Biodiversity and Sustainable Agriculture for Medicine, Health, and Food

Monnipha Sila-asna[1]
Ahnond Bunyaratvej[2]

Abstract

In mid-year 2011, the world population was increased to 7 billion. The rising figure of world population is estimated to be 8 billion in 2025 and 9.0 billion people in the year 2050. The overgrowth will be the critical threshold for biological chaos in future. The chaotic consequences include deteriorated environment, insufficient supply of food, insufficient medication for people, and lack of or poor quality shelter. Furthermore, diseases, disaster, starvation and poor sanitary are all negative consequences. Deforestation and urbanization destroyed biodiversity leading to natural disaster. Combination of at least two disciplines; medical science and agriculture might be the solution to this issue. The agricultural strategy is integration among biodiversity of ecology, plants and land for agriculture. Agriculture for medicine, health and good quality food will be the good direction of economic development with the solution of overgrowth of world population. Biodiversity provide complete trace elements from plants to human to fulfill good health condition. Research for value addition and value chain of plants products from rich resources of plants could then be of importance for adequate health system and food at global level in future. This article aims at creating model of combination between primitive wisdom and the newly advance knowledge of agriculture and medical science. An attempt of integrating agriculture, biodiversity and health in medical science, following the philosophy of sufficiency economy, is proposed in this article.

Keywords: Agriculture, Biodiversity, Food, Health, Medicine, Sustainability, Sufficiency economy

[1] Institute of Molecular Bioscience, Salaya, Mahidol University
Associate Fellow, Academy of Science, The Royal Institute of Thailand

[2] Pattana Yang Yuen Foundation, (PYY Foundation for Sustainable Development)

Introduction

Among plants and animal varieties, human is the tertiary consumer in all pyramid models: number, biomass and energy. Theoretically, the tertiary consumers could survive when they keep their number, mass and total energy in balance with plants and animals which are products and primary and secondary consumers. The overgrowth of human population or tertiary consumer during last decade is now leading to the biological alteration in food chain. More plants and animals are required for providing energy as food for human. Then, the land for agriculture and farming is of great demand. However, urbanization in many countries leads to land manipulation by human in following direction: deforestation, agriculture and construction. All of these processes lead to the change of natural land of biodiversity into man-made area. Construction makes people away from natural way of life. In addition, agriculture technology might be dangerous to human and cause deteriorating effect on environment. The authors of this article try to elaborate the problems of devastating effect to nature by human misconduct. The overgrowth of world population may, in the near future, leap across the threshold of critical mass leading to biological chaos. The model of integrating agriculture, biodiversity and health in medical science, following the philosophy of sufficiency economy, is proposed in this article.

Materials and Methods

As problems and future trend mentioned in the introductory part, the relevant subjects were studied as follows:

Data of world population growth were analyzed using histogram plot. Population, health and environment data are estimated among countries and regions of the world with special emphasis on Thailand and Southeast Asia.

To evaluate the impact of human population growth on social development, the necessaryitems of related matters (Figure 1) were selected by using the models of human basic needs. Basic needs for human compose of four main factors: food supply, drug for treatment, good shelter, and environment. The first two were selected in this study to find the good model by combination of agriculture and medical science. The models include two scenarios; optimal human population and overgrowth of human population.

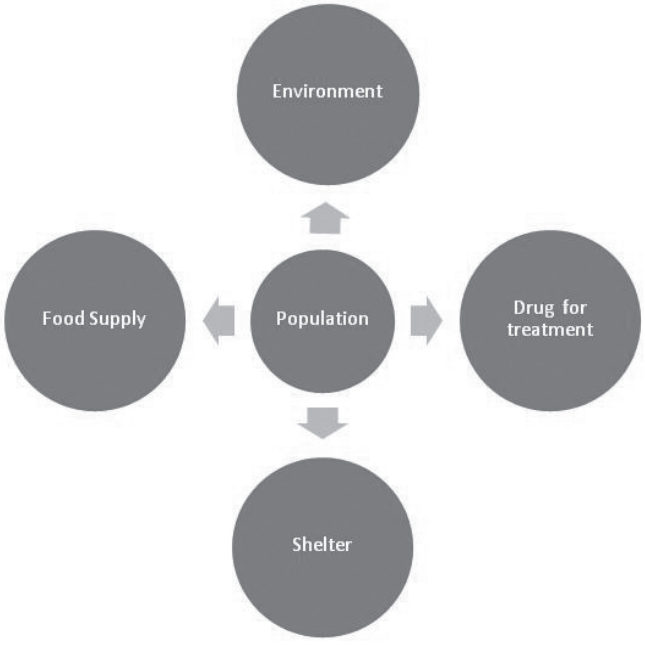

Figure 1: Basic needs of human in the scenario of optimal human population

Results and Discussion

Histogram of rising world population from year 1 to year 2083 was analyzed using geographic data (Rosenberg M., 2012). The world population was six billion in1999 and was estimated at **7,021,836,029** in mid-year 2011. Although control of population growth in some countries, particularly developing countries, has been successful the overall population is still rising during the current decades as shown in Figure 2.

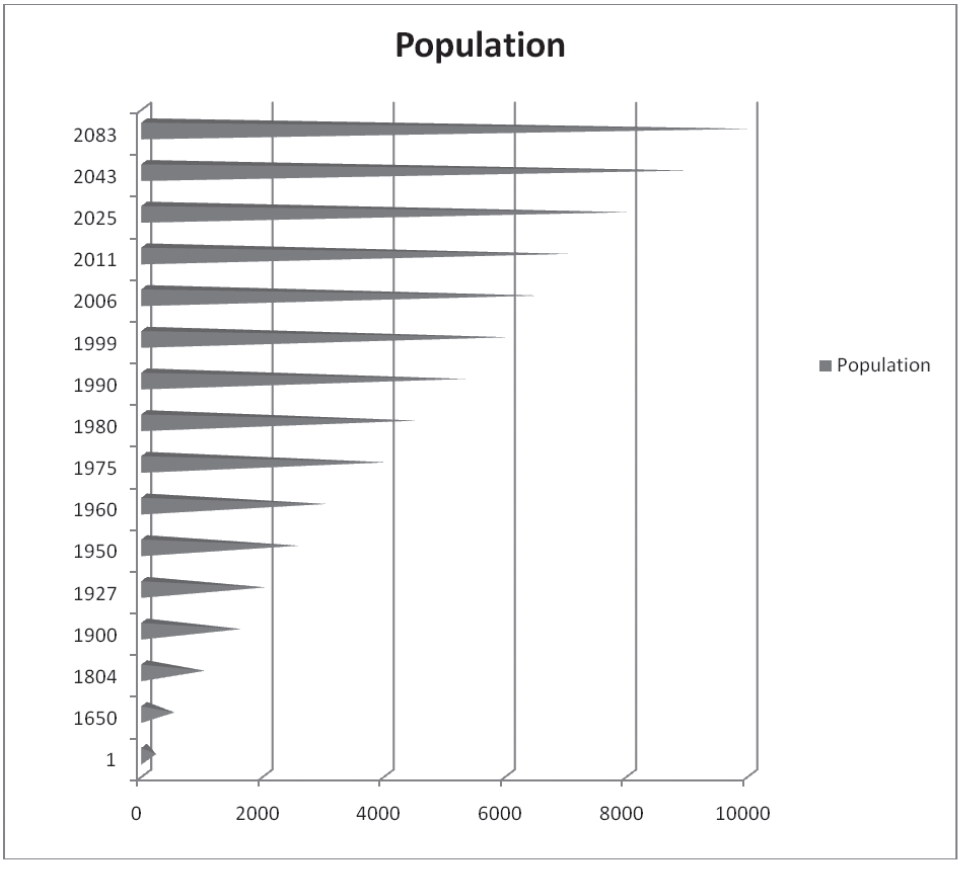

Figure 2: Histogram show rising world population from year 1 to year 2083.

For evaluation of the impact of population growth, data of population, health and environment were analyzed. With increasing world population, health and environment data were evaluated for the prediction of life expectancy at birth, health, land for living and agriculture in relation to population, percent urban and improved water supply (Table 1). The data indicates the problem of shortage food supply from agriculture might be the future issue due to increasing urbanization and inadequate water supply for people in some countries, particularly less developed countries. The average of life expectancy at birth in least develop countries is much lower than those of more developed countries at 19 years. This indicates the health condition must be improved simultaneously with agriculture and environment manipulation.

	Life expectancy at birth (year)	Population/ Square kilometer	Percent Urban	Percent of Population with Improved Water Supply (Urban)	Percent of Population with Improved Water Supply (Rural)
World	70	51	51	96	77
More developed	78	27	75	100	97
Less developed	68	69	46	94	76
Less developed (Excl. China)	66	60	44	93	74
Least Developed	59	41	28	80	54

Table 1: Population, health and environment data and estimates for the countries and regions of the world. (PRB's World Population Data Sheet 2011)

The population growth of Thailand is in good condition as shown by the sligh increase to 71.0 million people in the year 2050 as compared with 69.5 million in the year 2011. The total world population turns to be more than 9.0 billion people in the year 2050 from 7.0 billion in year 2011. Comparing among countries in Southeast Asia, Thailand has 70 percent of people with working age between 15-65 years. This figure is better than many other countries in South East Asia. The percentage of population having improved water supply in rural area is 77 (Population Reference Bureau MEASURE *communication*). Again, as compared with average figures in Asia and world, Thailand is still much better.

	Population Mid 2011	Projected Population Mid 2025	Projected Population Mid 2050	2050 Population as multiple of 2011	Percent of Population Age < 15	Percent of Population Age 65^{+}
South East Asia	602	698	796	1.3	28	6
Thailand	69.5	72.9	71.0	1.0	21	9
Myanmar	54.0	61.7	70.8	1.3	28	5
Vietnam	87.9	100.4	109.3	1.2	25	7
Malaysia	28.9	35.3	43.6	1.5	28	5
Singapore	5.2	5.8	6.1	1.2	17	9
Cambodia	14.7	18.0	22.3	1.5	33	4
Laos	6.3	7.9	10.3	1.6	41	4
Philippines	95.7	120.2	150.1	1.6	36	4
Indonesia	238.2	273.2	309.4	1.3	28	6
Timor	1.2	1.7	2.8	2.3	45	3
Brunei	0.4	0.5	0.6	1.5	30	4
Asia	4216	4780	5228	1.3	26	7
WORLD	6987	8084	9587	1.4	27	8

Table 2: Projected population and percent population distribution as of school and retirement ages in South East Asian. (countries Extracted from PRB's World Population Data Sheet 2011)

Agriculture has been then done in systematic way to gain sufficient supply of food at varying levels from individuals, family, community, country and global people.

For the sake of humanity, agriculture in the globalization era should be considered how to achieve adequate food supply for world population. However, for global sustainability, adequate food supply will not be an only target, but also the wise agriculture management of land and food quality for health is the matter to be seriously considered. Large mass of food is daily required particularly, in the situation of rapidly growing population. Misconduct of agriculture is not only lead to economic loss, but also negative impact both directly on human at individualism scale as well as to holistic scale between human and environment. Agriculture is responsible for 87 % of the total water used globally. A great deal of water is returned to surface runoff. Usually that water is contaminated however, whether used for agriculture, domestic

consumption, or industry. Water, agriculture and human health are closely related. More than 5 million people die each year from diseases caused by unsafe drinking water, and the lack of sanitation and water for hygiene (Postel, S.L., G.C. Daily et. Al). Human health, malnutrition and other related diseases are the matter to be seriously considered. World health organization (WHO) has recommended four strategies of intervention for preventing malnutrition. These include firstly, improved water supply, secondly, education for a healthy diet, thirdly improved access, by the poor, to adequate amounts of healthy food and fourthly, ensuring that industrial and agricultural development (WHO, 2000 , WHO/NHD/00.7).

Thailand has been a country of agriculture for more than 700 years. Wisdom of agriculture of Thai ancestor is precious heritage transferred from time to time until to our generation. In addition, medical wisdom has developed in Thai society as shown by the reflection of intelligence of Thai precursors in the welfare of Thai life style at that time. Advanced medical science has been currently been developed and adopted in Thai society. However, expenditure of medical service could hardly cover for the whole people in the nation. The solution to this issue is how to manipulate two disciplines; medical science and agriculture. This article has elaborated in an attempt of integrating and creating the model of combination between local wisdom and the newly advance knowledge of agriculture and medical science.

Basic needs for human

Four basis needs of human including environment, food, shelter and medication are brought up for addressing the new strategy of agriculture. The optimal world population and the balanced needs are shown in Figure 1. As shown in Figure 3, the scenario of world overpopulation will interfere with all these four factors. Deteriorated environment, insufficient food supply, shortage of drug for people, and lack of or poor quality shelter are the major consequence of overpopulation. Deforestation and urbanization cause degeneration of biodiversity. This leads to high risks of disaster, starvation, poor sanitary and diseases which are all the further consequences.

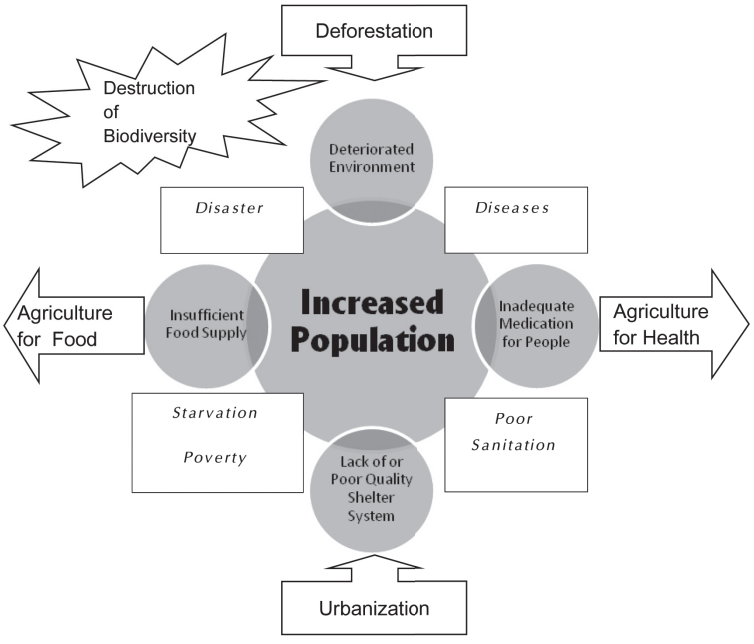

Figure 3: Analysis of increased population and consequences in relation to basic needs of human.

Insufficient food supply due to population overgrowth and the agricultureal model for food and health in Thailand

Thailand provided adequate food in the country and produced substantial surpluses of some commodities for export. The country's agricultural success is ability to adapt for increased world population in both quantity and quality. The quality is directly related to human health. Availability of large areas for cultivation is required. The acceptance of new technologies and the adoption of more intensive cultivation have extensively occurred in agriculture sector. During the mid-1980s, agriculture accounted for an average of about 25 percent of GDP, and agricultural commodities accounted annually for over 60 percent of the value of all exports (Falvey L, 2000).

This report proposed the synthesized models of agriculture for serving at least two basis needs of human i.e. agriculture models for food supply and for health as shown in Figure 4.

To understand the development of agriculture in Thailand, four models (A to D) are synthesized. Model A is the traditional way of life of the former Thai people. Food nutrients and food elements from plants in biodiversity could provide complete trace elements to human to fulfill good health condition. Although there are adequate food supply, agriculture for massive production of some particular types of food may cause a lack of some trace elements in food that causes poor health system e.g. malnutrition in large population as shown in Model B. We are now approaching the condition of overgrowth population with inadequate food both in quantity and quality (Model C). The problem in model C can be solved by model D of which agriculture is combined with biodiversity. Mass production is still performed using the appropriate technology, friendly to environment. At the same time, agriculture in biodiversity is strongly recommended for maintaining essential food elements for health. Some plants considered as useless weed, instead of throwing away, could be of importance for medication. For example, the seed extract of *Macuna gigantia*, the useless weed contains dopamine, the important substance for medication of Parkinson's disease. Such component could successfully induce neuronal cell differentiation (Kongros K, Bunyaratvej A, et al, 2012). Agriculture for both food and health will be the new potential of economic development. Quality of food is necessary for human health using as prevention, fortification and therapeutic effect on various human diseases. Almost 100 rich resources of natural plants could provide plant-derived compounds potentially served for drug development in clinical trials. However, many plant compounds are limited by low production which is not sufficient for clinical potential. Value chain management has to be systematically managed.

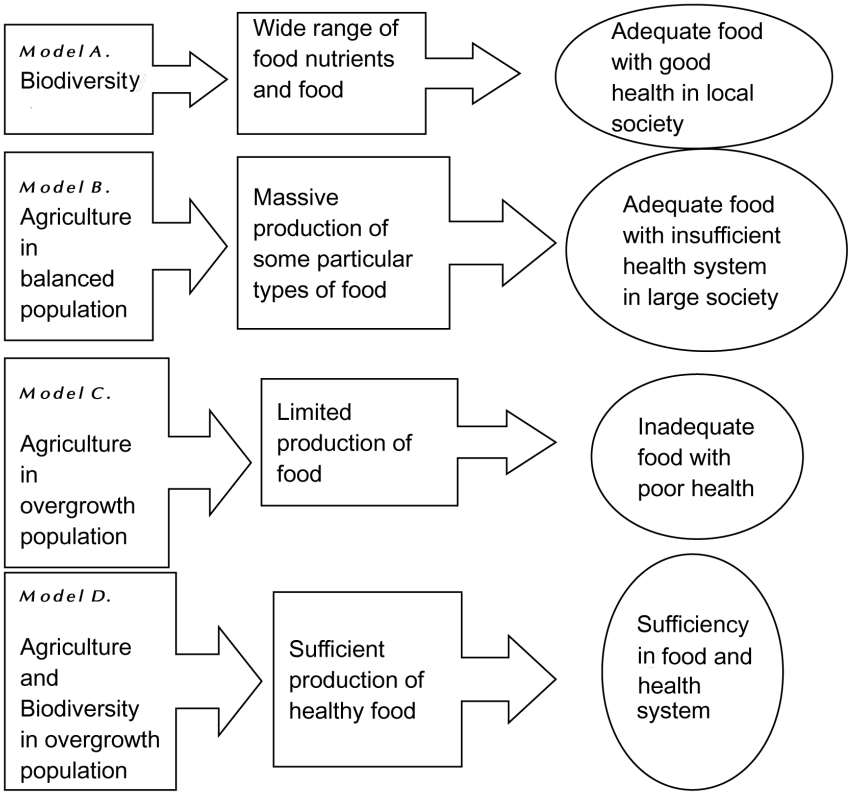

Figure 4: Synthesized Models of Agriculture and Biodiversity in Overgrowth Population

In conclusion, the good strategy of agriculture in Thailand is the integration among biodiversity of ecology, plants and land for agriculture. Many plants from biodiversity could provide complete trace elements to human to fulfill good health status. Value addition and value chain of drug research form plants from rich resources of plants could then be of importance, in future, for adequate health system at global level. To overcome the imbalance between overgrowth population and environment could be started from people with readiness in mind and attitude toward the philosophy of sufficiency economy (Royal speech, December 23, 1999). Hopefully, agriculture for medicine, health and food will be one of the future paths for people in the future scenario of overgrown population.

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