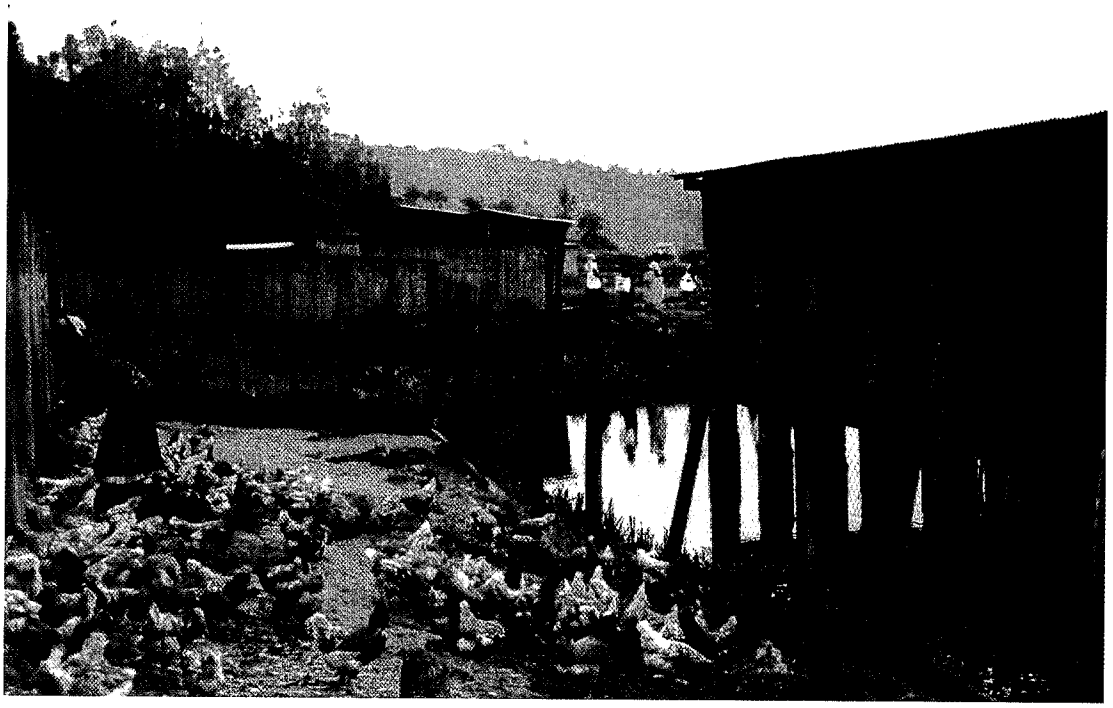
RWANDA WOMEN IN AQUACULTURE: CONTEXT, CONTRIBUTIONS AND CONSTRAINTS



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RWANDA WOMEN IN AQUACULTURE: CONTEXT, CONTRIBUTIONS AND CONSTRAINTS

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LIST OF ACRONYMS

FAO-UN	Food and Agriculture Organization of the United Nations
IDRC	International Development Research Center
MINAGRI	Rwanda Ministry of Agriculture, Livestock and Environment
NGO	Nongovernmental Organization
NRMP	Natural Resource Management Project
PD/A CRSP	Pond Dynamics and Aquaculture Collaborative Research Support Program
PPN	National Fish Culture Project
SPN	National Fish Culture Service
USAID	United States Agency for International Development

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RWANDA WOMEN IN AQUACULTURE: CONTEXT, CONTRIBUTIONS AND CONSTRAINTS

1. INTRODUCTION

Historically, women have made and continue to make important contributions that affect inter-generation resource transfer as care-takers of ecological and family resources. Women are a natural target group for any technology transfer program that aims to maximize production of food through efficient utilization of natural resources and labor. In Africa, women farmers could be the single, most cost effective, available resource for alleviating the African food crisis (Blumberg, 1989).

Aquaculture sector development at the global level has been viewed as a measure to improve food security, and a means of supplementary income for farm families.

> "The status of aquaculture development varies from country to country. In many countries, particularly in Africa, the aquaculture sector is based almost entirely on extensive farming practices primarily for subsistence and barter, with any surplus being sold in rural markets; in others, notable in Asia, Latin America, and most developed countries, it is based on semi-intensive and intensive systems for profit and trade, including exports" (FAO, edited by Nash, Engle, Crosetti 1987).

As in many labor intensive production systems, the aquaculture sector across Africa utilizes a female labor force. Technological interventions in the aquaculture sector can have a mixed impact on the economic and social integration of women farmers. Based on the information from 18 West African countries, Trottier (1987) summarized the issues relevant to women and aquaculture development in the region: 1) Introducing fish farming into some key areas may involve the introduction of new species for higher value markets and even exports. These efforts at times can displace women from their traditional economic role in fishery production. In such situations appropriate compensatory alternatives should be established to assist women. 2) Introducing fish farming mainly and exclusively for male beneficiaries usually adds tasks to the work load of women. This produces a predominantly negative impact on the women unless there are returns to them and they understand the work itself. 3) Access to fish ponds often liberates women from other fishing duties, and presents an opportunity to obtain fish more conveniently and regularly throughout the year. 4) Fish pond responsibilities may interfere with other activities, such as cropping, which have established rights of remuneration (FAO, edited by Nash, Engle, Crosetti, 1987). Further, Engle (1987) observes that, though around the world women are involved in aquaculture production, it is almost universally considered men's work. Women have almost no direct access to training or extension agents which enable them to acquire the knowledge necessary to increase productivity; only some 10-15 percent of the participants and trainers in training courses worldwide have been women. The percentage of women extension agents has been even

lower. The diversity in the development and management of the aquaculture sector in African region requires documentation of women's role in aquaculture in each country.

The purpose herein is to review the role of Rwanda women farmers in the aquaculture sector for fishery production. Rwanda's natural resource environment, along with its social and economic milieu, shape women's opportunities to contribute to their country's ecological and food resource development. This case study documents Rwanda women's contributions to aquaculture development in the ecological, social and economic milieu and considers constraints which hamper productivity in aquaculture.

2. RESEARCH DESIGN

The case study is a preliminary effort to understand the role of Rwanda women in aquaculture. The focus of the research orientation is qualitative. Therefore, the information is descriptive rather than inferential.

The data were collected during field research using qualitative techniques in the Southern region of Rwanda in 1992. The field research was carried out in cooperation with the Pond Dynamics Aquaculture Collaborative Research Support Program (PD/A CRSP). The sample included two categories of farm women groups, aquaculture extension agents, and aquaculture and pond dynamics scientists. The study was conducted in conjunction with a colloquium on "Women in Aquaculture" held at Kigembe Research Station in February, 1992, a fish culture research station in Rwanda. One group of farm women included the women farmers participating in the colloquium and the other group was made up of women farmers who did not attend the colloquium but were visited by the investigators at their pond sites. The women farmers participating in the colloquium were divided in three groups and each group was interviewed separately. The extension farmers and scientists were also interviewed separately. The sample consisted of 28 women farmer participants in the colloquium, 30 women farmers from three groups who were visited at the pond site, 10 extension agents and 8 scientists. The women fish farmers and the extension agents who participated in the colloquium represented communes from across the country.

Information was collected and analyzed using qualitative tools such as focus group methods and content analysis of responses. The interviews for the women farmers were conducted in the local language of Kinyarwanda. The extension agents and scientists responded in French. The women's interviews were recorded on audio cassettes and were transcribed by a Rwanda native fluent in Kinyarwanda and English. A team of three persons with expertise in gender issues in development and agricultural extension issues evaluated the content of responses to group concepts for similarity. The country background and project information were collected during literature reviews conducted in both the U.S.A. and Rwanda. In addition, the U.S. investigator's informal discussions with field personnel connected to the PD/A CRSP and observations of farmer groups at the pond sites contributed to understanding the context and content of women's participation in aquaculture activities.

3. RWANDA COUNTRY SETTING

3.1. Ecological Resource Environment

a. Topography and Seasons

The topography of Rwanda is rolling, with continuous patterns of hills and valleys. It is a land locked country surrounded by Zaire, Uganda, Tanzania and Burundi (Figure 1.a). The total land area is 26,280 sq. kilometers. The altitude varies between 1400 m at Lake Kivu to over 400 m in the volcano region. The annual temperature averages 19° C. The weather is warmer at the lower altitude in the eastern part of the country and colder in the high altitudes of the volcanic region and the Zaire-Nile divide (Figure 1.b).

Small marais (wetlands) cover approximately 90,000 hectares of Rwanda (Figure 2). These areas are among the last of the land resources to be put into agricultural use. An important agenda in the country's development strategy is the ecologically sound and socially relevant management of marais. The marais land area is the site for agriculture and aquaculture production. The productivity of marais may well determine the capacity of the country to feed the population, since subsistence farming is the primary production activity.

The four seasons in Rwanda are:

1. The short rainy season *(umuhindo)* from the middle of September to the middle of December. This is the first growing season.

2. The short dry season (*urugaryi*) from the middle of December to the middle of February. This season often passes unnoticed because rainfall is reduced rather than absent.

3. The long rainy season (*itumba*) from the middle of February to early June. This is the second growing season.

4. The long dry season (*icyi*) from early June to the middle of September. Most of the country has no rainfall for two or more months.

The duration of the seasons varies among the regions, with longer dry seasons in the east and longer rainy seasons at high altitudes.

b. Rwanda Agriculture, Animal Husbandry and Aquaculture Production Systems

At the micro level the family's economic well-being is intricately linked to the land productivity, which is influenced by natural resources and weather conditions. Hence, household productivity and national prosperity depend on judicious management of natural resources in the land locked mountainous country.

Figure 1a: Rwanda's Situation in Africa
Source: Delepierre, G. Les Regions Agricole du Rwanda. Bulletin Agricole du Rwanda 8 (4): 216-225, 1975

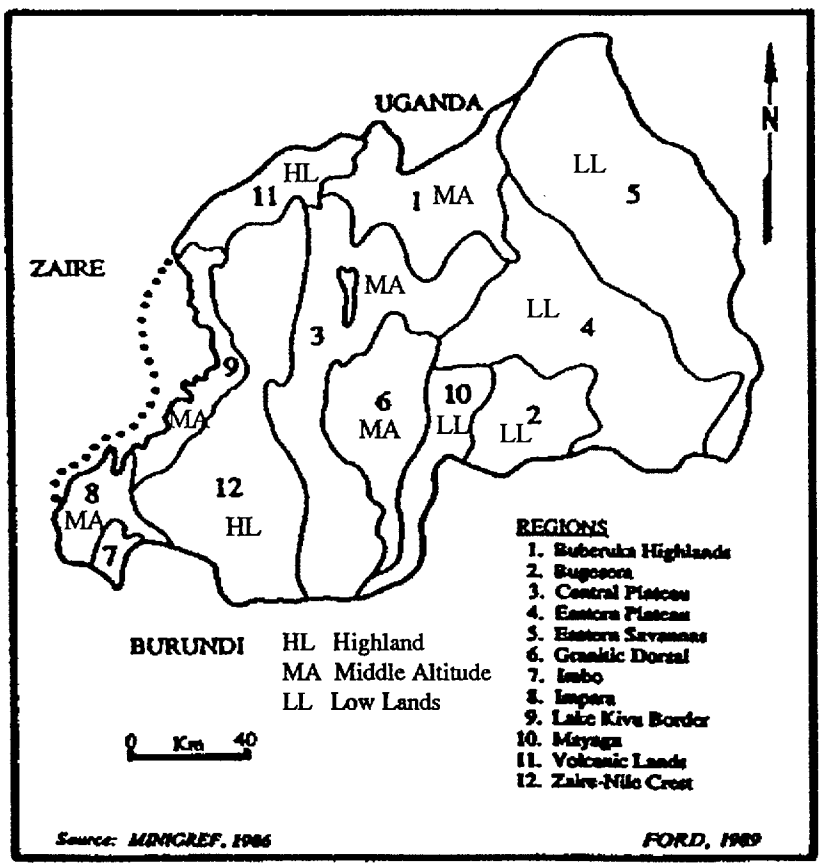


Figure 1b: Agro-climatic Zones in Rwanda
Source: Ford, E. Robert. The Dynamics of Human-Environment Interactions in the Tropical Montane Agrosystems of Rwanda: Implications for Economic Development and Enviromental Stability. Mountain Research and Development, Vol. 10, No. 1, 1990.

Figure 2. Rwanda Marais Land

There are three basic ecological zones: the highland zone, middle altitude zone, and the lowlands. The characterization of these zones is based on the interrelationships among natural and human phenomena: altitude, climate, soil, temperature, population, and markets. Each zone includes a set of agricultural activities and land uses. Rwanda is composed of 12 agroecological zones, which vary according to physical, climatological and biological features (Delepierre, 1975) (Figure 1.b). Rwanda's predominantly agro-based economic performance is vulnerable to adverse weather conditions.

The regional rainfall, population density, crops cultivated, and animal husbandry and fishery production information are provided in Table 1.

Table 1. Agro-ecological zones and production systems

ZONE BY ALTITUDE	REGION	CROPS	ANIMAL/FISHERY	POPULATION
HIGHLAND Reliable high rainfall	Volcanic Region Highlands of the Zaire/Nile Divide Region	Potatoes Peas Wheat Barley Maize Millet Tea Quinine Pyrethrum	Lake Fishery Cattle and small animal husbandry - rabbit and poultry	Densely populated
MIDDLE ALTITUDE Lower rainfall Adequate Less regular	Central Plateau Buberuka High Lands Granite Ridge Impara Lake Kivu Border	Bananas Beans Sorghum Sweet potato Arabica Coffee Peanuts Soya bean	Lake Fishery High altitude aquaculture pond fishery experiments Cattle and small animal husbandry - rabbit, goats and sheep	Most densely populated areas
LOW LANDS Uncertain Lower rainfall High drought risk	Mayaga Bugesera Eastern Plateau Eastern Savanna Imbo (Very Small)	Rice Sugar Cane Coffee Maize Beans Bananas Sorghum	Aquaculture pond fishery Cattle and small animal husbandry - rabbit, goats, poultry and pigs	Less densely populated

Source: G. Delepierre 1975. Les Regions Agricole du Rwanda. Bulletin Agricole du Rwanda 8 (4): 216-225. The information on fishery and animal production were collected by the U.S. investigator during field visits in February 1992.

The rural population is located in dispersed family compounds on the hill slopes, where traditional agricultural practices are used. The production land is of two types: hill fields near home site (*rugo*) and the wet lands that cover the lowest part of the narrow valley (marais). Another system of classification groups hill fields as low risk lands and marais parcels as high risk lands (Figure 3.). Ninety percent of all farms in Rwanda are located on hill summits or hillsides. Most cash crops are grown on hill fields and less valuable crops for home use are

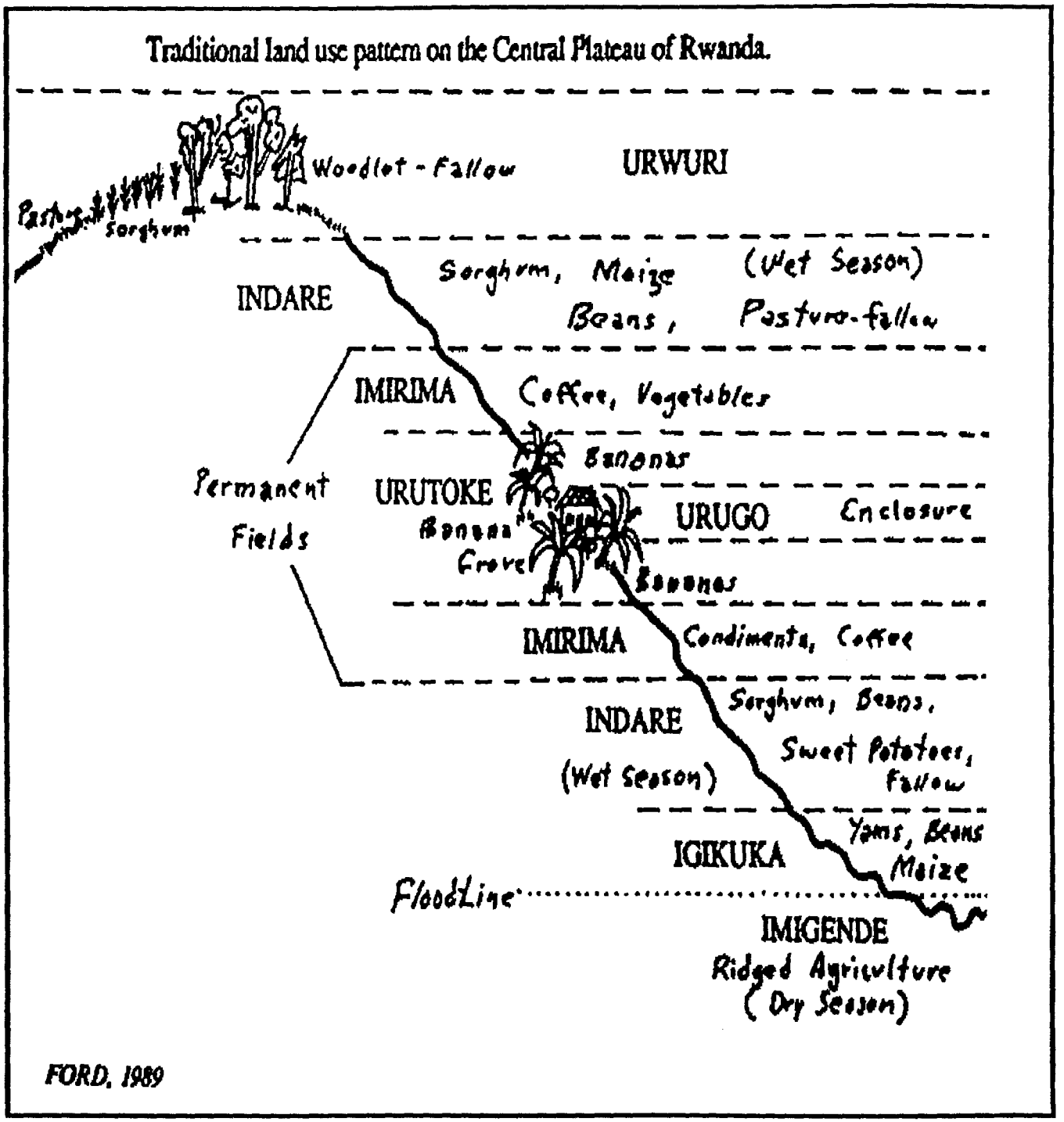


Figure 3: Land-Use Pattern in Rwanda
Source: Ford, E. Robert. The Dynamics of Human-Environment Interactions in the Tropical Montane Agrosystems of Rwanda: Implications for Economic Development and Enviromental Stability. Mountain Research and Development, Vol. 10, No. 1, 1990.

grown in the marais. The hill plots, surrounding the home, are intensively cultivated. Inter-cropping of coffee, banana, sweet potato and beans is common. The marais area is utilized for agricultural production to cultivate crops such as corn, colacase, sweet potatoes, cassava, beans, vegetables and for aquaculture production with fish ponds. Farm animals such as cows, goats, pigs and poultry are part of the farming system. Export-oriented cash crops are coffee, tea, pyrethrum, and white potatoes. Among these, coffee is the most common (Sikkens and Tammo 1988; and Development Alternatives 1986).

Ecological degradation of natural forests is caused by an increased demand to sustain forest products for the consumption needs of a growing population. Soil erosion and decreasing soil fertility are serious problems for the hill farms. These problems are precipitated by intensive cultivation, inappropriate agricultural practices and destruction of forests for fuel wood and other uses.

Water is a natural resource available in abundance to the Rwanda farmer, and is an important resource for aquaculture. While the upland terraces are contoured to retain water for crop production, and equitable and environmentally sound water management is a concern for both upland and downstream farmers.

Aquaculture is a technique that integrates management of water and land resources for fish production. The fish ponds are in the marais land. In 1987 about 51 hectares of marais land are utilized for fish ponds.

The Collaborative Research Support Program in Pond Dynamics and Aquaculture (PD/A CRSP) has emphasized aquaculture technology development efforts, utilizing local plant and crop waste for fish production. In addition, successful efforts have been made to develop technology for growing Tilapia in high altitudes. The crop patterns in three agro-climatic zones determine the content of agricultural tasks and gender roles in the subsistence and cash crop production. The gender roles relevant to aquaculture in the project area are presented in Table 3.

c. Population

Rwanda is a densely populated country with a population of 6.2 million in 1986. Population density is 390/Km. The annual population growth is about 3.3 percent. It is estimated that in the year 2000 the population will be 10 million. Infant mortality is 116 per 1000 live births. Only 5% of the population resides in the two urban areas, Kigali (200,000) and Butare (20,000).

3.2. Society and Economy

a. Social and Political Milieu

Rwanda has been inhabited since early times by the Hutu (Bantus) and the Tua (pygmies) ethnic groups. In the 15th century Rwanda highlands were invaded by the Tutsi (or Watutsis) of Ethiopia who set up a stratified, traditional society.

> "Rwanda's present ethnic mix of 89% Hutu, 10% Tutsi, and 1% Twa is a reflection of a complex socio-cultural and migration history. Close social and cultural interaction has existed for so long that most religious, marriage, and other customs are common to the three groups, and the same language Kinyarwanda is spoken" (Ford,1990).

Rwanda came under German colonization in 1897. German East Africa included Rwanda and Burundi. After World War 1, the territory named Rwanda-Urundi was placed under Belgian custody and administered from Congo (today's Zaire) where the colonial administration had set up quarters. Since then, Rwanda has seen a series of revolts and a civil war. In 1961, Rwanda became a Republic autonomous from neighboring Burundi. PARMEHUTU, (Party of the Hutu Emancipation Movement) which won the elections, played a role in reorganizing land distribution on private ownership. But the ethnic conflict and power struggle within Rwanda continued. Lacking other patterns, the PARMEHUTU reorganized society according to ethnic group interests: the Tuas were assigned the craft industry; the Tutsi, cattle raising, and land ownership was reserved for the Hutus. The system of agriculture was reduced to subsistence farming, with little surplus left over for the market. Between 1960 and 1970, Rwanda went through political turmoil and a coup, consequently, the economic situation deteriorated. Since the late 1970s, the government in power has supported "planned economic liberalism." Recently, measures to establish democracy and land rights are underway with the collaboration of national and multinational agencies.

b. Economy and Levels of Living

Rwanda is classified as a Low Income Developing country (World Bank, 1992). It has a per capita gross domestic product of approximately $310, generated primarily by the agricultural economy. In 1986 the per capita GNP was $290. Approximately 93 percent of the labor force in Rwanda is engaged in agriculture. Most of the estimated one million farm families are engaged in small subsistence farming. It has generally been observed that while subsistence production does not yield high surpluses, there is a substantial domestic market for subsistence crops such as: beans, sorghum, peas and potatoes, groundnut, sweet potatoes, and manioc crops that are consumed on the farm. The Rwanda subsistence system generally reflects the influence of both the farmer and pastoralist traditions (Ford, 1990). Major export products are coffee, non-ferrous metal ores, tea, crude vegetable materials and hides and skins.

According to Clay and Magnani (1987) in Rwanda,

> "Operating with about one hectare each, farm households are obliged to use their resources wisely. Farm production is subsistence-oriented, providing first for the households' need for food; market production is a secondary consideration. Beans and sorghum are preferred staples. Sweet potatoes, manioc, and peas also make up a significant part of local diet, and accordingly occupy much of the average family's available farmland. Virtually all farmers grow bananas for both home consumption and market. The vast majority of these bananas are of the variety used to produce beer through washing and fermentation, and are not consumed directly."

Seasonal fluctuations in food availability is common. The goal of the household is to obtain a good harvest and plan a food reserve for the rainy seasons or prolonged drought. The average daily per capita caloric intake is 1,935.

Rwanda farmers' housing condition is very basic. "The traditional residence is circular in shape with thatched roof. Its walls are constructed of mud packed firmly around a wooden frame and dried in the sun. The residence and a small work area are normally enclosed by a tightly meshed natural wall of euphoria plants, with an open entry at the front" (Clay and Magnani, 1987).

In recent times houses constructed of sun-baked mud bricks covered with cement and kiln-dried brick with corrugated metal and clay tiles are appearing in the country sides.

c. Household and Labor Attributes

Rural households in Rwanda today are generally monogamous nuclear family units composed of an average of 4.99 members; 78.3% of households are headed by males. The household unit also serves as principal labor unit, and has on average 2.5 workers (between ages of 15-64) who support an average of 2.5 dependents. The sex ratio in the rural areas for ages 15-64 is only 89, reflecting the large number of males who have migrated either temporarily or permanently in search of work (Ford, 1990). According to a government estimate, wage labor outside the home is a rapidly increasing phenomenon; the household's members work collectively an average of 210 days per year outside the home (almost 40% agriculturally related) (MINAGRI, 1987).

Ford (1990), identifies division of labor along the gender lines: women do most of the work on subsistence crops (cereals, tubers, legumes), while men work with cash crops (bananas, coffee). There is some sharing of work for land-clearing activities and for crops that require special heavy work at harvest time, such as manioc and sorghum. Weeding and other crop maintenance is almost totally women's work, as are most post-harvest activities. Men are responsible for most money transactions outside of home, such as buying of supplies and selling of banana beer. Women, however, are the primary producers of banana beer.

d. Status of Rwanda Women

In Rwanda, women comprise 50.6% of the population. Among them 97.9% are engaged in agriculture activities. It is estimated that 22% of women are the heads of households. On an average women bear 8.6 children, and child bearing begins at the age of 19.5 years. The average life expectancy for women is 56.6 years compared to 49.7 years for men. Among the women 56 percent are illiterate (Profil Socio-Economique de la Femme Rwandaise, 1991). General observations indicate that women work side by side in all subsistence crop production activities. Women bear many children and they are the primary nurturing parent. Thus bearing and rearing children along with agriculture activities contribute to women's heavy work load. Aquaculture ponds are in the valley and the access paths are steep. Traversing these hill paths with the manure for the fish pond is both a difficult and risky task. Rwanda women farmers accept the challenge of personal risk and difficult physical labor to participate in aquaculture production.

4. POLITICAL AND ADMINISTRATIVE STRUCTURE

Rwanda is governed by a President who is advised by a cabinet of ministers. The Rwanda government has seventeen ministries, all with central offices in Kigali. The fish culture activities are housed in the Ministry of Agriculture, Livestock and Environment, under a directorate of Fisheries, Aquaculture and Apiculture.

The local administration for agricultural development, including aquaculture, is a multilevel structure (Figure 4). The national territories of Rwanda are divided into 11 prefectures with 10 rural units and one urban unit. The prefecture is under administration of a *Prefect.* These administrative units are further divided into 143 *communes*. These communes are the basic administrative units in the Rwanda Republic. Currently, the commune is evolving into a decentralized community with an increasing role in local development.

A *Bourgmestre*, appointed by the President, heads each local communal administration. Communes are divided into about ten *secteurs*, each headed by a *Conseiller Communal.* Each secteur is divided into *cellules* representing groups of *collines* made of families. The cellules are headed by a *Responsable.* Very recently, another subdivision has been added. This level is based on 10 houses per group and each group has a *Chief of Houses.* Further down, the farmers are organized into production groups, called *farmer groups*, which is the level that receives production inputs and resources.

The *Bourgmestre* is vested with legal and financial authority at the commune level. The *Bourgmestre* collects revenue for the communal budget to pay its employees and to implement tasks assigned to its administration. This local administrator is responsible for organization of local community participation in "*Umuganda*" (community labor) and political activities. The attitude of these local administrators to large part can determine women's access to local productive assets and development resources.

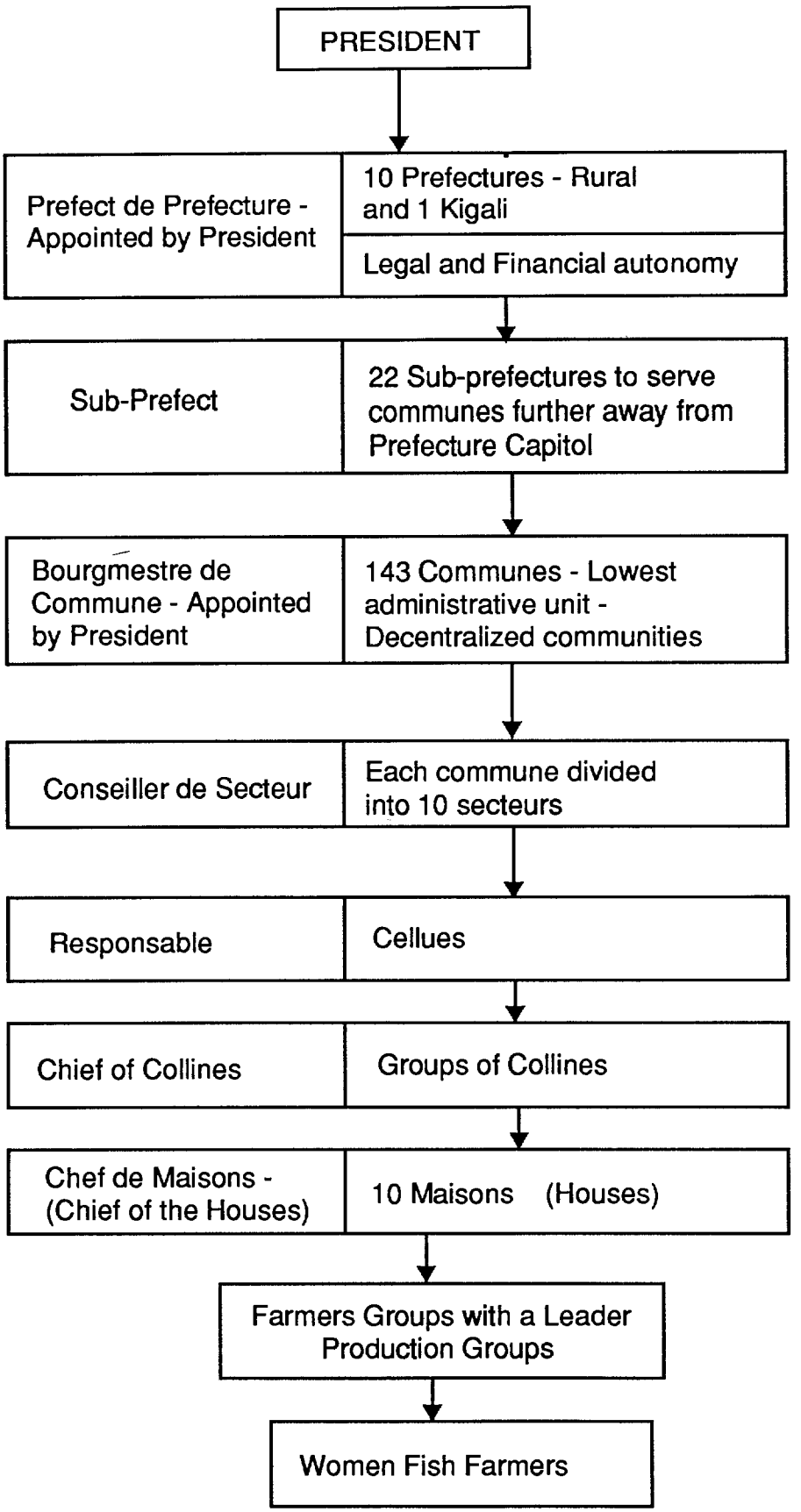


FIGURE 4: ADMINISTRATIVE STRUCTURE OF LOCAL GOVERNMENT
R. Balakrishnan, 1993.

The hierarchical appointment structure of the administration has the advantage of implementing a policy of gender equity in the development agenda through Presidential decree. The farmer groups can be represented by all male, all female, or a combination of male and female. In an all-female group women have opportunities to develop leadership skills. At the local administrative levels of government, there are no women administrators. Women's access to land and development inputs depends on the goodwill of administrators in a male dominated hierarchy. The administrators control information on development opportunities and distribution of resources such as land, credit, training, extension services and agricultural inputs. Thus men are the gate-keepers for women's opportunities to participate and increase productivity in aquaculture.

5. AQUACULTURE SECTOR

5.1. Role of Aquaculture in Rwanda's Ecological Resource Management

Ecological resources include land, forests, animals and aquatic resources. Inland aquatic resources are part of the human living environment, and aquatic products are important sources of food and income for poor people around the world. Aquaculture is the watery equivalent of agriculture; instead of using land as the growth medium, aquaculture uses water. Aquaculture has crops that are tended and harvested. Aquaculture, particularly on a small scale, is labor intensive, energy efficient, and conserving of natural resources (Egna, 1990). In Rwanda, aquaculture is promoted as an integrated production system, as it is associated with other agricultural practices; typically linked with gardens, animal husbandry, and/or forestry (Nathaniel and Moehl, 1989). Marginal land may be used for fish farming when it cannot be used for crop production (Michison 1986, Brown 1985; Veverica, 1990). Aquaculture is often combined with agriculture, horticulture, livestock production and rural development with great success as farmers realize that they can supplement their food supplies and income with small scale fish farms (Vincke, 1988; Brown, 1985: Schwartz et al. 1988; Kutty 1986; Coche and Demoulin, 1986). Aquaculture is based on sound soil management principles of recycling and refurnishing land with organic manure, which bears important implications for low input agriculture and sustainable development. In the present development era, Rwanda faces the dual dilemma of declining land productivity and escalating population. A dramatic increase in population places greater stress on arable land, consequently agriculture is being abandoned (Randolph and Sanders, 1988). In this context, aquaculture is a viable alternative production process to sustain land resources, and to improve household income-generating potential and nutrition.

5.2. Aquaculture Development in Rwanda

Aquaculture efforts in Rwanda-Urundi (then a Central African Region under Belgian administration) were introduced as early as 1928 by the Belgian government to improve labor efficiency and combat chronic protein malnutrition. Since then the aquaculture sector has received assistance from the Food and Agriculture Organization of the United Nations (FAO-

UN); the International Development Research Center (IDRC); and United States Agency for International Development (USAID). From 1983 to 1988 USAID's involvement in fish culture was through the Rwanda National Fish Culture Project (PPN), implemented by Auburn University. The project goal was to provide long-term technical assistance in aquaculture to the Government of Rwanda. An objective of the USAID Rwanda National Fish Culture project was to develop the capacity of Rwanda farm families to build and maintain productive on-farm fish ponds. The project emphasis was to improve fish culture extension training to disseminate aquaculture technology to farm families. This project concentrated in eight "aquaculture zones", which include approximately 75 percent of existing fish ponds. By the end of 1988, there were 2959 ponds in the project area, with a total surface area of 101 hectares. Nearly 10,750 families are involved in fish culture in the project area. At present, it is estimated that 1641 women farmers are involved in fish cultivation under the National Fish Culture Project.

> "During the period of PPN activity, the national average fishpond production was increased to 14kg/hectare/year, with nearly 20 percent of farmers producing more that 20 kg/hectare/year. At both levels, fish culture was found to have a positive impact on family income and nutrition. Moreover, fish culture offered a new enterprise for farm diversification and risk reduction which was complementary to traditional agricultural practices" (Moehl 1991).

Since 1988, the USAID-supported PD/A CRSP has established links with the National University of Rwanda to establish a research base in aquaculture. The colloquium on "Rwanda Women in Aquaculture" and the study were conducted in collaboration with the PD/A CRSP in Rwanda. An objective of the collaborative effort was to integrate gender issues into the aquaculture research and extension agenda in Rwanda.

5.3. Aquaculture Production Inputs and Outputs

As in every production system, aquaculture requires a set of production inputs. Access and ownership to these inputs determine the success of the fish pond operation and pond productivity. Women do not always have equal access to these resources.

a. Land Access, Land Rights and User Groups

Fish ponds are developed in the publicly owned marais lands. Short-term user rights are allocated to farmers by the local administrator. MINAGRI approves and registers long-term allocations of marais land. Farmers cultivate the marais land as a production group. Collective production practice allows access to the rich farm land for a large number of farmers. Government law institutionalized the traditional rules of collective use. Individual farmers can cultivate marais land. But neither male nor female farmers have ownership of the marais land and by that norm they have no ownership to fishponds located on the marais land. Women participate in fishery production through all-female and mixed groups that operate fish ponds through user rights to land on the marais.

b. General Locales of Fish Ponds

Fish ponds are situated in the bottom land of the valleys with steep hills on both sides (Figure 5). Typically a farm family lives on the hill in a house surrounded by small plots of land intensively cultivated by mixed crops of banana, coffee, sweet potato, cassava, and corn depending on the season. The banks of the fish ponds are also cultivated with vegetable crops such as cabbage, amaranth, collacase, hot pepper, and occasionally eggplant. The ponds are at least 1 to 2 kilometers from the house with foot paths on steep hills. The houses of group members who operate a pond are scattered all over the hill. The cows are grazed on the slopes of the hills. Some household have pigs, chickens, goats or rabbits.

c. Water for Fish Ponds

Water is a resource available in abundance in Rwanda. But pond dynamics require appropriate water regulation of the shallow end depth, deep end depth and control mechanisms. The scientists recommend depths of 40-50 cm at the shallow end, and 120-150 cm at the deep end. As control mechanisms to regulate temperature, an on/off method and no flow technique are recommended.

d. Manure for the Fish Ponds (Fertilization)

The integrated aquaculture promotes use of animal and plant waste for fishery production at the Kigembe and Rwasave research stations. At the field level the use of plant matter as an organic manure is predominant. Locally available materials such as banana stems, bamboo shoots, cassava leaves, sweet potato leaves and wild plants are used.

e. Fishlings to Seed the Fish Ponds (Stocking)

Initial batches of fishlings to seed the pond are supplied by hatcheries, such as the Rwasave Station and Kigembe Station. In subsequent production cycles, the farmers harvest the adult fish and the fingerlings. These fingerlings are the seed for future production.

f. Feed for Fish (Nutrients)

The technicians from the fish culture stations recommend feeding the fish once a day, five days a week and encourage use of local materials as nutrients. Rwanda fish live on a diverse diet of waste from human food consumption such as sorghum waste after beer production, banana peels, cassava root peels, sweet potato root peels, and at times rice bran.

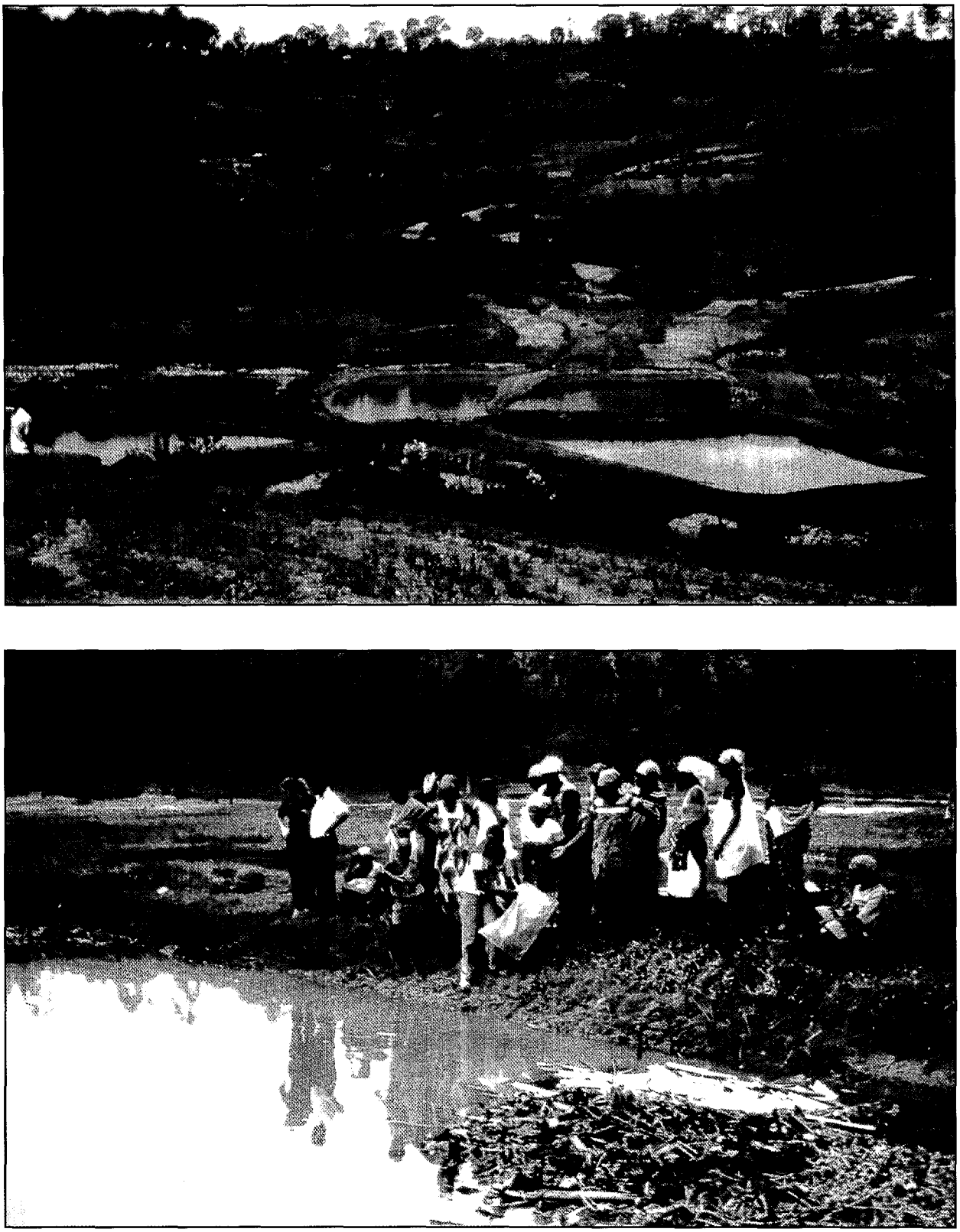


Figure 5.Location of Aquaculture Ponds

g. Technical Knowledge of Fish Pond Management

The technical training for farmers is provided through fish culture extension agents. The visits by extension agents are limited by the availability of staff and the mountainous terrain that makes access difficult. At this time, Kigembe Station provides occasional training for women farmers. There are fish culture manuals (which are outdated) available for secondary school level training. Technical sheets are prepared by the Rwasave Station for distribution sporadically. No extensive efforts for developing information materials, including audio visuals, are evident.

h. Labor for Aquaculture

Most frequently farmers participate in aquaculture as a group. Subsistence aquaculture in Rwanda is a family enterprise. All members of the family participate in various aspects of the production.

i. Harvesting the Pond

Scientists recommended that the ponds are to be harvested in a cycle of 7 to 9 months with an initial sample harvest at the 4th month after seeding. The ideal harvest is 20 to 25 Kg per are per harvest. This provides an opportunity for a sizable income once a year as well as a yearly opportunity for fish consumption to the group.

j. Economic Returns of Fish Harvest

The time limitations of the field work for this study did not allow opportunities to study the costs and returns on the fish harvest. In general, fish pond harvests are mostly consumed by the farmers and their families in the production group. The harvesting cycle is such that fish pond is harvested once a year. Thus, if there are any returns gained from the harvest, it is a highly variable seasonal income which depends on the pond productivity and risk of lost fish due to theft and consumption by wild animals. Pond productivity in part depends on availability of women's time to collect the feed and nourish the fishlings.

k. Use of Byproducts of Fish Pond

The byproducts of the fish pond can be a very good source of organic manure. A major barrier to utilizing the organic matter for soil replenishing is linked to the problem of transporting the manure from the valley to the homestead garden over the steep terrain.

5.4. Aquaculture Outreach

The extension service delivery is complex and disjointed at various levels (Figure 6). In addition, the involvement of multiple donors contributes to diverse philosophies, structures and approaches to extension delivery service in Rwanda. Very recently the World Bank has

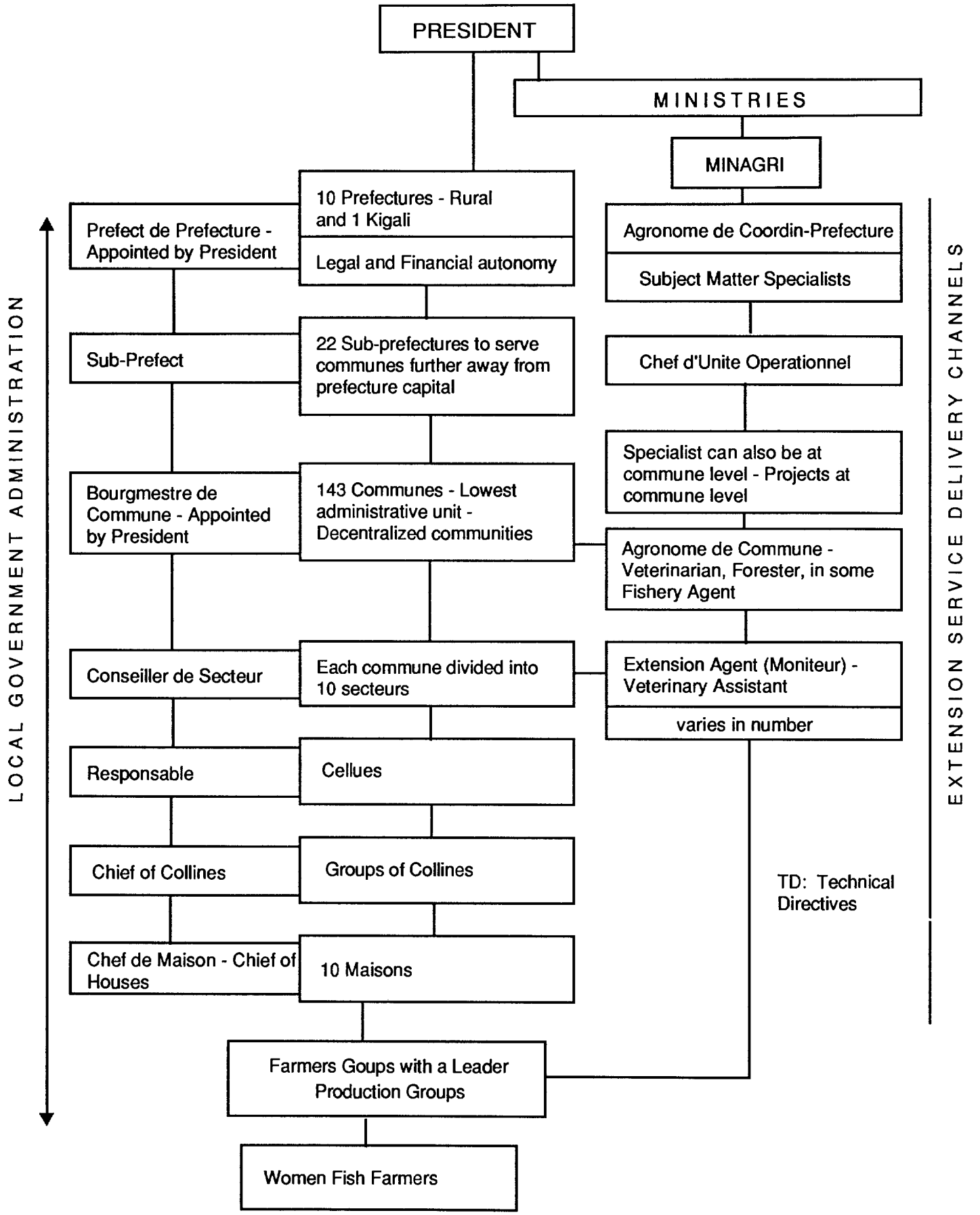


Figure 6: Extension Delivery System in Relation to Organization of Local Government
R. Balakrishnan, 1993

initiated the Training and Visit System to improve farmer's access to technical service. Most often, the fishery extension stands alone structurally.

In general, MINAGRI assigns a coordinator of agricultural activities at the prefecture level and an agricultural specialist and veterinarian to the communes. There are subject area specialists at the prefecture level and in some cases at the commune level. The subject area specialists placed in the communes are those trained in coffee production, bee-keeping, fishery and forestry. The number and type of specialists is contingent upon need and availability of financial resources. The agricultural specialist and veterinary assistant are employed by the commune at the *secteur* and their numbers vary depending upon the resource availability. Some extension agents are assigned to the *secteur* under the auspices of various development projects. The clientele groups, participant organizers and agencies for developing fish culture, are diverse with little or no coordination or mechanism for information exchange.

5.5. Aquaculture Outreach Clientele

The Rwanda clientele for aquaculture outreach is characterized by multiple participants in different types of institutions and farmer groups. Ministries other than MINAGRI promote aquaculture in Rwanda. Table 2 illustrates the diversity of clientele groups. Local representatives of these various agencies may or may not be in contact with the personnel of National Fish Culture Service.

Table 2. Aquaculture Activities and Clientele Groups

RESPONSIBLE MINISTRY	CLIENTELE
Ministry of Youth and Cooperatives	Farmer groups through Communal level "Cooperative trainer" Youth groups through youth director
Ministry of Primary and Secondary Education	School fish ponds
Ministry of Justice	Prison fish ponds
Ministry of Interior	Commune sponsored fishery ponds
Ministry of Public Health	Fish ponds connected with nutritional and health centers
Ministry of Agriculture, Livestock and Environment	National Fish Culture Service Fish ponds in Kigembe Station and training for local fish farmers and extension agents Fish ponds at Rwasave and assistance to fish farmers through National University of Rwanda
Varied projects and personnel under different programs	Individual and institutional fish ponds

5.6. Aquaculture Outreach to Women Clientele

Veverica (1988) conducted an informal survey of extension agents to identify women's access to fishery extension. According to this survey, 300 women were directly reached by the fish culture project's extension service since 1985; among these, were "individual pond owners", 173 women were members of 10 different women's collective cooperatives, and 113 women were members of 18 different co-ed cooperatives, with a total of 145 male members in the co-ed groups. In addition there are 15 women-oriented institutions possessing fish ponds. These include health centers, nutritional centers, schools, a prison, and a community development group. Without counting the institutions, it is estimated that women presently account for 10 percent of the fish farmers reached by project extension agents.

Veverica (1988) also recorded that Extension agents have noticed that women tend to follow their advice better than many men. Since agents are evaluated on the basis of rural pond productivity in their area, the agent himself is at an advantage if he works with more receptive women farmers. Women's household work load and family responsibilities make it

difficult for them to attend week-long training sessions at the training centers. The training staff in National Fish Culture Service program decided that instead of increasing the number of meetings to which women are called, the training should reach them where they presently gather such as at health centers and nutritional centers.

6. USA - RWANDA AQUACULTURE PROGRAM INSTITUTIONAL LINKAGES

6.1. Institutional Linkages for Gender Variable Integration in Rwanda PD\A CRSP

This effort to include a social science research component with the gender issues focus in the Rwanda PD/A CRSP is a combined effort by the Director of PD/A CRSP, the Director of the Women in International Development Program at Oregon State University, the PD/A CRSP scientist at the Rwasave Station and the Extension officer based at the Kigembe Station in Rwanda. These four female professionals initiated the project which focused on women in aquaculture in Rwanda. Oregon State University's Women in International Development program director took a leading role in developing the project and identifying the resources with a strong commitment of support from the PD/A CRSP Director. In Rwanda, similar collaboration was forged between scientists at the Rwasave Station and Kigembe Station. The commitment and informal collaboration among these professionals culminated in a project emphasizing gender integration in technology development.

6.2. Rwasave Station PD/A CRSP Farmer Linkages

The farmer linkages with PD/A CRSP at the Rwasave Fish Culture Station are informal. The PD/A CRSP research activities include field trials in the aquaculture ponds operated by individual farmers and farmer groups. These field trials serve the purpose of technology assessment at the farm level. Some of these farmer groups include women or are women-only groups. Women farmer contacts are created through field trial opportunities. At the supply end the Rwasave Station sells fingerlings as inputs for farmer groups to stock their ponds for a nominal price and provides technical advice to the extension agents and farmers. Currently, Rwasave Station staff and Kigembe Station personnel collaborate for training the extension agents, although Kigembe Station and MINAGRI are in charge of all extension and training activities. Training topics include: fish ball preparation, net-making and repair, fingerling selection and pond fertilization. The training activities focusing on fish ball preparation and net-making were held with the hope of developing small enterprises. It has to be emphasized that many of the dissemination activities are informal and are carried out as additional work beyond the mandated research responsibilities and work hours related to technology generation and assessment research. In this scenario, efforts to integrate a gender perspective are ad hoc and entirely based on project personnel's individual commitment and concern for Rwanda women farmers.

The PD/A CRSP has potential to build on these informal efforts to develop gender integrated field research programs. The PD/A CRSP can adopt explicit guidelines to integrate gender

issues into the research agenda and to specifically seek women fish farmers' perspective of aquaculture technology adoption constraints during field trials. It may also be advantageous to identify a few women farmer operated fish ponds and monitor them continually for their specific performance and constraints in utilizing PD/A CRSP technology.

6.3. PD/A CRSP Link With SPN Station in Kigembe

Formal PD/A CRSP farmer linkages in Rwanda began in 1989. Prior to that time, Auburn University was working in Rwanda through the USAID-supported National Fish Culture Project headquartered at Kigembe Station. Auburn still works with Kigembe on a consultancy basis through the NRMP project. The links between current PD/A CRSP personnel at Rwasave and SPN personnel at Kigembe were developed over time, since Auburn University has been involved in both projects.

The Rwasave research station has informal linkages with the Kigembe National Fish Culture Service Station (SPN). Scientists in the two stations foster and maintain informal communications on technology needs and production constraints of the farmers. Moehl (1991) recommends a formal research relationship between these two centers. The women in aquaculture colloquium project demonstrated a visible but informal linkage between PD/A CRSP scientists in the Rwasave Station and scientists in the Kigembe Station (Figure 7).

6.4. Kigembe SPN Research Station Farmer Linkages

The National Fish Culture Service located at Kigembe has extensive facilities for integrated aquaculture research and demonstration units. The service has an official mandate to train extension agents and coordinate all the fish culture extension efforts in Rwanda. The station is funded by USAID to train farmers in aquaculture. Thus the SPN Station at Kigembe is a logical choice to play an important role in expanding women's access to aquaculture technology by increasing the number of women farmers in the formal training programs and reaching women in the villages to expand their participation in fish culture activities. The center is equipped with training facilities including class rooms and shared housing for trainees. The station activities emphasize integrated livestock and fish pond systems. Hence the station plays a key role in training trainers to transfer aquaculture technology to the farmers. The linkages with the farmers are in the format of technology advice and intensive training for fish farmers at the station as well as fieldside demonstrations (Figure 7).

Women farmers' participation in training is not directed by predetermined objectives and followed through by planned intervention efforts. Women are integrated however, because of the interest and commitment of the station personnel. The station can make a far-reaching impact on women's access to training by establishing mandatory guidelines to identify and include women farmers in training programs and field visits in proportion to their participation in agriculture activities. In order to make the station an economically viable enterprise, it has various commercial activities such as a pond side canteen for visitors and the sale of fish and livestock products to the public. By nature of its structure as a

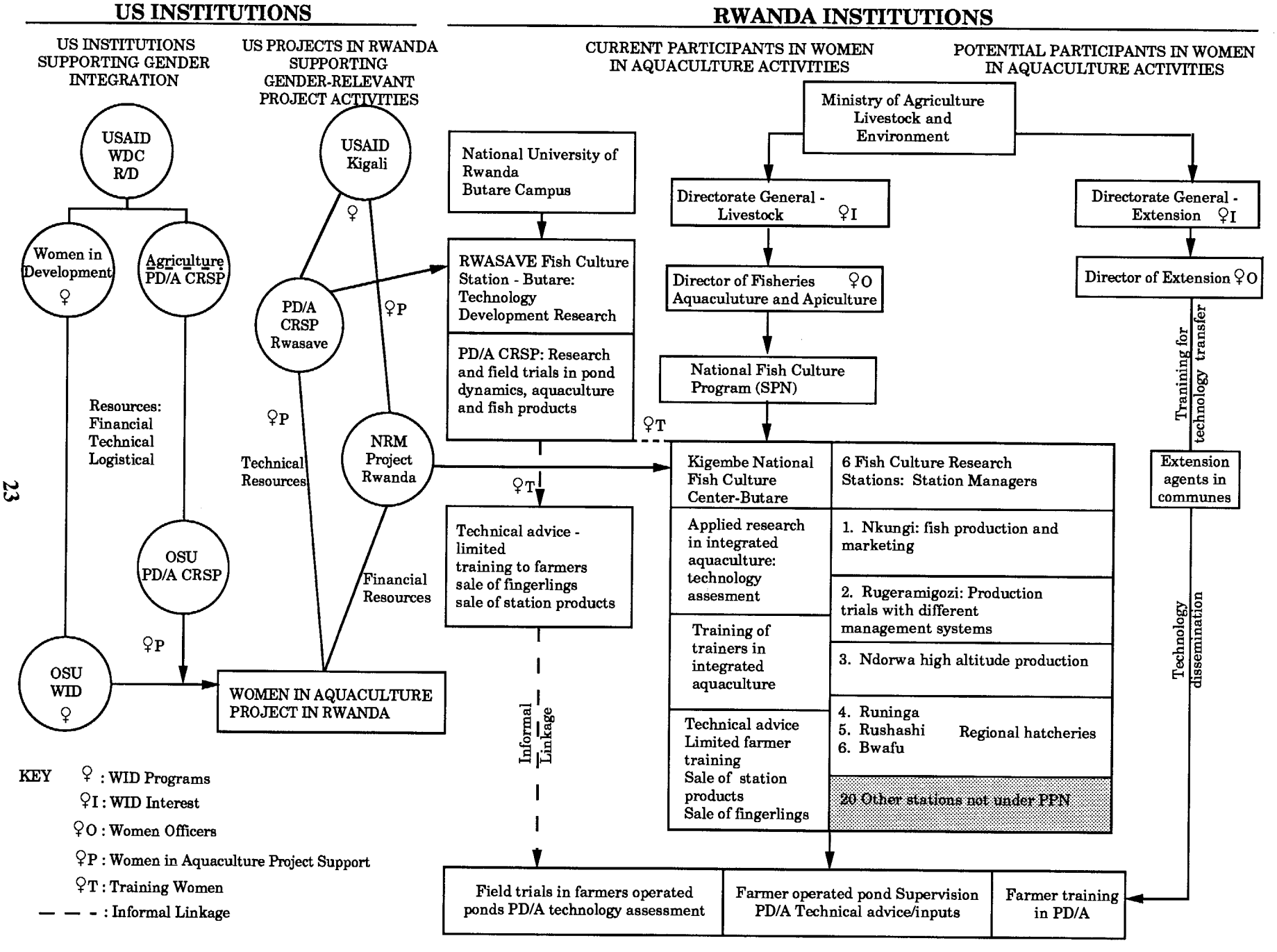


Figure 7: Institutional Linkages for Gender Integrated Aquaculture Development
R. Balakrishnan, 1993.

the sale of fish and livestock products to the public. By nature of its structure as a production, training, and sales center with a focus on integrated production systems, the station is an excellent venue to train women in integrated farming systems methods. Such integrated training program can assist women in gaining technological know-how to develop cereal crop and animal production (including aquaculture aspects). Rwanda women farmers can be trained to produce diverse products to address their households' consumption imbalances and at the same time counter natural resource degradation with appropriate land and soil management techniques. The commercial end of the station can demonstrate agricultural product marketing and pricing techniques to the women trainees. PD/A CRSP cannot have an impact on expanding women's participation in aquaculture without infringing on SPN activities. Thus the informal collaboration between PD/A CRSP based at Rwasave Station and SPN at Kigembe can be made formal and a process should be developed to coordinate gender integration in technology assessment, training and adoption. As illustrated in Figure 7, there are many possibilities to integrate gender issues in these institutions that collaborate formally and informally in aquaculture development.

7. ROLE OF RWANDA WOMEN IN AQUACULTURE

According to Food and Agriculture Organization of the United Nations,

> "In those countries where an aquaculture sector has been established, women have rapidly become involved in aquaculture at every level. Not only have they expanded their traditional fisheries roles in marketing, processing, and credit, but they have become active in farming (production) itself" (Nash, Engle, and Crosetti, 1987).

In Rwanda, participation by women has led to the rapid and successful growth of aquaculture (Personal Communication with Veverica, October 31, 1990). Rwanda women have successfully demonstrated their interest and ability to utilize modern aquaculture technology developed and disseminated through the Pond Dynamics and Aquaculture Collaborative Research Support Program (Koran, 1989). "Women fish farmers are most productive and easiest to work with. Extension workers are asked to seek out women trainees on the rationale that women's economic rewards from fish enterprise will be invested in family well-being" (Nyirahabimana, 1989).

7.1. Tasks by Gender in Aquaculture Production in the Project Area

In general aquaculture is labor intensive and demands physical and organizational skills to harvest a profitable output. A general description of aquaculture tasks and gender division of labor in the aquaculture is presented in Table 3. This was developed from the information provided by the women farmers and extension agents, and from observation at the pond sites by the investigator.

Table 3. Major Aquaculture Tasks and Gender Division

Aquaculture Task	Gender Division in Aquaculture Activities		Comments
Pond site selection	Occasionally women assist	Predominantly male	Land for pond is allocated by commune administrator. Male extension agent can influence the site selection playing an advisory role.
Cutting Grass	Women in general do not participate	Male	
Pond digging	Women assist in carrying mud	Predominantly male	Implements are under the ownership of men. Children assist.
Pond preparation (control mechanism, canal construction)	Women assist	Predominantly male	Done under the advisement of male extension agent
Water management	Women	Men	
Compost collection	Predominantly women	Men assist	Children assist.
Collecting and mixing compost	Predominantly women	Men assist	
Purchase and transport of fingerlings	Women	Men	Male extension agents assist.
Stocking	Women	Men	Male extension agents assist.
Collecting feed (household waste)	Predominantly women	Men assist	Children assist.
Feeding	Predominantly women	Men assist	Children assist.
Harvesting	Women assist	Predominantly men	Women do not like harvesting.
Pond cleaning	Women assist	Predominantly men	Women perceive this as a difficult task. Children assist
Marketing	Women	Men	Very little marketing. All sale is done at the pond site.
Processing for consumption Mostly cleaning fish for meal preparation	Women only		Processing is mostly cleaning of fish for consumption. Smoking and drying processes,if any are done by women.

Rwanda women and men share responsibilities in the aquaculture production system (Figure 8). Men perform tasks requiring tools that are owned by men and which are perceived to be physically hard such as digging the pond and harvesting. Even in women-only groups, men are asked to assist in these tasks. Similarly women are responsible for specific tasks. Women are exclusively responsible for collecting household waste for feeding the fish and participate extensively in collecting compost materials to enrich the pond nutrient level. Women's exclusive responsibility for composting has important implications for training them in appropriate resource use techniques; particularly in Rwanda where the compost is important organic matter for soil enrichment. Some view aquaculture production as being in competition with agriculture production for manure and land. Women need to be educated in the judicious use of available resources to balance aquaculture and agriculture productivity. But a different picture emerges in the consumption sphere, where women are exclusively responsible for the cleaning of fish and where necessary the processing of fish. While women either are responsible for or assist in most tasks in the production sphere, in the consumption sphere women are exclusively responsible for all tasks.

8. WOMEN'S PERCEPTIONS RELEVANT TO INTEGRATED AQUACULTURE ADOPTION

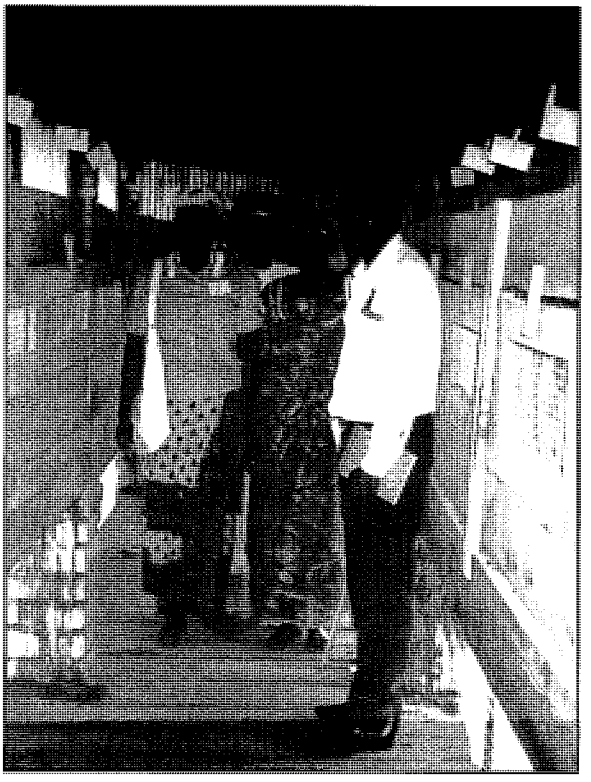
8.1. Economic and Social Advantages for Women in Adopting Integrated Aquaculture

Economic advantages accruing from the aquaculture adoption included access to land, access to good quality protein food and, in some cases, availability of cash income.

Rwanda's land based production is organized by farmer groups. A primary advantage in organizing in farmer groups is the access to land for production. In the integrated aquaculture system the pond bunds are utilized for garden crops which are cultivated by women. Women with access to ponds have a better chance of obtaining food for the family. A few expressed the view that staking the marais land for aquaculture ponds increased the acreage of land available for their families.

Women have often adopted aquaculture in lieu of small animal husbandry. This issue needs to be studied further. It is unclear which of the following elements contribute to the adoption: unavailability of pasture land, unavailability of either farm animals or labor to supervise the grazing animal. Since integrated aquaculture can include animal, crop and fish production, fish and animal production can be complementary.

Most women stated that they have taken up fish culture to provide for family food needs. Fish from the pond is perceived as ready and relatively cheap sources of protein. Women utilized the household waste such as cassava peels, banana peels, sorghum waste from beer brewing and any other household waste to feed the fish. In addition, edible wild greens were used to feed the fish. From the women's perspective these were free goods and when used to feed the fish produce good quality animal product to feed the family. There was also the



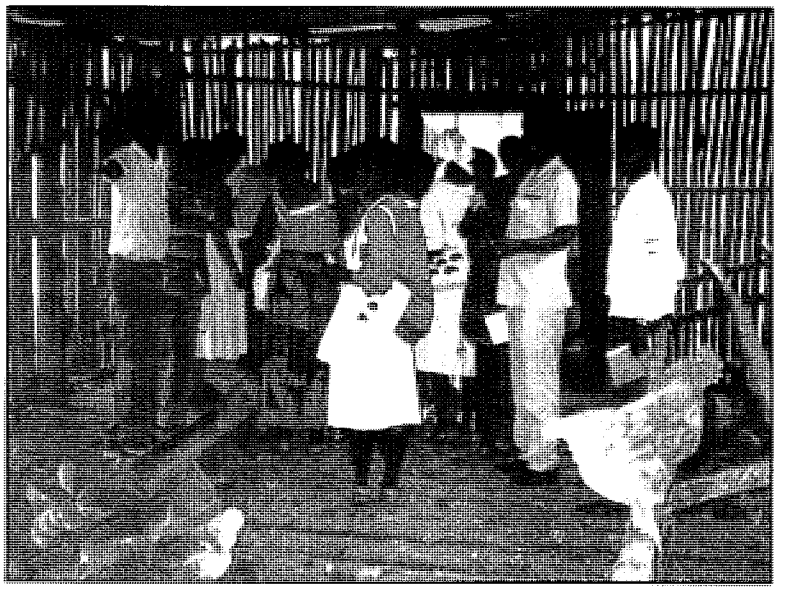


Figure 8. Portraits of Women in Aquaculture

potential to generate cash income from their aquaculture activities. Frequently women state they took up aquaculture to provide nutritious food for the children, and they have learned from nutrition centers the importance of fish as a protein source for good nutrition.

Some women's group have benefitted financially by selling the fish and banking the cash returns. The cash has been used to purchase inputs for agriculture production.

On the social benefits side, women enjoyed doing activities as a group and learned to organize allocation of tasks to group members for pond management. Some women stated that the group members pooled money to loan to needy members.

8.2. Gender Segregated Constraints on Aquaculture Production

In Rwanda, as in many developing countries, both men and women with limited resources face production problems. The broad categorization of domains and specific constraints for fishery production and additional restrictive impact of constraints on women are listed in Table 4.

Table 4. Gender Segregated Constraints on Aquaculture Production

Domain	Constraints	Restrictive Impact on Men and Women's Production	Specific Additional Restrictive Impact on Women's Production
Ecological	• Mountainous terrain that restricts pond size	• Same	
	• High elevation with a cool climate that impacts fish growth and production	• Same	
	• Availability of water of the proper quality	• Same	
Land	• Access to marais land depends on the goodwill of the local administrator	• Same	• Women's access more restricted due to cultural norms.
	• Lack of permanent tenure		• Women's access more restricted due to cultural norms that support male network; poorer knowledge of administrative system; local administrator's perceptions may be biased against women's access to land.
	• Lack of ownership of marais land and thus to the fish ponds	• Same	• Women's access more restricted due to lack of right to own property.

	• Population growth with excessive demand on the marais land	• Same	
	• Competing demands for limited marais area for agriculture, animal husbandry and aquaculture	• Same	
Labor	• Hard labor for pond digging, cutting grass and cleaning the pond	• Men are self-reliant	• Women are dependent on male labor
	• Demand on time for agriculture, animal husbandry	• Men and women have high demand on time	• Women have additional demand on time of household chores and child care
Credit	• Inadequate credit to invest in fish production	• Men have direct access to credit	• Women can get credit only with the approval of appropriate male family member
Production Process	• Inadequate fingerling availability	• Same	
	• Water management	• Men are self reliant	• Women depend on male labor
	• Compost and fish feed availability		• Women have additional burden of continually collecting household waste to feed fish
	• Technical knowledge comprehension	• Men have higher literacy rate	• High level of illiteracy further complicates learning production techniques
	•Tools for land clearing and digging ponds	• Men own the tools	•Women have to borrow from men the tools for clearing land and digging ponds
	• Harvesting and pond cleaning process	• Men self reliant	• Women depend on male labor
	• Marketing: logistical constraints	• Same	
	• Market contacts	• Men have more links with market	• Women have limited market access
Technology Transfer	• Inadequate Extension: direct training for farmers	• Same	•Women request information on preparing fish for family diet, an area that is not within the expertise of fishery extension agents.
Production loss	• Theft of fish and fingerlings	• Same	
Development Service Infrastructure	• Access to and assistance of commune administrator	• Same	•Women complain that the commune administrators have not responded well to their needs.

In general terms, both women and men as limited-resource farmers face similar constraints for aquaculture production. But women confront additional production constraints due to their gender. The sources of increased constraints are their role as child bearers and their child rearing responsibilities, social norms and traditional biases that deny equity in access to land, information and credit, and their lack of understanding of the administrative system that delivers development resources.

8.3. Reasons to Participate in Integrated Aquaculture

A main reason for women's participation in fish farming was access to fish for the family meal. Several women fish farmers mentioned that it was difficult for them to buy meat so they opted for fish farming to produce their own fish.

Education programs from the nutrition center also played an important role in adoption of aquaculture. The women of Cyangugu and Kayove (*Gisenyi*) communes were taught to eat the fish called Isambaza (*Limnothrissa*) at the Nutrition Center. They preferred to produce fish themselves rather than buying it so often.

Aquaculture activities were done in groups. Some were organized as all-female farmer groups and others were mixed groups of male and female farmers. In the mixed groups some husbands were also members. These men were called upon during their wives' absence to replace them in the pond work.

Some women organized their own fish production groups. Others entered fish aquaculture activities as a group, by the encouragement of their local administrative bodies or churches, and some entered to get access to valley bottom land (marais land) for production.

Some groups decided on fish farming instead of other agricultural activities. The women of Rwamiko (*Gikongoro*) had difficulty producing enough agricultural produce in the hills around the homestead, so they adopted the practice of cultivating in the lowlands. However, in the lowlands, where the soils conditions are poor for agriculture, they opted for fish farming.

8.4. Women Farmers' Experiences in Aquaculture Adoption

The woman with the most experience in fish farming started in 1957 through an association. some of the other women began in the 1970's, while the majority of women started their fish farming activities in 1986-1987. The most recent women fish farmers began in 1990-1991. The timeline coincides with USAID support for expanded National Fish Culture Service (SPN). A additional benefit of USAID sponsored integrated aquaculture research and extension has been increased participation of women.

8.5. Success of Women Farmers' First Efforts in Aquaculture

The success of womens' first efforts in aquaculture was variable. Some women fish farmers who started on their own without the help of an extension agent, dug the ponds poorly and often in inappropriate sites. Those who were assisted by extension agents with proper techniques did not have those problems. The management of water, fertilization, feeding and breeding of fishes posed some difficulties to the women who had not had training or advice from extension agents.

8.6. Women Farmers' Perceptions of Constraints to Participation in Aquaculture

Certain women fish farmers knew of problems caused by their neighbors and the administrative authorities who opposed fish farming. Some authorities were not well-informed and opposed aquaculture with the reasoning that the ponds bred mosquito larvae. The neighbors who opposed fish farming felt that the land used for aquaculture ponds took away from crop production. (The scientists did not weigh the mosquito problem to be a real one. Their perception is that ponds with fish are actually beneficial since the fish consume mosquito larvae). This may be well a problem of abandoned ponds and poor management of ponds. Further, it may well illustrate a knowledge gap and divergence in the perception of the problem between farmers and scientists. Another problem experience by some groups was the disintegration of the production groups by lack of cooperation or relocation of women.

The problems directly related to production were: poor pond construction, poor choice of species to raise, lack of manure and nutrient food for the ponds, poor harvesting techniques and lack of materials, and predators (thieves, birds, and frogs).

Women also noted that the support for aquaculture was not as extensive and intensive as it was for agricultural production. This may be due to the perception among the local administrators and planners that food production is related only to crop production and does not include fish production. The demand for marais (lowland) for fish ponds might be perceived as competition for limited land area in a land-starved overpopulated country.

Though women expressed their interest in integrated aquaculture production, at the present time integration is limited to fish ponds and garden crops on pond dikes. Predominant reasons for not including livestock are lack of resources to own livestock, and theft of livestock. These concerns suggest that there are situation-specific constraints at work regarding utilization of aquaculture production techniques on the farm.

Another general problem was lack of manure for the ponds. Scientists and extension agents recommended integration of livestock production such as pigs with fish farming. Livestock raising in certain areas of Rwanda presented some unique problems, such as lack of feed for the livestock, women's poor management of livestock and women's inability to obtain credit to purchase livestock. But for women in certain areas where it was customary to carry out diverse agricultural activities in the swamp and to get the assistance of men in the mixed

groups for livestock management, the problem of raising livestock for manure was not considered to be a serious problem. Additionally, the pond sites were far from home and it was unthinkable for the women to keep livestock away from home, especially at night, due to theft.

The majority of women fish farmers mentioned difficulty in preparing fish for consumption. Women sold part of the pond harvest. The fish harvests were not large enough to leave a surplus for the market, and a need for large-scale marketing structure is not yet recognized. Informal market networks may exist.

Women did not want credit, but the "experts" advised women to consider it at this colloquium. Most women saw fish farming as an activity that required little or no cash for start-up, and was able to generate cash. Among the women who were interested in credit as a potential source of finance, most who had tentatively approached the bank had been refused because of their illiteracy and lack of collateral.

The price of fish was always lower than the price of meat. In several areas the price of fish was fixed relative to that of meat by extension agents who organized the sales.

In certain areas like Bwakira and Kigembe, the availability of land for construction of new ponds was obstructed by neighbors and authorities. Certain groups, on the other hand, enjoyed access to a large area of land for many years. Others submitted to the effects of population pressure for land.

Concerning the information for women fish farmers, it was brought out that information dissemination of aquaculture technology has been neglected. The present colloquium was the first forum for information sharing among women fish farmers, extension agents and scientists.

9. RWANDA WOMEN'S UNDERSTANDING OF RESOURCE SUSTAINABILITY IMPACT OF INTEGRATED AQUACULTURE

Within the farming systems paradigm, sustainability outcomes can be relevant to family's consumption and ecological resources. Consumption resource sustainability can be viewed as the reliable source of food supply for household members and, where feasible, cash flow for other goods and commodities. The quality of food is another element of consumption needs. The basic concept of the link between fish and good quality protein is understood by women. This understanding of aquaculture as a source of protein food for the household is the prime motivator for participation by women. But the time between harvests is long (approximately 9 months) and frequently a large number of household members depend on a single pond harvest. The combination of limited and infrequent supply of fresh fish does not guarantee a sustainable food supply. In particular, since the household preference is for fresh fish, the

demand exceeds supply. The demand for fish production is an opportunity to expand women's participation in aquaculture production.

From the perspective of ecological resource sustainability, integrated aquaculture is developed on the principle of complementary production systems of agriculture, livestock, and fish. The recycled animal waste is a source of land and pond nutrients. In return the ponds yield fish as commodities for on-farm consumption and off-farm sale to provide cash income to the farm households. The waste from the pond bottom can be used as organic manure for the agriculture land. Nutrient cycling is advocated by the scientists in the PD/A CRSP. But the emphasis in extension information is on production of fish only. Extension agents and the scientists in their remarks always state that women do not feed the fish adequately and the level of pond nutrients is low. Extension agents identify lack of commercial fertilizer and fish feed as production constraints. The women are innovative in identifying local resources, such as household waste and wild edible greens to feed the fish. Their ponds are nourished by banana stems and local vegetation. The technique of in-pond composting is recommended by the SPN and PD/A CRSP scientists. The PD/A CRSP efforts have not focused the research on utilizing household waste as fish feed, but have encouraged women to follow this cost-effective feeding practice. Rwanda women play an important role in ecological resource sustainability by utilizing household waste for aquaculture production. This does not mean that women necessarily have a good understanding of the scientific premises of integrated aquaculture in fostering natural resource sustainability.

10. RECOMMENDATIONS FOR PARTNERSHIPS IN AQUACULTURE SECTOR DEVELOPMENT

10.1. Women Fish Farmers - Technology Adopters

Women fish farmers generated the following requests:

i. The communal-level authorities and the directors of agricultural services should help them with the same consideration as that shown to other agricultural activities.
ii. The training officers of the National Fish Culture Service should come to villages to offer an extensive on-site training for farmer groups.
iii. The fishery technicians and scientists should visit them often to advise them on how to increase fish production.
iv. Field visits should be organized to observe integrated aquaculture activities, particularly livestock integration.

10.2. Extension Agents - Technology Disseminators

Extension agents recommended that:

i. There should be a greater degree of collaboration with the administrative authorities. The term administrative authorities is broadly interpreted by the participants. It can be local government administrators, supervisors or officials from various ministries.
ii. Those who have found themselves unable to resolve an aquaculture production problem in their local area should be able to contact a technician from the National Fish Culture Service.
iii. Abandoned ponds should be given to capable people with the support of the commune authorities.
iv. Their training responsibilities should not include agricultural aspects.

10.3. Government Ministry Representatives - Technology Planners

Ministry representatives recommended that:

i. There be competitions for rewarding farmers who have demonstrated good fish harvest. Such fish competitions should offer special prizes for the encouragement of women fish farmers.
ii. There should be an increase in the number of extension agents as trainers to assist women in aquaculture methods.

10.4. Researchers - Technology Developers

The researchers gained an appreciation of the women farmers' enthusiasm and their ability to assimilate technical details of aquaculture production. They agreed that the women should be trained directly by the aquaculture scientists to avoid loss of information through extension agents. In many instances they felt the fish farming technology is not absorbed adequately by the extension agents. This inadequate preparation of extension agents leads to dissemination of misinformation or inadequate information to farmers. In particular, women farmers may have to deal with further degraded information, passed through the male heads of the farmer group or spouses.

The scientist group recommended that:

i. The researchers should develop information necessary for fish production by technical notes, radio, or other mass communication means to be placed at the disposal of fish farmers in general and women fish farmers, in particular, and any interested third parties such as non-government organizations promoting fish culture.
ii. The priority information content areas are: the choice of site, the staking and construction of ponds, the management of the water, the choice and breeding of appropriate fish species, the fertilization of the ponds and feeding of the fish, pest and

predator control, harvesting techniques, preserving and preparing fish for eating, public health and its relationship to fish farming.

iii. The researchers and other technicians should work closely with fish farmers.

iv. The political-administrative authorities should be made aware of the role of fish farming in rural development in order to eliminate the farmer's poor production methods.

10.5. Nongovernment Organization Representatives - Technology and Input Transfer Facilitators

The Nongovernment organization group recommended that the National Fish Culture Service should investigate the different possibilities of financing fish farming activities and inform those concerned. This group in Rwanda actively promotes women's participation in income generating activities, including fishery production. They are effective in organizing groups and moving material inputs and credit. But their ability to provide technical know-how is limited. There is no formal link between PD/A CRSP scientists and NGO's who are favorably inclined to assist women's participation in the aquaculture sector. The feasibility of providing aquaculture training by PD/A CRSP scientists for the NGO promoters of aquaculture should be explored.

11. STRATEGIES TO IMPROVE RWANDA WOMEN'S PARTICIPATION IN AQUACULTURE

Rwanda women contribute extensively to agriculture production and participate with enthusiasm in aquaculture activities. A key motivating factor for their participation in aquaculture is to provide food for their families, in particular to feed their children. Such a motivation should be capitalized to encourage women to participate in aquaculture training, integrating techniques of soil conservation and water resource management for achieving sustainability. Major constraints to carrying out this strategy are lack of extension staff to train the farmers in aquaculture and the lack of information content on appropriate resource use. A suggested strategy is to train the literate farm women who live in the local production area to assist other women farmers on a regular basis. Such a measure would be cost-effective since the women will be in the local area and it would in part eliminate the need for extensive development infrastructure. Further, women with the knowledge of aquaculture can assume a place of importance in the local community. These women can assist in sustaining the aquaculture efforts of other women farmers.

Women more than men face constraints in obtaining land for fish ponds, and tools for digging the pond. The land constraint has to be dealt with both at the policy level and through education of local administrators to assist women as fish farmers. Women's access to tools can be increased by providing tools on a credit basis for women. Alternatively, women's groups can be provided a set of tools to be used under the management of the group leader.

Women have the knowledge and the key responsibility for feeding the fish by utilizing household wastes. The aquaculture scientists can work with them to identify the nutritional quality of various local greens and food wastes as fish feeds. In addition, their incentive to participate in aquaculture can be used as a motive to encourage women to learn about their role in effective management of natural resources. Women will need assistance to integrate small animal husbandry so that it will support aquaculture and increase the pond yield.

Though integrated aquaculture as a crop, animal and fish production system is well demonstrated in research centers, constraints at the local production environment among the diverse agro-climatic zones do not always encourage adoption of integrated aquaculture. Further research with a larger sample of women farmers in field situations in the various agro-climatic zones can provide additional information to develop programs for Rwanda women fish farmers in aquaculture training and input assistance.

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