

# FOOD SECURITY: WHAT HAVE SCIENCES TO OFFER?

A Study for ICSU

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## Summary

The author was asked to examine what opportunities exist for the sciences to play in ensuring food security in the next century. In parallel to this, would there be a role for ICSU members and scientists of varied disciplines to play which would be effective and not duplicate existing efforts?

The results of a synthesis of the present food security situation and of food production for the future are presented (Section II). Synopses of 38 interviews with individuals and those in International Governmental Organizations and International NGOs (Section III) and a large literature base (Section V) are given.

It is concluded that ICSU could play an important and niche role in the sciences of food security (Section IV). Possible actions include an IPCC or IGBP-type organization, capacity building in resource poor/food insecure countries, mechanisms to influence agriculture and food related policies, and others. It is essential that whatever course is followed results in an active, well-directed, fundable body which is totally independent.

The conclusions of a discussion meeting held May 14/15, 1998 by the Committee on Sciences for Food Security are given at the end of the report (Chapter 12). Briefly, it was proposed that a Panel be set up which would seek 3 years initial funding to focus on helping scientists and technologists (in Universities, Institutes, NGOs and CBOs) in resource-poor countries or regions where there are food insecurity problems. The aim is to strengthen national scientific organizations and community projects with practical support and backing from ICSU thereby enhancing the scientific basis of food security work at the national level. [Please refer to Chapter 12].

It was also concluded that if the initial endeavour was successful then ICSU could consider setting up a more ambitious IGBP-type organization which would combine synthesis of food security issues with multidisciplinary targeted research by a multidisciplinary network of scientists.

Finally, it was proposed that the present committee make an input to CSD-8 (UN Commission on Sustainable Development) meeting in 2000 whose theme is Agriculture and Rural Development.



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# Section I Preamble

## Chapter 1 - Introduction

The objectives of this study (Food Security: What have Sciences to Offer?) were set by ICSU's Committee on Sciences for Food Security at an initial meeting of the Committee held in November 1995, as follows:

Why Sciences? Opportunities and Constraints

What are the critical issues and gaps - are there regional perspectives to be considered?

What is the relative strength of the ICSU family?

- a) based on individual capacities
- b) based on joint actions such as networking, outreach-communications, projects

Which organizations/institutions within ICSU could contribute what?

What are possible modalities of cooperation with other organizations outside ICSU?

In order to address these objectives a detailed literature survey was conducted of published and unpublished information (Section V, References). At the same time 38 people were interviewed in Rome, Washington DC, New York and the UK (Section VI). The aim was to obtain as wide a range of views as possible from International Governmental and Non-Governmental Organizations and from independent persons on the present and future food security situation and on what role sciences within ICSU could usefully play. No attempt was made here to discuss differences and similarities of views amongst the organizations and individuals and the opinions expressed in the large literature base which was surveyed. Rather all these views provided the basis for the conclusions of the present report.

In Sections II and III a synthesis of the literature and interviews is presented and in Chapter 11 the conclusions as to the options which ICSU may proceed further within sciences and food security are summarized.

The draft was circulated to members of the Committee and discussed at a meeting in May 1998. The conclusions of the meeting are given in Chapter 12. Comments by the Committee at the meeting and subsequently have been incorporated in the final version.



# Section II Key Background Information

## Chapter 2 - Present Food Security Situation

The FAO World Food Summit in November 1996 concluded that about 840 million people (15% of population) are undernourished and that under current prospects this would only reduce to 680 million by 2010 (10% of world population). This would be 18% of the population in the most vulnerable countries where 3 billion people would live (out of a world population of about 6.8 billion in 2010).

It is easy to gather such statistics from the literature but they miss the essence of the food security problem such as: a third of children (nearly 180 million) are malnourished and this may only drop to a quarter worldwide by 2020 and remain at 40% in South Asia; a third of the people in Sub-Saharan Africa will be food insecure by 2010 while the population may have doubled from today. Data at the country or local level will most likely show even greater disparities. Then at the household or individual level there will be significant differences which discriminate, for instance, against the poor, women and children and the aged, who suffer disproportionately and often seriously.

What is food security? A simple definition has been given by the World Bank (1986) - food security is access by all people at all times to enough food for an active, healthy life. This implies individual access in all seasons and all years not just for survival but for active participation in society. Further discussions on defining food security have been summarized by Maxwell (1998) as identifying livelihood security as a necessary and often sufficient condition for food security and focuses on the long term viability of the household as a productive and reproductive unit. Maxwell (and others) now favour the quality of the food entitlement (rather than just the quantity) where the emphasis is more on subjective assessment. A country and people are food secure when their food system operates in such a way as to remove the fear that there will not be enough to eat. In particular, food security will be achieved when the poor and vulnerable, particularly women and children and those living in marginal areas, have access to the food they want. Thus food security should be treated as a multi-objective phenomenon.

In the next section we examine briefly the changing perception of food security over the last 50 years or so.



## Chapter 3 - History of Food Security

There appears to be agreement that concerns on food security have progressed over the last 50 years or so from purely physical availability at the global level to the provisions of food to individuals and the role of poverty in ensuring year round access to food. The interaction between agriculture/food policies and socio-economic factors at the micro and macro-level is now considered crucial to ensuring food availability.

Swaminathan (1998) divides the post-war era into 4 phases (mainly from an Indian perspective).

- a) 1940/60s - food security was only considered in physical availability terms
- b) 1970s - economic access to food was considered equally important
- c) 1980s - food security must be considered at the level of the individual and not merely of the household (since within a household women and girl children tend to be undernourished)
- d) 1990s - recognition that micronutrients in addition to environmental hygiene and safe drinking water are important

He concluded that today we have to view food security from the viewpoints of physical, social, economic and environmental access.

Maxwell (1998) has distinguished 5 phases since 1974.

- a) 1974-1980: global food security - the world food crisis was evident from famines in Africa, doubling of international grain prices and large grain imports by the Soviet Union. FAO set up a committee on World Food Security and a World Food Council was established to monitor world food availability.
- b) 1981-1985: food entitlement and structural adjustment - questions of poverty and access featured since it was clear that production on its own did not assure consumption, and people needed access to food. This era coincided with structural adjustment activities where poverty reduction and basic needs were subordinate to debt management, macro-economic stability, etc.
- c) 1986-1990: the golden age - the 1984/5 African famine and the drawbacks of the social costs of structural adjustment changed the perceptions of food security which rose up in the international agenda.
- d) 1990-1996: poverty, not food security - poverty reduction was brought back to the front of the development stage and displaced food security; many donors abandoned or downgraded food security. Famines were seen to be far more associated with war and with drought (eg Southern Africa in 1992) which appeared to be managed reasonably efficiently. Thus the problem was not seen as a food security issue per se but rather one of managing food supplies in complex political emergencies characterized by social and policy breakdown.
- e) 1996-: where next? - another rise in food prices and renewed concern about the ability of the world to feed itself. Will the agenda shift back to Malthusian concerns of the 1970s with a focus on food production, often in high potential areas or will the concern with consumption and access be sustained?

It is concluded by Maxwell that there has been a significant change in the food security agenda since the mid-1970s. Instead of a discussion largely concerned with national food supply and price, we find a discussion concerned with the complexities of livelihood strategies in difficult and uncertain environments; and with understanding how people themselves respond to perceived risks and uncertainties. Thus, flexibility, adaptability, diversification and resilience are key factors. Intra-household issues are central. Food security must be treated as a multi-objective phenomenon where the identification and weighting of objective can only be decided by the food insecure themselves.





## Chapter 4 - Food Production and Availability

Thirty five years ago about half the population (1 billion people) of developing countries were undernourished - today it is under 20% (about 800 million people). During this period cereal yields, total cereal production and total food production in developing countries more than doubled while the population increased by 75%. As a result average daily calorie supply increased by a quarter from under 2,000 calories per person per day in the early 1960s to almost 2,500 calories in the mid 1980s, of which 1,500 calories was provided by cereals (Conway, 1997). This trend has continued into the mid 1990s so that the last 30 year period has seen a worldwide 19% per capita increase in food for direct human consumption with a 32% increase for developing countries as a whole. Today only 10% of the world population lives in countries with very low per capita food supplies (under 2200 calories) down from 56% in 1969/71 (de Haen et al, 1998).

However, these impressive gains have bypassed a large number of countries and population groups so that Sub-Saharan Africa is no better and often worse off today than 20 years ago and South Asia is still in a mid-low position as regards per capita food supplies. Nevertheless, considering India alone we see tremendous advances over the last 50 years - food grain production has increased four fold (50 to 200 Mt) while population has increased three fold (330 to 960 million).

These successes of the Green Revolution should be widely acknowledged but the shortcomings also need to be recognized. The resource-poor farmers and landless and especially those in marginal areas have not benefited significantly. The inability of such groups to improve their food security, in spite of substantial food production gains, is now recognized as a general failure to alleviate poverty within the context of enhancing agricultural resources so that employment and incomes may increase. How this is achieved is discussed later.

An aspect of agriculture which is often ignored is that 60-80% of the staple food production in developing countries is produced to a large extent by women. Unfortunately, in the past the role of women in local food production did not receive a sufficiently broad-based recognition so that their inputs were not targeted by yield-enhancing techniques. Now however, this is changing, albeit slowly.

IFPRI (1997) recently projected food production and consumption to 2020 using their updated IMPACT model. They concluded that there are signs of progress toward a food secure world but prospects are bleak if a business-as-usual scenario is used - there will be food insecurity in Sub-Saharan Africa and parts of Asia. Nevertheless, worldwide per capita availability of food is projected to increase around 7%. Not a dramatic percentage increase but certainly significant quantitatively as the population is also predicted to increase to about 7.6 billion.



## Chapter 5 - Demographic Situation

The rate of increase in the world's population has declined from 2.0% p.a. prior to 1970 to about 1.4% today. In 1997 the population was estimated at about 5.8 billion and growing by about 80 million a year (or 1 billion in 12 years) UNFPA (1998). The 2020 population is predicted to be about 7.6 billion with 90% of the increase occurring in developing countries whose share of the global population will be 84% (compared to 79% today).

The estimates of future population have been declining over the last decade as population growth rates decline. Lutz et al (1997) make a persuasive case that global population growth is slowing down and that there is a probability of two-thirds that the world's population will not double into the 21st century. They conclude that the fertility transition is well advanced in most developing countries and has even started in Sub-Saharan Africa. In 1960 woman gave birth to more than 5 children on average and today only 3. In order to stabilize world population while maintaining low death rates, births will need to average about 2 children per woman. Attaining this level will almost certainly take decades. Lutz et. al's median path projection is for 10 billion people in 2050 with a major concern (for them) of a doubling of the world's elderly people (>60 years).



## Chapter 6 - Sustainability and Agriculture

The significant increase in cereal (and some other crop) yields since the 1960s has been analysed in many publications (see for example Alexandratos, 1995; Dyson, 1996; Conway, 1997). Doubling and trebling of yields of rice, wheat and maize in both developing and developed countries is well documented. The so-called Green Revolution where breeding and agronomic practices were successfully combined undoubtedly improved the standard of living of billions of people.

The question being posed now is whether the yield growth rates of cereals can continue to keep up with population growth since globally they appear to have slowed down since the mid 1980s - declining from 2.3% p.a. to about 1.5% p.a. today and possibly only 1% p.a. over the next 25 years. However, the analysis is complex since developed countries have been decreasing productive capacity due to macroeconomic policies while in many developing countries where agriculture is of major importance to their economy they have maintained growth rates of all agricultural produce combined (besides cereals).

The question of China's food security (where rice yields have increased 2 fold from 1961 to 5t/ha today) and their possible import requirements received much publicity in 1996 when wheat and maize prices peaked in May 1996 after China became a substantial net importer in 1995. However, it should be realized that this peak (in the wheat price at \$260/t) was only a third in real terms of the peak price in 1974. The 1996 price move was due to a combination of circumstances and prices have declined by over half since then (early 1998). An analysis by International Food Policy Research Institute (1997) points out that predictions vary from China being a major cereal exporter to becoming the world's largest importer. IFPRI concludes that China is already a significant player on world food markets and is likely to become increasingly important. However, it does not represent a major threat to world food markets.

Global projections by IFPRI (1997) using a market-driven model indicate that developing countries as a whole will double their net imports of cereals up to 2020 reaching about 230Mt/p.a. Latin America will most likely not increase imports but Asia could quadruple imports due to rapid income growth while Sub-Saharan Africa will increase imports by 150% due to poor food production.

This situation is not thought to be satisfactory by Conway (1997) for a number of reasons. Firstly, the number of undernourished people is unlikely to decrease unless something new is done to increase food production locally. Many developing countries could not afford to be so dependent on food imports. Secondly, the model predictions depend on a significant rate of economic growth in developing countries highly dependent on the effectiveness of current economic reforms. However, the lack of infrastructure and institutional obstacles to reform are formidable. Thirdly, continuing increases in crop yields and production following recent trends are assumed, whereas these have in fact shown a degree of stagnation possibly due in part to environmental degradation caused by agriculture itself.

In his book *The Doubly Green Revolution*, Conway (1997) presents his ideas and synthesis from a CGIAR panel on *Sustainable Agriculture for a Food Secure World*. He believes that in order to provide enough food for everyone the following are required:

- (a) Increase food production at a greater rate than in recent years
- (b) Do this in a sustainable manner, without significantly damaging the environment
- (c) Ensure that it is accessible to all

He emphasizes the close link between agriculture and economic development. Increased production and employment in agriculture and natural resources can generate considerable employment, income and growth in the rest of the economy. Thus poverty alleviation is increased thereby improving food security. This scenario recognizes that food security is not a matter solely of producing sufficient food. In practice rural families decide on livelihood goals and then determine the optimal mix of activities (where) food security is usually but one goal; others are income and employment security and, linked to them, family size. Much evidence points to the fact that enhanced earning opportunities and education of women contribute significantly to lower fertility rate and thereby to food security for the whole family (see also Cleaver & Schreiber, 1994).

Conway (1997) provides a detailed and reasoned argument as to why and how major investments in agriculture and natural resources in developing countries could have multiple benefits, not the least of which is delivering food security. The mechanisms and policies needed for successful and sustainable agriculture are spelt out with the admonition that it cannot be left to market forces. Unfortunately, research to feed the poor is less attractive than high-value and capital-intensive farming and often involves long-term research in marginal areas and active participation of local farmers. The plea is for a second Green Revolution with public investment to benefit the poor more directly under diverse conditions while being environmentally sustainable i.e. the new Green Revolution must be more productive, be even more green in terms of conserving natural resources and the environment, and be more equitable. Its goal should be the creation of food security and sustainable livelihoods for the poor. The idea is to combine modern science and technology with economic and social reforms.



# Section III - Concerns of Organizations and Individuals

## Chapter 7 - International Governmental Organizations

### 7.1 FAO (Rome)

The World Food Summit in November 1996 and the outputs therefrom are essential reading providing background information and also policy decisions which are now being followed up. The plan of Action included 7 commitments, the first of which aims to ensure an enabling political, social and economic environment for eradication of poverty most conducive to achieving sustainable food security for all. A commitment was made to reduce the number of undernourished by half to 400 million by 2015. There is also a framework for discussions of food security issues, procedures for countries to prepare national action plans and for progress to be monitored through the FAO Committee on Food Security. The importance of sustainable agriculture and the human right to food was also acknowledged by the Summit.

An interesting background document for the Summit described success stories in food security with a number of countries being given as examples such as China, Burkina Faso, Costa Rica and Tunisia. The case studies illustrate the importance of the policy environment in determining the food security status of the people in any country. Establishing safety nets for the vulnerable and preserving them in times of economic hardship is an indispensable component for alleviating food insecurity (FAO, 1996).

Amongst the people who met in Rome there was agreement that food security was a crucial issue with a high profile and that there was a necessity to insert more science into the subject. FAO has a Special Programme for Food Security which is country-based with National Steering Committees. The Programme funds South-South co-operation with the exchange of field technicians/extension agents on a 2-3 year basis as a pilot phase. A Programme called FIVIMS (Food Security and Vulnerability Information and Mapping System) set up at the World Food Summit is monitoring undernourished people and issues of food access to provide scientific rationale for the estimates of numbers of malnourished people at a disaggregated level (Hunger map). At present, such adequate monitoring tools are generally lacking and hinder appropriate responses.

Issues of food quality, food safety, right to food, micronutrient status and effects of defined diets (especially those which are quantitatively inadequate), the interaction between food security and social/political stability, the need for rural sociologists in the studies and the increasing role of NGOs were discussed

A key issue of relevance to ICSU is the possibility of providing independent and additional scientific inputs into food security research monitoring and policy. It was suggested that an IPCC-like process was needed for food security to enhance the scientific background and then proceed in parallel with policy. This is an example from the successful IPCC process where discussions are now made with sound knowledge on many aspects of Climate Change. If a similar example was followed with food security where funds were invested in science this could be very cost effective in the future. An opportunity to put this forward could arise in the preparation for CSD-8 (UN Commission on Sustainable Development) meeting in 2000 whose theme will be Agricultural and Rural Development.

### 7.2 IFPRI (Washington, DC)

The December 1997 Food Policy Report *The World Food Situation: Recent Developments, Emerging Issues and Long Term Prospects* described the results of their analysis and modelling projections to 2020 (Pinstrup-Andersen et. al, 1997). It is concluded that in many developing countries food production is unlikely to keep pace with increases in demand for food - the food gap - could more than double in the next 25 years. An increasing share of food demand in developing countries (especially cereals and meat) will have to be met by imports from developed countries. This will be different for many low-income countries including most of those in Sub-Saharan Africa which will not be able to generate the necessary foreign exchange to purchase food on the world market. Many poor people within these countries will not be able to afford sufficient food. The poor could become more vulnerable to hunger if there is increasing volatility in the world food situation. This could also be aggravated by the halving of food aid over the last 5 years. Support for agriculture has also decreased significantly over the last decade.

It is predicted that the long-term trend for world cereal and meat prices will continue downward in real terms. But unless the poor in rural (and urban) areas can generate the necessary purchasing power they will not

benefit from lower prices. Policies and investments in rural areas to improve agricultural productivities and generate income are essential if food security is to be improved. The focus on agricultural research and policy should be on low-income developing countries, and particularly small-scale farmers in those countries. Governments should direct resources toward rural facilities which accelerate broad-based growth within and outside agriculture. Often agriculture extension and research is inadequately supported and is not directed to marginal areas where food security problems are prevalent.

The Report concludes that policy makers, researchers and others must take pro-active steps to minimize uncertainty in the world food situation in order to achieve food security for all people. Promotion of broad-based economic growth, especially agriculture, is considered necessary so their countries can feed themselves or generate income for imports. A world of food-secure people is within our reach, if we take the necessary action.

### 7.3 World Bank (Washington, DC)

The World Bank is a major funder of the CGIAR (Consultative Group on International Agricultural Research) where much of the Green Revolution R&D was performed. Ismail Serageldin a vice-president of the World Bank and Chairman of CGIAR (which commissioned the Conway Report on Sustainable Agriculture for a Food Secure World) said that it has been endorsed as requiring a double shift in the research paradigm. Firstly, an integration of crop specific research into a wider remit which brings in concepts of natural resource sustainability and management; this is needed to increase productivity and profitability of complex farming systems at the smallholder level and must include the active involvement of the farming communities themselves at all stages. Secondly, to utilize biotechnology to accelerate the breeding process and achieve the promise of all that science can do for the poor and the environment. Serageldin affirms that access to food is a human right and food security is the key to a prosperous and stable world. Equally, protecting the natural resources base on which food productivity depends is an obligation of all of us.

Alex McCalla, head of the Rural Development Division, emphasizes that food security, poverty reduction and natural resources management is 70% connected to rural development and that doubling yields of complex farming systems (which is required to feed a world with 10 billion people) is a considerable challenge because it involves physical, biological and social integration. The problem is compounded by the fact that it is difficult to get the attention of policy people as a result of which the crucial agricultural issue is inadequately addressed - funding for agricultural R&D and extension is declining on a worldwide basis, especially as directed to the more marginal producers (McCalla, 1997).

The question which McCalla raises is who is going to tackle the complex problem to ensure food security in the next century - the CGIAR system, National Academies Roundtable, ICSU, etc.

### 7.4 UNDP (New York)

Within SEED (Sustainable Energy and Environmental Division) there is a focus on food including food security research and monitoring and technical and policy issues e.g. natural food security action plans. Regional Offices also support agricultural research centres and capacity building. Within the Sustainable Livelihoods Unit of the Poverty Division there is field and policy work of direct relevance to food security e.g. a Malawi project with smallholders and macro-policy (which incidentally has aims and policies which are at odds with some other donors and NGOs - see later). The SL Unit uses 4 criteria in its projects: coping with stress and shock, economic efficiency, social equity, and ecological integrity. They emphasize that policy shifts do not always require money and that capacity building is essential at the local level.

### 7.5 USAID (Washington, DC)

An active US Committee on Food Security exists (a follow up from the World Food Summit) which is tracking food security within the country since it is still also a local issue. USAID itself focuses on access problems, micronutrition policies and environmental effects of food security. It is concerned that food aid gets confused with food security and that the former is decreasing greatly and thereby confusing the constituency which should be supporting long term food security programmes. It is also supportive of the roles played by NGOs of all types in the food security issue.



## Chapter 8 - Foundations and Non-Governmental Organizations

### 8.1 Oxfam (Oxford)

This NGO has been providing food aid at the grassroots level around the world since WWII. Its programme on food security in Southern/Eastern Africa has recently been re-evaluated to incorporate their experience since the widespread and very serious 1991/2 drought. They have concluded that the following are important for food security:

- (a) ways of increasing agricultural productivity in a sustainable way,
- (b) partnerships are required with NGOs and Government,
- (c) capacity building issues,
- (d) participation of women,
- (e) participatory extension systems,
- (f) alternative income generation,
- (g) land rights,
- (h) nutrition practices.

The organization feels that it must improve its learning for the future in

- (a) participatory approaches in food security projects,
- (b) off-farm income generation,
- (c) regional food markets.

### 8.2 Action Aid (London)

It also has had long term food aid and security programmes in Africa for some time. Its central goal in these projects is improvement in local agriculture with resulting improvements in food security. This has proved to be one of the most difficult sectors to help communities achieve sustainable improvements. It is clear that community livelihood systems which are agricultural/rural based are diverse and complex. All important determinants of food security appear to be the availability of off-farm employment or other income generating opportunities and remittances from outside the area. A focus on participating methods and helping farmers diversify and minimize their risks will require a great variety of approaches to provide food security at the local level.

This NGO is also concerned on how to link effectively micro-level realities with macro policy in food security issues. A theme which recurs amongst many NGOs is the lack of support for traditional foods like sorghum, cassava and beans which are crucial in periods of food insecurity while also providing basic level food at other times. Other issues frequently mentioned are the role of women, provision of micro-credit, income generating activities, decreasing post-harvest losses, nutrient deficiencies, poor infrastructure, lack of extension help for peasant farmers, and inability of Government to focus attention on the food insecure and small farms as a long term effort.

### 8.3 World Resources Institute (Washington, DC)

There is concern that hunger and food aid continues at the same time as the prestige of agriculture declines. There has been a shift in the scientific paradigm of centralised agricultural R&D where there was little credit

for appropriate agriculture and on-farm research was not well considered. Unfortunately this shift has not yet sufficiently focussed on interdisciplinary R&D to solve problems of food insecurity for the poorer and marginal farmers.

Integrated Farming Systems (a Kellogg Foundation programme) and Sustainable Agriculture (now supported by a number of organizations) are seen as essential ingredients for food security and sustainable systems around the world. How biologists (and other scientists) could make effective inputs e.g. into agroecology, and how they would get support and credit from their peers is still a difficult question. The appropriate institutional structures and policies must be in place if these approaches are to succeed.

#### **8.4 World Sustainable Agriculture Association (Washington, DC)**

Six principles are emphasized to guide efforts to achieve food security through enhanced sustainable food and farming systems:

- i) more sustainable agriculture is required for long term food security
- ii) an agricultural ecosystem approach (agroecology), rather than narrow production/yield objectives, is critical for resource-poor farmers
- iii) local and regional rural development goals must be linked with sustainable agriculture
- iv) urban agriculture to help the urban food-insecure needs encouraging
- v) research, education and extension for sustainable production and food systems is vital
- vi) public support and financial resources for sustainable food systems needs to be expanded

There is a strong plea made to learn from past mistakes to form interdisciplinary partnerships linking government, research and extension, producers and NGOs to place sustainable agriculture at the centre of rural development and improve security in the food system. Involvement and support of local farmers and communities with the accompanying social and economic benefits is seen as essential to providing a food secure environment where the natural resources are not degraded.

Actions to support these 6 principles should ensure public support for sustainable agriculture, promote local food production and marketing, enhance sustainable food production, targeted research, education and training, and promote women's access and entitlement to resources of all types.

#### **8.5 IDS/ODI (Institute for Development, University of Essex / Overseas Development Institute, London)**

These Institutes have programmes on food security, farming systems analysis, participatory research and analysis, etc.

A detailed study of household food security in Malawi by Deveraux (1997) highlights the multifaceted problem of food security. 30% of the rural population are malnourished, small land holdings are cultivated and many are women-dependent, and population growth is 3.3% p.a. Three approaches to food security are identified:

- i) National self-sufficiency by increasing food production through hybrid maize production and intensification.
- ii) Market liberalization with price incentives to encourage diversification into high value and export crops.
- iii) Targeted safety nets or research transfer for the poor (malnutrition and child mortality are very high).

There is considerable disagreement between Government, Donors and NGOs as to which of the approaches will ensure short and long term food security. However, Deveraux concludes poor households must increasingly diversify their sources of both food and income. In the long run, sustainable household food security can be guaranteed only if additional livelihoods are found to provide adequate and reliable off-farm incomes for Malawi's marginal smallholders.

Maxwell (1998) is concerned that improvement of food security nationally and internationally will require a balance of support for both high and low potential agricultural areas. Over emphasis on cash crops would be a disaster nationally but the appropriate level of support could generate income at the local level. There is no doubt, however, that agriculture and rural development should be combined to alleviate food insecurity.

There are 4 main issues with which Maxwell is concerned:

How to reverse the decline in aid which will affect development especially in rural areas.

Wider recognition is needed of the key role which rural programmes play in overall development.

Poverty is now considered of crucial importance in food security.

Lastly, the size and content of research in food security is inadequate and it is very difficult to involve developing country scientists in such work.

### **8.6 Ford Foundation (New York)**

It is felt that the food security issue will not disappear as a problem, it just seems to change emphasis over the years. It is important that food security does not fall off the agenda and the capacity for research and action does not atrophy. Strengthening scientific bodies worldwide is one way of supporting R&D policy at the country level. It is, however, necessary to integrate the natural and social sciences in these efforts and the National Academies should play a crucial role here.

It is possible that ICSU could play a role as an independent organization which FAO, IFPRI, World Bank, etc are clearly not. The social sciences and NGOs must be ensured of involvement in food security R&D.



## Chapter 9 - Individuals

### 9.1 Henry Kendall (Union of Concerned Scientists, USA)

He is concerned that food will be a looming issue in the future. Food insecurity will remain a problem. Has published with David Pimentel (Cornell University) on food and population and is a member of the ICSU Advisory Committee on Environment.

### 9.2 Norman Myers (Oxford)

He has published extensively on pOpulation dynamics and food security, eXcessive consumption and sustainable development, and recently on pEverse subsidies. He is particularly concerned that excessive and wasteful consumption, often encouraged by subsidies (direct and indirect) to agriculture, water and fuels, harms the environment and preempts food from poor communities.

### 9.3 Vernon Ruttan (University of Minnesota)

In two recent speeches he highlights his conclusions that almost all increases in world food production must come from higher yields - resulting from knowledge based on science, technology and human capital. Mechanical technology will be a substitute for land and biotechnology for land, but there must be transfer of this capacity to farmers in developing countries if they are to achieve productivities comparable to those of, say, Western Europe.

He is more optimistic now about the promise of biotechnology but concerned that there may still be surprises in store which science and technology policy are not well equipped to deal with. Concerns were also expressed on resource/environmental and health constraints and that population may not keep within the 9-10 billion range in 2050. There is also the worry that gains in agricultural production may not be as easily achieved in the future as in the past - this is compounded by the fact of decreasing agricultural research budgets and the interactions with environmental problems. He ends up by being cautiously optimistic about the possibilities of responding to the demands that will be placed on agricultural producers over the next half century. More effective bridges must be built, both in research and in practice, among agricultural, environmental and health communities.

### 9.4 David Norse (University College London)

He has previously been involved with FAO and International programmes focussing on resources availability. Was a member of the ICSU Food Security group which met in Dakar in 1995 and recently attended the Megasciences Forum held in Stockholm in February 1998.

He is concerned that there is no global scientific consensus or platform for agriculture similar to that for climate change, biodiversity and desertification. The public perception of food security (famine, disasters, war) and agriculture (surpluses, pollution, etc) is not very good. Generally, our analytical tools for stimulating and gaining public awareness are too narrow. The CGIAR has an image not correlated to its successes; it has low funding out of proportion to its good returns. The FAO also has image problems which it is trying to reverse.

Possibly what is needed is an IGBP-type organization for food security which would operate at the interface between science and policy (but it would require substantial funding). Maybe an IPCC Working Group would be a lead in order to generate consensus with a track record first. Any new committee/group should be active, have no vested interests, be fundable, and incorporate scientific capacity and technological expertise.

### 9.5 David Pimentel (Cornell University)

Has written extensively on problems of resource degradation e.g. soil erosion, population and food, energy use in agriculture, etc. He is concerned that the problem of food security is increasing as soil erosion, water deficiencies, less fertilizer use, yield decreases, paucity of agricultural research, pests and diseases, and population all interact.

He sees a very important role for the social sciences in motivating the public and for making changes in peoples and policy makers' behaviour. He advocates a much greater role for rural sociologists as opposed to

relying on anthropologists only in the food security debates and implementation of policies. Thus, he thinks that agricultural R&D must be much more proactive toward marginal producers.

Whatever ICSU establishes must not be part of another organization. It could be an IGBP-type organization but must be proactive and independent.

### **9.6 Partha Dasgupta (Cambridge University)**

Dasgupta agrees that we should not blame world hunger as a distribution entitlement failure or a production failure. Thus, the solution to food insecurity is neither solely a market solution nor a social security measure. What is needed are certain policies that encourage economic growth (e.g. provision of basic infrastructure) to improve the distribution of well being (e.g. primary education) and vice versa. He states that '...prime target...' for economic policy reforms should be the institutions (in particular, the structure of property rights) within which individuals, households, businesses, and communities go about their business.

Rural people who comprise 75% of the poor in Sub-Saharan Africa and South Asia and who depend directly on agriculture should be the focus. They face stringent constraints e.g. infrastructure, education, credit, insurance, and large risks which keep them in a poverty trap. Under-nutrition proscribes their ability to do productive work and affects their health so completing a circle of food insecurity.

Governments in many poor countries have long discriminated against agriculture, creating strong disincentives for farmers to invest in it... something like 50% of the agricultural income of poor countries has been transferred to the rest of their economies. Similar to the IFPRI model, Dasgupta supports the route of agricultural and social investments to improve food security substantially in poor countries. However, he is concerned about the effects of agriculture on the environment and the fact that unhappily, economists and demographers do not take ecology seriously. Thus models do not seem to take seriously the kind of constraints that could well display household effects in food production, such as water scarcity.

### **9.7 Alex Duncan (Oxford Policy Management Centre)**

He has been involved recently in a food security strategy framework project for the Southern African Development Community. In the past, food security focussed mainly on helping countries increase food availability but now the emphasis is more on household food security issues. The present programme promotes increases in agricultural production with enhanced food security at household, national and regional level combined with improved welfare (especially rural) by promoting increases in broad-based employment and income generation. There is an increasing urbanization along with manufacturing and services so that causes of food insecurity are likely to shift from drought to unemployment and old age. This implies that poverty alleviation, urban as well as rural, is now the prime food security concern.

Thus, Duncan sees effective policy to deal with poverty rather than food production only as being of prime importance for food security. He is, however, concerned that food production requires adequate funding for agricultural R&D which must be kept at an adequate level by both public and private funding and must be complementary. The continuing long-term decline in grain prices should not preclude R&D funding which is required to ensure productivity increases and lower prices. Both of these trends benefit all developing countries; only those with weak external trading positions may not be able to take full advantage of world markets and prices. It is these weaker developing countries where research and policy on poverty alleviation must be enhanced in order to promote food security.



## Chapter 10 - Additional Issues

A host of specific issues have been mentioned above and some have been discussed. Here I list issues which continually recur in the literature and in debates but have not been dealt with. Not to say they are unimportant but this report would become a thick book if they were covered.

- (a) Soil degradation (see Oldeman, Crosson)
- (b) Water resources (see Postel, SEI)
- (c) Biotechnology (see von Montagu)
- (d) Yield declines (see Conway)
- (e) Pesticides/pests (see Pesticide Trust; Pimentel)
- (f) Urbanization
- (g) Nutrition and Micronutrients (see FAO, Swaminathan)
- (h) Feed/cereals for animal/meat production (see IFPRI; Conway)
- (i) Fertilizer use (see Matson et. al, 1998)
- (j) Women and intra-household resources (see IFPRI; Haddad)
- (k) Food processing and safety (IUFoST; IUNS)
- (l) Has the debate swung too far from hunger to poverty? (see Pinstrup-Andersen)
- (m) Role of traditional foods
- (n) Energy use in agriculture (see Stout)
- (o) Perennial versus annual crops (see Land Report)

and undoubtedly others!

Smil (1994) in a reasoned presentation of the debate between doomsters and optimists concludes that it would seem realistic to conclude that the Earth could support a population of 10-11 billion during the next century. He also quotes from Malthus's second 1803 edition (following the famous 1798 edition forecasting disaster) which concludes that far from being entirely disheartening, and by no means preclude that gradual and progressive improvement in human society... Dyson's (1996) book also should be required reading for those involved in the food and population debates since he discusses in great detail trends in both parameters over the last decades and the possibilities for the future.

I end with 3 quotes to illustrate the inaccurate forecasts of the past and the difficulties which lie ahead to solve the food security issue in the next century:

So long as freedom from hunger is only half achieved, so long as two thirds of the nations have food deficits, no citizen, no nation can afford to be satisfied. We have the ability, as members of the human race, we have the means, we have the capacity to eliminate hunger from the face of the earth in our lifetime. We only need the will.

President J F Kennedy, 1963

The profound comment of our era is that for the first time we have the technical capacity to free mankind from the scourge of hunger. Therefore today we must proclaim a bold objective: that within a decade no child will go to bed hungry, that no family will fear for its next day bread and that no human being's future and well being will be stunted by malnutrition.

Dr Henry Kissinger, 1974

We believe that it is indeed possible to end world hunger by the year 2000. More than ever before, humanity possesses the resources, capital, technology and knowledge to promote development and to feed all people, both now and in the foreseeable future. By the year 2000 all the world's people and all its children can be fed and nourished. Only a modest expenditure is needed each year - a tiny fraction of total expenditure which amounts to \$650 billion a year. What is required is the political will to put first things first and to give absolute priority to freedom from hunger.

FAO World Food Colloquium, 1992



# Section IV - What role for ICSU?

## Chapter 11 - What role for Sciences and ICSU?

There are two questions:

Is there a role for the Sciences in food security in the next century? and What role could ICSU play in providing scientific inputs?

Considering the five objectives formulated by the ICSU Committee on Sciences for Food Security (Chapter 1) one can come to the following conclusions:

a) Why Sciences? It is very clear that food security is a complex issue that encompasses more than just food production although this is no doubt the cornerstone. Thus the social and economic sciences must provide an interdisciplinary basis along with the natural (biology, chemistry, maths, physics) sciences.

The difficulty which the different sciences experience in working together in interdisciplinary modes must be overcome if scientists in ICSU are to make a real contribution. We should see this as an opportunity to demonstrate that scientists can make a difference to practical and complex problems which span a wide range of issues.

b) Critical Issues and Gaps; Regional Perspectives? There does not appear to be any one issue or gap which can be clearly defined. The perception of food security has changed significantly over the last 50 years or so with poverty nowadays being considered a crucial factor (assuming that food can be produced where and when required given the appropriate incentives, infrastructure, etc.). Gaps in knowledge in the area of the interface between poverty and food security require filling by research. Regionally there may be issues/gaps which need addressing but these require local initiatives with the necessary inputs of scientists, policy makers, financial services, trainers/extension workers, etc.

c) ICSU Strengths? Its main strength is that it is independent and has prestigious National Academies of many developed and developing countries as its members. This combined with membership from a wide range of Scientific Organizations provides a unique ability to draw on quality and breadth for scientific inputs and advice. The question is how to make these strengths effective in ensuring food security in the next century. Research is still needed, for example, on the causes and approaches to alleviating food insecurity. Organizations and individuals from ICSU affiliates could become involved to interact with other organizations/individuals in food - insecure countries as a practical means of implementing such research and capacity building.

d) Which ICSU Affiliates? The initial meeting of the Committee drew up a list of potential ICSU bodies who might have an interest in collaborating in this project. Interest has been expressed (Section VII) by IGU (Geography), IUPAC Chemistry), IUFoST (Food Science), IUNS (Nutrition), IUPsyS (Psychology), ISSS (Soils), SCOPE (Environment), COSTED - IBN (Developing Countries - Biosciences) and TWAS (Third World). Only affiliates with a definite commitment to food security issues should participate.

e) Modalities of Cooperation with Non-ICSU Bodies? These could be at a formal level but this would most likely result in little direct action (but could provide a means of inputting independent scientific and policy advice to country level and international organizations in a valuable way). A more direct route could be to scientists, technologists, NGOs, CBOs, etc within countries where food security is an issue.

Of course, a critical concern is whether an ICSU-based organization would have a niche which did not significantly overlap and compete with any existing organization. Presently organizations such as FAO, World Bank, CGIAR, etc. provide differing theoretical and practical inputs to alleviating and understanding food security problems and issues. ICSU's distinction is that it would provide multidisciplinary and independent inputs to the scientific level of food security research and policy and capacity building. It would naturally collaborate with ongoing efforts but should be distinctive in its research and practical assistance in food security issues.

It is concluded that if ICSU is to play a role in food security in the next century it should have two basic criteria for such a role: (1) it must be active - both proactive and reactive; and (2) the work must be fundable. If both these are met then the results of the work might be effective in addressing food security issues. Complete

independence is a necessary requirement and is assumed at all stages. If all these criteria are not met then I do not see a fruitful role for ICSU. A number of options were proposed here with the aim of stimulating debate at the meeting on May 14/15, 1998 (Chapter 12).

a) An IPCC-type process where a scientific synthesis is made of the state of the art. This is then used for policy recommendations and independent advice. It is an ongoing process with continuing updates. [The Intergovernmental Panel on Climate Change has done two 4/5 year synthesis studies on the scientific and policy aspects of climate change. These have been generally considered of high quality and independent so as to be valuable in policy advise.

b) An IGBP-type organization which combines synthesis with targeted research by a worldwide network of scientists of all disciplines. It should have a well directed and tight secretariat (as also with IPCC) and have definitive goals, schedules and outputs. It must have influence otherwise it would be a waste of effort. [The International Geosphere - Biosphere Programme has recruited scientists worldwide to conduct research on key issues relevant to environmental issues. It also undertakes long term monitoring and training]

c) Direct involvement in capacity building in the agriculture/food related sciences and extension services in poorer developing countries. This could be at the research and/or training level.

d) Direct involvement with the education of women in poorer developing countries and with providing technical and credit facilities to improve household food security. This would involve mainly training and information transfer from successful schemes elsewhere.

e) Providing opportunities for earning-related activities in rural areas especially in agriculture. This would require practical scientific/technical inputs and advise on agro-industry activities.

f) A mechanism to influence agriculture and food related policies in developed and developing countries so as to ensure household and individual food security.



## **Chapter 12 - Conclusions from Committee meeting at ICSU (May 14/15, 1998)**

After considerable discussion of the various options proposed in the report it was concluded that ICSU should set up a Panel with existing Food Security committee (CSFS) members plus about 8 others from the key associations (e.g. IUFOST, food science; IGU, geography; IUPAC, chemistry, etc, which had expressed an interest and/or were most appropriate). The Panel would seek 3 years of funds to focus on helping scientists and technologists (in Universities, Institutes, NGOs and CBOs) in resource-poor countries or regions where there are food security problems. Scientists and technologists in biological, chemical, physical, social and economic fields would be encouraged to participate. The Panel would be independent of the existing Food Security Committee (CSFS) but the Panel should be self sustaining.

The aim would be to develop practical mechanisms to assist country scientists and technologists to do research and implement solutions to food security problems. This would help strengthen national scientific organizations and community projects with practical support and backup from ICSU, thereby enhancing the scientific basis of food security research at the national level. It was pointed out that there is expertise on food security in some developed countries but a serious lack of scientists working and/or interested in this area in many developing countries. There is, however, concern that overall there is an inadequate base of researchers and advisors on food security in both developing and developed countries. Assistance could for example, be given to establish Committees of agricultural and social scientists in selected countries at risk from food insecurity. They could prepare national food security assessment and strategy papers on what could be done to achieve food security in the next century. Complimenting such an endeavour could be the preparation of a study guide for national food security studies. This would cover both technological and institutional aspects of what could be done at the national level and would consider both domestic food production and the international trade basis for food security. It was also noted that the food security problem is unlikely to disappear in the coming decades (see Report above) and that surprises may indeed arise in the future.

The niche which ICSU could successfully fill is focussed on this lack of sufficient practitioners and activities in food security in resource-poor countries. Thus the 12 or so ICSU members who have an interest in food security would join together in a Panel which would be active in assistance to selected countries (eg with ICSU membership such as the 14 in Sub-Saharan Africa). Such country scientists would request collaboration on specific research and projects targeted on food security. Scientific experts from both developed and developing countries would be recruited to participate in the collaboration and provide input to the Panel at all stages.

The collaboration envisaged with country scientists would be independent of international governmental organizations but would obviously be complementary to them. Collaboration with national and international research centres was essential and should be on a mutually beneficial basis. The work must be demand-driven from in-country scientists and would provide support to these local scientists in their work and policy making. Feedback from the selected countries is an essential ingredient from the start of planning and during any implementation.

Thus the proposed ICSU Food Security Panel would be reactive to in-country scientific requests and priorities and proactive in its interaction with national scientific groups and academies. The Panel should make the key recommendations as to funding of assistance to country scientists and technologists. Support should only be given to active groups in a selective way so as to increase or mobilize food security work. It would seek to enhance the prestige and volume of work on food security issues by offering the highest level of scientific input and collaboration from those ICSU groups actively interested in food security. The scientific and technical inputs should have a longer term view than only short term crisis responses and should be cross-disciplinary. Full use must be made of information technologies to back up the personal scientist-to-scientist contacts which are the essence of any successful programme.

The committee proposed that the Panel would need about USD 130,000 per year to run a small office (one person) and fund 10 collaboration visits per year. This would include a small amount of funds to support local scientists in their research/monitoring directly associated with each collaborative visit. The funds would allow for scientific interchange backed up by information exchange. The programme should run for 3 years during which time its approach and success could be evaluated. Specific in-country project funding would require a separate strategy which the Panel would have to address early on when setting its agenda. The Panel should also consider how to support younger scientists directly as does the IFS (International Foundation for Science, Sweden, an ICSU member) and whether training and capacity building programmes on food security could be usefully supported, eg by TWAS (an ICSU member) and similar organizations.

There were discussions on examples of existing scientific groups which work on science and technology

problems in rural areas of developing countries. One such group is ASTRA (Application of Science and Technology to Rural Areas, at the Indian Institute of Science, Bangalore) which has nearly 20 years experience of such work and is still thriving. Another is in Ghana which is associated with the University of Ghana and works on food technology problems in villages and with agro-industry. The Panel must take advice from such groups early on as to how best to work with similar organizations and benefit from their experience with governments, agro-industry, communities, etc.

At the beginning of the discussions the committee decided that the following options (Chapter 11); (d) education of women & (e) earning activities, were not feasible for ICSU. However, options (c) capacity building and (f) policies, were important and interesting but should be incorporated into other objectives. Option (b) IGBP-type organization (research and synthesis within a global network), was considered too ambitious at this stage but might be an option in the future if the proposed Panel was successful.

This present report and the conclusions from the committee meeting should be completed by mid June and a Concept Note for funding should be prepared at the same time. All should be finalised by mid-September and requests for funding submitted in October after approval by the ICSU Board on October 5, 1998.

The committee also would keep in mind the possibility of making an input to the CSD-8 (UN Commission on Sustainable Development) meeting in 2000 whose theme will be Agriculture and Rural Development).

(Please note that references von Montegu and Stout cited in the text are missing from the reference list and will be included later)



# Appendix

## Appendix 1.

Abbreviations

### **CBO**

Community-Based Organization

### **CGIAR**

Consultative Group on International Agricultural Research

### **COSTED-IBN**

Committee on Science and Technology in Developing Countries-International Biosciences Network

### **CSFS**

Committee on Sciences for Food Security (ICSU)

### **FAO**

Food and Agriculture Organization

### **IUPAC**

International Union of Pure and Applied Chemistry

### **IFPRI**

International Food Policy Research Institute

### **IGBP**

International Geosphere-Biosphere Programme

### **IGU**

International Geographical Union

### **IPCC**

Intergovernmental Panel on Climate Change

### **ISSS**

International Soil Science Society

### **IUFoST**

International Union of Food Science and Technology

**IUNS**

International Union of Nutritional Sciences

**IUPsyS**

International Union of Psychological Science

**NGO**

Non-Governmental Organization

**SCOPE**

Scientific Committee on Problems of the Environment

**TWAS**

Third World Academy of Sciences

**UNDP**

United Nations Development Programme

**UNPF**

United Nations Populations Fund



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*Last Updated: December 1, 1998*