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## The Impact of Floricultural Industry on the Environment in Ethiopia

**Author Details: Nimona Fufa Hunde**

Ethiopian Institute of Agricultural Research, Kulumsa Agricultural Research Center Assala, Ethiopia. P.O.Box – 480

### **Abstract:**

*Floriculture is one of the booming sectors in Ethiopia and a good way of generating income for both the owners and the government. Besides this, different environmentalists complain about the industry because the industry uses too many pesticides and chemical fertilizers which damage the environment. The objective of this paper is to review the ecological implication of floriculture industries on surrounding environment. Environmental implication of floriculture involved the intensive use of water as well as soil, the water, and air pollution because of its intensive and toxic chemical usage and waste disposal system of the industries. The flower industry uses, 90% of groundwater resources. As planting media 40% uses soil bed, hydroponics 30% and the rest 30% also used both planting media. The waste is discharged directly to the water body by 30% of the farm, and 40% are a drain to the land. The land use change is also visible, 30% of the farm is established on local farmer's area, and 40% are established on state farm area, and the rest 30% is established by removing the swampy area. Therefore, to assure the environmental sustainability of the booming projects of the floriculture industry. Different environmental protection strategies were developed and recommended to improve the problems. As wastewater recycling, Wastewater treatment, Vegetation Buffer preparation, integrated pest management (IPM) practices, Health, and safety training to workers, and application of Strategic Environmental Assessment/SEA/ are good practices to minimize the impact and For better, sustainable and conducive environment sake.*

**Keywords:** Floriculture industry, sustainability, IPM, EIA and SEA

### **1. Introduction**

Floriculture as an industry began in the late 1800s in England, where flowers were grown on a large scale on the vast estates (Wikipedia, 2009). The industry continues to advance since that period. Floriculture can be defined as “a discipline of horticulture concerned with the cultivation of flowering and ornamental plants for gardens and for floristry, comprising the floral industry.” It can also be defined as “The segment of horticulture concerned with commercial production, marketing, and sale of bedding plants, cut flowers, potted flowering plants, foliage plants, flower arrangements, and noncommercial home gardening.” Flowers are luxurious products with high social value and rarely used for food. The demand for these luxurious products has increased in the international market in recent years. The international market for flowers reached \$40 billion at the end of 2008 (Getu, 2009). The Netherlands is the leading exporter accounting for some 54 percent of world trade. Floriculture is one of the blooming sectors in Ethiopia. The first private floriculture companies, Meskel flower, and Ethio-flora started activities around 1997 on a few hectares of land (Nigussie Kassa, August 2006). Today, the Ethiopian Investment Agency has given a permit to 251 investors in the floriculture sector until 2008. The rapid growth of floriculture in Ethiopia is due to different factors like suitable climatic and natural resources, high level of support by the government, favorable investment laws and incentives, proximity to the global market, the efficiency of the transport system and availability of abundant and cheap labor.

According to Fliess *et al.*, (2007), as reported in recent years, the global flower industry has received some negative publicity because labor unions, environmental activists and other NGOs have raised a number of issues linked to conditions of production on developing country flower farms. Inappropriate choice of cultivation methods and a wide range of use of chemicals and fertilizers realized for damage large areas of land and water (Fliess *et al.*, 2007). Long working hours and hazardous conditions are also common. These social and environmental conditions started to be realized in the late 1980s by many northern country consumers and caused the introduction of international social and environmental standards for the industry (Frank & Cruz, 2001 p.72). Nowadays there are a lot of international, regional and local social and environmental standards to solve and minimize the risks of the industry. Ethiopia has developed her own national code of practice based on

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International Code of Conduct, the national labour and environmental laws, international labels like MPS and Euro GAP, occupational health and safety standards, and world health organization(WHO) standards. This section highlights the kinds of environmental risks - use of fertilizers, pesticides, and safe disposal of wastes - involved, the extent of the threat and the activities undertaken by other nations to combat the risk.

## **2. Environmental Implication of Floriculture**

Environmental implication of floriculture involved the intensive use of water as well as soil, the water, and air pollution because of its intensive and toxic chemical usage and waste disposal system of the industries are other areas of interest. The only alternative to chemical/artificial fertilizers is the use of organic cultivation. Nitrogen in fertilizer can produce nitrates, which can be washed away from fields by rain or irrigation, eventually finding their way to water bodies and soil. Water pollution, soil and water quality degradation, human and cattle health effects, air pollution, risk on aquatic life, as well as waterlogging and salinization are only a few of the undesired impacts (Mulugeta,2009). Pesticides (which include herbicides, insecticides, fungicides and more) can contaminate organisms, soil, water, turf, and other vegetation. It is estimated that less than 0.1 percent of the applied pesticide reaches the target pest, leaving 99.9 percent as a pollutant in the environment, including the soil, air, and water, or on nearby vegetation. The adverse effect of pesticide use includes degrading water and soil quality, the effect on non-targeted lives like soil organisms, aquatic life, human beings, insects, cattle, etc., air pollution, an increase of pesticide resistance by targeted pests (Mulugeta,2009). Here are the main environmental impacts of floriculture.

### **2.1. Impact on Soil**

The soil is a dynamic living system with a variety of micro- and macro- floral and faunal species including *bacterium actinomycetes, fungi, nematodes, arthropods, crustaceans, and earthworms*. This flora and fauna play a primary role in the degradation of plant and animal residues and other organic matter in the environment as well as in nitrogen fixation, nitrification and the release of nutrients from soil minerals(Frankenberger.et.al, 1991). Anything that affects their activities, in turn, affects the function of soils in crop production, and in the global carbon and nitrogen cycles (Jess Silver and Becky Riley, 2001).

A growing crop does not take up all the nutrient ions in the fertilizer applied to the soil. Generally, healthy soil contains enough nitrogen fixing bacteria, which fixes sufficient atmospheric nitrogen to supply the needs of the growing plants. But continued use of chemical fertilizers may destroy these nitrogen-fixing bacteria and many other micro- and macro- the organism of the soil. In addition, an acid in chemical fertilizers, such as sulfuric acid and hydrochloric acid, which tends to increase the acidity of the soil, reduces the soil's beneficial organism population and interferes with plant growth (Mulugeta,2009). Another most visible impact is the depletion of the soil through the intensive usage of fertilizers and chemical as well as during the waste disposal of cut flowers. The different types and amount of chemicals expose the soil to loss its natural fertility. They have a different character and reacted differently when they apply to the soil and change its texture, acidic value, and fertility. A researcher from Colombia stated the treats that "Flower farmers in Colombia don't realize that the intensive use of the soil, the water and the intensive and excessive use of chemicals is going to convert the Savannah of Bogota into a sterile land," (USEPA, 1996)

### **2.2. Impact on Water Pollution**

Another water related problem is water pollution that causes a problem for human and animal health. Flower farms mostly use hazardous chemicals in the form of fertilizers or pesticides which can be easily washed off from the ground and enter in to water bodies. Moreover, excessive usage of inorganic chemicals in the farms which later produce Nitrate soon after will get into water bodies by which can be washed away from the farms by rain or some other means can cause serious damage on people (eutrophication). On rare occasions, this nitrate will cause infants led to death. Solid wastes and toxic chemicals that contaminated water body can develop water born disease.

Water scarcity, as well as pollution combined, can affect the environment and social sustainability. Societies who depend on rivers and lakes for their livelihood might become frustrated and may lead them to migrate to another place for a better water resource. To challenge this problem sometimes, local farmers confront with

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commercial farms and conflict might arise where and how to access the water. A way of resolving such kind of problem is minimal, and there is no clear way of participating stakeholders on how to manage the water resource.

There are many fertilizers, which leak through the soil to the groundwater or ditches and streams, thus causing water pollution. In a process known as *eutrophication*, fertilizer washed from fields into surface waters stimulates algae growth, which blocks sunlight needed by aquatic vegetation putting their survival at stake. This loss in vegetation disrupts the food chain, leading to the death of economically important aquatic life. Moreover, this causes depletion of oxygen found in the water thus degrading the quality and usability of the water (Mulugeta,2009). Pesticides can move from the site of the application via drift, volatilization, leaking, and runoff. Pesticides, including herbicides, can and do leak to contaminate groundwater. Once groundwater is polluted with toxic chemicals, it may take many years, a huge expense and a complex process for the contamination to be cleaned up. As a result, the contamination (by pesticides) of ground and surface water, which supplies the greatest part of drinking water, is a serious problem worldwide. When pesticides contaminate water, they can be harmful to the fish and other marine or freshwater animals that live there (Mulugeta,2009). Additionally, Solid wastes and toxic chemicals that contaminated water body can develop water born disease (Abiy,2011). Lake Naivasha in Kenya floriculture farms has been accused of polluting the lake water through extensive use of chemicals, which has had a heavy effect on the lake's biodiversity. Fishermen highly blame that fish stocks are declining, and the lake is being polluted by chemicals. Because of this there is usually conflicts raised between the community and the flower farms and some of them are feeling insecurity to produce comfortably (Becht *et al.*, 2006). Aquatic life is in danger with floriculture industries effluent of wastewater. As a result of the Second North Sea Conference in 1987, a number of countries agreed to reduce discharges of certain chemicals in to water systems (Megara and John, 1999). Researchers took small samples of water from local rivers and flower farms and samples of discarded flowers from the farms. Flower farmers deny channeling water into rivers and natural water courses after they have watered their flowers. But investigators found that very few would treat water after it had passed over the pesticide-covered flowers (Stevenson *et al.*, 1997). Most use of excessive amounts or improper application of fertilizers and pesticides that result in harmful chemical contamination of the total environment and high pollution effect on water bodies (Whiles *et al.*, 2000). A number of proclamations and several rules are passed considering water resource and in order to maintain environmental sustainability. However, none of them prevent current environmental degradation and pollution.

### **2.3. Impact on Air**

Some fertilizers, like Urea, spread in the fields with the help of sprayers and the ammonia therein react with the water present in the air causing the formation of ammonia oxide, and hence air pollution. Foliage moves away from the area of application, and contaminate the environment. As much as 80-90 percent of applied pesticides can be volatilized within a few days of application (Mulugeta,2009). Due to its high volatility nature , is estimated that only 0.1 percent of the total applied pesticide attain its intended goal but the rest 99.9 percent leaves as an air pollutant. And the pesticides applied in the greenhouses travels an average distance of 1,500 miles, adding significantly to global warming and air pollution (Anon, 2003). According to Abiy (2011), there are still some hazardous chemicals that are still in use. The use of methyl bromide is not officially encouraged by any institution. However, it is not yet banned from the application in flower production. Methyl bromide is a fumigant that is regarded to be a serious ozone depletion agent. Ethiopia ratified the Vienna Convention and Montreal Protocol in October 1994 to help support in the regulation of the use of ozone depleting chemicals. According to Getu (2009) pesticides has a capacity of contaminating organisms, soil & water. Due to its high volatility nature , is estimated that only 0.1 percent of the total applied pesticide attain its intended goal but the rest 99.9 percent leaves as an air pollutant. The pesticides applied in the greenhouses travels an average distance of 1,500 miles, adding significantly to global warming and air pollution (Anon, 2003).

UWEA (2006) mention in its research in Ugandan floriculture industries the neighboring communities of flower farms complain of a smell when spraying is going on at the farm. It was reported that bees necessary for

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pollination have disappeared due to spraying hence poor yields in the surroundings. The findings of IEDECA in Ecuador also showed that one of the reasons for the rising of conflicts between flower farms and the surrounding communities were the smell released from the floriculture industries during the application of pesticides. Thus, they include in one of local legislation that companies now set grounds leaving a distance of 1000 m from the residential areas and that 20% of the companies ground be left for green areas and fences (Frank & Cruz,2001). It is believed that the Sector usually uses more pesticides than conventional ones. E.g., recent data from Ethiopian Agricultural research Institute show that “18 of the 96 insecticides and nematicides imported by the flower farms were not on the MPS-code list (the list of pesticides registered in Ethiopia) and similarly for 19 of the 105 fungicides.” (Ecologist 2009)

#### **2.4. Water resource utilization**

One of the major nature of flower farm is it *consumes a high amount of water*. E.g., One hectare of a flower farm consumes over 900 cubic meter water per month (Organic consumers Association 2006). Some study shows that about 90% of the flower is made up with water. This means that exporting flower is like exporting water. Despite the use of high level water by flower farms, they are very reluctant to use an effective way irrigation system that will lead the case much worst (Ethiopian review 2010). Recent research showed that there is a loose of natural capacity in river Awash. Since Most farms follow the step of the Awash River valley or its tributaries around the Great Rift Valley in order to take their positional advantage to proximate themselves to the capital city, Addis Ababa, in which the main cargo flight service is located. This led to rivers and lakes to lose their natural capacity due to high water consumption. In this region particularly there are a lot of local farmers who are dependent on water for their crop cultivation and cattle breeding. Decreasing the water level of those lakes and rivers in which their life is dependent on made them frustrate, instable and finally put their future livelihoods in danger. Considering Kenya’s flower industry as a reference, still conflict going on by a concerned local people and flower farm investors those who depend on their live in Lake Navisha. There is a clear procedure on Ethiopian legislation bodies and Ethiopian Horticultural Producers and Exporters Association (EHPEA) about how much water a single farm should use per area. However, the water level is dropping from time to time, and there is no action is implemented to tackle this problem. In the future, water expected to displace oil as the greatest resource challenge, and Water is central thing for survival, and without it, life would be impossible. Water is a central component of Earth’s ecosystems, providing important controls on the weather and climate and it should be given high consideration for conservation.

#### **2.5. Waste Disposal Feature and Impact on Surrounding Environment**

Floriculture activities produce different types of waste ranging from liquid to solid, hazardous to non-hazardous, and in effect require safe waste disposal and differentiated treatment. Empty chemical containers (fertilizers, pesticides) and their washing waters and obsolete chemicals are the major spheres of concern in addition to which other agricultural wastes such as cut off crop parts, unused soil, and wastewater are generated in the sector. In the UK, waste has been understood as any substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of a process; or, any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled (not explosive) (<http://www.envocare.co.uk/hazardous>). Hazardous wastes are those which contain hazardous substance(s) in quantity liable to cause death, injury or impairment to living beings, pollution of waters, or an unacceptable impact on the environment if not properly treated, handled or disposed of. It is believed that toxic/hazardous wastes have an adverse effect on the environment and human health. These include increased exposure to cancer, and children born near toxic waste sites can be physically deformed or have developmental disabilities (<http://www.answers.com/topic/toxic-waste>). There are different types of waste disposal mechanisms including landfill, incineration, anaerobic digestion, and recycling. Unfortunately, they are unevenly implemented partially because of the cost involved.

According to Abiy (2011) Chemical containers, diseased plants, the residue of cut-flower Stems and plastics are some of the major solid wastes. It is known that up to 500 tons of residues per hectare per year are generated from flower farms. Liquid waste that cannot be reused or recycled should be collected and kept in impermeable

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containers or solar evaporation ponds. The waste residue should be transported off-site for safe disposal at a local, council-approved waste disposal area. However, the flower farms in Ethiopia have been heavily criticized for not having adequate means of waste management systems.

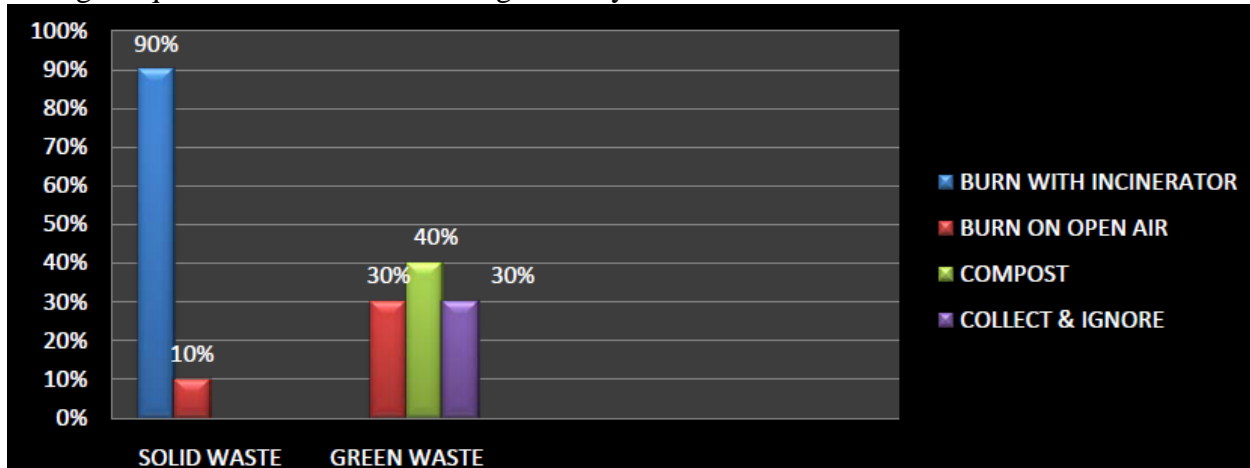


Figure 1: Percentage of solid waste and green waste disposal (source: own survey, 2013)

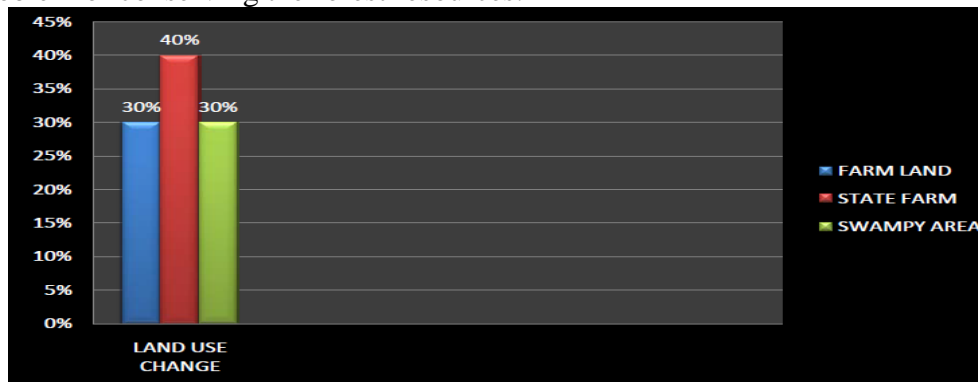
Table 1: Hazardous Pesticides use in Ethiopia

Comercial Name	Use	Hazard	WHO
Aldicarb	Insecticides/nematicides	Extremely Hazardous	WHOIa
Ethoprophos	Insecticides/nematicides	Extremely Hazardous	WHOIa
Cadusafos	Insecticides/nematicides	Highly Hazardous	WHOIb
Carbofuran	Insecticides/nematicides	Highly Hazardous	WHOIb
Dichlovos	Insecticides/nematicides	Highly Hazardous	WHOIb
Fenamiphos	Insecticides/nematicides	Highly Hazardous	WHOIb
Methiocarb	Insecticides/nematicides	Highly Hazardous	WHOIb
Methomyl	Insecticides/nematicides	Highly Hazardous	WHOIb
Monocrotophos	Insecticides/nematicides	Highly Hazardous	WHOIb
Omethoate	Insecticides/nematicides	Highly Hazardous	WHOIb
Oxamyl	Insecticides/nematicides	Highly Hazardous	WHOIb

Source: (Sisay Misganaw, 2007) and WHO chemical hazard category

### 2.6. Impact on Land Cover Change

According to Fatuma (2008), most of the local communities and previous landholders perceived and explained the issue of land use change in association with the shortages of agricultural products, fuel, and construction woods and price increase as well as the rapid climatic change seen in the locality. They were stressing that because of most of the agricultural lands and eucalyptus plantations were changed from forest cover and farmlands to floriculture farms. Therefore, there has seen a shortage of agricultural products and forest products. Most of the people in Holeta area explained, as a result of their poor livelihood and increased prices of produce they couldn't afford to purchase agricultural and forest products as per their needs. This finding was confirmed by the ILO (2006) report document on Ethiopia which stated that one of the side effects of floriculture expansion is a problem of conserving the forest resources.



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Figure 2: Percentage of land use change for floriculture usage change (source: own survey, 2013)

**Conclusion**

Economically the floriculture industry is playing a vital role and contributes a lot to country's Growth and development program (GDP), but in another side, the industry has its own environmental and social health impact, due to the input the industries utilize. The fertilizer, chemicals, intensive use of surface and groundwater, and the conversion of wetlands and farmlands for flower industries, the bad smell from chemicals, the waste disposal to a water body and some health problems (which are visible in some workers) this all are negative impacts of the industry. The river around the flower farms are highly exposed to direct effluents of fertilizer wastes from flower farms, and the water quality of the river is changed, and the eutrophication process is taking place which finally brings severe consequence to the ecology of the river.

**Improvements to be done**

The flower industry highly contributes for environmental impacts; the waste waters are a drain to a water body and the soil media which they plant the flowers are highly vulnerable for direct chemical contact, and the workers are highly contaminated by hazardous chemicals. For better, sustainable and conducive environment sake, the floriculture industries must be practices the following recommendations.

- The wastewater has to be treated before it is discharged to the nearby rivers. The wastewater is incorporated with varieties of chemicals that pollutes water and soil of the surrounding environment.
- Floriculture industries wastewater has to be recycled rather disposed directly to the environment.
- Using these mechanisms for solid wastes, such as cans of chemicals and cartoons rather than disposing to the environment. Landfill mechanism is applied by burring the solid wastes in to the land, and the incinerator is burning the waste without or minimal smokes in a container like building.
- *(IPM) practices*: promoting integrated pest management use and use of environmental friendly agro-chemicals are highly encouraged.
- Rather than using soil media for planting, using hydroponic is advisable.
- Continuous workshops and training about the chemicals and the importance of wearing safety materials.
- keeping a certain safe distance for floriculture farms from a residential area, and agricultural practices. Implementation of buffer zone management can include practices like planting trees in their farmyard to minimize any environmental risks from floriculture.
- The floriculture industry is a huge industry, the waste due to the fertilizer usage may change the quality of water bodies and the soil media also become infertile due to the chemicals spray on it and high amounts of fertilizer solution with acid. Therefore, these all impacts must be studied and emphasized not only as one flower farm impact rather as a sector or floriculture industries impact on environment cumulatively.

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