International Agricultural Research for Combating Land Degradation in Central Asia

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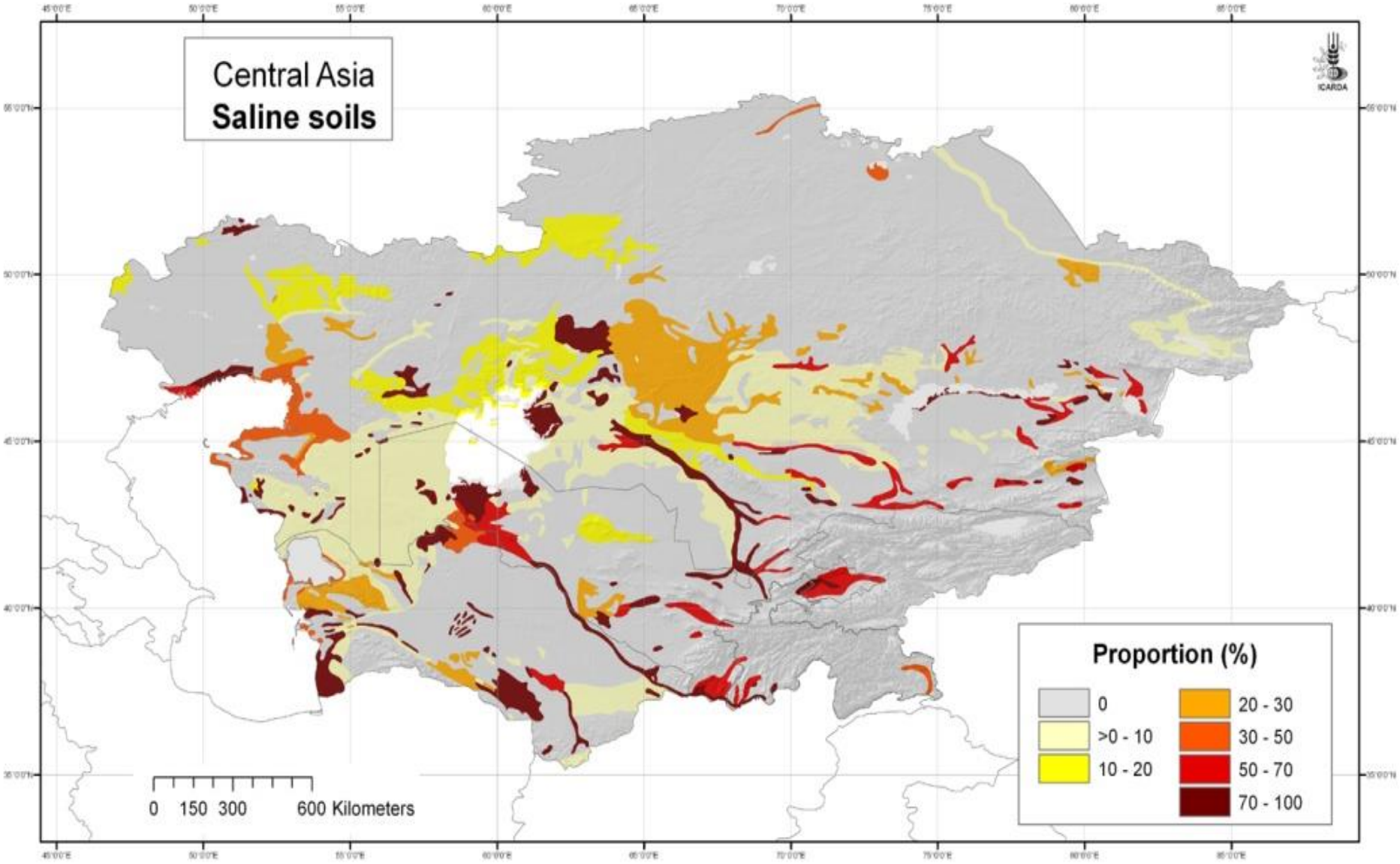
Structure of presentation

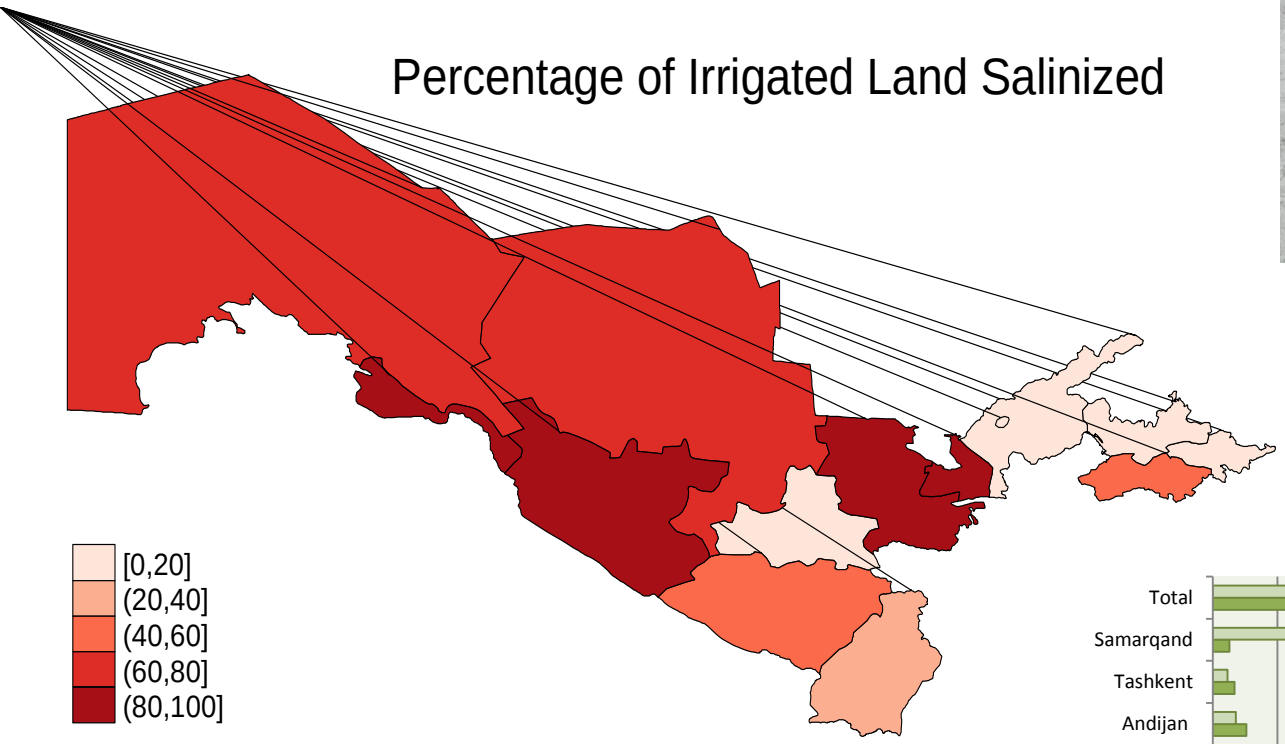
- The challenge of land degradation in Central Asia
- Regional cooperation
- Integrated research for agricultural development
- Some approaches and technologies
- Knowledge management
- Economics of land degradation
- Outlook

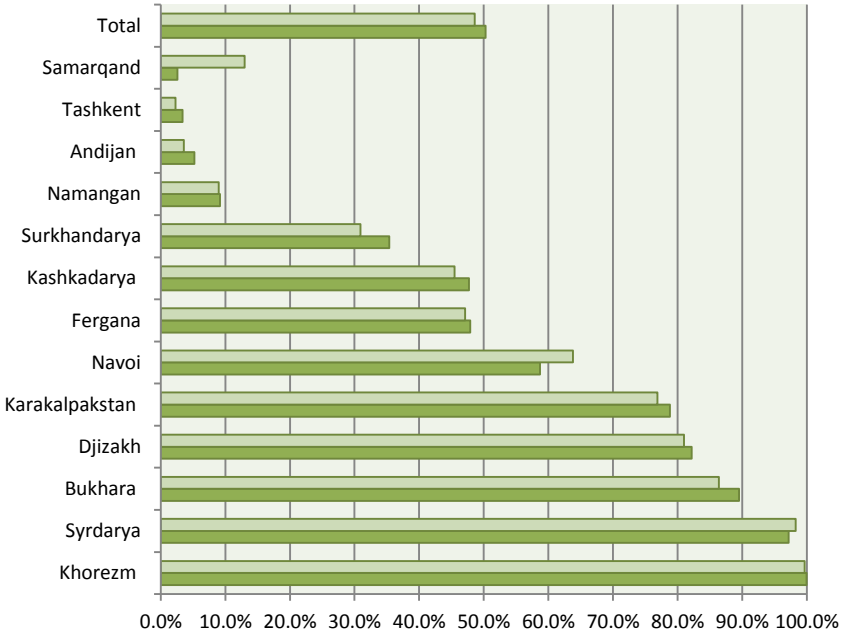
Land degradation

- Environmental and socio-economic problem
- Linked to irrigated agriculture: old infrastructure and lack of water distribution planning
- Consequences for human health – rampant pollution
- Soil salinity mapped on 36 million ha
- Salinity and waterlogging affect 90% of the lower Amudarya, between 40-60% of the irrigated cropland in Central Asia
- Water and wind erosion
- Overgrazing of pastures
- As a result, low yields, low water productivity and low incomes



(E. De Pauw et al., ICARDA, 2009)

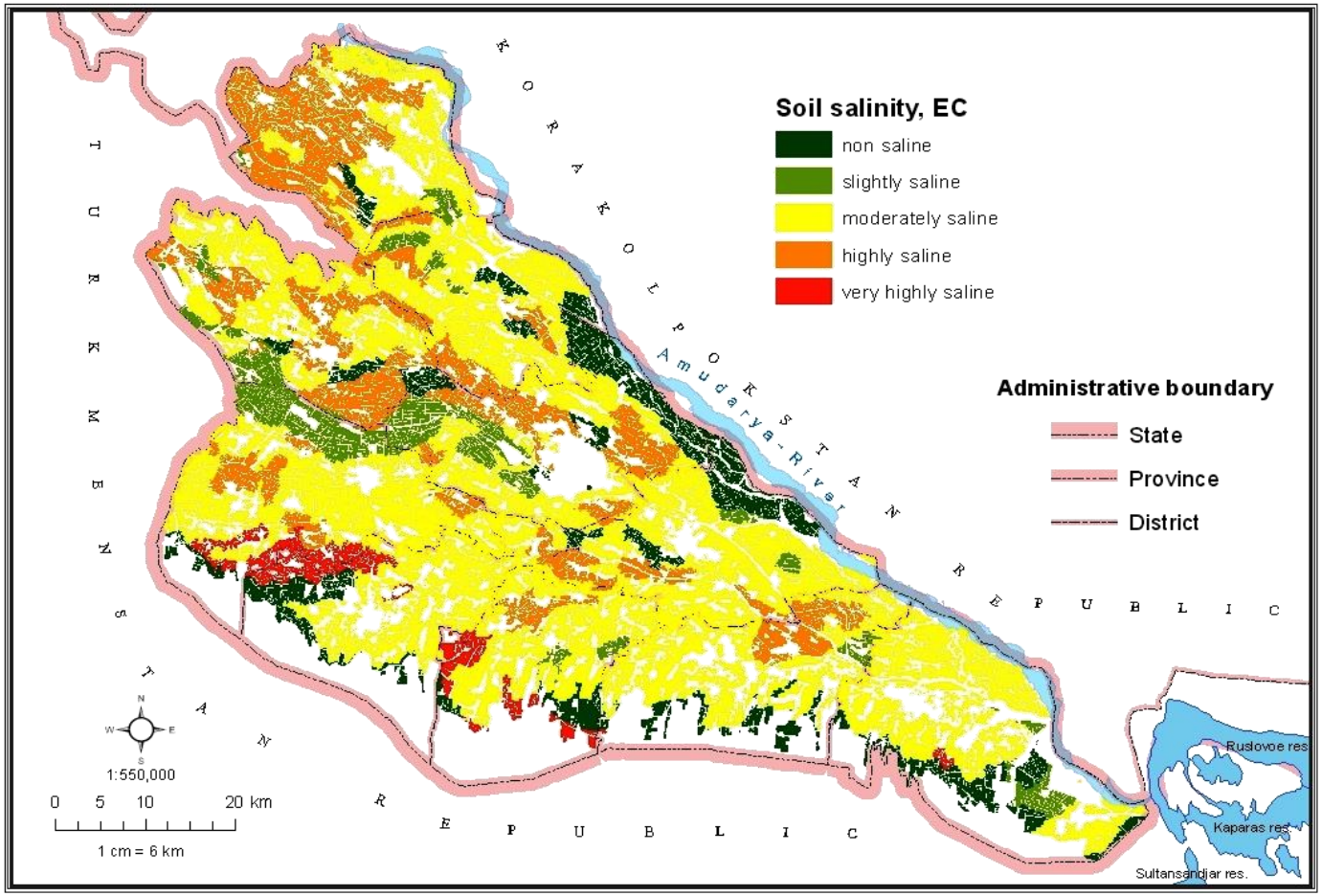




- Abandonment of degraded lands: every year 30,000 ha (Land Reclamation Fund, 2013), i.e. about 0.7% of irrigated area;

(State Land Cadastre Committee, 2013)

Mapping marginal lands – Khorezm province



Mapping marginal lands prone to soil degradation in Khorezm province, Uzbekistan (Aral Sea Site): soil salinization map (EC, dS/m) (from technical report KRASS, April 2014)

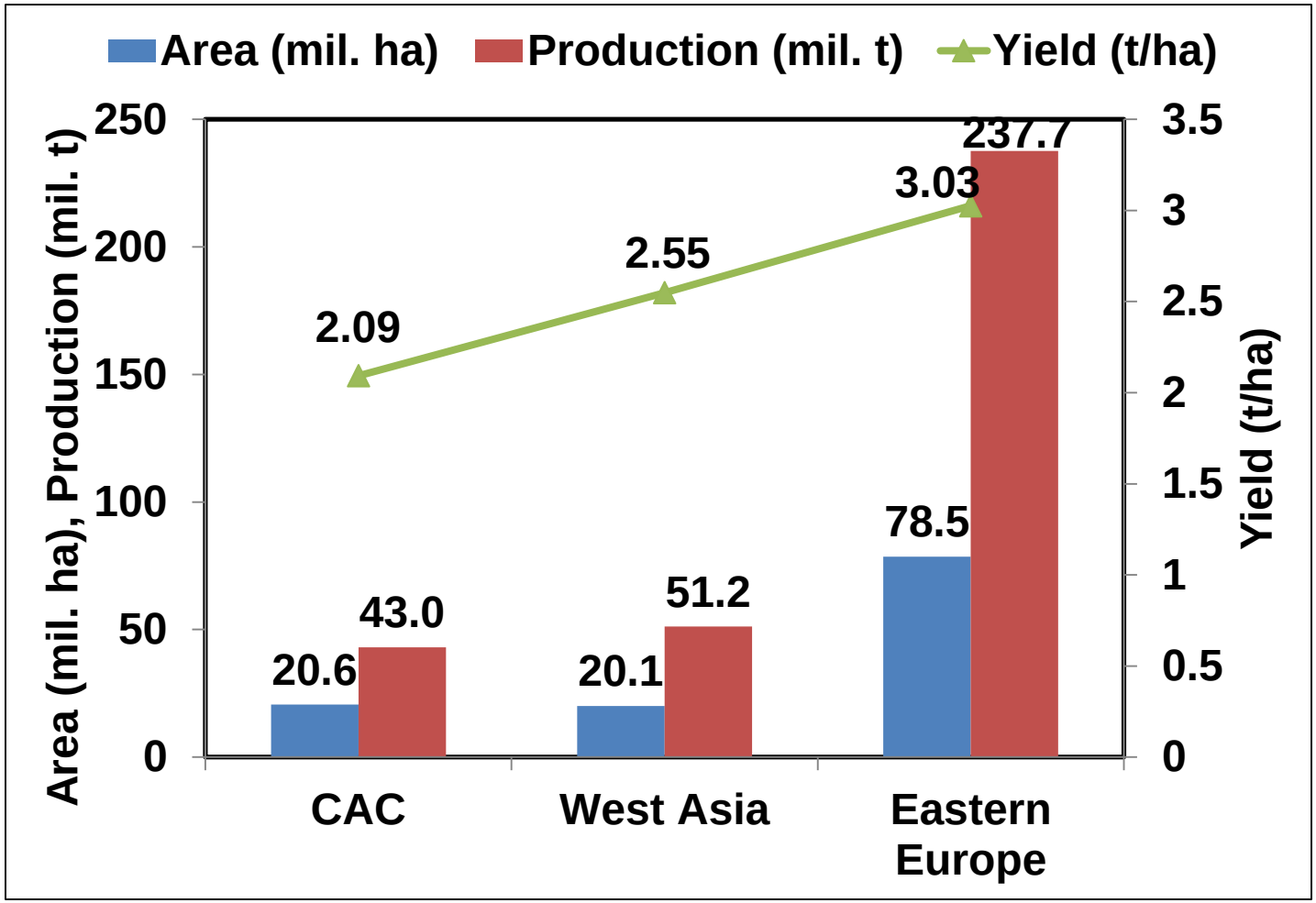
Land degradation and resource exploitation threaten Central Asia's fruit trees

- Centre of origin and/or diversity for many temperate fruit and nut species (apple, walnut, pistachio, almond, cherry, cherry, plum, apricot, pear, peach, pomegranate)
- Conservation of local varieties and wild populations of these species is crucial:
  - Under serious threat
  - Well-adapted to local conditions (drought, temperature extremes)
  - Stable yields
  - High palatability and valuable nutritional qualities
  - Resistant to pests and diseases
  - Basis for development of new varieties

Food security: cereals produced in CAC region

Crop	Area (mil ha)	Production (mil t)	Yield (t/ha)	Seed (mil t)
Barley	2.181	3.968	1.820	0.374
Buckwheat	0.067	0.038	0.562	0.003
Cereal, nes	0.143	0.170	1.186	0.000
Maize	0.390	1.798	4.616	0.036
Millet	0.042	0.051	1.227	0.002
Mixed grain				
Oats	0.151	0.271	1.794	0.022
Rice	0.198	0.711	3.589	0.030
Rye	0.025	0.041	1.672	0.020
Sorghum	0.004	0.015	4.175	0.000
Triticale				
Wheat	17.361	35.969	2.072	3.220
Total	20.561	43.033	2.093	3.707

Area, production and yield (all cereals)



Regional cooperation

- United Nations Convention to Combat Desertification (UNCCD) and other UN conventions
- National action plans and implementation measures developed but hindered by lacking capacities and resources
- International Fund for Saving the Aral Sea (IFAS) in 1992
- Central Asian Countries Initiative for Land Management (CACILM) in 2006; currently efforts ongoing for a Phase II
- Central Asia and the Caucasus Association of Agricultural Research Institutions (CACAARI)
- New Climate change adaptation and mitigation program (CAMP4CA) by the World Bank

Existing partnership: Regional Program for Sustainable Agricultural Development

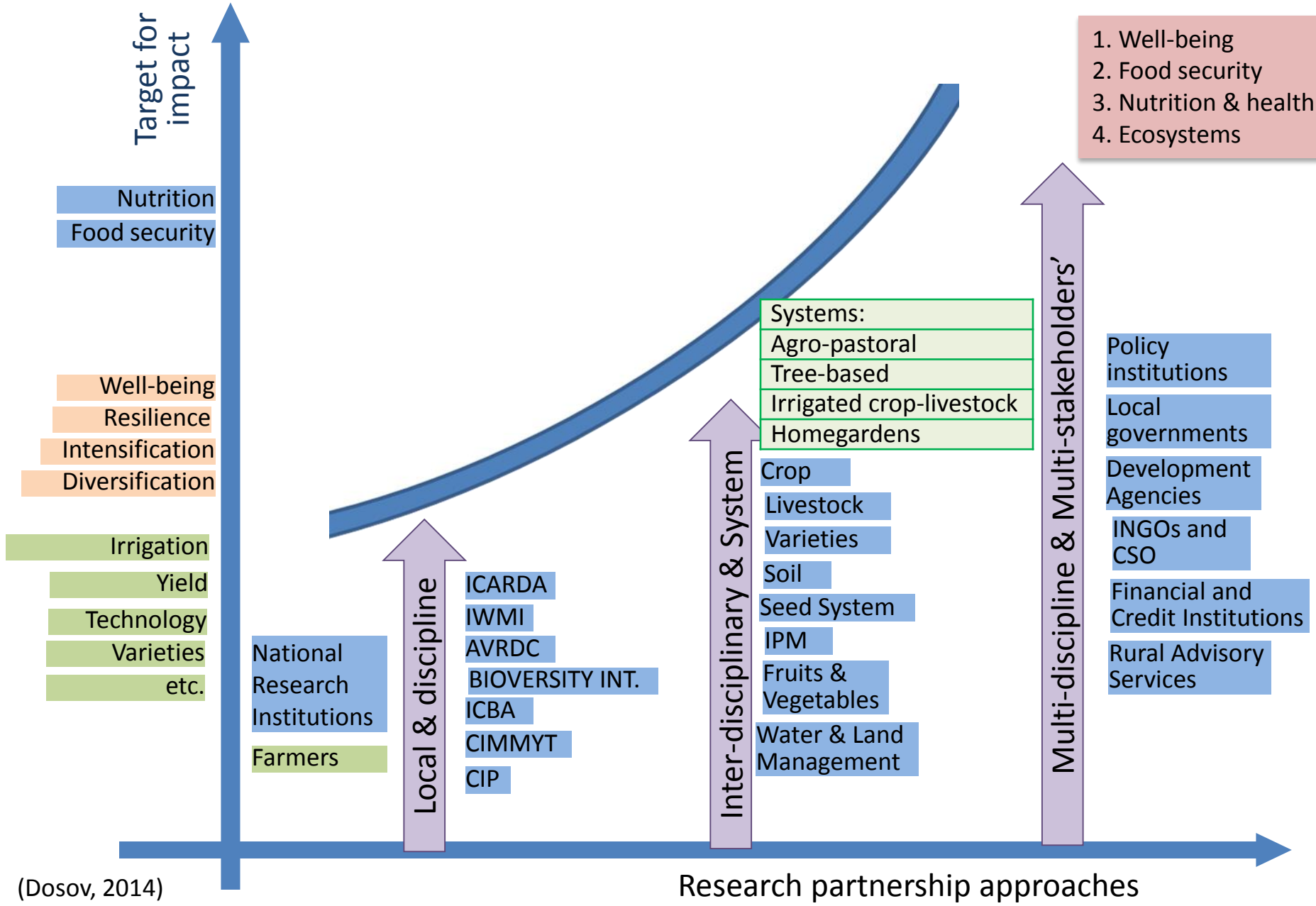
- Operational since 1998
- Eleven International Agricultural Research Centers
- Strong partnership with national research systems in Central Asia and the Caucasus (CAC)
- Each Center has own mandate and expertise – transfer, testing and development of technologies
- Strengthening local institutions, training: 130 courses with more than 2500 participants
- Climate resilient germplasm (crop improvement) and natural resource management practices (conservation agriculture, water management, sustainable land management, biodiversity, livestock)

www.cac-program.org

CAC
ЦАК

ICARDA
Science for Better Livelihoods in Dry Areas

Evolution of Research Partnership

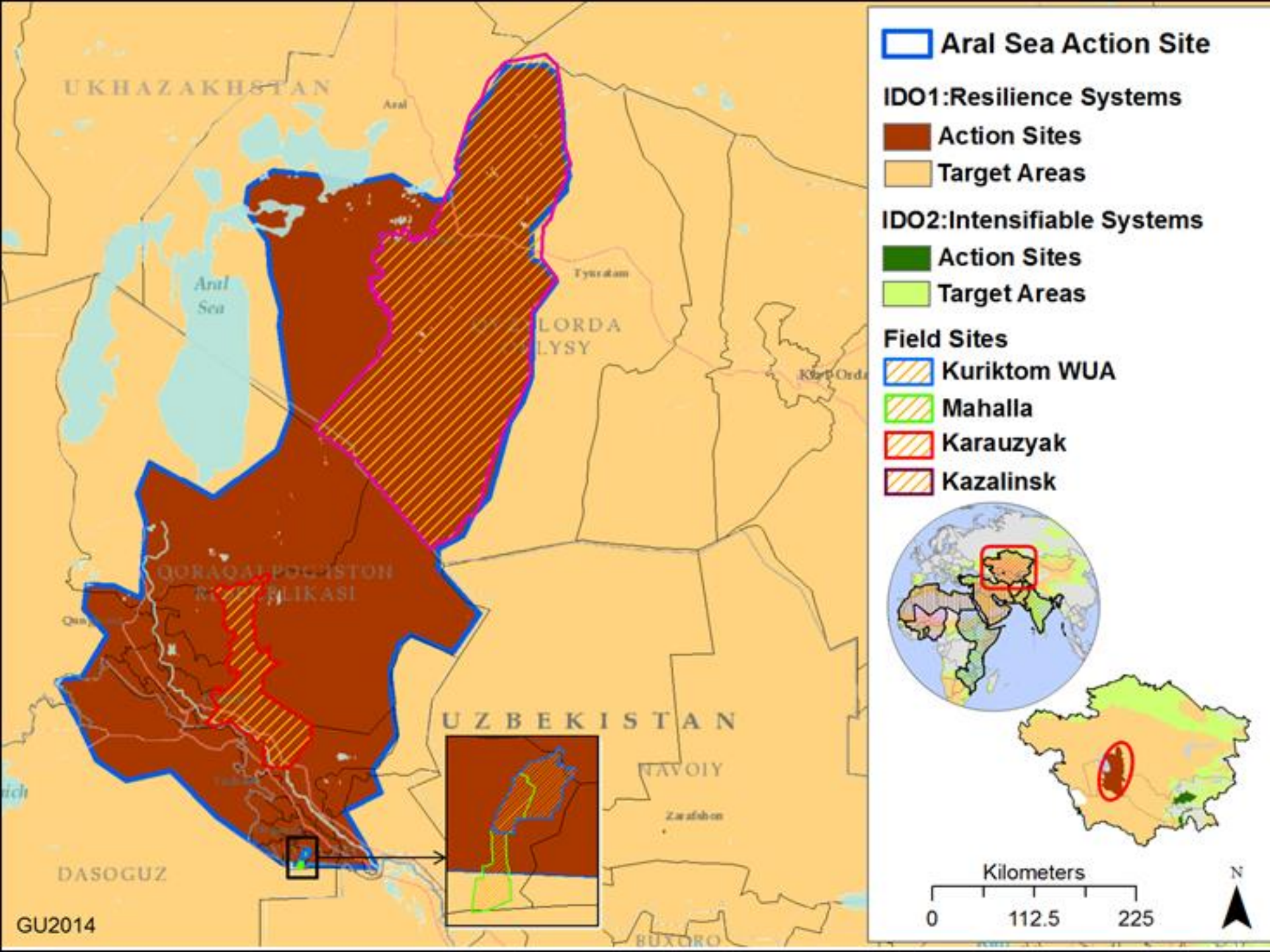


(Dosov, 2014)

Dryland Systems Program: integrated research

CGIAR
RESEARCH PROGRAM ON Dryland Systems

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Aral Sea Action Site
IDO1:Resilience Systems
Action Sites
Target Areas
IDO2:Intensifiable Systems
Action Sites
Target Areas
Field Sites
Kuriktom WUA
Mahalla
Karauzyak
Kazalinsk
UKHAZAKHSTAN
Aral
Aral Sea
UZBEKISTAN
NAVOIY
DASOGUZ
BUXORO
Kilometers
0
112.5
225
N
GU2014

On-farm adaptive trials and seed systems

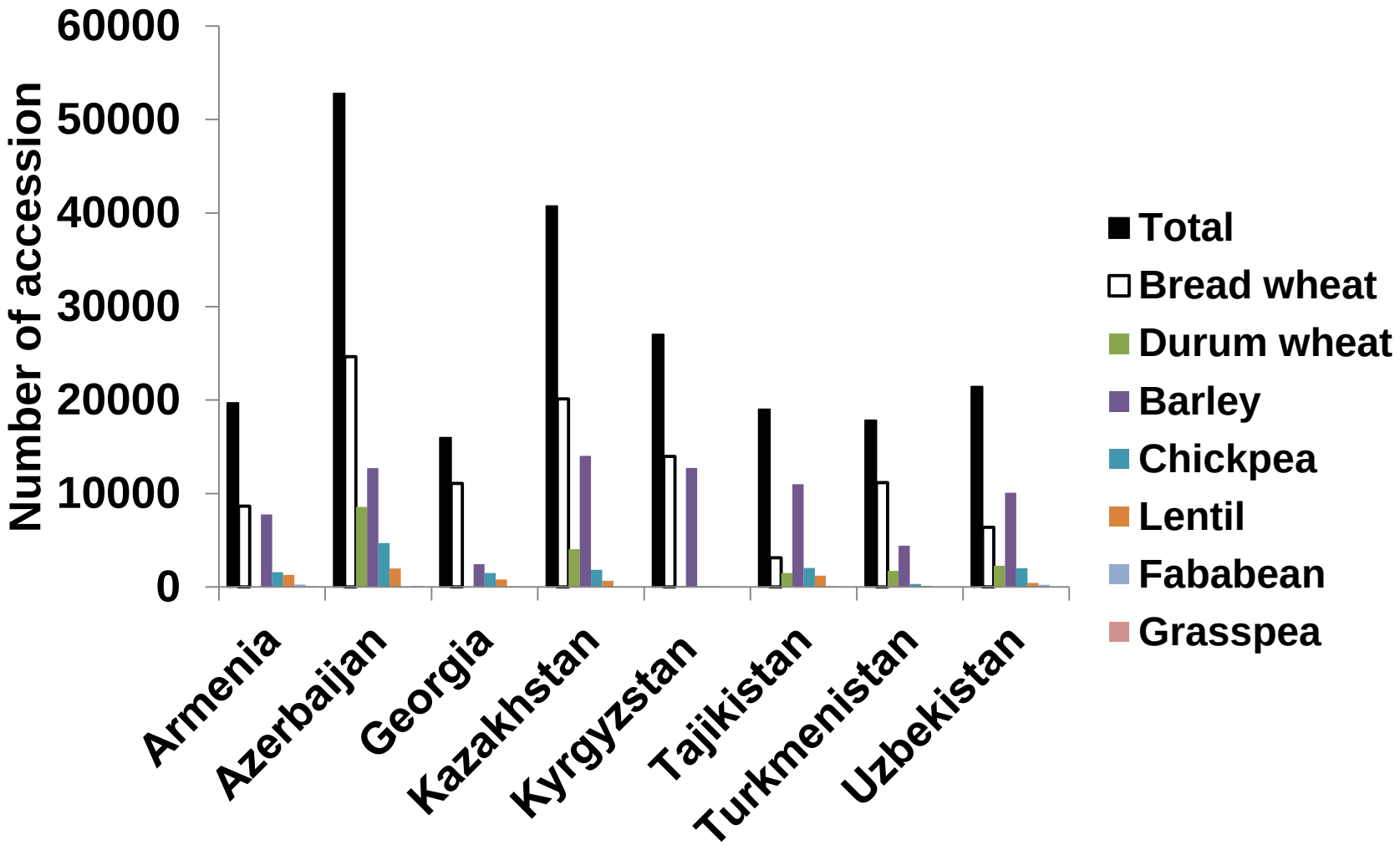
Constraints – drought, heat, frost and salinity

Selection of stress tolerant winter wheat varieties, Khorezm 2013

Evaluation by farmers, Karakalpakstan 2014

Evaluation by farmers, Khorezm 2014

Germplasm introduction and evaluation since 1998 ICARDA



Salinity, drought, heat and frost tolerant winter wheat, Turkmenistan

Dashoguz, Turkmenistan

135U 6.1/5/CNDO/R143//ENTE/MEXI75/3/AE.SQ/4/2*OCI,
CMSW01WM00832S: -030YE-30E-1E-0E-4E-0E

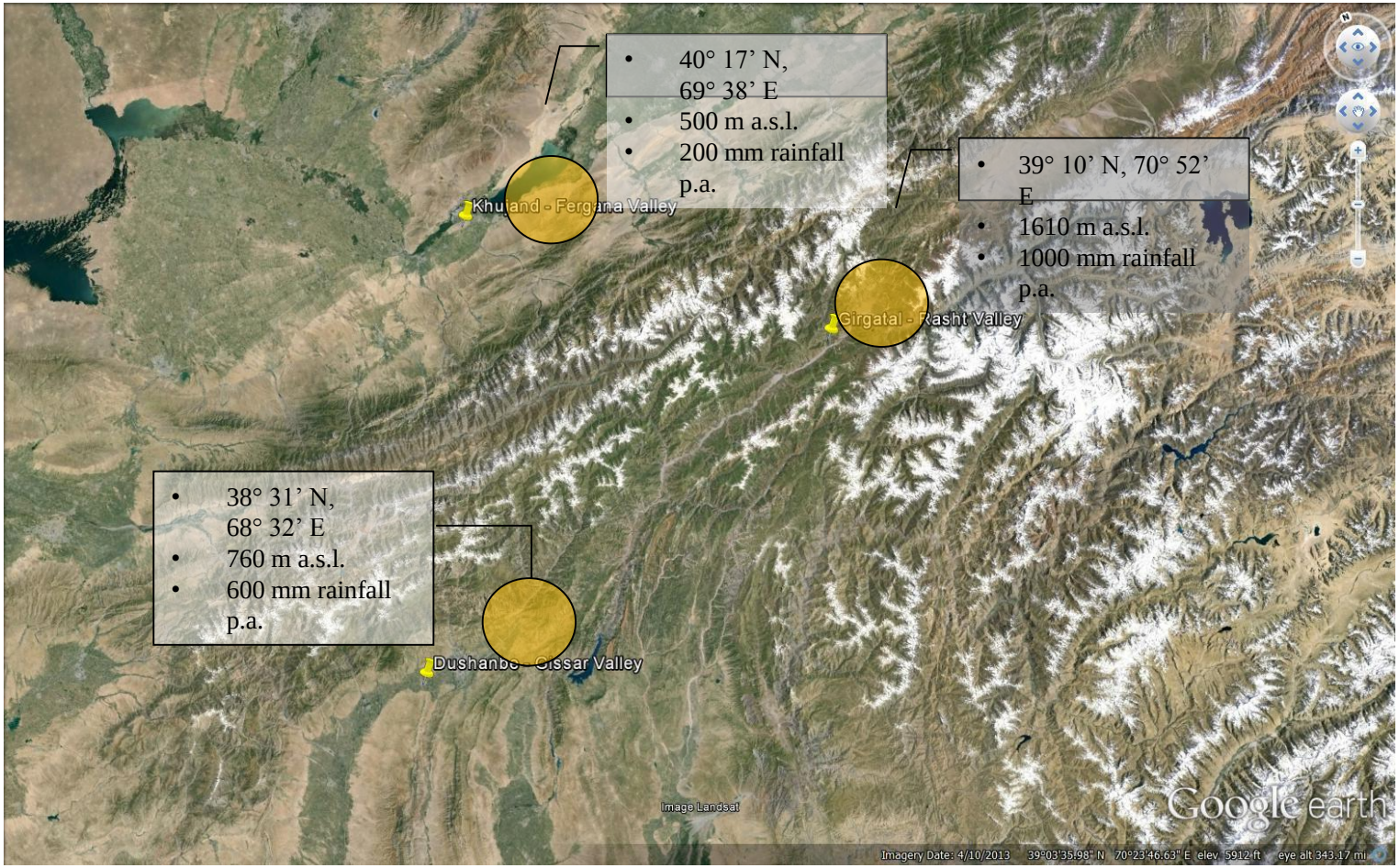
Submitted as new variety in Turkmenistan

(R. Sharma, 2015)

Conservation agriculture

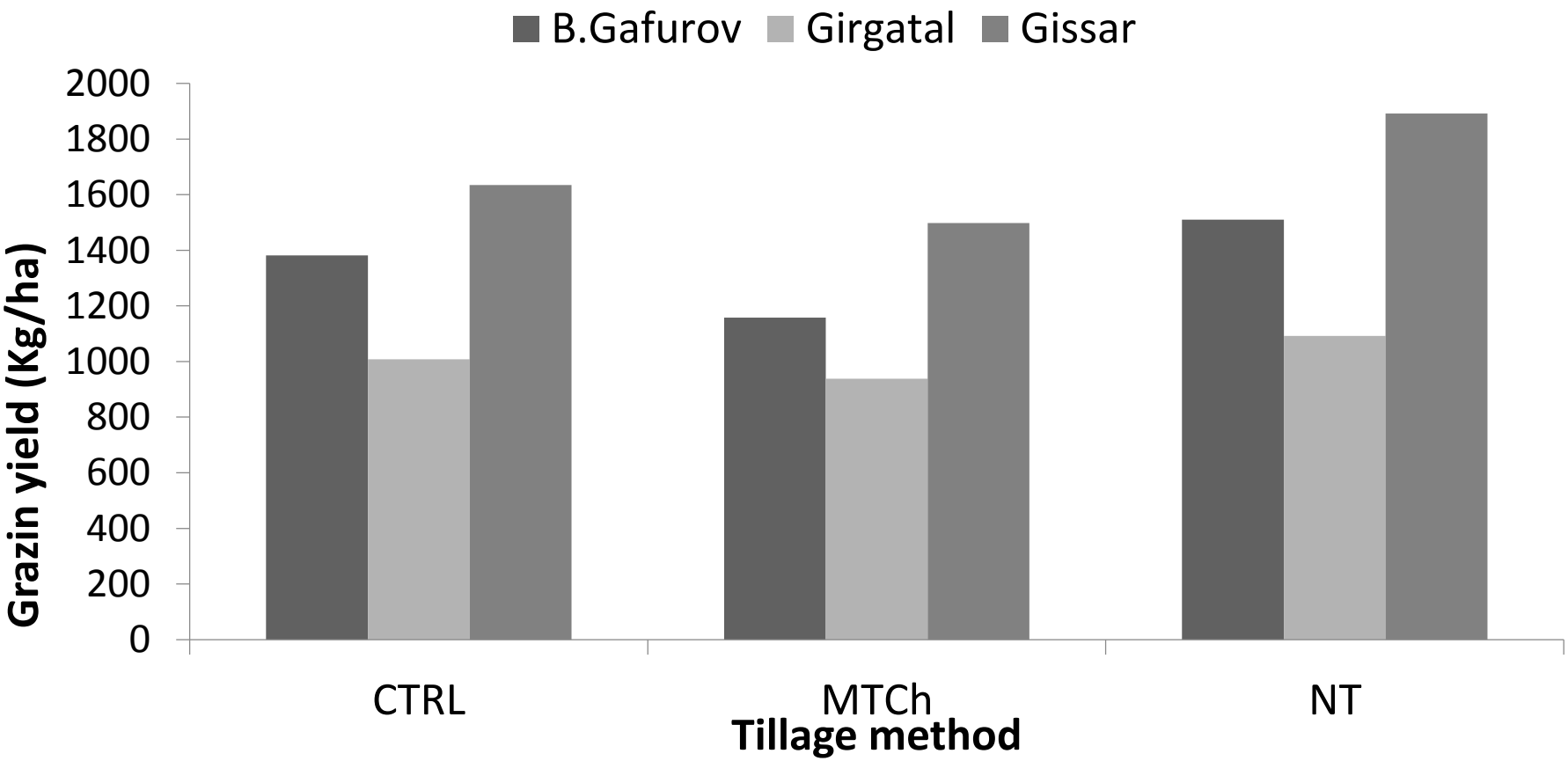
- Global concept of resource-saving crop production: minimum or zero tillage, crop residue retention, rotation
- Almost 2 million ha in Kazakhstan
- Demonstrated fuel savings of 50-75%
- Large-scale implementation in irrigated agriculture lacks proper machinery, awareness of farmers
- Field research and demonstration trials in Azerbaijan, Kyrgyzstan, Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan
- Policy support

“Integrated Crop-Livestock Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in Central and West Asia and North Africa” project sites in Tajikistan



(A. Nurbekov, 2015)

Effect of tillage on the productivity of winter wheat under rainfed conditions in Tajikistan



Raised-bed seeding

Туркменистан

Diversification of production: introducing legume crops for soil improvement, increasing farmers' income

(Mungbean cultivation as a catch crop in Fergana, Aug. 2014) photo by Ram Sharma

Diversification of production

(Sesame seed harvest in Karabuga village, Karakalpakstan, Sept. 2014) photo by Mahmoud Shaumarov

On-farm water management

Weirs

Evapotranspiration simulators (Etgage)

Tensiometers at depth 30 cm, 60 cm and 90 cm to control changes in soil moisture

(Sh. Mukhamedjanov, 2015)

Agroforestry for salinity control and land rehabilitation

- Bio-drainage control on-farm by using salt tolerant tree plantations
- Sands-fixing forest belts
- Domestication of multipurpose trees/shrubs
- Pasture improvement, energy security
- Climate change adaptation measures, C-sequestration

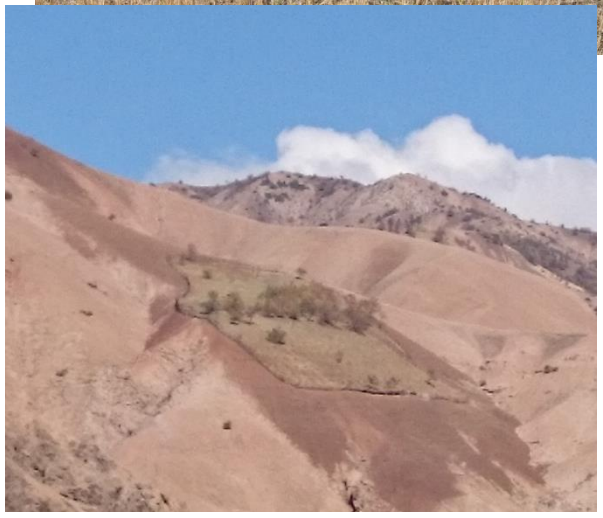
Populus and *Morus* species on medium saline clay-loamy soils with shallow water table (1.5-2 m). Photos by Kristina Toderich

نزرع للغد
ICBA
AGRICULTURE FOR TOMORROW

Knowledge management in CACILM phase II

Central Asian Countries Initiative for Land Management (CACILM)
IFAD/ICARDA project: collecting, synthesis, dissemination of SLM practices
Described in WOCAT format -- agroforestry:
-- Land improvement through pistachio plantations
-- Garden based agroforestry
-- Reclamation of degraded lands through agroforestry
-- Growing arundo reeds as buffer strips
-- Afforestation or sand stabilization techniques around settlements
-- Converting pastures to orchards and for feed crops
-- Perennial feed grasses in native forests
-- Growing trees on slopes using trenches

www.cacilm.org



Переход от пастбищных земель на фруктовые и кормовые участки

- Технология предназначена особенно для пастбищных земель с чрезмерным выпасом, что приводит к снижению вегетативного покрова, уплотнению почвы и плоскостной и линейной эрозии;
- Применение технологии восстанавливает деградированные участки, снижает эрозию почв;
- Увеличивает производительность: хороший урожай фруктов;
- Многообразие: выращивание различных видов фруктовых деревьев на участке.

Агроэкосистема: пастбищное
Источник: ВОКАТ, Таджикистан

Knowledge management (CACILM Phase II)

Agroeco-system	Technology package	KAZ	KRG	TJK	TKM	UZB
Irrigated	Raised bed	Almaty; South Kazakhstan	Chuy valley	Central Tajikistan	Ahal province	Yakkabog and Bayavut districts
Mountain	Agroforestry		Osh province	Rasht valley		Planned
Rainfed	Conservation agriculture	South Kazakhstan	Chuy province	Central Tajikistan	Lebap province	Kashkadarya province
Rangeland	Pasture improvement	Almaty province	Osh province	Sogd province	Ahal province	Farish district

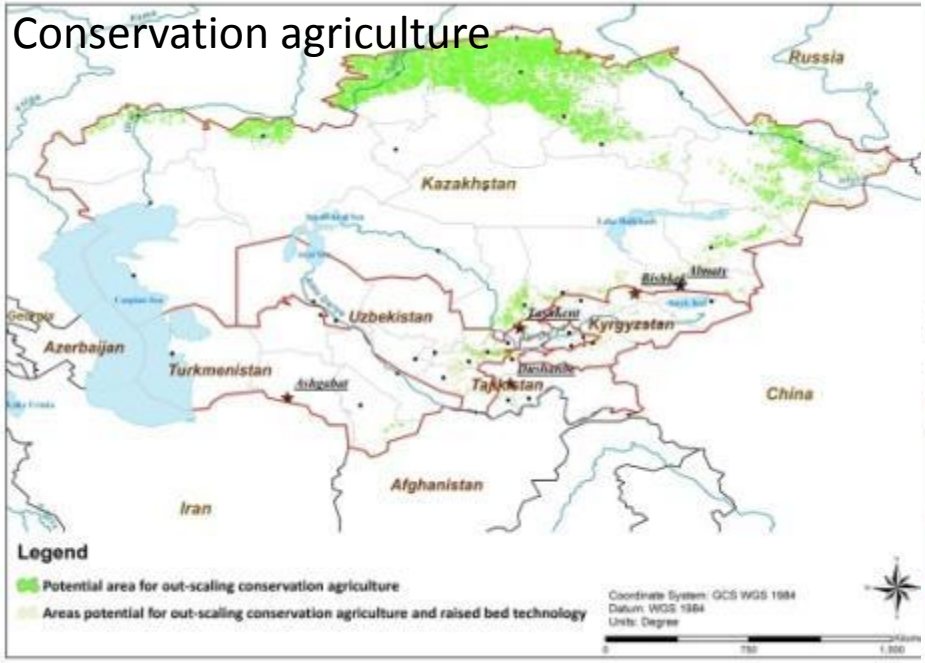
Demonstration sites

Similarity maps for each agro-ecosystem

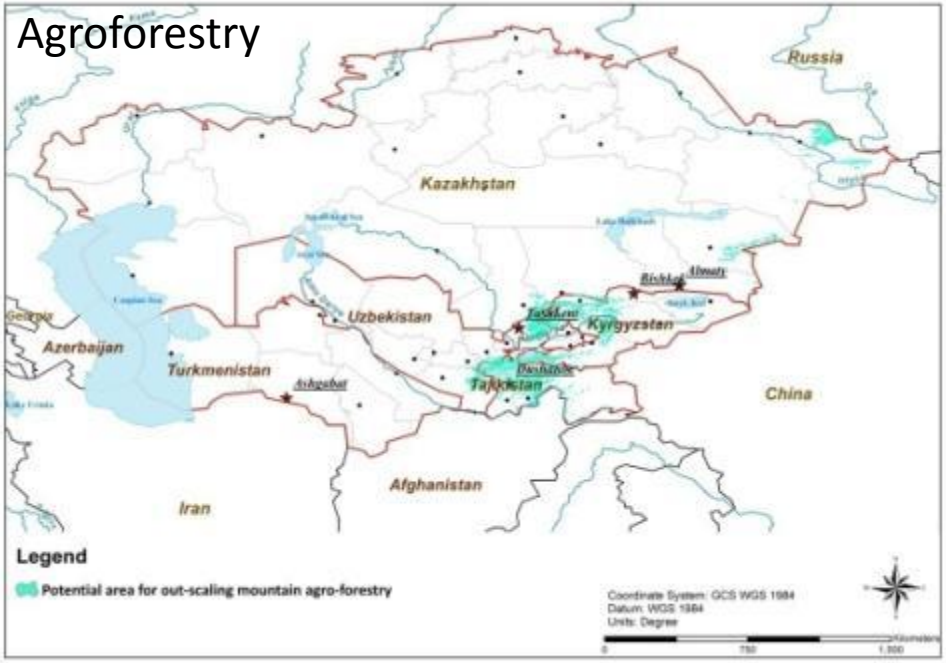
Pasture improvement

Raised bed technology

Conservation agriculture

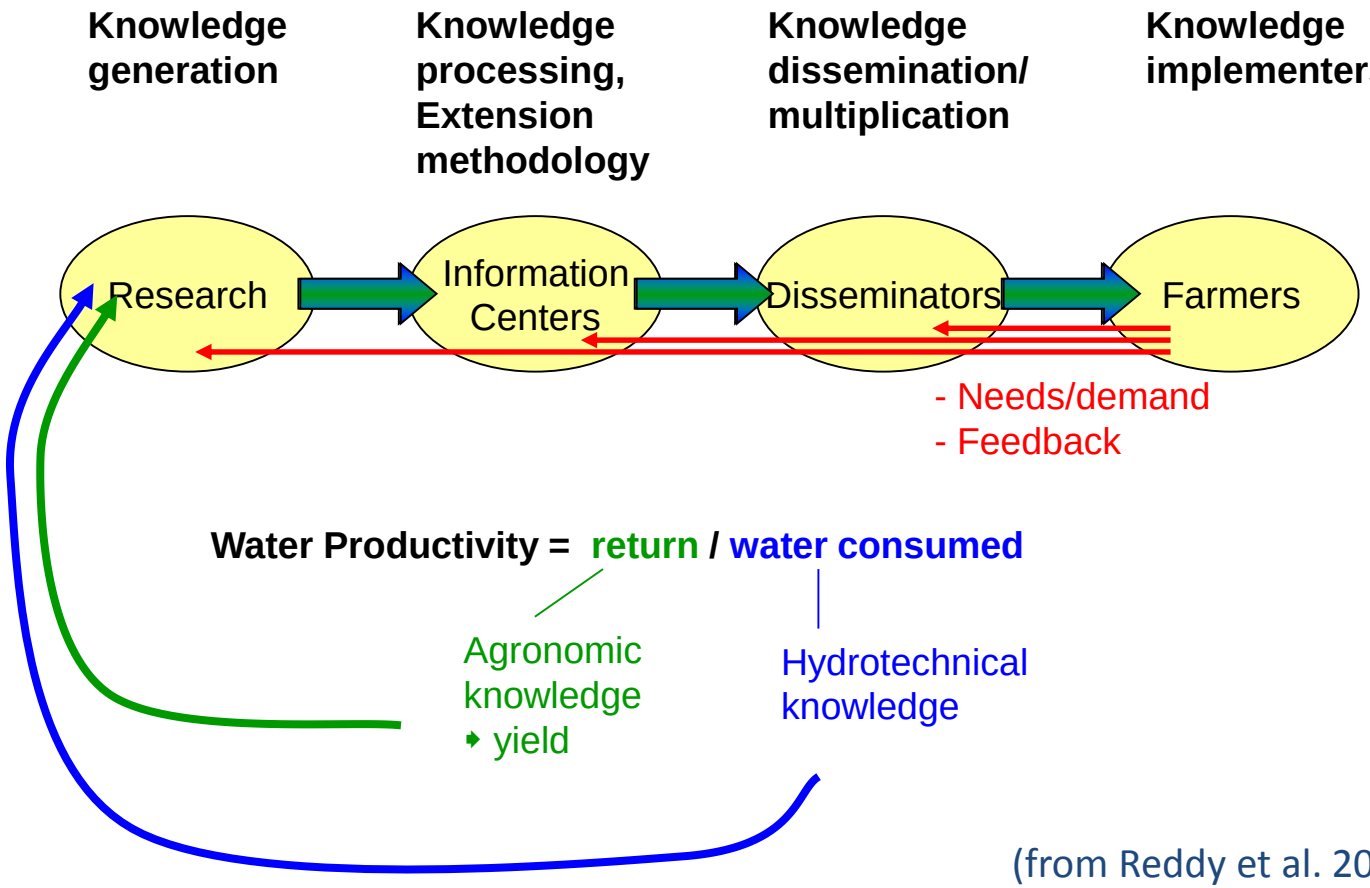


Agroforestry



Innovation Cycle

Two water management projects in the Fergana Valley (2002-2012) pioneered a framework for scaling up cooperation mechanisms and introduced the concept of Innovation Cycle, which makes knowledge produced at the research centers easier accessible to farmers in WUAs. The projects provided farmers with information and training resources in improved water accounting and management.



(from Reddy et al. 2012)

THE ECONOMICS OF LAND DEGRADATION

A GLOBAL INITIATIVE FOR SUSTAINABLE LAND MANAGEMENT

- The Global Initiative “The Economics of Land Degradation” (ELD)
- Purpose: to provide economically sound approaches to facilitate solutions for the progressing problem of land degradation
- Officially launched at the regional meeting of the UNCCD, hosted by Turkmenistan in Ashgabat, in August 2014
- At the bi-annual ministerial meeting of the Intergovernmental Commission on Sustainable Development Asia in Dushanbe, in November 2014, the ELD Central Asia Initiative received high political support
- Economic research on specific topics in each of the partner countries, interpolating results/data into a regional report

Research components

The research in each country will include:

- identification of the current status of ecosystem services,
- cost benefit analysis of land degradation,
- potential options for improvement of the situation towards the sustainable use of lands.

Target study agro-ecosystems include:

- Kazakhstan – forests; Kyrgyzstan – highland pastures; Tajikistan – foothills and low mountains; Turkmenistan – lowland pastures; Uzbekistan – irrigated agriculture

The initiative is being implemented by the Regional office of ICARDA in Tashkent and CGIAR Program Facilitation Unit for Central Asia and Caucasus with close coordination and support from the UNCCD and ELD Secretariat and the regional GIZ FLERMONECA project

Farmers' Field Days

(Photos by Ram Sharma, 2014)

Outlook

- Wider role of the partnership – building bridges
- Data, information and knowledge management
- Integrated research approaches
- Engagement of farmers – participatory research
- Enabling environment – capacity building, training
- Up- and out-scaling of innovations – involvement of policy makers at all levels; rural advisory services
- Wider development objective: sustainable livelihoods