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COMMITTEE FOR INLAND FISHERIES OF AFRICA

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OPPORTUNITIES FOR THE INTEGRATION OF IRRIGATION AND AQUACULTURE

SUMMARY

The integration of irrigation and aquaculture aims at increasing overall farm production through improved efficiency of water use, use of labour and other inputs as well as through the diversification of the farming system. Fully integrated techniques face a number of constraints and, although a number of integrated technologies are currently being practised by farmers across the region, it is necessary to closely examine these, making improvements as needed. Furthermore, the wider adoption of these techniques by farmers will require technical assistance and training. Accordingly, a proposal for a programme on *Integrated Inland Water Resources Management in Drought-prone West African Countries* is summarized for consideration by the Committee. It is foreseen that this programme, although initially concentrating on the West African subregion would ultimately expand continentwide, including the establishment of an African Integrated Irrigation/Aquaculture Network.

Opportunities for the Integration of Irrigation and Aquaculture

INTRODUCTION

1. West Africa's population is expected to grow from its present level of 260 million to approximately 490 million by 2025. Today, the urban population corresponds to 40 percent of the total and urbanization is anticipated to continue to increase. With these changing demographics, demand for food will increase and use of irrigation will need to expand to meet the increased urban demand for fruits, vegetable, rice and fish through aquaculture.
2. Much of Africa is classified as economically water-scarce, and many countries are facing severe financial and capacity problems in meeting their water needs. Accordingly, agricultural production relies increasingly on the use of irrigation to reduce risks associated with the extreme rainfall variability.
3. While there is an urgent requirement to increase the water supplies through additional storage, conveyance and regulation systems by 25 percent or more by the year 2025, there is a decreasing trend in external financing. Internal resources and stakeholder participation have to be mobilized to fill the gap.
4. The *Vision of Water for Food and Rural Development in West Africa*, elaborated during an Expert Consultation (Accra, Ghana, May 1999), recognized the need to improve water use efficiency and productivity. Increasing water productivity is central to producing food, to fighting poverty and reducing competition for this essential resource.
5. *Integrated Water Resources Management* (IWRM) is an important concept underlining the translation of the Vision into action; promoting the co-ordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of ecosystems. At the *World Water Forum and Ministerial Conference* (The Hague, Netherlands, March 2000) governments were requested to establish policies and strategies for IWRM by 2005.
6. Fish farming and other forms of aquaculture are one component of integrated water management, which produces products of high nutritional quality. The *Twenty-first FAO Regional Conference for Africa* (Yaoundé, Cameroun, February 2000) acknowledged the importance of aquaculture and recommended that FAO “assist governments in elaborating effective aquaculture policies and streamlining public sector support to foster increased aquaculture production”. The Conference endorsed the policy objective of increased food production and food security through expansion of efforts in areas of sustainable land and water use and development.
7. The *Bangkok Declaration*, elaborated during the global *Conference on Aquaculture in the Third Millennium* (Bangkok, Thailand, February 2000), echoed these sentiments. The Conference stated that “the potential of aquaculture to contribute to food production has not been realized across all continents”, while “aquaculture complements other food production systems and integrated aquaculture can add value to current use of on-farm resources”.
8. In this framework, Integrated Irrigation/Aquaculture (IIA), the marriage of two water utilization systems, is a strategy to achieve improved agricultural productivity from every drop of water, while improving the financial sustainability of investments in irrigation. Adopting IIA through the process of Integrated Water Resources Management maximizes efficiency and cost effectiveness while

contributing to food security. At community level, IIA provides the stakeholders with more opportunities to feed themselves and hence provides them with incentives for better water resources management.

INTEGRATION OF IRRIGATION AND AQUACULTURE (IIA)

9. Irrigation and aquaculture have been employed in Africa for decades, the former experiencing more success than the latter. There have been few sustainable introductions of aquaculture. An analysis of lessons of past efforts clearly demonstrates a need for a reorientation of priorities away from intensive, high-cost systems or costly extension programmes, which governments cannot support and a focus on increasing fish production through integrated, extensive technologies, adapted to local conditions using low-cost, locally available inputs.

10. IIA can be especially advantageous in water-stressed areas where there is already considerable pressure on limited aquatic resources. To optimize utilization it is absolutely essential to take a truly integrated approach to water management where the same volume is used for several production systems – this is integrated irrigation/aquaculture.

11. Nonetheless, the strictly integrated nature of IIA requires that existing technologies be evaluated and improved, while new integrated systems are developed which provide the prerequisite of *more crops per drop*. Some potential innovations, such as improving the quality of fingerlings stocked in marshes and other areas, are relatively easy to implement; others require carefully planned on-farm trials to ensure economic viability, social acceptability and environmental compatibility.

12. Integration can take place where water is first used in fish culture systems before passing to other production systems (i.e., aquaculture upstream of agriculture), where the water is first used for crops and then collected to raise fish (i.e., aquaculture downstream from agriculture) or where the agricultural and fish crops occupy the same space.

13. A series of recent FAO-sponsored missions have assessed IIA activities in West Africa from the irrigation and aquaculture points of view. IIA may be a new concept but it is not a totally new technology. Examples of existing IIA systems include:

- the “Chinese” model of integrated vegetables, rice, animal husbandry in Bagre, Burkina Faso;
- the “BAD-Ouest” model of integrated rice and fish in Man, Côte d’Ivoire;
- integrated management of inland valleys as in Luenoufla, Côte d’Ivoire;
- integrated models from P.P.C.O. in Daloa, Côte d’Ivoire;
- integrated rice, vegetable and fish in seasonally flooded areas as demonstrated in Kita, Mali;
- integrated floodplain management as demonstrated in Mopti, Mali; and
- rice/fish culture with the two crops occupying the same rice paddy.

14. It has been estimated that adoption of IIA systems could add more than 10 000 t of fish to markets in Senegal, Burkina Faso, Mali and Niger. It has also been estimated that Mali and Burkina Faso alone possess over 3.3 million hectares that could come under irrigation and thus have significant IIA potential.

15. IIA activities are not limited to the West African subregion. A current IFAD-funded project covering Malawi, Zambia and Zimbabwe is identifying and diffusing new IIA technology, and the

ALCOM Programme in the SADC Region has been involved in IIA for several years. ICLARM studies in Malawi and Ghana found that integrating a pond into the farming systems could produce almost six times the cash generated by the typical smallholder without a fishpond.

16. A feasibility study for IIA activities in Zambia described a number of ways that fishponds could be incorporated into farming systems. These include:

- ponds at the highest point of gardens -- water can be pumped or gravity-fed from the water source into the pond and then siphoned onto the fields, with the fertilizer in the pond water available to the agricultural crops;
- ponds in flat waterlogged areas – this makes use of unused land and groundwater, but construction costs can be high and the ponds are frequently not drainable;
- ponds in sloping waterlogged areas – also making use of unused land and groundwater but with cheaper construction costs and the possibility of complete draining;
- ponds as enlarged irrigation wells – wells dug for “bucketing” of pumping water can be enlarged to increase the storage capacity and accommodate fish, but fertility will be low as the wells are constantly recharging with groundwater; and
- ponds parallel to water distribution systems – ponds that are not integrated directly into the water delivery system, but constructed at close proximity, frequently using the same water source and benefiting from by-products from the agricultural crops.

17. A related study in Tanzania and Zambia found that farmers practising irrigation were motivated to adopt fish farming to meet three felt needs: the need for protein; the need for diversification; and the need for flexible water allocation. Adoption rate was the highest when farmers felt the need for two or more of these aspects. This same study indicated that improved water use was achieved through the integration of aquaculture in several ways:

- improved use of high water discharge – where the reservoir servicing the irrigated fields has very high volume discharge that is difficult to manage, small storage ponds can first be filled from the reservoir and used for growing fish as well as providing water for the gardens through gravity flow or siphoning;
- improved use of irregular water supply – where demand exceeds supply, farmers often establish rotation systems where water is only available on designated days; building storage ponds allows for water use when the normal supply is “turned off”; and
- improved use of constant water flow – where flow is continuous but limited, the size of the irrigated fields is limited by the quantity of water available; since irrigation takes place during the day, night-time flow can be captured in storage ponds and subsequently used for expanding the area under irrigation.

CONSTRAINTS TO INTEGRATION OF IRRIGATION AND AQUACULTURE (IIA) DEVELOPMENT

18. Although IIA has a high potential, there are a number of constraints confronting its future development. These include, among others:

- frequently high capital costs of developing irrigation schemes coupled with difficulties in obtaining credit;
- competition for, and sometimes high costs of inputs, including labour, feed, seed, fertilizers (both organic and inorganic), pumps, etc.;

- competition with products produced in less costly systems, hence having a lower market price;
- inefficient water management, both technical (i.e. poor equipment) and managerial (e.g. weak user groups);
- land tenure issues, including conflict between user groups, making ownership unclear and hence investment problematic;
- difficult climate, including temperature extremes, recurrent droughts, poor soils, etc.;
- theft;
- poor co-ordination among stakeholders, combined with a lack of a participatory approach;
- under-funded and understaffed government agencies being adversely affected by on-going Structural Adjustment Programmes; and
- lack of awareness of, and access to information on IIA.

19. A proposal for action to address these and other constraints and promote the expansion and development of IIA activities is described in the following section.

A PROPOSAL

20. A programme on *Integrated Inland Water Resources Management in Drought-prone West African Countries* (IIWRM) is proposed. IIWRM would contribute to improved food security. It would promote research and development activities for IIA and further the sustainable use of water and land resources in concert with the *Vision of Water for Food and Rural Development in West Africa* whose framework calls for specific activities including:

- the promotion of appropriate and affordable technologies to improve water productivity which are flexible and take into consideration traditional farming practices, values and capabilities; and
- the promotion of capacity building at all levels.

21. The objectives of the proposed IIWRM are:

- a) strengthened national capacities to assess IIA potential and improve IIA technologies by the end of year two;
- b) agricultural and fish production increased by 25 percent through the establishment of environmentally, economically and socially sound integrated production systems (improving land and water productivity) by the end of year five;
- c) also by the end of the fifth year, improved processing, preservation and commercialization of agricultural and fishery products with a focus on women's involvement; and
- d) by the end of the fifth year, regional cooperation and information exchange on IIA research and development strengthened through a functional IIA Network.

22. The programme will have a two-tiered approach. The first tier consists of a core of four countries (Côte d'Ivoire, Burkina Faso, Mali and Niger) which will be actively involved in IIA research and development. Each country will establish a national network to ensure free flow of

information, coordinated by a designated lead institution. National networks will be subsequently linked to a subregional network coordinated by a relevant regional institution. As technologies were developed and the subregional networking fine-tuned, the second tier will become active. This will include countries or other stakeholders from the region outside the core which wish to participate in the network.

23. Further details of the proposed IIWRM programme are available in information document CIFA/2000/Inf.6 - *Programme Profile: Integrated Inland Water Resources Management in Drought-prone West African Countries*.

Suggested Action by the Committee

24. The Committee is encouraged to:

- review the information provided concerning IIA and the programme for *Integrated Inland Water Resources Management in Drought-prone West African Countries*;
- review the proposal for implementation of the programme, its objectives and their relevance to national priorities;
- suggest a way forward if it supports the proposal; and
- provide specific comments and recommendations to be incorporated into the Programme Profile.