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FARMING IN THE CITY

AN ANNOTATED BIBLIOGRAPHY OF URBAN AND PERI-URBAN AGRICULTURE IN THE PHILIPPINES WITH EMPHASIS ON METRO MANILA

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Urban Harvest is the CGIAR systemwide initiative on urban and peri-urban agriculture, which aims to contribute to the food security of poor urban families, and to increase the value of agricultural production in urban and peri-urban areas, whilst ensuring the sustainable management of the urban environment.

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Urban Harvest Annotated Bibliographies on urban and peri-urban agriculture contain a list of citations from articles, books, documents, theses and reports followed by an annotation or brief description. The material has been selected from a variety of sources and disciplines on urban and peri-urban agriculture in order to motivate interdisciplinary discussion and comment. The author(s) alone is (are) responsible for the content.

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INTRODUCTION

Metropolitan Manila or Metro Manila is the capital and the premier urban area of the Philippines. Metro Manila is the heart of the nation's economic, political, social and commercial activities. It was formed by virtue of Presidential Decree 921, issued in 1976, that includes 14¹ cities and three municipalities². The region covers a land area of 636 km², accounting for a mere 0.21% of the total land area of the Philippines. In stark contrast, it is the second most populous region in the country. With unabated heavy in-migration, the population is projected to be at eleven million by the end of 2004. It comes as no surprise that Metro Manila is the most densely region in the country: 16,051 persons/km² in 1999. (National Statistical Coordination Board Statistics, 1999).

Urban agriculture in Metro Manila existed long before “urban agriculture” became a catchphrase and before the presence of urban agriculture was recognized by local administrators, academics and scientists. For example, available documents from the 1970s describe 10-hectare unbuilt government lot in Pasay City teeming with leafy greens and vegetables for commercial production. This site was eventually destroyed with rapid urbanization. However, nowadays remnants of such practices are still visible in some residential subdivisions of the metropolis.

This annotated bibliography is the first attempt to compile information on urban agriculture in Metro Manila. The diverse sources and the nature of the information found in this annotated bibliography reflect the multidisciplinary character of urban agriculture. Sources of primary information include: institutional publications (accounting for 28% of the total collated), unpublished student theses (19%), proceedings of conferences/workshops (16%), the Urban Agriculture Magazine (13%), scientific journals (10%), project reports (6%), techno-guides and professorial chair lectures (3% each), and scientific poster papers (2%).

Several observations can be made regarding the data presented. Urban agriculture in Metro Manila takes several forms; from backyards to communal gardens and from institutional to commercial plots, geared for household consumption, for the market or, more commonly, for a mixture of both. Urban agriculture tends toward crop cultivation rather than livestock production, which reflects the general restriction against the latter in the city. Although there are several municipal projects on urban agriculture in place, no law directly and specifically linked to the promotion and development of urban agriculture has been enacted by the national government.

The annotated bibliography not only concentrates on literature dealing with crop/livestock production, but also focuses on several related issues, such as the natural environment, which could provide significant positive or negative impacts on urban agriculture in Metro Manila. These issues are of considerable importance in dealing with the local environment and human health. Fortunately, data on climate change in Metro Manila, specifically due to rapid urbanization, are available. Studies related to the various sources and types of air pollutants, as well as heavy metals (for example, lead and cadmium), which have an important bearing on the

¹ The original core city of Manila, Mandaluyong, Malabon, Marikina, Pasig, Quezon City, Kalookan, Valenzuela, Las Piñas, Makati, Muntinlupa, Parañaque, Pasay and Taguig

² San Juan, Navotas and Pateros

quality and safety of vegetables produced in the metropolis, have also been included in the annotated bibliography. Only one report is cited regarding the nutritional contribution of urban vegetable gardens to poor city households. Several studies dealing with the conversion of urban biowaste into compost, which is a potential input to urban agriculture, are also provided.

The critical linkages of various agricultural activities—from production to marketing—among urban, peri-urban and rural communities are well represented in the compilation. Literature cited in respect to this, include the work on sampaguita [*Jasminum sambac* (L.) Ait.] flower production and garland making in rapidly urbanizing communities peripheral to Metro Manila and the supply of vegetables to the metropolis from adjacent provinces.

Reports on the practice of urban agriculture found in cities outside of Metro Manila have been included in the annotated bibliography. Most of these reports provide insights into research and development approaches that tackle the myriad nuances of local urban agriculture. Lessons derived from these experiences could contribute to a better appreciation and understanding of the urban agriculture efforts of local communities. Some studies on urban greenery, mostly dealing with forest trees, are also presented. Timber species, together with ornamental plants, are mainly utilized as major components for the beautification programs of Metro Manila.

This annotated bibliography tries to be as comprehensive as possible in terms of scope. Much effort has gone into gathering available information; particularly that classified as “gray” literature. The growing recognition that urban agriculture is crucial to the development of, not only Metro Manila, but also other Philippine cities.

ASSESSMENT OF URBAN AND PERI-URBAN AGRICULTURE

Ali, M. and F. Porciuncula. 2001. *Urban and Peri-urban Agriculture in Metro Manila: Resources and Opportunities for Food Production*. Technical Bulletin No. 26. Shanhua, Tainan, (Taiwan): Asian Vegetable Research and Development Center (AVRDC). 45 p. (1, 20)*

Key words: urban poverty, crop production, technology

Relevant urban and peri-urban agriculture activities can offer partial solutions to problems of unemployment, malnutrition and exposure to pollutants for the urban poor in Metro Manila. For effective planning of such activities, the opportunities and resources available in a city need to be explored. Applying this framework, the study investigates the geography, climate, demographics, resources, infrastructure and marketing networks of Metro Manila.

The report reveals that not enough land and water are available in Metro Manila for crop production on a scale that would be of any real benefit to the urban poor. If, however, urban agriculture is considered in a broader sense to include small-scale livestock and poultry production, indoor crop production, farm-product processing, and marketing activities, then it can generate gainful employment for the target sector. The Department of Agriculture has adopted this approach, and plans to distribute broilers, ornamental and vegetable seedlings, and spawn for mushroom culture to boost such activities.

Another approach is to reduce the cost of food through the introduction of new technologies into surrounding areas that supply food to Metro Manila. The Asian Vegetable Research and Development Center (AVRDC) has adopted this method by initiating a vegetable development project in the nearby province of Nueva Ecija. Various technologies are being tested at the site to reduce seasonal fluctuations in vegetable supply, reduce pesticide inputs and residues, partly replace inorganic with organic fertilizers, and improve profitability. Input-output marketing systems and efficiency are being studied, and system models are being formulated to stimulate the environments for technologic adoption and to enhance vegetable supplies to Metro Manila.

The report provides general guidelines that can be used as a model for agricultural activities to assist the poor in other cities.

Yokohari, M., K. Takeuchi, T. Watanabe, and S. Yokota. 2000. Beyond greenbelts and zoning: A new planning concept for the environment of Asian mega-cities. *Landscape and Urban Planning* 47 (3–4): 159–171. (14)

Key words: urbanization, rural-urban linkages, land use, urban planning

* Code for location of entries, see p. 56

Asian mega-cities have had explosive growth in the post-war decades. Such growth has, however, resulted in serious environmental problems including air and water pollution and a lack of adequate urban infrastructure. This growth has also created a chaotic mixture of urban and rural land use on the fringe of the cities. Western urban planning concepts, such as zoning and greenbelt additions, have been applied to cities such as Tokyo, Seoul and Bangkok to encourage controlled urban growth. With the possible exception of Seoul, these landscapes at the edges of Asian mega-cities indicate such attempts have not had significant success. Historically, Asian cities place land use patterns of urban and rural character next to each other. The paper examines such vernacular landscapes, which in the past have demonstrated a workable relationship between urban and rural environments.

The authors argue that a planning concept that respects the mixture of urban and rural land uses should be developed and applied to encourage ordered growth of Asian mega-cities. Farm and wooded landscapes provide key ecological functions, visual amenities and cultural services that help justify the continued relationship of rural and urban land use mixes. A planning concept that respects the vernacular landscape of the past can help provide new stability to the Asian environment of the 21st century.

Yokohari, M. 2003. Agro-activities in the fringe of Asian mega-cities. *Journal of the Japanese Institute of Landscape Architecture*, International edition, No.2: 128–133. (14)

Key words: peri-urban agriculture, land use, urban planning

Urban fringe landscapes with a juxtaposition of segmented agricultural lands and urban land uses, generally thought to result from the incomplete application of Western urban planning concepts, have been regarded as a symbol of disordered Asian urban fringe areas. The paper discusses the concept that such a mixture of urban and agricultural land uses in the outskirts is not a modern invention of Asian cities, but may be identified in their history. The city of Edo, former Tokyo, established as the “practical” city of Japan in 1603, is an illustration of this point. Almost half of the land area of Edo was in agricultural use, even up to the end of the Edo era. This was despite Edo’s being one of the largest cities in the world with a population over one million in the early 19th century. The case of Edo exemplifies a vernacular landscape characterized by a mix of agricultural lands in an urban area.

The report also describes the various activities relating to agriculture that are found today in the fringe of Asian mega-cities—including professional farming, poverty alleviation programs, community gardens and backyard gardening. Two examples cited in the paper are the agro-activities being conducted in Metro Manila, Philippines and Tokyo Wards, Japan. These facts suggest that the order of land use in the fringe of Asian mega-cities was not achieved by a simple application of Western urban planning concepts, but that agro-activities are a vernacular element of the area. The integration of agro-activities in the urban fabric is one of the key issues for bringing a new order to the urban fringe landscapes of Asian mega-cities.

CROP PRODUCTION

Fojas, A.E.C., Jr. 1982. Production and management of a 0.5 hectare market garden in Pasay City, Metro Manila. Unpublished B.S. thesis, Department of Horticulture, College of Agriculture, University of the Philippines, Los Baños, Philippines. 41 p. (14)

Key words: urban agriculture, marketing, crop production, farming systems, vegetables

This is the oldest available document on urban agriculture in Metro Manila. The report provides an overview of urban agriculture in Barangay Pilipino in Pasay City, and specifically discusses the vegetable production and marketing practices of one of the successful farm workers in the area.

Barangay Pilipino, one of the 200 barangays (the basic political units) of the city, is strategically located about 300 m from the Manila Domestic Airport. About 10 hectares of land in the barangay are devoted to the cultivation of lettuce, mustard, spinach, green onion, celery and pechay [bok choy]. Garden areas, which range from 50–300 plots of about 7 m², are established on unbuilt lots owned by the government.

The bulk of the report concentrates on the socioeconomic profile and production techniques of a farm manager, who was hired by a financier to oversee the day-to-day activities in the city farm. The farm area was initially 1.2 hectares, but a big part of it was cleared off in 1981 to make way for the construction of the Light Railway Transit (LRT) System terminal. The remaining 0.5 hectares of land is divided into more than 300 plots planted with various vegetables.

Basic workforce consists of the farm manager and four laborers who are paid on a weekly basis. The vegetables grown are based on early maturity, adaptability, high demand and good yield. Maintenance practices are regularly followed. Divisoria, a major wholesale/retail market in Manila, serves as the main outlet for the vegetables.

Some problems encountered on the farm are lack of irrigation water during the dry months, lack of government support in terms of technical needs, and the ever-looming threat of displacement of the farmers as the area becomes highly commercialized. Despite these constraints, vegetable production in the city is shown to be profitable.

Garcia, J. N. 2002. Urban agriculture in the Philippines: The case of three Metro Manila Projects. Unpublished B.S. thesis, Department of Agribusiness Management, College of Economics and Management, University of the Philippines, Los Baños, Philippines. 124 p. (13, 16)

Key words: urban agriculture, marketing, crop production, socioeconomic analysis, water

The study evaluates the production and marketing strategies of three vegetable farms established in two residential areas (Dasmariñas Village, Makati City and Greenfields I Subdivision, Brgy.

San Agustin, Quezon City) and a government hospital compound (Lung Center of the Philippines, Quezon City) in Metro Manila. The primary data was obtained through in-depth interviews with the key personnel of the city farms.

The report highlights the interesting contrasts and similarities among three urban agriculture projects. First, San Agustin farm is a local government initiative, which provides food and income for poor urban households. Second, the vegetable gardens at Dasmariñas Village are a premier subdivision developed by the Ayala Corporation, which were established primarily to beautify the residential area. Lastly, the hospital farm, aimed at supplementing the vegetable needs of its Dietary Department and making the routine work of the ground crew personnel more productive.

Farm sizes range from about 1,200 m² to 1,900 m². Multiple cropping is the common practice, utilizing several leafy and fruit vegetables. Farm inputs are sourced from a private agrochemical company or the Department of Agriculture Region 4. The vegetables produced for San Agustin are mainly sold to the barangay households. Dasmariñas Village's products are sold to its maintenance crew. The hospital farm products of the Lung Center of the Philippines are for the Dietary Department and hospital employees.

Watering is a problem on the three sites. Dasmariñas Village has watering constraints because of low water pressure and San Agustin lacks water, which is due to its own low water supply. The hospital farm project is beset by insufficient funds. Furthermore, pest and disease incidence are the most common problems encountered on the farms.

The study confirms the frequently reported socioeconomic benefits of urban agriculture. Future prospects for city garden initiatives vis-à-vis the current situation of urban agriculture in the Philippines are also presented.

Guanzon, Y. B. and R. J. Holmer. 2003. Basic cultural management practices for urban vegetable production in the Philippines. *Urban Agriculture Magazine* 10: 14–15. (7, 21)

Key words: farming styles, crop production, integrated crop management, wastewater

The report describes the various cultural management practices employed in the production of vegetables in an urban setting, with the City of Cagayan de Oro as a model example. Topics discussed include cultivar selection, methods of planting vegetable crops, soil management and fertilizers, water management and pest and disease management.

To fully support urban vegetable production, further research information is needed on the following: 1) improved vegetable varieties with adaptation to tropical lowland climates, pest and disease resistance, higher nutrition values and longer shelf life; 2) technologies for composting biodegradable wastes; 3) integrated crop management to minimize the application of chemical pesticides in densely populated areas; 4) efficient and economic irrigation systems which minimize water use, and 5) safe use of wastewater for irrigation.

Hardiyanto. 2003. Crop production system and level of toxic metals in urban agriculture areas in Las Piñas and Parañaque, Metro Manila, Philippines. Unpublished Ph.D. dissertation, Department of Horticulture, College of Agriculture, University of the Philippines Los Baños, Philippines. 158 p. (14)

Key words: crop production, leafy vegetables, marketing, heavy metals, environmental health

The nature of urban agriculture in the cities of Las Piñas and Parañaque, Metro Manila is characterized in terms of farmer socioeconomic profile, crop production, marketing systems, and levels of environmental pollutants. A total of 36 and 40 farmers, respectively, were surveyed from the urban farming areas in the BF Resort Village, Bgy. Talon Dos, Las Piñas, and in the Multinational Village, Bgy. Moonwalk, and Parañaque.

The intra-urban agri-enterprise mainly involves the commercial production and marketing of short-cycle leafy vegetable crops, utilizing vacant lots within a residential subdivision.

The average garden plot size per farmer is 1437 m² for Las Piñas, and 380 m² for Parañaque. Leafy vegetables such as pechay, mustard, lettuce, spring onion, and kinchay [Chinese celery] are the common crops grown. Pechay is the most popular crop in both farming sites. Crop cultivation and maintenance basically follows the traditional method. Water for irrigation is obtained from a nearby river and subdivision canals. About 70-90% of the farmers sell their produce directly to buyers who visit regularly them on the farm.

The concentrations of the toxic metals, lead (Pb) and cadmium (Cd), in pechay and soil and water samples are found to be below the standard limit, and thus, considered safe for human consumption. In contrast, the water used for irrigation shows high contamination of coliform bacteria, making it a potential hazard to humans.

The study also reveals that the annual net income of the urban farmers, from vegetable production, is not substantial but still above the poverty threshold per capita (US\$360 in 2000) in Metro Manila.

Pasion, C. Q. 2004. Vegetable production at the Bulaklakan at Gulayan community garden in Barangay Holy Spirit, Quezon City: An urban agriculture initiative. Unpublished B.S. thesis, Department of Horticulture, College of Agriculture, University of the Philippines Los Baños, Philippines. 69 p. (14)

Key words: low input agriculture, crop production, urban agriculture

The *Bulaklakan at Gulayan* community garden in Brgy. Holy Spirit, Quezon City, formally launched in 1998, is the first recipient of government support on urban agriculture under the Urban Agriculture Program of Department of Agriculture Region IV. The project aims to develop vacant lots into vegetable and ornamental gardens and to serve as a community showcase on city farming. The farm practice report presents an overview of the history and

municipal management of the model project and describes the different cultural practices involved in urban vegetable production. A profile of the farmers involved in the community garden is also given.

The urban community garden, with a total land area of 5,516 m², is built partly on government land and partly on a private residential subdivision. The site is equipped with ten plastic houses; three water-pump units, a small nursery area, a water reservoir, and a multipurpose hall. The project is under the management of the local government unit and is overseen by a hired farm supervisor.

No formal arrangements are made between the urban farmers and the local government in tilling of the garden plots. The urban farmers occupy a total of 1,558 m² of land, with each farmer cultivating a plot ranging in size from 30 m² to 1080 m². The farm supervisor and his assistant cultivate the remaining garden plots.

Pechay is the most common crop grown in the area. Other crops cultivated are mustard, camote [sweetpotato] tops, cauliflower, broccoli, cabbage, yardlong bean, corn and radish. Regular maintenance work includes weeding, fertilizer application and watering. Harvesting is usually done only when there are buyers visiting the farm. Almost all produce is sold to the barangay household members, while half of the farmers engage in crop production mainly to supplement household income.

Sazon, R. A. 1991. Vegetable production and management at Ikapati Farm, Diliman, Quezon City. Agriculture Unpublished B.S. thesis, Department of Horticulture, College of Agriculture, University of the Philippines Los Baños, Philippines. 135 p. (14)

Key words: crop production, marketing, farming systems, vegetables

This major practice report (thesis) documents vegetable production and management at Ikapati Farm, right in the heart of Quezon City, the biggest city of Metro Manila. It is the only farm in the country that adheres to the principles and practices of biodynamic farming; developed by the European scholar and philosopher Rudolf Steiner.

The Ikapati Farm occupies 3 hectares of land leased from the University of the Philippines, Diliman. Mr. Nicanor Perlas, a noted writer and strong advocate of biodynamic farming, established it in 1989 as a private agribusiness enterprise.

Production operations are undertaken within the four-fold principle of sustainable agriculture known as SAFE (sustainability, availability of inputs, feasibility in terms of capital and ecological soundness). The uniqueness of the farm lies in its adherence to the time of sowing seeds based on a biodynamic sowing calendar, which takes into account the working balance between terrestrial energies and man's management of the environment. Leafy and fruit vegetables; legumes, culinary herbs, root crops and rice are the crops cultivated in the farm. Farm-produced compost and chicken manure are utilized to condition and enhance the fertility of the soil. Pests and diseases are controlled using nets, plastic covers and by spraying biodynamic

preparations. Water for irrigation is sourced from a local water supplier and rainwater collected in man-made ponds.

The harvested products are either delivered directly to customers or displayed in the farm store for walk-in buyers. The Makati Garden Club is a major outlet of the farm. Several fast-food establishments and restaurants in Metro Manila are regular clients. Training activities related to biodynamic farming are also regularly held in the farm.

The report shows the feasibility of establishing both a sustainable and a profitable farming venture in the city.

Undan, R. C., P. S. Nitural, A. S. Roque, and D. V. Liban. 2002. *Urban Agriculture: A step-by-step guide to successful container farming in the city*. Quezon City, Philippines: Foresight Books Publishing and Distributing Co., Inc. 55 p. (1)

Key words: low input agriculture, crop production, farming styles

The book is based on the urban agriculture model developed by Central Luzon State University in the Science City of Muñoz, Nueva Ecija. It focuses mainly on the utilization of various types of containers for use in the production of vegetables and other food plants.

The handy popular guide caters primarily to interested growers and hobbyist who have little background on horticultural crop production and, at the same time, desire to maximize the use of limited space available in urban areas. For easy reference, the book is conveniently divided into five chapters. Chapter I provides a brief introduction to container farming and its advantages. Chapter II tackles the aspect of planning the container farm – selecting the appropriate site, choosing the type of plant to grow and preparation of compost and soil mixtures. Examples of crops that can be grown in containers are the leafy vegetables, root or bulb crops, legumes, fruit vegetables (tomatoes, eggplants, okra) vine fruits (squash, cucumber, bitter gourd), tree vegetables (horseradish, sesban), herbal plants and mushrooms. Chapter III considers various practical tips in choosing containers, sourcing and planting of vegetable seeds, watering, fertilizer application, control of pest and diseases, and harvesting. Chapter IV is devoted to a picture gallery of landscapes using food crops in containers. The last chapter is a short discussion of a framework for an urban agribusiness model.

LIVESTOCK AND FISH-RAISING

Caperiña, M. J. C. 1997. Profitability analysis of gamecock raising in Metro Manila, 1996. Unpublished B.S. thesis, Department of Agricultural Economics, College of Economics and Management, University of the Philippines Los Baños, Philippines. 55 p. (13, 16)

Key words: animal production, income, socioeconomic analysis

The study evaluates the profitability of gamecock rearing in Metro Manila. Specifically, it describes the management practices adopted by gamecock raisers; compares the profitability of small-and large-scale operations; identifies the constraints that beset gamecock rearing and suggests viable solutions to these problems.

Primary data was collected through personal interviews with 30 gamecock raisers in seven cities (Caloocan, Las Piñas, Makati, Marikina, Muntinlupa, Pasig and Quezon City) and one municipality (Malabon) of Metro Manila. Descriptive method of analysis was used in characterizing the management practices employed by the gamecock raisers. Cost and return analysis was done to compare the profitability of small-scale (less than 100 gamecocks) and large- scale (more than 100 gamecocks) operations.

Management practices analyzed indicated feeding and watering, deworming, delousing, dubbing, housing and treatment of diseases. Feeding is done twice a day. Dubbing, trimming or removing of the comb and wattle of a gamecock, is primarily done to lessen the unnecessary weight on the gamecock's head, which is an advantage during actual cockfights. Gamecocks are confined to different types of houses depending upon the stage of training.

The operation of both small- and large-scale farms was found to be highly profitable; the former, however, generated more income than the latter.

The major problems encountered in gamecock rearing are: high cost of investment, high cost of promotion and occurrence of bad weather. Recommendations given by the author to mitigate these problems include: 1) strict implementation of vaccination programs to anticipate illnesses brought on by sudden change in climatic conditions, 2) provision of high quality infrastructures and gamecock feeds, and 3) a more aggressive marketing of their produce.

De Leon, G. T. 1982. Economics of Vermiculture in Metro Manila. Unpublished B.S. thesis, Department of Agricultural Economics, College of Economics and Management, University of the Philippines Los Baños, Philippines. 49 p. (13, 16).

Key words: vermiculture, marketing, income

The study assesses the economic viability of earthworm farming or vermiculture as an agribusiness. Primary data regarding the nature of the earthworm farmers and their production and marketing practices were gathered through personal interviews with 13 earthworm growers

in the following cities of Metro Manila: Las Piñas, Makati, Mandaluyong, Manila, Marikina, Pasay, Pasig, Parañaque and Quezon City. The profitability of vermiculture was determined through cost and return analysis.

The study provides a good characterization of the earthworm growers. The results show that most of them are male; all are married, of middle age and with substantial formal education. Who have been involved with vermiculture for one year or less, utilizing an average production area of 103 m². Depending on the volume of earthworm stocks, the farms are classified as small-scale (300 kg or less) and medium-scale (> 300 kg but < 800 kg). Vermiculture is not the main source of income for the growers. Only one species of earthworm, *Pheretima asiatica*, is used.

A description of the various practices involved in vermiculture, aided by photographs, is an important component of the study. Practices such as preparation of beddings, feeds, earthworm boxes, watering, feeding, cultivating and harvesting are provided in detail. Earthworms are mainly sold to earthworm breeders while castings are sold to garden owners.

Market promotions include the use of classified advertisements, billboards and giving free lectures. A detailed computation of the labor requirement, capital investment and net returns shows that earthworm farming is fairly profitable. Aside from the problem of irregular markets, the study also notes that the high cost of producing earthworms, particularly in terms of feedstuff, can be a major deterrent to new entrants to the industry. The need for government intervention in research and development related to production and marketing is suggested.

ENVIRONMENTAL AND HUMAN HEALTH

Ajero, M. Y. 2002. Future emissions of Metro Manila. Proceedings of IGES/APN Mega-City Project, January 23–25. Japan: Institute for Global Environmental Strategies. (22)

Key words: environmental health, air pollutants, indicators,

Metro Manila is one of the mega cities in Asia challenged with problems of air pollution and greenhouse gas (GHG) emissions. A rapidly increasing population intensifies the consumption of energy, the demand for transportation and multiplies waste generation, consequently increasing concentrations of air pollutants and GHGs in the atmosphere. This paper reports on the projected emissions of GHGs and other pollutants from Metro Manila, for the year 2020, based on emission patterns of the city established by data covering the years 1980, 1990, 1995 and 2000. Sources covered are electricity consumption, road transport and solid waste.

Consumption of electrical energy has been increasing in past decades for residential and commercial/institutional use. In 2020 the projected consumption of the residential sector is expected to triple the 2000 consumption level due to increased dependence on electrical appliances and a shift from traditional mechanical to electrical mechanisms. By 2020 CO₂ emissions from electricity consumption by all sectors is projected at 24,140 Gg (giga grams), as much as 45% of the total being residential.

The projected emission increase in 2020 particularly from transport is expected to be three to five times the values for 2000, with the highest increase for total solid particles. Consequently, the value of methane released from solid waste is predicted to almost triple within a similar span of years.

Among the three sources of GHG emissions, transportation will continue to contribute more than half. From 2000 to 2020, the share of emissions from transportation will continue to increase while that of both electricity and solid waste is expected to decrease. Also, the average annual growth rate for CO₂ emissions is about 7% from the transportation sector and close to 5% from each the electricity and the solid waste sectors.

The 2020 projections assume a condition where no mitigation options and efficiency alternatives are implemented.

De la Cruz, M. E. 2003. Cadmium and lead contents of vegetables and soils in urban farms utilizing subdivision wastewater and creek water for irrigation. Unpublished B.S. thesis, Institute of Chemistry, College of Arts and Sciences, University of the Philippines Los Baños, Philippines. 64 p. (13, 15)

Key words: heavy metals, vegetables, urban agriculture

This is one of the few studies that examined the levels of the toxic metals lead and cadmium in the vegetable crops upland kangkong (*Ipomea aquatica* Forsk.), saluyot (*Corchorus acutangulus* Lam.) and pechay (*Brassica chinensis* L.) grown commercially in small farms in North Fairview and Diliman, Quezon City. Analysis of the toxic metals in plant and soil samples was done using flame atomic absorption spectrophotometry.

The presence of the toxic metals depends upon the type of crop, farm site and post-harvest washing. All vegetable samples are contaminated with lead and in some cases simple washing can reduce this. Based on unwashed samples, no significant difference in the amount of lead is detected in the vegetable crops grown in each farm site. Cadmium is also detected in all plant samples except for kangkong, grown in North Fairview, and washed pechay in Diliman. A discussion on plant attributes is provided to account for the differential accumulation of the heavy metals by vegetable crops.

Higher levels of lead and cadmium in the vegetable samples, and cadmium in soil samples are recorded in Diliman compared to North Fairview. The Diliman farms are located near three major city roads, and are therefore more exposed to vehicular emissions of Pb. The farms in North Fairview are established inside a residential area. Cd contamination is suggested to come from fertilizer application, pesticide spraying and use of wastewater.

Based on international standards, the levels of Pb exceed the maximum allowable limit (MAL) set by the Agency for Toxic Substances and Disease Registry (ATSDR, 1.0 ppm), but not by the Environmental Protection Agency (EPA, 4.0 ppm). Cd levels are still below the MAL set by ATSDR (1.0 ppm) and by the Australian National Health and Medical Research Council (0.5 ppm).

Estoque, M. A. and M. Sta. Maria. 2000. Climate changes due to the urbanization of Metro Manila. Manila. *Observatory Scientific Report No. 3*, June. Manila Observatory, Ateneo de Manila, Philippines. 11 p. (8, 23)

Key words: environmental health, urbanization, environmental exposure

The report describes the effects of urbanization of Metro Manila on temperature and rainfall in the city using primary observational data monitored at two stations; Port Area, a coastal station located at the edge of the metropolis, and Science Garden, an inland station about 10 km northeast of Port Area.

A significant trend in rising temperatures at both stations is observed, with an increase of about 1°C during the 35-year observational period. This rate of warming is equivalent to about 3°C in 100 years, which is approximately 10 times that of the estimated average rate of warming for the entire globe. In contrast, analysis of corresponding temperature observations during the same period for two rural stations shows no systematic temperature trend, suggesting that the warming trend at both Port Area and Science Garden is due to the urbanization of the Metro Manila area. Data on temperature and rainfall are analyzed from the period of 1961 to 1997.

The study indicates only a slight effect of urbanization on rainfall over Metro Manila. The effect occurs primarily outside the metropolis, along the downwind direction according to the prevailing wind, primarily over regions north of the city.

Some socioeconomic implications of urban climate change are also presented. It is predicted that the excessively high temperatures due to urban heat island will increase morbidity and loss of productivity, especially in the poor districts of the city. No adverse effect of rainfall brought about by urbanization is expected to occur over the city per se; the additional rains, however, may even benefit the vast farmlands north of Metro Manila. To minimize the damaging effects of urbanization, the authors suggest incorporating information derived from climatological investigations such as those provided in the paper for proper urban planning.

Estoque, M. A., R. T. F. Balmori, and G. R. H. Lorenzo. 2003. A study of NO₂ observations at the Manila Observatory Quezon City, (Philippines). *Manila Observatory Scientific Paper No. 11*, July. Manila Observatory, Ateneo de Manila. 15 p. (8, 24)

Key words: air pollutants, ecosystem health, indicators

Nitrogen dioxide (NO₂), which results from vehicular emissions, is an important air pollutant in urban areas. It is known to induce many types of respiratory diseases, produce destructive effects on vegetation and accelerate the corrosion of metals. In order to determine the characteristics of the time variations of the pollutant, observations of NO₂ at the Manila Observatory, in the Ateneo de Manila Campus, Quezon City, were analyzed using Differential Optical Absorption Spectroscopy during the months of June and August, 2002.

The analysis shows that the average concentration in August is greater than that of June. Based on all observations, the average variation during a 24-hr period is characteristically semidiurnal, with maximum levels occurring in the morning as well as in the evening. The evening maximum is higher than the morning maximum by about 30%. Day-to-day variations indicate the occurrence of four types of diurnal changes: Type 1 – major maximum in the evening and a minor or negligible morning maximum; Type 2 – only one maximum which occurs near noontime; Type 3 – major morning maximum and insignificant or minor evening maximum, and Type 4 – low concentrations without any significant maximum or minimum throughout the 24-hr period.

These variations have been hypothesized to be due basically to large-scale prevailing atmospheric conditions, which control the development of different types of mesoscale disturbances, such as sea breezes and mountain-generated wind. In turn, these mesoscale disturbances generate the occurrences of the different types of diurnal fluctuations in NO₂ levels. Unfortunately, the current lack of meteorological data has hindered the researchers from verifying their hypothesis. They suggested, however, the application of an atmospheric model to test the hypothesis theoretically. The model should include an equation, which predicts the concentration of NO₂ in terms of physical processes involving transport, diffusion, sources and a sink (an area or site where substances are finally deposited).

Grifal, R. B., E. D. Ayo, and R. P. Ulibas. 1997. Status of heavy metal concentrations in soils and plants of Metro Manila and neighboring provinces. Paper presented at 9th National Research Symposium. Bureau of Soils and Water Management, Diliman, Quezon City, Philippines. April 6–7. 42 p. (3)

Key words: heavy metals, environmental health, vegetables, pollutants

This paper reports on the level of heavy metals in soils and plant materials collected from various sites in Metro Manila and the neighboring provinces of Laguna, Cavite, Rizal and Bulacan. Analysis of heavy metals was done using atomic absorption spectrophotometer.

The heavy metals that are found to exceed the critical limit for soil obtained from different sampling sites include: lead – Metro Manila (Quezon City); cadmium – Laguna (Los Baños); nickel – Metro Manila (Quezon City, Pasig and Marikina), and Bulacan (Hagonoy and Calumpit) and copper – Metro Manila (Quezon City), Laguna (Los Baños, Biñan, Sta. Rosa and Calamba), Cavite (Silang and Tanza) and Bulacan (Pililla).

Some plants were observed to be accumulators of certain heavy metals: spinach (Pb, Cd and Ni), pechay (Pb and Cd), mustard (Pb), tomato (Cd and Cu), sambong (Pb and Cu), stringbeans (Ni) and kangkong (Cu). The levels of these heavy metals range from 0.6 ppm to 48 ppm.

The levels of cobalt (Co), zinc (Zn) and chromium (Cr) in both soil and plant samples collected are all below the critical limit.

Air pollution (specifically from vehicle emissions), heavy application of inorganic and organic fertilizers, and industrial effluents have been identified as significant sources of heavy metal pollutants. Soil properties such as pH, organic matter, and amount and type of clay minerals are shown to influence the solubility and levels of these heavy metals in the soil.

The authors suggest the need to 1) regularly monitor agricultural soils for heavy metal content, particularly in areas suspected of being polluted, 2) educate farmers on good agricultural practices particularly in terms of fertilizer and pesticide usage, and 3) strictly implement proper waste treatment and disposal of industrial effluents.

Holmer, R. J., L. G. Janubas, G. E. Potutan, and W. H. Schnitzler. 2001. Pest management strategies of peri-urban vegetable growers in Cagayan de Oro City. Paper presented at the 13th NOMCARRD Regional Symposium on R & D Highlights, Farmers'/Investors' Forum and Media Conference, Aug. 9–11. NOMIARC, Dalwangan, Malaybalay City, Philippines. 20 p. (19)

Key words: integrated crop management, crop production, environmental health

Peri-urban vegetable production offers affordable, nutritious foods for the growing urban population and addresses the increasing problem of micronutrient deficiency among children and women. These opportunities, however, are constrained by the perceived indiscriminate

application of pesticides, particularly in relation to hazards to human health and environment. For the Peri-urban Vegetable Project of Xavier University College of Agriculture, funded by the INCO-DC program of the European Union, a survey was conducted on the pest management strategies of 100 randomly selected vegetable farmers in Cagayan de Oro City.

Several important insights on pest management practices are reported in the paper. More than 80% of the farmer respondents used chemical pesticides in their last three croppings. About 40% employ mechanical control measures and the use of natural substances such as soap solution. The majority of the farmers apply insecticides and fungicides about 5 times each per crop, herbicides 2–4 times, while mechanical and natural control 2–5 times. Almost all pesticide applicators use a backpack for spraying. Although 92% use protective measures when applying pesticides, only one or two safety measures are utilized. Almost half of the pesticide applicators reported being ill the last time they sprayed. The top three symptoms experienced include headache (38%), nausea (21%), and chest pain (13%).

Of the 24% who have heard of the integrated pest management (IPM) program, only 13% received training in it. One third of those trained changed their pesticide practices, using less toxic products with better effects on pest control.

The authors recommend undertaking more research on the following aspects: 1) ways to make natural control measures more competitive than application of synthetic pesticides, 2) the use of vegetable varieties resistant to pests and diseases and 3) improvement of fertilization and irrigation practices to produce healthy crops.

Uriarte, M. T. 1996. Air pollution-resistant plant species recommended for urban areas. Techno-Info Series. Environment Research and Development Services, Department of Environment and Natural Resources – National Capital Region, Quezon City, Philippines. Vol. 4, Nos. 1, 2, and 3. (4, 5)

Key words: air pollutants, agroforestry, ecosystem health, diffusion

The report is a three-part technology information series describing plants with varying degrees of resistance to air pollution. It is based on a 1979 study by the Department of Environment and Natural Resources on the uptake of air pollutants by local plants.

Volume 4, No. 1 of the series features the following plants classified as highly resistant: *Nerium indicum* Mill., *Spathodea campanulata* Beauv., *Canna indica* L., *Bougainvillea spectabilis* Wild., *Areca catechu* L., *Caesalpinia pulcherrima* (L.) Sw., *Thevetia peruviana* (Pers.) Merr., *Leucaena leucocephala* (Lam.) de Wit, *Aleurites moluccana* (L.) Willd., *Coleus blumei* Benth., *Vitex parviflora* A. Juss., *Albizia falcataria* (L.) Nielsen, *Pandanus odoratissimus* L., *Codiaeum variegatum* (L.) Blume, *Catharanthus roseus* (L.) G. Don., *Allamanda cathartica* L., *Gmelina arborea* L. and *Pedilanthus tithymaloides* (L.) Poit.

Species that are moderately resistant are described in Volume 4, No. 2. These include: *Samanea saman* (Jacq.) Merr., *Cynometra ramiflora* L., *Cordyline terminalis* L., *Acalypha wilkesiana*

Muell-Arg., *Annona muricata* L., *Diospyros philippensis* (Desr.) Burke, *Pisonia grandis* Span., *Pterocarpus indicus* Willd., *Cassia nodosa* L., *Calophyllum inophyllum* L., *Triplaris cumingiana* Fisch and Mev., *Euphorbia pulcherrima* Willd. and *Ficus elastica*.

The last series, Volume 4, No.3, lists the plants that are sensitive to pollution such as: *Bauhinia malabarica* (Roxb.), *Ficus benjamina*, *Psidium guajava* L., *Barringtonia asiatica* L. Kurz., *Chrysophyllum cainito* L., *Ricinus communis* L., *Lantana camara* L., *Erythrina orientalis* (L.) Merr., *Dieffenbachia picta* (Lodd.) Schott., *Plumbago auriculata* (Thumb.), *Cassia fistula* L., *Hibiscus rosasinensis* L., *Anthocephalus chinensis* (Lam.) Rich ex Walph, *Gliricidia sepium* (Jacq.) Walp., *Swietenia macrophylla* King, *Mangifera indica* L., *Polyscias ornatum* Bull. Merr., *Canarium ovatum* Engl., *Ixora chinensis* Lam., *Terminalia catappa* L. and *Cassia fruticosa* Mill.

Each plant entry gives information on its common name, local name, scientific name, family name, morphology, propagation/distribution and uses.

The semi-technical discussion serves as a good reference guide for students, practioners of urban agriculture and forestry, and urban landscape horticulturists.

FOOD SECURITY AND NUTRITION

Boncodin, R., D. Campilan, and G. Prain. 2000. Dynamics in Tropical Home Gardens. *Urban Agriculture Magazine* 1(1): 19-20. (7, 25)

Key words: homegarden, biodiversity, eco system health, food security, human nutrition

Home gardens are small areas of cultivated land immediately surrounding a homestead. Most initiatives to support and promote home gardens are directed towards improving household income, food production and family nutrition. Less attention is drawn to exploring inherent diversity within home gardens, and assessing its contribution to the achievement of multiple functions.

The article presents the findings of the International Potato Centre (CIP)-sponsored Users' Perspectives with Agricultural Research and Development (UPWARD) study in 1994 aimed at examining biodiversity issues in home gardens, and their links to household strategies for food security and family nutrition. Lantapan served as the project site, which is part of the Manupali watershed in Mindanao.

Results of the study indicate that home garden diversity varies with the three distinct agroecological zones of the watershed, with more plant species in the upper (1500-1800 m above sea level [asl]) and lower (below 700 m asl) zones than in the middle (700-1500 m asl) zone. Perennials dominate the two lower zones, while mostly annual vegetables and ornamentals proliferate in the upper ecological zone.

Annual crops for utilitarian goals dominate home gardens of farmers from lower economic strata, while those tended by persons of higher economic status are mostly perennials using primarily for aesthetic purposes. Home gardens contribute 14% of the household daily food intake cost, representing 22% of the household daily wage. Contribution increases to almost 50% among those in the lower-income group. Crop diversity decreases during the dry months and increases in the wet months.

The study offers significant research opportunities for exploring ways to improve and consolidate these complementary functions of home gardens in overall household management.

Florentino, R. F., G. M. Villavieja, T. E. Valerio, F. F. Escano, and B. E. Raymundo. 1989. Food and nutrition problems of urban centers: Metro Manila as a case study. Food and Nutrition Research Institute, Department of Science and Technology. 32 p. (6)

Key words: urbanization, crop production, food consumption, human nutrition

The study was undertaken by the Food and Nutrition Research Institute (FNRI) to determine the effects of urbanization on food supply and demand and nutritional problems of urban centers,

particularly Metro Manila. Data were taken mainly from past FNRI nutrition surveys, secondary information from other agencies and available relevant literature.

Metro Manila draws inordinately large amounts of its food supply from the rest of the country, resulting to an urban bias due to bigger demand capacity, higher income level, and fast growing population in the metropolis.

The diet pattern in Metro Manila is characterized by higher consumption of various types of food products. In spite of this, the average diet in Metro Manila is still inadequate. The major nutritional problem is protein-energy malnutrition, with the lowest income quartile of households as the most affected. In 1987, this bottom-income group had a per capita food energy intake of merely 1410 kilocalories (71.1% adequate) and protein intake of 39.3 grams (79.4% adequate). Among pre-school children in the same category, 4.2% were suffering from chronic malnutrition, 15.5% from acute malnutrition, and 19.7% from simple stunting. Prevalence of anemia was 33.9%, thiamine deficiency, 25.3%, and riboflavin deficiency, 16.1%.

With increasing urbanization, the food pattern in Metro Manila will continue to change to more popular and western-type convenience foods. Economic factors such as income and prices are expected to have bigger impact on nutritional status than urbanization per se.

Recommendations to improve the level of food supply and demand and nutrition in an urban center like Metro Manila include: 1) the integration of nutritional objectives into urban development plans, and 2) setting in place a balanced development strategy for *both* urban and rural sectors vis-à-vis the growing urbanization, migration from the rural areas, and the resulting pressure on physico-economic resources in both sectors.

Ramirez, M. A. R. M. and C. V. C. Barba. 2002. Vegetable gardens and nutrition in SSS Gardens, Barangay Pinyahan, Diliman, Quezon City. *Journal of Nutrition* 49 (3-4): 38-53. (6, 12)

Key words: human nutrition, food consumption, homegarden, marketing

The nutritional and economic contributions of vegetable gardening activities in terms of purpose of 14 market-directed and 8 home-oriented gardening households in SSS Gardens, Barangay Pinyahan, Diliman, Quezon City were examined from January through May 1994 using the case study approach. Nutritional contribution of gardens in terms of mean one-day per capita nutrient adequacy by source was determined. Three-day records of household food consumption using a modified 24-hour recall of foods consumed, a one-month record of vegetable consumption sourced from the household's own gardens, one-week household food expenditure and one-month household income served as primary sources of data. Cost and returns analysis of vegetable production was done to measure the profitability of the activity.

Overall, food security was more assured among market-directed gardeners than their home-oriented counterparts. Mean one-day per capita nutrient intake from home grown produce was higher among market-directed than home-oriented gardening households where differences were

found to be statistically significant for protein, calcium, thiamin, riboflavin and ascorbic acid. While market gardens have the potential to supply as much as 51.1% of requirements for vitamin A and 36% for ascorbic acid among market-directed gardeners, home gardens supplied only 13.5% of requirements for vitamin A and less than 5% for the other nutrients.

Cost and returns analysis showed that large market-directed gardening households earned a net income of PhP 7,015.97 above cash cost over a 5-month period, while small market-directed gardening households earned an estimated PhP 4,783.22, but yielded negative returns when computed over total cash cost, reflecting opportunity cost of labor and other self-owned resources.

Policy and programmatic implications and recommendations are put forward.

URBAN GREENING/FORESTRY

Dela Cruz, J.F. 2003. Health status of trees and other plants with emphasis on pathological problems at the Ninoy Aquino Parks and Wildlife Nature Center. Unpublished B.S. thesis, Department of Forest Biological Sciences, College of Forestry and Natural Resources, University of the Philippines Los Baños, Philippines. 77 p. (17)

Key words: urban parks/forestry, agroforestry, ecosystem health

The Ninoy Aquino Parks and Wildlife Nature Center (NAPWNC), a recreational park with a natural forest setting, is strategically located at the heart of Quezon City, the largest city in Metro Manila. In recent years the vegetation in the park has been showing signs of deterioration, which can be attributed to a host of confluent factors. The practicum report focuses on the assessment of the condition of plants, with emphasis on trees, at the NAPWNC, particularly in relation to disease occurrence.

The study site was limited to two areas of the park, the Mini-Forest and the Park Center, which cover a total of 1.5 ha. Plant evaluation was done through ocular inspection and measurement of some tree biometrics.

A total of 353 trees, belonging to 15 families, can be found in the site. The dominant trees are narra, mahogany, palosanto, raintree and gmelina. The health condition of 40% of the trees is rated good; 36%, fair; 20%, poor and 4%, dying. Results of the disease diagnosis reveal that about 60% of the trees are infected with fungal diseases.

An important component of the report is the series of photographs of priority trees with diseases, together with information on the volume of tree defect, recommended treatment (from tree surgery to total replacement) and cost of rehabilitation. The author also points to some of the problems that have aggravated the current condition of the tree; soil compaction, vandalism, presence of informal settlers at the periphery of the park, presence of over 100 mounds of termites, which are potential agents for the spread of diseases, and insufficient government funds for tree maintenance. The data generated is a useful index in the restoration and rehabilitation of the trees in the recreational park.

Ebora, J.B. 1997. Valuing the economic benefits of urban forestry in selected cities and municipalities in Metro Manila. Unpublished M.S. thesis, Department of Forest Resources Management, College of Forestry and Natural Resources, University of the Philippines Los Baños, Philippines. 161 p. (17)

Key words: income, agroforestry, methods

The study estimates the economic benefits of urban forestry in Pasay City, San Juan, Quezon City, Manila and Parañaque, Metro Manila. Primary data were gathered from a total of 586 respondents in the target sites. Estimates of the benefits of urban forestry were accomplished

using the contingent valuation method (CVM), where respondents are asked, through a structured questionnaire, how they will react to certain hypothetical situations. In this case, the respondents willingness to pay (WTP) for a benefit was assessed from four hypothetical conditions: 1) a private trust fund is created to ensure the provision of urban forestry services; 2) the urban forestry situation improves with a private trust fund; 3) people are obliged and able to contribute for the improvement of urban forestry; and 4) concerned government agencies shall create a common fund where everybody must contribute. Descriptive statistical tools and stepwise multiple linear and logit regressions were used in the analysis.

The paper reveals a high level of awareness of the respondents on the importance of urban forestry. The results show that WTP values are influenced positively by income, personal expenditures, proximity of houses to urban forests, time spent by individuals outside houses/buildings and commuting to and from places of work. Age and years of formal education affect WTP negatively. Respondents are willing to pay more for the benefit if they are obliged to and capable of paying.

The report identifies also the key concerns that need to be addressed: more tangible results of greening projects, information and education campaign, and direct involvement of the people in greening activities.

Morales, A. B. G. 2003. Survival growth and performance of knife acacia (*Acacia auriculiformis* A. Cunn. Ex. Benth.) on overfilled median islands of Sucat Road, Parañaque City and Metro Manila. Unpublished B.S. thesis, Institute of Renewable Natural Resources, College of Forestry and Natural Resources, University of the Philippines Los Baños, Philippines. 40 p. (16)

Key words: ecosystem health, agroforestry, air pollutants

Overfilling, the piling of soil and other filling materials above and around the root collar of trees, is commonly observed on landscape plants growing in median islands in some roads of Metro Manila. This practice has been reported to adversely affect the growth and development of trees because of decreased root aeration, build-up of CO₂ and toxic gases in the rhizosphere and improper growth of lateral roots. There is no information available regarding the effect of overfilling on *Acacia auriculiformis*, a popular ornamental tree in Metro Manila; hence, this particular research work.

The study examines and compares the survival, growth and performance of *A. auriculiformis* in overfilled and non-filled median islands in two sites in Metro Manila: the Sucat Road in Parañaque city, and the Meralco Avenue and Ortigas Avenue in Pasig city. The biophysical environment of both sites and the area of planting and the type of filling materials used were, also, assessed. Descriptive analysis, as well as simple inferential statistics, was used to evaluate the results.

Pollution levels in both sites are found to be high but still within tolerable limits. The soil samples are generally sandy in character, with higher organic matter and N content in overfilled

samples. Garden soil and soil from construction sites are used for overfilling purposes. Growth and performance of the trees in overfilled and non-filled median islands are, however, similar. This suggests the tolerance of *A. auriculiformis* to overfilling and possibly the adverse conditions present in the target sites.

Moriwake, N., A. M. Palijon, and K. Takeuchi. 2002. Distribution and structure of urban green spaces in Metro Manila. In *Metro Manila: In search of a sustainable future. Impact analysis of Metropolitan policies for development and environmental conservation*, ed. T. Ohmachi and E. R. Roman, 185–198. Diliman, Quezon City (Philippines): University of the Philippines Press. (10)

Key words: land use, agroforestry, urbanization, legumes

Much of the existing green spaces in and around cities are diminishing due to urbanization. It is critical, therefore, to establish policies that promote conservation and creation of green spaces based on a thorough understanding of the urbanization process. It is within this context that a field vegetation survey of the vertical structure and species composition of green spaces in Metro Manila was conducted based on six major land-use types: high-and low-density residential areas; commercial areas; industrial areas; parks and areas of urban-rural mixture. Land-use GIS data and land-cover data from satellite images were used to calculate green cover-pixel ratio for each land-use type.

The results revealed that the green-cover ratio, an indicator of spatial quantity of greenery, exceeds 20% in low-density areas and parks, and less than 10% in the rest of the land-use types examined. A similar trend observed for a numbers of trees. Species diversity in low-density residential areas is higher than the average observed in most sites. Little species diversity is observed in both commercial and industrial areas. The average tree height in commercial areas is higher than the average tree height over all sites, suggesting that green space is spread vertically in this type of land-use. Fruit and ornamental species predominate in both types of residential areas, while shade plants and ornamentals are more popular in commercial areas. Over 55% of fruit species made-up the total sample in the mixture of urban-rural areas. Although the results for industrial areas are varied and unclear, the proportion of shade species is relatively high compared with those in other land-use types.

The study gives useful insights into comprehensive landscape planning in relation to urban green space distribution in Metro Manila. It highlights the inappropriateness of uniform landscape planning and the need to apply different planning policies to well-planned urbanized areas.

Ono, K., A. Meguro, and K. Iiyama, 2002. Carbon circulation and functions for the development of urban green spaces in Metro Manila. In *Metro Manila: In search of a sustainable future. Impact analysis of Metropolitan policies for development and environmental conservation*, ed. T. Ohmachi, and E. R. Roman, 199-210. Diliman, Quezon City (Philippines): University of the Philippines Press. (10)

Key words: environmental health, air pollutants, land use

Global warming caused by the increase in emission of greenhouse gases such as CO₂ is a worldwide problem. Vegetation plays an important role in CO₂ sequestration because it fixes CO₂ in cell walls from the atmosphere through photosynthesis. Urban green spaces are expected to have such a function, but the way to estimate the ability of CO₂ sequestration by urban vegetation has not yet been established. This study determines the amount of CO₂ sequestered by green spaces in an urban area with Metro Manila as the experimental site. Emission of CO₂ in Metro Manila was estimated using the data from the Greenhouse Gas Inventory Project of the Manila Observatory. Gross CO₂ fixation in the metropolis was calculated using data on the vegetation cover area of various land-use types and the amount of CO₂ taken up by each vegetation type. The rates of CO₂ uptake by vegetation in woody, grassland and agricultural land are assumed to be 12, 10 and 12 t CO₂ /ha/year. Net CO₂ fixation, on the other hand, was computed by multiplying gross CO₂ fixation by biodegradation ratio (the ratio of recalcitrant remains against biodegradation). Ratios utilized are 85%, 88% and 99% for wood, grass and agricultural crops, respectively.

The findings reveal that vegetation in Metro Manila sequesters about 29×10^3 t of CO₂ annually on condition that vegetation is kept stable. This value is only about 0.2% of emitted CO₂ from Metro Manila (14.5×10^6 t CO₂/year). Even if the total area of Metro Manila is covered with forest, only 0.8% of CO₂ emission from the metropolis could be sequestered. In Metro Manila, therefore, urban vegetation, which is assumed to be a critical factor in the management of urban green space, plays a negligible role in CO₂ sequestration.

Palijon, A. M. 2001. A Strategy for the Enhancement and Rehabilitation of Green Spaces in Metro Manila. Metro Manila Commission Professorial Lecture presented June 29, 2001 at the Operations Room, College of Forestry and Natural Resources, University of the Philippines Los Baños, Philippines. 33 p. (18)

Key words: land use, natural resource management, environmental health

The state of Metro Manila's green spaces warrants the search for a holistic and sustainable enhancement and rehabilitation strategy. A system approach to appraise and analyze the interacting biophysical, social, economic, political and institutional conditions that are directly or indirectly influencing the health of the green spaces can provide mechanisms necessary to conscientiously determine the real issues and concerns. The paper presents a framework for this type of analysis. The case of the major thoroughfares, specifically the gateway to the Philippines, that is, from Ninoy Aquino International Airport (NAIA) to the mouth of Pasig River via Roxas Boulevard, is used for the analysis.

The use of the framework has helped to generate sufficient information to characterize the existing situations of the green spaces and in drawing the issues and concerns. On the basis of the results of the analysis, the paper recommends a framework to achieve an ideal level of sustainable green space management. It includes various institutional, social, political and

biophysical programs designed to address the issues and concerns identified, which will need multidisciplinary and multisectoral involvement.

Palijon, A. M. 2000. Urban forestry: an approach to environmental enhancement in the Philippines. Metro Manila Professorial lecture presented June 23, 2000 at the Operations Room, College of Forestry and Natural Resources, University of the Philippines Los Baños, Philippines. 31 p. (18)

Key words: agroforestry, land use, policy,

Urban forestry (UF) is an emerging science and art in the field of resource management, which deals specifically with the management of urban vegetation systems aimed at enhancing the environment for the physiological and socioeconomic wellbeing of the society.

The paper discusses a number of UF policies and programs that have been formulated and implemented by the Philippine government. Policies include establishment of permanent city/municipal forests; tree parks and watersheds; greening of private lands; nonconversion of green space into other uses; and penalizing the cutting and destroying of trees and other plants in any public green spaces.

Local government units (LGUs) have also initiated their own greening programs to make their city a showcase of clean, green and wholesome urban environment. Greening offices have been created and ordinances have been formulated to implement more effectively greening and other environmental activities.

Implementation of greening programs is faced with some constraints like vandalism, lack of resources, unsustained support, encroachment/squatting and conversion of green spaces into other uses.

Existing national greening policies and programs must be fully implemented. A permanent institutional body with a well-defined organizational structure and sufficient appropriations needs to be installed to implement a holistic UF program. The capabilities of LGU greening offices must be developed to improve green space management. Local legislation must be aggressive in formulating tree ordinances and allocating funds for greening. A systematic education and information program must also be carried out to engender a more participatory UF program.

Research areas that need to be studied include inventory and mapping of UF resources; urban ecology; environmental and socioeconomic values of urban forest; cultural management practices, and policies, local ordinances and organizational strategies.

LIVELIHOOD ISSUES

Agbayani, A. L. P., R. J. Holmer, and W. H. Schnitzler. 2000. Purchasing patterns of institutional users of fresh vegetable in Cagayan de Oro City. Peri-urban Project Report, Xavier University College of Agriculture. 44 p. (19)

Key words: vegetable, crop production, marketing, income

Peri-urban and urban vegetable production has great potential in Cagayan de Oro City, a rapidly developing city in Mindanao. The supplies of vegetables in the city come mostly from nearby Bukidnon province, the town of Claveria and even from Luzon. A key factor to sustainable vegetable production lies in adequate markets for the produce. This paper addresses this issue and presents the results of a survey on the purchasing demands of institutional users for fresh vegetable in Cagayan de Oro. Interviews were conducted among 100 institutional respondents consisting of 10 hospitals, 20 schools, 20 hotel and restaurants, 26 restaurants, 14 canteens, 5 government institutions and 5 private institutions.

Seventy percent of the institutions buy vegetables on a daily basis. These are sourced mainly from the two wet markets in the city. Only 13% of the respondents buy from supermarkets. Institutions spend 9.5% of their food budget on vegetables. Monthly procurement of vegetables is around US\$ 10,200 (US\$ 1=PhP 50), which accounts for 44% of the total expenditures on fruits and vegetables outside the home in the city. Most purchases are paid in cash. Hotels, restaurants and private hospitals usually avail of 15-day term credits. The five vegetables bought in largest quantities weekly are squash (6.3 kg), cabbage (6.1 kg), potato (5.8 kg), carrots (4.4 kg) and papaya (3.8 kg).

Other relevant statistics found in the paper are: relative preference for tropical and temperate types of vegetables, the level of prohibitive price for buying vegetables, product size specifications and acceptability of pre-peeled and pre-sliced vegetables.

To better capture the institutional market, the authors suggest that urban farmers should plan their production in such a way as to achieve regularity of supply. Growing of different types of vegetable and test marketing by a group of local producers can also be explored.

Agbayani, A. L. P., R. J. Holmer, G. E. Potutan, and W. H. Schnitzler. 2001. Quality and quantity demand for vegetables. A survey in a Philippine urban setting. *Urban Agriculture Magazine* 5: 56-57. (7)

Key words: vegetable, food consumption, human nutrition, crop production, cash crops

This communication discusses the results of two surveys conducted to characterize the demand of private households, vendors and institutional users for fresh vegetables in Cagayan de Oro City, Philippines. This surveys aim to provide baseline data for decision-makers and farmer-

practitioners to improve market transparency for vegetables and thus contribute to producer and consumer linkages.

Results of the survey reveal the following insights. Rice is consumed by almost all of the household respondents, followed by vegetables, fish and meat. Farmers are the highest consumers of vegetables and the least of meat. The most popular vegetables consumed are horseradish tree leaves, eggplant, squash, string beans and tomato. Major motivations for vegetable consumption are high nutritional value, a flavor additive to diet and to stay in good shape. Important considerations for buying vegetables are freshness and being free of spots and damage, texture and price. Medium sizes of vegetables are preferred as compared to larger or smaller sizes. Estimated daily per capita consumption of vegetable is less than 100 g, far below the recommended intake of 200 g.

The majority of the retailers get their vegetable supply from wholesale markets. Farmers sell their produce mainly to wholesalers and contractors often dictate prices. Most of the vendors purchase their vegetable supply every day.

The top five vegetables bought in large quantities by institutional users are: potato, squash, cabbage, carrots and papaya. On the average, institutions allocate 9.5% of their marketing budget to vegetables. Prices considered prohibitive depend upon the type of vegetable bought. Shelter institutions but not hospitals, hotels and restaurants are open to buying pre-peeled and pre-sliced vegetables.

The authors recommend the need for the government and the NGOs to exert more efforts in educating consumers on a better vegetable diet and in improving the city's market setup.

De Guzman, C. C. 2003. Sampaguita livelihoods of peri-urban Metro Manila, Philippines: Key actors, activities, benefits and constraints. In *From Cultivators to Consumers: participatory research with various user groups*, 229-238. Los Baños, Philippines: Users' Perspectives with Agricultural Research and Development International Potato Center (CIP-UPWARD). (7, 14)

Key words: cash crops, livelihoods, microenterprises

The sampaguita [*Jasminum sambac* (L.) Ait] flower is the Philippines' national flower. The white, dainty flowers with soothing fresh scent are primarily strung into garlands, which find use as religious adornments in churches and homes, and decorative ornaments in wedding ceremonies and vigils for the beloved dead. The smallness and simplicity of the fragrant flowers belie the magnitude of dependence of so many people on this ornament as an important source of livelihood.

The paper discusses the various features of the sampaguita livelihood system in the municipality of San Pedro, Laguna, Philippines. The entire livelihood system, which is anchored primarily on the production of flowers and their preparation into garlands, involves eight key players: the farmer, the flower picker, the supplier, the vendor, the abaca fiber cleaner, the garland-making contractor, the garland maker and the garland seller. The sampaguita livelihood is an example of

a viable peri-urban enterprise that links production of flowers in rural areas to the distribution and selling of garlands in adjacent Metro Manila. Aside from providing income and various types of employment to a large number of workers, the sampaguita agribusiness also offers several socio-cultural benefits not only to its major actors but also to the community as a whole. These benefits include making the youth productive, promotion of self-confidence and independence among women, promotion of loyalty and trust, and provision of a deep sense of community tradition.

Several problems related to production, post-production and socioeconomics beset the livelihood. R and D agenda in support of the sampaguita livelihood system is proposed.

De Guzman, C. C. and P. A. Tusi. 2001. Urban agriculture models in the Philippines: A two-area case study on agricultural livelihood systems. Terminal Project Report. *Users' Perspectives with Agricultural Research and Development*. Los Baños, Philippines: International Potato Center (CIP-UPWARD) 99 p. (7, 14)

Key words: livelihoods, cash crops, crop production, income

The report gives an assessment of two models of urban agriculture (UA) enterprise represented by the intra-urban vegetable production in North Fairview, Quezon and the peri-urban sampaguita [*Jasminum sambac* (L.) Ait.] livelihood system in San Pedro, Laguna. Through field visits and interview with key informants the two models were evaluated in terms of location, major players, production system, support mechanisms and needs based on problems encountered.

In North Fairview the mostly leafy vegetables produced by the farmers are grown in garden plots inside a residential subdivision. The sampaguita livelihood involves the cultivation of the ornamental plant and the preparation of its floral buds into garlands. Flower production is strategically located in provinces adjacent to Metro Manila, while garland making and flower trading are concentrated in San Pedro. Both operate on a commercial scale, with Metro Manila as the major market. The key players in the vegetable production are the financier, farmer and trader. The major actors in the sampaguita agribusiness are more diverse, consisting of the farmer, flower picker, trader, vendor, garland-making contractor, fiber cleaner, garland maker and garland sellers. The sampaguita farms are mostly owned by the farmers, while the land cultivated by the vegetable growers are owned by the subdivision residents, who allowed the urban farmers to till their unbuilt lots. Both do not receive any institutional support. Women and youth play a critical role in the sampaguita livelihood; only a few of them actively participate in the vegetable production venture. In both cases the main impact of the livelihoods is in terms of income and employment.

To fully assess the contribution of urban farming to city development, the report recommends the need to conduct further research on the linkage of these examples of Urban Agriculture activities to food security, income alleviation, waste management and open space development.

Navasero, M. V., M. M. Navasero, V. R. Daquioag, C. C. De Guzman, C. M. Bajet, and R. Boncodin. 2004. Sustaining the sampaguita flower/garland livelihood system in peri-urban Metro Manila. Poster paper presented at the 26th Annual Scientific Meeting of the National Academy of Science and Technology. Westin Philippine Plaza, Pasay City, July 14-15. (7)

Key words: microenterprises, cash crops, marketing, integrated crop management, pesticides

Sampaguita (*Jasminum sambac* L.) flower production, garland making and marketing are traditional livelihood activities in and around Metro Manila. The paper presents some of the highlights of a collaborative and interdisciplinary research project which aims to 1) assess the sampaguita livelihood systems in peri-urban Metro Manila, 2) identify key problems and opportunities for sustainable flower production and garland making, and 3) develop and introduce appropriate technologies based on priority problems and opportunities.

Results indicate that the sampaguita livelihood system extends from urban marketing centers in Metro Manila to rural production areas in Pampanga and Quezon where eight key actors derive financial and socioeconomic benefits. San Pedro, Laguna, the major center for flower trading and garland making, represents the peri-urban nexus of the entire livelihood system. Two priority concerns identified are: 1) declining productivity of plants due to high infestation of pests and diseases especially on aging plants, and 2) heavy pesticide use. Chemical spraying is done every 1–2 days and floral buds are harvested less than 24 hours after spraying during the lean season, when prices of sampaguita flowers are high. The potential danger of chemical pesticides is not only confined to farmers but also to other sampaguita workers. Analysis of pesticide residues reveals that 7–8 out of the 9 pesticides analyzed are detected on samples collected from farmers down to the garland sellers. The most frequently detected pesticides are carbamates, organophosphates and pyrethroids.

Participatory consultations with farmers highlight the lack of knowledge and information on sampaguita pests and diseases, and type and level of pesticides to use, which result in improper crop protection practices. To address these problems, ongoing participatory on-farm trials compare farmer's and introduced pest management practices. This is the initial step in the development of IPM that is anchored on correct pest diagnosis and appropriate pesticides.

POLICY AND PLANNING

Duran, L. S., Jr., J. H. Batac, and P. Drechsel. 2001. Planning in a changing environment. The case of Marilao in the Philippines. *Urban Agriculture Magazine* 4: 40-42. (7, 26)

Key words: composting, urban planning, waste, marketing, policy

Marilao is a municipality with approximately 15,000 households located on the fringe of Metro Manila. With more than 850 business firms and housing projects competing for 2,625 ha of municipal land, affordable land for a new waste disposal site becomes a dilemma. This paper describes the planning and implementing strategies adopted by the municipality to solve this problem.

The preparation of a development plan for waste utilization and disposal requires interactive consultations with different sectors of the community. After brainstorming on appropriate solutions, the need for more stakeholder participation and investment programs to overcome the waste crisis, a proposal for the establishment of a municipal composting facility was finalized.

The article emphasizes the critical role of the NGO community and the commitment of local households in the success of the composting program. To ensure stable supply of organic household waste, source separation at the household level was initiated. The NGOs gave expertise in promotional campaigns, participatory planning techniques and implementation strategies.

In general, marketing principles are employed for all activities of the project. Municipal investments are not limited to the composting facility itself but also encompass those in developing models on urban agriculture and improvements on the solid waste collection system. Municipal compost is produced at about 1 ton per day using a compost fungus activator. Compost supply eventually cannot cope with farmers' demand. A scheme, known as the Networking for Urban Renewal Through Urban Ecology (NURTURE) Plan, was developed to identify farmer-beneficiaries who practice solid waste segregation and have open spaces for cultivation.

The paper stresses the need for a strong political will on the part of the local government unit in managing development programs. It is a necessary factor in motivating the NGOs and the community households.

Pabuayon, I. 1995. Policy on urban agriculture/forestry. Paper presented at the Urban Agriculture Planning Workshop held on June 1. PCARRD, Los Baños, Philippines. 10 p. (14)

Key words: local government, policy, agroforestry, urban agriculture, land use

The growing requirements of urban areas for food supply, additional sources of income and a cleaner environment engender the pressing need to develop a strategic plan for urban

agricultural/forestry (UA/F) development. Such a plan, however, requires strong policy support. This paper reviews some of the existing policies related to urban agriculture/forestry in the Philippines. Policy documents obtained from various government agencies, which would play a major role related to UA/F, are examined.

The Department of Agriculture lacks a definite policy statement on urban agriculture since its priority is countryside development. Indications of the agency's support for urban farming, however, is gleaned through its Urban Food Project and some related policy reform measures such as improvement of industrial waste management and pollution control, and preservation of the best agricultural lands for agricultural use. In contrast, the Department of Environment and Natural Resources (DENR) has already incorporated urban forestry as a major component of its Master Plan for Philippine Forestry Development. An Urban Forestry Division was even created under the Forest Management Service of the DENR to implement related programs. Other government agencies such as the Housing and Land Regulatory Board, the Housing and Urban Development Coordinating Council and the Department of Interior and Local Government also have existing policy provisions indirectly favorable to the development of UA/F.

Critical broad policy issues that needs to be addressed to strengthen and promote UA/F include land use conflicts, inadequacy of laws, management responsibility and coordination among institutions concerned, financial support for UA/F, monitoring and evaluation of existing programs, policy advocacy and public awareness, and integration of UA/F in the over-all urban development framework and defining specific strategies for implementing such.

Potutan, G. E., W. H. Schnitzler, J. M. Arnado, , L. G. Janubas, and R. J. Holmer. 2000. Urban agriculture in Cagayan de Oro: a favorable response of city government and NGOs. In *Growing Cities Growing Food: Urban Agriculture on the Policy Agenda*, ed. M. Bakker, M Dubbeling, U Sabel-Koschella, and H Zeeuw, 413-428. Feldafing, Germany: DSE. (19)

Key words: local government, policy, urban agriculture, peri-urban agriculture, crop production,

This is a case study of urban and peri-urban agriculture (UPA) in Cagayan de Oro, a booming city in the central coast of Northern Mindanao. The paper provides several informative statistics on agricultural production in the city and gives highlights of the various surveys related to UPA conducted by the Xavier University under its European-funded Peri-Urban Vegetable Project (PUVeP).

The bulk of the paper concentrates on the role of the local government unit in the promotion of UPA. The city government cooperates with PUVeP in collecting plant wastes from a wholesale market. The wastes are used for different experiments on composting and compost application. Through PUVeP initiatives, several city ordinances favorable to UPA have been passed such as the Greening Project and the provision of agricultural extension services to farmers. Legislations pertaining to home and school gardens and access to government lands for urban and peri-urban farmers have also been proposed.

The city's favorable response to the development of UPA has been attributed to: 1) the realization of the potential of UPA for enhancing food security (through research by PUVeP and other institutions), and to 2) the development of a critical mass of advocacy by farmer groups and NGOs. Local activities are backed by a sustained flow of information through the media and by successful cooperation of NGOs and government. A network of NGOs called the Philippine Partnership for the Development of Human Resources in the Rural Areas is instituting tripartite partnership among NGOs, people's organizations and local government unit.

The success of integrating UPA in general policy is still limited. No general plan exists that brings together the different UPA activities. Support extended to aquaculture, livestock and poultry, and school gardens is also wanting. Overall, the city is in the initial stage of developing economically and ecologically sustainable agriculture.

RESEARCH AND DEVELOPMENT APPROACHES

Aquino, E. M. and J. H. Batac. 2003. Investment to reduce urban poverty in the Philippines. *Urban Agriculture Magazine* 9: 34-36. (7, 27)

Key words: urban poverty, marketing, waste, policy, composting

The article discusses the strategy carried out by the municipal government of Marilao, Bulacan in addressing poverty through its program on urban agriculture and biodegradable waste composting. The program utilizes two critical approaches: the compost-based, homegrown potted vegetable production and the mandatory savings scheme among growers.

Implementation of both components was started with the allocation of funds by the municipality for the initial purchases of plastic pots and seeds, and for the organization and management systems. This effectively addresses the constraints of limited access to land and costs of inputs for the landless urban poor while ensuring them with a supply of safe, fresh and nutritious food.

Excluding costs for family labor and acquisition of compost, cost/benefits analysis of compost-based, homegrown vegetable production reveals that the cost of production amounts to US\$ 0.24/month while benefits total at US\$11.20/month. To recover the monthly cost of operation, and thus make it financially sustainable, an individual mandatory savings scheme of US\$0.02/day or US\$0.30/month was implemented. This amount represents less than 10% of the daily income of the landless urban poor. The savings scheme involves the installation of a management system consisting of individual account ownership, on-site safe keeping, clear and straightforward recording and accounting, and spot auditing among peers.

The paper also describes the Moncada Women's Credit Cooperative (MWCC) and its involvement in waste management and composting program in the municipality of Moncada, Tarlac. The credit cooperative saw the potential of solid waste management for revenue generation and established linkage with the municipality for a Zero-Waste Management and Recycling Project. A compost facility was set up in 1999, with the compost being sold to members of the cooperative. Both the local government and the cooperative are looking into the potential of converting Moncada into organic farming municipality in the future.

Boncodin, R., J. Sim, and B. Gayao. 1999. Sweet potato snack food enterprise development in urban and peri-urban setting: working through local agencies and groups in Baguio city, Philippines. In *Learning to Manage Livelihoods: New Perspectives in Rootcrop R & D*, 141-149. Los Baños, Philippines: CIP-UPWARD. (7)

Key words: institutions, rootcrops, livelihoods, homegardens

The paper examines the partnership dynamics in a sweet potato enterprise development project in Baguio city, Philippines. In collaboration with the International Potato Center (CIP)-Users' Perspectives with Agricultural Research and Development (UPWARD), the multi-agency project

is designed to promote the commercialization of nutritious snack foods made from traditional sweet potato varieties and to make sweetpotato-based school and home gardens viable production systems.

The report discusses the different activities and roles of the various agencies and peoples' organizations in the establishment of a viable sweet potato food enterprise that provides livelihood to a number of peri-urban and urban households. Supply of sweet potato material is provided by the Farmers of Aringay Processing Enterprise from La Union and the Balakbak Elementary School Multi-purpose Cooperative. The processing component is taken care of by the Barangay Nutrition Scholars Association, some member families of the Family Core Group Association, Inc. and a private bakery. With permission from the Department of Education, Culture and Sports Baguio City School Supervisor, market tests are conducted in several elementary and secondary schools, the most potential outlets of the sweetpotato-based snack food products. On the other hand, the Northern Philippines Root Crop Research and Training Center, which spearheaded the project's implementation, actively provides technical backstopping, market analysis and process documentation.

Recommendations are also given to make the enterprise self-sustaining and profitable. These include: 1) further study to solve the agronomic problems of growing sweet potato to ensure higher yield and better quality of roots, 2) development of schemes to stabilize supply of raw materials, reduce farm price of sweetpotato and satisfy processing demand, 3) analysis of nutrient content of food products, 4) identification of processing qualities of traditional varieties, 5) market analysis, 6) capacity building for project collaborators, 7) fast-tracking of researches in improving the quality of food products and 8) information dissemination and market positioning.

Burleigh, J. R. 1999. Special project. Manila peri-urban vegetable project. *AVRDC Report 1998*, 94-98. Shanhua, Tainan, Taiwan: Asian Vegetable Research and Development Center. (28)

Key words: crop production, integrated crop management, socioeconomic analysis, leafy vegetables

The paper is the annual report of the AVRDC Manila Peri-urban Vegetable Project in the Philippines sponsored by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). The project aims to 1) stabilize the supply of safe and nutritious vegetables to metropolitan areas, such as Manila, and 2) develop an approach for information acquisition, testing and dissemination suitable to other peri-urban areas in Asia.

The paper highlights the results of the following project components: socioeconomic, integrated nutrient management, integrated pest management (IPM) and new technologies for off-season production of vegetables.

The vegetable growers of San Leonardo, Nueva Ecija provided the primary data for the socioeconomic aspect of the project. Key information is given related to the social and economic environments of the vegetable farmers, their principal sources of information, public market

outlets, major constraints to vegetable production and initial perceptions of the technologies introduced by AVRDC and Central Luzon State University.

Significant results for the three studies on integrated nutrient management are briefly discussed. The balanced fertilization studies on pak choi [bok choy] and grafted tomato, and on pak choi/radish cropping sequence using complete fertilizer, household waste compost and chicken manure compost reveal that replacing half the recommended fertilizer rate with either of the two composts does not affect crop yield.

IPM tackles principally the findings of three pesticide treatments (farmer practice, researcher-managed and untreated) on pak choi established in collaborator farms to demonstrate pest identification, monitoring of pest intensity, use of natural enemies and judicious use of effective pesticides. Incidences of web blight and insect-feeding-damaged plants are significantly greater in untreated plots than in farmer- or researcher-managed plots. Yield is higher from the researcher-managed plots compared to the other two treatments.

Off-season production of vegetables is shown to be better using grafting techniques; cultivation under protective shelter and planting on raised beds mulched with dried neem leaves.

Burleigh, J. R. 2000. Special project. Manila peri-urban vegetable project. *AVRDC Report 1998*, 94-98. Shanhua, Tainan, Taiwan: Asian Vegetable Research and Development Center. (29)

Key words: rootcrops, integrated crop management, technology, organic farming, pesticides

This is the 1999-progress report of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)-funded AVRDC Manila Peri-urban Vegetable Project based in Central Luzon State University, Nueva Ecija.

Surveys conducted among vegetable farmers in select towns of the province reveal that the farmers possess the education, experience and financial resources needed to assess and possibly invest in new technologies. Over all, vegetable production is profitable but characterized by excessive use of fertilizers and pesticides.

Experiments on the use of burned rice hull on pak choi show its positive effect on weed reduction and soil organic matter, but not on yield. Composted vegetable refuse or chicken manure does not substitute for inorganic fertilizer on pak choi, radish and onion. Introduced management practices on pak choi are superior to the farmer practice in terms of yield. Grafting tomato on eggplant rootstock can enhance tomato productivity during the hot, wet season. Field performance of *Brassica* cultivars has been evaluated, but no definite recommendations have been given yet.

Results of field trials on pak choi, onion and radish to contrast farmer practice of pesticide treatment with those based on monitoring of pest intensity and nil pesticide vary depending upon the farm site and the crop. Pesticide residue analysis in pak choi shows that residues of chlorpyrifos exceed the established maximum level in the farmer practice plots. Other pesticide

residues are detected in non-treated plots, suggesting the possibility of spray drift from nearby fields. Pesticide bio-efficacy tests on pak choi reveal that there are more effective chemicals than the ones currently used by the farmers. Some beneficial arthropods of major insect pests on pak choi are identified. Results of the study on the biological control of the podborer *Maruca vitrata* on yard long beans are also presented.

Activities implemented in relation to capability building and technology promotion are briefly discussed.

Burleigh, J. R. 2001. Manila peri-urban vegetable project. *AVRDC Report 2000*, 133-140. Shanhuah, Taiwan: Asian Vegetable Research and Development Center. (30)

Key words: farming styles, integrated crop management, innovation, technology, pesticides

The report provides the significant accomplishments for the year 2000 of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)-sponsored AVRDC Manila Peri-urban Vegetable Project based in Central Luzon State University, Nueva Ecija.

Based on field experiments, survey data, and introduced technologies from AVRDC to improve production of pak choi show significant improvement in yield and net income when compared to traditional farmer practice. Perceived constraints to full implementation of introduced technologies are related to their capital and labor requirements.

Experiments on grafting of tomatoes onto eggplant or tomato rootstock under shelter to enhance off-season tomato production reveal higher percent survival and yield of grafted plants compared to the non-grafted controls. Percent survival of grafted tomatoes with or without rain shelters is not affected by scion, rootstock and shelter. Yield, however, is significantly higher in grafted plants and those under rain shelter.

Several accessions of pak choi, Indian mustard, non-heading cabbage, Chinese kale, choysum and kangkong are evaluated for year-round production in the lowlands. Significant yield differences among tested cultivars are observed only for Indian mustard and Chinese kale.

To develop and promote IPM strategies, field trials on pak choi are conducted to compare farmer- and researcher-managed plots for yield and pest development. Researcher-managed plots yield significantly more than the farmer-managed plots in two out of three trials. Incidences of two major insect pests are the same in both plots. Residues of several insecticides are detected in pak choi but the levels are generally less than the maximum residue level by a cited standard. The use of screen houses in growing several leafy vegetables is found to limit insect damage and to enhance yield compared to open field production. The report also assesses some parasitoids of diamondback moth, cabbage webworm and yardlong bean podborer, which can be used in the biological control of these insect pests.

Burleigh, J. R. 2002. Manila peri-urban vegetable project. *AVRDC Report 2001*, 103-113. Shanhuah, Taiwan: Asian Vegetable Research and Development Center. (31)

Key words: leafy vegetables, income, composting, agroprocessing, integrated crop management

This paper is the 2001 progress report of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)-sponsored AVRDC Manila Peri-urban Vegetable Project based in Central Luzon State University, Nueva Ecija.

Studies on the consumer choice of pak choi cultivars identify the accessions Black Behi, Bbp21, Bp03 and Bp29 as the most preferred. Interviews with participants to the Farmer Field School on pak choi production reveal an increase in adoption of some practices after the training. Results of a survey of farmers from Quezon, Laguna and Batangas show the relationship of some socioeconomic factors with pak choi yield and farm income. Data are presented projecting the concomitant increase in income and employment of input suppliers and traders with an increase in pak choi production.

Generally, trial experiments on pak choi fail to demonstrate the benefit of composted household waste as a supplement to the farmers' fertilizer practice of solely relying on inorganic fertilizers. The study on fertilizer levels for grafted tomato recommends the use of 60N-38.7P-124.5K kg/ha in alfisol soils. Tests for the appropriate potting medium for eggplant and tomato point to the advantage of a mixture of coco coir and composted household waste for enhancing seedling growth.

Among the different accessions of leafy vegetables evaluated, the pak choi variety Bp21 and Ia02 for kangkong variety Ia02 are the highest yielding.

Grafted tomato studies confirm the value of rain shelters and grafting in hot-wet season tomato production. CL5915 and CHT501 are identified as valuable scions.

Results of the various integrated pest management work on pak choi reveal the following: soil solarization is a potential non-chemical technique to curb insect infestation; an integrated crop management scheme implemented in Southern Tagalog reduces insect damage by about 50%; the insecticides phenthoate and spinosad are most effective in reducing insect damage, and a 10- μ g dosage of a synthetic pheromone appears adequate to attract male moths of *Hellula undalis*.

Burleigh, J. R. 2003. Manila peri-urban vegetable project. *AVRDC Progress Report 2002*, 128–141. Shanhuah, Taiwan: Asian Vegetable Research and Development Center. (32)

Key words: leafy vegetable, technology, innovation, integrated crop management

The report highlights the 2002 activities of the GTZ-funded AVRDC Manila Peri-urban Vegetable Project based in Central Luzon State University, Nueva Ecija.

Assessment of technology transfer methods for pak choi cultivation shows that very few farmers adopt the introduced technologies. Constraints to adoption include: high capital, labor demand, non-availability of organic fertilizers and unattractive market prices.

Trader and consumer preferences need to be considered in the evaluation of vegetable cultivars. Several examples of preferences are given for each type of vegetable. Based on on-farm trials conducted in Luzon, promising cultivars of pak choi, non-heading Chinese cabbage, choysum, Indian mustard, Chinese kale and kangkong are characterized.

Results of the study on grafted tomato, with or without shelter, in various experimental sites in Manila, Laguna, Batangas, Nueva Ecija and Tarlac show that, in general, grafting gives higher plant survival and a significant yield advantage in hot-wet season. Yields are also higher with shelter. Among the tomato scions examined, CHT501 is the consistent top performer.

For the integrated pest management component, black leaf mold has been identified as the dominant foliar disease of grafted tomato during the hot-wet season. Experiments on the control of two major pests of pak choi are also tackled. Several insecticides are found to effectively reduce the damage caused by striped flea beetle in the rainy season but not in the cool-dry season. Larval count of cabbage webworm decreases as rainfall increases. Sex pheromone studies on cabbage webworm recommend the placing of the pheromone trap at a height of 50 cm and incorporating 1 μ g dosage of the pheromone. The wing trap design is the most effective but costly. Flight activity is highest between 4 A.M. and 6 A.M.

Included also in the report are some statistics on the project's training and outreach efforts.

Burleigh, J. R., and L. L. Black. 2001. Supporting farmers towards safe year-round vegetables in Manila. *Urban Agriculture Magazine* 3: 15-16. (7, 33)

Key words: crop production, vegetables, integrated crop management, technology

The article focuses on part of the Philippine component of the project "Development of Peri-Urban Vegetable Production Systems for Sustainable Year-round Supplies to Tropical Asian Cities". The project aims to design, test and implement production systems for sustainable year-round supplies of vegetables in Metro Manila.

Analysis of the food supply in Metro Manila reveals that urban agriculture only produces about 0.5% of the annual vegetable needs of the metropolis. Per capita vegetable consumption has declined through the years, which suggests inadequacy in vital nutrient and energy uptake among the city's residents. Increased vegetable consumption can correct some of these deficiencies. The year-round supply of vegetables in the city is limited by several problems, which include those related to production in peri-urban areas.

The paper primarily reports on the survey designed to characterize the socioeconomic profile and agricultural practices of peri-urban farmers in the municipality of San Leonardo, Nueva Ecija. The province supplies 13% of pak choi and 17% of all vegetables sold in Metro Manila.

The farmers possess the education, experience and financial resources needed to assess the merits of and possibly invest in new technologies. Vegetable distributors generally dictate marketing system. All farmers resort to chemical control of pest and diseases. Safe handling and safe storage of pesticides are not common practices. Integrated pest management (IPM) is perceived to require moderate labor inputs and time. Implementation of IPM activities, however, is found to be complicated, and thus, not adaptable to the farmer's enterprise. The authors emphasize the need to address such perception in the preparation of IPM training documents and exercises.

Activities mentioned to improve peri-urban production and pest management of vegetables to sustain supply to Metro Manila include the use of raised beds, rain shelters, screen structures and organic fertilizers, and the regular monitoring of pest intensity.

Cabanding, D. J. 2000. Country Report: Philippines. In *Urban Fringe Agriculture*, ed. R. A. R. Oliver, 197-200. Tokyo, Japan: Asian Productivity Organization. (11)

Key words: urban poverty, food security, urban agriculture, policy, vegetables

The Republic Act 8435, also known as the Agriculture and Fisheries Modernization Act, 1997, prescribes urgent related measures for modernizing the agriculture and fisheries sector in the Philippines. The Department of Agriculture (DA) has been tasked to implement the Act, which became effective in 1998. The Act implements two policies that conform to the Agenda of the President of the Philippine Republic, namely poverty alleviation, social equity and food security. To address these policy issues, an approach has been established by the DA's Regional Field Unit No IV (which Metro Manila is part of) for a special program known as the Urban Agriculture Program (UAP). The paper discusses the nature of the program, its activities and accomplishments.

The UAP is an urgent stopgap measure for assisting non-farming poor families in Metro Manila. The major objective is to promote urban agriculture in order to help alleviate poverty, social inequity, and attain food security. The report briefly discusses the three major projects implemented under the Program: the *Gulayan at Bulaklakan sa Kapaligaran* (Vegetable and Ornamental Gardening), "Backyard Broiler Production" and "Technology Demonstrations of Vegetable Production at Schools". The various interventions undertaken include extension service; information dissemination and training; marketing, matching and cooperative development; land use planning and management, and policy advocacy.

A total of 95 family groups comprising 3,635 members of the *Gulayan at Bulaklakan sa Kapaligaran* have been organized, with about 15 tons of assorted vegetables harvested from community gardens. In addition, ten vegetable and medicinal plant nurseries have been established, and about 24,000 assorted potted plants distributed to Boy Scouts/teachers in Region IV. On the other hand, a total of 27,000 broiler chicks, plus feed and vitamins, have been distributed to 2,888 beneficiary families, which have produced approximately 3 tons of chicken.

Campilan, D., R. Boncodin, and C. De Guzman. 2001. Multisectoral initiatives for urban agriculture in Metro Manila, Philippines. In *Scientists and Farmers. Partners in Research for the 21st Century Program Report 1999-2000*, 433-443. Lima, Peru: International Potato Center (7)

Key words: urban agriculture, food security, livelihoods, environment health, policy

In recent years, the number of agricultural activities in Metro Manila has dramatically increased. Urban households have pursued urban agriculture as a means of improving their food security, livelihoods and the environment. The paper examines the various multisector initiatives that address the needs and opportunities for urban agriculture in the metropolis.

Local systems of urban agriculture in Metro Manila range from backyard and container gardens for meeting subsistence food needs to commercial vegetable farms for increased household income. Through various policy, research and extension interventions, public- and private-sector groups serve as key actors to support household food security and livelihood of urban farming households. The International Potato Center (CIP)-convened Strategic Initiative for Urban and Peri-urban Agriculture (SIUPA, now known as Urban Harvest) has contributed to improved coordination and enhanced capacity for urban agriculture in the city. A key element in this collaborative effort is the partnership between SIUPA and the Philippines' Inter-Regional Integrated Research, Development and Extension Program on Urban Agriculture (IIRDEP) in addressing key problem areas in urban agriculture—food safety, production systems and environmental protection. The collaboration has been formalized through a project called Capacity Development to Urban Agriculture Research, Development and Extension in the Philippines, which seeks to 1) help IIRDEP develop links with programs and organizations supporting global efforts to promote urban agriculture; 2) identify and respond to training-related needs of individuals and institutions involved in the IIRDEP; and 3) develop mechanisms for information dissemination and exchange.

De Guzman, C. and P. Banatlo. 1999. Urban agriculture: its basic features and promotion in local communities. Paper presented at the joint Agro-Industrial Development Program and Policy Initiative and Technical Assistance Project Lecture Series, University of the Philippines Los Baños, Philippines. January 8. p.42 (14)

Key words: urban agriculture, local government, urban planning, crop production

The strategic proximity of some municipalities of Laguna to Metro Manila has made them very favorable investment sites for the development of various industrial, commercial and residential projects. Rapid urbanization in the area has led to the inevitable loss of prime agricultural lands. It is against this background that the Urban Agriculture Project (UAP) of the Agro-Industrial Development Program (AIDP), of the College of Agriculture, University of the Philippines Los Baños, was developed and initiated in 1995. The paper discusses the basic nature of the project and some of its activities in collaboration with local government units.

The UAP is essentially an extension project that aims to 1) institutionalize sustainable urban agriculture (UA) projects; 2) promote socioeconomic development especially among low-income

urban and peri-urban households through the concept of UA; and 3) create awareness of and improve the quality of urban landscape through environmental greening projects. Central to the project is the establishment of a strong linkage with local government units (LGUs).

The urbanizing municipalities of Los Baños, Calamba, Sta. Rosa, Biñan and San Pedro in Laguna were the major participants to the project. The UAP helped in the development of and provided technical support to various agri-based livelihood projects, which were funded and implemented by the respective municipalities. Among the interventions extended include hands-on training on vegetable and cut flower production, livestock fattening and breeding, flower arrangement, container vegetable gardening, fruit juice and puree processing and meat processing. The project was instrumental to the development of community gardens and provided expertise in the landscaping of municipal parks.

To maximize the promotion of UA there is a need to: develop local production systems suited to urban conditions; formulate policies supportive of UA initiatives and look into the potential of integrating processed urban biodegradable waste to urban crop production.

Department of Agriculture. 2003. *Status Report: Kabuhayan sa Gulayan*. Urban Agriculture Program. Department of Agriculture Regional Executive Office. Department of Agriculture Compound, Diliman Quezon City No. 4. p. 7 (2)

Key word: urban agriculture, crop production, policy, local government

The paper reports on the activities and accomplishment, from 2001 to 2003, of the extension project *Kabuhayan sa Gulayan* (Livelihood through Vegetable Gardening) under the Urban Agriculture Program of the Department of Agriculture Region IV. The project is actually a continuation of a similar activity, the *Gulayan at Bulaklakan sa Kapitaligiran*, which was established in 1998 by the same government agency and now given the new name [*see Cabanding (2000) in this annotated bibliography*].

The number of community vegetable gardens and techno-demo farms which have been established through the project are: 22 in Quezon City, 5 in Caloocan city, 4 in Malabon, 2 in Muntinlupa, 4 in Manila, 3 in Las Piñas, 7 in Navotas, 3 in Pateros, 1 in Parañaque, 6 in San Juan and 2 in Valenzuela, all in Metro Manila; 2 in Rizal province and 1 each in the provinces of Cavite and Laguna. The total area allotted to the various project sites is around 84 ha with about 4,300 poor families as beneficiaries. The paper also provides information on the specific contact person involved in the project.

Gayao, B. 1995. From diagnosis to action research: The case of sweet potato homegardens in Northern Philippines. In *Taking Root: Proceedings of the Third UPWARD Review and Planning Workshop*, 36-40. Los Baños, Philippines: CIP-UPWARD. (7)

Key words: agricultural research, homegarden, rootcrops, participatory research

The paper briefly discusses the results of the diagnostic study on the nature of urban sweetpotato homegarden system in Baguio city, northern Philippines, and some of the accomplishments of the project involving the development of participatory user-oriented sweetpotato-based gardening technology. The study is a collaborative work between the Northern Philippines Root Crop Research and Training Center based in Benguet State University and the International Potato Center (CIP)-Users' Perspectives With Agricultural Research and Development (UPWARD).

About 27% of the total household population in the city engages in backyard agricultural activities. Sweetpotato is listed as second to the most common backyard crops grown in 3,420 households in the area, next only to chayote. Almost all backyard gardens have sweetpotato planted in 5-2,000 m², covering a total aggregate area of 29.43 ha. Sweetpotato plantings are not limited to backyards, but can also be found in a variety of sites e.g. ripraps, roadsides, along irrigation canals, etc.

Threats to backyard cultivation are also identified and these include: lack of space for planting, lack of water, very low yield and low economic returns. These problems have been attributed to; the growing population; presence of more profitable livelihood ventures; continuous use of land without fertilization, shading and use of low-yielding varieties.

To encourage and support sweet potato household gardening, a participatory user-oriented approach was conducted in the development of sweet potato-based gardening technology. Overall, promotional efforts gained positive results in terms of 1) number of participants who avail themselves of planting materials for personal use, 2) additional knowledge on nutritional value of sweet potato, 3) increased crop diversity in their gardens, 4) increased knowledge of other uses of sweet potato and 5) growing interest shown by neighbors and other institutions.

Holmer, R. J. 2000. The Peri-urban Vegetable Project of Xavier University College of Agriculture. Paper presented at the 12th NOMCARRD Regional Symposium on R & D Highlights, Mindanao Polytechnic State College, Cagayan de Oro, Philippines, August 10–11, 2000. p.16 (19)

Key words: agricultural research, crop production, marketing, peri-urban agriculture

A research project on peri-urban vegetable production and marketing systems was conducted from October 1997 to August 2000 in three Southeast Asian cities, which represent different levels of urbanization: Ho Chi Minh (Vietnam), Vientiane (Laos) and Cagayan de Oro (Philippines). The study was jointly carried out by research institutions from the Philippines, Vietnam, Laos, France and Germany funded by the INCO-DEV Program of the European Union Commission. The Philippine component of the project was implemented by Xavier University College of Agriculture (XUCA) in Cagayan de Oro City.

The paper reports on the nature of the six research work packages common to all collaborating cities. These involve: 1) socioeconomic and anthropological assessment of peri-urban vegetable production, consumption and marketing in the three cities; 2) crop improvement; 3) soil

management and plant nutrition; 4) integrated pest and disease management; 5) water management, and 6) marketing.

Highlights of the accomplishments for the Philippine activities are also emphasized. A database on peri-urban vegetable production, consumption and marketing has been developed for Cagayan de Oro City. Improved local varieties of some fruit and leafy vegetables, legumes and papaya have been evaluated and can be recommended for commercial production under tropical low elevation conditions. Work on the control of lepidopterous pests of cauliflower shows the advantage of incorporating different sticking agents to chemical and biopesticides, for reducing pest population. Drip irrigation experiments on tomatoes and cauliflower reveal that water used by drip irrigation was found to be only 72% of the quantity used by hand sprinkler irrigation. Critical results of the survey on the purchasing patterns of institutional users of fresh vegetables in the city are also presented. Experiments on composting of market wastes and the potential use of the finished product for peri-urban agriculture are still ongoing.

Holmer, R. J. 2001. Appropriate methods for microenterprise development in urban agriculture. *Urban Agriculture Magazine* 5: 51-53. (7, 19, 34)

Key words: microenterprise, methods, urban agriculture, gender

Microenterprise is defined as an enterprise employing less than ten workers, inclusive of the owner-operator and family workers. It generally refers to the enterprises of the poor and can be classified in terms of production, processing, input delivery and service delivery. Microenterprise development addresses the development objectives of poverty reduction, empowerment of women, employment generation and enterprise development as an end in itself. Two methods for microenterprise development for urban agriculture (UA) are distinguished: analytical and intervention. The paper discusses and illustrates these two approaches using examples.

Analytical methods may involve explanatory study/situation analysis, feasibility study and market/network/cluster analysis. The intervention method, based on the needs identified in the analytical methods, tackles human resources development, startup and strengthening assistance, and influencing conditions/platform advocacy.

The author provides as a specific example for analytical method the identification of present practices of urban food production. This approach has been adopted in the European-funded Peri-urban Vegetable Project in three Southeast Asian countries. On the other hand, human resources development as a tool for intervention can encompass entrepreneurship training, improved group and cooperative management, good program and project management and updating of curricula of agricultural universities and colleges.

The methods described show some insufficiencies in forecasting supply and demand, and integrating technical, social and ecological concerns. Further gaps are appropriate tools to identify the aptitude of a potential entrepreneur and to ensure proper integration of already existing gender tools or development of more appropriate ones into microenterprise development programs. To further enhance microenterprise in UA, the following is needed: publication of

relevant materials, training of UA participants on gender issues, incorporation of models and dissemination of the outputs, more research on identifying existing UA systems, and creation of awareness and better linkage of UA to existing microenterprise development programs.

Holmer, R. J., M. T. Clavejo, S. Dongus, and A. Drescher. 2003. Allotment gardens for Philippine cities. *Urban Agriculture Magazine* 11:29-31. (7, 19, 35)

Key words: low input agriculture, livelihoods, agricultural research, land use, waste management

The paper discusses the establishment of allotment gardening pilot projects in Cagayan de Oro City, a major city in southern Philippines. Allotment gardens are characterized by a concentration in one place of several small land parcels that are made legally available by city authorities to individuals or families for the sole purpose of growing horticultural crops. The projects, which are funded through a European grant, will serve as model centers to enable future extension of allotment gardening to other Philippine cities.

The paper focuses mainly on area selection, participant selection and setting-up of allotment gardens. Suitable areas are identified on the basis of a) accessibility to water and transportation; b) no rent or reasonable rental cost; and c) availability of a contiguous area of at least 3200 m² to accommodate eight family units of 400 m² each. Beneficiaries are screened based on their income, their willingness to do actual garden work, to participate and share experiences, their residency near the project site, and being residents of the pilot barangay. A pilot barangay allotment garden consists of 8 individual family units, with each family unit being assigned a 20 m x 20 m garden area. Crops cultivated are cucurbits, solanaceous crops, legumes, leafy vegetables, etc. The garden incorporates a compost heap for the biodegradable household waste.

The project has enabled the urban poor of the city to have legal access to vacant lands in the city for agricultural purposes. It is expected to contribute to the success of the solid waste management program in the area.

Recommendations to ensure long-term continuity of the project include: project advocacy and promotion; inclusion of norms and values in training programs; consultation with the city council on tenure strategies, and conduct of more research, particularly related to integrated pest management.

Potutan, G. E., L. G. Janubas, J. Marnado, J. Holmer, and W. H. Schnitzler. 1997. Peri-urban vegetable production, consumption and marketing in Cagayan de Oro. Philippines. *Kasetsart Journal (Natural Science)* Kasetsart University, Bangkok. 32:61-66. (19, 36)

Key words: agricultural research, socioeconomic analysis, consumption, marketing, human nutrition

The paper reports on the results of a survey conducted among vegetable growers, vendors, and consumers in the urban and peri-urban districts of Cagayan de Oro, a city in southern

Philippines. The study aims to 1) describe the socioeconomic characteristics of the three major sectors; 2) determine interactions between vegetable consumption, production and marketing; and 3) evaluate and prioritize constraints to urban vegetable production and its impact on the community. A total of 300 respondents, 100 each from the three sectors, were interviewed.

The data reveals that most respondents consume less than one half of the daily requirement for vegetables despite a high level of awareness of their nutritional value. The amount of vegetables produced is often inadequate to supply the demands of consumers. Constraints associated to peri-urban vegetable production are high night temperatures, pests and lack of capital. The present marketing setup also suffers from lack of good storage, grading facilities, limited display areas and lack of low-interest credit sources.

Based on the survey results, further research should be conducted on the following: 1) determination of factors affecting low vegetable intake; 2) breeding of vegetable varieties adapted to lowland areas; 3) development of crop production technologies suited to urban and peri-urban environment; and 4) diversification of marketing outlets. The critical findings of the study must also be shared and discussed with city officials, agricultural research institutions and the major actors involved in vegetable production and marketing. In particular, more efforts are needed from the government and NGOs to educate consumers of vegetable diets.

Nazarea, V. P., M. C. Piniero, and R. P. Mula. 2003. *Urban Gardens: Persistence and Change. Users Perspectives with Agricultural Research and Development.*. Los Baños, Philippines: CIP-UPWARD 54. p. (7)

Key words: home garden, culture, policy, methods, agricultural knowledge/information

The publication presents the significant findings of a collaborative research project on the nature of urban homegardens, not only as a repository of diversity of food and non-food crops, but also of cultural beliefs and practices.

The document is divided into four sections. The first section presents an overview of the research problem, concepts, methods and results. The project identified two areas in Baguio city, the Lower Quarry and Loakan, as homegarden research sites, with a total of 21 homegardeners interviewed. Research methods employed include inventory of plants, preparation of homegarden maps and analysis of life histories of homegardeners. Edible crops figure prominently in the homegardens, underlining the contribution of homegardens to food security. Food crops for subsistence are predominantly planted in Lower Quarry, which is mainly populated by landless and relatively poor migrants. On the other hand, ornamentals, wood and fruit trees are mostly cultivated in Loakan, where the residents are economically and politically more advantaged. Compared to the objective and more accurate maps rendered by the project researchers, plants illustrated in homegarden maps, drawn by the cultivators themselves, are variously emphasized depending upon their significance to the homegardener.

The second section is an ethnographic account of six homegardeners and their life histories. The first-person narrative case presentation dramatizes the strategies employed by the homegardeners in coping with their marginalized conditions.

The third section discusses briefly some of the significant policies that impact on urban homegardens, with particular emphasis on the Indigenous Peoples' Rights Act of 1997. Institutional programs supporting and promoting homegarden development are also described.

The last section identifies the basic steps in memory banking protocol, which is a systematic documentation of knowledge associated with traditional crops and plants. Guidelines in establishing rapport, mapping of home gardens and effective techniques for eliciting life histories are provided.

Malague, I. R., III, M. Yokohari and K. Kobayashi. 2003. Identification of the changing patterns of agricultural lands in the urban fringe of Metro Manila. *Journal of the Japanese Institute of Landscape Architecture* 66 (5): 901-904. (14)

Key words: land use, urbanization, urban planning, policy

The mixture of agricultural and urban land uses in the urban fringe of Metro Manila is undergoing a process of change because of the conversion of agricultural lands. The objective of this study is to identify the changing patterns of agricultural land use, and their differences between the lowland and terraced agricultural landscapes. The two types of agricultural landscapes based on landform were selected from the rapidly urbanizing area of Cavite, which is adjacent to Metro Manila. Land use maps were developed from spatial database derived from image interpretation of aerial photographs in 1982 and 1997. Each land use map was divided into landscape units which was based on the following assumptions: 1) presence of agricultural and urban activities can be identified by the presence of their respective land uses, 2) a decrease in area coverage of agricultural land use occurs with an increase of urban land use and 3) an increasing fragmentation of agricultural land use occurs with an increasing contiguity of urban land use. Changing patterns were identified by how landscape unit types were changed between the two time periods.

The results of the study reveal that the direct change of landscape units from agricultural to urban, and the abandonment of agriculture at landscape unit scale is only identified in the terraced agricultural landscape. It is recommended that in strategic planning that adopts appropriate land use arrangements with the co-existence of urban and agricultural land uses, patterns of change in landscapes with different topographical features must be considered.

Schnitzler, W. H. and R. J. Holmer. 1997. Initial results of and European Union financed project on urban vegetable production in Southeast Asia. *Kasetsart Journal (Natural Science)* Kasetsart University, Bangkok. 32: 21-26. (19)

Key words: Southeast Asia, socioeconomic analysis, culture, crop production, agricultural research,

The paper gives an overview of the research project on urban and peri-urban small- and medium-scale enterprise development for sustainable vegetable production and marketing systems (PUVeP) in the cities of Ho Chi Minh (Vietnam), Cagayan de Oro (Philippines) and Vientiane (Laos). The project is funded by the INCO-DC program, of the European Union, in collaboration with research institutes from Germany, France, and the three Southeast Asian countries.

Research work packages common to all project sites generally involve 1) the analysis of the socioeconomic and anthropological situation of urban and peri-urban communities, and small- and medium-scale farm enterprises, and 2) technology research. Specific research undertakings focus on plant nutrition and soil management (particularly the utilization composted market waste), plant protection/integrated pest management, water management and crop improvement.

Only the preliminary data on the socioeconomic and anthropological study in the Philippines are presented. Key results of the survey done in Cagayan de Oro show that the daily per capita consumption of vegetables is below 100 g. Tomato, eggplant and head cabbage are the vegetables with the highest overall consumption in the city. The average farm size for vegetable production is 0.5 ha. Only 12% of the farmers receive training in IPM. Basic constraints in farming are unfavorable climatic conditions and high pest pressure. Problems in marketing include the seasonality of vegetable supply, unavailability of display area in the market and lack of capital.

Ongoing activities for other research thrusts in the three cities are briefly mentioned.

RURAL-URBAN LINKAGES

Watanabe, M., M. Yoshida, and H. Ohta. 2002. Circulation of organic matter between Metro Manila and Pampanga lahar-affected areas in Pinatubo. In *Metro Manila: In search of a sustainable future. Impact analysis of Metropolitan policies for development and environmental conservation*, ed. T. Ohmachi and E. R Roman, 281-293. Diliman, Quezon City (Philippines): University of the Philippines Press. (10)

Key words: recycling, composting, waste management, environmental health

Recycling of urban waste through composting is an effective means of substantially reducing garbage destined for open dumpsites or sanitary landfills. Composting of organic materials, such as kitchen and market wastes, offers beneficial effects to the natural ecosystem. Converting this into compost will not only solve the health hazards created in its immediate surroundings, but can, also provide an important source of fertilizer and soil conditioner to farmers.

The paper discusses the potential of utilizing compost derived from biodegradable waste of Metro Manila for rehabilitation of problem soils, such as lahar-affected areas. Lahar, brought about by the 1991 eruption of Mt. Pinatubo, has damaged vast agricultural lands in Central Luzon. The study specifically focuses on the lahar-affected areas in Pampanga, a rural area near Metro Manila. The dynamics of lahar and aquifers, and the process of natural-vegetation recovery were examined through satellite image analysis, electric exploration, drilling and chemical analysis of groundwater and soils. Crop response to composted garbage in lahar was also determined.

Physico-chemical and microbiological studies indicate that the ecological restoration level of the lahar deposits has partly risen to the level equivalent to normal field soils. Urban organic waste can supplement the shortage of N and microbial communities that may contribute to N turn-over. Crop refuse, kitchen garbage, and sanitary waste are the possible organic sources for composting to be applied to lahar soils. Experiments also show that kitchen garbage and manure contribute to the growth of crops in lahar.

A separate study conducted by Dela Cruz (2003) [*cited in this Annotated Bibliography*] reveals that the projected amount of compost generated from the biodegradable waste of Metro Manila will be more than sufficient to satisfy its requirement for urban agriculture. The current paper offers a useful alternative for the excess material.

URBAN RESOURCES – ACCESS AND USE

Dela Cruz, M.C.C. 2003. The integration of biowaste and urban agriculture: Prospects and issues. The case of Metropolitan Manila, Philippines. Unpublished M. S. thesis, Sub-department of Environmental Technology, Wageningen University, Netherlands. p.92 (14)

Key words: waste, composting, technology, recycling

Closing the open linear system where composting and urban agriculture play a major role is the central basis of this study. The paper analyzes the various potentials and issues confronting the integration of biowaste and urban agriculture (UA); having Metro Manila as subject area. The research looks into the potential amount of nutrients that can be recovered by composting household biowaste using three different scenarios: full recycling, Philippine law and “let it be”. The first alternative assumes that all urban biowastes will be transformed to compost. This view is optimistic that an efficient system exists to allow processing of the entire volume of compostable wastes. The second scenario is based on the Ecological Waste Management Act that mandates the reduction of 25% of waste from the waste stream. This is to be implemented upon the 5-year implementation of the Act and shall increase in the succeeding years. It assumes that 25% of biowaste will be inputted to composting. The last alternative considers the current recycling rate of 6% covering both biodegradable and non-biodegradable wastes.

Mass flow analysis manifests that UA in Metro Manila cannot fully close the open linear system. Conversion of even a fraction of biowaste into compost is sufficient to provide inputs to the small area now devoted to UA in the metropolis. Surplus compost, therefore, needs to be transported outside Metro Manila.

The paper also recommends various strategies to strengthen and fully integrate composting in UA in the metropolis, which include, among others, the 1) development of cost-effective and efficient technology; 2) provision of technical assistance in the production of quality compost; 3) development of market within the metropolis; 6) changing the role of the government from regulator to facilitator for efficient waste management; 7) shifting away from the traditional valuation system for land classification, and 8) application of economic incentives.

De la Cruz, M. M., C. C. De Guzman, J. C. L. van Buuren, and B. Hamelers. 2004. The integration of biowaste and urban agriculture: Prospects and issues. The case of Metropolitan Manila, Philippines. Unpublished paper, Sub-Department Environmental Technology, Wageningen University, Netherlands. 9 p. (14)

Key words: waste, composting, recycling, solid waste

Presently, Metropolitan Manila (MM) generates about 6,000 tons of municipal solid wastes per day of which 2,800 tons are estimated to be biodegradable. Despite a legal framework and policy

that aims at recycling 25% of the biodegradable wastes, presently only 160 tons/day of these biowastes (about 6%) is source-separated and processed in 22 small-scale composting plants. Evaluation of the performance of 3 of these plants revealed flaws in obtaining compost with the officially required quality standards. A survey among 50 horticultural farmers showed that only 34% of them use organic fertilizer. The main impediments for increased compost application are low expectations about the yields of compost versus inorganic fertilizers, the relatively high price and cumbersome handling of the bulky product.

At 25% recycling in MM an agricultural area in the order of 20,000 hectares would have to apply municipal biowaste-based compost in quantities of ca 10 tons/hectares/year, which is far more than the agricultural area within the city's boundaries.

Enhancement of the municipal biowaste reuse chain in MM would require synchronous expansion of the markets, the composting and the collection of segregated wastes. In order to develop a vision on chain enhancement a research program covering Manila and several other South East Asian megacities is proposed.

A determined collaboration of the stakeholders involved in the chain, farmers, compost producers, waste generators, waste collectors and waste managers, is seen as a prime prerequisite in the development of this vision.

Japan International Cooperation Agency – Metropolitan Manila Development Authority (JICA-MMDA) Master Plan Report. 1998. The Study on Solid Waste Management for Metro Manila in the Republic of the Philippines. Pacific Consultants International and Kokusai Kogyo Co., Ltd. 165 p. (9)

Keywords: solid waste, recycling, local government

The document discusses a practical and sustainable Master Plan to improve the solid waste management (SWM) system in Metro Manila. The Master Plan takes into account a wide variety of planning issues regarding public awareness and participation, technical alternatives, and institutional and financial arrangements.

Results of the Waste Amount and Composition Survey (WACS) reveal that the total waste generation in Metro Manila is estimated at 5,350 tons/day, with household waste contributing 74% of the total. Waste generation varies with income level: 500, 451 and 344 g/person/day for the high-, middle- and low-income group, respectively. Of the amount discharged, around 73% are collected; the rest are illegally dumped. In most households, waste discharge is not segregated. Waste recycling is estimated at 200 tons/day.

Based on technical, environmental, financial, economic, and social considerations, the study recommends the use of intermediate treatment facilities such as an incinerator, a sorting plant and composting facilities coupled with the establishment of inland and sea landfills to improve current SWM efforts.

A major social constraint to a successful SWM is the location of the final disposal area, which has always been met with strong opposition from affected local residents. Other social issues that need to be addressed are: leadership and political will towards SWM improvements, promotion of public health benefits, improvement of refuse recycling systems, extension of collection services to informal settlers, provision of better working conditions to disadvantaged workers of the SWM sector, and coordination of ongoing initiatives to improve SWM.

A new institutional arrangement for SWM, involving the formation of management cooperatives with LGU (local government unit) groups to handle transfer facilities and sanitary landfills, is recommended. Urgent actions that need to be undertaken are: improvement of the present sanitary landfill, acquisition of sites for SWM facilities, reinforcement of LGU and MMDA performance in SWM, institutional arrangement prior to introduction of incineration plants, and establishment of a framework for the privatization of SWM.

Trüggelmann, L., R. J. Holmer. and W. H. Schnitzler. 2000. The use of municipal waste composts in urban and peri-urban vegetable production systems—potentials and constraints. In: ATSAF Tagungsband, Deutscher Tropentag Berlin, Oct. 14-15, 1999, 56–57. Landwirtschaftlich-Gärtnerische Fakultät. Humboldt Universität, Berlin, Germany. (19)

Key words: waste, composting, marketing, peri-urban agriculture.

Composting of the organic fraction in city waste and the use of the finished product as soil amendment and plant nutrient source for urban and peri-urban agriculture (UPA), has frequently been suggested as a development approach to improve solid waste management and to promote UPA. The paper assesses briefly the potentials and constraints of such an approach. Emphasis is given on the presentation of the initial results of a horticultural evaluation of municipal waste compost (MWC).

Reduction of composting costs and effective compost marketing appear to be the key issues for the success of MWC. The marketability of MWC hinges upon dependable supply, product consistency and specification, proven performance and reasonable pricing. The efficiency of MWC for horticultural production also needs to be evaluated. To provide such information, fertilizer trials, involving eight different levels of nitrogen and phosphorus combined with five different rates of market waste compost and chicken dung, have been designed for tomato and pechay. The study was conducted at the Manresa Research Station of the Xavier University in Cagayan de Oro City. Only data on the growth and yield of tomato are presented.

Results show that all organic fertilizer treatments increase plant height significantly over the control. At an equal rate of 2.1 tons/hectare, chicken dung is more efficient in stimulating growth than MWC. The inorganic nutrients have less impact on tomato stand homogeneity than organic fertilizers. The reverse is noted in terms of number of flowers/plant at the beginning of fruit setting. Across all mineral fertilization rates, MWC supplied at 4.2 tons/hectare increases yield significantly over the control. Additional application of nitrogen and phosphorous promotes total and marketable yield compared to treatments where only MWC or chicken dung is provided. For

MWC to be effective, it should go hand in hand with a balanced application of inorganic nutrients.

Institute for Local Self-Reliance 2000. Wasting and recycling in Metropolitan Manila, Philippines. Presented for Greenpeace Southeast Asia, Diliman, Quezon City. Washington, D.C. 17 p. (14)

Key words: waste, recycling, composting, solid waste

This report offers an outline of a solid waste management strategy for Metropolitan Manila. This strategy places precedence on disposal reduction through waste reduction, reuse, recycling, and composting. In particular, this report critiques the plan for waste management for Metropolitan Manila as proposed in the 1999 report “The Study on Solid waste Management for Metro Manila in the Republic of the Philippines” and other incineration-based proposals. Incineration has been theoretically banned in the Philippines following the passage of the Clean Air Act in 1999. This legislation explicitly bans all types of incineration yet the government continues to entertain incineration-based proposals. For example, the 1999 plan (hereafter referred to as “The Plan”), developed by the Japan International Cooperation Agency (JICA) and the Metropolitan Manila Development Authority, proposes to manage the region’s waste through 10% recycling (including composting). The remaining waste would be disposed in two new landfills—a new inland sanitary landfill and a new sea landfill developed in Manila Bay. The Plan proposes that waste be incinerated before disposal at the sea landfill.

Using common recycling, waste reduction, and composting technologies and implementation strategies from around the world, this report provides an alternative approach to managing municipal wastes. The alternative is both environmentally friendly and economically more attractive than disposal-oriented options.

Environmentally, the alternative approach is better as it reduces, reuses, and recycles materials that otherwise would have to be extracted from the earth. Furthermore, less material is disposed of in landfills. By eliminating proposed incinerators, Manila will avoid both toxic air emissions and potential for contamination of Manila Bay.

Economically, recycling can be less expensive than traditional disposal oriented systems. Recycling requires less capital and operating expenses. Furthermore, recycling sets the foundation for new recycling businesses and increased employment.

KEY FOR LOCATIONS OF ENTRIES

1. Central Luzon State University
Science City of Muñoz, Nueva Ecija
2. Department of Agriculture – Bureau of Agricultural Research
Urban Agriculture Division
Department of Agriculture Compound, Diliman, Quezon City
3. Department of Agriculture – Bureau of Soils and Water Management
Elliptical Road, corner Visayas Avenue, Diliman, Quezon City
4. Department of Environment and Natural Resources (Main Library)
Visayas Avenue, Diliman, Quezon City
5. Department of Environment and Natural Resources – National Capital Region
2nd Flr. Aaronn Bldg.
20 Araneta Avenue Extension, Quezon City
6. Food and Nutrition Research Institute (Library)
Department of Science and Technology
Bicutan, Taguig, Metro Manila
7. International Potato Center (CIP) – Users’ Perspectives With Agricultural Research and
Development (UPWARD)
c/o IRRI DAPO Box 7777, Metro Manila
8. Manila Observatory
Ateneo de Manila Campus
Loyola Heights, Quezon City
9. Metropolitan Manila Development Authority (MMDA)
3F MMDA Building
EDSA corner Orense St., Guadalupe, Makati City
10. National Center for Transportation Studies
Apacible St., UP Campus, Diliman, Quezon City
11. Southeast Asian Regional Center for Graduate Study and Research in Agriculture
(SEARCA)
UPLB Campus, Los Baños, Laguna
12. University of the Philippines Diliman, College of Home Economics (Library)
Diliman, Quezon City

13. University of the Philippines Los Baños (Main Library)
College, Los Baños, Laguna
14. University of the Philippines Los Baños, College of Agriculture, Department of Horticulture
College, Los Baños, Laguna
15. University of the Philippines Los Baños, College of Arts and Sciences, Institute of Chemistry
College, Los Baños, Laguna
16. University of the Philippines Los Baños, College of Economics and Management (Library)
College, Los Baños, Laguna
17. University of the Philippines Los Baños, College of Forestry and Natural Resources (Library)
College, Los Baños, Laguna
18. University of the Philippines Los Baños, College of Forestry and Natural Resources, Institute of Renewable Natural Resources
College, Los Baños, Laguna
19. Xavier University, College of Agriculture
Manresa Farm, Fr. W. Masterson Avenue
9000 Cagayan de Oro

Articles available on the Internet:

20. <http://avrdc.org/pdf/tb26/TB26.pdf> (accessed August 10, 2005)
21. http://www.ruaf.org/no10/14_15.pdf (accessed August 10, 2005)
22. [http://www.iges.or.jp/en/ue/pdf/megacity02/data/PDF/04-6\(AJERO\).pdf](http://www.iges.or.jp/en/ue/pdf/megacity02/data/PDF/04-6(AJERO).pdf) (accessed August 10, 2005)
23. http://www.klima.ph/publication/other_publications/02_ScientificPapers/007010/ppr3.pdf (accessed August 10, 2005)
24. http://www.observatory.ph/resources/publications/techreport_details.php by request (accessed August 10, 2005)
25. <http://www.ruaf.org/1-1/19-20.html> (accessed August 10, 2005)
26. <http://www.ruaf.org/no4/40-42.pdf> (accessed August 10, 2005)

27. http://www.ruaf.org/uam_9.html#Philipp or http://www.ruaf.org/no9/34_36.pdf (accessed August 10, 2005)
28. http://www.avrdc.org/pdf/99annual_report/manila.pdf (accessed August 10, 2005)
29. http://www.avrdc.org/pdf/00annual_report/manila.pdf (accessed August 9, 2005)
30. http://www.avrdc.org/pdf/ann_rpt01/13manila.pdf (accessed August 9, 2005)
31. http://www.avrdc.org/pdf/ann_rpt02/13_manila.pdf (accessed August 9, 2005)
32. <http://www.avrdc.org/pdf/PR2003.pdf> (accessed August 9, 2005)
33. <http://www.ruaf.org/1-3/15-16.pdf> or <http://www.ruaf.org/1-3/15-16.html> (accessed August 10, 2005)
34. http://www.ruaf.org/conference/methods/papers/upa_methods_topic6_marketing_microenterprise_en.doc or <http://www.puvep.com/publications/Marketing%20assessments.pdf> (accessed August 10, 2005)
35. http://www.puvep.com/allotment_gardens_for_the_philippines.pdf or http://www.puvep.com/publications/29_phil.pdf (accessed August 10, 2005)
36. <http://www.puvep.com/publications/peri61-66.pdf> (accessed August 10, 2005)

LOCAL INSTITUTIONS INVOLVED IN URBAN AGRICULTURE

Baguio City Nutrition Council

City Hall, Baguio City

Contact Person: Mrs. Angelita Sabado
Coordinator

Benguet State University

La Trinidad, Benguet

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