

FEED THE FUTURE INNOVATION LAB FOR COLLABORATIVE
RESEARCH ON AQUACULTURE & FISHERIES
(AQUAFISH INNOVATION LAB)

SITE DESCRIPTIONS
FOR THE 2013 - 2015 IMPLEMENTATION PLAN



Updated March 2015

AquaFish Innovation Lab
Oregon State University
Corvallis, Oregon USA





AQUAFISH INNOVATION LAB: SITE DESCRIPTIONS 2013 - 2015

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The mission of the AquaFish Innovation Lab is to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. Bringing together resources from Host Country institutions and US universities, the AquaFish Innovation Lab emphasizes sustainable solutions in aquaculture and fisheries for improving health, building wealth, conserving natural environments for future generations, and strengthening poorer countries' ability to self-govern.

Disclaimers

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Acknowledgments

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Cover Photo

A collection of algae stocks in vials under a grow light at the Institute of Marine Sciences - University of Dar es Salaam in Stone Town, Zanzibar. Photo by Caleb Price.

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INTRODUCTION

The Feed the Future Innovation Lab for Collaborative Research on Aquaculture and Fisheries (AquaFish Innovation Lab, or AquaFish) is one of several agricultural Innovation Labs supported by the U.S. Agency for International Development (USAID) under the authority of Title XII of the International Development and Food Assistance Act of 1975. Its mission is to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. AquaFish is tasked by USAID to “develop more comprehensive, sustainable, ecological and socially compatible, and economically viable aquaculture systems and innovative fisheries management systems in developing countries that contribute to poverty alleviation and food security.”

The site descriptions included in this document provide detailed information on selected research locations for the five current AquaFish projects for Implementation Plan 2013 – 2015, including infrastructure, facilities, and other relevant capabilities. The descriptions include eight countries and over 30 Host Country (HC) institutions in formal funded partnerships. More than 70 other institutions collaborate in informal partnerships. The five projects feature 33 investigations.

The site descriptions are sorted by project and provide maps, information on the general location of each site, and details on each facility. Data for AquaFish sites which are no longer active can be accessed in earlier editions of the Site Descriptions on the AquaFish website at: <http://aquafish.oregonstate.edu>.

UNIVERSITY OF MICHIGAN



DEVELOPMENT OF MORE EFFICIENT AND ENVIRONMENTALLY SUSTAINABLE AQUACULTURE SYSTEMS
FOR NEPAL

NEPAL

(Information provided by Dr. Jim Diana, US Lead Project PI)

AGRICULTURE AND FORESTRY UNIVERSITY

Country Map



General Location

Rampur, Chitwan, Nepal. AFU is located in the Terai southwest of Kathmandu (see map of country), near the town of Narayangarh, in the southern portion of Nepal's central plain, approximately 160 km southwest of Kathmandu.

Nepal is a small country with a diverse climate, from the highest peaks in the world with alpine tundra to low level plains with a tropical climate. AFU is situated in the plains of Nepal, where 94% of fish ponds in the country are found, making this an ideal location for conducting aquaculture research.

DESCRIPTION OF AREA/REGION

Climate

Humid sub-tropical, wet-and-dry type, with distinct dry and rainy season.

Temperature

Annual average: 24.7 °C

Range of monthly average: 18.0 – 30.6 °C

Absolute minimum: 7.8 °C

Absolute maximum: 37.9 °C

Precipitation

0.6 – 626.5 mm per month and an average of 2,323 mm annually; low month is January, an average of 1.5 days of precipitation; high month is July, with an average of 29 days of precipitation.

Humidity

A warm and humid atmosphere prevails throughout the year, with an annual mean relative humidity of 85%.

Seasonality

Nepal has clearly defined wet and dry, hot and cool seasons, with wide temperature variation throughout the year. The rainy season is from June to October, the cool dry season is from November to February, and the hot dry season is from March to May. The hottest month is generally April, and the coolest is January.

Topography

Geographically, Nepal is divided into three ecological regions: the mountain zone in the northern portion of the country, the central hill zone, and the southern Terai, or plains. In contrast to high altitudes found in the first two regions, average elevation in the Terai ranges from 100-300m above sea level.

Geology/Soils

Chitwan is a valley surrounded by Silwalik Range in the north and Churiya Range in the east, west, and south.

Soil and Water Data

Soils in the Terai are the most fertile in Nepal, and the region accounts for 70% of the country's agricultural lands despite making up only 17% of Nepal's total area.

Layout of the Site**DESCRIPTION OF SITE****Map Coordinates**

27°38'14.1\" N and 84°21'25.2\" E

Elevation

257 m

General Background

The AFU, Rampur campus occupies an area of approximately 210 hectares near the town of Narayangarh, southwest of Kathmandu. AFU's research pond complex is one of several aquaculture facilities operated by its Aquaculture Department. Facilities at AFU include laboratories for analysis of water chemistry and fish body composition; ponds and tanks for experiments; infrastructure for safety and protection of experimental materials; and an aquaculture laboratory with equipment such as ovens, a muffle furnace, water distillation, autoclave, centrifuge, electronic balance and deionizer column, as well as consumable

chemicals. AFU has 38 earthen ponds ranging from 100 to 450 m² in size and 18 concrete tanks (24 m² each), along with drainage canals. There is also an area for growing terrestrial crops that may be of interest for fish feed components, as well as an area used for rearing livestock and poultry (ducks) that can be used in integrated aquaculture research. The Research Farm is fenced with barbed wire and cement poles, and supplied with electricity. The covered hatchery facility includes indoor tanks and a well water supply system.

Water Supply

Supply of water for the AFU pond complex comes from underground water having pH of 8.3 and total alkalinity of about 130 mg/L as CaCO₃.

Soils

Sandy loam

Support Facilities

The Nepal Agricultural Research Council (NARC) collaborates with the main site at AFU. NARC operates several Fisheries Research Centers throughout the country. Present plans are to conduct spawning research at the Pokhara station and in Rampur, Chitwan. All of these stations have access to ponds for experiments, labs for physical and chemical analyses, and other facilities like local lakes, cages, and additional experimental apparatus.

The Directorate of Fisheries Development (DoFD) is the development/extension wing for aquaculture and fisheries of the Department of Agriculture, Government of Nepal. The DoFD operates several Fisheries Development Centers throughout the country. The DoFD collaborates in demonstration projects at the Bhairahwa fisheries station and Dayanagar farmers' field developed by AquaFish.

Affiliations

<i>In-Country</i>	<i>U.S.</i>
Agriculture and Forestry University	University of Michigan
Department of Aquaculture and Fisheries	School of Natural Resources and Environment
Rampur, Chitwan, Nepal	Ann Arbor, Michigan, USA

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Rampur, Chitwan, Nepal	Ann Arbor, Michigan, USA

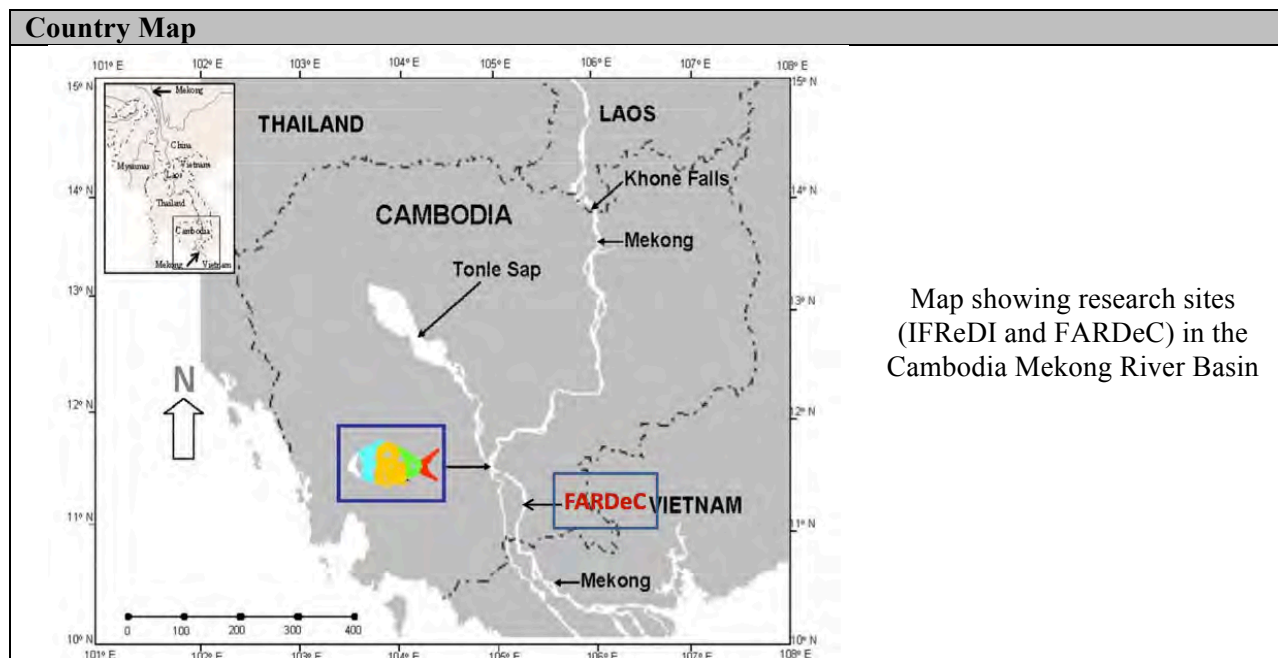
UNIVERSITY OF CONNECTICUT AT AVERY POINT



IMPROVING FOOD SECURITY, HOUSEHOLD NUTRITION, AND TRADE THROUGH SUSTAINABLE
AQUACULTURE AND AQUATIC RESOURCE MANAGEMENT IN CAMBODIA AND VIETNAM

CAMBODIA

(Information provided by Dr. Bob Pomeroy, US Lead Project PI)



INLAND FISHERIES RESEARCH AND DEVELOPMENT INSTITUTE (IFReDI), PHNOM PENH



Inland Fisheries Research and Development Institute (IFReDI) building, located in Phnom Penh (left), and IFReDI laboratories (right).

General Location

Fisheries Administration, 186, Norodom Blvd., Phnom Penh, CAMBODIA

DESCRIPTION OF AREA/REGION

Climate

Köppen classification *Aw*: *Humid tropical group (A), tropical wet-and-dry type (w)*. Distinct dry and rainy seasons are observed.

Temperature

The temperatures are remarkably and uniformly warm throughout the year and subject to small variation due to elevation, season and maritime influences. Temperatures are high except during the early part of the northeastern monsoon when occasional outbreaks of cool air from central Asia sweep over the land. Cool spells occur during December and January, and the weather is hot and dry from the end of February to the break of the monsoon. These conditions last until the southwest monsoons commence in May. Mean minimum temperature is 22°C in the area. Monthly average highs in Phnom Penh range 30 - 35°C, and average lows range 22 - 24°C.

Precipitation

The rainfall is generally plentiful, but it is unevenly and seasonally distributed and largely depends on geographic orientation. Annual average precipitation is 2,000-3,000 mm in the low mountains of the northeastern region and 1,400-1,600 mm in southwestern coasts. About 90% of the annual precipitation falls between May and October (i.e., the wet or rainy season). The average number of wet days varies from less than one day a month in December and January to more than twelve days a month in August and September. The monthly average precipitations range from 7.6 mm in January to 251.5 mm in October.

Humidity

The relative humidity is highest in the monsoon season at slightly more than 80% and lowest in March at just over 60%.

Seasonality

All of Cambodia has clearly defined wet and dry seasons, with little temperature variation throughout the year. The rainy season is from May to October, the cool dry season from November to February, and the hot dry season from March to May. The hottest month is generally April, and the coolest is January.

Topography

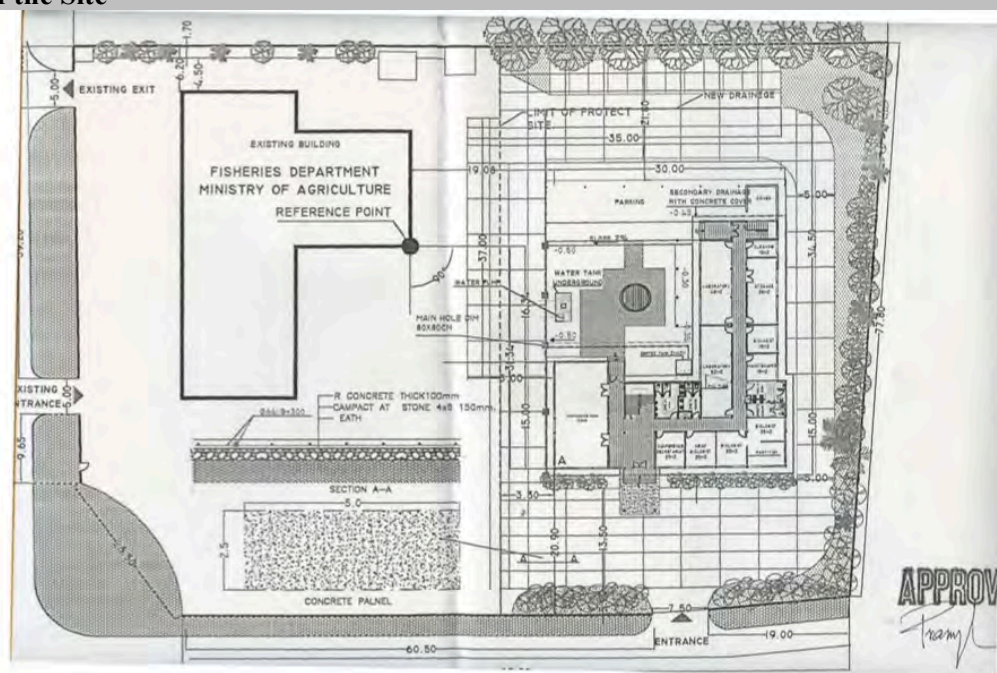
The area is part of Cambodia's vast, nearly level central alluvial plain (the Mekong or Mekong Delta Plain, which extends through Vietnam to the South China Sea through several tributaries and through canals which have been constructed in Vietnam to regulate flooding), and located at the confluence of the Mekong, Tonle Sap, and Bassac rivers. These rivers provide potential freshwater and other resources.

Geology/Soils

Influence of the Mesozoic sandstone and its weathering products is attenuated by Tertiary and Pleistocene igneous geology and by Pleistocene and Holocene sediments that mantle a considerable proportion of the major rice growing parts of Cambodia. Recent and Pleistocene alluvial/colluvial sediments that now form the parent material for most of the agricultural soils of Cambodia are substantially derived from the weathering and erosional products of the Mesozoic sandstone. However, low hills from felsic igneous intrusions particularly in south and southeast Cambodia have also supplied siliceous sediments for the recent and older alluvial/colluvial terraces. In the northeast and west of Cambodia, basaltic lava flows of the Pleistocene cover significant areas of older alluvial terraces. Finally, the sediments deposited by the Mekong River along its flood plain and in the basin of the Tonle Sap mean that much of central Cambodia is dominated by recent alluvial/lacustrine sediments derived in part from the Mekong River basin and in part from the immediate basin of the Tonle Sap.

Soil and Water Data

At IFReDI, the soils are quite acidic, with an average pH value of 4.9. Sand content averages 40%, silt 35%, clay 25%, organic C 7.2 mg/kg, and total N 0.7 g/kg.

Layout of the Site**DESCRIPTION OF SITE****Map Coordinates**

11° 33' 15" N and 104° 55' 21" E

Elevation

28m

General Background

IFReDI occupies an area of approximately 0.5 ha located in the capital city of Phnom Penh. IFReDI, which is under the supervision of the Fisheries Administration, comprises six Divisions listed as follows:

- Biological Division
- Laboratory Division
- Socioeconomic Division
- Technology and Information Transfer Division
- Kandal Stung Fisheries Research Station
- Administration Division

Presently, IFReDI has four senior researchers with Ph.D. degrees in biology, development communication and rural/community development from abroad (i.e., Belgium, Japan, Philippines, and Vietnam). There are twelve staff members holding M.Sc. degrees in fisheries biology, aquaculture and aquatic resources management, natural resources management, watershed management, agricultural economics, development communication, and rural planning and development from both foreign (Australia, Malaysia, Philippines, Thailand, and Vietnam) and national universities. There are also 24 staff members holding B.Sc. degrees in fisheries science, aquaculture, and fisheries economics.

The IFReDI staff have extensive experience in fisheries biology and ecology, aquaculture development, fisheries policy development and planning, fisheries resources, development, management, and conservation, socio-economics and livelihoods, and participatory fisheries resources management.

The IFReDI laboratory complex houses instruments for measurement of the biological, physical, and chemical parameters of importance in fisheries and aquaculture.

Water Supply

Supply water for IFReDI laboratory comes from public/city water taps and ground water wells.

Soils

The soils at IFReDI are quite acidic, with average pH value of 4.9. They have sand contents averaging

40%, silt 35%, clay 25%, organic C 7.2 mg/kg and total N 0.7 g/kg.

Support Facilities

Laboratories and personnel at the Inland Fisheries Research and Development Institute (IFReDI) are available to the AquaFish Project.

IFReDI has a very rich fisheries library, networking with FAO, MRC, WorldFish, and other libraries in the world.

IFReDI research and development activities are funded by the Royal Government of Cambodia, AquaFish Innovation Lab, MacArthur Foundation, MRC, ADB, OXFAM, WorldFish Center, DANIDA, SIDA, FAO, SEAFDEC, NACA, IUCN, ACIAR, UNEP, JICA, WWF, CI, NEF-Japan and EU.

IFReDI has close cooperation with the following universities and research institutes to strengthen research and exchange knowledge and information:

- USA (7): UCONN, URI, OSU, UW, Texas A&M U, Florida Museum of Natural History, and Princeton University
- Australia (2): QUT & Murdoch University (Perth)
- Europe (6): SU/BHIEE/RSAS (Sweden), KULEUVEN and UG (Belgium), University of Toulouse, University of Paul Sabatier (France), & The Natural History Museum (London, UK)
- Asia (18): LARReC and National University of Laos (Laos); RIA 2 and CTU (Vietnam); KU and IFReDI/DoF, Ubon Ratchathani U, Srinakharinwirot U and Maejor U (Thailand), AARM/AIT (Thailand); LGFS/UT, JWRC, and Kyushu U (Japan); USM (Malaysia); and RUA, PLNSA, CHNSA and RUPP (Cambodia)

Affiliations

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FRESHWATER AQUACULTURE RESEARCH AND DEVELOPMENT CENTER (FARDeC)



Freshwater Aquaculture Research and Development Center's building located in Prey Veng province, Cambodia (left), and a domesticated-broodstock pond for AquaFish's snakehead project (right).

Layout of the Site



DESCRIPTION OF SITE

Map Coordinates

11° 16' N and 104° 17' E

Elevation

7m

General Background

The Freshwater Aquaculture Research and Development Center (FARDeC), previously known as Bati Fish Seed Production and Research Station, is located along the bank of Tonle Toch (small) River of the Mekong basin in Bati village, Peam Ro district, Prey Veng province, about 68 km from the capital city of Phnom Penh by national road N°11. It has a total land area of about 13 ha.

FARDeC is the second largest of a series of aquaculture centers supervised by the Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries. It has major responsibilities in freshwater fish fingerling production of indigenous species such as river catfish, walking catfish, climbing perch, silver barb and recent giant freshwater prawn and snakehead, and exotic species including tilapia, Chinese carps and Indian carps for distribution to fish farmers. In addition, the center has

experience in operating a series of experiments on hatchery, nursery and grow-out performances of both indigenous and exotic species, especially river catfish and giant freshwater prawn, and also provides training and technical assistance to fish farmers. The center consists of offices, a biological laboratory, training and workshop building, a library, a dormitory, a storage building, one pump station, a commercial pellet feed mill, a hatchery, and a complex of experimental tanks and ponds for broodstock, nursery and grow-out. There are a total of 73 ponds, including eight ponds of 200 m², thirty 300 m² ponds, and fifteen 600 m² ponds with concrete, five 600 m² ponds, and fifteen 2,000 m² ponds. The twelve 300 m² ponds have been assigned to the AquaFish project.

Water Supply

The water is pumped by a diesel-powered hydraulic pump from Tonle Toch (small) River and directly supplied by gravity to the ponds, whereas tanks are supplied by ground water from an on-site well. The power is supplied by generator and solar panel, and expected to connect with electricity in the near future.

Soils

According to Dr. M. C. Nandeesha 1991, the major problem with the center soil is its high percentage of sand and low percentage of clay. The water holding capacity of the soils with high sand content is poor. The infiltration rate of the Center soil is expected to be more than 5-7 cm/day.

Coarse sand (%): 28.8

Fine sand (%): 38.0

Silt (%): 13.4

Clay (%): 15.4

pH: 5.5

Avg. N (kg/ha): 454.7

Avg. P₂O₅ (kg/ha): 45.2

Avg. K₂O (kg/ha): 100.8

Zinc (ppm): 0.48

Copper (ppm): 0.77

Manganese (ppm): 28.0

Iron (ppm): 8.6

Boron (ppm): 0.16

Support Facilities

Students from The Royal University of Agriculture (RUA), Prek Leap National College of Agriculture (PNCA), and Kampong Cham National School of Agriculture (KCNSA) in Cambodia conduct thesis research at FARDeC and the AquaFish site (e.g., snakehead domestication and breeding; tilapia pond characterization), and also assist in various activities in the center. A pellet feed mill and a laboratory are available in the center. A variety of agricultural by-products (e.g., corn, rice bran, wheat bran, soybean meal etc.) are available from the various mills. Inorganic fertilizer is available at agricultural supply stores; organic fertilizers are available from local farms at low cost. The water quality laboratory of the Ministry of Agriculture in Phnom Penh has been used for water analysis. FARDeC has worked and is working with various local, regional and international organizations and agencies such as PADEK (1993-1997), APIP/world Bank (2000-2004), FAIEX/JICA (2005-2010), AIMS/MRC (2005-2010), AquaFish-CRSP (2010-2011), and DFID (2011).

Affiliations

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VIETNAM

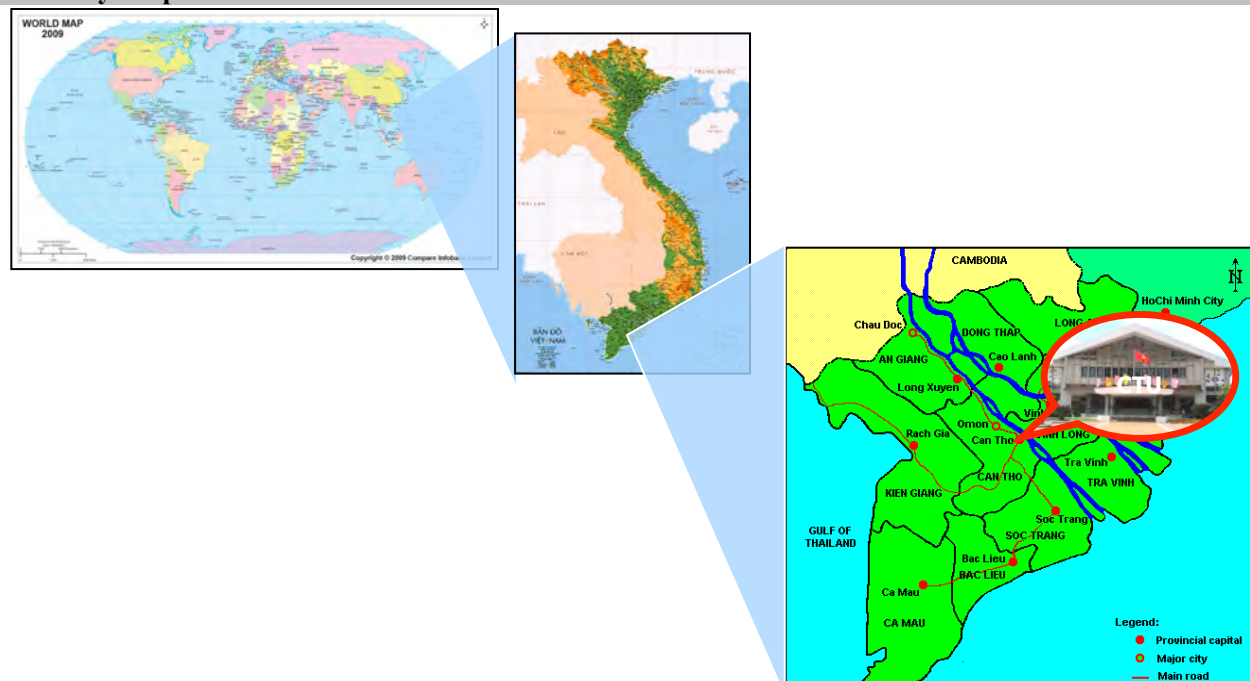
(Information provided by Dr. Bob Pomeroy, US Lead Project PI)

CAN THO UNIVERSITY



Can Tho University – College of Aquaculture and Fisheries

Country Map



Maps and location of Vietnam, Mekong Delta, and Can Tho University

General Location

Can Tho University (CTU) is located in Cantho City, Vietnam, in the center of the Mekong Delta.

DESCRIPTION OF AREA/REGION

Climate

The Mekong Delta belongs to Humid tropical group (A), tropical wet-and-dry type (w). Distinct dry and rainy seasons are observed.

Temperature

The temperatures are warm year round and subject to small variations due to elevation, seasonal and maritime influences. The average temperature ranges from 26 to 28°C in the Mekong River Delta. During the months of December and January the temperatures are generally lower, while the climate becomes hot and dry from the end of February to until the southwest monsoon begins in May.

Precipitation

The rainfall is generally high but varies by season, and is unequally distributed depending on geographic orientation. Annual average precipitation ranges between 1,600-1,800 mm in northeast part of the Delta and can exceed 2,000 mm on the Southwestern coast. About 90% of annual rainfall occurs between May and November (i.e., the wet or rainy season). Heavy rains are common in July and August. The monthly average precipitations range from about 8 mm in January (dry season) to 250 mm in September (rainy season).

Humidity

The relative humidity is highest at about 80-85% in September, and lowest in March at the level of 60-65%.

Seasonality

The weather in the Mekong River Basin (MRB) of Vietnam is divided into 2 seasons. The rainy/wet season is from May to November while the dry season lasts from December to April. It is hottest in May and April, but coolest in December and January.

Topography

The MRB of Vietnam is a vast lowland area. The total natural area of about 4 million hectares spreads from the Cambodian border to East Sea and the Gulf of Thailand. It is famous for two flood plains: Dong Thap Muoi and the Long Xuyen Quadrangle. There are two main branches of the Mekong River (Hau and Tien rivers) with a cross-network of natural and man-made canals that transport about 500 billion cubic meters of freshwater from upstream to the sea every year. In the wet season, water flow of the river is about 40,000 m³/s, more than 20 times greater than flows during the dry season (around 1,800 m³/s).

Geology/Soils

There are two major types of soils in the MRB of Vietnam. Alluvial soils are found along the Tien and Hau rivers and cover an area about 1,100,000 ha (about 28% of the Mekong Delta). Acid sulphate soils: occupy 1,590,000 ha mainly in the Plain of Reeds and the Long-Xuyen – Ha Tien quadrangle. These are classified into (i) potential acid sulphate soils, which cover about 1,089,236 ha (28% of the Delta) and actual acid sulphate soils, which occupy 510,027 ha (13% of the Delta). Salinity soils are found along the coastal regions covering an area of 808,749 ha (21% of the Mekong Delta). The remaining soils are upland and mountainous peat soils. Alluvial soils are mainly located along the main river branches (Hau and Tien rivers). Actual acid soils and potential acid soils are common in the flood plains. Hilly and peat soils are mainly observed in the areas along the Cambodia border and the western coast. Saline soils are mostly located with mangroves in the eastern coast.

Soil and Water Data

In addition to the soil information above, water flow of the river in the wet season is about 40,000 m³/s – more than 20 times that of the dry season (1,800 m³/s). Water flow in dry season is about 1,700 m³/s. There are 9 provinces and cities with between 1.4 - 1.9 million ha and 9-10 million of people affected by annual floods.



Elevation

Sea level

The College of Aquaculture and Fisheries (CAF) at Can Tho University (CTU) was established in 1979. For over 30 years, CAF has been developing itself to fulfill its missions of education, research and technical transfer in the aquaculture and fisheries fields. These efforts help meet the demand for manpower and advanced technology for development of aquaculture and fisheries in Vietnam and the Mekong Delta.

- Dept. of Applied Hydrobiology
- Dept. of Aquatic Biology and Pathology
- Dept. of Aquatic Nutrition and Products Processing
- Dept. of Freshwater Aquaculture
- Dept. of Coastal Aquaculture
- Dept. of Fisheries Management and Economics
- Center for Aquaculture Promotion
- Administration Unit

CAF has a system of advanced laboratories, hatcheries, and field stations in both freshwater and brackish water areas, which meet the functions of education, research, and technology transfer locally and internationally.

Laboratories

- Laboratory for water and sediment analysis: analyzing more than 30 environmental parameters of sediments.
- Laboratory for fish pathology: analyzing parasites, bacteria, virus and cytology
- Laboratory for aquatic animal nutrition and feed: analysis of all feed quality parameters, feed ingredients such as protein, carbohydrate, lipid, fiber, mineral, moisture, Vitamin C, fatty acids
- Applied molecular biology laboratory: specializing on physiology, nutrition and pathology.
- Laboratory of food safety: analysis of residues of drugs and chemicals in water, sediment and fishery products.

Wet labs

Live food production; Mud crab broodstock and larval production; Reproduction of ornamental fish; Showroom for aquatic animal specimens. Two wet laboratories are used for nutrition research (100 tanks of 500 liters, 100 tanks of 100 liters). CAF also has one small mill (200 kg/hours) for aquatic feed processing.

Experimental stations

- Freshwater fish hatchery located at the University campus has been operating to reproduce plenty of fish species such as common carp, mud carp, tilapia, several catfish species and some wild fishes (snakehead, broadhead catfish, snakeskin gourami, etc.)
- Marine shrimp and giant freshwater prawn hatcheries (based on-campus)
- Brackish-water field experimental stations in Vinh Chau, Soc Trang province (with a total area of 15 ha) and Bac Lieu province (6.5 ha).

The university has been establishing collaborations with more than 120 institutions around the world, which aids the development of bilateral and multilateral cooperation programs for CTU. From 2007 to 2011, CTU signed more than 110 Memoranda of Understanding and Agreements with universities, institutes, and international organizations representing many countries including Australia, Belgium, Canada, Denmark, England, Finland, France, Germany, Japan, Malaysia, The Netherlands, South Korea, Spain, Sweden, Taiwan, Thailand, and the United States.

Water Supply

Water for the operation of laboratories and experiments at CAF is sourced from public water taps with a pH of 7.5 – 8.0, and an alkalinity of 30-50 mg/L.

Water for ponds is sourced from a small Bun Sang canal behind CAF. The main water source of this canal is directly from the Hau river. Typical water parameters include: pH (6.5 – 7.0), Alkalinity (30-50 mg/L), Ammonia-N (0.02-0.05 mg/L), and nitrate-nitrite-N (0.02 mg/L).

Soils

See above

Support Facilities

In collaboration, CAF also has strong relationship with the Vietnam Fisheries and Aquaculture Institution Network (ViFINET), and more than 30 international universities and organizations.

Affiliations	
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PURDUE UNIVERSITY



AQUACULTURE DEVELOPMENT AND THE IMPACT ON FOOD SUPPLY, NUTRITION, AND HEALTH IN GHANA
AND TANZANIA

GHANA

(Information provided by Dr. Kwamena Quagraine, US Lead Project PI)

Country Map



Map showing AquaFish research sites in Ghana

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY (KNUST)



Department of Fisheries & Watershed Management, Institute of Renewable Natural Resources, KNUST, Kumasi

General Location

The KNUST Department of Fisheries and Watershed Management Aquaculture Facility is located roughly 13km east of Kumasi, in the Ashanti Region. This area is in the transitional forest zone, and has an elevation that ranges between 250 – 300 meters above sea level.

DESCRIPTION OF AREA/REGION

KNUST has the laboratory space and limited facilities for analysis of water quality of effluents from fish farms. Laboratories that complement those of the Faculty of Renewable Natural Resources include the Water Quality Labs at the Departments of Civil Engineering, Chemistry, Biochemistry and Applied Biosciences. Where necessary, the Ghana Water Company, Kumasi, at some cost, has allowed KNUST to access its water quality laboratories for mutual benefit. KNUST has its own fishponds that are primarily used for teaching and research for both undergraduate and graduate students.

KNUST in Kumasi is strategically located in Ghana as far as fish farming is concerned. Kumasi is a strategic market center with the largest open market in West Africa, and is a central hub for Ghana.

Climate

KNUST is within the Kumasi metropolis, which falls within the wet sub-equatorial type.

Temperature

The average minimum temperature is about 21.5°C. The maximum average temperature is 30.7°C.

Precipitation

Precipitation varies from around 5 mm in the dry season to nearly 200 mm in the wet season. It also varies by location, as the drier, northern parts of the country consistently receive less precipitation.

Humidity

The average humidity is between about 60% and 85%, depending on the time of day.

Seasonality

Precipitation and temperature vary significantly. The hottest and driest periods occur between October and March.

Topography

The country is mostly plains, with a plateau area in the south-central of the country below the massive Volta Basin.

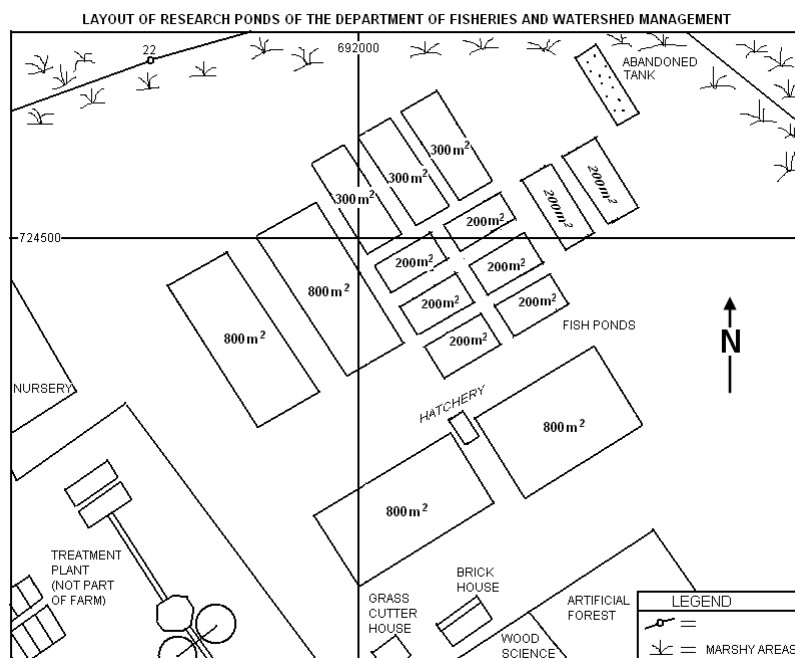
Geology/Soils

Kumasi falls within the moist semi-deciduous South-East Ecological Zone, with rich soils that are ideal for agriculture. The Kumasi Metropolitan area is dominated by the Middle Precambrian Rock, which is utilized in the construction industry. There are a few small-scale mining activities, including stone quarrying and sand industries.

Soil and Water Data

The major soil type is the Forest Ochrosol, which is a very rich type used for the production of agricultural commodities such as vegetables, plantain, corn, and cassava, etc.

Layout of the Site



KNUST - Aquaculture Teaching and Research Ponds

DESCRIPTION OF SITE

Map Coordinates

6° 40' 0" N, 1° 37' 0" W

Elevation

250m

General Background

Farmer trainings and workshops have been conducted in collaboration with the Ministry of Fisheries in Kumasi using facilities of both institutions, including the Pilot Aquaculture Training Centre in Kumasi and at the Department of Fisheries and Watershed Management at KNUST.

The aquaculture teaching and research ponds are a major component of the farm complex of the Faculty of Renewable Natural Resources at KNUST. There are fifteen (15) earthen ponds of varying sizes, all of which are spring-fed. The ponds lie near the River Wiwi, which traverses the university campus from the south end. Three of the ponds have a total surface area of 300m², eight have a surface area of 200m² ponds, and four have a surface area of 800m². The average pH values of the pond waters range from 6.5-7.5, whilst water temperatures range from 25.3°C- 26.5°C. There is also a wet laboratory, a storeroom, a small hatchery, and a site for a duck pen.

Current work and research at the fish farm include tilapia and catfish fingerling production, and fish feed and nutrition experiments to find locally sourced, cost effective feed for fish production for reducing

dependence on imported feed. Most feeds available are made on-farm, and this represents a setback to a viable aquaculture production. Research is needed to identify local feeds and formulate them. Most commercial feeds are imported from Brazil or Israel but many have questioned the sustainability of these imports. Efforts are being made to produce extruded feed for the aquaculture industry and the government is backing this fully.

Water Supply

Water supply is from two surface water treatment plants, the Owabi and Barekese headworks located 10km and 16km from Kumasi, respectively. The supplies of water from these headworks serve Kumasi metropolis as well as surrounding communities outside the metropolis. The area has a 13,800m³ storage reservoir located at Suame, and 1,900m³ capacity reservoir located at KNUST.

Soils

The major soil type is the Forest Ochrosol, which is a rich type used for the production of agricultural commodities such as vegetables, plantain, corn, and cassava, etc.

Support Facilities

KNUST collaborates with many international agencies and universities in the UK, USA, Canada, Netherlands, Israel, Germany, South Africa, and several other African universities. It has affiliations with some new university colleges in Ghana to provide oversight as they develop curricular standards that meet international requirements. There are several formal and informal linkages with various institutions, such as the Council for Scientific and Industrial Research (CSIR), and these frequently offer limited training facilities for both undergraduate and graduate students.

Affiliations

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Current Contacts

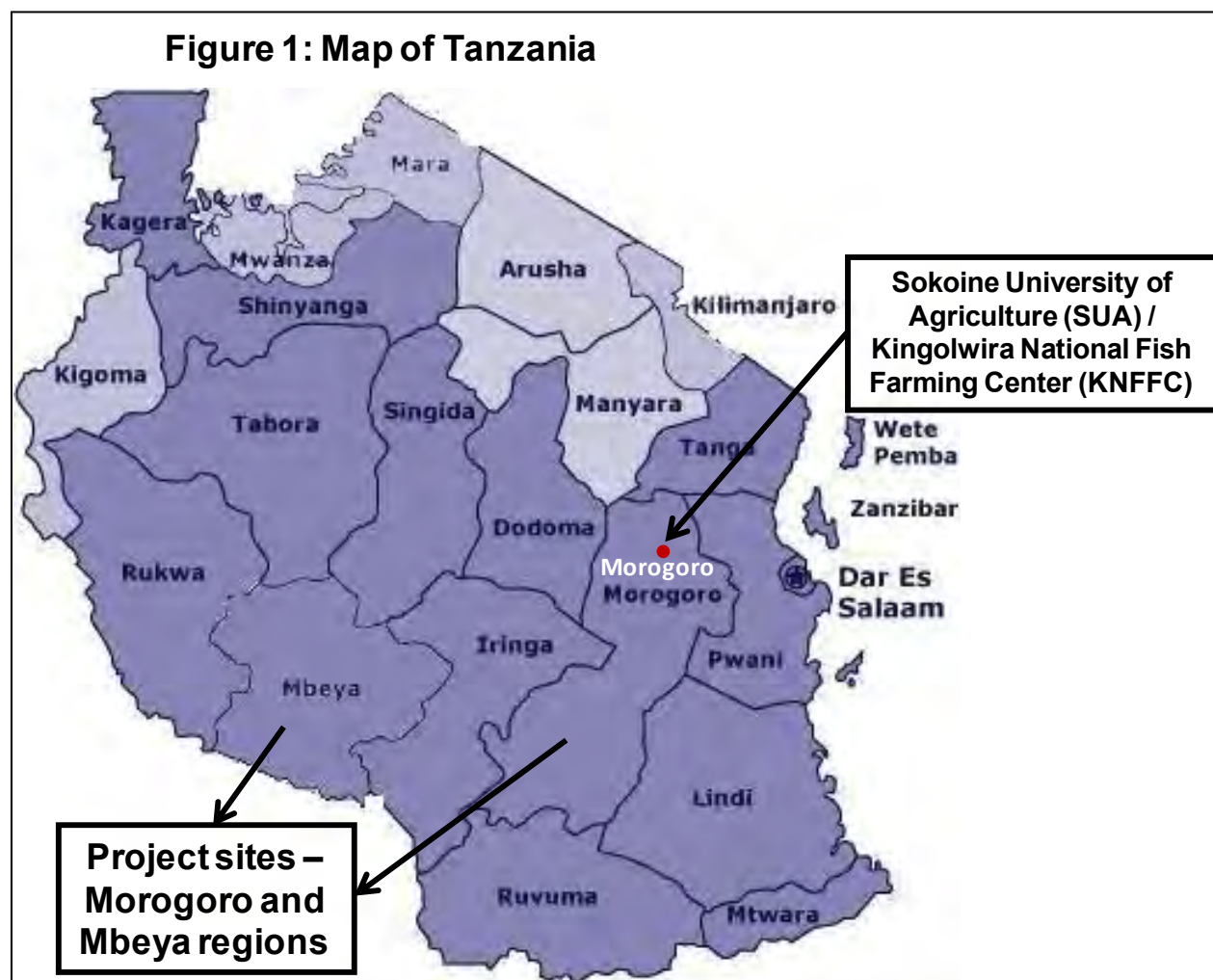
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TANZANIA

(Information provided by Dr. Kwamena Quagrainie, US Lead Project PI)

Country Map

Map of Tanzania and AquaFish project sites.



SOKOINE UNIVERSITY OF AGRICULTURE AQUACULTURE RESEARCH FACILITY



Kingolwira National Fish Farming Center Aquaculture Research Facility



Sokoine University of Agriculture Aquaculture Research Facility

General Location

Sokoine University of Agriculture is situated 3 km from the center of Morogoro Municipality, which is about 200 km west of Dar es Salaam. The University is located between 6° – 7°S and 37° – 38°E.

DESCRIPTION OF AREA/REGION

Freshwater aquaculture is concentrated in six regions in Tanzania: Arusha, Kilimanjaro, Morogoro, Iringa, Mbeya, and Ruvuma. Morogoro and Mbeya have the most fish farming activities.

The Morogoro Region is one of 20 Regions in mainland Tanzania. The Region lies between latitude 5° 58" and 10° 0" to the South of the Equator and longitude 35° 25" and 35° 30" to the East. It is bordered by seven other regions: Arusha and Tanga regions to the North, the Coast Region to the East, Dodoma and Iringa to the West, and Ruvuma and Lindi to the South.

The Mbeya region is located in the South Western Corner of the Southern Highlands of Tanzania. The Region lies between Latitudes 7° and 9° South of the Equator, and between Longitudes 32° and 35° East of Greenwich. The Mbeya region lies at an altitude of 475 meters above sea level, with high peaks of 2981 meters above sea level at Rungwe. Mbeya shares borders with the countries of Zambia and Malawi to the immediate South; Rukwa Region to the West; Tabora and Singida Regions to the North; while Iringa Region lies to its East, with Tunduma and Kasumulu in the Mbozi and Kyela districts, respectively,

being the main points of entry into the neighboring countries of Malawi and Zambia.

Mikindu Village

Mikindu is a village in the mountainous areas of the Morogoro region. Aquaculture is practiced extensively in this area with many fish ponds located near homes. Most farmers utilize animal and vegetable by-products to feed fish, which can reach over 200 grams in six months. Fish farmers in the area have organized themselves into fish farmer groups, which allows the farmers to actively participate in national extension programs.

Kingolwira National Fish Farming Center (KNFFC), Morogoro

Workshops and farmer training programs are conducted at Sokoine University of Agriculture (SUA) and the Kingolwira National Fish Farming Center (KNFFC), Morogoro. KNFFC started in 1989 with funding from UNDP-FAO and the United Republic of Tanzania government. The center has a reliable water supply, an office building, a vehicle and two motorcycles, and 12 ponds. The center also has 18 four-meter diameter round concrete tanks in the hatchery/nursery section and there are 12 rectangular 1 X 0.5 meter concrete tanks. The center operates integrated fish farming with animal husbandry, whereby poultry pens, and pig and goat buildings are constructed adjacent to the earthen ponds. The center also has ten 10 earthen ponds that are off-site about 14 kilometers from KNFFC.

Climate

The climate is generally tropical with marked seasonal and altitudinal temperatures and high rainfall variations causing dry and rainy seasons.

Temperature

The mean annual temperatures in the Morogoro region vary with altitude from the valley bottom to the mountaintops. The average annual temperature varies between 18°C on the mountains to 30°C in river valleys. In most parts of the region, the average temperatures are almost uniform at 25°C. In general the hot season is from July to September. Temperatures in Mbeya range between 16°C in the highlands and 25°C in the lowlands areas.

Precipitation

In the Morogoro region, the annual rainfall ranges from 600 mm in the lowlands to 1200 mm in the highland plateau. However, there are areas that experience exceptional drought with less than 600mm of rainfall. These areas are in Gairo and Mamboya divisions in the North of Kilosa District, and the Ngerengere Division in the East of Morogoro Rural District.

The Mbeya region enjoys abundant and reliable rainfall. Annual rainfall varies between 650 mm in the Usangu Plains, and up to 2600 mm in Chunya on the Northern shores of Lake Nyasa in Kyela District, and highlands of Rungwe and the Southern parts of Ileje District.

Humidity

Humidity is much higher on the coasts than inland, and is particularly low during the winter months.

Seasonality

The area receives an average annual rainfall of between 600 – 1000 mm and has bimodal rainfall; the short rains occur between November and December, followed by a short dry spell between January and February. The main rainy season is from March to May. The period between June and October is a dry season. The soils around the University main campus are mainly oxisols, with scattered patches of sandy-loams, with pH ranging between 5.5 and 6.0.

The rains in the Mbeya region normally start in October and continue until May, with dry and cold spells occurring between June and September. The crop-growing season in most parts of the region begins in November and continues until May.

Topography

The topography varies from the plains along the coast, to a plateau in the center of the country, and highlands in the north and south of the country.

Geology/Soils

The dominant natural vegetation is that of *Hyperrhenia* spp and *Sporobolus* spp dotted with Miombo and Acacia bushes. However, established pastures have modified the vegetation and the dominant species are *Chloris gayana*, *Brachiaria* spp, and *Pennisetum purpureum*.

The regions lie at an altitude of 475 meters above sea level with high peaks of 2981 meters above sea level at Rungwe. The major topographic features of the Mbeya region are the low elevation of the Western Rift Zone that covers Lake Rukwa and Nyasa; and the Eastern Rift Zone that covers the Usangu Plains and the neighboring parts of the Ruaha Trough. The lowlands within the Rift Valley lie between 500m and 1400m above sea level. Of the regional surface areas, 61,868 km² is dry land, about 57,000 km² arable land, and 1,757 km² is covered with water.

Soil and Water Data

In most arable areas, soils are commonly of moderate fertility, coarse or medium textured and varying from sandy loams and alluvial solids to cracking rocks. Although large areas of the regions are cultivated, large tracks of land are still covered with natural vegetation such as "Miombo" (*Broschystegion*, *Julbernardia*) woodlands. Areas with rains between 800-1200 mm per annum favor the growth of Miombo woodland, while areas with less rain, especially in the North of the region, support the growth of wooded grassland and bush lands of dense thickets of acacias and thorny trees. Areas with higher rainfall support forests, often evergreen and bamboo except at the highest elevations, where afro-alpine grasslands occur.

DESCRIPTION OF SITE**Map Coordinates**

6° 49' 0" S, 37° 40' 0" E

Elevation

500 m

General Background

The Sokoine University main campus, where the aquaculture facilities are located, lies on the slopes of the Uluguru Mountains at an altitude of about 500 – 600 m above sea level.

The aquaculture section is under the Department of Animal Science and Production. The Department maintains 20 concrete cylindrical tanks with a diameter of 3 m, and 10 earthen ponds with dimensions of 20 m x 15 m. The Department also has an animal nutrition laboratory for analysis of feed samples. The laboratory has a capacity of carrying out proximate analysis, NDF and ADF determination, and determination of mineral anti-nutritional contents of various feed stuffs. In terms of human resources, there are two persons with Ph.Ds and three persons with M.Sc. in aquaculture, respectively. Among those with M.Sc., two of them are currently undertaking Ph.D studies. The Department is in the process of recruiting two additional staff for aquaculture. There are many staff members in various fields of Animal Science (e.g., Animal nutrition, Animal breeding, and genetics) in the Department who assists the aquaculture section.

Water Supply

Water used for the aquaculture ponds and tanks at SUA originates from a stream located on Mount Uluguru. Water temperatures range from 25 to 29°C. Dissolved oxygen ranges from 5.3 to 8.1 mg/L, and pH ranges from 6.7 to 7.2.

Soils

The soils around the University main campus are mainly oxisols with scattered patches of sandy-loams with pH ranging between 5.5 and 6.0.

Support Facilities

The Tanzania Fisheries Research Institute (TAFIMA) has the overall responsibility for all the research on fisheries in the country, and the Faculty of Aquatic Sciences and Technology (FAST) at the University of Dar es Salaam and other government fisheries centers and institutes are involved in training as well.

Affiliations	
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UNIVERSITY OF DAR ES SALAAM - INSTITUTE OF MARINE SCIENCE, ZANZIBAR



The sign outside of the University of Dar es Salaam in Stone Town, Zanzibar

General Location

The project site is at Fumba, which is located in the southwest of Unguja Island of Zanzibar, at the tip of Fumba Peninsula, and overlooks the Menai Bay. The villages have a sea-based economy consisting mostly of fishing, cockle gathering, and seaweed farming. There is a small building for the Chaza cooperative society (Umbrella Cooperative for all the villages) with a small shop and Savings and Credit Cooperative Society (SACCOS) office.

DESCRIPTION OF AREA/REGION

Climate

The climate is generally tropical with marked seasonal and altitudinal temperatures and high rainfall variations causing dry and rainy seasons. The area is located within the equatorial belt of the western Indian Ocean and is subjected annually to two periods of seasonal winds; the South East Monsoon winds ("Kusi"), which last from April to September and the North East Monsoon winds ("Kaskazi"), which last from November to March.

Temperature

Average highs are between 28 and 32°C. Average annual lows are between 22 and 25°C.

Precipitation

Average rainfall ranges between 20 and 60 mm in the Kusi season (June – October) and 130 – 170mm in the Kaskazi season (April – September).

Humidity

Humidity is much higher on the coasts than inland, and is particularly low during the winter months.

Seasonality

The area is located within the equatorial belt of the western Indian Ocean and is subjected annually to two periods of seasonal winds; the South East Monsoon winds ("Kusi"), which last from April to September and the North East Monsoon winds ("Kaskazi"), which last from November to March.

Soil and Water Data

The intertidal shores of the villages are characterized by sea grasses, interspersed with sandy and rocky patches. The topographical nature of the shore supports a number of living creatures that colonize three main habitats: sea grass meadows, sandy areas, and coral reefs.

DESCRIPTION OF SITE

Map Coordinates

6° 8' 0" S and 39° 19' 0" E.

Elevation

0-15 m

Affiliations

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NORTH CAROLINA STATE UNIVERSITY



ENHANCING AQUACULTURE PRODUCTION EFFICIENCY, SUSTAINABILITY, AND ADAPTIVE MEASURES TO
CLIMATE CHANGE IMPACTS IN BANGLADESH

BANGLADESH

(Information provided by Dr. Russell Borski, US Lead Project PI)

BANGLADESH AGRICULTURAL UNIVERSITY



BAU on-station AquaFish Innovation Lab experimental ponds and the BAU Water Quality Lab

Country Map

Map of Bangladesh showing the BAU research site in red and the greater Khulna (including Khulna University), Bogra, and Barisal region for on-farm/field trials in blue.

General Location

The primary host country site for the NCSU project is Bangladesh Agricultural University (BAU). The BAU campus is located near Mymensingh city, which is in the North Central region of the country, about 120 km (75 mi) north of Dhaka, the capital of Bangladesh. BAU is located on the western bank of the old Brahmaputra River, 5 km south from Mymensingh Railway Station.

DESCRIPTION OF AREA/REGION**Climate**

Mymensingh and the rest of Bangladesh are considered tropical wet and dry climate (*Aw*) under the

Köppen climate index. It is generally cooler than Dhaka due to the close proximity to the Himalayan mountains. The cooler dry season ranges from November to February, and the monsoon season starts in May or June and continues until August, when it rains heavily and continues sometimes for days and even weeks.

Temperature

The average temperature ranges from 18°C in January and increases to around 28°C from April to October, and then steadily declines to an average temperature of around 20°C in December.

Precipitation

The amount of rainfall is very high in Bangladesh because of its location in the tropical monsoon region. The winter season is very dry, and accounts for only 2% - 4% of the total annual rainfall. Rainfall during the rainy season is caused by the tropical depressions that enter the country from the Bay of Bengal. These account for 70% of the annual total in the eastern part, 80% in the southwest, and slightly over 85% in the northwestern part of Bangladesh. The amount of rainfall in this season varies, from 1000 mm in the west central part to over 2000 mm in the south and northeast. Average rainy days during the season vary from 60 in the west-central part to 95 days in the southeastern, and over 100 days in the northeastern part. Overall average rainfall is 11 mm in January during the dry season, and peaks to almost 500 mm in July during the monsoon.

Humidity

In the eastern areas, the lowest humidity occurs from January to March. The relative humidity peaks to around 80-85% from June to September. The average relative humidity for the whole year ranges from 70 to 78%, depending on location.

Seasonality

Mild winter (October to March); hot, humid summer (March to June); humid, warm rainy monsoon (June to October)

Topography

Mostly flat alluvial plain; hilly in the southeast.

Soil and Water Data

The soil is mostly alluvial and some deltaic toward the south, sandy to silt/clay.

Layout of the Site

**BAU On-Station
Experimental
Ponds**

DESCRIPTION OF SITE**Map Coordinates**

24° 43' 31" Latitude, 90° 26' 8" Longitude

Elevation

205m

General Background

The government established BAU in 1961 as the premier agricultural institute of higher education, research, and extension, and it plays a similar role as the land-grant research universities in the US. The main task of BAU is to increase the quality and standard of higher agricultural education needed to produce the next generation of agricultural teachers, scientists, extension agents, and entrepreneurs. It is a residential university mandated to offer higher education and research in agriculture, including conducting examinations, conferment of degrees, and granting affiliation. The partnership between AquaFish Innovation Lab and BAU is ideal for building capacity in the aquaculture and fisheries sector, and for development of sustainable aquaculture practices that can enhance the food security and welfare of the people of Bangladesh. The university has the needed infrastructure, experience and expertise to carry out productive research. There are 100 research ponds in the Fisheries Field Laboratory of BAU, for which 27 ponds will be dedicated to AquaFish Innovation Lab activities. Bangladesh Agricultural University also has a Water Quality and Pond Dynamics Laboratory, Nutrition Laboratory, Pathology/Microbiology Laboratory, and other facilities for undertaking research of international quality.

Water Supply

The BAU Fisheries Field Laboratory has a reliable year round supply of water for culturing fish derived from ground water pumped from deep tube wells, and is supplemented with rainwater during the monsoon. The ground water is clean and has a neutral pH.

Soils

The soil is mostly alluvial and some deltaic toward the south, sandy to silt/clay.

Support Facilities

Khulna University is a public university in Southwest Bangladesh. The Fisheries and Marine Resources Technology (FMRT) Discipline was established in 1992 with a mandate to establish an avenue for

research and academic programs in all aspects of fisheries. The university is situated at Gollamari, Khulna, Bangladesh, by the river Moyur, beside the Khulna-Satkhira highway. The teaching staff of the FMRT Discipline possess specialized knowledge in the areas of Fish Biology, Marine Science, Aquaculture, Fisheries Management, Genetics and Fish Breeding, Ecology, Oceanography and Post Harvest Technology. There are some present research-oriented laboratories including a Water Quality Lab, Aquaculture Nutrition Lab, Fish Microbiology lab, Fish Genetics and Biotechnology Lab, and Post Harvest and Fish Processing Lab. Some of the basic water quality analyses from on-farm trials in the region will be conducted in the water quality lab.

Dhaka University Institute of Nutrition and Food Science (INFS) is the premier nutrition institution in Bangladesh, located in central Dhaka. INFS is highly equipped for teaching undergraduate, graduate, and post graduate courses, as well as for research in the areas of physical and inorganic chemistry, advanced carbohydrate biochemistry, nutritional epidemiology, nutritional biochemistry, and food science. For this project, faculty from INFS are involved in developing the questionnaire for the household nutrition surveys.

Affiliations

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AUBURN UNIVERSITY



AQUACULTURE DEVELOPMENT IN KENYA AND UGANDA: ADVANCING COST-EFFECTIVE TECHNOLOGY, MARKET ASSESSMENT, AND END-USER ENGAGEMENT

UGANDA

(Information provided by Dr. Joe Molnar, US Lead Project PI)

KAJJANSI AQUACULTURE RESEARCH AND DEVELOPMENT CENTRE



General Location

Kajjansi Aquaculture Research and Development Centre (KARDC) is located in an urban area in the Wakiso district. Kajjansi is located 11 km along the Kampala – Entebbe highway and 1.2 km off to the right on the side of Uganda Clays Ltd.

DESCRIPTION OF AREA/REGION

Climate

Tropical to semiarid

Temperature

Tropical climate; average temperatures (17-29 C). The warmest month is January.

Precipitation

There are two distinct wet seasons: the long rainy season from March to May, and the short rainy season from September through November. The average precipitation is 1380 mm.

Humidity

Humidity stays relatively moderate.

Seasonality

There are two dry seasons from December to January, and June to August.

Topography

Mostly plateau rimmed by mountains.

Geology/Soils

Ferralitic soil.

Soil and Water Data

The main source of water is the Kajjansi River, a kilometer away from Lake Victoria. The center is also served by the main grid of National Water and Sewerage Cooperation.

Layout of the Site

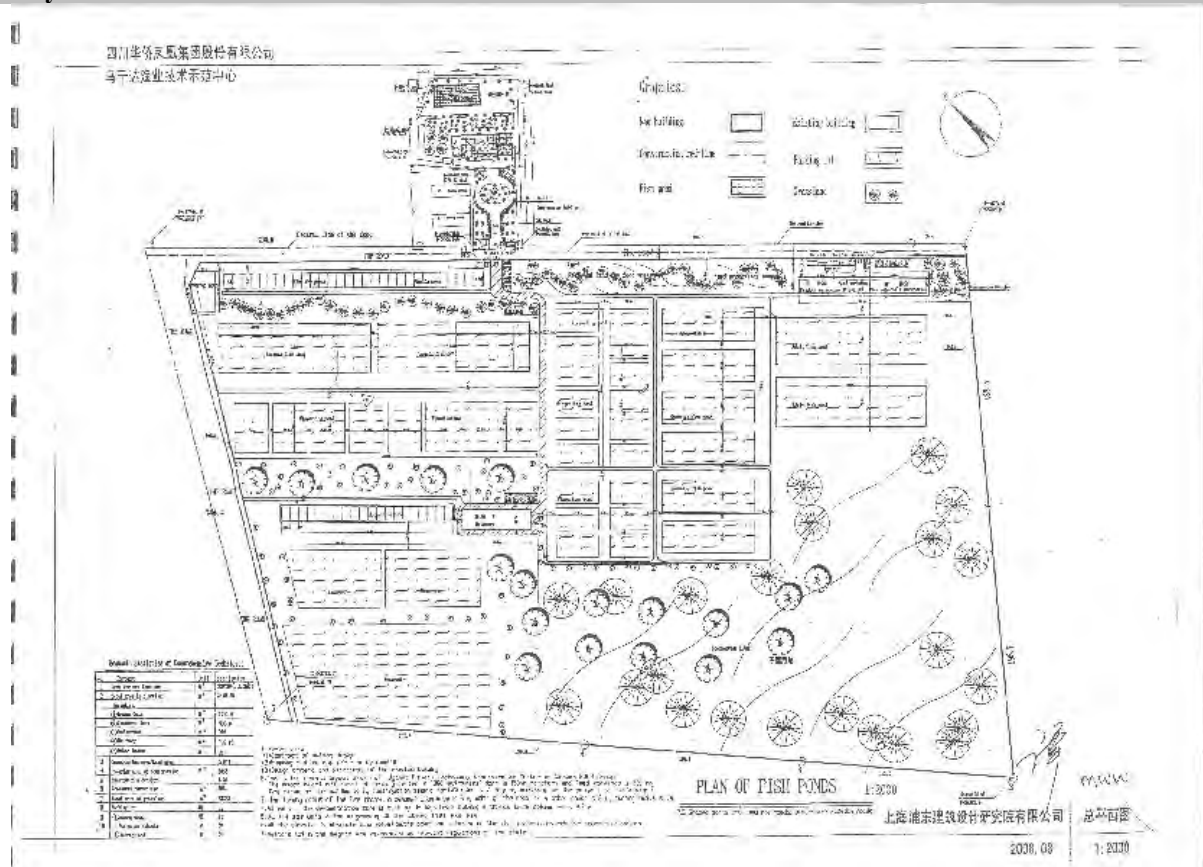


Figure 1: Plan of Kajjansi Fish Ponds

DESCRIPTION OF SITE**Map Coordinates****Elevation**

Latitude: 0°13'19.1"N, Longitude: 32°32'04.9"E

1,190 m

General Background

KARDC is the largest and only research center in Uganda charged with developing technologies and information through research to improve aquaculture production and guide stakeholders in planning, investing, and developing aquaculture. KARDC is the national center responsible for aquaculture research and development, and is a branch of the National Fisheries Resources Research Institute (NAFIRRI). KARDC is comprised of two locations: the main offices and ponds are located on approximately 49 acres, and the low cadre staff houses are one kilometer away on about two acres.

Water Supply

The main source of water is the Kajjansi River, a kilometer away from Lake Victoria. The center is also served by the main grid of National Water and Sewerage Cooperation.

Soils

Ferralitic

Support Facilities

N/A

Affiliations*In-Country*

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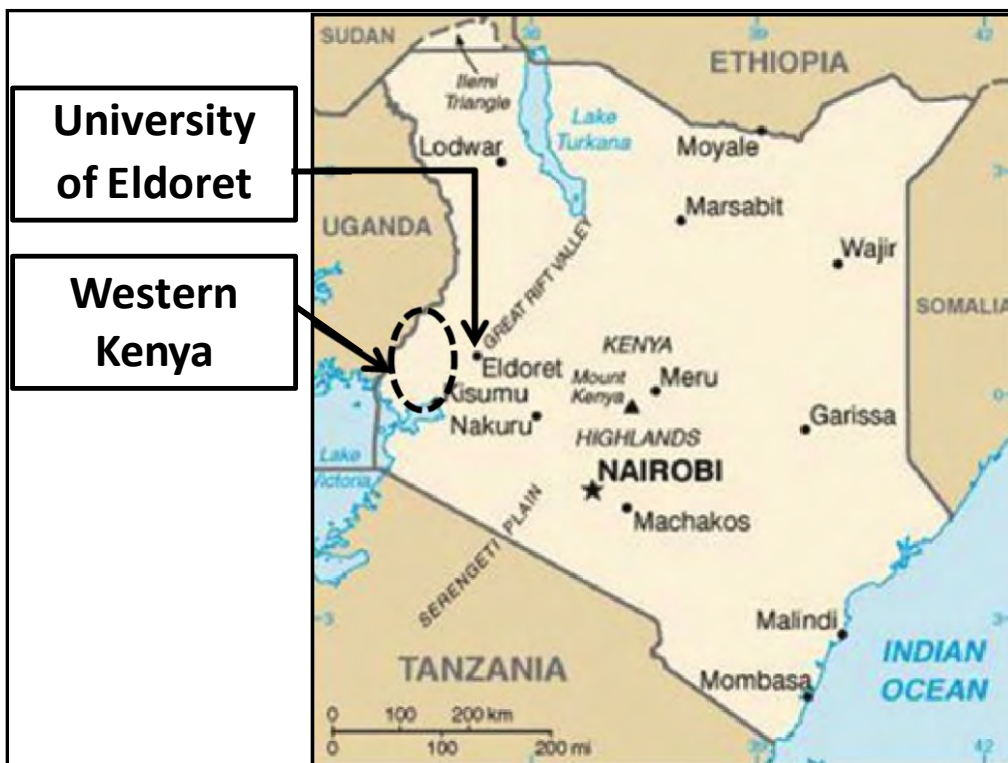
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KENYA*(Information provided by Dr. Joe Molnar, US Lead Project PI)*UNIVERSITY OF ELDORET**Country Map****General Location**

The University of Eldoret Aquaculture research facility is located 12 km outside of Eldoret Town, along the Eldoret-Ziwa-Kitale road.

DESCRIPTION OF AREA/REGION**Climate**

Tropical along the coast and arid inland

Temperature

The highest temperatures occur in March, and lowest occur in July. The daily average varies between 16 to 22° C. The cool season average varies between 13 to 19°C. The warm season average varies between 17 to 25° C.

Precipitation

Rainfalls average about 1223 mm. Rains are unimodal and fall from March to September. The “long rains” fall from March through May, with a single-month peak of 500 mm or more in April. There is a distinct cool season that occurs between June and August, when rainfall is at a minimum. Even though there is little rain, the skies tend to be overcast much of the day during this period. A rainy period known as the “short rains” occurs between October and December.

Humidity

Humidity in the highland region surrounding the campus ranges from around 40% to 90% in the afternoon during the dry season, and between 50-60% in the rainy season.

Seasonality

Rains are unimodal and fall from March to September. The “long rains” fall from March through May

with a single-month peak of 500 mm or more in April. There is a distinct cool season that occurs between June and August, when rainfall is at a minimum. Even though there is little rain, the skies tend to be overcast much of the day during this period. A rainy period known as the “short rains” occurs between October and December.

Topography

The ponds are located on a gently rolling region that tapers into wetlands well vegetated by papyrus reeds and other aquatic macrophytes.

Geology/Soils

Soils are igneous in origin and underlain by tertiary volcanic rocks (phenolites) characterized by low natural fertility. The soils in this region are acidic with soil pH ranging from 5.5 to 6.4. They are red friable over petroplinthite and are classified as rhodicferralsols. Clay content averages 30% and the soils have a high water holding capacity. The area is characterized by brown loamy soil—soil structures are mostly granular indicating low water seepage due to small soil pores.

Soil and Water Data

Water supply to the ponds is from a 1.2 hectare spring-fed reservoir and is supplemented by municipal main water supply when necessary. Ponds were designed according to FAO recommendations with features such as inflow by gravity, drains with adjustable pipes, sloping sides, and a drainfield that intercepts effluent in a Cyprus papyrus swamp prior to entering the receiving water body.

Layout of the Site

Aerial photograph of University of Eldoret Aquaculture production and research facility.

DESCRIPTION OF SITE**Map Coordinates**

Latitude: 34° 50' E, Longitude: 0°03' and 0°55' N

Elevation

2180 m

General Background

The University of Eldoret Fish Farm is operated by the Department of Fisheries and Aquatic Sciences, which is housed in the School of Natural Resource Management. Students from the University and several other institutions conduct field studies at the farm. Considerable attention was given to both the design and future operations of the fish farm. The main facilities are comprised of a hatchery, quarantine unit, and fishponds alongside supporting facilities of a seminar room, laboratories, workshop, and offices. Supplies of fertilizers, chicken feed, and feed ingredients, such as rice bran, are generally readily available, at least in Eldoret town.

The University of Eldoret offers MSc and PhD degree in Fisheries with an Aquaculture option. The University also offers a BSc in Fisheries and Aquatic Sciences, and a two-year Diploma in Aquaculture and Fisheries Management. Other short courses in aquaculture are offered by the Department of Fisheries and Aquatic Sciences at the University of Eldoret. The University of Eldoret Fish Farm has an area of approximately 10 hectares, of which 5 hectares are ponds. There are 47 fishponds of various sizes, ranging from 100m² to 0.2 hectares in size. It was designed to fulfill a number of roles:

- To be a practical facility in support of fisheries students studying aquaculture;
- To act as a demonstration unit to promote the potential of freshwater fish farming to community leaders, government officials, extension workers and entrepreneurs (to be achieved through practical training courses, visits, 'open days', and the dissemination of information);
- To serve as a Regional Centre of Excellence for research into appropriate aquaculture methods and for the development and assessment of equipment, feeds, and husbandry practices, including economic

- evaluations of production methods;
- To function as a supplier of juvenile fish to farmers in the region in order to generate local revenue and assist fish farming development;
- To provide applied research opportunities for faculty members and visiting scientists.

Water Supply

Water supply to the ponds is from a 1.2 hectare spring-fed reservoir and is supplemented by municipal mains water supply when necessary.

Soils

Soils are igneous in origin and underlain by tertiary volcanic rocks (phenolites) characterized by low natural fertility. The soils in this region are acidic with soil pH ranging from 5.5 to 6.4. They are red friable over petroplinthite and are classified as rhodicferralsols. Clay content averages 30% and the soils have a high water holding capacity. The area is characterized by brown loamy soil—soil structures are mostly granular indicating low water seepage due to small soil pores.

Support Facilities

Bidii Fish Farmers Extruder

Luanda

P. O. Box 378, Luanda-Kenya

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bidiiifishfarmersselfhelp@yahoo.com

Affiliations

<i>In-Country</i>	<i>U.S.</i>
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MWEA FISH FARM



The Mwea Fish Farm in Kirinyaga County

General Location

Mwea Aquafish Farm is in Kirinyaga County, on the slopes of Mount Kenya. It is 110 kilometers Northeast of Nairobi on the Nairobi/Embu road and 1.5 km from Kimbimbi town and can be accessed throughout the year through a good all weather road.

DESCRIPTION OF AREA/REGION

This is a “Model Fish Farm” where Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*) are raised in earthen liner ponds, and concrete tanks. It began in August 2009 on 3.5 hectares of agricultural land. Initially, most ponds (measuring 300 m²) were constructed on sandy/loam/clay soils.

Climate

Tropical wet-and-dry with distinct dry and rainy seasons.

Temperature

The annual average maximum temperature is 28 C with peaks in July, August, January and February, and with an average annual minimum temperature of 15 C.

Precipitation

The average annual rainfall at Mwea Tebere is 1006 mm (over 16 years) and at Mwea Experimental farm it is 890 mm (over 12 years).

Humidity

Humidity ranges from 90% in early morning to 40% in the afternoon. Monthly averages of (pond-side) humidity are 63% in October and 79% in July.

Seasonality

The warmest period occurs between February and April. There is a distinct cool season between June and August, when rainfall is at a minimum. Even though there is little rain, the skies tend to be overcast much of the day during this period. A rainy period known as the “short rains” occurs between October and

December. The “long rains” fall from March through May, with a single-month peak of 500 mm or more in April.

Topography

1050 m above Sea level

Geology/Soils

The area, like most of the Mwea volcanic plain, is underlain by the Thiba olivine basalts (a fairly uniform series of usually non porphyritic, fine-grained grey basalts erupted from Mt. Kenya), which are Pleistocene in age. Generally the soils vary from reddish brown clays on ridges and upper slopes through very dark greyish brown clays on lower slopes to dark brown to very dark greyish brown compact clays in depressions. Also found are stony and gravelly soils.

DESCRIPTION OF SITE

Map Coordinates

Latitude: 0°36.73'S, Longitude: 37°22.84'E

Elevation

1,050 m

General Background

Mwea Aquafish Farm produces approximately 100,000 Nile tilapia fry per month (or 1.2 million annually). This level is maintained for three years, with the hope that production will increase to 200 million fry produced annually after five years. To sustain this production, it is estimated that 200 females stocked will each produce 200 eggs each per spawn. The farm also maintains 3,000 African catfish Brooders - a high quality breed. Survival is usually very low and to sustain production at 100,000 per month, the farm continues to hold 3,000 brooders (2000 males and 1000 females).

Mwea Aquafish Farm integrates livestock with fish and crops with fish. The farm grows quality bananas, vegetables and root crops alongside fish. Ponds serve as water storage structure and, as such, become a key asset of water supply to crops. Waste accumulated in pond as sludge is pumped, when draining a pond, into vegetable gardens to increase vegetable production. The farm operates a Zero-discharge water policy and any water due for release is pumped back into the farm to irrigate crops. Mwea Aquafish has a classroom that can sit 40-50 students/farmers.

The hatchery has both Nile tilapia and catfish breeding units. It houses a conference room and a Laboratory. This is an excellent facility for research and quality seed production. Annexed to the hatchery is the Recirculating Aquaculture facility. This runs on an 80 m³ water holding tank feeding into 8 hexagonal rearing tanks each holding 500 pieces of Nile tilapia. The production capacity of each tank, whose volume is 20 m³, is 1,000 kg tilapia in a year in two cycles of 500kg per cycle.

Water Supply

Water is pumped from three reservoirs constructed next to a small stream that runs past the lower part of the farm into head tanks then discharged into the ponds by gravity. The third water source

Support Facilities

Students from the University of Nairobi, Moi University, and several other institutions conduct field studies at Sagana.

Affiliations

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U.S.

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