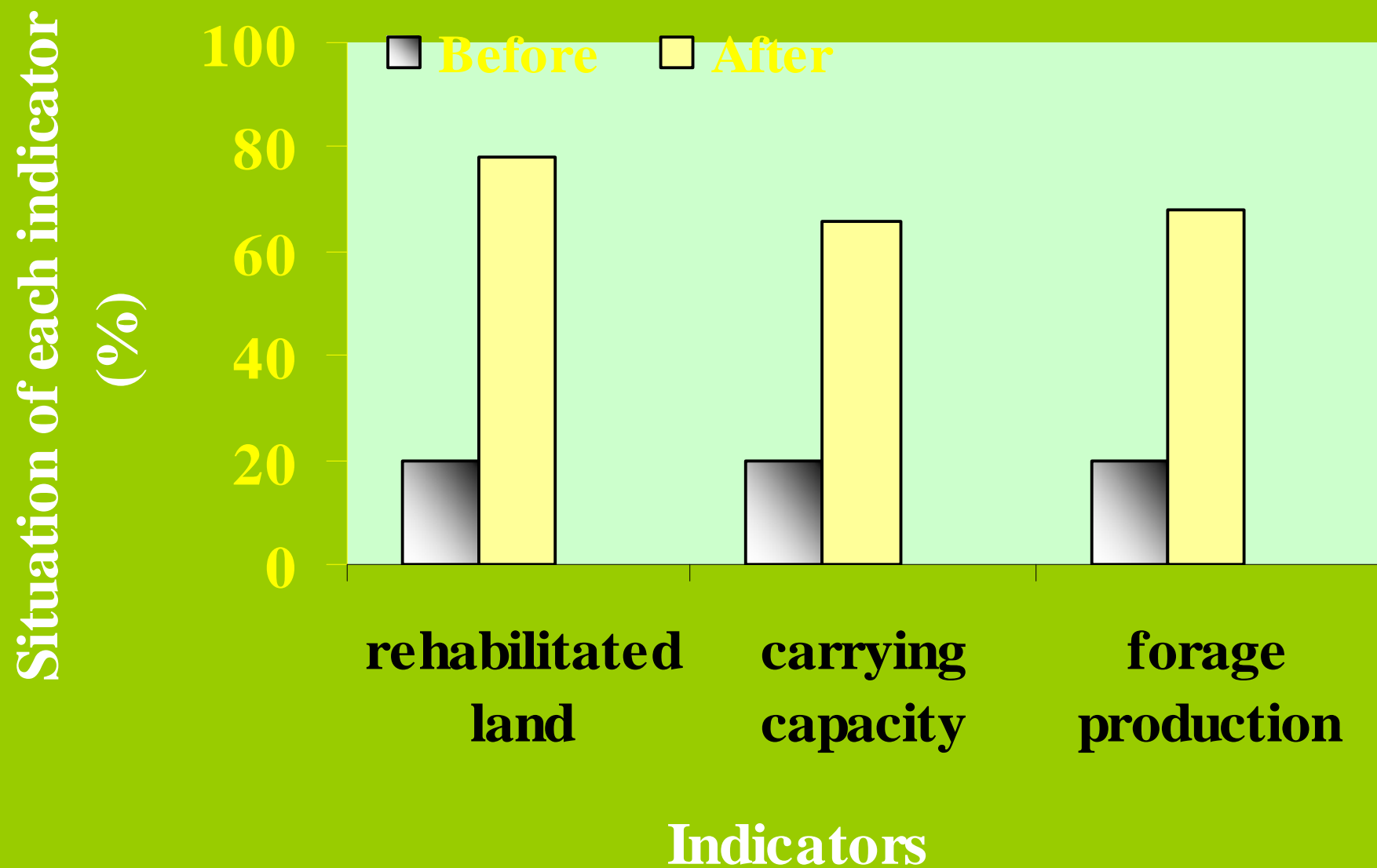


**Sample of the results in graph form**

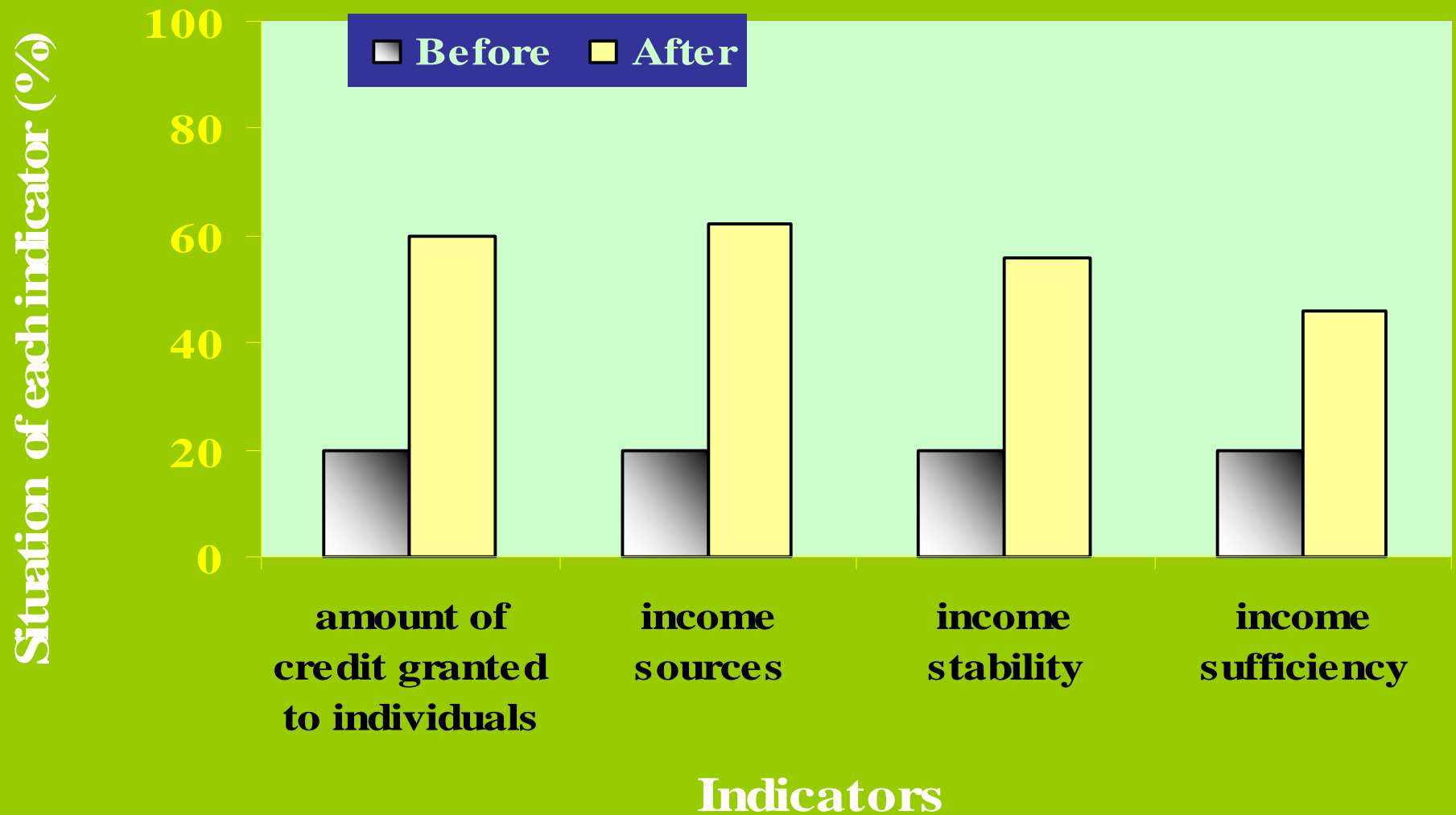
## **Productivity Dimension**



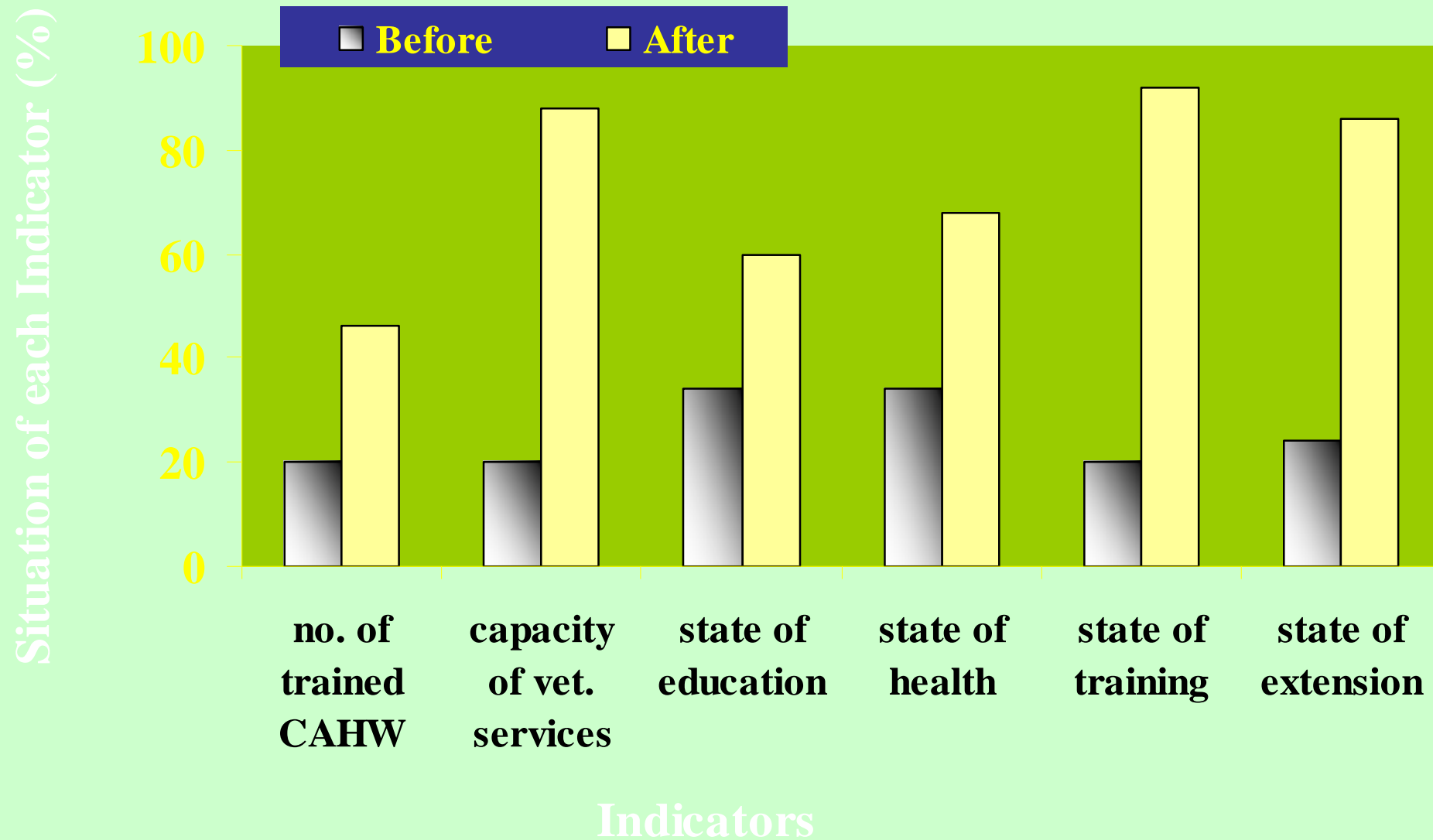
## *Natural capital*



## Financial Capital

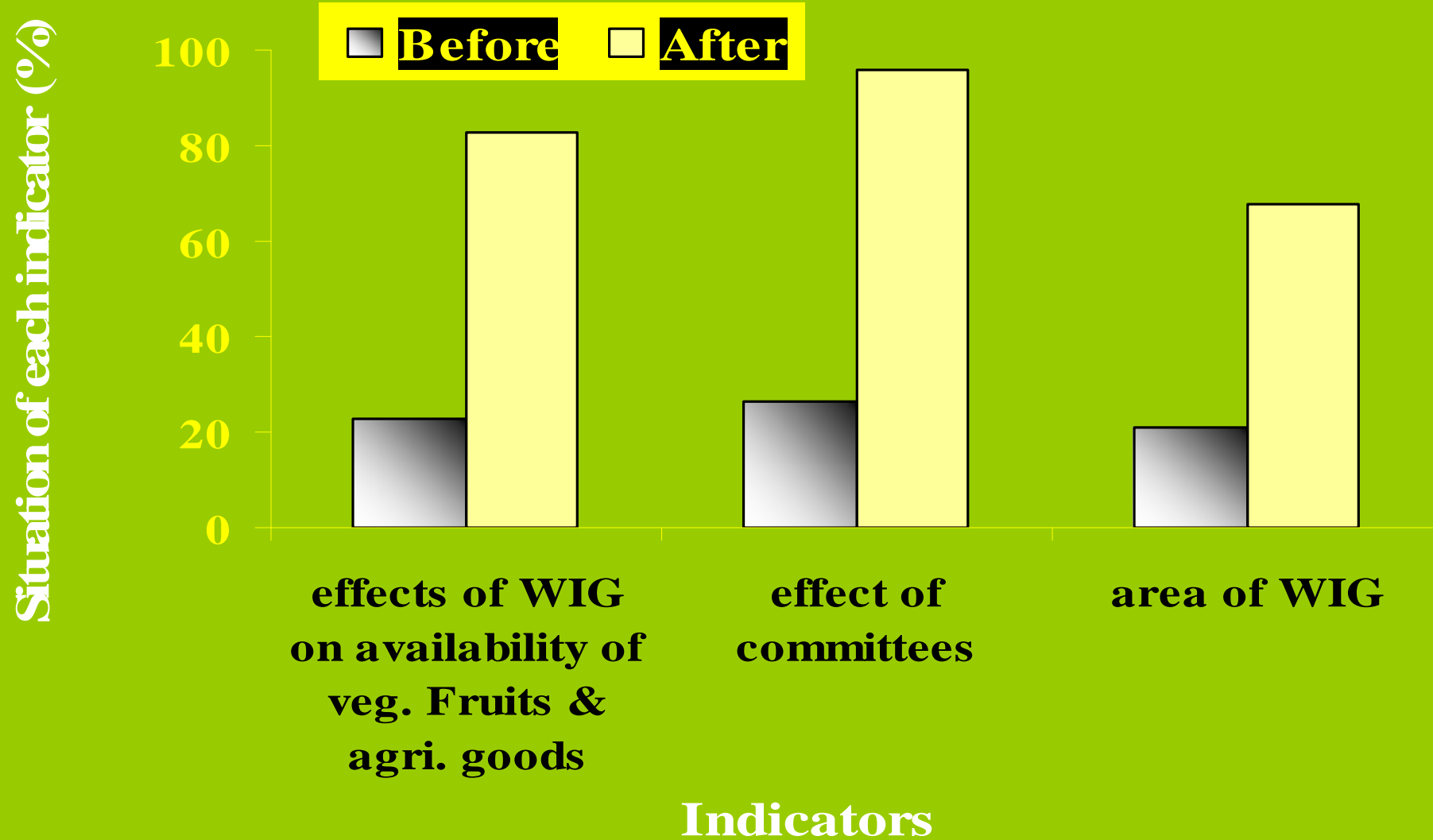


## *Human Capital*





## Social Capital

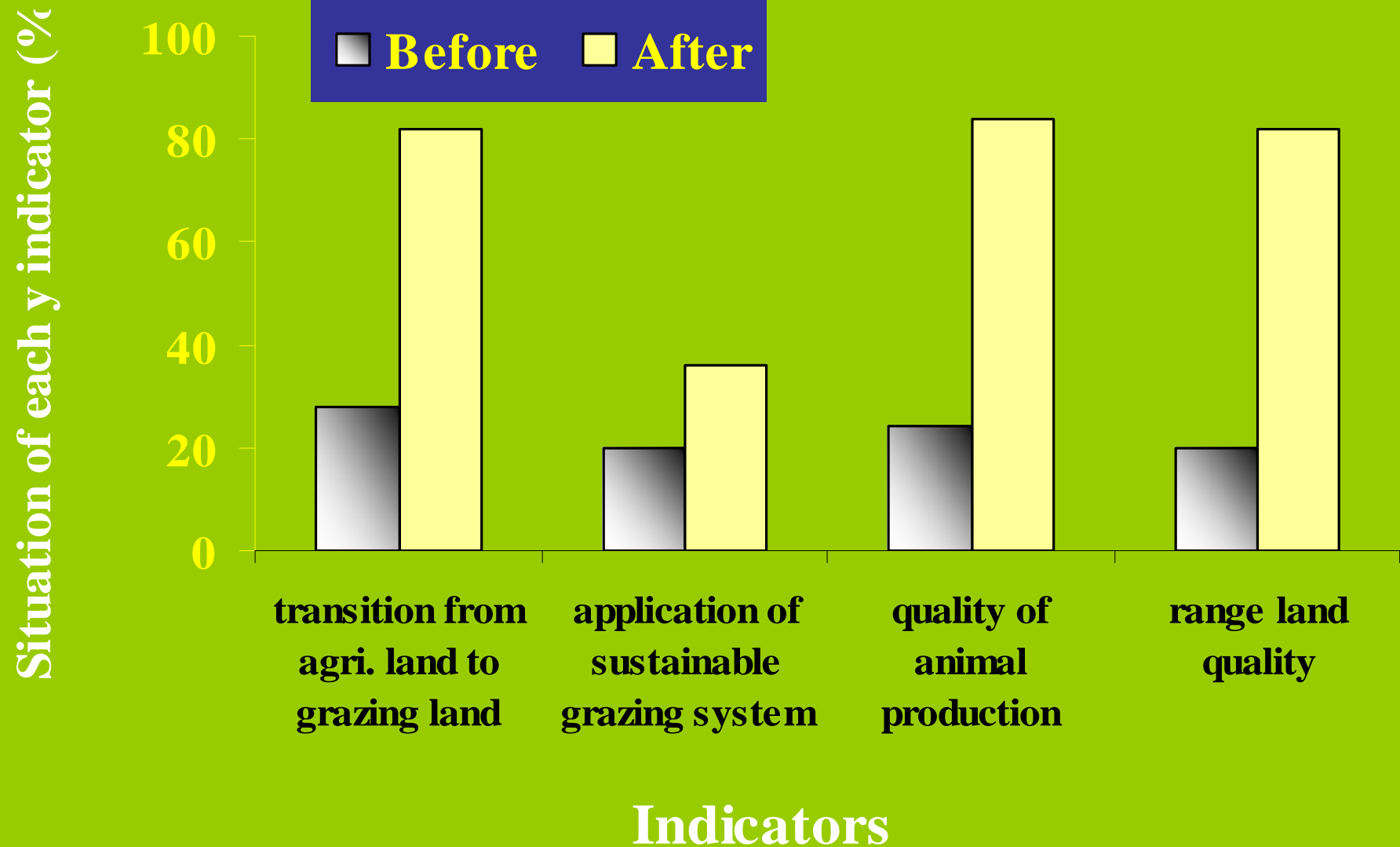




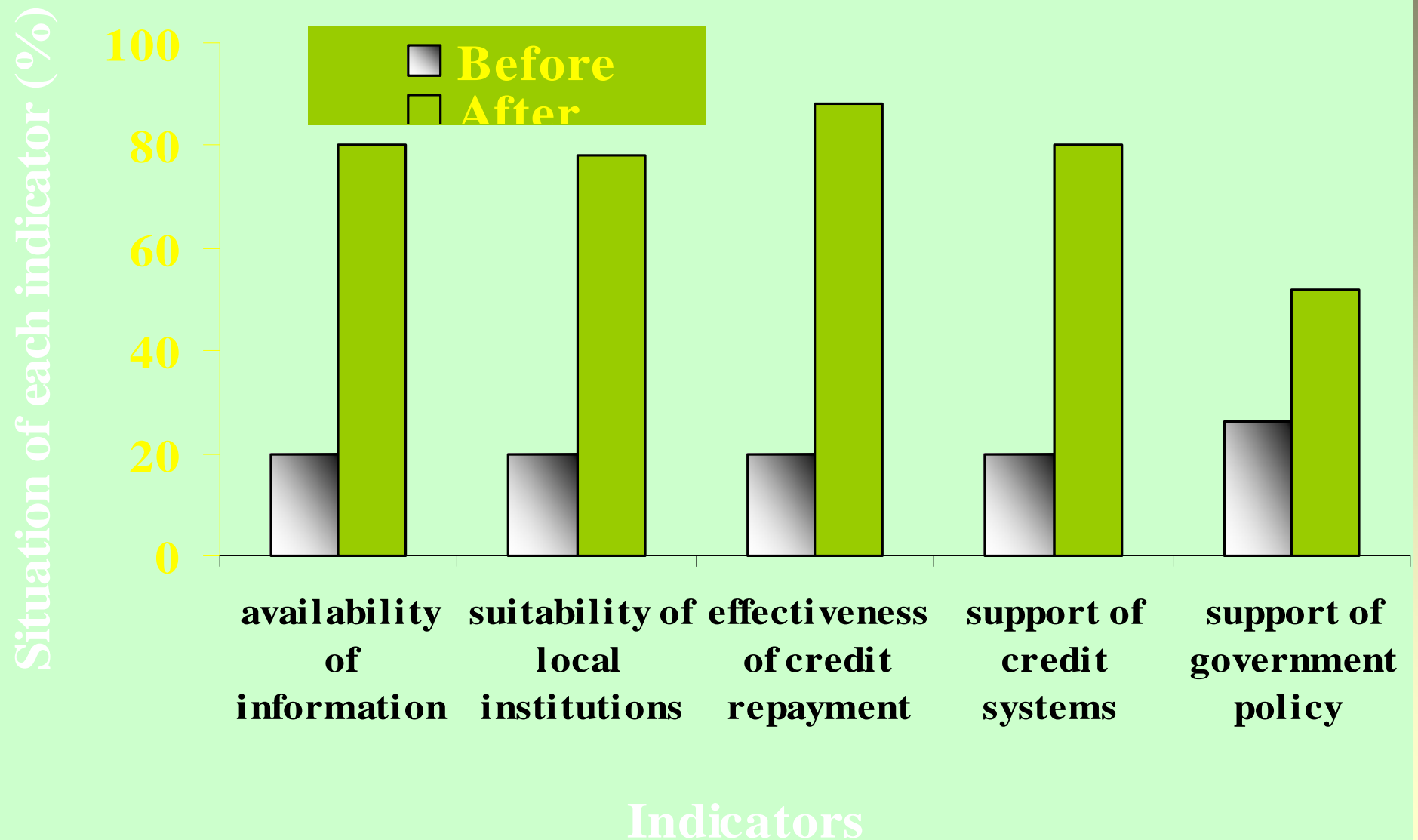
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## **Sustainability Dimension**

## *Natural Capital*

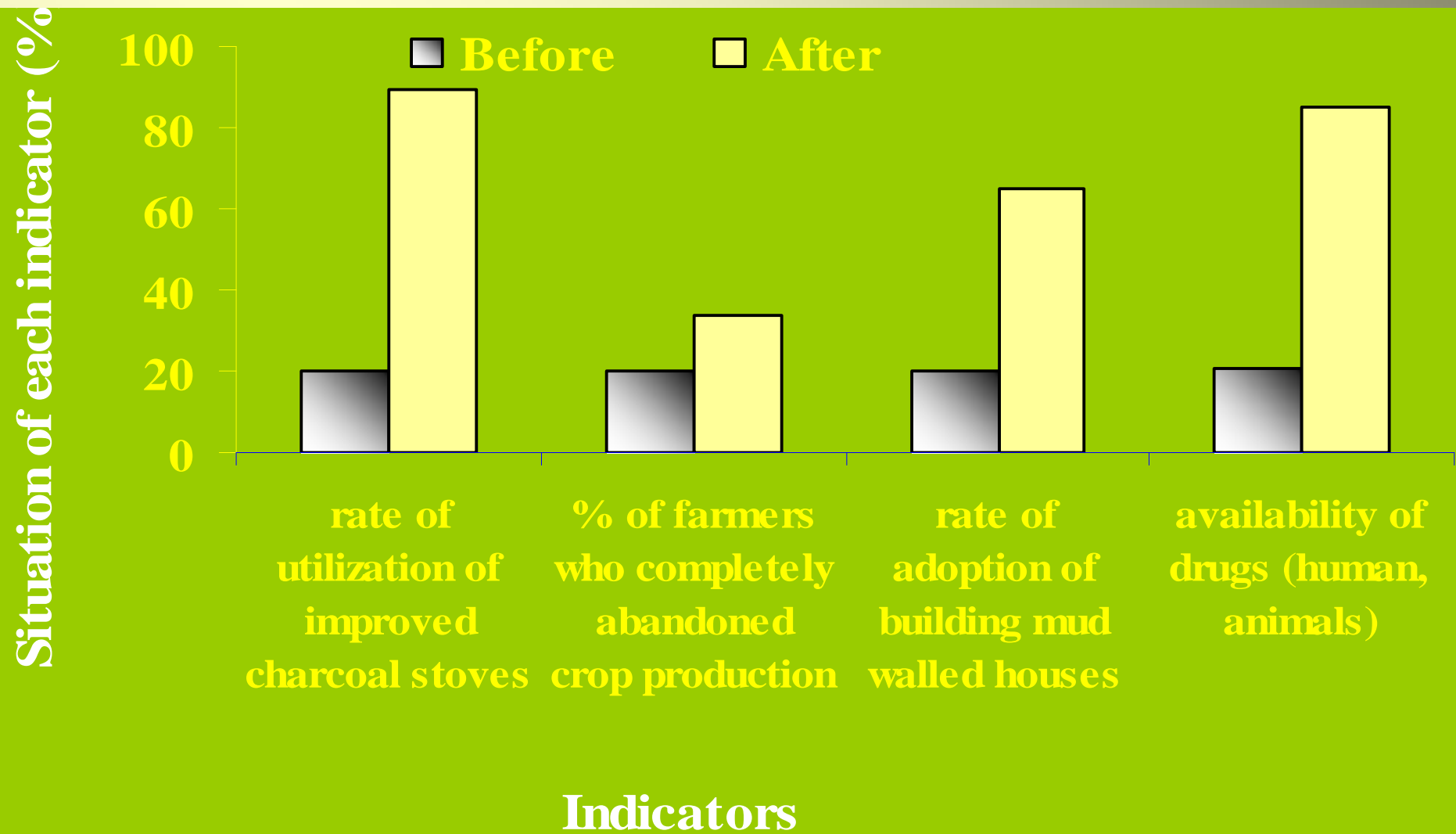


## *Financial Capital*

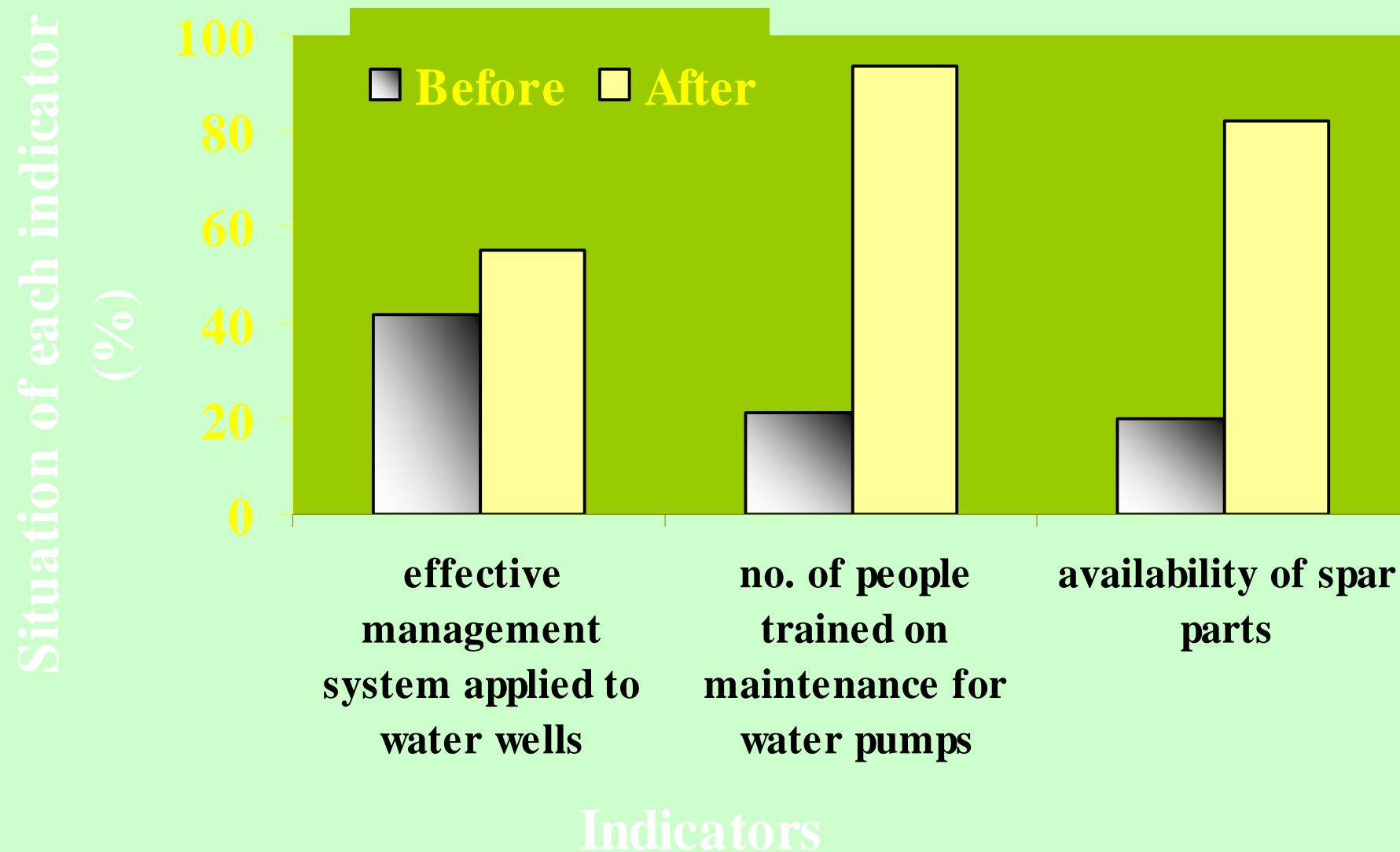




## *Human Capital*



## Physical Capital



## Equity Dimension

- Chances of marginalized groups (women, poor, migrating tribe) increased significantly particularly with regard to:
  - access to grazing land
  - access to credit
  - access to social services
  - access to training
  - participation in decision-making



## Policies and institutions

- The micro-policies in the project area were influenced by the following bodies:
- (a) **Committees-** Sustainability of activities
- (b) **NGOs** (SECS & CARE International)-  
Awareness
- (C) **Traditional leaders:** The Traditional administration played major role in natural resources management for very long period in different parts of Sudan particularly in traditional areas (Social security , Nafir etc..)

## Conclusions

- **Using SL Approach as a tool in adaptation assessment :**
- **Enable national planning processes to effectively consider the most vulnerable groups; articulate unique local vulnerabilities**
- **Identify locally-relevant resilience-building options**
- **Build understanding of micro- and macro-level enabling conditions for adaptation**
- **Build local adaptation awareness and engage local NGOs (potential adaptation project implementers)**

**For information:**

**[www.AIACCPROJECT.COM](http://www.AIACCPROJECT.COM)**

**Thanks**

