



## The environment in education: Pesticides in Lebanon

**Akl M. Kairouz \***, Department of Internal Medicine, American University of Beirut, Riad El Solh St, Beirut, Lebanon.

**Issam Y. Atala**, Department of Internal Medicine, American University of Beirut, Riad El Solh St, Beirut, Lebanon.

### Suggested Citation:

Kairouz, A., M. & Atala, I., Y. (2015). The environment in education: Pesticides in Lebanon. *World Journal of Environmental Research*, 7(2), 99-117.

Received 19 January, 2015; revised 22 February, 2015; accepted 23 April, 2015.

Selection and peer review under responsibility of Dr. Nehir Varol, Near East University, Cyprus.

©2015 SPROC LTD. Academic World Education & Research Center. All rights reserved.

---

### Abstract

Environmental Issues in Education: The Case of Pesticides in Lebanon In the untamed world of globalization, rapid industrialization, and the gluttony for material consumption centering on the rapid depletion of certain natural resources, all coupled with high emission of polluting carbons and chemicals, the ecosystem lost its balance pushing this tiny planet, earth, towards natural catastrophes. This research highlights the main environmental issues and problems citing Lebanon as an example of many developing countries, caused by reckless behavior and policies, as they fail to design and adopt solutions to a series of complicated problems. The main question revolves around what causes humans to persist in mismanaging the natural resources that sustain their existence? The immediate answer may be summarized in these words: ignorance, individualism and greed. The authors aim at highlighting the setting and formulation of an international strategy, focusing particularly upon the problem of global warming. The case of misuse of pesticides in the Lebanese agricultural sector and their fatal impact upon the environment will be highlighted. The stress will be on the role of education in forming and shaping ecological awareness, at schools, universities, media, NGOs, and particularly governmental institutions. The paper concludes by calling for launching the setup of an international strategy to establish lobbying chapters in every country. The aim would be to follow up on public and private policies while applying effective academic and practical steps in schools and universities to develop an effective awareness of environmental problems. It invites governments, municipalities, socio-religious groups and NGOs to assume their active roles and awaken the common citizen's consciousness and responsibilities through ecological promotion and replenishment activities to sustain a balanced ecosystem for future generations to enjoy.

Keywords: natural resources, pesticides, agricultural sector, education, ecosystem, environment.

---

\*ADDRESS FOR CORRESPONDENCE: **Akl M. Kairouz**, Department of Internal Medicine, American University of Beirut, Riad El Solh St, Beirut, Lebanon. E-mail address: [ea32@aub.edu.lb](mailto:ea32@aub.edu.lb)

## 1. Introduction

The nature that nurtured and clothed the human species is sounding the alarm of its continual destruction; for the industrialist man is "changing the face of earth" seriously damaging the ecosystem and threatening centuries of human civilization. Government and states, worldwide, are heavily concerned with the invention of mass destruction arms and power tools at costs exceeding, on a yearly basis, the one trillion US dollars (Norton & Taylor, 2009). This large portion of the global economy is spent on violence, mutual suicide, and self-destruction. In contrast, many verbal and written statements, in addition to ineffective documents, are dedicated to promote quality of life and environmental sustainability under the honorable pretext, to save the planet and its inhabitants. That encompasses humans, flora, mammals, birds, fishes, and geographic physiological mapping before the ultimate catastrophe strikes.

This topic was chosen due to its importance since it revolves around one of the silent ecosystem killers in Lebanon, as it spreads poison and death. Yet no effective remedies are insight. The objective of this research is to highlight pressing environmental problems in general and particularly in Lebanon.

The study is divided into four parts: the first, clearly and briefly identifies the more pressing environment problems outlining the causes, whether tangible or intangible, as well as their intensity; the second revolves around governmental policies and remedies that have been or might be formulated and adopted, although not yet implemented; the third emphasizes the role of education as a priority venue to develop, at all levels, popular awareness of the danger and available solutions; the fourth stresses solutions, policies, finances, and follow ups that should be based on an international commitment, will and efforts, whereby all member states forming the international community and organizations ought to review and implement whatever decisions that need to be taken, including sharing, in financing projects for environmental replenishment and sustainability.

We submit that people of the world, and specifically the developing countries, have enough of undelivered promises, and they are waiting for an effective leadership to initiate changes before too late.

The authors invites the honorable representatives from various countries, and who are participating in this consortium to join together, to create an international intelligence force and lobby, equipped with specific strategies to place this matter as a priority on international and national agendas for immediate action.

The collected data, in this research, heavily relies upon fragmented works by a great number of colleagues and institutions concerned with the degradation in the environment conditions. It begins with analysis of various types of pollution, such as air pollution, water, soil, chemicals, carbon dioxide, agricultural, chemicals... ending with global warming.

The great majority of these studies scientifically, display and describe the problems stressing the negative impact upon the quality of life, the world economy, human health and existence, yet there is no clear international strategy adopted and implemented, outlining clear and feasible remedies.

What is needed and requested is to investigate and outline clear strategy for action through international policies, to reduce the immediate adverse impact of the damages already done, and to save what could be salvaged.

The central and only question that ought to be raised in this colloquium is: should we create and maintain a planet with high quality of life, or increase the desert for death? There is no stand in a grey area on this matter.

## 2. The State of Pollution in the Middle East

The alarming pollution trends and status are worldwide catastrophic, for the problem is “bred by ignorance and greed” (Baroud, 2010)

The pollution and obstruction of the ecosystem in the developing world are triggered by many factors and contaminants; the most important of which are hereby, summarized as:

- Industry

This sector uses below standard fuel combustion and emission of toxic material that accumulate in the air for several years before moving out of earth atmosphere. The fuel involves large amounts of sulfur, generation, of deadly SO<sub>2</sub>. The main polluting industries are refineries, cement plants, and others industries that dump their solid and liquid residues in water drainages leading to nearby streams and flowing into costal seawater negatively affecting sea life (Jadam, 2010).

- Non-Industrial Pollutants

The solid waste pollutants constitute the main sources to contaminate fresh water and soil; especially since there is almost complete absence of operational sewage treatment plants and system in most developing countries particularly in Lebanon. (Khalaf Etal 2011) Furthermore, in the absence of an effective water treatment system and preservation, solid residues contaminate most underground fresh water, causing wide spread of typhoid, hepatitis, and dysentery, at such intensity reaching national epidemics (Ibid). In Lebanon, Beirut is the only city with a solid waste treatment center.

Nationally, rivers, springs, and underground drinking waters are heavily impacted by raw sewage and other wastes, whether domestic or industrial.

Unfortunately, waste waters are is dumped into the rivers' banks, carrying to the sea large amounts of human and animal wastes such as food remains, chemical products, fertilizers, petroleum, and derivatives plastic products, in addition to a wide range of metal products that threaten, and in some cases, destroy the lives of aquatic animals and plants. The death of sea turtles, e.g. dolphins, other species of fish and algae, generates a remarkable increase in jelly fish population (Tohme, 2010).

The problem is further aggravated by the multiplicity of Lebanese key actors who proved so far scandalously, ineffective in managing the water sectors. This includes several ministries, water establishment departments, public agencies, municipalities and others. The results ended up with: duplication of tasks, inefficiency in performance, lack of communication and coordination, and last, flagrant corruption.

In the meantime, air and water contamination accelerate without treatment. The Lebanese Counsel for Development and Reconstruction (CDR) assisted by the UNDP and WHO prepared in the year 2010 a master plan to deal with solid waste management. Unfortunately this work remains ink on papers, buried in bureaucratic drawers (CDR, 2010)

Many laws, since, were enacted lacking implementation mechanism. The Ministry of Planning was abolished and with it all urban planning; construction violations are unchecked especially on riverbanks and seashores.

The results of this chaotic failure to understand the environmental issues led to having urbanization, claim 65% of the national land, while agriculture, in general, is responsible for 29%, and the woodland for 3%. (Ibid)

- Soil Degradation

The uncontrolled usage of pesticides and fertilizers, besides killing harmful bacterial insects, kills also useful bacteria, birds, and plants, leading to decomposition and sterility of the soil. The cheap

chemicals and their unrestricted use, demonstrate the lack of awareness amongst all parties whether importers of chemicals, distributors, and farmers.

Pesticides pollution, urbanization, deforestation, urbanites, fertilizers and insecticides, exert huge negative impact on agricultural life and soil degradation, poisoning it. Furthermore, farmers often irrigate with contaminated water, especially in the summer month to offset water shortages.

The greatest danger lies in the applied pesticides and fertilizers that comprise nitrates. Agriculture will not then be the only victim of soil pollution. A great number of mammals, fish, birds, even wild life, and rare aromatic and medicinal plants would be damaged and suffer extinction. Lebanon hosts over 600 wild plants species. According to Tohme & Thome, professors of botany, 2007, 52% of Lebanese flowers do not grow in Europe, or the Mediterranean region. As for the endemic species, 17 are rare, 4 are extinct, and 16 threatened (Thome & Thome, 2008). Furthermore the illegal hunting tools used such as led pallets, poison the soil reaching the underground fresh water and contaminating it. In the rivers, illegal overfishing is practiced through dynamite and small size trawling nets threatening the life of many fish species. It also damages the natural habitat urbanization has not yet claimed and abused (Chalak et al., 2011).

The Agriculture case: prohibited pesticides

The soil pollution decomposition alters its natural, chemical and biological properties, negatively affecting all living beings. Pollution deprives the soil from its fertility.

The focus in this paper dwells upon the unregulated use of pesticides by the farmers. Chemicals are applied to control nematode species, insects, weeds and fungal bacterial diseases. Crops are sprayed by pesticides to kill harmful insects. In this process the soil is also sprayed. The environmental harm of the pesticides is in the fact that most of them are heterocyclic compounds that slowly decompose causing high toxicity for a longer period. The case is worse in greenhouses.

A list of pesticides is exhibited showing the type and life span of each.

Table 1. Commonly used pesticides and their life-time in the soil in Lebanon.

| Pesticide        | Type               | Pesticide half-life |
|------------------|--------------------|---------------------|
| Aldrin           | Hydrocarbon melcor | 2 months            |
| Karbail (sivini) | Carbonate          | 1 month             |
| Forat( thimbt)   | Organic phosphate  | One month           |
| Baraon           | Organic phosphate  | 20 days             |
| Methyl parathion | Organic phosphate  | 20 days             |
| Malathion        | Organic phosphate  | 20 days             |

Source: Anthony J McMichael et al. in Comparative Qualification of Health Risks. P137

It must be noted that pesticides of low solubility remain in the soil for a long time affecting the quality of the produced vegetables. DDT, for example remains for 30 years unlike karboforam that stays for one week due to its high melting point.

The factors that are destroying the ecosystem are too many and already well defined by environmental researchers. The following listing is only designed as a reminder to the reader to understand the urgency and magnitude of the problem.

- The municipal wastes in urban and semi urban areas as well as rural areas. The specific selected region is the Bekaa Valley.
- Hazardous waste from hospitals and industries; Some are smuggled from foreign countries in Europe
- Uncontrolled and untreated garbage in cities and villages, including households wastes

- Mining industries, mainly cement crushing rocks and power plants in addition to petrochemicals from refineries.
- Food and animal wastes
- Untreated sewage and garbage wastes
- Fuel, oil and carbon emission
- Uncontrolled usage of fertilizers and pesticides (nitrates, nitrogen, DDT...)

#### Overview of the agro sector in Lebanon

Although agriculture in Lebanon remains, in general, family owned and managed with few co-ops attempting to survive, the sector as a whole comprises approximately 4.500 SMEs averaging 6 employees per unit.

Table 2: Current Land Utilization in Lebanon, 2010

| Land utilization    | Area(hectares) | Percentage of total land area |
|---------------------|----------------|-------------------------------|
| Irrigated crops     | 67,000         | 6.4                           |
| Non-irrigated crops | 218,00         | 27                            |
| Uncultivated plants | 75,000         | 34                            |
| Woodland areas      | 60,000         | 6                             |
| Urbanized lands     | 630,000        | 60                            |
| Total               | 1,050,000      | 100                           |

Source: National Report on the Environment and Development in Lebanon (2010), Ministry of state for Environment, Republic of Lebanon. See also National Report 2010. OP.CIT

### 3. Death of Species

Agriculture is not the only victim of pollution since a huge number of mammals, fish, birds, and wild plants are or may also become extinct.

Overharvesting of natural resources occurs on many levels. Unregulated hunting laws and hunting malpractices reflect birds 'slaughters every year. Reckless hunting is seriously impacting selected bird populations. Lebanon is situated on one of the world's key migratory bird corridors and has turned into a death trap or even slaughter for avian populations.

### 4. Birds in Lebanon

Lebanon is the main route of migrating birds; consequently. Therefore, millions migrate to Lebanon during autumn coming from Africa and ending as victims of unregulated hunting policies.

Out of Lebanon's avifauna (395 species), three species (*Sterna bengalensis*, *Francolinus francolinus* and *Merops persicus*) have vanished, 6.3 percent are threatened and 32 percent are rare. According Ramadan Jaradi et al 2008, Lebanon's bird species include three critically endangered, 8 vulnerable and 17 near threatened species.

Table 3. Number of bird species coming to Lebanon

|  |     |
|--|-----|
| Number of Lebanese bird species in the Near East to the Caspian sea                              | 9   |
| Number of bird species simultaneously existing in Lebanon and Europe                             | 218 |
| Number of bird species that nest in Lebanon  | 57  |
| Number of bird species that would be nesting in Lebanon under favorable environmental conditions | 11  |
| Migrating bird species in springtime only  | 39  |
| Migrating bird species in autumn only  | 17  |
| Migrating bird species in springtime and autumn  | 20  |
| Migrating bird species which leave Lebanon in autumn and return in spring                        | 13  |
| Bird species that spend winter in Lebanon  | 36  |
| Bird species that pass at least once a year through Lebanon                                      | 121 |

Source: Evans (2010) Imported Bird Areas in the Middle East, Birdlife conservation series No.2 Birdlife International.

“Most of Lebanon can be considered as a huge ‘bottleneck’ for migratory raptors and storks, therefore despite the intense shooting massacres that populations of these birds endure in Lebanon, it would be meaningless to define any particular sites for protection in isolation. To conserve these species, wide-scale enforcement of the current hunting regulations is necessary” (Evans 2010).

Table 4. known endangered bird species in Lebanon

|                    |                          |
|--------------------|--------------------------|
| Aquila heliaca     | Imperial eagle           |
| Crex crex          | Corncrake                |
| Serinus syriacus   | Syrian serin             |
| Falco naumanni     | Lesser kestrel           |
| Larus audouinii    | Audouin’s gull           |
| Alectoris chukar   | Chukar partridge         |
| Gallinago media    | Great snipe              |
| Aythya nyroca      | Ferruginous duck         |
| Botaurus stellaris | Great bittern            |
| Falco cherrug      | Saker                    |
| Aquila pomarina    | Lesser spotted eagle     |
| Larus cachinnacs   | Yellow-legged gull       |
| Pernis apivorus    | European honey buzzard   |
| Gyps fulvus        | Eusarian griffon vulture |
| Accipter brevipes  | Levant sparrow hawk      |

Source: Evans, M.I. (1994) Imported Bird Areas in the Middle East, Birdlife conservation series No.2 Birdlife International

As for the marine life, overfishing of several species (using dynamites, small illegal size trawling nets, and massive collection of mollusks) has so far caused irreparable damages. Furthermore, the destruction of natural habitat reflects the uncontrolled of cutting of trees, destruction of medicinal and aromatic plants, the estimated market value of which is 29.6\$ million per year (Bariche, 2007).

The disappearance and deterioration of the life of plants and animals in Lebanon is accelerated by two additional main unregulated factors mainly the rapid increase in urban areas, and damage to natural habitat. The use of pesticides and dryness of swamps, for example **Ammiq wetlands** in central Bekaa, resulted in the death and extinction of many useful plants.

## 5. Endangered mammals species

AS for the endangered mammal species in Lebanon, the following table provides some clear indications:

Table 5. known endangered mammal species in Lebanon.

|   |                   |
|---|-------------------|
| Canis lupus pallipes (Sykes)              | Wolf              |
| Herpestes ichneumon (L.)                  | Egyptian mongoose |
| Felis silvestris tristami (Poc.)          | Wild cat          |
| Sciurus anomalus syriacus (Eh.)           | Squirrel          |
| Lutra lutra (recently extinct in Lebanon) | Common otter      |

Source: Tohme, George and Henrietta, (2008). Ecology of Lebanon; facts and Exemples, Lebanese university, Natural Science Section 17,

The entire sector of plants and mammals falls under the authority of the Ministry of Agriculture that is understaffed, operating on a limited budget, lacking assessment and planning, toppled with the absence of authority to efficiently repair damages to nature and humans. (Pesticides Action Net).

The excessive and unregulated use of pesticides, according to a study by the Department of Preventive Medicine at Northwestern University, Feinberg School of Medicine, Chicago, in 2009 proved to be internationally fatal.

The study shows that groups working with pesticides exhibit immunotoxic and hemotoxic activities. That includes prevalence of chromosomal abnormalities in non-Hodgkin's lymphoma (NHL) (Chiu BC, Blair A., 2009).

Based on a study Whitney U-test and the Kruskal rank test of variance, it was clearly discovered that farmers were in much need of education about pesticides safety. Furthermore, efficient legislations must be enacted and enforced (knowledge and Practices, 2010).

## 6. Training the farmers

Training the farmers requires many efforts and an adequate budget, special programs by skillful experts in chemicals. The task is a difficult one for it requires the public and private sectors cooperation and coordination of actions.

Most of the farming area in Lebanon revolves around the Bekaa Valley that is located between two chains of mountains. At the foot of these mountains, hundreds of villages have been irresponsibly built, lacking adequate water and sewage networks. Instead poisonous wastes are buried underground, slowly seeping into the underground fresh water contaminating it. This polluting process has reached a very dangerous limit since the underground fresh water used for irrigation is presently either contaminated, or worse, mixed with the sewage septic wells in addition to large amount of chemical residues from pesticides and fertilizers... The tragic irony, in this whole matter lies in the need for continual pesticides applications. On a bi-weekly basis, crops must be sprayed, due to either the bacteria that has developed some kind of immunity, or the vicious circle of bacteria multiplying through billions of laid eggs since the natural enemies of that bacteria have been eliminated with pesticides.

## 7. Man- made sources of agricultural pollution

Besides the chemical fertilizers and pesticides, the local villagers and inhabitants do contribute much to increment the problem. The most important factors comprise:

- Industrial waste pollution dumped in agricultural land or in irrigating waters.

- Deforestation leading to reduction of oxygen and increase in CO<sub>2</sub> emission; loss of migratory birds which acted as environment cleaners reducing the number of rodents and insects.
- Outdoors fire producing CO<sub>2</sub>, or incineration of waste including plastics and hazardous products.
- Emission of gazes such as sulfur dioxide(SO<sub>2</sub>), nitrogen dioxide(NO<sub>2</sub>), carbon monoxide(CO) and carbon dioxide(CO<sub>2</sub>).
- Rapid and unplanned, nor properly administered urbanization trend triggering a series of natural calamities and disfiguration.
- Worse, the dumping of millions cubic meters of garbage and households waste that, later on, get partially mixed with the soil poisoning it.

The following list exhibits the mostly used poisonous pesticides:

Table 6. The mineral fertilizers and waste-derived fertilizers considered as the most important sources that pollute soil with toxic elements.

| Elements   | Phosphate Fertilizers | Nitrogen fertilizers | Organic fertilizers | Fertilizers made of wastes |
|------------|-----------------------|----------------------|---------------------|----------------------------|
|            | Mg/ Kg of fertilizers |                      |                     |                            |
| Arsenic    | 1200-2                | 120-2.3              | 25-3                | 52-2                       |
| Boron      | 115-2                 | —                    | 0.6-0.3             | —                          |
| Cadmium    | 170-0.1               | 8.5-0.05             | 0.8-0.1             | 100-0.01                   |
| Cobalt     | 12-1                  | 12-5.4               | 24-0.3              | —                          |
| Chromium   | 245-66                | 19-3.1               | 0.36-0.01           | 21-0.09                    |
| Copper     | 300-1                 | —                    | 172-2               | 3580-13                    |
| Mercury    | 1.2-0.01              | 2.9-0.3              | 0.36-0.01           | 21-0.09                    |
| Magnesium  | 40.2000               | —                    | 969-30              | —                          |
| Molybdenum | 60-0.1                | 7-1                  | 3-0.05              | —                          |
| Nickel     | 38-7                  | 34-7                 | 30-2.1              | 279-0.9                    |
| Lead       | 225-7                 | 27-2                 | 27-1.1              | 2240-1.3                   |
| Tin        | >100                  | —                    | —                   | —                          |
| Selenium   | 0.5                   | —                    | 2.4                 | —                          |
| Uranium    | 300-30                | —                    | —                   | —                          |
| Vanadium   | 1600-2                | —                    | —                   | —                          |
| Zinc       | 1450-50               | 1.42                 | 566-15              | 5894-82                    |

Source: Fathi Mohammad Msaylhi, healthy and medical geography, Majed Publishing and distribution house, Cairo, 2008.

Chemically, pesticides belong to different very dangerous groups.

Organic phosphorus pesticides including parathion, malathion, dichlorovos, and dyazevon are all pesticides of high and medium consistency and toxicity in nature, harmful to human beings.

1. Chlorinated hydrocarbons that include insecticides like aldrin, endrin DDT compound, dieldrin, cobon, chlorine hypoxide, and jamscan, all are very toxic, very persistent, and fat-soluble that cause cancer infection.
2. Carbamate pesticides such as sivin, tmik, and baygon. These pesticides are similar in their effect to organic phosphorus pesticides.



3. Rodicides that include zinc phosphide and coagulation inhibitors. They cause inflammation in the respiratory system, bloody urine and deadly tumors in the human body.
4. Other pesticides include lead and calcium arsenates, copper oxides, and mercuric pesticides. All of the abovementioned pesticides contain very toxic compounds. (Ministry of Environment 2002)
5. The impact on soil pollution by pesticides differs according to the type of pesticide itself, and its life-time in the soil as well as its type and composition. Moreover, the environmental harm of these pesticides arises from the fact that most of them are heterocyclic compounds that slowly decompose while some contain heavy elements with high toxicity level for plants. Thus, the increase in the fragmentation output increases the accumulated amount of chlorine, phosphorus and nitrates exceeding the internationally allowable limit in agricultural environment to reduce the unhealthy impact upon animals or humans.

The risk of pollution in the country by pesticides increases in protected crops. Plants cultivated in greenhouses acquire high temperature and high air humidity. Therefore, the greenhouse environment stimulates a rapid growth of plants, and at the same time, encourages growth and reproduction of pests forcing farmers to often spray plants for short term with pesticide pests. The possibility of soil and plant pollution by pesticides in the closed greenhouse atmospheres is bigger than that in open atmospheres. Crops in greenhouses such as cucumber, tomato, zucchini, strawberry, and cantaloupe are collected in frequent intervals, sprayed at the same time in frequent intervals, and then collected a short time after being sprayed. Soon they become excessively polluted by the sprayed pesticide, and in most cases, washing the fruits and vegetables do not remove the pesticide since some of them are absorbed by the external tissues of the crops. (Ibid)

The Lebanese soil contains a number of diseases, which interfere with its productivity. The most important soil borne diseases are the nematodes (microscope worms), various fungal and bacterial diseases and weeds.

## **8. The effects of agricultural pollution on human health.**

Agricultural pollution in addition to air, water, and other types carries a great and negative impact upon human health. According to researches undertaken by the World Environment Party and other NGOs, in addition to governmental sources the following threats have been identified:

- Cancer of all kinds, mainly lung disease. It has been estimated that Lebanon ranks number 2 after Iraq in relation to cancerous disease. The information is based upon the proportionality of populations.
- Asthma, malnutrition, mental disturbances and even starvation
- Malaria, encephalitis, salmonella, dysentery
- Dengue fever(DHS)
- New diseases. and types of flu
- Symptoms of thoracic allergy, asthma, arteriosclerosis, and cancer.
- Enlargement of the liver, emergence of skin and eye diseases, and stomach disorders.
- Memory loss and existence of some dullness and idleness.
- Destruction of the genetic elements in the cells and formation of distorted cells.

Despite the tragedies that may be caused by pesticides, yet they cannot be entirely dispensed because that would lead to a scary proliferation of insects and pests .However, any plant cultivated in the area would still contain the residues of these pesticides.

### **9. The most significant issues that face the agricultural sector in Lebanon are:**

1. Limited surface area of private individual land tenure prevents mechanization and modernization of the production tools and technology.
2. Uncontrolled costs of raw materials: seeds, fertilizers, pesticides, and fuel.
3. Shrinking of agriculture labor force from 40% to 12%, in search for a more rewarding economic life in industry.
4. Inadequate financial agricultural credit system to help troubled farmers, who often are granted loans at very high interest rates.
5. Severe shortage of water quantities and quality needed for irrigation, particularly when only 25% of cultivated lands are irrigated, leading to low production, desertification, shift in demographic balance and hunger.
6. Lack of FDI investments needed in this sector to implement the newest technology, equipment and developmental projects.
7. Incompetence of the bureaucratic technical staff, due to the loss of a large number of technicians who emigrate, lack of new blood in the administrative sector resulting in high job-vacancy rates. (Greenberg, 2009)
8. Faltering of the Lebanese production discharge in foreign markets, manipulation of illegal imported goods, production costs increase causing Lebanese production regionally and internationally to be non-competitive.
9. Housing expansion at the expense of green areas and fertile agricultural lands, due to population increase poor planning and urbanization pressure, in addition to the lack of clear legislation on land investment and protection.
10. Deforestation due to negligence and abuse: fires, falling trees, concretization of the land etc... These facts contribute to the loss of green space required to purify the air, and to severe erosion of agricultural soil, thus creating many environmental calamities. Experts' reports estimate that the amount of agricultural soil drifted to sloping areas range between 125-150 m<sup>3</sup>/annually; consequently, the soil keeps losing its productive capacity year after year.
11. Pesticides abuse increases production costs, and harms to the environment and humans in the absence of regulations and control.

### **10. The adverse consequences of the current situation**

The current agricultural environment produces many negative consequences on all areas of the country's human and flora development.

1. Poverty no longer allows the farmer to adapt to the general standard of living. As a result, he/she is forced to immigrate to the city or to a foreign country. Leaving the land creates social, economic, and political burdens upon himself and his environment.
2. High cost of production disturbing the balance of food security.
3. High cost production which complicates the marketing of similar and competitive products in foreign markets.
4. Exposures of the Lebanese environment to critical problems are worsening with time. E.g. pollution, bacteria spread, cancerous chemicals, effects on humans etc.

5. Loss of fertile and productive agricultural areas, in the absence of a clear replenishment strategy (Shehab, 2012).

### **11. Education and the farmer**

Since education and training in schools and universities are absent, and since the government anticipates no plans for action to alleviate these urgent ecological problems, some private organizations have taken upon themselves modest steps to help the farmers. Yet, in the absence of legal and governmental control, a handful of farmers are willing to modify their practices because of economic factors. Effective training requires certain steps to be followed:

- Publish clearly written instructions about the pesticides: type, proprieties, efficiency and objectives to be achieved.
- Clearly indicate the safest ways to administer a specific pesticide, how to store it, handle and where to dispose of it.
- Outline the pesticide's dangerous impact on human health and level of toxicity
- Indicate the impact pesticides would have on the life and productivity of the soil and environment.
- Outline the safety procedures to be adopted. How to read negative symptoms caused by the pesticide.
- Indicate what would be the alternatives to a particular harmful pesticide?

### **12. Environmental education**

The protection of nature and man through sustaining an ecological balance requires continual educational efforts at all levels.

In the past decades, raising issues about the environment in Lebanon was regarded as controversial ... to the extent that some considered it as trivial! However, with time, the importance of environment in human life is becoming a public issue, although very few, seriously, listen. Environmental culture has become a requisite necessity for each individual. The environment had advocates who defend it, work on upholding its flag, and race to raise environmental awareness – especially environmental risks, that is facing humans, causing numerous diseases, without being publicly realized.

The sense of responsibility toward the environment is not the duty of concerned authorities alone; it is the duty of every man, women and child. This implies a sense of true citizenship and belonging to the homeland extending to the universe. To maintain the cleanliness is limited to an area, but of every street as it is well is a national duty. This is the environmental culture that needs to be spread and applied. Trees e.g. are complementary to human lives, and thus cannot arbitrarily be cut down or burnt. Water is a diminishing wealth, it is the most valuable commodity that exists, and the most expensive when lost; therefore, everybody is responsible to preserve this indispensable, irreplaceable wealth rather than overuse it. What is required is that the citizens shall be made fully responsible towards the environment. The issue, first and foremost, requires a globally alive conscience and self-censorship away from thinking of the penalties imposed. There is a need to sense and discover beauty in nature. This certainly does not need a lot of money and does not require complicated plans and studies that remain ignored. The need is to plant in human mind the "Green" culture, develop awareness, and focus on the meaning of citizenship.

As a result, efforts of all those responsible promoters of a healthy environment shall be integrated until environmental and cultural awareness meet the targeted challenges. Local communities and civil society organizations must be involved in finding and applying solutions.

The world has become accustomed to celebrate environmental days and festive occasions each year in folkloric manners. In the Middle East the Arabs agreed to allocate a day of the year named "Arab Environment Day", provided a slogan is determined each time. The slogan for 2009 was "Education for Sustainable Development." The twentieth of every October has become a holiday for celebration.

Raising awareness and consciousness among the individuals and organizations to acquire skills and knowledge in Lebanon, is a target sought by environmentalists until every human bears a full responsibility to protect his/her surrounding, and country's natural resources. It has, theoretically, become a must to insert environmental concepts in the academic curricula for all ages, in order to deepen the awareness and culture amongst students. Unfortunately no progress is being yet reached. Education should establish morals and values that instill the respect of environment and the necessity of its existence and sustainability, after humans have gone far beyond limits, ruining and polluting it, draining its resources, without thinking of the future generations. The objective is to awaken man's awareness and nurture the ethical and aesthetical values of nature, so that the environment is preserved (Chehab, 2012).

### **13. Indiscriminate use of Pesticides: risks and damages**

As a result of several field studies, it was proven that the misuse of pesticides is harmful to public health and plants of various kinds, as well as to the soil (Shaka & Saliba, 2003).

The different types of agricultural pests are considered to be forming the most important agricultural production constraints. Numerous studies indicate that pests cause 15 - 65% loss in crops.

To get rid of these pests, many methods and techniques have been used. However, using chemical pesticides is still the most widespread in the world, if not the only, and even the only remedy against agricultural disasters, pests, diseases and epidemics. Using pesticides have developed, particularly since 1941, when pesticide D.T.T. was discovered for the first time quickly after the spread of inorganic compounds. Soon thereafter, insecticides as hydrocarbon, endrine, and endo sulphate spread rapidly. The harmful effects of these substances, that cause carcinoma, malformations and neurological disorders, etc. led to the prohibition of most pesticides in this group and encouraged the use of organ phosphorus compounds with all derivatives. Thereafter, cream compounds were used, in addition to derivatives of pyrethroids that were industrially prepared, characterized by their light toxicity to humans and animals, and their high efficacy in pest control.

Nevertheless, the problems arising from the use of prohibited pesticides randomly and unscientifically, by Lebanese farmers, in addition to the serious damages inflicted on humans and animals, assumed dramatic proportions due to:

The absence or incapacity of scientific field research and laboratory tests designed to analyze pesticides and identify their residues on food, water, soil and environment.

Lack of agricultural and technological awareness by a large number of farmers are facts that opened the door for most pesticide traders to take on the responsibility of acting as experts, guiding the sector, imposing programs on plant protection and control, diagnosing disease taking advantage of all means of publicity and media to their own benefits to market their pesticides. In short, they imported those pesticides and imposed high prices away from state control. (Huda Shako, 2003)

The most significant problem of pesticides in Lebanon nowadays, despite the existence of few related laws and regulations, is bound to the policy of importation by unsupervised traders, most motivated by profits regardless of quality or side effects. Perhaps, the most dangerous of all, is the continuous import, sale, and use of pesticides although internationally although prohibited. (SELDAS, 2005)

The use of pesticides in Lebanon, amidst a political chaos, has become a major problem requiring action but officials do nothing even though the consequences are disastrous.

They disrupt the natural balance of organisms, and, as a result, produce imbalance in agricultural pest control programs.

Affect health problems in humans and animals

Due to the misuse of pesticides new problems are triggered

Emergence of strains of pests resistant to the effect of pesticides, generation after generation, difficult to eliminate even with other more effective and toxic pesticides was used.

Disturbance in the normal balance of pests, whereby the natural enemies of agricultural pests, (predators and parasites) are eliminated as well. The harmful effect kills other beneficial insects such as bees, pollinators, butterflies, birds and others.

Direct health damage to agricultural and wild animals present in the fields during the spraying process, for pesticides contaminate animal food and drinking water. Their residues are stored in animals' and birds' tissues for years, or might appear in their products such as milk, eggs, and others, that are transferred to man causing death sometimes.

Since pesticides are transferred directly to man by contact, inhaling, in taking of agricultural and animal products containing the residues of toxic pesticides like vegetables, fresh fruits, as well as meat, eggs, milk, fish products, and others. Toxicity symptoms upon humans include:

Severe toxicity within four days that might cause immediate death.

Semi-chronic toxicity that appears within ninety days, through symptoms of nervousness.

Delayed neurotoxicity is caused by some phosphorous pesticides, known by the symptoms of paralysis and movement deficit. Victims of this phenomenon are numerous in Lebanon and developing countries.

#### **14. Green House gases and other emissions (GHGE)**

The most emitted gas is Carbon Dioxide that was estimated at fifteen million eight hundred three thousand tons in 2001. This emission was mainly produced by the unregulated and unchecked transportation sector. The burning fossil fuel produces high percentage of sulfur, responsible for 70% of CO<sub>2</sub> emission, while the industrial sector emits 14%. Methane gas emission, due to disintegration of organic wastes, is about 82%. The remaining percentages of gases emission are caused by forest fire, burning used tires, garbage, and solid waste.

The main deficiencies in sustaining the eco balance system in Lebanon have been identified by several university groups, researches and studies. All of them agree on the following issues:

- Absence of clear policy to train the farmer, evaluate agricultural operations and assist in applying the necessary remedies described by law and international standards.
- Absence of mechanism for consultation, and follow up, on a regular basis, to correct possible violations when they occur.
- Absence of assessment and monitoring practices in relation to the dangerous effects caused by misusing pesticides, especially in the absence of laboratory testing, as well as holding regular learning seminars to develop the farmer's skills and awareness.
- Almost total absence of coordination of efforts and cooperation between government's ministries, and departments to check and stop the illegal importation of prohibited chemicals for agriculture purpose.

- Absence of statistical data and information to encourage participation by the private sector and NGOs in offering solutions. It is unfortunate that the lack of statistics in Lebanon covers almost all major areas including employment, labor, poverty, emigration, desertification, energy, water, medical products, food, education, import/export and so forth.

### **15. Education and training of the farmer**

Since education and training in schools and universities are near absent, and since the government foresees no plans for action to alleviate these urgent problems, some private organizations have taken upon themselves modest steps to help farmers. Yet, in the absence of legal and governmental control, few farmers are willing to modify their practices because of economic financial benefits. For any type of effective training, certain steps have to be followed:

- Publish clearly written information about the pesticide: type, proprieties, efficiency and objectives to be achieved
- Clearly indicate the safest way to administer a specific pesticide, way to store it handle it as well as how and where to safely dispose of it
- Outline the pesticide's impact on human health and level of toxicity
- Highlight the impact on the life and productivity of the soil an environment
- The safety procedures to be adopted
- Inform how to read negative symptoms caused by the pesticide?
- Determine what would be the alternatives to a particular harmful pesticide?

### **16. Assessment of the environment reality in Lebanon**

Considering that the annual demographic growth is about 3%, the increase in consumption may reach 5% leading to an increase in household waste by 2%.

The main problem resides in the absence of any legal and political authority to deal with these flagrant violations. The adoption of a Laissez-faire policy, whereby, the powerful individual or group, whether in the government or out, stand above the law and above the general welfare has intensified the problem. Militias govern while public officials and bureaucrats perform.

Furthermore the system lacks control over prices, taxation and breaking criminal monopolies. The country is being transformed into a block of desert concrete suppressing the green space and with it the citizens' health. Garbage and waste in plastic bags are dumped on all roads and highways by the citizens of all ages with no sense of responsibility whatsoever. This research aims further at assessing the awareness the average citizen receives from education about the urgency of sustaining the ecological balance and determining the prevalence of reporting violations of the international conventions such as that of Stockholm (POP).

### **17. Environmental awareness in the Lebanese educational system**

The environment has become a hot topic in schools and universities throughout the world but not in Lebanon. The environmental awareness among children and adults is almost null. Despite many private Lebanese institutions' efforts there is a huge lack of environmental awareness in the educational system. The alert remains mute and real action is not taken. In contrast, many Lebanese officials refer to themselves as environmentalists. They advocate the preservation, restoration, replenishment, and sustainability of the natural environment. In reality, through their indifference,

silence, and corruption, they destroy the environment. There is an evident lack, in the political process of any pro environmental lobbying, activism, and education in order to protect natural resources and the ecosystem through sustainable management of natural resources and the ecosystem.

Presently, the Lebanese educational system lacks adequate curricula to teach environmental awareness and ways to respect and save the environment. It is unfortunate that private schools and universities fail to dedicate even a minimal part of education to environmental awareness.

## **18. Conclusion and solutions**

Whatever solutions may be proposed, even implemented, would remain short of achieving optimum results and objectives due to the multiplicity of actors involved in the process, which needs to be regulated, such as:

- The laboratories and factories that produce the pesticides and other types of harmful chemicals with high toxicity.
- The traders, who export and import the chemicals, store and distribute them to generate financial gains.
- The reluctance of public authority to double check the chemicals for safety, quality, hazardous storage, dissemination and others.
- The farmers, who use the products, mix them, apply and repeat application without being fully aware of actual subsequent hazards that often lead to death.

The remedies to these problems call for a joint action between the public and private sectors, especially in the developing countries, and particularly in Lebanon. It calls for an international joint effort and actions that ought to be immediately establishes to formulate global strategies to deal with these poisonous chemicals. Similar strategies should also be developed to deal with other pressing environmental problems such as air, water, and soil pollution, deforestation, global warming and others.

This research, although it singled out the area of pesticides, calls however, for some daring and innovative actions to set up new and serious tracks in promoting and saving life on earth.

The author's proposed strategy may initially appear ambitious, and somewhat difficult to achieve; it is, however a must if future generations are to survive in a healthy environment.

The author, as Secretary General of the World Environment Party, calls upon all members present, especially those of the educated, ruling, business, professional, men and women elites to join forces and unite in an unlimited campaign and mission to promote the quality of life.

The proposed recommendations express a variety of strategies for review and implementation, in most suitable ways, for specific countries and environments.

### *18.1. General strategy*

It is important that the following actions may be applied to all the developing countries in the world to ameliorate, and slowly reduce the negative effects upon their specific environments.

- Establish in every country a specific organization with the power to lobby and politically influence respective governments and policies to reduce the major problems caused by lack of awareness and misuse of pesticides and fertilizers in agriculture as well as handling any other issues related to sustaining a healthy environment.

- Increase the land allocations specified for proper and organic agriculture particularly when green projects may be performed.
- Apply the latest technology to agricultural production to reduce costs, and pollution contamination and other harmful consequences.
- Strictly respect international standards and intensively train farmers.
- Allocate to farmers financial facilities and income to survive with dignity without resorting to cheap and unethical techniques in managing the land and produce.
- Encourage citizens and rural areas, through financial assistance, to embark on replenishing natural resources such as reforestation, protection of valuable birds, beneficial bacteria, to repair damages to the ecosystem. It is essential that a sustained replenishment policy of natural resources be devised and applied without delay.
- Regulate the quarries works to stop destroying the natural habitat of so many species. In Lebanon the distortion affects more than three thousand hectares of green forest lands that are beyond susceptibility to reclamation or rehabilitation.
- Establish, regardless of cost, a proper network of sewage waters treatment based on latest technology. Furthermore, regulate all excavation of underground wells through clear laws that would heavily penalize violators, nationally and internationally.
- Build more agricultural unpaved roads to provide clear access to firefighting engines to protect forests from such disasters.
- Set up funds and programs through schools, NGOs, clubs, and even political parties to plant on a yearly basis millions of trees in arid lands. It's recommended to involve high schools and university students through national programs and activities.
- Establish in every country a highly equipped and staffed forest department to deal with planning, violations handling and remedies. This group will also be responsible to visit farmers, train them and continually check their performance and crops in laboratories.
- Revise in schools, beginning with first graders until graduation from universities, courses in modern curricula, teaching the theory and practice on how to save the environment by reducing any form of pollution, whether by individuals or groups. It's important to understand and be convinced that each one of us humans is a guardian and defender of the ecosystem.
- Encourage and support coops to strictly supervise the packaging and cooling plants.
- Assist the farmers in other areas such as creating man-made lakes, irrigation channels and others.
- 

### *18.2. Specific strategy for Lebanon*

Since the Lebanese situation can best be described as chaotic, whereby no governmental authority regulates, checks, trains, supervises, and evaluates agricultural produce, it is mandatory to devise and strictly apply sustainable strategies racing against time. The call is upon the Lebanese government, in the first place, then upon all governments, represented in the colloquium to consider the following recommendations:

- Revise existing laws and policies regulating the import, manufacturing, use and application of pesticides and fertilizers in the agricultural sector by adopting a gradual taxation policy on illegal and prohibited imports or products such as methyl bromide, DDT.
- Setup clear dates and deadlines to implement, enforce the strategies and policies and establish an efficient mechanism for review.



- Request from the ministries of education, agriculture, health, and economics to form a permanent joint committee to coordinate with schools and universities, research centers and farmers, on all matters of education, starting with kindergarten till graduation from the university. The teaching should highlight how to protect the environment, as well as its importance for health and safety.
- Request a complete revision of the educational system, at all levels, to integrate teaching topics about the importance value and protection of the environment, the development of sustained green energies, recycling of garbage as well as others, in all programs. It is imperative that educators develop and learn how to sustain the human conscience around ethical ecological issues. Furthermore offer university degrees in ecology and environmental sustained development. Encourage and finance national research programs and laboratories to correct wrongdoings when they occur.
- Enact strict laws to penalize polluters of all kinds and everywhere, specifically in public and natural areas by adopting a proactive stance and behavior.
- Outlaw hunting practices whereby hunters kill anything alive from birds and animals using led pellets that poison the soil and underground water. This massacre of birds and plants should be stopped. The killing of all species of eagles, cranes, singing birds, and others should be outlawed to restore and reinvigorate the ecosystem balance.
- Encourage and request from the Lebanese banking sector to integrate in its activities financing specific ecological projects through grants, long term loans facilities specifically for reforestation, the use of alternate sources of energy, small environment safe businesses etc.
- Lower to the minimum (not exceeding 5%) the tariffs on the importation of hybrid cars or any products that are directly related to saving the ecosystem in areas of heating, energy, communication etc. Hybrid cars' usage should be mandatory in the city center. That in addition to opening up around 25,000 jobs in the field of environmental issues.
- Make sure that all construction permits must meet determined standards and planning regardless of the "Wasta", and that no housing permit will be issued without including the installation of solar systems for many purposes.
- Teach and demand from the farmers' full compliance with the norms and rules relating to modern irrigation techniques, the application of fertilizers and pesticides, as well as treatment of the soil and reduction of its degradation.
- Establish national police and warden departments to teach selected municipality police and officials ways to deal with promoting environmental awareness, and instructing the citizens, farmers and industrialists about how to protect the environment.

Recommendations for the daily behavior by the citizens.

- Save energy by turning the light off when not needed.
- Unplug electrical equipment from power
- Save water usage.
- Opt for recycling products.
- Attempt to use common transportation means
- Mandatory installation of solar panels.
- Stop littering the streets and nature.
- Grant the municipalities wider powers under strict observance and penalty

The author based on these information and dangers offers the following suggestions for immediate action:

1. Modernize the agricultural production at low costs using advanced new methods.
2. Provide the farmer with a fair income commensurate with his peers' in other economic sectors.
3. Preserve the environment through strict application and implementation of policies; develop rural areas in an integrated manner, and encourage citizens in rural areas to go back to their lands for living, so natural resources are optimally used. This step requires national cooperation.
4. Reconsider the occupational HR practices on filling in vacant positions, and on introducing new expertise in the public management.
5. Ensure the farmer with the benefits of Social Security or other types of insurance by establishing a National Security Fund to compensate for losses due to national disasters.
6. Move toward new and alternative crops (tropical and others), that find marketability in domestic and foreign markets. Strictly abide by safe international standards and regulations..
7. Encourage and support coops, supervising the centers for packaging and cooling as well as supporting the diversification and organic agriculture.

In summary, the governmental strategy should deal with agriculture as an economic, and social developmental issue rather than merely economic one. Reducing rural migration requires efforts to achieve economic growth in such areas by providing water for irrigation to enable the transformation from low-income traditional produce to high-income modern produce; and from non-irrigated traditional plantations to high double-valued ones. This transformation shall be accompanied with incentives, financial mechanisms (facilitating loans), agricultural counseling, and marketing process, in order to increase efficiency.

#### *19. Conclusion*

Altogether, worldwide Ministries and institutions of the public and private sectors, in coordination with the universities, research centers, farmers, NGO's and international organizations should work together, for the realization of alternatives that preserve Lebanon as well as the developing countries to ensure high yields of healthy quality products. Also, there is a great need to establish effective agricultural warden organizations to assist and train farmers by highly skilled engineers who are equipped with the latest scientific technological discoveries.

There are no more excuses for delays, regardless of reasons or justifications, for not focusing on the critical problems of environmental concern. Life on this planet is inevitably threatened. What is required is a cultural educational revolution to awaken human awareness around the dangers as well as the importance to preserve and balance the ecosystem.

Volunteers, scientists, writers, politicians, businessmen and women, families, schools and universities, need to form and organize international global teams to raise the flag in defense of the quality of life vs. death.

## References:

- Anthony J Mcmicheal et al. (2008). in Comparative Qualification of Health Risks : Global and Regional Burden Burden of Disease of Disease due to Selected Major Risk Factors, ed. Ezzati, M. Lopez, A.D. Rodgers, A & Murray, C.J.L., 1543-1649. Geneva: World Health Organization, 137.
- Chalak, L., Noun, J., El Haj, S., Rizk, H., Assi, R., Attieh, J., ... & Sabra, N. (2011). Current Status of Agro-biodiversity in Lebanon and Future Challenges. *Geneconserve*, 10(39), 23-41.
- Evans, M.I. (2010). *Imported Bird Areas in the Middle East*, Birdlife conservation series No.2 Birdlife International. Profile of five beaches in Lebanon. Prepared by G. Khalaf et al. National Center for Marine Science- World Health Organization. March 2011.
- Sana Mohammad Chehab 2012, Managing the Environmental Problems in Lebanon: the Agricutuarl Application of Pesticides. (MBA thesis at Sagesse University) Beirut.
- Taylor, B. D., & Norton, A. T. (2009). Paying for Transportation What'sa Fair Price?. *Journal of Planning Literature*, 24(1), 22-36.
- Baroud, R. (2010). *My Father was a Freedom Fighter: Gaza's Untold Story*. Pluto Press.
- Jadam, J. (2010). State and Trends of the Lebanese Environment, Ministry of Environments Lebanon. *Waste Management, Ministry of Environment Lebanon*, 264-297.
- Tohme, G., & Tohme, H. (2010). Espèces nouvelles de plantes du Liban. *Lebanese Science Journal*, 11(2), 133-138. Data obtained from A. Fidawi, Programme Manager, water & wastewater, CDR, September 2010.
- Thome, M. (2008). Multifunctional roles for MALT1 in T-cell activation. *Nature Reviews Immunology*, 8(7), 495-500.
- Bariche, M. (2007). Diet of the Lessepsian *Fistularia commersonii* (Teleostei, Fistulariidae) off the coast of Lebanon: preliminary results. *Rapp. Commis. Internation. Mer. Medit*, 38, 425.
- Tohme, G. & Henriette (2008). Ecology of Lebanon: Facts and examples, Lebanon University, Natural Science Section 17 (published in Arabic)
- Concentration measurements and chemical composition of PM-10-2.5 and PM-2.5 at a coastal site in Beirut Lebanon, Huda Shaka, Najat Saliba, 2003.