



40 Years ISRIC – Anniversary Seminar World Soil Issues and Sustainable Development 9th March 2006

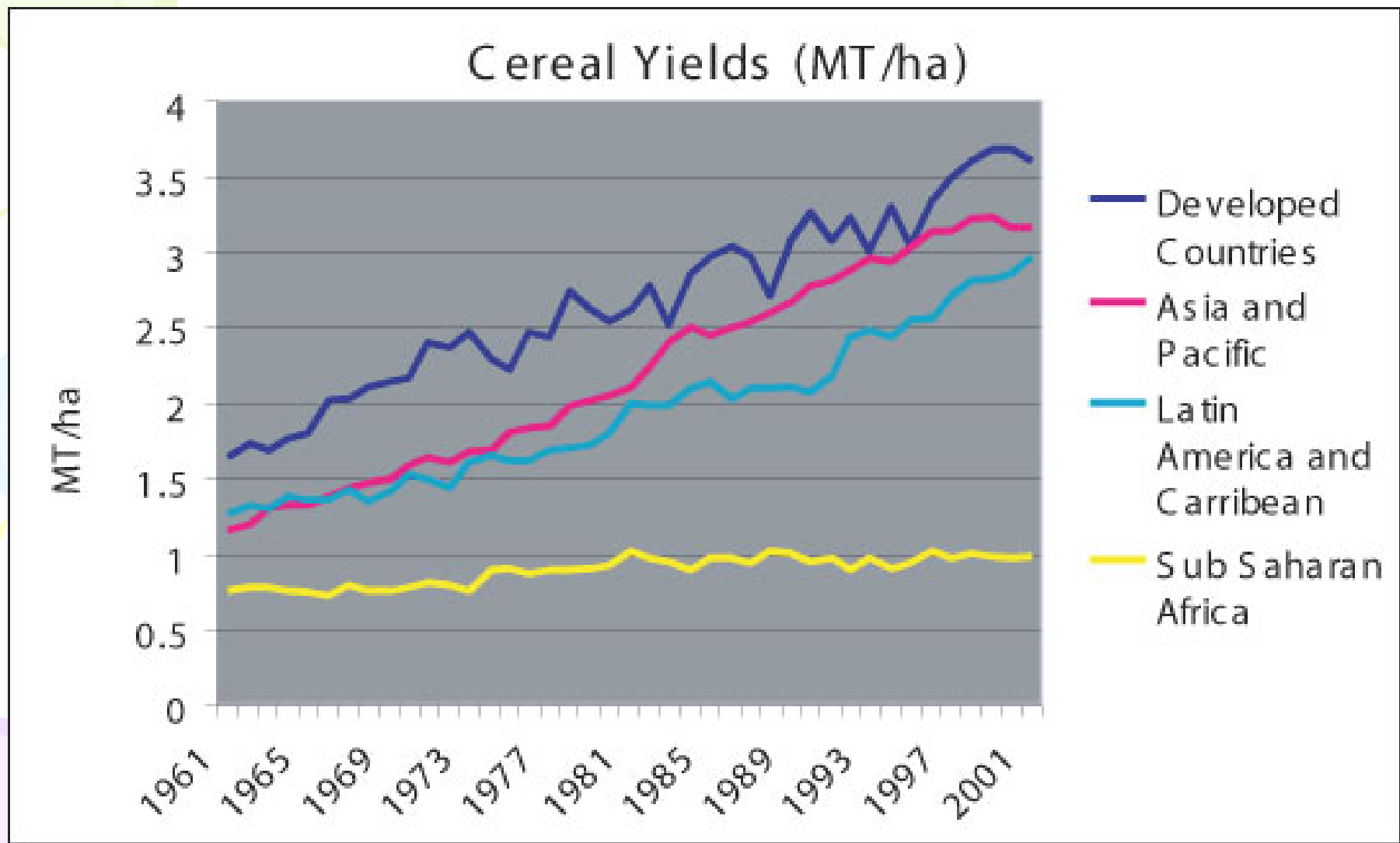
Quick-win Solutions to Integrated Management of Soil Health in Semi-Arid Africa

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SWMnet of ASARECA**

THE Challenge

Smallholder agriculture in semi-arid SSA is in a crisis since farmers are not producing enough to support their own health, let alone soil health

Stagnated Productivity of Agriculture in SSA



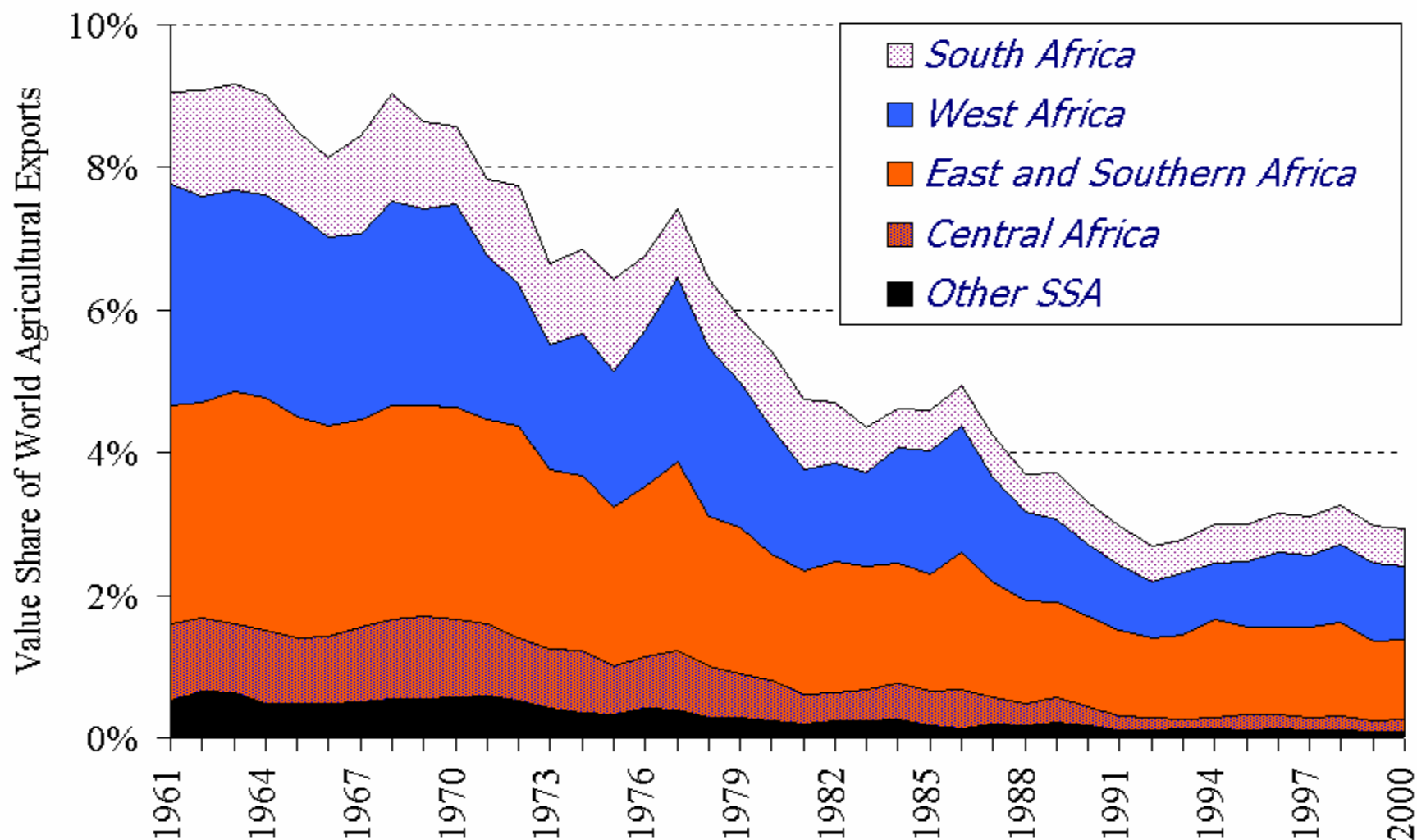
Source: FAOSTAT

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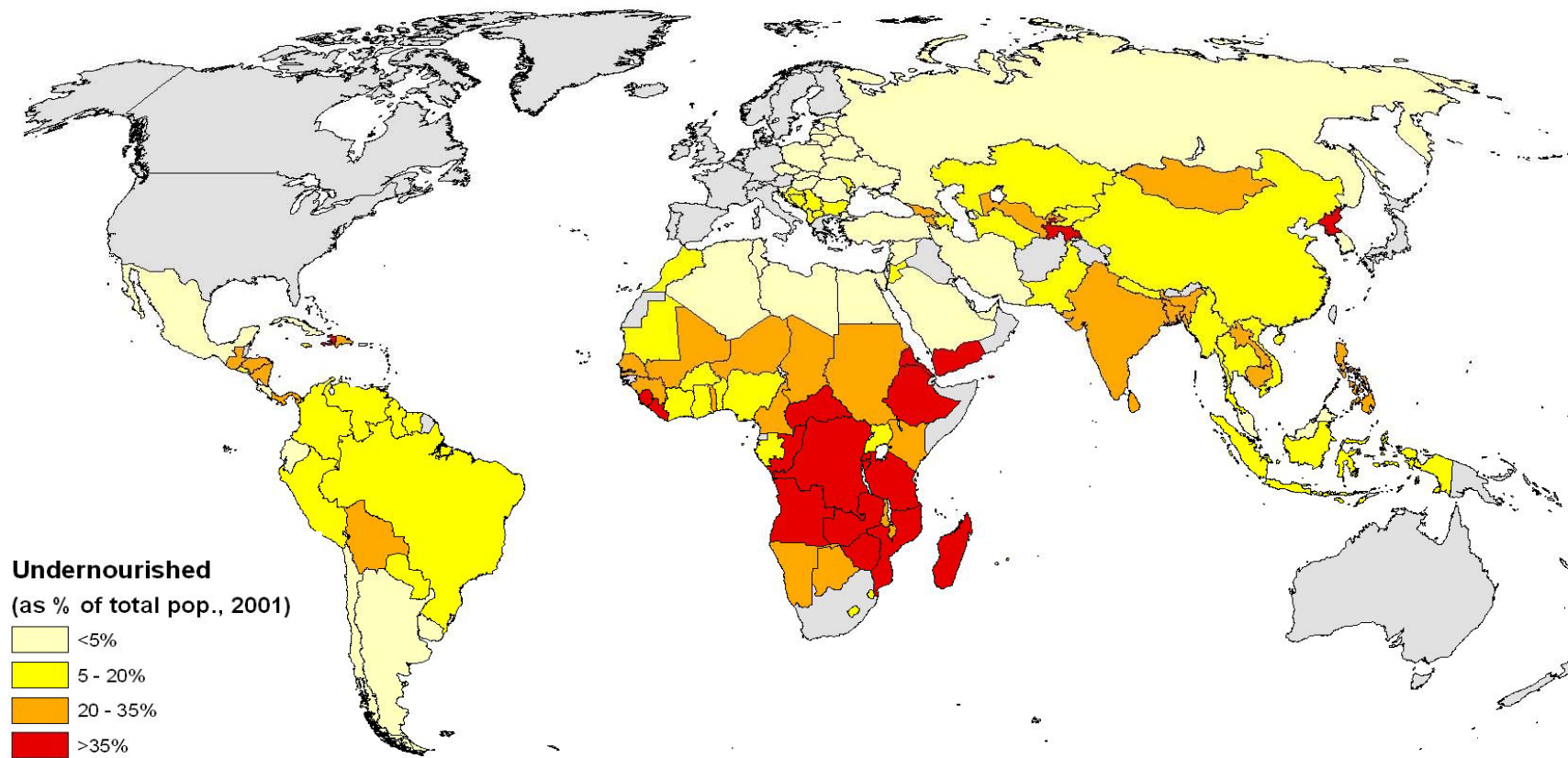


”Even, overall, Africa’s share of the world’s value of agricultural exports has been declining”



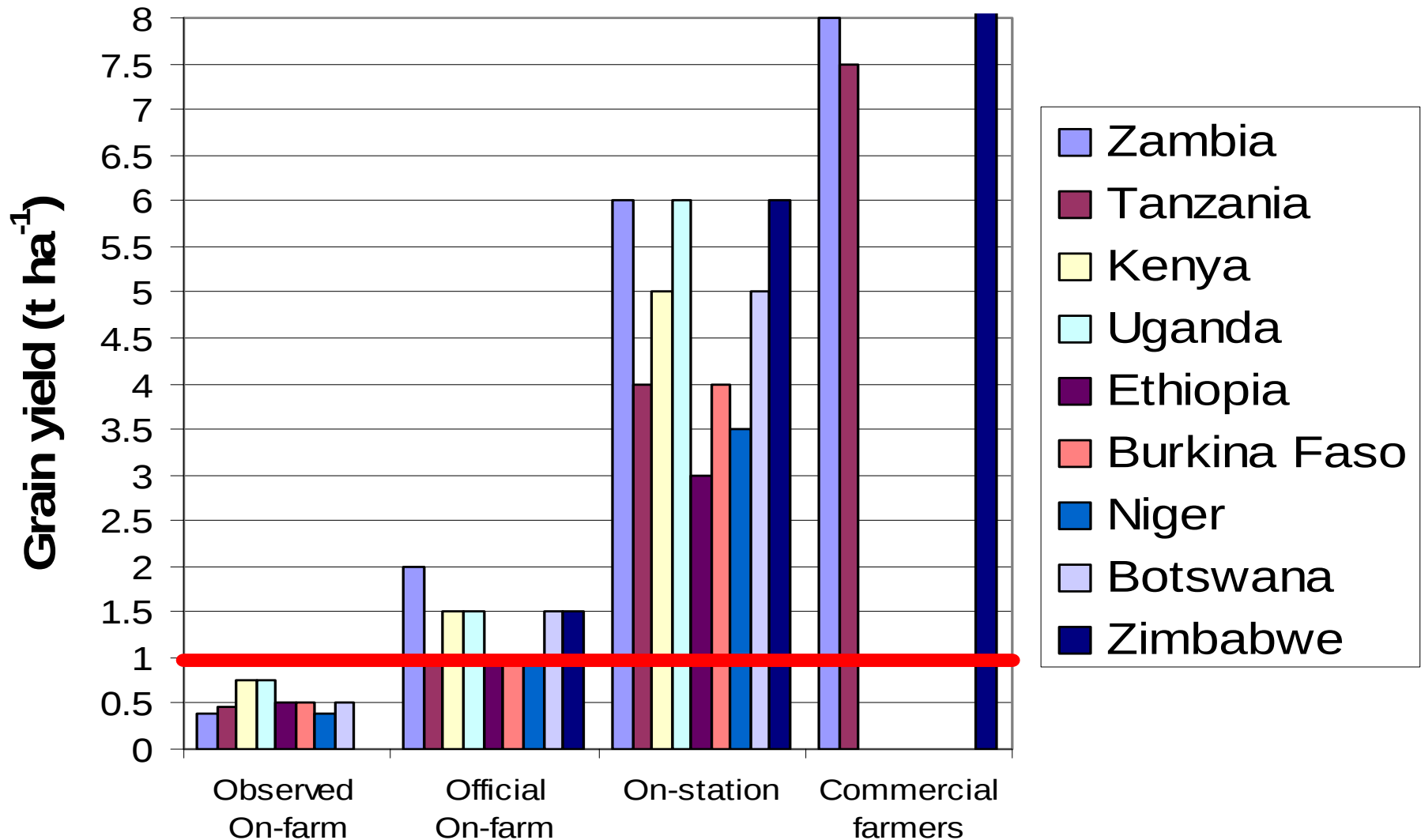
Source : FAOSTAT data (2002)

And has the highest proportions of undernourished population



Mainly because ...

Yields on Smallholder Farms are too Low



Rainfed agriculture in SSA is a smallholder Affair BUT ...

- It employs most of the regions poorest and most vulnerable.
- It provides 90% of locally produced food staples.
- It leaves a cereal deficit projected to rise to 35 million tons per annum by 2025.
- It attracts little investments in interventions for increasing productivity and maintaining soil health.

Main constraints

Productivity of labor, land and water is limited by three main factors:

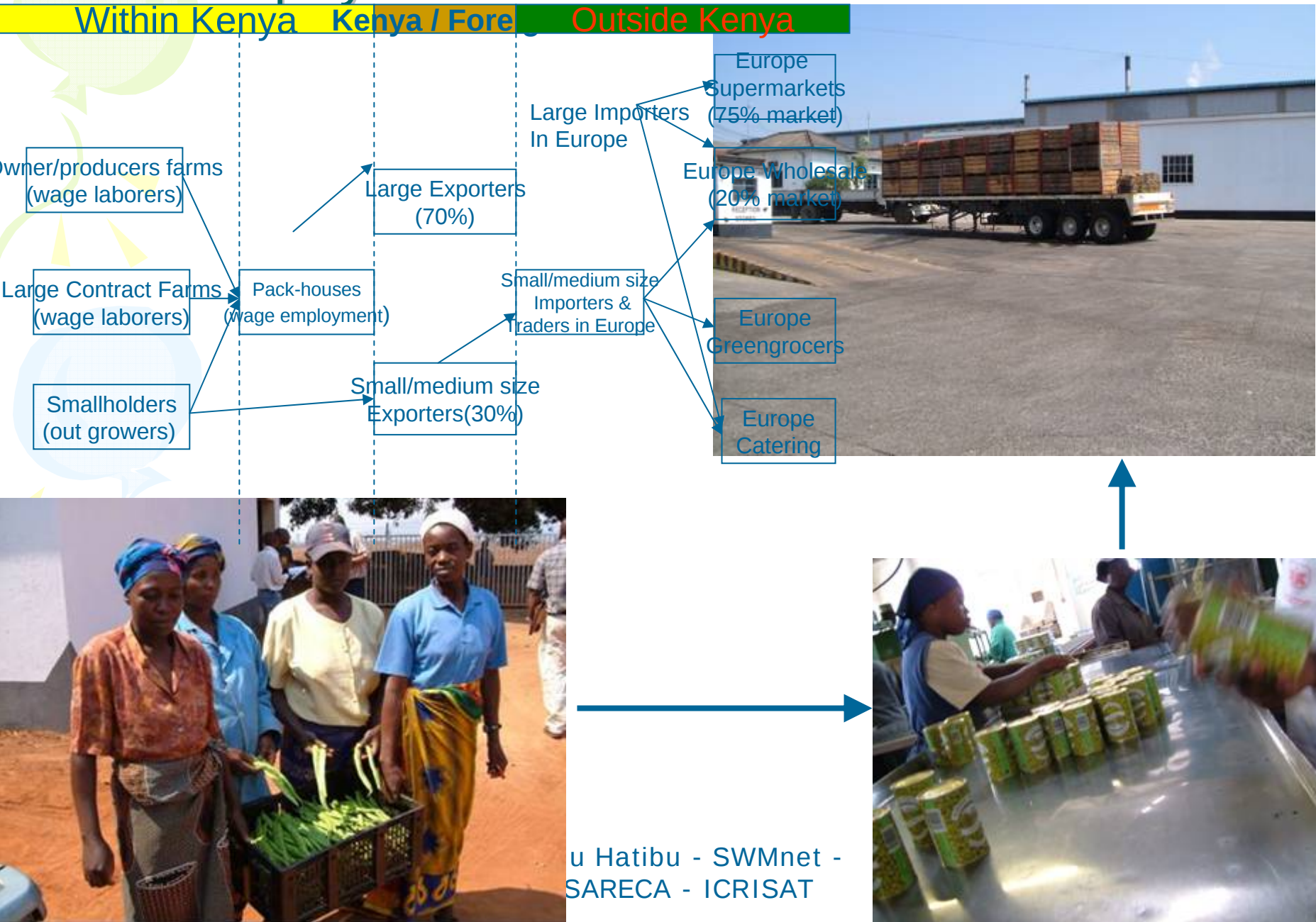
- **Pests including weeds,**
- **Shortage of soil nutrients (especially Phosphorous), and**
- **High variability in soil-moisture and associated risk.**

BUT – the most BINDING constraint is lack of adoption and investments to put the perfected K.I.T into Use

Because of:

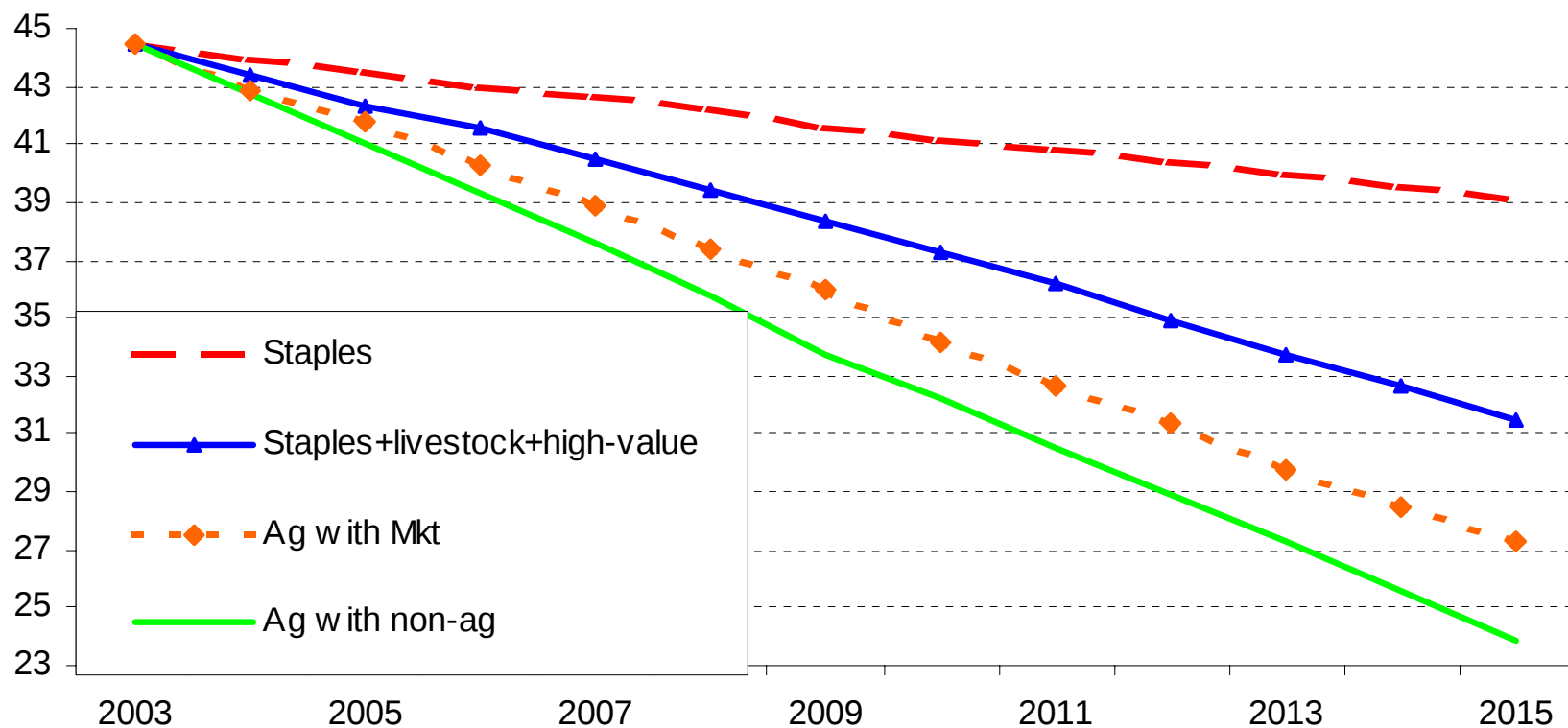
- Poor ratio of benefit to costs, as a result of
- Inadequate development or complete lack of food trade, leading to
- Wastage of the surplus produced in seasons of good rains, which
- Prevents the creation of wealth and building of assets, which in turn
- Limits ability to cope with poor seasons, perpetuating vulnerability, hunger and poverty

Evidence show that joining value chains pays even for smallholders ...



So the first part of the Equation is Income Generation by the poor...

National poverty ratio (%)
under different growth scenarios



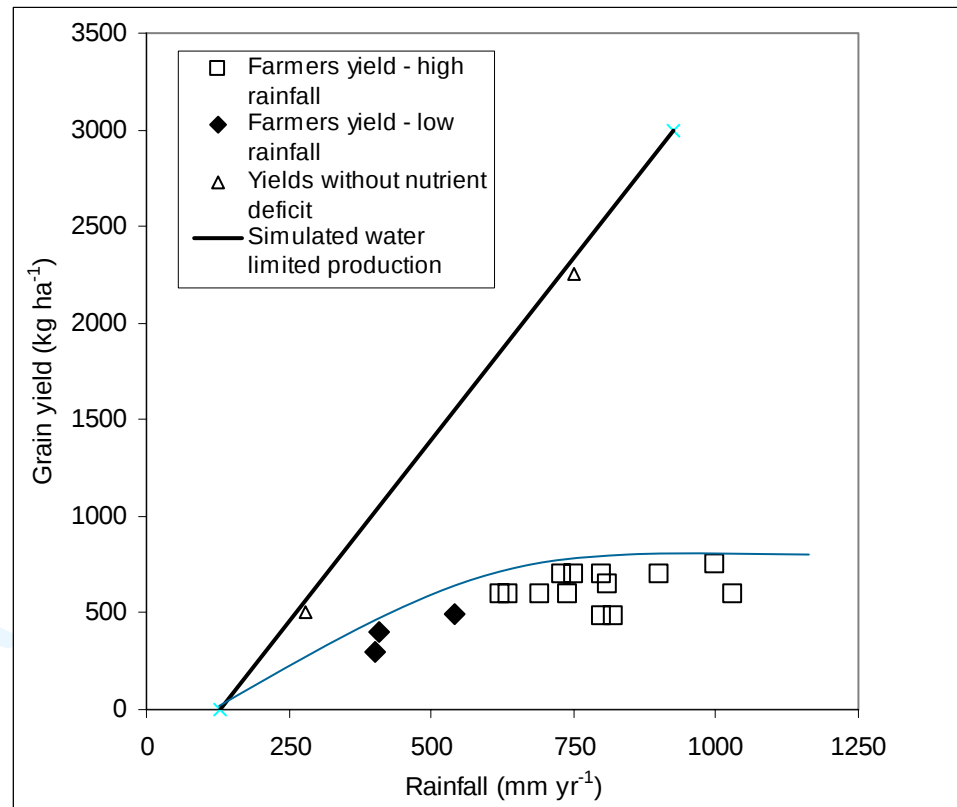
Ethiopia case study after ASARECA & IFPRI, 2005

The second underlying factor is...

- The high variability of soil-moisture available for plant growth, **which**
- Frequently nullify gains from investments in other productivity enhancing interventions, **as**
- Evidenced by the current food crisis in Eastern and Southern Africa – which we have seen all too frequently before

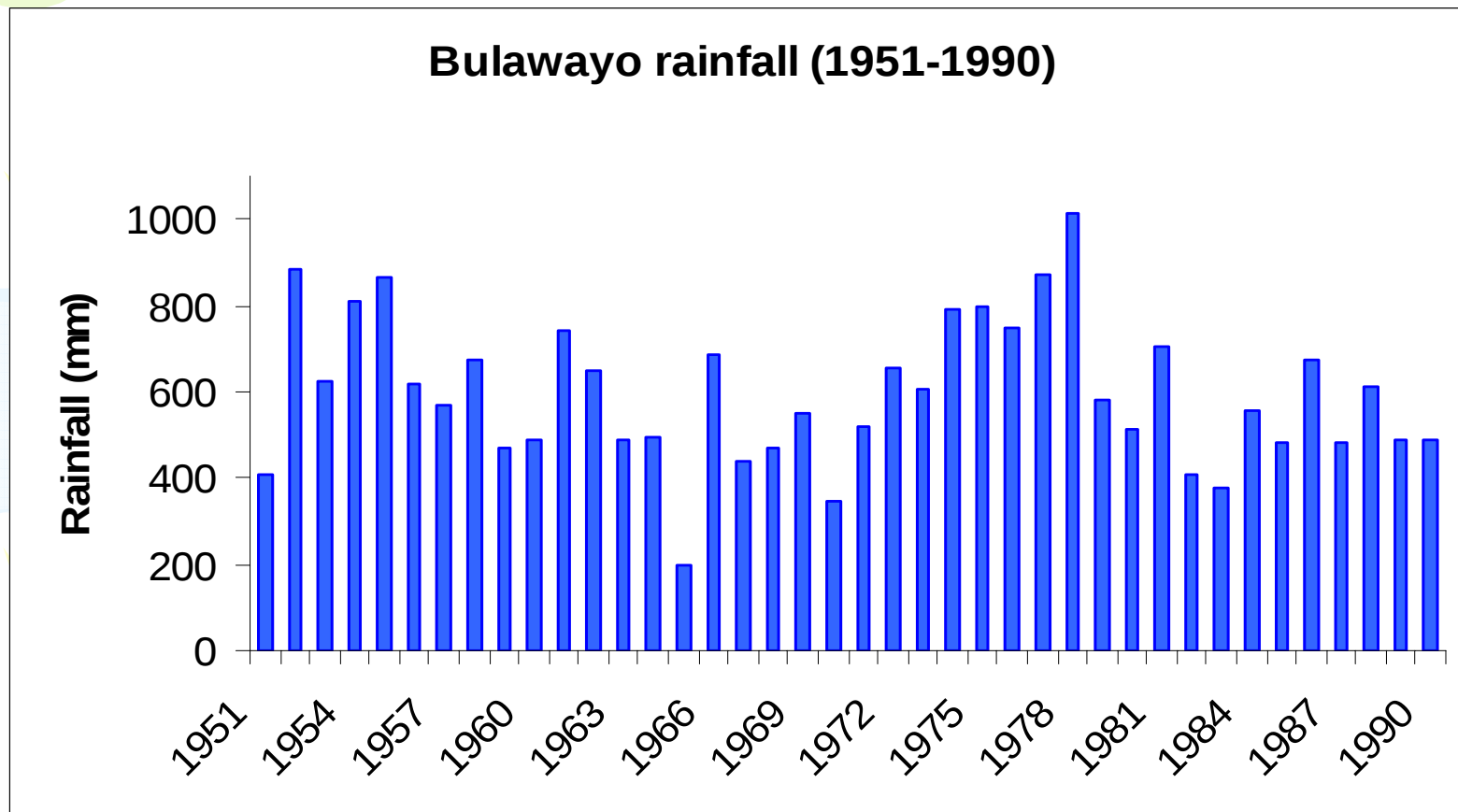
NOTE: the *Green Revolution* in Asia first took root under irrigated conditions

Yes, soil nutrients are often most limiting



Adapted from Breman et al., 2001

But due to variability, investments are too risky



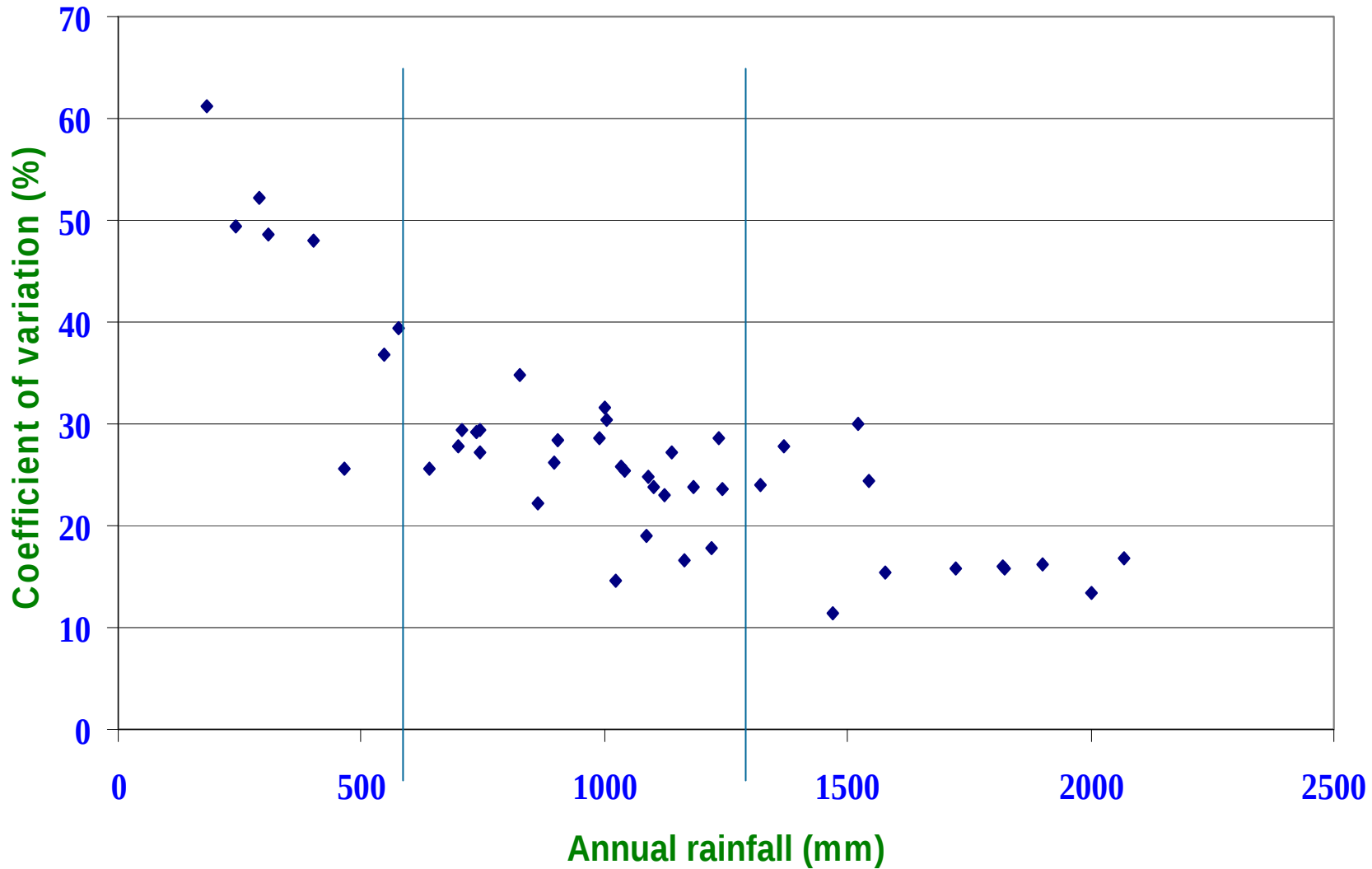
More importantly the rainwater does not stay in the soil...

Because of high intensity rains



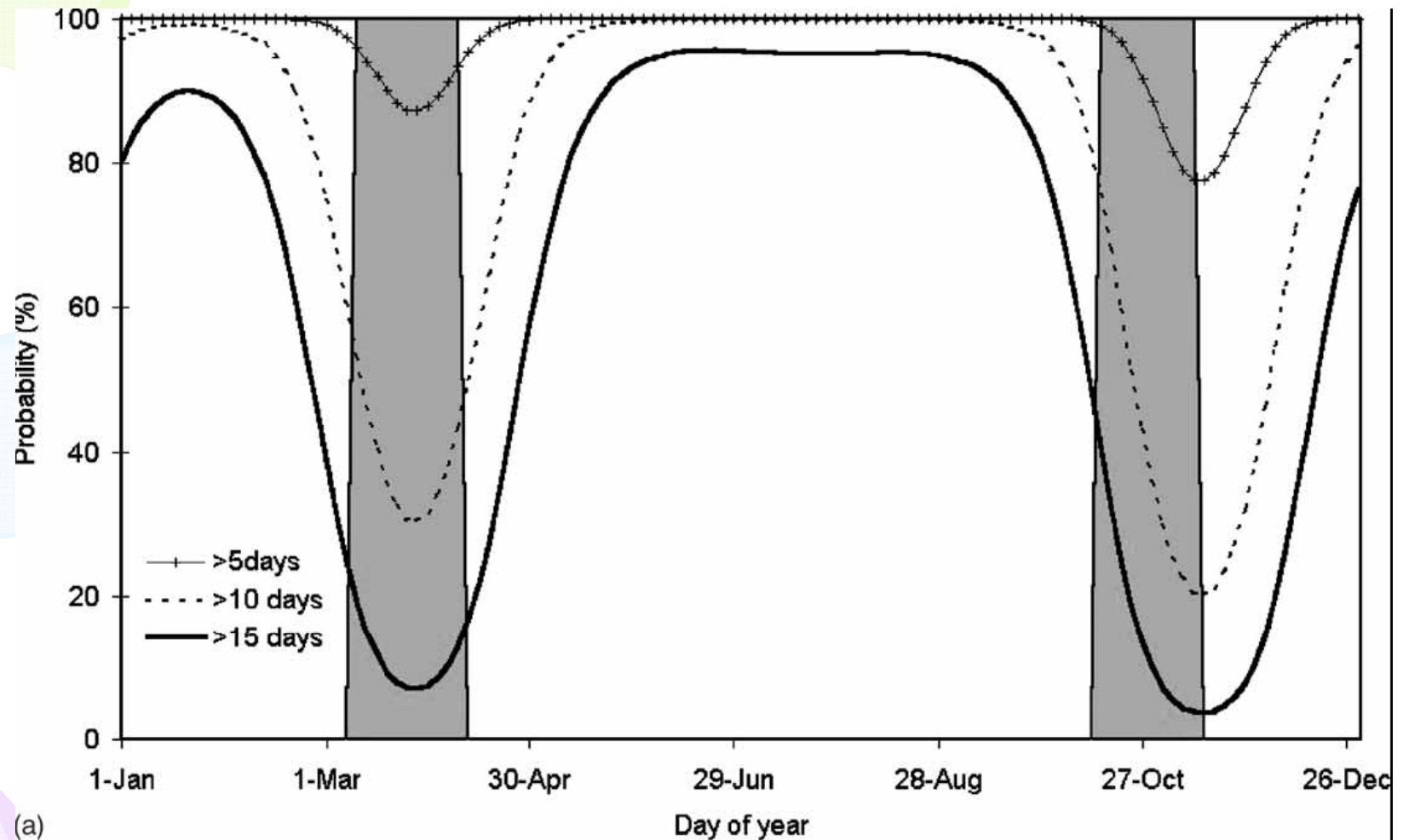
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The variability is higher in dry areas



After Rao, 2005

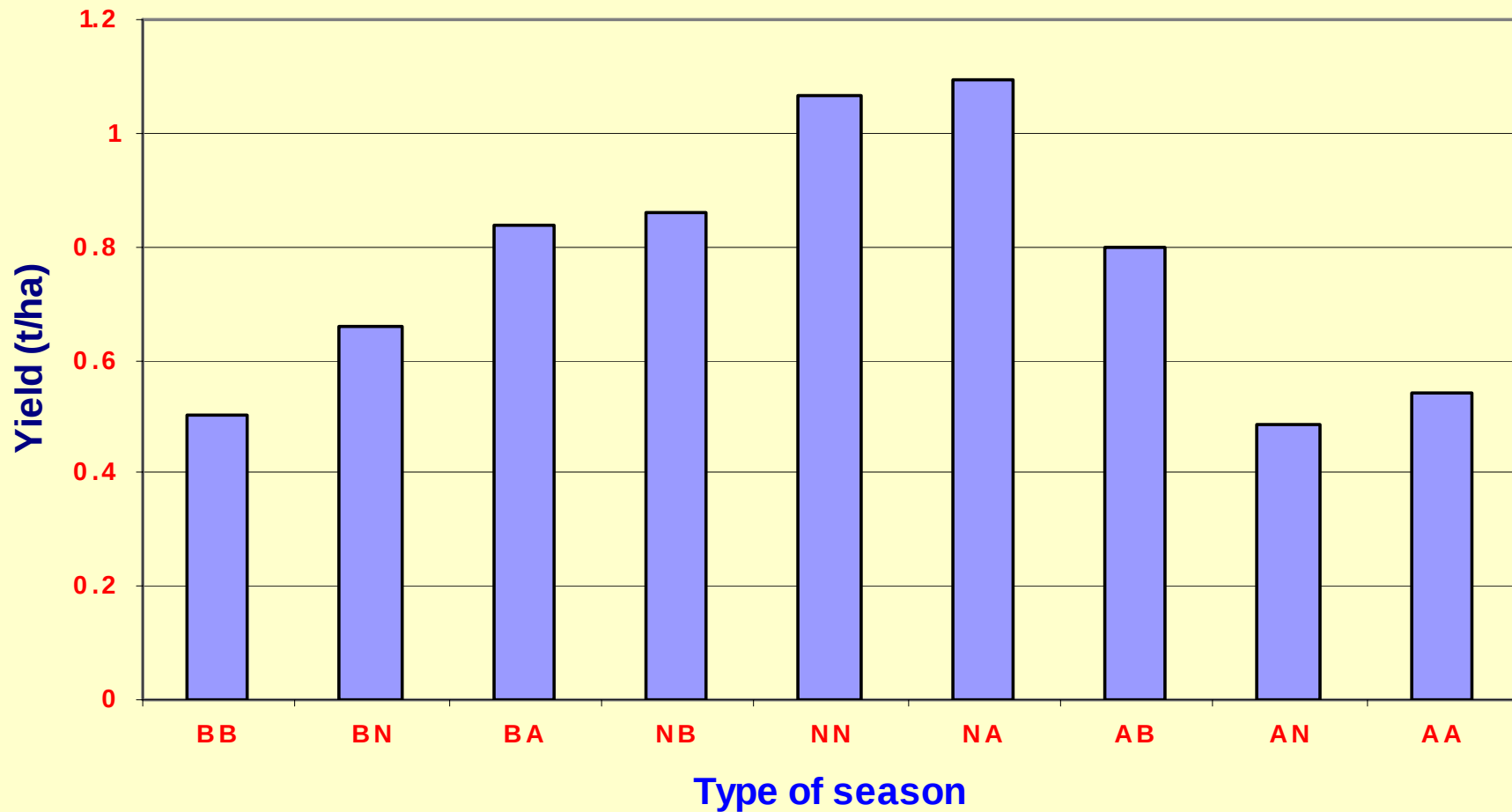
...and High Risk of within-season Dry Spells



(a)

After Barron et al., 2003

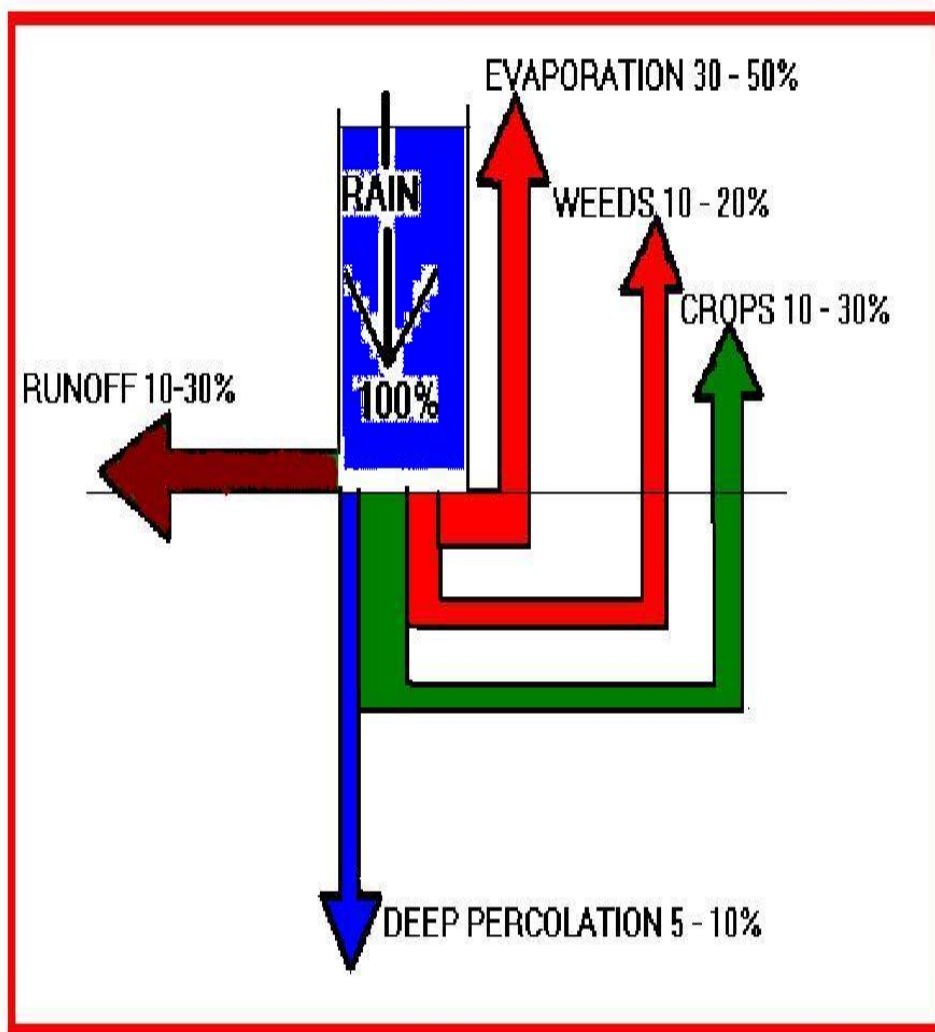
Leading to Risk Management Strategies which do not exploit good rainy seasons...



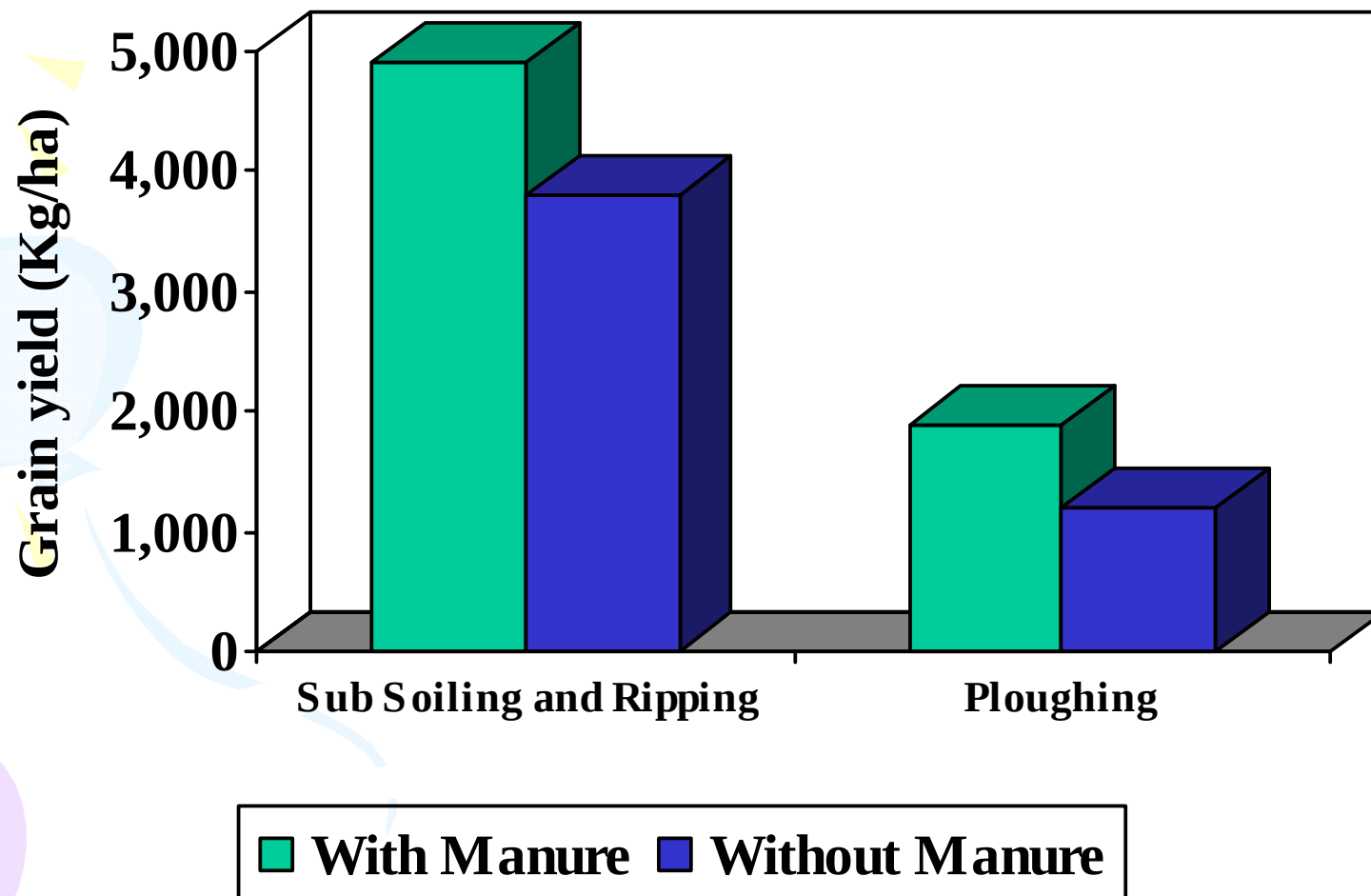
Rainfall conditions during short and long rain seasons and maize yield in Machakos district (B=below normal; N=normal; A=above normal)

Entry point strategy 1:

Get the rainwater into the root zone and hold it



The Benefits are Substantial

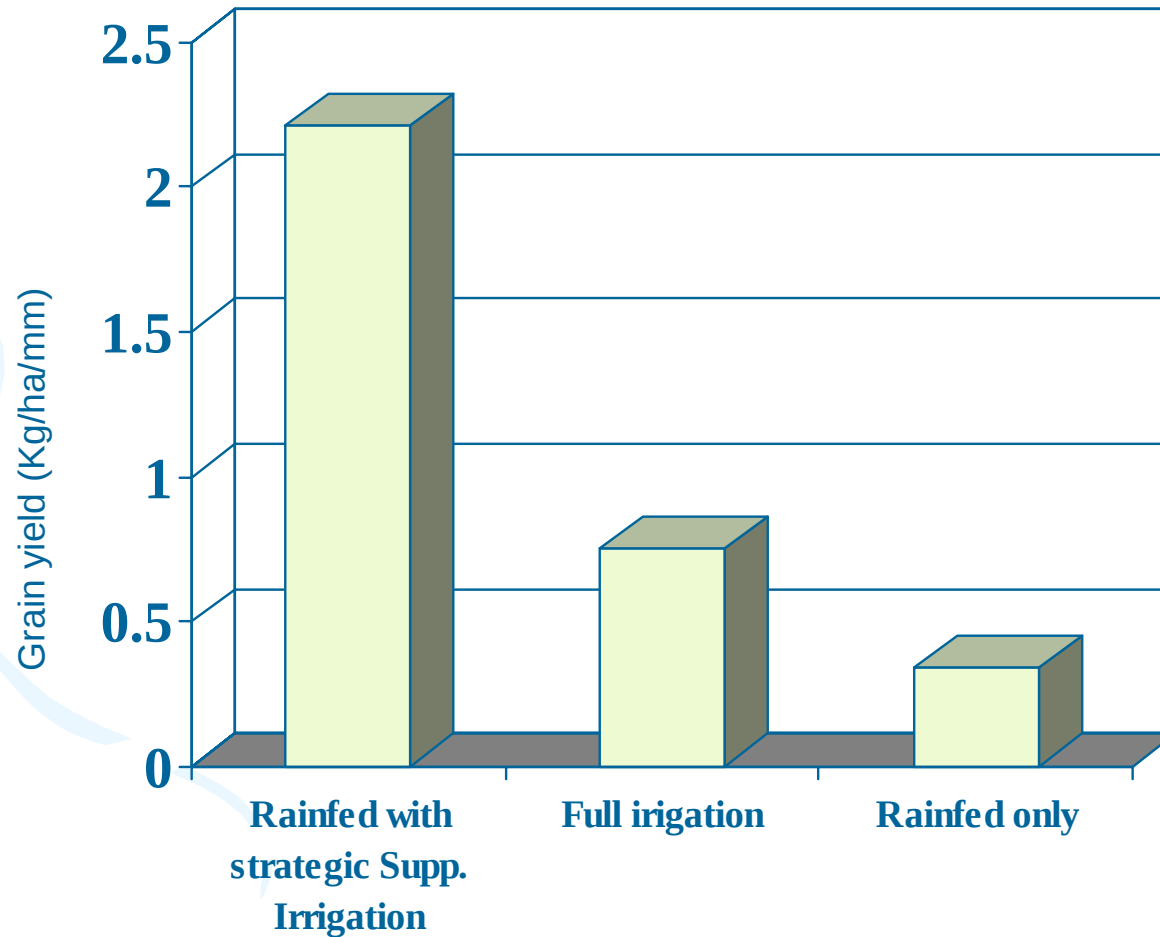


Quick Win ACTION

Treatment of land (crop and pasture) with appropriate interventions for enhanced rainwater capture, infiltration, and soil-water storage capacity. These require enterprises in:

- Sub-soiling and ripping services, which in return require,
- Machinery supply, service and maintenance, supported by
- Regional manufacturing for economies of scale

Entry point strategy 2: Mitigate Dry Spells with Supplementary Irrigation



After ICARDA



Quick Win ACTION

Integrated management of watersheds, including:

- Small water storage + Simple irrigation kits –
- Enhanced soil fertility improvement
- Relatively well developed rural infrastructure
- Affordable means of transportation
- The right mix of enterprises

Quick Win ACTION: Integrated management of watersheds



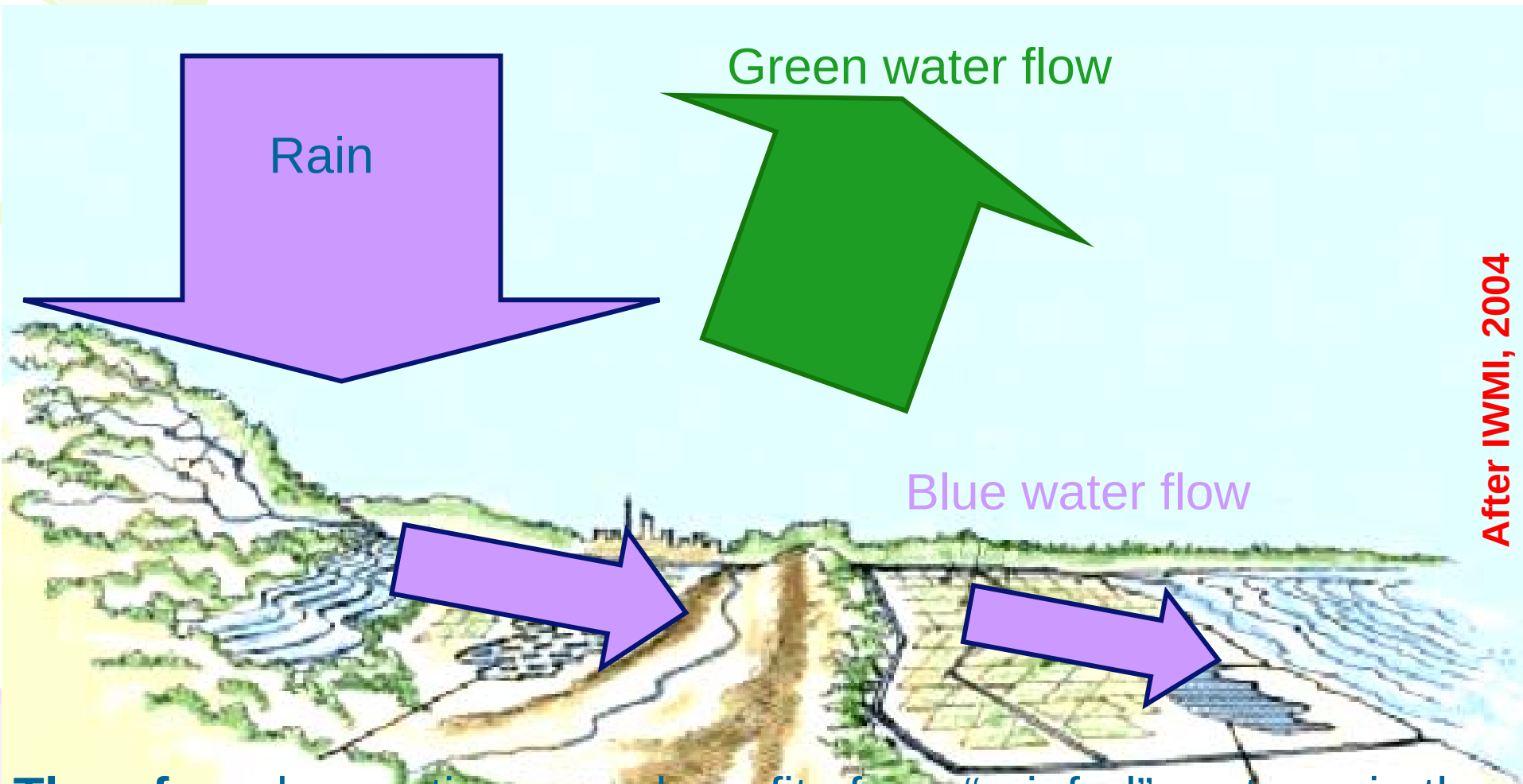
After ICAR

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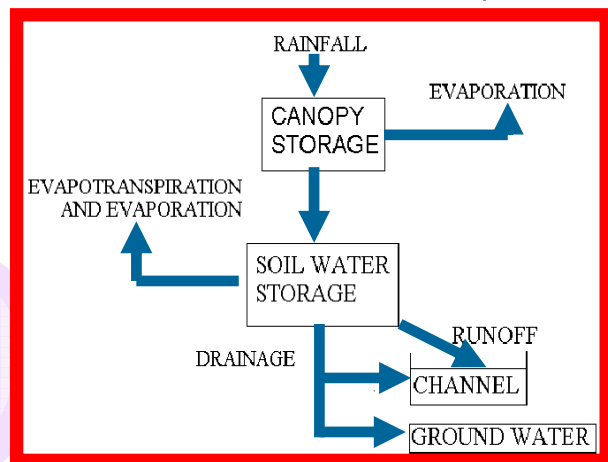
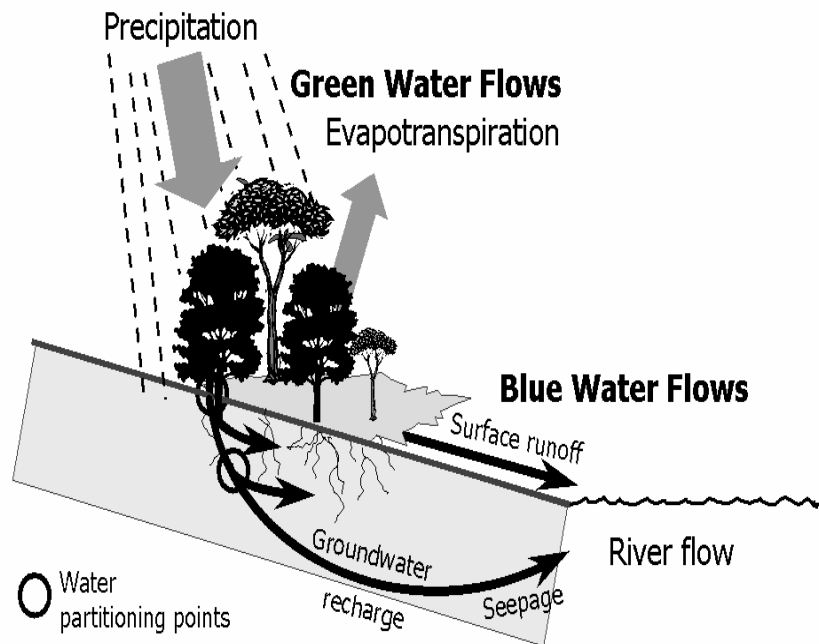
Most water is depleted upstream anyway



After IWMI, 2004

Therefore, harvesting more benefits from “rainfed” systems in the upper catchments is a **Critical** water management intervention

For Effective use of Green Water



- **Green water resource** – soil moisture generated from direct rainfall infiltration on its way to vaporize
- **Green water flows** – total evapo-transpiration from soil moisture
- **Productive green flow** – Transpiration of plants we use *beneficially*
- **Non-productive green flow** – Evaporation flows
- **Blue water flow** – surface runoff and base flow
- **Blue water resource** – groundwater, lakes, reservoirs, wetlands

Water - Land - Livelihoods Interaction

LIVELIHOOD OPTIONS WATER USE OPTIONS

Food trade,
Dairy,
Employment,
Sanitation

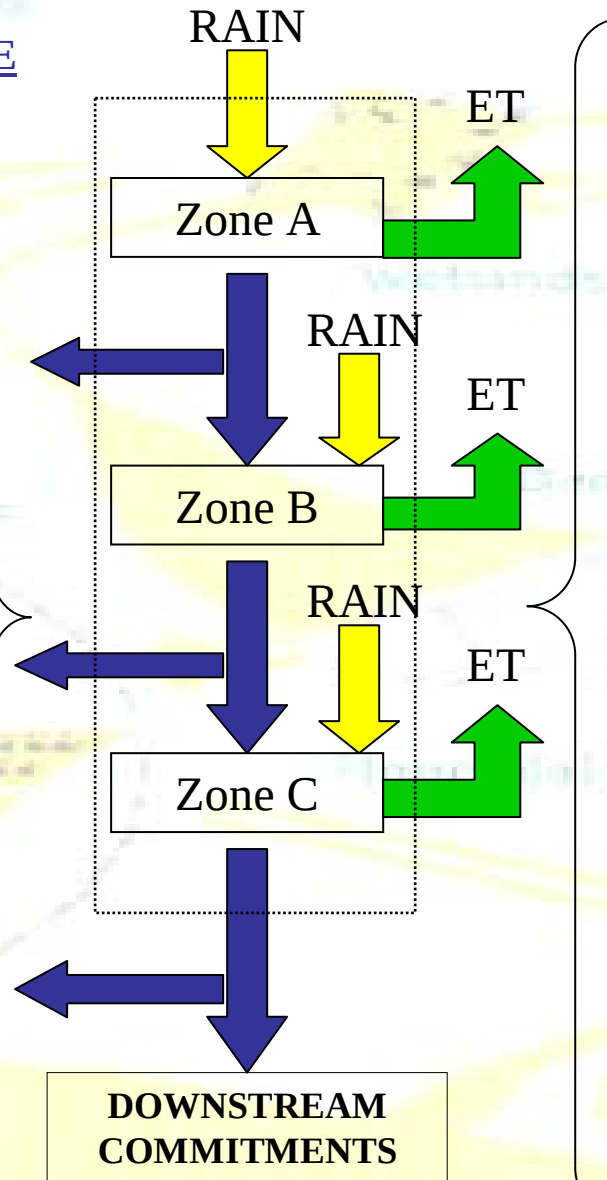
Electricity
sale

Export high
value crops

High value
agric
products

Irrigation
Domestic
Industrial
H.E.P.
Fishing

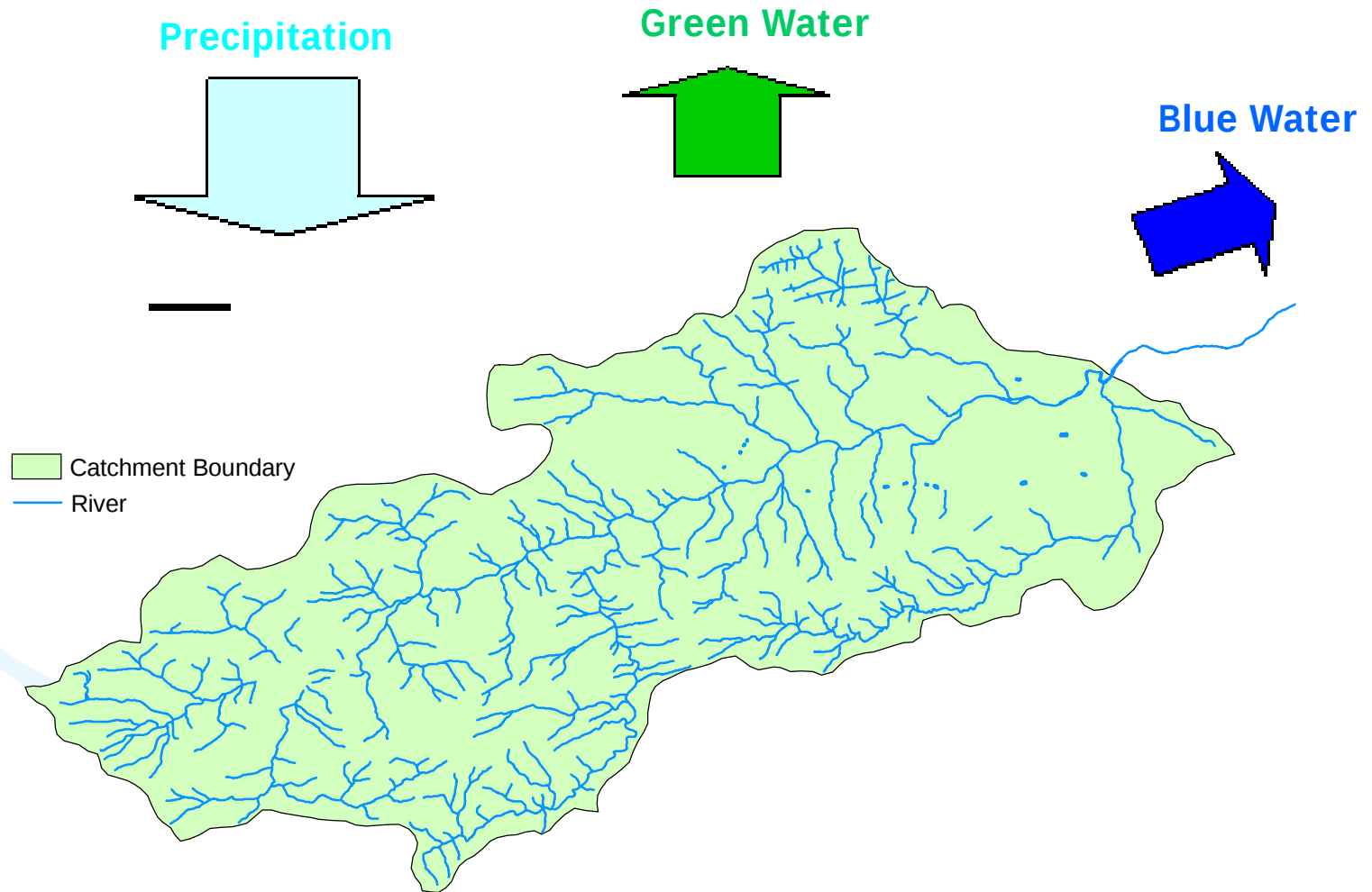
**ENVIRONMENTAL
RESERVE**



<u>LAND USE OPTIONS</u>	<u>LIVELIHOOD OPTIONS</u>
Natural Forestry	Forest Products Tourism
Commercial Forestry	Timber Fire wood
Tree Crops	Food supply Export trade
Annual Crops	Food supply and enterprises
Rangelands	Livestock enterprises Wildlife - tourism
Wetlands	Fishing Tourism

WATER - LAND - LIVELIHOODS **TRADE-OFFS**

by CAMP PROJECT: SWMRG-SUA, KN-SA, UNEW-UK & DFID-FRP



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After CAMP, 2003

SCENARIO 1 - Increase in Forest Cover
"Green Water Flow"

"Blue Water Flow"

Consumptive use

543 mm yr⁻¹

318 mm yr⁻¹

Total Precipitation

859 mm yr⁻¹

After CAMP, 2003

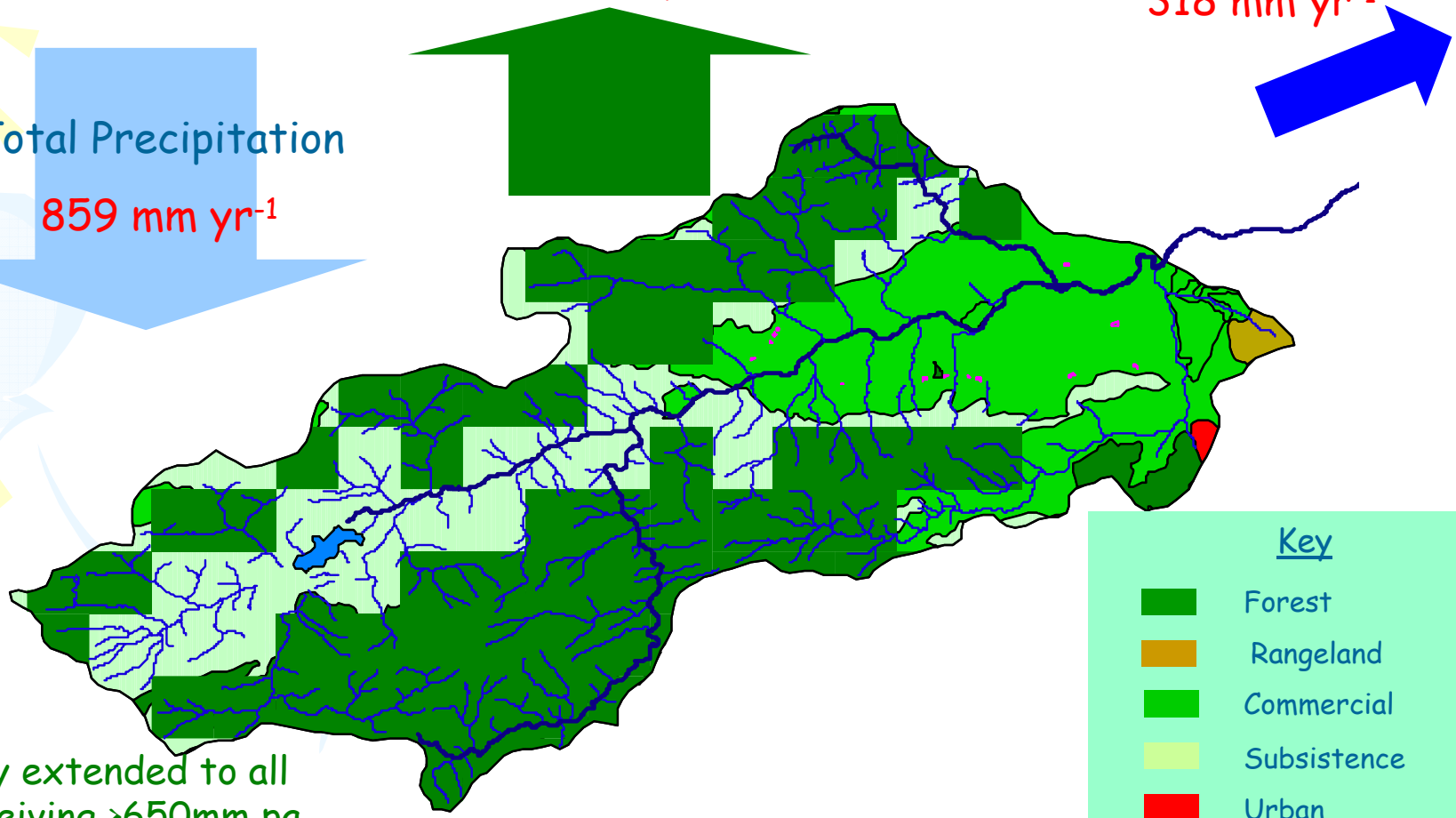
Forestry extended to all
land receiving >650mm pa.

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Key

- Forest
- Rangeland
- Commercial
- Subsistence
- Urban
- Water bodies
- Rivers
- Catchment boundary



SCENARIO 2 - Complete ban on forestry

"Green Water Flow"

Consumptive use

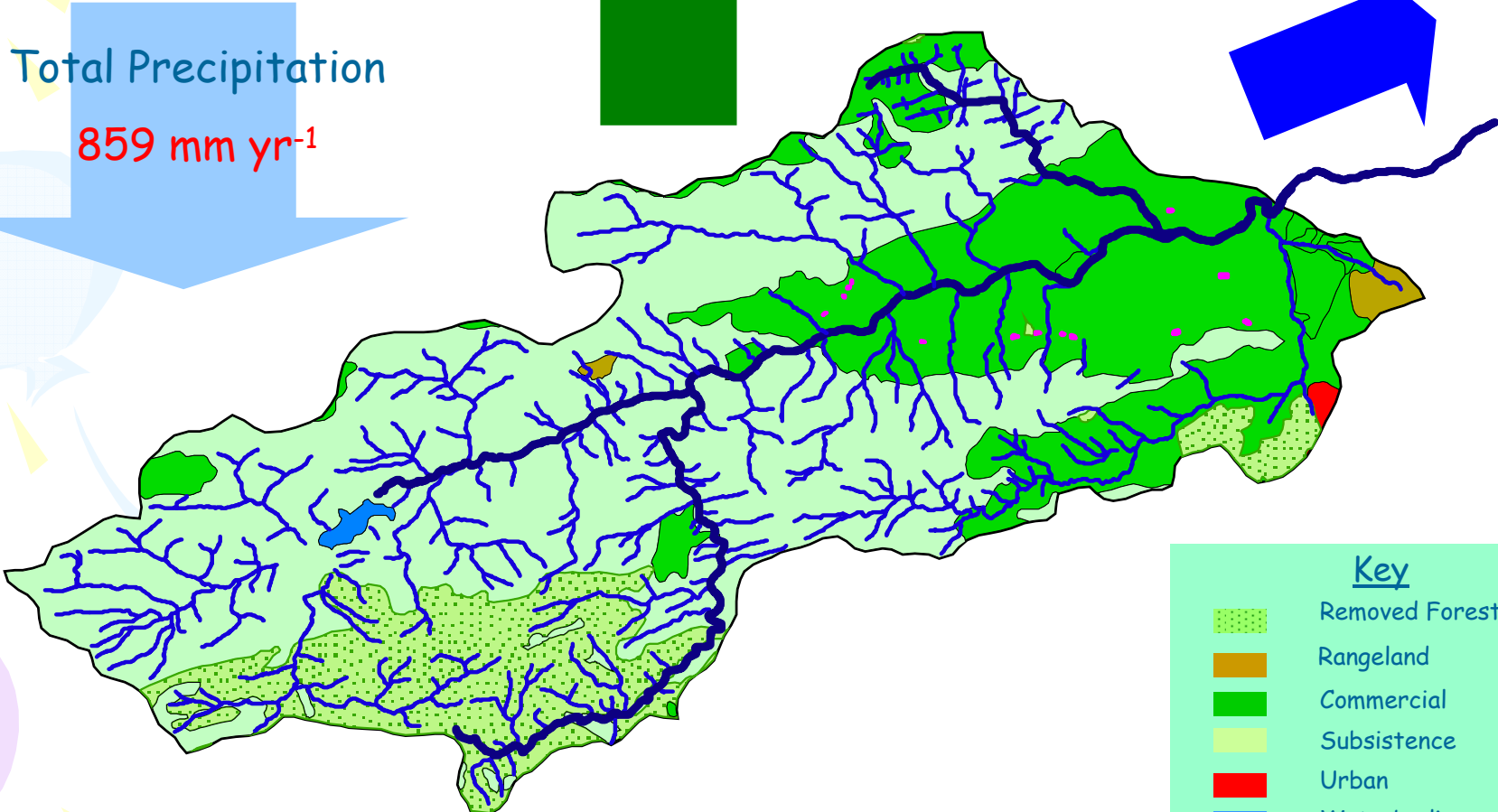
484 mm yr⁻¹

"Blue Water Flow"

375 mm yr⁻¹

Total Precipitation

859 mm yr⁻¹



After CAMP, 2003

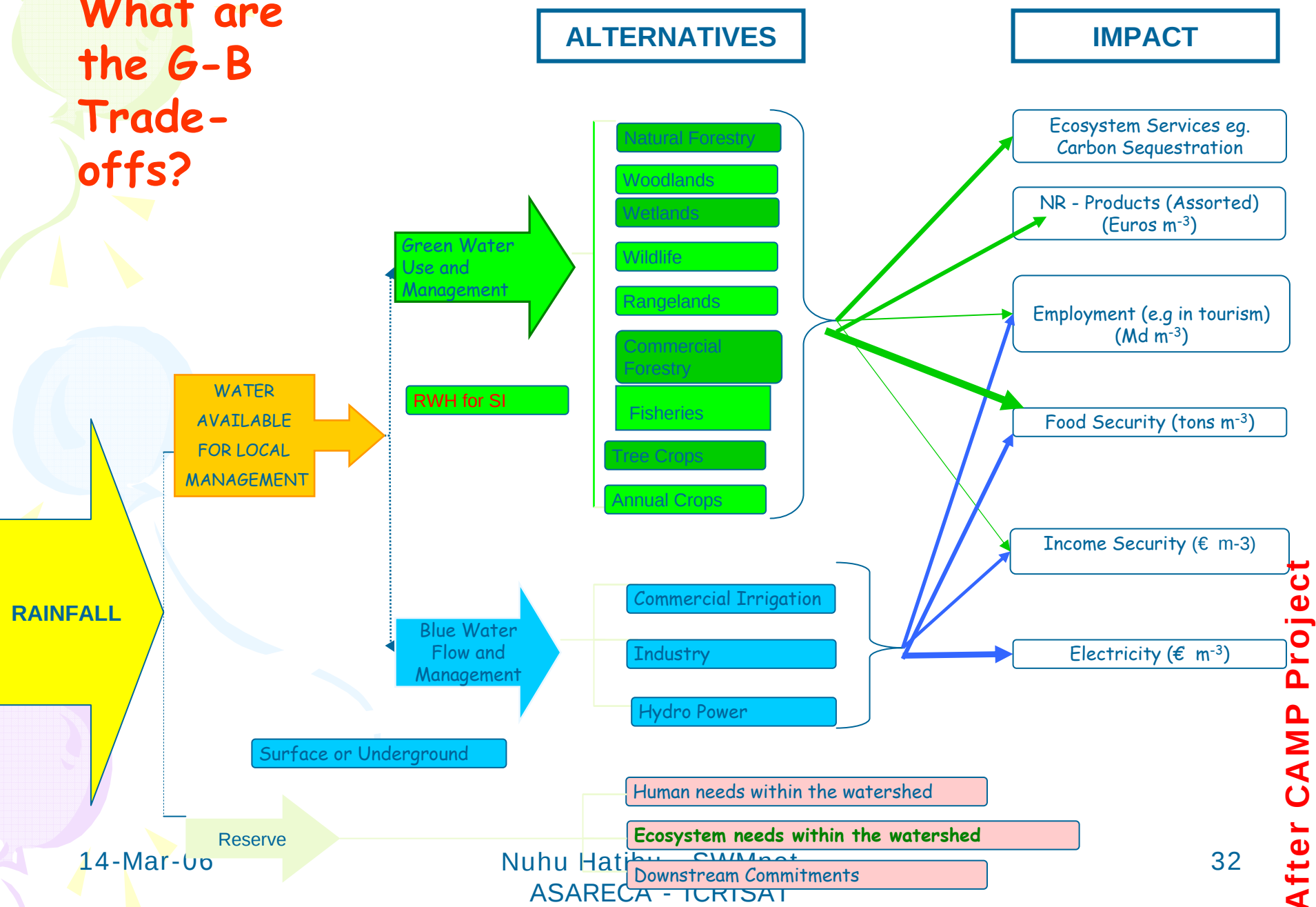
Key

- Removed Forest
- Rangeland
- Commercial
- Subsistence
- Urban
- Waterbodies
- Rivers
- Catchment boundary

14-Mar-06

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What are the G-B Trade-offs?



But Trade Remains the Key - **Because...**

- It facilitates adoption of technical innovations
- Helps to exploit spatial and temporal oscillations in food harvests – *reducing food losses*
- Helps to protect assets of the poor from frequent wiped-out
- Enables the poor to pay for own recovery from crisis – and build confidence
- Will reduce the need for costly investments required to mitigate effects of meteorological droughts

How can it be done?

- Food exchange arrangements – using “futures” trade principles – *e.g maize without borders*
- Rigorous climate modeling and forecasting and mapping of spatial oscillations in food harvests
- Appropriate response with necessary and sufficient management interventions
- **Improved infrastructure and affordable means of transportation**

In Summary

- 1) **Variability** of soil-moisture is one important binding constraint to sustainable soil health in SA-SSA
- 2) Soil health management should focus on:
 - ✓ Efficient systems of rainwater capturing and mitigation of dry spells, and
 - ✓ Soil nutrients inputs to fully exploit good rainy seasons
- 3) But, nothing will work without radical improvement in local, national and regional trade in food commodities and products
- 4) Which in turn requires rapid development of non-agriculture sectors



Thank

You

