

Beyond climate information

What else is needed for food security and
poverty alleviation?

Jacob W. Kijne

Motto:

- *Each day our world witnesses 800 million people going hungry and about 170 million children under 5 years of age suffering from malnourishment. This situation is a human tragedy on a vast scale. Made even more heartbreaking because it is avoidable. (IFPRI,2002)*
- Stop blaming the weather: the world growth enough food. What the hungry need is economic growth (Economist, June 15, 2002)

Why and How?

- Who benefits?
- What impacts? Intended and unintended?
- How do we do it?
- Where does the climate information come in?

Contents

- conditions for food security.
- food security and rural poverty
- rural poverty
- food production
- irrigation and food production
- water scarcity
- constraints on food production
- institutions and policies
- promising options for increasing production
- conclusions

Conditions under which food security should be achieved

- globalization and further trade liberalization
- technological changes, e.g. molecular biology, IT
- degradation of natural resources, water scarcity
- health and nutritional crises, e.g. HIV/AIDS, under- and over-nutrition
- rapid urbanization
- changing structure of farming
- violent conflicts
- climate change

Food security and rural poverty

- food availability
- food quality
- access to food
- reduce people's vulnerability

Population living below \$1 a day

- South Asia 515 million
- East Asia and Pacific 446 million
- Africa 229 million
- Latin America 110 million
- TOTAL: about one-third of the population of the developing world

Trends in child malnutrition

	1970	1985	1995
South Asia	72.3	61.1	49.3
SSAfrica	35	29.9	31.1
East Asia	39.5	26.5	22.9
WANA	20.7	15.1	14.6
Latin Amer	21	10.6	9.5
ALL	46.5	36.1	31

Rural population living in favored lands (%)

	best land	% pop.
SSAfrica	8.5	27
Asia	16.6	37
Latin Amer	9.6	34
WANA	7.8	24
All 105	10.7	35
countries		

Root causes of poverty

- Poor people have no tangible assets (land and livestock) and lack formal education and technical skills
- They live where the land is marginally productive and where there is little basic infrastructure, or live in cities
- Rural poverty and malnutrition is usually tied to the land
- More women than men are poor (can't own land)

Annual growth in cereal yields, %/yr

	1967-82	1982-94	1995-2020
developing	2.9	1.8	1.2
world	2.2	1.5	1
developed	1.6	1.3	0.7
source: IFPRI, 1999			

Food production

- food production is now increasing faster in the developing world than in the developed world
- by 2020 the developing world will be producing 59% of the world's cereals and 61% of the world's meat (Source: Pinstруп-Andersen et al., 1999)
- net cereal imports by developing countries is expected to almost double between 1995 and 2020, and many developing countries will no longer be self-sufficient in grain production

Food production (cont.)

- In the 1980s, 10 % more yield gave rise to 4% more jobs in agriculture; now 10% more yield results only in about 1% more jobs in agriculture
- hence, yields have to grow much faster for employment opportunities to increase in the rural areas and for people to be able to purchase their basic food (source: Michael Lipton, Crawford lecture, 1999)

Irrigated land per capita

- the world's irrigated land has decreased from a peak of 48 ha/1000 people in late 1970's to around 40 ha/1000 people now (compare arable land in MIC countries of 0.23 ha/capita)
- traditional agriculture needs 0.6 ha of arable land to meet the per capita dietary requirements
- without irrigation the minimum food needs of less than half the world's population would be met
- *ergo*: output of existing arable land needs to be increased to feed the world's population

Irrigation and food production

- Two-third of additional food demand in 2020 to come from irrigated land
- Growth rate in grain yields in Indian S.C. declines
- Annual growth in demand for wheat in developing countries 1.58%; rice 1.23%, maize 2.35% and other grains 2.09%
- Expected increase in net cereal import in S. Asia from 0.3 MT (1995) to 20.8 MT (2020)
- World-wide some 70% of water withdrawal used for agriculture (90% in China)

More

- Average annual renewable water supply per capita in WANA 1500 m³/year *versus* 7000 m³ (world)
- It was 3500 m³/year in 1960 and is expected to drop to 700 m³/year in 2025
- In 1990 only 8 of 23 WANA countries had water supply > 1000 m³/year
- For Pakistan required growth in grain production: 2.5% a year; assumed growth rate in irrigated area 0.5% a year and in cereal yield 1.5% a year.

World water consumption

sector	1900	1960	1995	2000	
population		3029	5735	6181	
irr.land	47	142	253	264	
agriculture	321	1005	1753	1834	
industrial	5	21	50	53	
municipal	5	31	83	88	
reservoirs	0.3	30	188	208	
population in millions, land in million ha, water consumption					
in cubic km per year 2000 is a forecast					

Water withdrawal per sector

	water withdrawal % of total use				
1995	agriculture	industry	domestic	reservoir	
Africa	63%	8.1	4.4	24.7	
Asia	80	6.9	9.9	3.2	
Latin Amer	58.6	17.2	15.4	8.7	
2025	increase or decrease compared with 1995 values				
Africa	-15.7	122	36.4	-7.7	
Asia	-10	37.7	53.5	3.1	
Latin Amer	-24.6	31.4	54.5	12.2	

Water scarcity

- physical scarcity: there is no more
- economic scarcity: we can't afford to develop more
- lack of social adaptive capacity; examples of social adaptation: to produce more value per unit water, to import 'virtual' water

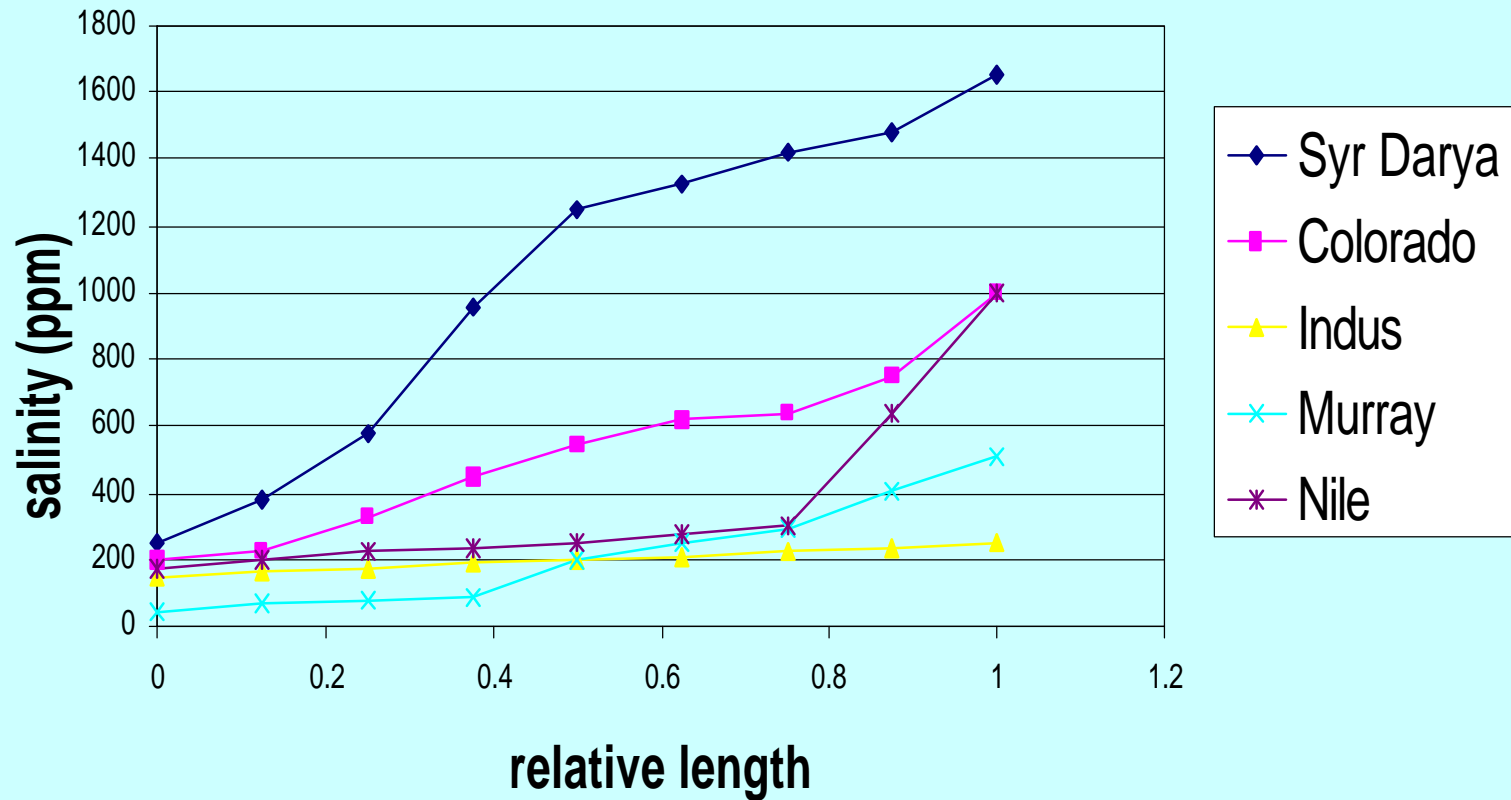
Constraints in food production

- Salinity and waterlogging
- Causes:
 - rising saline groundwater
 - pumped (recycled) groundwater
 - seawater intrusion
 - diversion of inflows from fresh and salt water lakes for irrigation
 - construction of salt storage basins

More about salinity

- Contributing factors
 - excessive seepage from canals
 - poor farm water management
 - government policies and (hidden) subsidies; inadequate planning
 - poor construction and maintenance
 - absence of drainage measures
 - clearance of natural deep-rooted vegetation from catchments and replacement by pasture & agr. crops

salinity profiles in rivers



Murray-Darling Basin Initiative

- one-sixth of Australia and includes 24 rivers
- salinity is natural feature; intensification has led to conflicts with human and environmental needs
- integrated approach: improve water quality, balance various water needs, and conserve nature
- restrictions on amount of drainage to water table; new crops and better irrigation; intercept saline groundwater and transport to evaporation ponds
- community and environmental education, volunteer community groups

Effect of institutions and policies

- investments in India in rural roads had greater impact on rural growth and agricultural development than investments in research and extension, and in irrigation
- investments in irrigation had impact on productivity growth but contributed little to poverty reduction
- marginal returns to infra-structural investments in rainfed areas exceeded those in irrigated areas

Case study from Bangladesh

- comparison of life in village Fatepur on island in river delta between 1978 and 1999
- effect of infra-structural change (flood protection embankment around island and irrigation development) was change from subsistence economy to cash economy
- infant mortality reduced by 1/3; women's life expected increased by 15 years; rice production twice as high; incomes 50% higher; richer landowners hire labor, hence more employment for landless
- no systematic involvement of users, and irrigation project performs below its capacity, subsidized by Government

Case study (cont.)

- Market town now 15 minutes away by rickshaw
- NGO's (20,000 in Bangladesh) focused on education and women development; critical of irrigation project
- nearly 70% enrolment of children of the landless in NGO-run schools
- lack of engagement between NGO's and Government; are NGO's becoming a parallel state, financed by foreigners and accountable to nobody?
- the likes and dislikes of the the NGO's are not necessarily those of the common people
- cultural changes leave some men disoriented

Farmers' participation

- Conditions for success:
- firm government commitment
- sustained support from bureaucracy for the establishment of new institutions
- rules and regulations: developed by farmers; have power of law; accepted by parliament; strictly enforced
- role of social organizers in establishment of FO
- training and technical support of farmers

More on participation

- Inability to integrate local knowledge into scientific assessment practices
- better understanding of the complexity of the issues may lead to greater uncertainty thus rendering decision making problematic
- little understanding of the tradeoffs involved in participation decisions in research (greater public participation may increase political legitimacy, but decrease scientific credibility of the research)

(Trieste Workshop, February 2002, Packard Foundation)

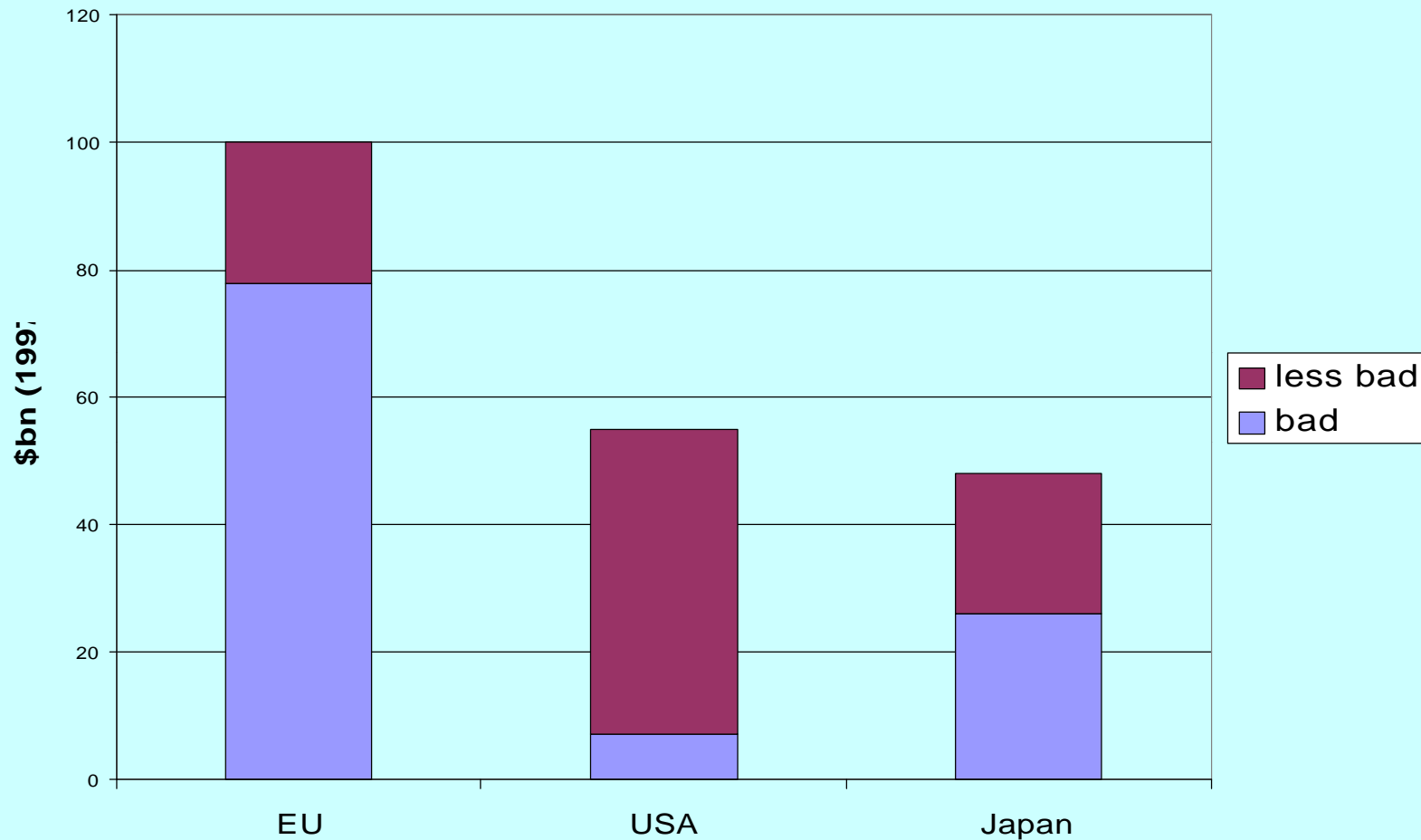
New water law in South Africa

- public consultation and approval by SA cabinet
- water is common resource; no ownership granted
- rights given for basic human and environmental needs; or permit for use over a fixed period
- objective is to manage quantity, quality and reliability of the water resource to achieve optimal, long term sustainable benefits for society
- example of legal innovation (source: Asmal, 1998)

Agricultural trade

- within OECD, annual state payments to agriculture exceed Africa's entire GDP
- rationale: environmental protection, food security, maintaining rural communities,
- protect their own farmers against 'unfair and uncompetitive markets'
- In EU, prices of lamb, butter and sugar are all more than twice the world market price, and rice 1.9 times. (Economist June 9, 2002)

Total agricultural subsidies



Low and middle income countries

indicator	LIC	MIC
GNP/cap	\$410	\$2000
urban pop	31	50
pop growth	2.00%	1.20%
agric share	27%	10%
people/km	73	40
arable Ind	0.19	0.23

Opportunities in semi-arid tropics of Sub Saharan Africa

- Rainfall partitioning: of the incoming rainfall 30-50% evaporates from the soil surface, 10- 25 % is run-off from the fields, another 10-30 % drains from the rootzone, and only 15 to 30% is actually used for transpiration from the crop (Lundqvist et al., 1999)
- promising technologies: conservation tillage, water harvesting for supplemental irrigation

Increasing crop water productivity

- increase yield per unit water transpired: increase harvest index, shorten growth period, apply water during sensitive stages, right crop sequences
- reduce non-beneficial water use: reduce weeds, zero tillage, mulching, maintain drains
- improve effective use of all water sources: synchronize crop duration with rainfall and low evaporative demand, increase root uptake, alternate wetting and drying of rice, reuse drainage and seepage water

Most promising genetic approaches

- reduce EVT without reducing production: improve leaf cooling - heat tolerance trait known
- increase production without increasing EVT: increase C allocation to product - traits for harvest index and stay-green factor known; multiple cropping - trait for short duration identified
- increase abiotic stress tolerance: flooding - trait for submergence tolerance; salt stress at reproductive phase - some traits; drought escape - short duration trait

Conclusions

- Challenges in increasing food security: at plant level (when do the drought periods occur?), in rainfed agriculture (how to capture the short torrential rains?), in irrigated agriculture (how to stop irrigation when it rains, and recharge groundwater?), institutional (what institutional arrangements work well for empowering beneficiaries?), governmental (“Good governance in poor countries would end hunger faster than rich-world aid” (Economist, 15 June 2002), what is political will?)

Conclusions (cont.)

- hopeful signs: at plant level traditional and molecular breeding have identified traits and genes for drought and salt tolerance; increased productivity in rainfed areas by supplementary irrigation; expansion of drip, trickle and sprinkler irrigation; conjunctive use of groundwater and surface water; adoption and adaptation of water productivity-enhancing practices if farmers are given appropriate incentives.

Conclusions (cont.)

- food security/rural poverty is a complex issue
- climate downscaling is one of the tools that will provide additional data and information to decision makers, farmers, plant breeders, those engaged in human, animal and plant health, etc.
- information consists of recent bits of experience and available information has vastly expanded; knowledge is organized and has structure; what is needed is to turn data and information into usable knowledge

Conclusions (end)

- Our combined knowledge is probably sufficient to solve most food security and rural poverty problems; what we have not yet done is to combine our knowledge to the maximum effect to address these problems.
- ‘Evolution works for sheep and roses, but not for the ideas of people. They don’t improve, they change’ (A.J.P.Taylor, English historian)
- that 800 million people go hungry can be and should be avoided.