

New science and technologies to the rescue of the Horn of Africa



Fawzi Karajeh

f.karajeh@cgiar.org ; icarda-cairo@cgiar.org

www.icarda.org

For the meeting

National Resilience in the Horn of Africa and the Arabian Peninsula

17-21 October 2011

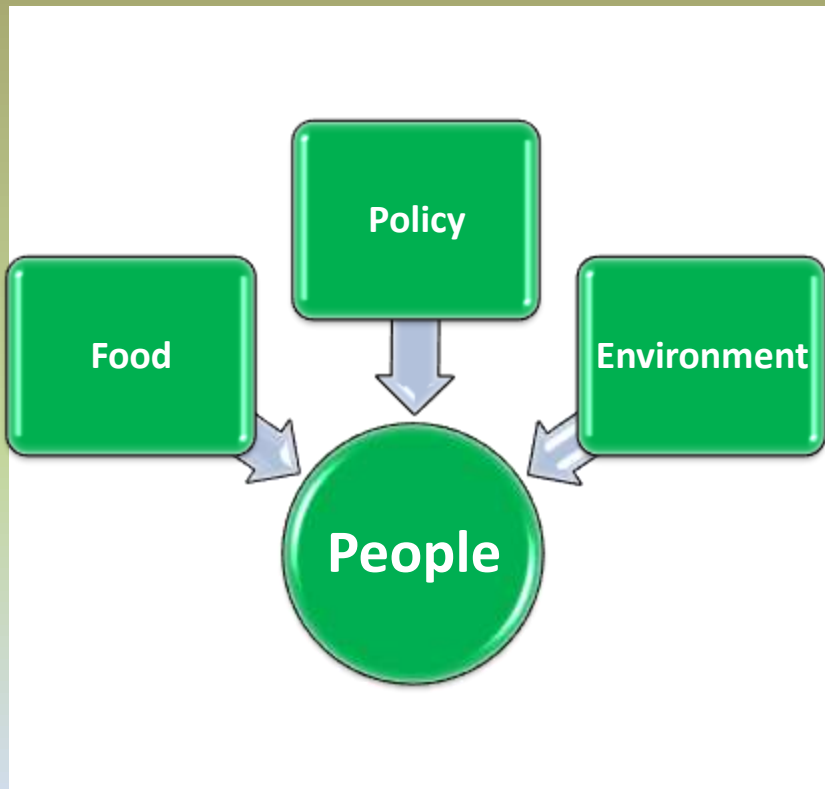
Milan, Italy

Presentation Outline

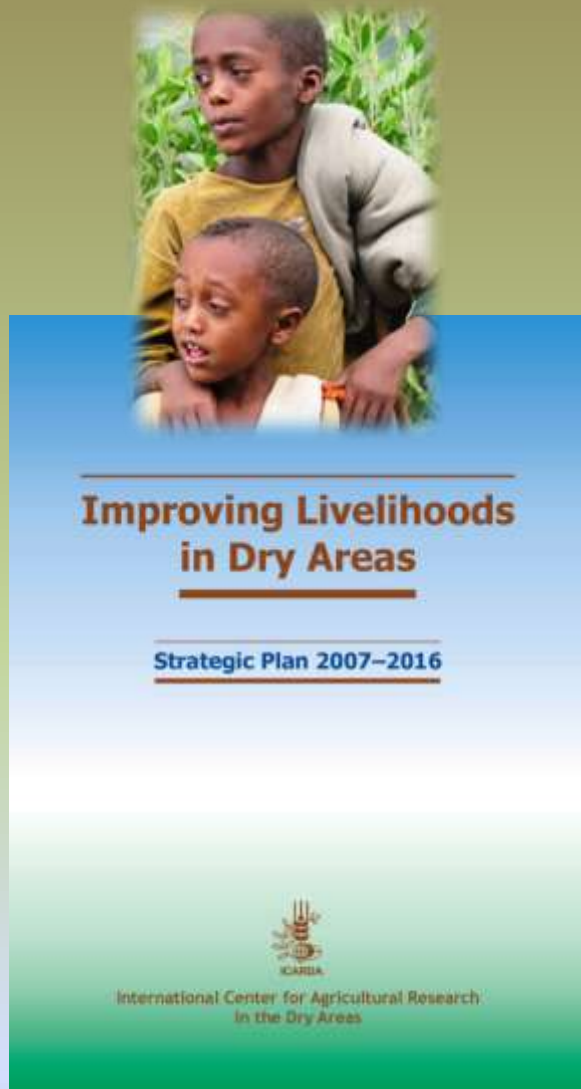
1. ICARDA and CGIAR
2. Challenges facing the dry areas of Africa
3. Opportunity within the dry areas of Africa
4. ICARDA's Research Programs
5. Selected proven technologies ready for out scaling
6. Proposed ideas for research
7. Concluding remarks



CGIAR Strategic Objectives



ICARDA's Strategic Objectives



Major Challenge Facing Agriculture in dry area regions

- **climate change,**
- **lack of adequate natural resources,**
- **lack of enabling agricultural policies,**
- **insufficient investment in agricultural research and development,**
- **shortage of experienced scientists,**
- **poor seed production and distribution programs, and**
- **lack of inter-regional and sometimes inter-institutional collaborations.**



CRP1.1: Integrated Agricultural Systems for the Poor and Vulnerable in Dry Areas

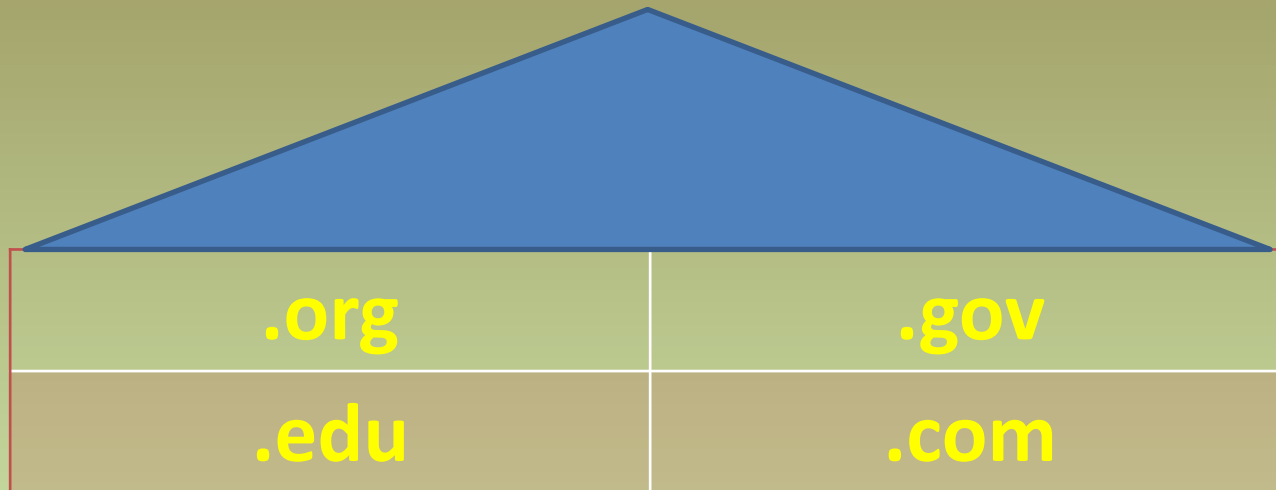
A systems approach for sustainable, profitable dryland agro-ecosystems

Research that focuses on individual components of an ecosystem, in isolation, leads to limited impacts on the ground (bottom). Dryland agro-ecosystems involve complex and dynamic relationships between multiple components: soil, water, crops, vegetables, livestock, trees, fish ... and people. If this reality is not well understood, research outputs are not always adopted by the intended users. When researchers join farmers, livestock keepers, foresters, and fishers, focusing on integrated systems rather than individual components (top), understanding increases, research becomes demand-driven, and outputs are aligned to user's needs. This approach leads to more effective use of natural resources and better food security and livelihoods for resource-poor households.

Adapted from CRP1.1 document



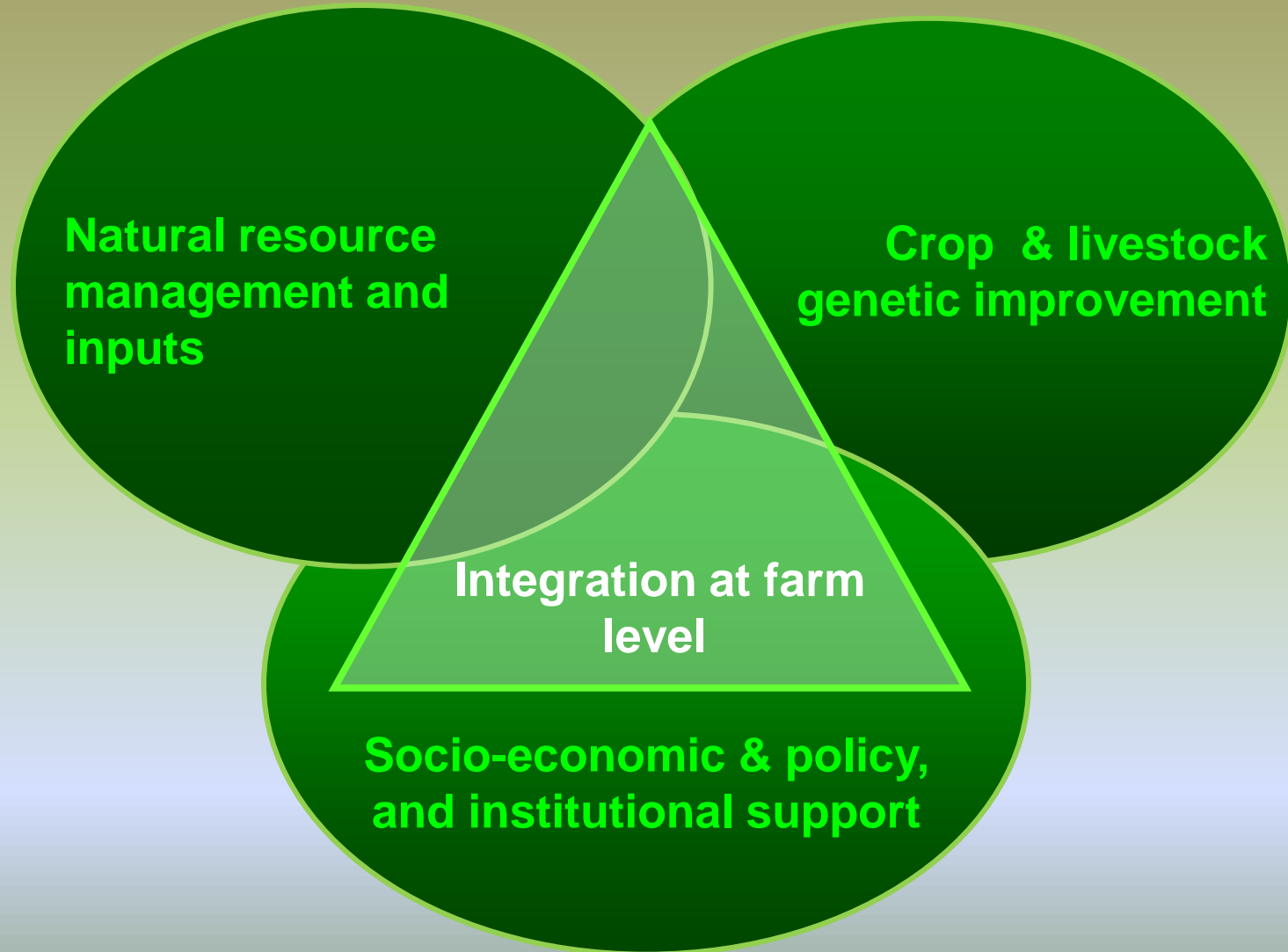
Improve resilience through partnerships



- Agricultural Research Center of the Ministry of Water Resources and Irrigation
- National Water Research Center of the Ministry of Agriculture and Land Reclamation
- Educational and research institutions, and colleges of agriculture of several universities
- Water Users Associations
- Farmers groups and farmer associations
- Rural development sectors at government level
- Development projects funded by International donors
- Private sector

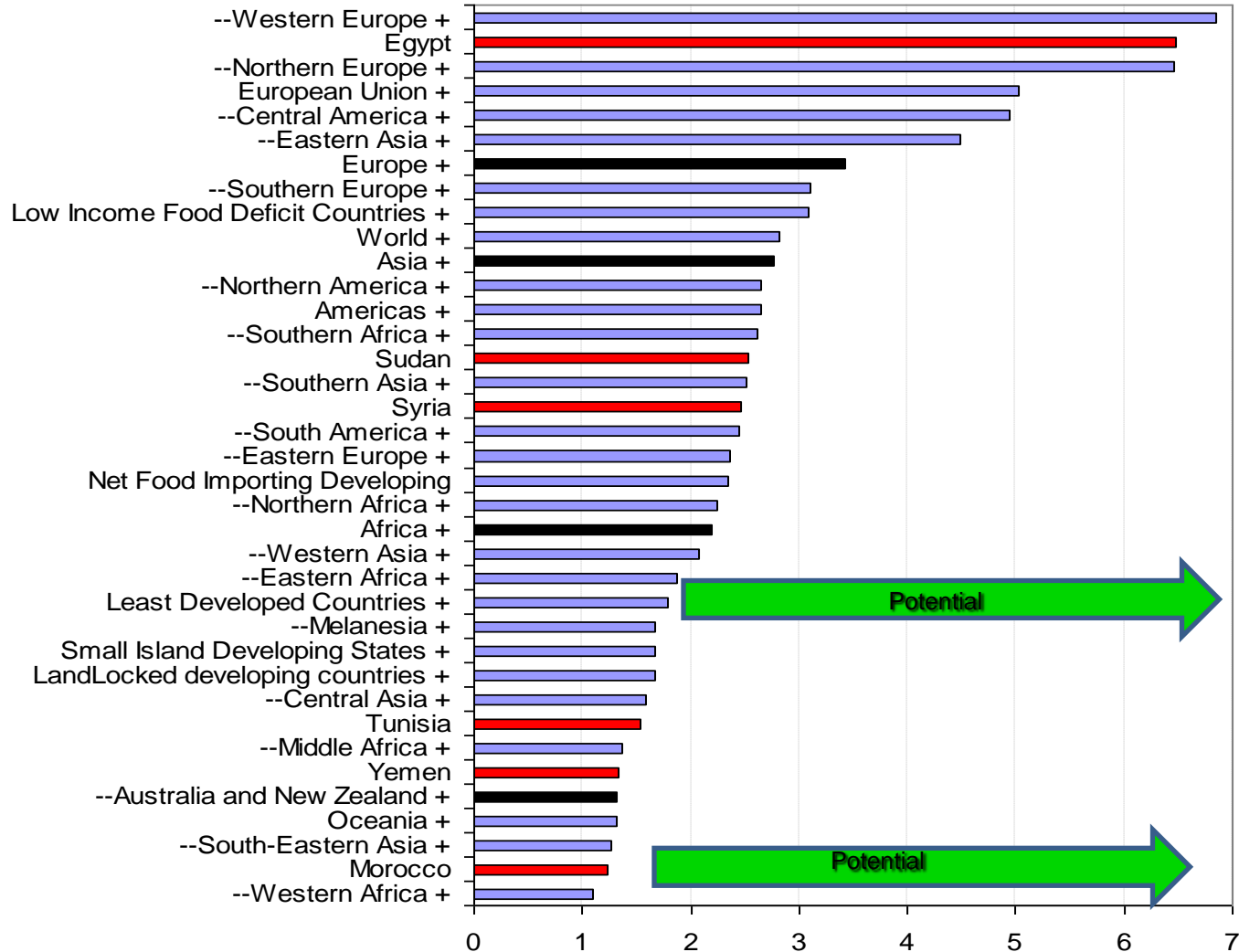
Stakeholders and Partners

ICARDA's Main Research Programs



Bridging the Widening Yield Gap

Avg. Wheat Production per area t/ha for (2005-2007)



Food insecurity and the way forward

The increase in food demand will need to be met by productivity increases and the diversification of the food supply.



Should be achieved without compromising the already scarce natural resources.

Achieving food security will require significant progress in:

1. Use of best available technology including the use of biotechnology
2. In the context of climate variability and change, special attention must be given to the production of more water use-efficient, drought-resistant, salt-tolerant, multi diseases resilient plants for the production of food and feed;
3. Develop techniques to decrease losses of harvest, post-harvest losses, increase storability, transportability, and increase the nutritional value;
4. Biofuels should not be allowed to compete for the same land and water that produce food for humans and feed for their livestock;
5. Develop and/or maintain a fair interregional and international trading system that allows timely access to food;
6. Cultural and food intake habits changes to ensure healthier and more efficient use of agriculture products and minimize food waste- public awareness campaign; and
7. Better understanding of potential inhabited hotspots as a result of climate variability and change- floods, droughts, and their socioeconomic resilient level.



"Horn of Africa Drought Crisis"



- The Horn of Africa encompasses **Somalia, Ethiopia, Eritrea, Djibouti and Kenya.**
- It's one of the most food insecure regions in the world.
- Famine Early Warning Systems Network, FEWSNET, reported that this year was among the driest since 1950 (<http://www.wfp.org/crisis/horn-of-africa>).
- **Causes of the crisis?**
 - Long-term and frequent drought-- poor crop harvest, poor rangeland productivity, and low livestock productivity
 - Conflicts
 - Rising food and fuel prices
 - Lack of regional inter-regional trade cooperation

||
||

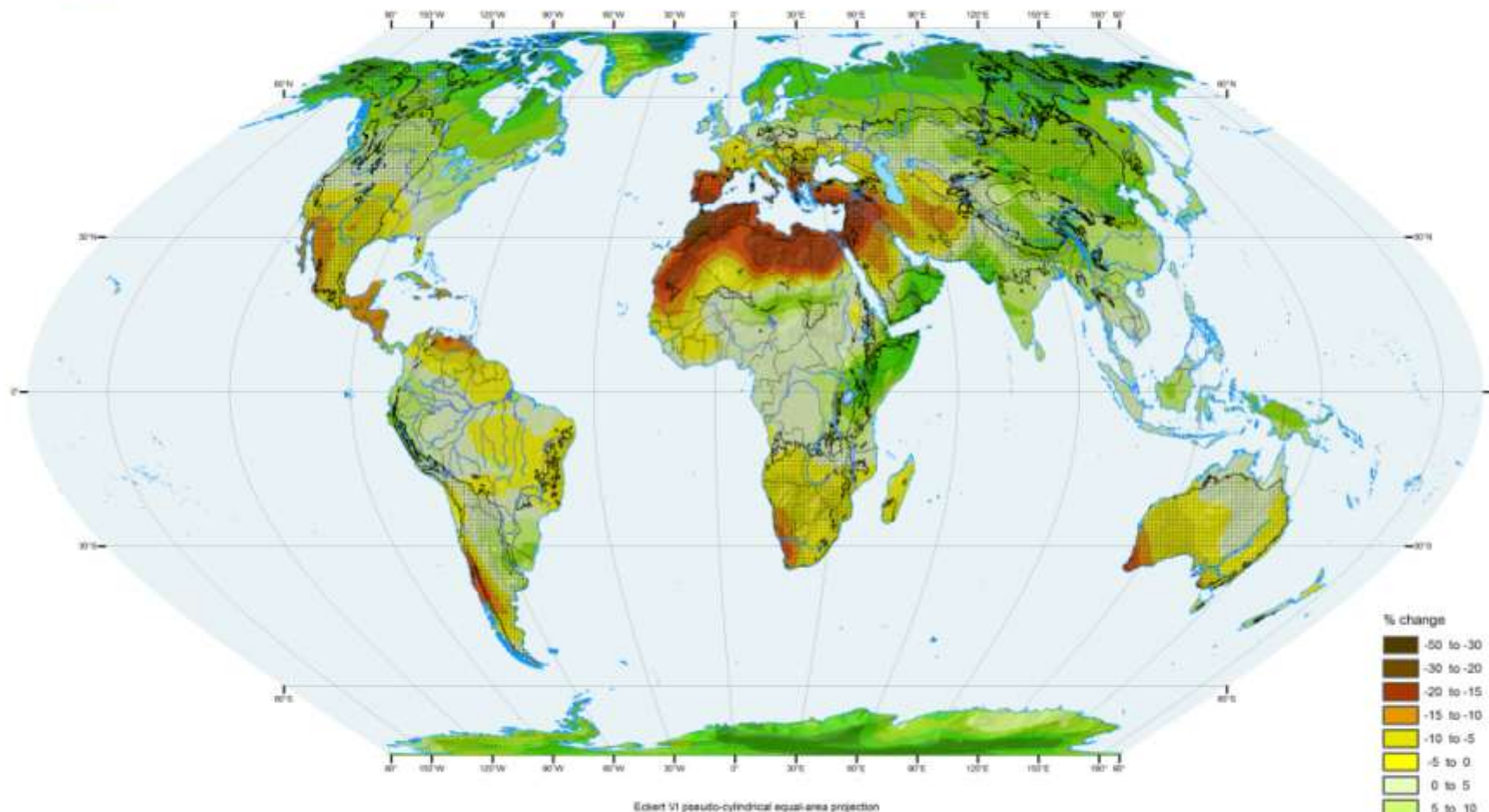
a flood of refugees from Somalia into neighboring countries, in turn, caused a crises to over 13 million people (WFP).





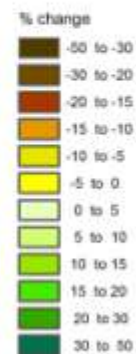
Relative Change in Mean Annual Precipitation, 1980/99 to 2080/99

IPCC scenario A1B, average of 21 General Circulation Models



Map prepared by GIS Unit, ICARDA, 2010. GIS handling: L. Hassen, T. Shababiyeh
Source: computed using data from IPCC Assessment Report 4, 2007
ICARDA follows United Nations standards on delineation of country boundaries

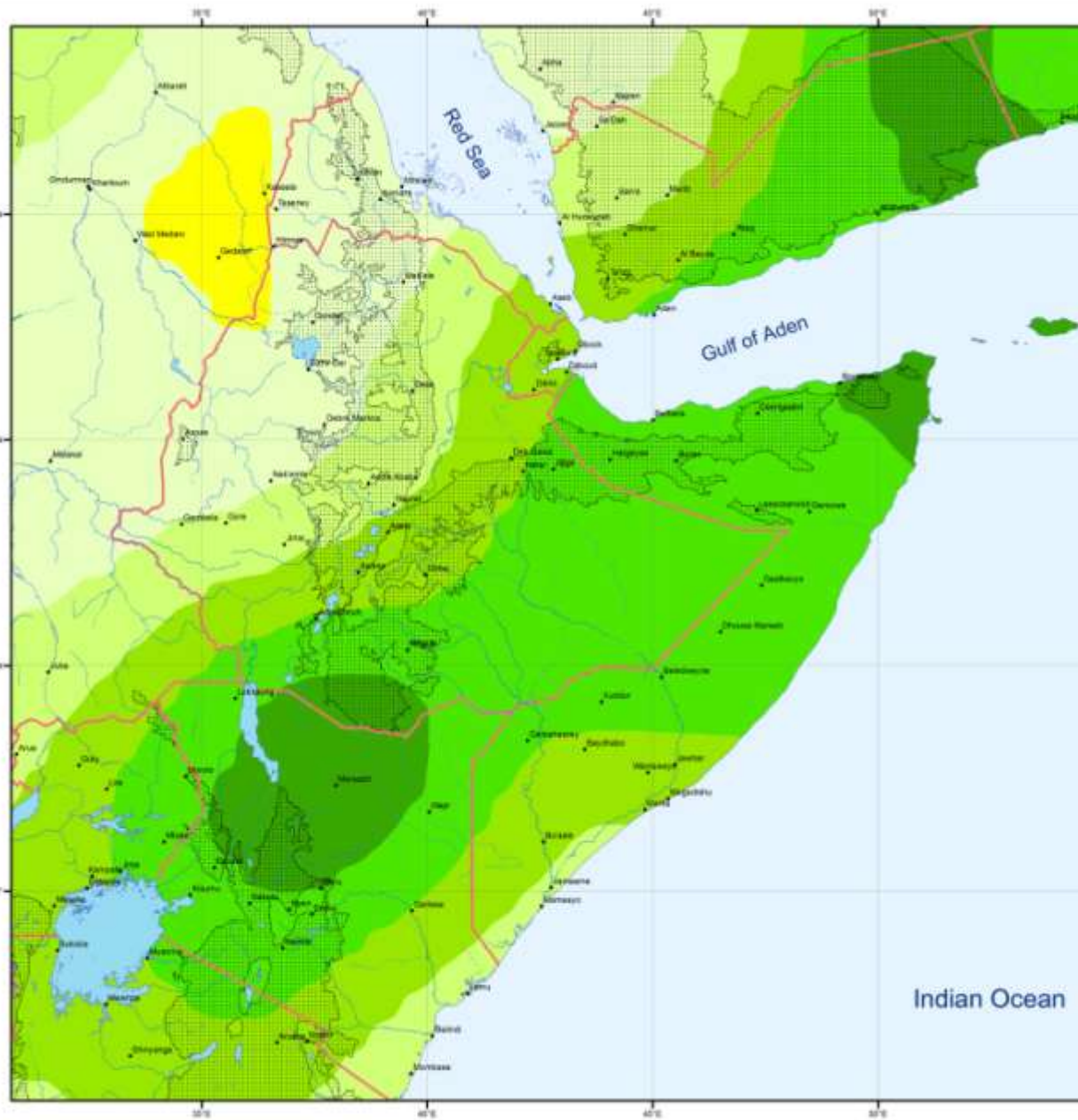
non-tropical drylands (extent 1980/99)



Horn of Africa

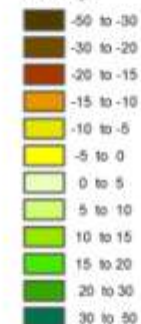
Relative Change in Mean Annual Precipitation, 1980/99 to 2080/99

IPCC scenario A1B, average of 21 General Circulation Models



Legend

% change



 Non-tropical drylands (extent 1980/99)

 Cities

 Rivers

 Lakes

 Sea

 International borders

scale: 1:10,000,000



Map prepared by GIS Unit, ICARDA, 2011
GIS Handling: L. Abate

ICARDA is not authority on country boundaries and follows United Nations practice for country boundary location as indicated on the UN cartographic web site (<http://www.un.org/Depts/Cartographic/english/main.htm>).

New technologies to the rescue (1/3)

Land

- Land suitability and use practice
- Use satellite imagery to classify soils and monitor soil conditions
- More research to understand the soil fertility depletion and buildup and not just add chemical fertilizer needs

New technologies to the rescue (2/3)

Water

- Basin, regional, country, and farm-level water management.
- Develop regional CC modeling for local action.
- Nonconventional water sources (drainage, brackish, recycled water use) with nonconventional agriculture production systems (protected agriculture/cash crops; hydroponic agriculture)

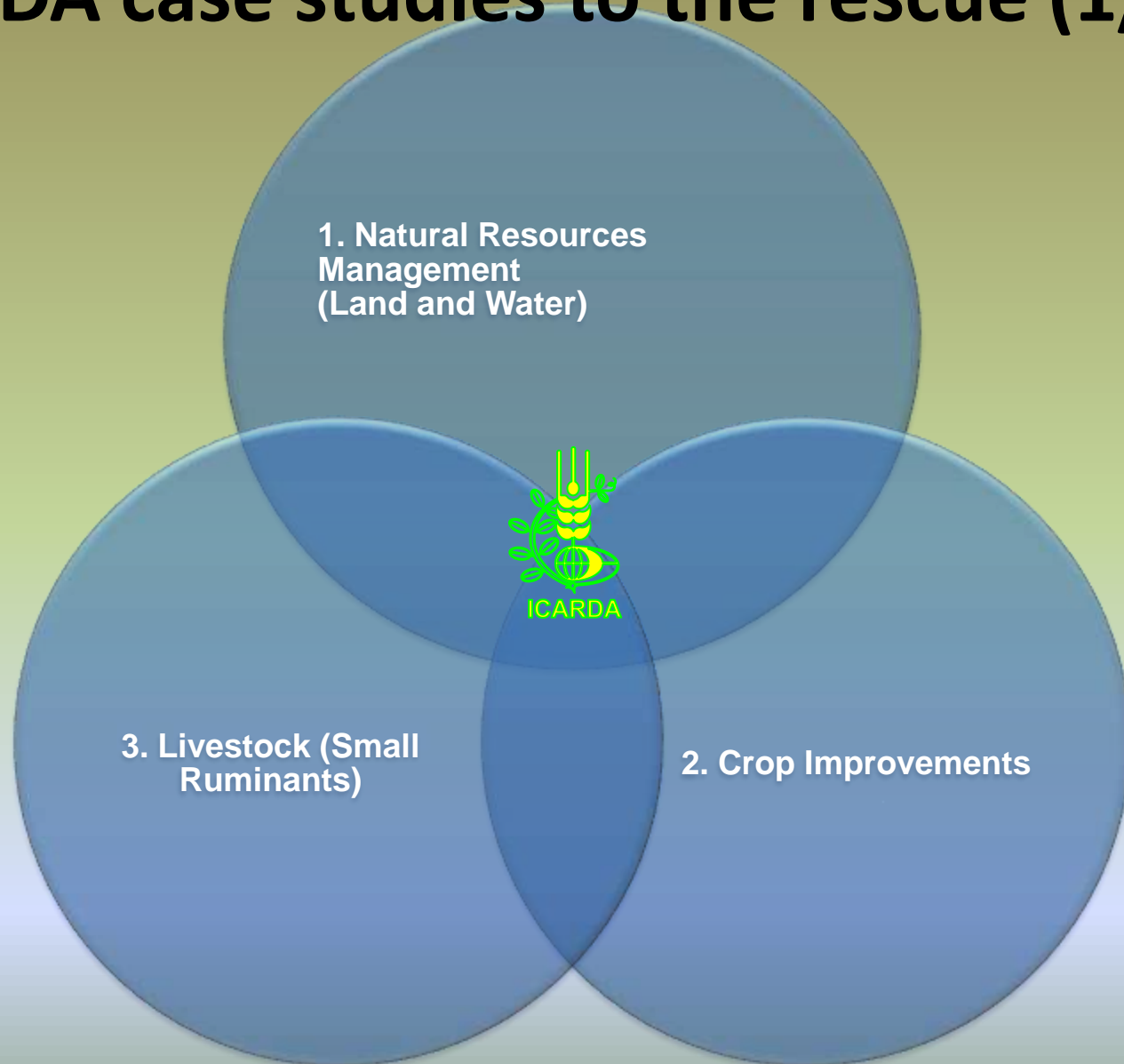
New technologies to the rescue (3/3)

Plants

- Improved and more resilient cultivars
 - Shorter growing season
 - Improve the nutritional qualities of food crops- increase the vitamin **A** content of rice, and **high protein** content to wheat
 - Halophytes characteristics use – open the possibility of adding this capability to crop in more aggressive way
 - Improve cereal-legume based farming systems coupled, where applicable, with livestock production system.
- Research findings to be treated as an international public good (IPG), in turn, on the long run reduce the need for humanitarian assistance



ICARDA case studies to the rescue (1/3)



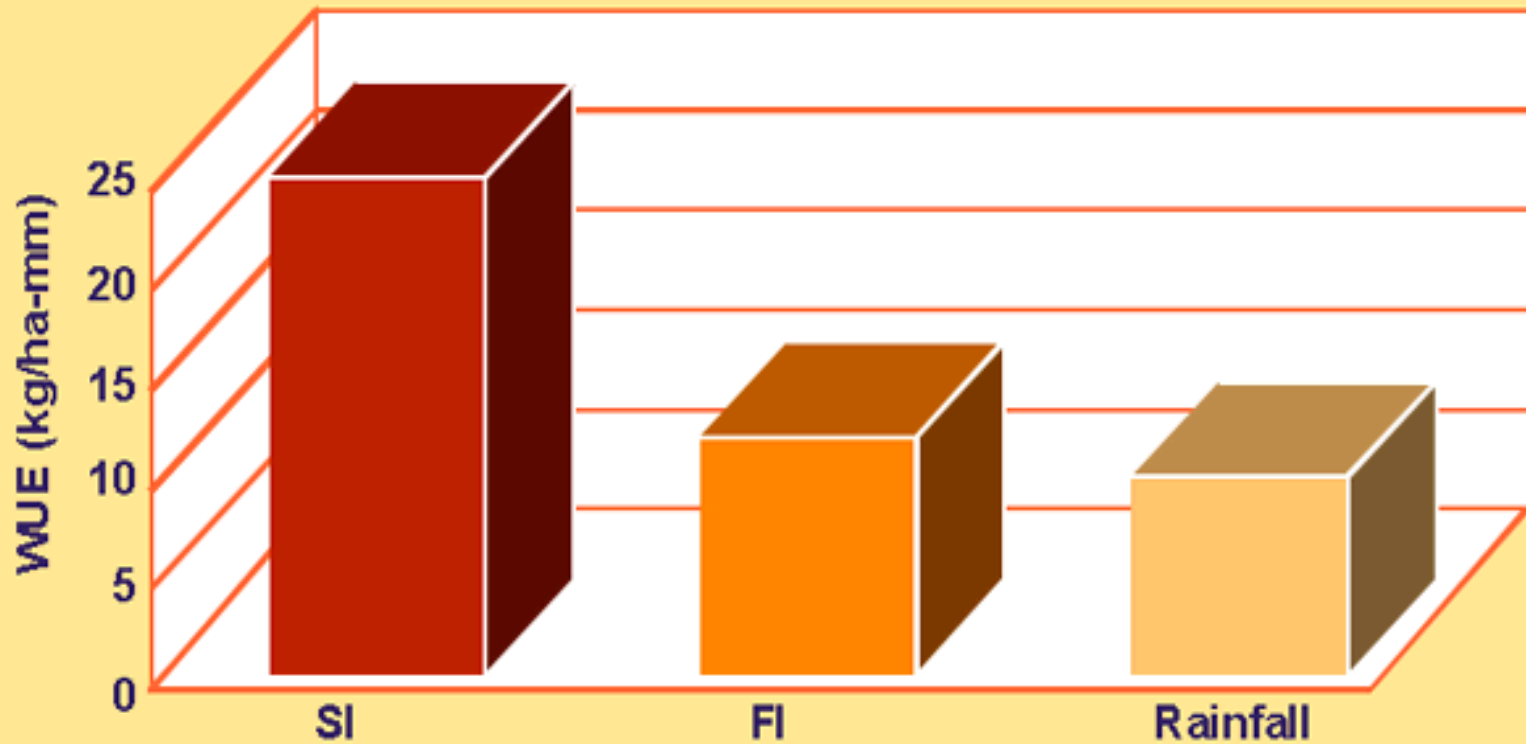
Case study to the rescue (1/3)

1. Natural Resources Management

- Water harvesting and supplemental irrigation techniques
- Conservation agriculture technologies including mechanization options

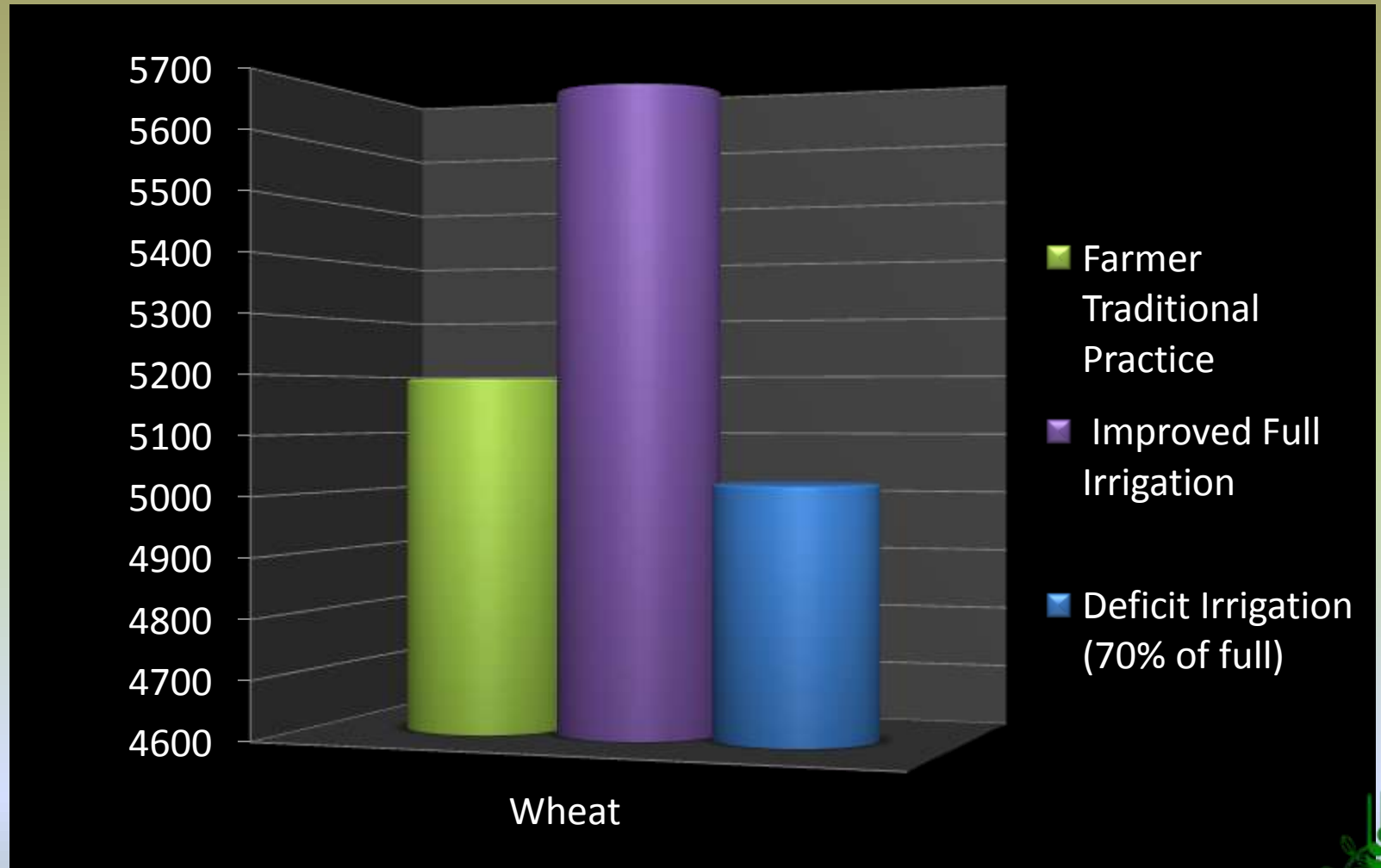


Potential of WUE: Supplemental Irrigation (SI), Rainfed and Fully Irrigated (FI) Areas



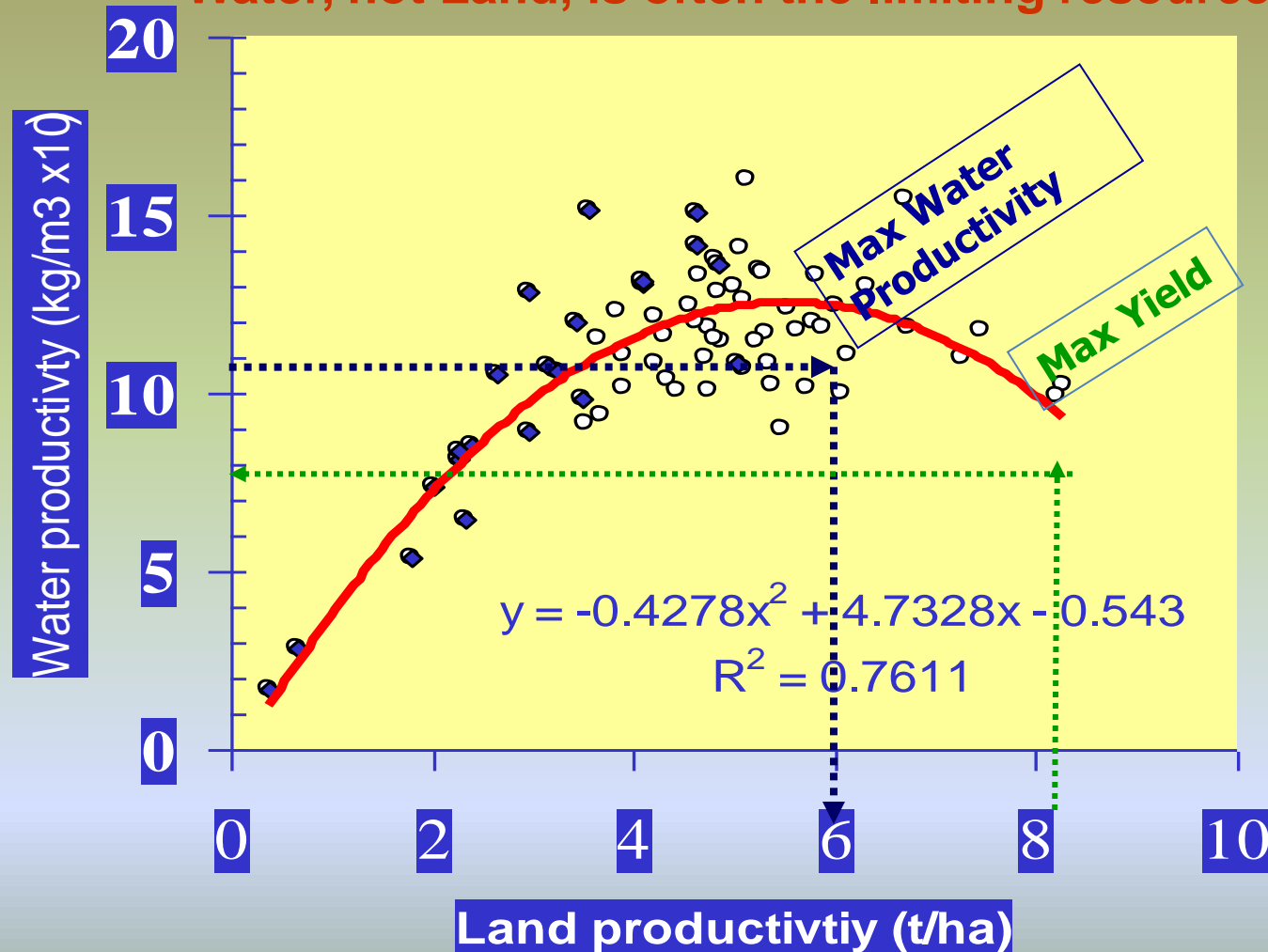
WUE: Water Use Efficiency

the net returns (Rs./ha) for winter season



Tradeoffs between Water & Land Productivity - Deficit Irrigation

Water productivity can be increased substantially
Water, not Land, is often the limiting resource



Case study to the rescue (1/3)

Water harvesting work for farmers and national food security

Eritrea

Produce a 'suitability map' of the Zoba Debub area, to assess the potential of different macro- and micro-catchment water harvesting techniques. The analyses show that 70% of the Zoba area is suitable for at least one of the micro-catchment harvesting approaches.



Yield = 2 X traditional

Case study to the rescue (1/3)

Improved varieties and practices to improve nutrition, employment, farm incomes, in turn, food security

Egypt

Recommended production packages for wheat

- Improved cultivars
- Sowing date: 2nd half of November
- Adequate seed-bed preparation- i.e. raised bed planting
- Use 5-6 irrigation events
- Use of 35 kg/ha Phosphorus' dominant fertilizer
- Seed-bed Preparation
- Use of 170 Kg Nitrogen /ha
- Use ammonia injection (where available)
- Pest Control as needed



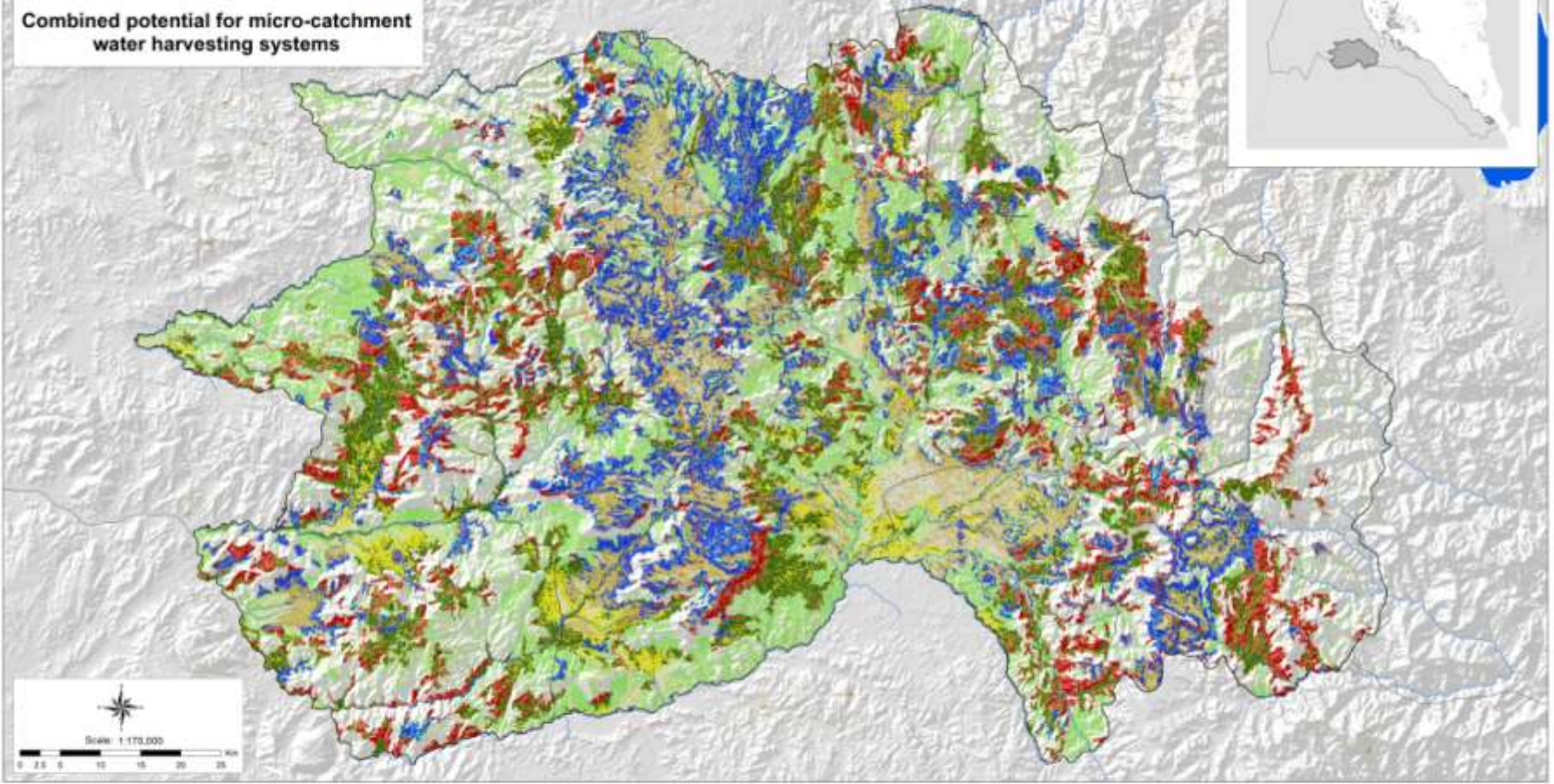
Yield = 1.25X traditional \approx \$0.5 billion



Eritrea Zoba Debub



Combined potential for micro-catchment water harvesting systems



Legend

Map prepared by GIS Unit, ICARDA, 2010.
Author: E. De Pauw.
GIS handling: M.F. Tulaymat.

ICARDA is no authority on country boundaries and follows United Nations practice for country-boundary location, as indicated on the UN cartographic web site
<http://www.un.org/Depts/Cartographic/english.htm>

- Unsuitable for any micro-catchment system*
- Suitable for system 11
- Suitable for systems 11 or 12
- Suitable for systems 11, 12 or 13
- Suitable for system 21
- Suitable for systems 11 or 21
- Suitable for systems 21, 22, 31, 41 or 51

- Suitable for systems 11, 21, 22, 31, 41 or 51
- Suitable for all micro-catchment systems except 11, 12, 13, 6
- Suitable for all micro-catchment systems except 6
- Suitable for system 6
- Suitable for systems 21, 22, 31, 41, 51, 6
- Suitable for all micro-catchment systems except 11, 12, 13

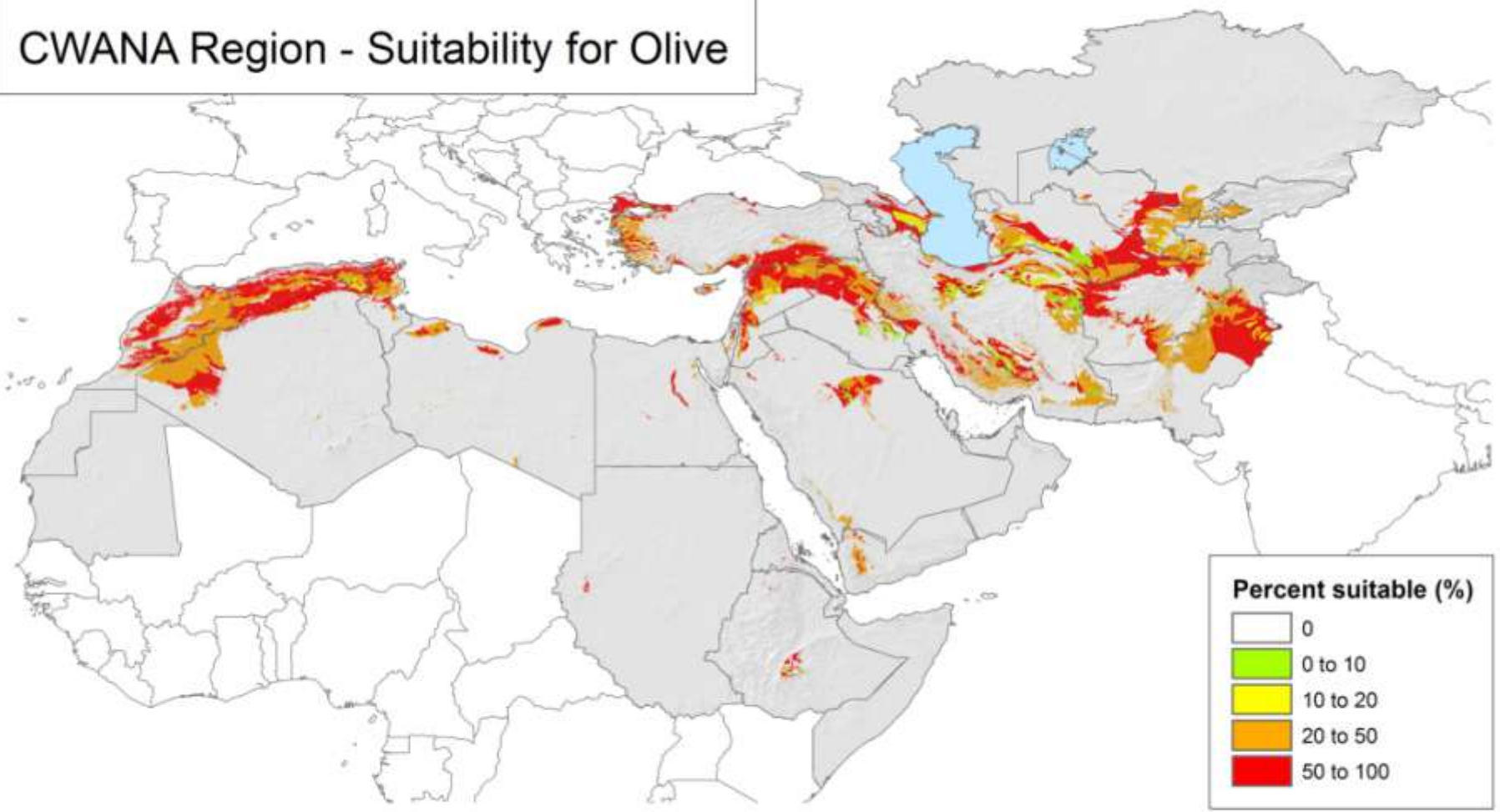
- zoba
- subzoba

- Major roads
- Minor roads
- Drainage lines

- Sub-Zoba Centres
- Unverified dams**
- Verified small dams: Constructed before 2006/2007
- Verified medium-sized dams: Constructed before 2006/2007
- Observation Points 2010: Observation points ICARDA Team April/May 2010
- ★ Spate irrigation areas

Notes:
 *System 11: contour ridges - range shrubs
 System 12: contour ridges - field crops
 System 13: contour ridges - tree crops
 System 21: semi-circular bunds - range shrubs
 System 22: semi-circular bunds - field crops
 System 23: semi-circular bunds - tree crops
 System 31: small pits - range shrubs
 System 33: small pits - tree crops
 System 41: small runoff basins - range shrubs
 System 43: small runoff basins - tree crops
 System 51: runoff strips - range shrubs
 System 52: runoff strips - field crops
 System 53: contour bench terraces
 **Small and medium-sized dams appearing on Map of Ministry of Agriculture, but not visible on Google Earth images dated 2006 and 2007. Either very small and/or dry dams or dams constructed since 2006/2007

CWANA Region - Suitability for Olive



Water harvesting for drinking



Water harvesting for supplemental irrigation



Regional Networks

Regional

- 1. Wheat Improvements Network**
- 2. Legume Improvement Network**
- 3. Water Use Efficiency Network**
- 4. Regional Agriculture Information Network, ICARDA's RAIN)**

International

Global Rust Network

Horn of Africa Network/Task force

New proposed projects- Regional Partnerships

- 1. Use of improved crops and agricultural technologies for sustainable management of ecosystems and poverty alleviation in the dry areas of eastern and central Africa**
- 2. Unlock the potential of rainfed agriculture productivity through integrated ecosystem management systems**
- 3. Improve productivity of salt-affected soils through appropriate reclamation and management practices**
- 4. Increased investments into sustainable land and water management through improved agricultural productivity, environmental sustainability and social equity**
- 5. Integrated ecosystem valuation approach to help stimulate investments and promote responsible land management**
- 6. Capacity development to prepare practitioners to meet the emerging agriculture, land, and water productivity challenges**

Concluding Remarks

- **Business as usual is not an option and working in partnership and in an integrated agro-ecosystem based research are a must:**
 - optimize the R&D systems;
 - promote scaling-up applicable innovations;
 - deepening our learning and share our increasing knowledge.
- **Solution options are a moving targets**
- **Ecosystems degradation and climate variability and change is believed to influence rural poor disproportionately, thus more research for development in rural area is needed**
- **Climate change is global problem, but required local solutions. Thus, local and regional data gathering to refine the model predictions are needed.**





Thank You