CENTER DIRECTORS' COMMITTEE

NOTE ON INTEGRATED NATURAL RESOURCE MANAGEMENT

15 March 1999

The 1998 CGIAR System Review recommendation number 5 included a number of proposals for strengthening Integrated Natural Resource Management (INRM) research. The Centre Directors Committee presented the following response on Recommendation 5 to the Consultative Council at its meeting in Brussels in January, as follows:

- **The CDC does not endorse the establishment of an additional network for INRM, but strongly supports the proposed conceptual framework and the need for increased support of ongoing INRM activities in the CGIAR.**
- INRM should be seen as an approach that permeates the entire CGIAR, as a pillar of equal importance to integrated gene management (IGM). INRM is not amenable to being addressed through a single "international network". In fact this reductionist proposal runs counter to the more desirable objective of organizing research around natural resource management problems in a demand-driven way.
- The CGIAR has already invested heavily in establishing INRM-type ecoregional consortia and systemwide programmes, such as Livestock, Soil/ Water, and Alternatives to Slash and Burn. These programmes focus on the relationships between the resilience of the natural resource base on one hand, and poverty reduction and food security on the other. The next logical step for the CGIAR should be to reap full advantage of the time and financial investments made in these established programmes by providing sustained support.
- Emphasis should be made on scaling-up the research from the plot or farm scale to the watershed/village, national, regional and global scales. National, regional and global concerns such as carbon sequestration, greenhouse gas emissions, agrobiodiversity, deforestation, desertification and depletion of coral reefs should become a more explicit part of the CGIAR agreed agenda.
- The CDC strongly supports the Review's emphasis that technological research should go hand-in-hand with policy research at the same geographical scale. INRM is by definition interdisciplinary and highly participatory.
- INRM consortia based on ecoregions or problem areas should be operated through the leadership of the Centers already responsible. The CDC Committee on Sustainability and the Environment (CSE) will take explicit leadership for a system-wide sharing of experiences, approaches, results and ways to control the high transaction costs of INMR partnerships. The CSE will take the initiative to ensure increased cohesiveness and synergies of INMR between centers and with partners.
- Considerable confusion is associated with the use of the term "INRM" in the CGIAR. The CSE will also work on clarifying concepts and terminology.

- The suggestion about joint preparation of national agricultural research strategies must not imply that CG centres develop strategies for our NARS partners.

The Council accepted the CDC response and requested the CDC was to prepare a paper elaborating on these issues. The CDC discussed these issues further at its retreat in The Hague at the end of January and agreed upon the following statement on INRM for submission to the TAC meeting in Rome in March.

A CDC RESPONSE TO THE SYSTEM REVIEW RECOMMENDATIONS ON INRM

Background

In the past the CGIAR has principally focused on natural resource management (NRM) issues in the context of food security. For instance the CGIAR can claim major achievements in the fields of integrated pest management. However there is a broad set of NRM issues, beyond food security, where the CGIAR has not in the past been a major player. The high level of connectivity within all natural resource management systems has made it difficult to demarcate the priority areas of NRM research for the CGIAR.

In the late 1980s and early 1990s there was considerable discussion within the CGIAR on the questions of achieving better "integration" of NRM research and on the pros and cons of broadening the CGIAR agenda. This led to the inclusion of IWMI, ICLARM and ICRAF in the CGIAR and to the establishment of CIFOR.

The TAC 1992 "Review of CGIAR Priorities and Strategies" study concluded that there could be major benefits from integrating the natural resources research of CGIAR centers at the ecoregional scale. The 1994 Stein Bie report on the CGIAR response to Agenda 21 concluded that the CGIAR should expand its agenda to address a number of environmental and NRM issues which UNCED had identified as international priorities. The 1995 Lucerne ministerial level meeting emphasized NRM and environment as legitimate objectives of the CGIAR but was not explicit about how they should be addressed. It should be noted that UNEP became a co-sponsor of the CGIAR at this time. TAC subsequently reviewed these issues in its "Priorities and Strategies for Soil and Water Aspects of Natural Resources Management Research in the CGIAR" (1996).

Increased attention to NRM issues within the CGIAR coincided with a period of funding crises and downsizing of many centers. This prevented the centers from fully responding to the challenges and opportunities for NRM provided by, inter alia, ecoregional approaches. In 1997 the CDC initiated a study of experience with ecoregional research and this led to the CDC report "Progress in the Ecoregional Initiatives" (1998) which reaffirmed the view that major NRM issues could best be addressed through centers working together in priority ecoregions and in an integrated manner. This was consistent with the trust of the System Review recommendations.

The reality is that the CGIAR has been responsive and dynamic in responding to many INRM concerns. However, the overall visibility of INRM research in the CGIAR is low and this may have led to the perception that not enough is being done. The two pillars of the CGIAR as proposed by the System Review contrast sharply in their visibility. The integrated gene management pillar is highly visible while the INRM pillar does not share the same high profile.

The CDC believes that the term INRM is not sufficiently understood in a uniform way to all CGIAR stakeholders.

Natural resources can be defined as those that are generated by natural bio-geochemical processes and solar energy that yield useful flows of services to humankind. The natural resources the CGIAR focuses on are soil, water, atmosphere, animals and plants. Integrated natural resource management research in the CGIAR consists of the manipulation of these natural resources within the context of agriculture, forestry and fisheries in a systems approach. There is a need to adopt this broad definition of INRM research and to establish the comparative advantage of the CGIAR within this very large research domain.

INRM research in the CGIAR consists of managing these natural resources to support the CGIAR mission of: contributing to food security and poverty eradication through research promoting sustainable agricultural development based on the *environmentally sound management of natural resources.*

Working at Multiple Scales

INRM research takes place at multiple spatial scales: global, ecoregional, watershed and farm/household. It often also deals with time scales longer than those of conventional agricultural research in order to promote long-term sustainability. The CGIAR works at the following spatial scales using different mechanisms.

- **Global scale**. The CGIAR is increasing its involvement in the global INRM debates. It is a major provider of analysis to a number of inter-governmental natural resource conventions or fora. It contributes to a number of policy dialogues as described in the CDC paper on policy research. The CDC has allocated the lead responsibility in dealing with the following post-UNCED initiatives to specific centers:
  - Biodiversity: IPGRI
  - Desertification: ICRISAT
  - Forests: CIFOR
  - Climate change: ICRAF
  - Mountains: CIP
  - Coastal marine resources: ICLARM
  - Water resources: IWMI

- **Ecoregional scale**. Much of the CGIAR INRM research is conducted through inter-center collaboration in priority ecoregions. The current understanding of the ecoregional approach is that it is research conducted in **"agroecological zones geographically defined and addressing major environmental issues and employing multiple scales in time and space."** The CGIAR at present has a number of systemwide and ecoregional programmes, which fit this definition, as shown below with the convening centers indicated in brackets.

  Systemwide Programmes:
  - Plant Genetic Resources (IPGRI)
  - Alternatives to Slash and Burn Agriculture (ICRAF)
  - Livestock (ILRI)
  - Global Mountain Initiative (CIP)
  - Soils (CIAT)
  - Water (IWMI)
  - Integrated Pest Management (IITA)

  Ecoregional Programmes:
  - Andean mountains-CONDESAN (CIP)
  - African Highlands (ICRAF)
  - Rice-Wheat Consortium--Indo-Gangetic plains (ICRISAT)
  - Latin American Hillsides (CIAT)
  - Latin American Lowlands (CIAT)
  - West and Central Africa Humid-Subhumid-EPHTA (IITA)
  - West Asia -North Africa drylands (ICARDA)
  - Inland valleys of West Africa (WARDA)
  - Desert Margins Initiative (ICRISAT) *not implemented*

Most ecoregional programmes operate at the community/watershed scale at selected benchmark sites.

- **Farm-Household Scale**: Another important area of INRM work is at the household/farm level. Most CGIAR Centers emphasize INRM priorities in the areas of farming systems, IPM, nutrient management, etc.

Action Plan

1. The CDC believes that the CGIAR can best contribute to INRM and broader environmental objectives by strengthening ecoregional research capabilities and particularly by reinforcing intercenter cooperation at key ecoregional benchmark locations.
2. The CDC proposes to strengthen its Committee on Sustainability and the Environment (CSE) by including center scientists who are leaders in INRM research. CSE will continue to be chaired by a DG, with additional DG's as members. It will take responsibility to assure the implementation of a strengthened INRM pillar in the CGIAR by the centers.

3. The CDC recognizes that there are major gaps in the research coverage of current ecoregional programmes, for example measurement of carbon sequestration and greenhouse gas emission in many ecoregions. A gap analysis in the form of a matrix of systemwide and ecoregional environmental issues will be undertaken by CSE.
4. The CDC also recognizes that locally, nationally and internationally resources tend to be spent on addressing symptoms of environmental degradation rather than understanding the underlying causes. We believe that a strong case can be made for donors to shift resources away from palliative "environmental protection" and towards investments in research to understand the underlying cause of natural resource degradation.
5. Centers believe they should further exploit their ability to address NRM issues beyond the confines of individual countries. There are potential opportunities to look at cross border environmental issues (large watersheds, for example).
6. The CDC proposes a number of immediate steps to strengthen INRM research in the CGIAR.
   - Further studies of relationships between natural resource depletion and poverty.
   - Case studies of the economic, social and environmental returns from INRM research.
   - Better understanding of the relationships between natural resource depletion and both sectoral and extra-sectoral policies. For example the impacts of agricultural policies on forests and fisheries; of land degradation policies which focus on soil erosion and ignore soil nutrient depletion and soil fertility policies which focus exclusively on fertilizers.
   - The need to bring INRM issues fully into the NARS agenda and to build NARS capacity in INRM research.
   - The special need to strengthen INRM research in sub-Saharan Africa, where poverty and resource degradation are most acute
   - Incorporation of appropriate climate change and biodiversity research issues in the research agendas of the CGIAR centres.

The overall conclusion of the CDC is that the CGIAR has great potential in the field of INRM. The extent to which this potential is realised will depend largely on the incorporation of this action plan, with TAC approval, into the research agendas of the Centres. The System Review clearly sees INRM as an area of great potential impact. However, the full capacity of the CGIAR as a major provider of knowledge and understanding of integrated natural resource management can only be realized if adequate resources are made available for this purpose.

TAC Comment on CDC Paper on Integrated Natural Resources Management

(SRP Recommendation 5)

The paper is an excellent start to a System response to Recommendation 5 of the Systemwide Review.

The CGIAR is facing an increasing array of challenges concerning integrated natural resources management (INRM). The growing scarcity of water supplies, ongoing loss of soil, continued deforestation and the apparent lack of success in dealing with them in much of the developing world have led to a questioning of past NRM efforts. The concern of short- and long-term climate change and their associated instabilities are adding yet new dimensions to the CGIAR environmental programme.

- TAC agrees with the SR Recommendation 5 that there is need for strengthening and for increased clarity and focus of INRM work in the CGIAR, and that INRM activities should be under regular assessment and update. This should be based on ecosystem science, the understanding of ecosystems as suggested in Recommendation 5 (attached). There is need for establishment of a conceptual framework for INRM.

- TAC agrees with the CDC and the CBC that there should not be an additional Systemwide network established for INRM, but that it should remain a part of a sustainable production systems effort. The two are inextricably linked.

- TAC endorses the CDC recommendation that the CDC Committee on Sustainability and the Environment (CSE) will take leadership for Systemwide sharing of experiences, approaches, results, and ways to control the high transaction costs of INRM partnerships. TAC will work with the CSE in that endeavour.

- TAC will work with the CSE to incorporate appropriate areas of global climate change work in the INRM portfolio.

- TAC will work with the CDC to rapidly implement lessons learned from its ongoing review of ecoregional programmes, due for completion in late 1999, to increase the effectiveness of ecoregional methodologies as an INRM tool. It is agreed that these ongoing programmes can serve as platform for much of the System's NRM work.

- TAC will work with centres to increase their use of production ecology as a tool in INRM work within the framework of sustainable production systems.

Discussion

The definition of natural resources given by CDC is a useful beginning point:

"Natural resources can be defined as those that are generated by natural bio-geochemical processes and solar energy that yield useful flows of services to humankind." The natural resources the CGIAR focuses on are soil, water, atmosphere, animals and plants.

The CGIAR has broadened the "returns" from NRM that it works with from an exclusive focus on crop yield in the 1960s to a wide range of goods and services derived by farmers and local communities. The beneficiaries of those services are understood to be the ecosystem itself, crops, animals and local communities. Since the CGIAR deals primarily with human-managed systems, it is appropriate to always consider beneficiaries. A people-centred definition is critical to the CGIAR goals of increasing food security and to the elimination of poverty. Services rendered through INRM must be improved. This has been a shortcoming of much previous NRM work.

The manipulation of natural resources within the context of agriculture, forestry and fisheries includes the commitment of human, economic, and institutional resources. To be successful, the primary benefits of natural resources management must go to those providing these inputs. To the farmers first, then the community and nation. This use of natural resources to provide services, within the framework of human-managed systems, is the basis for INRM, and illustrates the impossibility of separating them either conceptually or programmatically.

It was TAC's view of the artificiality and subjectiveness of that separation that led to their combining in the agreed logframe as Purpose 1 "NARS develop improved production systems which will effectively raise productivity while conserving biodiversity, land and water."

It is understood that the major efforts in preserving genetic diversity of the CGIAR are a part of NRM, but are handled in separate programmes within the system. This is reflected in the approved logframe as output 2, which, along with its indication, is stated as follows:

Output 2:	Germplasm of selected species and their wild relatives for priority crops, livestock, trees and fish are collected and managed, and procedures for germplasm conservation are developed and made accessible to NARS and other partners.

Indicator	
2.1	For CGIAR-mandate species a sufficient number of accessions to represent genetic diversity of species and wild relatives are conserved and managed *ex-situ* according to CGIAR policy as well as evolving international standard and agreements with respect to acquisition, storage, characterization, documentation, regeneration and distribution.
2.2	Other priority species (as determined by scientific need) are conserved and managed *ex-situ* according to international standard and agreements with respect to acquisition, storage, characterization, documentation, regeneration and distribution.
2.3	Appropriate strategies, techniques and relevant information with regard to reliable, efficient and effective *ex-situ* germplasm conservation are accessible to users.
2.4	Improved methods and tools for assessing and monitoring critical processes and functions within and between ecosystems that affect the *in-situ* emergence and maintenance of biodiversity have been researched and tested with users.
2.5	Strategies and guidelines for *in-situ* management of biodiversity in agricultural, forest, aquatic and rangeland ecosystems have been developed and tested with users. *(Aspects of quantity, time, and location/region will have to be specified for each project separately.)*

The enhancement of goods and services provided through natural resources management (productivity) is defined under output 3, which is purposefully constructed to maintain their integration. It is assumed that productivity must be sustained or increased by any direct investment in stabilizing natural resources.

Output 3	Management practices and research methodologies for sustainable production systems and for natural resource conservation are accessible to NARS and other partners.

Indicator

3.1 Productivity-increasing, resource conserving practices are accessible to NARS and other partners which have the demonstrated capacity to:

a) Increase or sustain and stabilise productive of agriculture, aquatic and forestry production.

As illustrated by the ability to: produce larger quantity and/or higher quality products, reduce year-to year production variability, improve safety in use of inputs, increase output per unit of labour, shift farms towards a market driven economy, make maximum use of biological methods to enhance productivity, reduce the impact of factors that limit production, or make available post-harvest processing and marketing methods to add value to raw products and reduce post-harvest losses.

b) Conserve and make better use of natural resources and reduce degradation of or improve water, soil, and air quality.

As illustrated by the ability to: reduce soil loss, increase soil quality, increase water use efficiency, improve water harvesting in arid and semi-arid ecosystems, maintain water tables, hold chemical loading to low levels, maintain surface and groundwater standards at locally acceptable levels, maintain air quality, reduce greenhouse gas emissions, properly manage effluents from agricultural, forestry and aquatic systems, make improved use of low quality water for aquaculture, or maintain genetic diversity in agricultural forestry, and aquatic systems.

c) Enhance the quality of life.

As illustrated by the ability to: reduce drudgery, provide increased quality and quantity of food for families, increase farm gate income, and create new employment opportunities.

3.2 Reduce the direct and indirect adverse effects of agriculture on the health of producers and their communities.

3.3 Research methodologies are developed and accessible for regional organizations and networks of NARS that enhance collaborative and participatory development of integrated management practices for agricultural, forestry and aquatic systems.

As evidenced by: broader utilization of emerging research methods such as biotechnology, agroecology, GIS, and modelling (production and hydrologic, inter ail participatory research); better extrapolation of knowledge and technology from research sites to agroecologically equivalent production areas; improved regional co-operation through better design and execution of research conducted at multiple sites; or improved technology transfer among NARS.

Note: The relative emphasis of indicators and outputs will vary according to specific outputs and approaches for individual projects.

Production ecology as a tool for integrating productivity and natural resources management

Centre "retooling to manage the sustainability of ecosystems" is focused on, but not limited to the science of production ecology.

An ecosystem (as mentioned in Recommendation 5, attached), existing in a geographic location, is a complex biological and physical infrastructure, in which energy and nutrients are captured and transformed by micro-organisms, plants and animals. It can be as small as a handful of soil, a field, a farm, a forest, a lake, community or the planet itself. Organisms interact with each other in the process of generating flows of energy, nutrients and complex plant and animal products. Production ecology is the science of describing and managing those interactions and flows to achieve desired output, either of goods or services. In short, in agriculture or aquaculture, it is the managing of biological processes for high productivity and for environmental quality. Production ecology is equally useful at high flow rates for tightening flows for efficiency and extremely high yields, and for mobilising and containing nutrients under conditions of scarcity. It is useful irrespective of input levels.

It should be understood that all production systems of forestry, fisheries and agriculture are based on management of carbon stocks and flows. Carbon is a regulator of soil quality, of nutrient flow and of the efficiencies of control of other natural resources. The stocks of natural capital, including that of carbon in the production system, must be maintained at optimum levels for the environment and for the stage of development that the production system represents. Winkelmann (CGIAR Activities and Goals: Tracing the Connection, Dec., 1998, p. 14) presents a useful summary of CGIAR views on maintenance of stocks. This is a major point of intersect with global climate change interests.

There is significant scope for use of production ecology (agroecology) to enhance research within INRM. A useful discussion of this was presented in the paper "Towards defining a pro-poor natural resources management strategy in the CGIAR", the conclusions and recommendations from the CGIAR-NGOC Consultation on NRM, October 22-23, 1998. While agroecology is especially useful for broadening the NRM services provided to poor farmers, TAC stresses that it applies across the board to all production systems. The science of production ecology is evolving rapidly in many ARIs. The work of IRRI in its landscape-level IPM work is especially noteworthy (IRRI, 1997-1998. Biodiversity: Maintaining the Balance (60 p). This report focuses mainly on pest management, but is a good start. The understanding and enhancement of biological processes to increase productivity and improve environmental quality is equally effective at containing and improving efficiency of flows at high flow rate and input use as it is at mobilising nutrients and increasing efficiencies at low rates. It applies to all systems, not just to those of poor farmers. Traditional practices discussed in the CGIAR-NGOC papers were developed under low-resource conditions to optimize local resource use. They usually have a sound ecological basis. The understanding of the underlying processes is essential to their improvement and spread.

As a practical matter, a small number of relationships and flows tend to predominate farmer concerns (economic or environmental) in a particular environment and socio-economic

setting. In densely settled landscapes, high productivity agriculture must contain nutrients and crop and animal residues at high flow rates from soil to crop or animal and back to soil, both to avoid loss and contamination of surface and ground water. The need for pesticide use must be reduced. In many systems carbon stocks are at sub-optimal levels for production efficiency and natural resource protection. The building of carbon stocks, along with reduction in emissions of methane and nitrous oxide are a part of the CGIAR role in improving atmospheric quality. In some systems water capture and management predominates. Production ecology provides understanding and allows concentration on those key processes and relationships that are determined to be critical. It is an "integration" science.

Production ecology science, the understanding of processes, flows and relationships, is a key component of the international public goods dimension the Centres can and should bring to INRM partnerships. It will help guide the improvement and application of the many alternative production and landscape management technologies.

Specific Comments on the "Action Plan"

The points stated are on target. A note of caution is suggested in undertaking "further studies of relationships between natural resource depletion and poverty". As part of the TAC "Study on CGIAR Research Priorities for Marginal Lands", Dr. Sohail Milik conducted a rather thorough literature search of such studies, concluding that there is no clear evidence of a consistent linkage, the multiplicity of causes of poverty seems to obscure a clear relationship. If an a particular ecoregion such a relationship were to be shown, it might add urgency to work there, but the science and ultimate technologies to be used in alleviation of both poverty and degradation are unlikely to be changed by the relationship. Is it worthwhile to try to prove or disprove the hypothesis?

Finally, INRM requires an increasing range of partners. Most implementation is done at the farm and community level. Community involvement is critical. Most successful INRM has a significant civil sector component, often, but not always, involving organizational skills of NGOs. The Centres must continually review their partnership alliances as they intensify their INRM research. They must reassess the format of their output flows to meet the needs of NARIs as well as civil sector groups whose linkage to NARIs is often tenuous.

Annex I

From "Comments of Working Groups on the Recommendations of the System Review Report"

RECOMMENDATION 5	
The Panel recommends that the CGIAR enhance its research methodology by adopting an integrated natural resource management approach. Further, the organization of an International Network for Integrated Natural Resource Management will link productivity research with the environmentally sound management of natural resources. The network should be based on, among other things: • Centres that are retooled with sciences needed to manage the viability and sustainability of ecosystems; • a definition of the corresponding methods at different spatial scales, particularly at local levels; • adoption of precision farming techniques in relation to tillage, irrigation, nutrient supply and pest and post-harvest management; • development of indicators for measuring sustainability; • development of sustainable systems of management for aquatic resources; • joint preparation of national agricultural research strategies by respective NARS and a consortium of IARCs; and • development of more bottom-up, demand-driven projects.	**WG1:** (Proposed for CGIAR endorsement) "The Panel recommends that the CGIAR enhance its research methodology by adopting an integrated natural resource management approach. Further, the organization of international networks for Integrated Natural Resource Management will link productivity research with the environmentally sound management of natural resources. The network should be based on, among other things: • Centres that are retooled with sciences needed to manage the viability and sustainability of ecosystems; • a definition of the corresponding methods at different spatial scales, particularly to local levels; • adoption of knowledge intensive farming techniques in relation to tillage, irrigation, nutrient supply and pest and post-harvest management; • development of indicators for measuring sustainability; • development of sustainable systems of management for aquatic resources; • joint preparation of national and regional agricultural research strategies by NARS, regional and global fora, and a consortium of IARCs; and • development of more bottom-up, demand-driven projects, in partnership with NARS; • development and implementation of new methodologies for ecoregional research including GIS, explorative and extrapolative approaches; and • a widened food security basket through inclusion of minor and underused millets, grain legumes, tubers, and other crops in relation to cropping systems approach."