Environmental Sustainability Issues in Philippine Agriculture

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ABSTRACT

Farming and fishing are major sources of livelihood in rural households in the Philippines. Farming systems in the country are complex, multi-faceted, and geared to promote efficient production and a steady source of income. However, these have also wrought unwanted consequences on the environment, notably soil erosion, water pollution, groundwater depletion, loss of natural habitats, and loss of biological diversity. Farming systems are affected by exogenous environmental factors; in turn, the farming systems also affect agricultural production resource bases. Initiatives from various sectors to mitigate the adverse environmental impacts of farming systems and to protect the agricultural production bases are in place in terms of policies, programs, and action projects.

BACKGROUND

The Philippines is predominantly an agriculture-dependent country; about one-third of the land area of 30 million hectares (ha) is classified as agricultural lands. Agriculture has contributed about 20% to the country's gross domestic product (GDP), 24% to total export earnings, and 46% to total employment in the last 15 years [Bureau of Agricultural Statistics (BAS) 2003]. Agriculture accounted for 19.6% of the GDP in 2003.

The country's 2004 population, on the other hand, was around 85 million, of which about 32.15 million (39%) relied on agriculture and agriculture-related industries [National Statistics Office (NSO) 2000; Population Resources Bureau (PRB) 2004]. About 21.7 million (67.3%) out of the total 31.3 million poor Filipinos depend on agriculture (Sana 2004). With the high population growth rate (about 2.3% annually), it is estimated that by year 2025, 5.24 million hectares more of frontier lands will be converted to accommodate the needs of the population [NSO, 2000; Environmental Management Bureau, Department of Environment and Natural Resources (EMB-DENR) 2004].

Food crops, particularly rice and corn, continue to be the major contributors to agriculture's gross value added and have become major sources of growth. However, the main sources of export earnings are banana, pineapple, coconut, sugar, and mango (BAS 2004).

While one-third of the country's total land area, or 10 million ha, is actually farmed, only 58% (5.8 million ha) of agricultural lands are suitable for crop production. Furthermore, only 2.5 million ha are considered to have the potential to respond to intensive agriculture or can be cropped once a year (BAS 2004, DENR 2003). The details of the distribution by crop and hectarage are as follows:

Table 1. Land utilization

Land Utilization	Area (Million Ha)	Percent
Arable lands, cereals, sugar cane	4.3923	39.45
Crops mixed with coconuts	3.7478	33.66
Coconut plantations	1.1326	10.17
Crops mixed with other plantations	0.3652	3.28
Fishponds from mangroves	0.1952	1.75
Other plantations	0.0908	0.82
Other fishponds	0.0101	0.09
Grasslands	1.2000	10.78
Total	11.134	100.00

Over the years, the Philippines' changes in agricultural land use can be gleaned in relation to the changes in forest areas. The forest cover in the country has been continually decreasing over the years, from 26% in 1970 to only 18% in 2000 (Table 2). This implies that forest land conversion into other land uses such as agricultural, residential, commercial, and industrial uses have been very rapid in the last three decades.

Table 2. Changes in forest and agricultural lands, Philippines, 1970–2000

Year	Forest Area		Agricultural Lands	
	Area (million ha)	Percent[a]	Area (million ha)	Percent[a]
1970	10.9	36	8.95	30
1980	7.4	25	12.16	41
1990	6.2	21	13.10	44
1995	5.6	19	13.09	42
2000	5.4	18	11.50	38

Note: [a] Percentage is in relation to the Philippine total area of 30 million ha.
Source: *DENR-EMB* 2002

Increased agricultural production has always been a priority in relation to environmental protection in the Philippines. Environmental concern for the agricultural resource base has been heightened starting in the 1990s due to such factors as the inappropriate use of modern farm techniques, deforestation, conversion of prime agricultural lands, cultivation of marginal upland areas, and depletion of fishery resources.

Changing demands for food have affected the country's poultry and livestock industry. As the population's incomes rise, demand for meat and meat products also tends to increase, and poultry and livestock farming is intensified. Livestock and poultry provide protein sources (meat, milk, egg), manure, draft power for land preparation and the transport of farm inputs and products, and an income-savings scheme for small farmers. But there are concomitant environmental issues that must be confronted alongside the intensified poultry and livestock production. Boosting livestock (cattle, carabao, swine, goat, horse) production may contribute to the conversion of forest areas into grazing lands, thereby aggravating soil degradation. Wastes from poultry and swine farms may pollute water systems and thus pose health hazards.

Aquatic resources have been a most important part in the daily lives of Filipinos, who are heavily dependent on both freshwater and seawater resources. Aquatic ecosystems, especially the marine and coastal areas, provide many essential environmental functions, including the recycling of nutrients, as habitat for many organisms, and as recreation as well as livelihood for people. Vast coastal waters seem to reduce the significance of the country's lakes, rivers and reservoirs; yet these freshwater resources provide domestic and industrial water supplies, irrigation for agriculture, fish supply for landlocked communities, and transportation.

The Philippines is an archipelago of around 7,100 islands with a total coastline of about 18,000 kilometers. The country's coastline area covers about 11,000 square kilometers (km^2) of land and 267,000 km^2 of marine waters. Due to its archipelagic configuration, about 70% of the 1,526 municipalities, including large cities are located within the land portion of the coastal zone (Vergara 1999). About two-thirds of the country's population live in the coastal zone, and are thus directly influenced by the coastal environment.

In terms of freshwater resources, the Philippines has 69 lakes and 421 principal rivers. There are also seven major reservoirs ranging in size from 150 ha in Binga to 8,900 ha in Pantabangan. These man-made reservoirs are multipurpose (e.g., for hydroelectric power generation, irrigation, domestic water supply, and flood control). Freshwater resources serve as a source of water for domestic, agricultural, and industrial activities, and as fishing grounds (aquaculture and open-access fishing).

With the constant pressure of a high population growth rate as well as the intense competition in the world market, the Philippines is revitalizing its agricultural and fishery sectors. Under the Medium Term Philippine Development Plan for 2004-2010, two million hectares of agribusiness land are to be developed as a source of livelihood and to generate additional employment (NEDA 2004). Inevitably, however, as the country accelerates the pace of efforts to cope with the globalization initiatives and ensure food security for the population, it cannot but

confront the environmental impacts that threaten the agricultural production bases.

ENVIRONMENTAL IMPACT ASSESSMENT OF PHILIPPINE FARMING SYSTEMS

The major concerns of the Philippine agricultural sector revolve around the urgency for: (a) increased production to sustain the food needs of the growing population (or food security), (b) employment generation to meet the 10-point agenda of the government, and (c) greater global competitiveness. Along the path to achieving these goals, however, the country must also contend with the threat to the sustainability of the croplands and fishery resources. Agricultural intensification, for example, as practiced especially in corporate, large-scale farms, has solved certain problems of low production but, at the same time, it has also created environmental and social problems. Table 3 summarizes the effects of agricultural practices and farming systems on the Philippine environment.

The Philippines' croplands are presently under severe environmental stress: prime or productive agricultural lowlands and alluvial plains are rapidly shrinking and the decreasing man-land ratio has led the landless to occupy and cultivate ecologically unstable marginal lands. Such practice has resulted in the severe degradation of the agricultural resource base, with subsequent problems of accelerated soil erosion, siltation of irrigation systems, intense flooding, and water pollution.

Soil Erosion

Soil erosion problems in the Philippines are quite pronounced due to the geographic and climatic conditions that are aggravated by improper cultivation practices. Two-thirds of the country's total land area are hilly and mountainous, making these areas susceptible to soil erosion (DENR 2003). Soil erosion inflicts on agriculture a number of negative direct impacts and side-effects, namely:

Table 3. Effect of agricultural practices and farming systems on Philippine environment

Farming System Practice	Problems Addressed	Some Environmental Problems Created
Mechanization of land preparation, planting and harvesting	Labor inefficiency	Soil erosion, energy dependency, labor reduction [a]
Intensive use of inorganic nitrogenous fertilizer	Low crop yield	Ground water contamination, pests, soil and water pollution [b]
Continuous and indiscriminate use of chemical pesticides	Crop loss to pests	New pests, resistance to pests, water pollution, human poisoning, chemical dependency [c]
Planting of hybrids and genetically narrow varieties	Low crop yield and non-uniform traits	Aggravated pest problems, loss of local adaptations, chemical dependency, high input expenses [d]
Reduction of fallow periods of shifting cultivation areas	Low production	Accelerated soil erosion [e]
Cultivation of fragile, marginal upland areas	Inadequacy of land for farming	Deforestation, accelerated soil erosion, sedimentation of river systems, biodiversity loss [f]

Sources: [a] Padilla 1999; Briones 1990; Alcantara 1988
[b] Briones and Robles 2005; Loevinsohn 1987
[c] Loevinsohn 1987; Rola 1990; Robles 1999; Briones and Robles 2005
[d] Rola 1990; Briones and Robles 2005; Loevinsohn 1987; ADB 1994
[e] Sajise et al. 1996; Briones 1990
[f] Sana 2004; Sajise et al. 1996; World Resources Institute 1994.

low crop productivity, reduction of the capacity of water conveyance structures, destruction of wildlife habitat, and destruction of standing crops.

About 9 million ha (out of the total land area of 30 million ha) are under varying degrees of erosion, and approximately 1 million ha of agricultural lands are very susceptible to soil erosion especially during the rainy season (EMB 2003). According to a 2003 study of the Bureau of Soils and Water Management (BSWM), approximately 5.2 million ha of the country are classified as severely eroded, 8.5 million ha as moderately eroded, and 8.8 million ha as slightly eroded.

The Philippine uplands are even more vulnerable to accelerated soil erosion primarily due to inappropriate land uses. Over the years, the uplands have been subjected to encroachment due to increasing human pressures. As shown in Table 2, the annual rate of deforestation in the 1970s and 1980s was about 130,000 ha per year. There is also a continuing population movement to the uplands where public lands are considered as free-access resources. Shifting cultivation and indiscriminate logging are the major causes of soil erosion in the Philippine uplands.

Chemical Pollution from Farming Practices

Farming systems in the Philippines during the past few years can be generally characterized by intensive farm production using inorganic fertilizers and pesticides. While production inputs offer advantages in terms of increased crop production and protection, there are certain negative externalities involved in their use. Over-utilization of these inputs decreases the soil's humus content, which adversely affects its infiltration and water-holding capacities. The loss of these two vital soil characteristics, in turn, makes the soil loose and more susceptible to erosion. There are other ecological and health problems associated with the use of fertilizer and pesticides, as discussed below.

Inorganic Fertilizer. Following the introduction of high-yielding varieties (HYVs) of rice in the Philippines in the late 1960s, fertilizer consumption in the country has increased steadily through the years. The government encouraged higher consumption of chemical fertilizers and pesticides by subsidizing farmers through a multitude of crop improvement programs. Nitrogen became the most popular fertilizer nutrient demanded by Filipino farmers; this is mostly used in rice, corn, sugarcane, and other plantation crops. In fact, importation has been resorted to, given the inability of local manufacturers to meet the demand for fertilizer.

There are ecological problems associated with chemical fertilizer use. Excessive use of this input is known to cause acidification of the soil. For example, in Loo Valley in Benguet Province, the excessive use of chemical fertilizers in vegetable gardens has lowered the soil's pH level to an average of 4.4 (Medina 1990). Acid soils are vulnerable to erosion because of the characteristic low electrolyte levels in the soil solution. Acidity also depletes fertility through the development of toxic levels of iron and by lowering the amount of most essential nutrients in the soil. In addition, soil microbia, which are partly responsible for nutrient release, are adversely affected.

The use of chemical fertilizers also poses some health problems. The contamination of drinking water with nitrate concentration greater than 45 parts per million (ppm) can cause metheglobinemia, a disease which affects both livestock and human infants (Rola 1990). Another health hazard results when nitrates in the food or in the digestive system combine with protein to form nitrosoamines which are carcinogenic.

Nitrogen and phosphorus nutrients from fertilizers are washed down by run-off water into freshwater bodies, thus creating eutrophication problems. One glaring example is the much eutrophied Laguna Lake in Southern Luzon. Of the 3,600 mt of nitrogen that enter the lake and primarily cause the recurrent growth of algal blooms, 77.2% is agricultural in origin [Laguna Lake Development Authority (LLDA) 1998].

Pesticide. The emergence of the pesticide industry in the Philippines in the early 1950s coincided with the introduction of DDT, 2,4-D, Endrin, and Malathion (Elazegui 1989). With the launching of the Green Revolution in 1965, the government embarked on a program of crop protection based on chemicals. Since then, the massive use of pesticides has become the norm in the various government national food production programs.

However, the use of pesticide as a crop protection agent has many negative effects. One effect is the health hazards it poses to farmer-users. Loevensohn's (1987) study showed that the widespread use of pesticides by farmers in Central Luzon was followed by a 27% increase in deaths among them from causes other than physical injury. An average of 503 cases of pesticide poisoning, of which 15% died every year, had been reported from 1980 to 1988. Human milk in some towns of Laguna Province was found to contain DDT.

The widely used insecticides in the country are carbofuran, endrin, parathion, and monocrotophos, which are all classified by the World Health Organization as extremely or highly hazardous (Macracken and Conway 1987). Another problem with the continued reliance on chemical pesticide is its capacity to cause pest build-up. One documented case is that of the diamond back moth (*Plutella xylostella, L.*) which exhibits multiple resistance to malathion, methyl parathion, DDT, diazinon, meviaphos, and carbaryl, and is developing resistance to newly introduced insecticides (Barroga and Rejesus 1981, cited in Alcantara 1988).

Rola (1989) attributed the continued use of pesticides by farmers to the lack of knowledge of alternative pest controls that would give them the same level of production and profit. Several studies have pointed out that current pesticide utilization by farmers are not efficient. For instance, Medina (1990) found out that reduced spraying (4 times) has not significantly lowered the yield when compared to the actual farmer's practice which consists of nine sprayings. Similarly, in the trials covering 105 farmers in 1980-1983, only 50% yielded a significant difference in yields between completely protected and untreated fields. This was probably because of the use of resistant varieties and the presence of natural enemies, implying inefficiency in the present level of pesticide usage (Rola 1989).

Pesticide hazards in the country are compounded by the widespread ignorance of the hazards involved, poor labeling, inadequate supervision, and the lack and/or difficulty of wearing protective clothing due to the prevailing hot farm conditions (Briones and Robles 2005).

Conversion of Prime Agricultural Lands into Other Land Uses

As an offshoot of the constant government urgings to attract foreign investments, to generate more employment opportunities, and to decongest major population centers, thousands of hectares of agricultural lands across the country have been, and are being, converted into other land uses. In the process, vast fertile agricultural lands go to waste as they are converted to non-agriculture land uses, while environmentally critical, marginal areas have been opened up for agricultural purposes. Landless farmers dislocated from lowland communities usually encroach on forestlands where they practice lowland agricultural practices that further cause resource degradation as shown in Table 2.

For example, in the provinces of Cavite, Laguna, Batangas, Rizal, and Bulacan, there is an ongoing massive conversion of prime agricultural lands to housing, commercial establishments, and industrial estates. About 20,000 ha of farmlands were converted every year (from 1970 to 1980) to be used for other land uses. It is estimated that more than 100,000 ha of agricultural lands all over the country are targeted for conversion in the next five years to give way to industrial, commercial, residential, and tourism uses (Cardenas 1998).

A study (BSWM 1991) estimated that irrigated rice lands were converted to urban uses (settlements and industry) at an average of 2,267 ha/year. For the period 1987-91, land use conversion in the country covered a total of 11,337 ha. Translating this land conversion into production figures, it is estimated that a hectare of prime agricultural land removed is equivalent to at least three hectares of rainfed areas and five hectares of ecologically fragile rolling upland farms, deprived of their capacity to produce food staples.

Apart from directly altering the physical environment through clearing farmlands and building industrial projects, land conversion lessens the coverage of the government's Comprehensive Agrarian Reform Program (CARP). The shift in land use has provided landowners (of rice, corn, sugarcane, and coconut) with another viable pretext for circumventing the redistribution of lands to the tenant-farmers that have long tilled these lands.

Loss of Genetic Diversity (Biodiversity)

Biological resources—genes, species, and ecosystems that have actual or potential value to people—are the physical manifestations of the earth's biological diversity or 'biodiversity.' The Philippines is one of the countries with the highest number of species of plants and animals per unit area [Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources (PAWB-DENR) 1992]. The primary issue besetting the country's biodiversity is related to habitat alteration, which results from land use changes that reduce the area of natural conditions. Wherever clearings, settlements, and agricultural activities are established, species are displaced and this has consequences on the ecological balance.

Although the country is home to an extraordinary variety of life forms, its biodiversity is also faced with problems and threats. Forest cover has been drastically reduced; only about 5% of coral reefs remain in excellent condition; seagrass beds and mangrove areas have been lost. It has been estimated that about 50% of national parks are no longer biologically important (PAWB 1996).

The present orientation of Philippine agriculture towards more extensive use of monoculture and uniform strains erodes the genetic potential of local and indigenous crops. Uniform strains and high-yielding varieties (HYVs) have now replaced local varieties in most Philippine farms. While these HYVs are more productive in terms of volume of output, they are, however, also more disease-prone and heavily reliant on intensive labor and chemical inputs. Thus, the use of these improved varieties exposes the farmers to greater risks of pest- and disease-related crop failures. Furthermore, the potential to improve the crops' resistance to pests and diseases is diminishing with the extinction of many of the wild strains from which crops are developed. Intensive and continuous planting of the same crops every year also favors the build-up of pests and diseases. Monoculture is not a serious problem but there are attendant environmental problems associated with monoculture that can be addressed with appropriate farming practices. Farmers are already aware of this concern.

In poultry and livestock, incessant cross-breeding and varietal manipulations have reduced their genetic variability. The Food and Agriculture Organization (FAO) notes, for example, that 30% of the world's breeds of cattle, sheep, hogs, and chicken are now threatened by extinction (FAO 2000).

Intensification of Livestock and Poultry Farming

Changes in the demand for food have also had their impact on poultry and livestock farming. As incomes rise, the demand for meat and meat products also tends to increase, triggering an intensified poultry and livestock farming. But there are concomitant environmental issues that arise in the wake of intensified poultry and livestock production.

Animal waste management. Intensification of animal production causes environmental problems. In the disposal of manure produced by farm animals, a high proportion of mineral and nutrient content is released, thereby increasing the risks of polluting the water systems, by affecting river and coastal fisheries and thereby posing a threat to the supply of clean drinking water. The smells emanating from manure affect the living and working environment of the local population and have had adverse effects on recreation and tourism in the areas. The rearing of animals in artificial conditions also creates the need to produce feeds, usually in the form of cereals and fish meal concentrates, putting more pressure not only on agricultural production but also on the fishing industry. In confined spaces, animals become susceptible to the spread of disease, and feed is often supplemented by medicines which persist in manure and water, and add to the problems of waste disposal. A study conducted by Alcantara et al. (1996) indicates that the pollution loading of the Laguna Lake from swine and poultry farms comprises 3,944 t/year of nitrogen and 1,314 t/year of phosphorous. These chemicals contribute to the eutrophication of the Lake.

Animal waste management in confined system can be properly addressed by installing wastewater treatment facilities. However, this may be too costly for small livestock growers.

Grazing. Philippine grasslands are rapidly expanding, which is the result of forest degradation that gives rise to open lands where grass species establish and dominate. Grasslands, an important resource for the livestock industry, can support only one or two animals per hectare, which may lead to low meat production. As shown in Table 4, the Philippines has 900,000 ha of open grasslands in 2004 which represents 3% of the country's total land area. The dominant species is cogon (*Imperata cylindrica*) which covers 30 to 80% of the natural grassland vegetation in the Philippines (EMB 2003).

Overstocking may result in overgrazing, the disappearance of desirable range species, growth of weeds, and soil erosion. The recommended ecologically sound stocking rate for Philippine grasslands is one animal or cattle for every two hectares of land.

Table 4. Pasture area in relation to the total grasslands area, Philippines, 1972 –2004

Year	Grassland (million ha)	Pasture Area	
		Area (million ha)	Percent
1988	1.82	0.465	26
1995	1.50	0.227	15
1996	1.45	0.220	15
1999	1.20	0.153	13
2004	0.90	0.113	13

Note: [a] Percentage is in relation to the grassland area.
Sources: ERDB 1995; FAO website 2005.

Aquatic Farming Systems: Coastal and Freshwater (Including Groundwater)

The water resources of the Philippines include inland freshwater (rivers, lakes, and groundwater), and marine (bay, coastal, and oceanic waters). Overall, there is sufficient water but not enough in highly populated areas, especially during the dry season.

Coastal. The coastal ecosystems of the Philippines are some of the most productive and biologically diverse in the world. The interdependence between the economic system and such coastal and marine resources as fisheries, mangroves, seagrass, and coral reefs, is one of the focal points of study in sustainable development.

The major threats to Philippine coastal resources are: (1) siltation due to deforestation and improper agricultural practices, (2) settlements and coastal land development, (3) nutrient enrichment due to agricultural fertilizer run-off and sewage, (4) industrial pollutants, (5) destructive fishing methods, (6) overfishing, (7) storms and typhoons, and (8) others (aquarium fishing, mariculture, coral extraction, diseases such as red tide, and tourist/diver damage).

Mangrove resources in the Philippines have been decreasing steadily. Among the regions, Region 9 still has the highest percentage of mangrove areas left at 45%, followed by Region 4 at 24%, and Region 10 at 16%. The swamp forest reserves are found in Palawan, Quezon, Camarines Norte, Camarines Sur, Albay, Sorsogon, Marinduque, Masbate, Mindoro, Leyte, Cebu, Bohol, Lanao del Norte, Misamis Occidental, Davao, Surigao del Norte, Surigao del Sur, and Zamboanga del Sur (EMB 2004).

The decimation of mangroves is largely due to human developmental activities which fall into several major categories, namely: infrastructure, industry, urban expansion, agricultural effects, the direct removal of mangroves for firewood, and timber, and the construction of mariculture ponds. The conversion of mangrove swamps into capital-intensive brackish-water fishponds is considered the more controversial issue in mangrove ecosystem management.

Mangrove areas are still decreasing, although at a much slower rate than in the 1980s. In the 1990s, the rate of mangrove depletion was less than 3000 ha/year or about 3%, while in the early 2000s, mangrove loss has been minimal due mainly to legal prohibition of mangrove cutting. The total mangrove areas of the country hovered around 100,000 ha in 2004 (DENR-EMB 2004).

Fisheries. Fisheries comprise a major component of the agricultural sector, providing a main source of food for the population, and contributing to the national income, employment and export earnings. Close to 1.5 million workers were employed in the fishery sector in 2003: 26% in aquaculture, 68% in municipal fishery, and 6% in commercial fishery.

Fishery-related livelihood includes fish distribution and marketing, fish processing (like fish canning), operation of ice plants and cold storages, and other allied industries such as net making, boat building, and boat engine motor sales and repairs. The fisheries sector is classified as municipal, commercial and aquaculture.

Aquaculture. Aquaculture fishery includes fishing operations involving all forms of farming fish and other fishery species in fresh, brackish, and marine water areas. For example, in mariculture, finfish, crustaceans, mollusks, and seaweeds are reared in the tidal and intertidal areas along the shorelines. Cages and pens are stocked with groupers and seabass. Wood and bamboos are used for the attachment of spats of mussels and oysters. In seaweed culture, floating or sinking nets and lines are used as culture attachments.

Environmental problems have also cropped up with aquaculture as a farming system. In some cases, aquaculture competes with catch fisheries, in terms of space, and obstructs water transportation. Pen and cage culture obstructs or slows down the free flow of currents, thus, promoting a rapid rate of siltation. Unconsumed feeds in the pens and cages pollute the surroundings, thus triggering eutrophication that ultimately results in fishkills.

Freshwater Ecosystem. The main sources of pollution in the freshwater systems are domestic sewage, and garbage and wastes from industry, agriculture, mining, and land development projects. As mentioned above, chemical residues from agricultural activities find their way to the river systems, thereby adversely affecting the water ecology, which ultimately affects human health.

When heavy deposits of suspended sediments or silt flow into rivers and lakes, the rate of shallowing is hastened. Sunlight may fail to reach deeper into the water, to the detriment of photosynthezing aquatic flora, thus, adversely affecting the fishery productivity.

Groundwater is replenished or recharged by rain and seepage from rivers. The recharge or extraction potential is estimated at 20,200 million cubic meters (mcm) per year. Groundwater contributes 14% of the total water resource potential of the Philippines. Region X has the lowest potential source of groundwater compared to its surface water potential, while Regions I and VII have the highest potential. Ground water is used for drinking by about 50% of the people in the country. A high percentage (86%) of piped-water system uses groundwater as a source.

Based on the water rights granted by the National Water Resources Board (NWRB) since 2002, about 60% of the groundwater extraction is without water-right permits, resulting in indiscriminate withdrawal. In terms of sectoral demand, agriculture has a high demand of 85%, while industry and domestic uses have a combined demand of only 15%.

Pollution of groundwater may come from domestic wastewater, agricultural runoffs, and industrial effluents. This occurs when contaminants reach the aquifer or water table in the form of leachate. Domestic wastewater is the main contributor of bacterial contamination to the groundwater supplies. The presence of coliform bacteria in drinking water supplies can cause water-borne diseases such as diarrhea, cholera, dysentery, hepatitis A, and others. Another problem is saline water intrusion, which is caused by over-exploitation or excessive withdrawal of groundwater. This reduces water availability for domestic usage, including drinking and agricultural use.

POLICY RESPONSE TO ADDRESS ENVIRONMENTAL CONCERNS IN THE AGRICULTURE AND FISHERIES SECTOR

Environmental concerns are firmly based on the country's political agenda and are reflected in the changing policies of the government. The administration and management of the environment and natural resources has been bureaucratically centralized and vested to certain national government agencies. Two lead agencies, the DENR and the Department of Agriculture (DA), have been mandated to ensure the sustainable use of resources through proper management, protection, and rehabilitation of degraded coastal and marine environments.

The management of Philippine environment encompasses both preventive and proactive approaches; it involves government and non-government institutions as well as communities that support various ecological and conservation restoration programs. The formulation of a

national plan of action for sustainability began as early as 1989 with the adoption of the Philippine Strategy for Sustainable Development. Taking into consideration global action plans in the UNCED's Agenda 21, the Philippine National Action Plan for Sustainable Development was formulated. This plan provides a framework for the action aimed towards achieving the goal of sustainable development (Briones 1999).

The Agriculture and Fisheries Modernization Act (AFMA) of 1997 is "an act prescribing urgent related measures to modernize the agriculture and fisheries sectors of the country in order to enhance their profitability, and prepare said sectors for the challenges of globalization through an adequate, focused, and rational delivery of necessary support services, appropriating funds therefore and for other purposes" (DA 1999).

An outstanding feature of AFMA in relation to environmental sustainability is the identification and delineation of the Network of Protected Areas for Agriculture and Agro-Industrial Development (NPAAAD) and the Strategic Agriculture and Fishery Development Zones (SAFDZ). The NPAAAD and SAFDZ "shall serve as basis for the proper planning and strategic agriculture and fishery development and in the identification of suitable crops, livestock, and fishes that can be economically grown and commercially developed for local and international markets, without irreversible environmental and human health problems."

AFMA requires that all lands suitable for the economic and commercial development of agriculture and fishery be identified, set aside, and protected from unwarranted future conversion from other competing uses. There are four types of lands that need to be identified for agriculture and fishery modernization and protected from unlawful land use conversion (DA 1999; Elazegui 1999):

a) the Network of Protected Areas for Agriculture and Agro-Industrial Development (NPAAAD) – referring to privately-owned lands identified from the alienable and disposable lands;
b) the Strategic Agriculture and Fishery Development Zone (SAFDZ);
c) the Model Farms – identified from SAFDZ; and
d) the Watershed Areas, identified in coordination with DENR.

AFMA is hoped to transform the Philippine agricultural landscape but as of now, its meager budget is inadequate for its full implementation. What can be considered a concrete accomplishment though is that the country has already put in place the legal and administrative framework to insure environmental sustainability in relation to agricultural practices.

The Fisheries Code of 1998 promotes an integrated and community-based management approach to fisheries management. Its implementation requires devolving to various local government units the production of individualized ordinances for each municipality, which provide for the development, management and conservation of the fisheries and aquatic resources, and integrating all pertinent laws. The Code significantly addresses the "utilization" of fisheries and aquatic resources through the following state policies:

- Achieving food security as the overriding consideration of fisheries;
- Limiting access to fishery resources to citizens of the Philippines;
- Rationale and sustainable development of fishery resources;
- Protection of the rights of fisherfolk and giving priority to municipal fisherfolk in the exploitation of municipal waters;
- Provision of support to the fisheries sector through research, financing, infrastructure, and marketing assistance;
- Granting the private sector the privilege of utilizing the fishery resources.

The Code affirms the full jurisdiction of the local government units over waters up to 15 kilometers from the shoreline as provided for by the Local Government Code in 1991. It is in these shorelines that the bulk of the marine resources lies; a considerable fraction of the country's population relies on these resources for livelihood.

Biodiversity conservation in the Philippines is embodied in the **National Integrated Protected Area System (NIPAS) Act of 1992.** Most of the job of safeguarding the country's biodiversity

will be achieved by the development of protected habitats selected to protect viable examples of all major ecosystems and hence conserve populations of most of the country's living species.

The NIPAS Law is focused on the delineation and creation of protected areas. However, protected area (PA) establishment raises concerns about ecosystem representation, size, community participation, and management effectiveness (World Resources Institute 1994). In the Philippine setting, the issue on PA is at times more a political rather than an ecological concern. As such, community participation and management effectiveness are at stake. The extent of the participation and involvement of the community in the process of NIPAS implementation is yet unresolved. A more basic issue is whether the community is indeed given the avenue to express how they want to manage the area.

CONCLUSION AND RECOMMENDATIONS

To respond to the urgent needs of a burgeoning population, while tackling the problems spawned by increasing poverty, fiscal deficits, and globalization realities, the Philippine agricultural sector, in general, has embraced the tenets of modern or conventional agricultural practices.

For most Filipino farmers (from the small-scale rice farmers or ornamental plant growers, to the large-scale banana plantation operators), the intensive use of chemical inputs and improved crop varieties has become a common practice. However, there is a growing awareness on the unsustainability of many existing agricultural practices because of their inevitable environmental costs that threaten the livelihood source of these farmers.

Although there are policy initiatives (such as AFMA and the Fisheries Code) that are being done to make Philippine agriculture more responsive to environmental concerns, there are difficulties in operationalizing such policies on the ground. The difficulty stems from the lack of resources and political will to implement the needed changes, coupled with the basic orientation of communities to favor livelihood activities over environmental protection.

The transformation of the country's farming systems requires a land- or resource-use planning approach and the formulation of explicit goals for alternative land uses. Planning is also necessary to define incentives for sustainable use, and to promote changes of attitude and values toward improved land options. The constant pressure on forestry and fishery resources is an example of how weak policy planning implementation can lead to the indiscriminate use of common-property natural resources.

The framework within which agricultural production can increase without leading to widespread environmental damage should have at least four elements:

- Initiation of dynamic, community-based, and participatory land-use planning processes that identify and mitigate the risks of natural resource degradation and other adverse environmental impacts;
- Socioeconomic support to improve the capacity of farmers and fisherfolk in poorer areas to manage efficiently their resources through holistic management systems, hand in hand with the equitable distribution of productive resources, access to capital, and employment opportunities;
- Greater investment in human capital and rural infrastructure, including the improved use of information and communication technology, and training and empowering municipal agricultural workers to work with farmers and fisherfolk in applying environmentally sound production methods; and
- Ongoing assessment, monitoring, and evaluation of environmental impacts in all segments of the food production chain through information management, decision-support systems, indicators of sustainability, and geographic referencing of information (especially by linking agro-ecological zone characteristics to district and national planning units.)

All in all, what is really needed is to have adequate safeguards to ensure that the agricultural technology is applied in the least damaging, most environmentally sustainable way. Such safeguards

may include appropriate and environmentally-friendly technologies (e.g., integrated pest management, agroforestry). As such, a responsive Philippine agriculture in the context of the emerging global environment must be anchored on the following concerns: efficiency and growth, for increased productivity and competitiveness; equity, wherein the benefits of growth must be equitably shared; sustainability, which means that growth and equity must not be viewed only across income groups but also between generations, and; environmental integrity, to insure that the production bases are protected and managed.

Environmental integrity emphasizes that development should be promoted and carried out in ways that are not destructive to the natural resource base. The preservation of agricultural ecosystems must always be an important consideration in areas where fisheries and agricultural development are carried out. This is to ensure the long-term sustainability of the Philippine agricultural sector, in particular, and the environment, in general.

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