

Review Article

CONSIDERING THE ROLE OF AGRICULTURE IN EXACERBATION OF ENVIRONMENTAL HAZARDS

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ABSTRACT

Literature review reveals that sustainable development has three essential dimensions: economical, social and environmental. According to “sustainable development commission”, the most important component of sustainable development is considered to be “conserving environment”. Agriculture and Forestry are the main activities of human being in the world. Researches show that agricultural activities all around the world have unbelievable hazardous effects on environment. This fact has caused a number of international concerns about ecologic aspect of sustainable development. In the other hand, confliotions between farmers economical interests and urge of conserving the agricultural and natural resources ecologies has amplified the crisis.

The most severe risks of agricultural activities for environment are categorized as: 1) soil erosion, 2) pesticide pollution, 3) greenhouse gases, 4) pollution of water resources, 5) negative effects of agricultural activities, and 6) health hazards. It seems that improving farmers’ public knowledge and their environmental attitude, using public media and education, and economical incentives can be of remarkable help in decreasing environmental hazards.

Keywords: *Environmental Hazards, Sustainable Development, Agriculture*

INTRODUCTION

Human is continuously degrading and polluting water, soil, jungle and other sector of nature. This is not only a threat for health and welfare of local societies, but also decreases economic growth (Dimara et al., 1999) the ecosystem in which all rural activities is done also includes the air we breathe, the water bodies around us and the earth we step on. Unfettered activities of human can compromise environment (Sarkarand Chakrabarti 2007).

Agriculture and Forestry are the main activities of human being in the world. Researches show agricultural activities have incredibly had hazardous impacts on soil, water quality, biodiversity, meteorological patterns and long term efficiency of agricultural activities in local and regional levels. This has caused serious international concerns about economic part of sustainable development. Soil erosion, uncontrolled farming, soil low nutrient level, problems in water management and infections and diseases are the environmental factors that can be obstacles, as hard as economical and social limiting factors, in reaching to agricultural sustainable development (National Research Council,1993). Despite other sectors, agriculture sector is a multifunctional one. Except food and oil fiber production, it imposes deep effects (positive or negative) on lots of local, national and global economical and ecosystemic elements (FAO, 1999).

Since early 1970’s and as agriculture was developing, the term of “sustainability” in agriculture was born and environment fans warned the world about the oncoming danger (Bewsell and kani, 2004). Sustainable development is substantiated by association of all development activities by efficient management and conservation of natural resources. This concept is initiated in individual level and ends in local activities

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and national levels. Development process must support three dimensions: environmental, social and economical. It also should include the safe use of basic natural resources for next generations (Matias, 2000). In fact, sustainable development is not a modern idea. Concerns about negative and dangerous effects of development plans on environment made the basis for introducing the concept of sustainable development in phoenix sessions, 1971 and Stockholm declaration, 1972. In the 1987 Bruntlund report, sustainable development was the key axis. Finally, in Rio declaration (1992), sustainable development was emphasized as a general system (Naghizadeh, 2006).

Reviewing the available literature about development shows that sustainable development is consisted of three main dimensions: environmental, economical and social. From the view point of international commission of environment and development, environmental sustainability is one of the scopes of sustainable development (Roa and Rogers, 2006). According to sustainable development commission, the most important component of sustainable development is conserving the environment (Mironga, 2005) that sustainable agricultural environment is the most dimension of it. This dimension is based on conservation of natural resources and emphasis on lesser use of hazardous inputs and pollutant chemical materials (Karami and Hayati, 1999). Sustainable environmental agriculture is to emphasize on soil and water ecological balance, food health and quality control of rural society (Mironga, 2005). Agriculture and environment are in close contact with each other and so, agricultural activities affect most of natural resources of the world, such as soil, fresh water and biodiversity (Johnson and ashry, 2002). As researches of Nazemossadat (2006) shows, optimized use of water resources, minimum tillage, multifarming systems, crop management, using green maneuver, using compost and optimized use of fertilizers and pesticides are the factors that are important in environmental agriculture in IRAN (Arabiyoone et al., 2009). Several societies in the world are really concerned about environmental function of agriculture sector. Governments are seeking for approaches to increase the level of acceptability of environmental problems in agriculture sector (Seymour and Ridley, 2005). One of the problems that has provoked environmental crisis is the low accessibility of environmental activities, temporally and spatially, and cannot be seen. Also, it is hard to justify the expenses of environmental management functions against economical revenue of not implementing these approaches. What's more, it is not possible to understand the environmental hazards in field, immediately. Sometimes it is not also possible for farmers to find out these hazards out of field (Valentine et al., 2007). This shows the necessity of improving knowledge, science, attitude and behavior of farmers, as the main agents of environmental modifications of agriculture sector. Conflicts between economical purposes of agriculture sector and necessity and importance of environmental conservation, especially in underdeveloped countries, have created new key roles for agricultural extension experts (Mirzayee and Tahmaseb, 2010).

Numerous studies about assessment of sustainability of agricultural activities done by international institutes such as World Bank, FAO, International Department of Development, have led to introduction of a framework and assessment model for sustainability of agriculture, focusing on economical, social and environmental dimensions in national and international levels. This framework is named "DPSIR" and includes five sections namely as: Driving forces, Pressures, States, Impacts and Responses. Here each of these sections is introduced:

Driving forces: The change procedures in industry, agriculture, families, energy and transportation and are known as causes of environmental variations.

Pressures: human activities that affects environment, such as land use and overuse of underground water.

State: Visible changes in environment like Air, soil and water quality, accessibility of resources.

Impacts: Effects of change in environment such as agricultural production, drought, floods, and economical expenses return.

Responses: feedbacks earned from the societies to environmental effects via taxes, new policies, investments and managements (Rao and Rogers, 2006).

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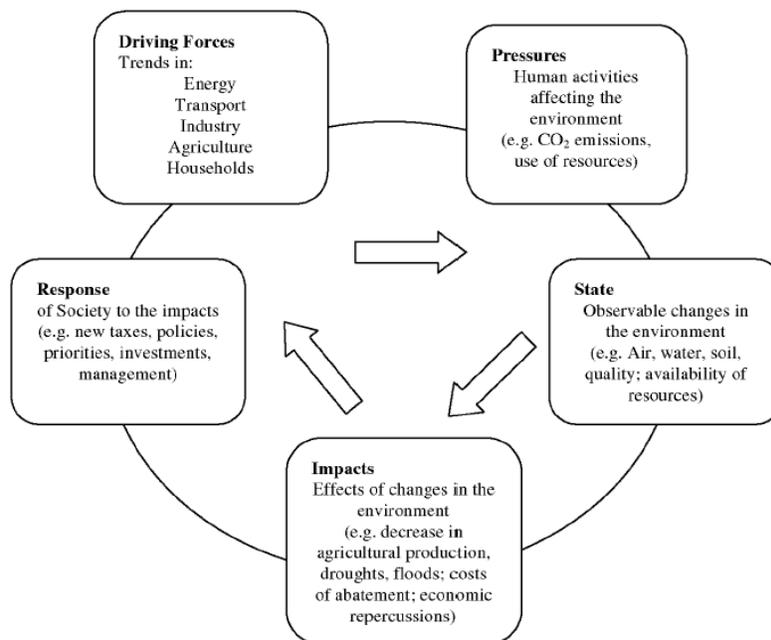


Fig 1-DPSIR framework (Roa and Rogers, 2006)

Initiation of Environmental Concerns

Before this, environmental effects of agricultural industries were not regarded and so there were few environmental limitations on agricultural methods. It was believed that agriculture is a nature-friendly activity. For the first time, pesticides made some public concerns about agricultural environment in United States, 1960. In 1970, it was confirmed that professional agricultural activities, which were intensified by economical incentives of agricultural policies, have had reverse effects on environment. It is now fully known that agriculture-environment interactions are sophisticated, but we also know that agriculture and environment are interrelated, simultaneously. Nevertheless, nobody can refuse that huge problems have prevented compiling modern agricultural methods and environmental concerns (warren et al., 2008).

Now, at the dawn of the third millennium, the main concern of international organizations and experts is the incidence of increasingly environmental problems, which “human” is the main agent and victim of that (Emadi, 2006). Increasing rate of environment degradation, decadence of biota and flora varieties, lack of rechargeable natural resources and large extent of environmental pollution have not only threatened health of today’s generation, but also have put the next one in a very serious danger (Nasirpour, 2006).

Environmental function of agriculture has worried lots of societies. In Australia, farmers and government use the term “clean and green” for describing agricultural production. The word “green” means producing the food with an environment-friendly method (Seymour and Ridley, 2005).

Environmental Ventures of Agriculture

According to USDA, modifications in agriculture structure, field and jungle management have made lots of environmental problems and concerns. These concerns are: Soil erosion, Damages to wetland area, Limitation of free lands, Nutrient management, Energy conservation and production, Lack of access to natural jungle fields, Propagation of green house gases and Carbon sequestration, Water conservation and decreasing the flood, Air quality (Mendoza, 2006).

Social and economical effects of environmental change in lots of developing countries are so important, since in these countries, agriculture is the main way of livelihood (Roa and Rogers, 2006). In IRAN,

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agriculture sector has a key role in national economy, so that it supplies 18% of gross national production, 25% of occupation, more than 85% of food supply, 18% of non-oil exports and 90% of raw materials needed for industries. For specific climate of IRAN that suffers from some inescapable facts such as drought and undesirable temporal and spatial distribution of precipitation, agricultural production and sustainable agriculture is related to logical use of natural resources and environment (Heidari et al., 2008). Agriculture is known as a fundamental pollutant and has wide-range effects on environment (Newman, 1997). Soil erosion, jungle and pasture degradation, deletion of soil microorganism, soil salinity, agricultural water pollution, increasing quantity of nitrate and phosphate due to fertilization, burning the remained part of the crops, lack of biodiversity, uncontrolled use of pesticides and ammoniac pollution due to maneuver are the most environmental challenges of agriculture sector (Zhang et al., 2010).

Rasool-of (1994) expresses these factors as the main factors of unsustainability:

- 1- Lack of access of rural societies to land, inputs and other resources.
- 2- Lack of sufficient knowledge in decision-makings about social and economical effects of development plans.
- 3- Not accessible technologic choices, suitable for environment.

He believes that unsustainability of agriculture can be considered in three family, rural societies and national levels (Rasool-of, 1994). As a brief, the main environmental hazards due to agricultural activities can be categorized in six below topics: a) Soil erosion; b) Pesticide pollution; c) Green house gases; d) Water resources pollution; e) Negative effects of agricultural activities; f) Negative effects on human health. Here comes a description for each topic.

a) Soil Erosion

Soil erosion is a main challenge in reaching to sustainable production. It is a very important process in soil degradation. Effective management of soil erosion is a key section in sustainable agricultural production. Erosion will unceasingly continue except erosive factors such as run off and wind can be controlled (Yoo et al., 1992).

Soil quality can be defined as soil capacity for enduring repeated experiences of planting, without any negative effect on agricultural efficiency and environment quality. Erosion has a negative effect on field. Unsuitable plans of land use and plantation methods can be factors of erosion in weak lands. Repeated tillage can also have several effects on soil conservation. No tillage management, which means weeds control using herbicides and plantation without tillage, is planned to lessen degradation of soil by tillage. Although conservative tillage, containing mechanical control of weeds using disks and forks, can minimize the number of tillage operations, but it is a destructive method comparing to no tillage approach. Erodability of soil specifies the amount of sediment due to erosion. There are two methods to determine the quantity of erosion: wind erosion equation for wind erosion and universal equation of soil degradation for water erosion. The magnitude of soil carbon is also an indicator of soil quality. Decreasing organic material of soil is related to soil fertility, soil structure degradation and soil erosion (Viglizzo et al., 2006).

Soil conservation consists of mechanical and nonmechanical methods. The latter method includes proper use of land, field management, suitable tillage, vegetative operations, using technology, mulching or remaining mulches, crop rotation and intensive vegetation (Rostami, 2010).

b) Pesticides pollution

Using pesticides have initiated concerns all around the world, e.g.:

- 1- Depreciation of soil and water
- 2- Changing the water quality
- 3- Negative effects on biodiversity.

It is not significant to calculate the damage caused by pesticides absolutely, so it is determined by a relative index. For this purpose, the maximum usual usage of insecticides, herbicides and fungicides is used (Viglizzo et al., 2006).

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c) Green house Gases Propagation

One of the most important environmental effects of agriculture in nature is the propagation of green house gases and hence, warming of earth. The main gases which create this state are carbon dioxide (CO₂), methane (CH₄) and nitrogen oxide (NO₂). Agriculture is one of the responsible of propagation of these gases.

d) Water Resources Pollution

Pollution of water bodies due to domestic and industrial wastes, sewage and chemical materials used in agriculture is the most intricate environmental problem. Overuse of fertilizers and pesticides has degraded soil and water (Sarkar and Chakrabarti, 2007). Phosphor can be easily leached from agricultural soil and contaminate water bodies (Newman, 1997). Agriculture is responsible for about 50% of Phosphor available in England waters (Defra, 2004).

e) Negative Effects of Agricultural Activities

New plantation without regarding the time needed between two plantation, plantation in poor lands, not balanced use of fertilizers, not proper irrigation planning and management, overgrazing and intensive plantation are some of important factors that can degrade the land. Changing land use of jungles to use for agriculture, overuse of woods and excavation operations have caused some concerns (Sarkar and Chakrabarti, 2007).

f) Negative Effects on Human Health

Environmental effects of modern agriculture on human health include :

- 1) Pesticides contaminate water bodies and harm human and wild life health.
- 2) Nitrate and phosphate originated from fertilizers, manure and waste water due to silage, can contaminate waters and help the growth of algae, hence oxygen decrease and fishes death.
- 3) Soil erosion can clog waterways and make run off to flow on land, erode it and the muddy flood damage natural resources.
- 4) Harmful residuals and microorganisms have had dangerous effects on users.
- 5) Methane, nitrogen oxide and ammonia produced from fertilizers and manure have degraded biosphere of atmosphere (Pretty et al., 2001).

Cancer, problem of hormonal function and damages to livers are some of the hazards of agricultural chemical materials (Sarkar and Chakrabarti, 2007).

Table 1- Hazardous effects of agricultural chemicals on human health (Schreier and Las, 2002)

Agro-chemical	Maximum contamination levels	Health Effects	
		Established	Potential
Nitrate	10mg/No 3- N	Methaglobinemia	Nitrate conversion to nitrite and N-Nitroso compounds affecting thyroid, endocrine functions
Metals(Cd,As,Cr,Zn,Cu)	0.01 to 0.05 mg/L	Impaired kidney functions, skin disorder, tumour	Cancer risk
Pesticides (chlorinated hydrocarbons like DDT, organophosphate like Malathion, Carbamate like Carbaryl)		Affects nervous system and reproduction, affects enzymes and muscles	Cancer risk

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CONCLUSION

Literature review shows that environmental hazardous effect of agriculture sector in different levels in considerable and remarkable. Conflicts between economical purposes of agriculture sector and necessity and importance of environmental conservation, especially in less developed countries such as IRAN, with small and separated fields, critical situation of drought and water shortage have created new key roles for agricultural extension experts. In order to assess approaches, due to importance role of human (who is main responsible in decision making about environment), it seems that improving knowledge and environmental attitude of rural societies using public media and education, incentives and economical facilities by governmental responsible is necessary. Also, providing suitable and accessible technologic facilities of soil and water conservation for farmers can help overcoming environmental crisis.

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