

**Asia-Pacific Forest Invasive Species Network (APFISN)**  
**A Report on the Stocktaking of National Forest Invasive Species (FIS)**  
**Activities in the Philippines<sup>1</sup>**

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**1. Country background**

The Philippines forms part of the Southeast Asian region. It is the archipelago between the Philippines Sea and the South China Sea, east of Vietnam. The archipelagic character has given the country extensive territorial waters and a long coastline about twice that of continental United States of America. Because of extensive territorial water, the Philippines adopted the Archipelago Doctrine as a basis in determining the inland and territorial waters of the country. With its total land area of 115,830 sq. mi. (300,000 sq. km), it constitutes 2% of the total land area of the world and is classified as a medium sized country.

Geographically, the Philippines is about 1,000 kms. From the southeast coast of the mainland of Asia lying on the western margin of the Pacific Ocean. It lies between 21<sup>0</sup>.55' east and 126<sup>0</sup>36' east longitude. Its boundaries are formed by three large bodies of water on the west and north by the South China Sea, on the east by the Pacific Ocean, and on the South by the Celebes Sea and the coastal waters of Borneo. The country's location makes it strategically important not as

the meeting ground of various cultures but also as the distribution center of goods within the region.

The country's 7,107 islands and islets is clustered into three major groups: Luzon, Visayas and Mindanao. Of these, Luzon and Mindanao comprise the two largest islands with land area of 105,000 and 95,000 square kilometers, respectively, which together represent two-thirds of the total land area of the country. Forty-five of the islands have an area of 100 square kilometers or more and their aggregate areas comprise 98% of the total area of the archipelago.

## **Climate**

The climate of the Philippines is tropical and maritime. It is characterized by relatively high temperature, high humidity and abundant rainfall. The country has two marked seasons, dry and wet on the western shores facing the South China Sea, where the dry season generally begins in December and ends in May, with the wet season covering

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The rest of the year. The dry season shortens progressively eastward; the rain is heaviest along the eastern shores facing the Pacific Ocean. From June to December, typhoons frequently strike the archipelago at an average of 19 typhoons per year.

The average monthly relative humidity varies between 71% in March and 85% in September. The mean temperature is between 25 to 27° C with a range of 21°c to 34° C to as high as 270 cm.

### **Topography**

The Philippines is generally mountainous to moderately rolling. The terrain is mostly mountains with narrow to extensive coastal lowlands. The elevation range is extreme: the lowest part is found in the Philippine Sea at 0 meter elevation, while the highest point is found in Mt at 2,954 m above sea level.

### **Population**

As of July 2005 estimate, the population of Filipinos is about 87.9 Million, with a population growth rate of 1.84%.

### **Economy**

While still agricultural developing country, the Philippines is an important destination for outsourcing and an exporter of electronics and labor. The latest Gross national Product (GNP) as of 2004 based at current prices is US\$ 90,555.098 (P4, 618,310.00) at P51 to US\$ 1. On the other hand, the latest Gross Domestic Product (GDP) is US\$ 84,312.391 (P4, 299,932.00) at P51 to Us\$1, based

at current prices. GNP and GDP by industrial origin is shown in Table 1. Per capita GNP is P56, 109.00 (in current pesos).

**Table 1. GNP and GDP by industrial origin (at current prices) in pesos and in dollars.**

Industry	(in pesos)	(in dollars)
1. Agriculture, fishery and forestry	P637, 764.00	US\$ 12,505.176
2. Industry	1,372,497.00	26,911.705
3. Service Sector	2,289,671.00	44,895.509
Gross Domestic Product (GDP)	4,299,932.00	84,312.391
Gross National Product (GNP)	4,618,310.00	90,555.098

### **Extent of Forest Area, by forest Type**

The actual forest cover in the Philippines is about 18% of the total area, or a mere 0.4 M has. The remaining virgin forest area is less than a million hectares due to rapid deforestation. Within the terrestrial ecosystem, at least 11 forest types have been identified. The major vegetational formations in the Philippines can be grouped into two recognizable forest formations - lowland tropical rainforests, and lower montane forests. Most widespread is the dipterocarp forest accounting for some three quarters of lowland rainforest, about 805,000 has. Classified as old-growth forests and 2.7 million ha. As residual forests. Unfortunately, 90% of the lowland forests have been destroyed over the past 2-3 decades primarily due to indiscriminate and excessive timber harvesting and, to some extent, kaingin-making. A bog portion of the total area of the Philippines is now occupied by re-growth. Together with cogon (*Imperata cylindrical*) grasslands, secondary vegetation forms one of the country's most characteristic and extensive vegetative type. This type of vegetation resulted from a combination of man's activities such as logging and shifting cultivation. The

remaining forest types are categorized as follows: pine forest – 227,900 ha; sub-marginal forest (includes the upper montane and subalpine rainforests) – 1.04 million has; and mangrove forest – 112,400 has. (Table 2).

**Table 2. Philippines forest types, other land – uses and their respective areas (DENRUNEP 1997).**

Forest type	Area (in hectares)	Percentage of total area
Forest	5,391,717	17.9
Dipterocarp	3,536,017	11.7
Old-growth	804,000	2.6
Residual	2,731,117	9.1
Pine	227,900	0.7
Submarginal (includes limestone and ultramafic forests)	475,100	1.5
Mossy	1,040,300	3.4
Mangrove	112,400	0.3
Brush land	2,232,300	7.4
Other land use	22,375,983	74.5
Total	30,000,000	100.00

### **Forest Land Ownership and Management Authority**

According to the Regalian Doctrine, the King of Spain claimed ownership of the forests of the Philippines, but during the American period, the vast forests were declared public land and owned by the state. As such, no citizen claimed ownership to any forest land. Forest guards were employed to guard and protect

forests from squatters, illegal loggers, poachers, etc. However, there were so few forest guard to be effective in guarding natural forests. Then, the public forests were distributed among holders of Timber License Agreements (TLAs) who in turn logged the forests. There were 180 TLAs in 1986 and this 17 existing, 4 are suspended and only 4 are operational. These were united in an association known as the Philippines. Wood Producers Association (PWAP). Two of the known old time TLA holders as of this date are PICOP Resources, Inc. (PICOP) and Surigao Development Corporation (SUDECOR). PICOP is one of the first few organizations that established early in the 1970's. SUDECOR is also a private logging company in eastern Mindanao.

Cognizant of deteriorating ecological conditions and the importance of legal intervention, the Philippine government, through the Department of Environment and Natural Resources (DENR), has recently accelerated its efforts to institutionalize mechanisms designed to facilitate proper conservation and sustainable use of biological and genetic resources. DENR being the government agency primarily responsible for the conservation, management, development and proper use of the country's environment and natural resources, specifically forest and grazing lands, mineral resources including those in reservation and watershed areas, and lands of the public domain.

National Integrated Protected Areas System (NIPAS) Law (R.A. No. 7586) was enacted on June 1992. NIPAS define laws that provide for the establishment and management of the country's protected areas and conserving genetic resources and biological diversity. National Parks established before 1992 became the initial components of NIPAS and almost 300 of these are currently proclaimed with a total area of more than 4 million has, including some marine parks and reserves and mangrove swamps. The great majority are terrestrial

ecosystems representing different types of forest formations ranging from a small 1-ha. Forest park to the large 72,000-ha national park.

The Philippines government has banned timber harvesting in old-growth forests, mossy forests, and forests above 1000m elevation and with 50% slope. Many of these areas now form part of the NIPAS.

### **Role of Forests and Forestry in the National and Community Economies**

Forests are part of 'where we live' – that is, they are environmental. Forests also affect 'how we live' – they have development impact on lives. They help supply people's needs and fulfill their aspirations. In the Philippines, from the 1950's to the 1970's the dipterocarp forests became the object of tremendous interest because of their economic importance to the country. It was during this time that export of wood products ranked first in the foreign exchange earnings. In the early 70's to the 1980's, warnings were raised by experts regarding the alarming rate of forest products extraction. More than anything else, improper harvesting has brought more destruction than positive results.

Ecotourism is inextricably linked to cultural diversity, biodiversity and sustainability of natural resources. Minus the protected areas or resource base, ecotourism will not prosper. In June 17, 1999, Executive Order (EO) 111 was issued establishing a formal organizational structure for ecotourism development in the Philippines. It requires the formulation of the national ecotourism strategy which provides the mechanism for sustainable ecotourism development should a community – based approach be pursued.

The Rajah Sikatuna Protected Landscape (RSPL) in Bohol in the Visayas, is one ecotourism site in the country that is going to be community-based. The ongoing improvement activities within the area are closely monitored by the

Protected Area Superintendent (PASu), of the local DENR and the Soil and Water Conservation Foundation, Inc. (SWCF) that facilitates the funding of the project.

## **2. Forest Invasive species background**

Several species of trees and agricultural plants were introduced in the Philippines with good intention (please see attached checklist). Foremost was for more cover crops and multiple-purpose species to meet the various needs of bare vast lands of the country. The paper mulberry, *Broussonetia papyrifera* for example was introduced in 1935 to augment bast fiber producing tree crops in the Makiling Forestry school campus. From Hawaii, coronitas (*Lantana camara*) was introduced as ornamental shrub but escaped to become serious pest of young secondary forests thickets, orchards and farms. *Sweitenia macrophylla* was first planted in 1907 (and *S. mahogany* in 1911) both intentionally introduced for cultivation. These three species are now all over the Philippine archipelago.

The mahogany became invasive because of the following attributes of the species each fruit of mahogany in a capsule contains an average of 62 winged seeds. Assuming 50 capsules per tree can be dispersed per fruiting season, that's 3000 seeds, blown at a distance of 20 to 40 meters. The seeds being recalcitrant germinate in less than a month and even inside the pod (Fig.1). Dipterocarps fruit and seed irregularly in intervals of 4-5 years and therefore stand no chance competing with mahogany. Mahogany seeds contain food reserves and germinate hypogeal. This means that even if the initial light is relatively poor, the young mahogany plant develops even without initial photosynthesis. True photosynthetic leaves com later and are adopted even in sun-flecked shade to partial shade. Hardened mahogany seedlings are even relatively drought resistant. It is a common observation in mature mahogany plantations in the

country that the under story vegetation is dominated by mahogany seedlings as well (fig.2). Nearby areas can also be invaded by mahogany (Fig.3).

Another plant, *L. camara* may occur as a compact shrub or a scrambler more than 5 m high, often used as a hedge plant because it forms impenetrable barriers. However, it is the same quality that makes it such a menace when it invades agricultural land and forestry plantations. The entire plant is said to be toxic, and ingestion of the leaves and fruit can poison cattle and sheep, exhibiting as increased sensitivity to sunlight. Lantana is difficult to control, as it will coppice and form dense thicket if it is simply slashed and left. Physical labor is intensive, may increase risk of soil erosion when uprooting large plant. A combination of physical and chemical control is best. All forms of control should be followed by revegetation to prevent seedling from forming new thickets.

Some agricultural plants introduced in the country are now becoming pests or weeds of forest areas. Mile-a minute, *Mikania micrantha*, was introduced from the South and Central America as cover crops or garden ornamental but now considered invasive species and is a problem weed throughout the warm, humid region of south-east Asia including the Philippines. The vine was able to spread rapidly because of its efficient reproduction. A single plant can produce up to 40,000 seeds per year. The small, black seeds with bristles at one end are dispersed by wind and adhere to clothing or animal fur. Vegetatively, the plant can regenerate from small fragments, each nodal stem being able to produce roots on contact with the soil. The weed climbs up other plants to reach the sunlit tree canopy, smothering the host plants in the process, deprive them of light needed for photosynthesis and compete with hosts for nutrients and water. In the Philippines, the weed is being controlled through mechanical means, although a biocontrol agent is reported in other countries (rust fungus *Puccinia spegazzinii*) no record yet that the fungus is being used in the Philippines.

The shrub *Chromolaena odorata* is another invasive weed present almost everywhere in the Philippines. It thrives on disturbed lands and form dense thickets that smother indigenous vegetation, reducing biodiversity (Fig. 4). Its growth decreases productivity of any main crop/tree where it is growing along with. The control of the weed requires integrated approach. Repeated follow-up work is necessary, as chromolaena is capable of vigorous growth from stem coppice, root suckers and light seeds, more than a million per plant. Seeds are dispersed by wind, water and by adhering to animals, humans, vehicle and machineries. The use of herbicide and annual burning regime are possible but are not quite economically feasible under Philippines agriculture and forest farming. The presence of defoliator pest/moth *Pareuchaetes pseudoinsulata* is effective in some areas in the country but its massive use is not yet applied. The stem-causing-gall fly *Cecidochara connexa* has been reported but not present in the country. The galls are said to distort the stem, reduced plant growth and dieback of chromolaena with heavy pest infestation.

*Occinia grandis*, ivy gourd has no record of its introduction in the country but like mile-a-minute, it smother host plant, compete for sunlight, water and nutrients. Its red ripe fruits are attractive to animals/birds and therefore, their wastes served as means of seed dispersal. The weed's tuber like primary roots served as persistent part of survival, especially during dry season and difficult to uproot too.

With the introduction of fast growing exotic tree species, came along some invasive features and introduced pests and diseases as well. The broad leaves of *Gmelina arborea* became so attractive to defoliator *Ozola minor*. *O. minor* is abundant during the early part and the end of the rainy season when shoots of yemane are young and succulent. Increment loss in height and diameter of

young *G. arborea* is directly proportional to the degree of defoliation. At the nursery level and in young plantations, regular application of insecticide fenvalerate (active ingredient) is effective against the larva.

The *leucaena* or ipil-ipil psyllid, or *Heteropsylla cubana* Crawford are sucking insects which feed on the sap of their host plants, The pest was introduced into the Philippines and Southeast Asian and Pacific region sometime in the early 1980. Its introducing has completely disrupted the use of *Leucaena leucocephala* in the country. It has caused rapid and extensive damage and mortality to leucaena. Although a complex of natural enemies are associated with *H. cubana*, none is effective enough to protect ipil-ipil trees. As a result, a moratorium was recommended on the planting of the host tree, except for research, until seeds of resistant varieties or crosses become available.

In the Philippines, *Swietenia macrophylla* and *Toona calantas* are attacked by the shoot borer *Hypsipyla robusta* Moore (*Lepidoptera: Pyralidae*). New plantings of the large leaf mahogany, especially in Mindanao was stopped because of the extensive damage caused by the insect. Damage is principally caused by the larva that bores inside the shoot and feed on its content. Affected shoots dry up and breaks off. Heavy and repeated infestations result in forking, crooked stems and often permanent stunting. Various approaches have been proposed for the shoot borer problem. It is important not to stimulate the growth of mahogany, especially in its early stage, by fertilizer application. The pest preferentially attack young vigorously growing trees with juicy and succulent terminal shoots. Closer spacing to reduce the development of vigorous lateral branches, which are attacked as well, should be encouraged. Mixed planting with other non-host fast-growing tree species could reduce shoot borer infestation because the faster growing trees provide lateral and overhead shade.

The pink disease of *paraserianthes falcataria* caused by *Corticium salmonicolor* may have been originated from Tropical America. The pathogenic fungus has been recorded to infected a number of tree species including fruit tree in the Philippines. These include *Azadirachta indica*, neem tree; *Eucalyptus* spp., *Tectona grandis*, teak; *Tamarindus indica*, citrus spp. And very recently, a medicinal shrub, *Cassia alata*, L., akapulco. The fungus is still spreading nationwide due to increasing or widening host range.

The gall rust of *P. falcataria* caused by *Uromycladium tepperianum* as well as root rot of *Acacia mangium* caused significant infections in their own hosts but is now receding. For the gall rust, precautionary measures are being practiced by the plantation owners. Since the infective spores of the fungus are windborne, the tree species should not be planted on high elevations. The movement of any propagules from diseased to disease-free areas has been regulated. Monoculture should not practiced.

The root rot disease of *A. mangium* (and *A. auriculiformis*) caused by *Phellinus noxious* is also in the receding status inspite of being invasive (Figures 5 and 6). The species are no longer widely used for reforestation purpose. Mangium and auri are susceptible to this infectious disease and mangium to the destructive longhorn beetle. For the disease, a biological control, another fungus, *Trichoderma viridae* was found to control the pathogen by its antagonistic effect.

### **3. Management and Institutional Framework**

There are no existing laws and regulation that deal specifically on FIS in the Philippines; however, the Philippine quarantine Law is used as an instrument that regulates introduction of any plant species in the country

The country participation to APFISN initiated the awareness to address the risk and control of invasive species. The Department of Environment and Natural Resources (DENR) through the Forestry Sector is the one involve in the network. Recognizing the need to conduct researches along this area, participation to the network is now lodged from the forestry sector to the research sector of the same department, which is the Ecosystems research and development Bureau (ERDB). As far as forest invasive species is concerned, the research sector is in the position to asses, monitor and develop measures of control.

#### **4. Strategies, mechanism and measures to control FIS**

As far as plants or weed species are concerned, there are no general mechanisms or measures to control all invasive weed species. Specific control are applied only to the most problematic ones like *Chromolaena odorata*, and *Coccinia grandis* vines that affect reforested areas. Control measures include mechanical and chemical approaches. Brushing and herbicide applications to sprouts of *C.odorata* are usually done to control them. Brushing and uprooting of twining vines that smother growing trees are normally done. Herbicide applications to these highly prolific species are usually done in agricultural and grazing areas.

Some materials were being published regarding the problem and control of *C. odorata* which casued the abandonment of most grazing areas in public forest lands. Due to the high coast for a long term control of this weed, most stakeholders chose not to pursue any measures and allow the massive invasion of these species and eventually abandoned the areas.

## **5. Facilities and seminars available for national and regional cooperation**

The Ecosystems Research and Development Bureau (ERDB) is now undertaking a research on the “Determination of Impacts of Introduced Forest Tree Species in the Philippines” where old reforestation species are visited/inspected. Data collection includes tree Diameter at breast Height (DBH) and height measurements, under canopy vegetation and soil analyses, pests and diseases, and effect of the species introduction to the people and the community as a whole.

Basic laboratory facilities such as pathology, entomology, botany, soils and chemistry are present in ERDB.

### **Technical Resource Persons:**

Marcilina V. Pacho-Pathologist, ERDB, College, Laguna

Horacio O. San Valentin – Entomologist, ERDB, College, Laguna

Dr. Emelina Mandia – Botanist/ Taxonomist, De La Salle Univ., Taft Avenue, Manila

Dr. Nestor T. Baguion – forest Ecologist, College of Forestry University of the Philippines, College, Laguna

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## 2. Checklist of forest invasive species present in the Philippines

Scientific name	Common name	Origin	Introduction		Pathways Of Spread	Vector s	Distribution Pattern	Rate Of Change	Major Hosts	Threat Level	Impacts/ danger
			Method	Year							
A.Higher plants 1. <i>Broussonetia papyrifera</i>	Paper mulberry	Eastern Asia	Intentional; for bast fiber tree augmentation	1935	Wind dispersal	Man	grows in open disturbed areas	Fast spreading	N/A	national	eradication of other species
2. <i>Lantana camara</i>	Coronitas	Hawaii	Intentional; for ornamental use	1930	Wind and water dispersal	Man	Thrive in many sites and soil conditions	Fast spreading	N/A	national	eradication of other species
3. <i>S.macrophylla</i>	Mahogany	Central and Southern America	Intentional; for forest production use	1907	Wind dispersal	Man	Could monopolizw forest floor under the same species plantation	Spreading	N/A	national	Threat to biodiversity
4. <i>Leucaena leucocephala</i>	Leucaena; ipil-ipil	Africa	Intentional introduced for cultivation	1910	Wind and water	Man	Could occupy steep, bare slopes and form pure stands	Receding	N/A	national	Prone to pestes and diseases
5. <i>Mikania micrantha</i>	Mile-a-minute	South and central America	Introduced as cover crop and garden ornamental	-	Water,wind,bird dispersal and adhere to cholothing or animal fur	Man/fur-cover animals	Colonize open and disturbed areas forest edges, road-sides	Spreading	Tree	national	Smother tree
6. <i>Acacia mangium</i> <i>A. auriculiformis</i>	Mangium Auri	Sabah -	Intentional for reforestation purposes	1977	Wind dispersal	Man	Can thrive in many sites; increased seed germination after fire	Spreading	N/A	national	Prone to pests and diseases; prolific germination after fire

7. <i>Chromolaena odorata</i>	Chromolaena Triffid or siam weed	South and Central America	Maybe accidentally introduced with forestry or pasture seeds	-	With dispersal; seeds can cling to animals, clothes, contaminate crop seeds, vehicles	Man/animals	Flourish in disturbed habitats, and burn lands; agricultural, natural forest, planted forest, grassland, shrublands	Density increased with increased opening top 100 of words worst invaders	Tree	national	Compete trees/ smother tree seedlings
8. <i>Coccinia grandis</i>	Ivy gourd	Africa, India, Asia	Brought by migrants for shoot as food		Birds/animals Excretion, disposed as wastes	Birds	Agricultural, natural forest, planted forests disturbed sites	Massive biomass spreading	Trees	national	Smother trees, hosts of pests and viruses
9. <i>Mimosa invisa</i>	Giant sensitive plant	S. America Brazil	Possibly mixed with imported seeds		Wind animal. Water dispersal	Man	Disturbed sites; open/planted sites	Spreading	Trees	national	Twining; smothering
<b>B. Insect Pests</b> 1. <i>Ozola minor</i>	Measuring worm	-	Spread of indigenous host trees	-	Expending host tree plantations	-	In Gmelina plantation in Central Luzon	Receding	<i>Gmelina arborea</i>	regional	Kill host trees
3. <i>Heteropsylla cubana</i>	Jumping lice	Carribaeen	-	1980	-		Occurred nationwide	-	<i>Lwucaeca leucoce-phala</i>	national	Stunting; shoot rosetting, or host's death
3. <i>Hypsipyla robusta</i>	Shoot borer	Indigenous in Asia	-	-	Air or wind spread	-	Luzon, Visayas and Mindanao	Receding	<i>Sweitenia macro-pylla</i> <i>Toona calantas</i>	national	Death of infected shoots; repeated attack results to poor growth

<b>C. Pathogens</b> 1. <i>Corticium salmonicolor</i>	Pink disease/canker	Tropical America	Infected Planting stocks	early 1980	wind disposal	man	Mindanao and Luzon	Increasing due to widening of host range	<i>Paraseriotes falcata</i>	national	death of infected branches
2. <i>Uromycladium tepperianum</i>	gall rust	New Zealand	Infected planting stocks	late 1980	wind dispersal, maybe thru infected seeds	animals/insects	Mindanao and Luzon	Receding	<i>P.falcata</i>	national	shoot swelling and curling; crown thinning; in severe case, death of host
3. <i>Phellinus noxious</i>	Root rot	Fiji	Infected potting media	early 1990	water dispersal; can spread thru root grafts		Mindanao and Luzon	Receding	<i>Acacia mangium</i> <i>A. auriculiformis</i>	national	death of host trees