# Social and economic aspects and environmental damages associated with the soil use resources

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**Abstract:** Soils represent the single-most important natural resource on which human existence and prosperity depend. Since thousands of years ago, the use of soil has brought several advantages for human beings. The land-use management offers several ecosystem services, which are defined as components of nature, directly enjoyed, consumed, or used to yield human well-being, such as freshwater, food, fiber and also shelter. However, the practices related to this natural resource began to be gravely intensified during the past centuries. In this report it is discussed the conflicts between social and economic benefits and potential environmental impacts associated with the use of soil, as follows: farming and mining benefits and conflicts, local communities and large-scale projects, and environmental impacts caused by inappropriate practices. It was concluded that the optimal use of these natural resources would not only ensure continued availability of the basic human, but also improve the overall environment

**Keywords**: Agriculture, ecosystem services, land-use, mining, natural resources

# Aspectos sociais e econômicos e danos ambientais associados com os recursos de uso do solo

**Resumo:** Os solos representam o recurso natural único mais importante em que a existência humana e a prosperidade dependem. Desde há milhares de anos, o uso do solo trouxe várias vantagens para os seres humanos. A gestão do uso da terra oferece vários serviços de ecossistema, que são definidos como componentes da natureza, diretamente apreciados, consumidos ou utilizados para produzir bem-estar humano, tais como água doce, alimentos, fibras e também abrigo. No entanto, as práticas relacionadas a este recurso natural começaram a gravemente intensificarem durante os séculos passados. Neste trabalho são discutidos os conflitos entre benefícios sociais e econômicos e os potenciais impactos ambientais associados ao uso do solo, como: agricultura e mineração benefícios e conflitos, comunidades locais e projetos de grande

escala, e os impactos ambientais causados por práticas inadequadas. Concluiu-se que a utilização adequada desses recursos naturais não só assegura a disponibilidade contínua para a sociedade, mas também melhora o ambiente como um todo

**Palavras-chave**: Agricultura, serviços de ecossistema, uso da terra, mineração, recursos naturais

## Introduction

According to Natural Resource Stewardship and Science (2011), soil is defined as the unconsolidated portion of the earth's crust modified through, chemical, physical and biotic processes into a medium capable of supporting plant growth. Furthermore, soil properties influence the natural and the physical structure of the landscape and ecosystems. Since thousands of years ago, the use of soil has brought several advantages for human beings. However, the practices related to this natural resource began to be, gravely intensified during the past centuries, which brings society the concern about the environmental impacts and socio-economic issues that have been involved. Therefore, it is essential that land-use practices companion sustainable economic models, due to the fact, that several lands have being degraded due to unappropriated soil use, indicating that projects for mitigation measures should be fulfilled for affected areas. Given that, this paper is going to discuss the conflicts between social and economic benefits and potential environmental impacts associated with the use of soil.

## Discussion

Good land-use management offers several 'ecosystem services', which are defined as "components of nature, directly enjoyed, consumed, or used to yield human well-being" (Boyd & Banzhaf, 2007, p. 619), such as freshwater, food, fiber and shelter, as well. Among these services, agriculture has been the most widespread practice related to soil and it has benefited society throughout the centuries. Moreover, mining and smelting of metal ores have a significant participation in industries and in economy overall.

Agriculture not only provides food, fiber and fuel, it also receives several ecosystem services (Swinton, Lupi, Robertson & Hamilton (2007), see (Figure 1). Furthermore, mining and agriculture have an

important role in economy. Since the Industrial Revolution to the 21st century, the increasing of the manufacturing industry brought a necessity for metals. As a result, they are now mined in most countries and many of them have an increasing use for primary production (Thornton, 1996).

Hydroelectric companies, among other large-scale projects, have benefited people with thousands of employments and with energy power, with investments in new technologies. Even so, conflicts may be originated when the concerns of certain groups are neglected, especially when use of resources and income distribution are involved (Klimpt et al., 2002, p. 1306). One of the ethical dilemmas that arise is between the infrastructure affecting local communities and their rights involved and the potential benefits that could be brought for the region (Klimpt et al., 2002, p. 1306).

Mining operations are often confronted with ethical dilemmas as well. They can either have a positive impact by developing infrastructure, for example hospitals, roads, schools and housing, or force local people to move, induce loss of freedom of movement and disconsiderate dwellers' traditions (Hilson, 2002, p. 66). In addition, demographic changes can be the most important consequence from mining, since new employees and foreigners move to the area, causing a disruption in the community and affect the local water supplies and hunting activities (Hilson, 2002, p. 66-67).

The environment also suffers several negative impacts with human activities (Figure 1). Mismanagement of land use has affected millions of people when executing a few practices, and between them is agriculture. For example, freshwater ecosystems and water quality have been affected by excess of fertilizers and atmospheric pollutants (Foley et al., 2005, p. 570). Furthermore, $1.5 million hectares of arable land each year was lost by soil salinization due to irrigation, with $11 billion of estimated lost production, (Wood & Sebastian, 2000, as cited in Foley et al., 2005, p. 570).

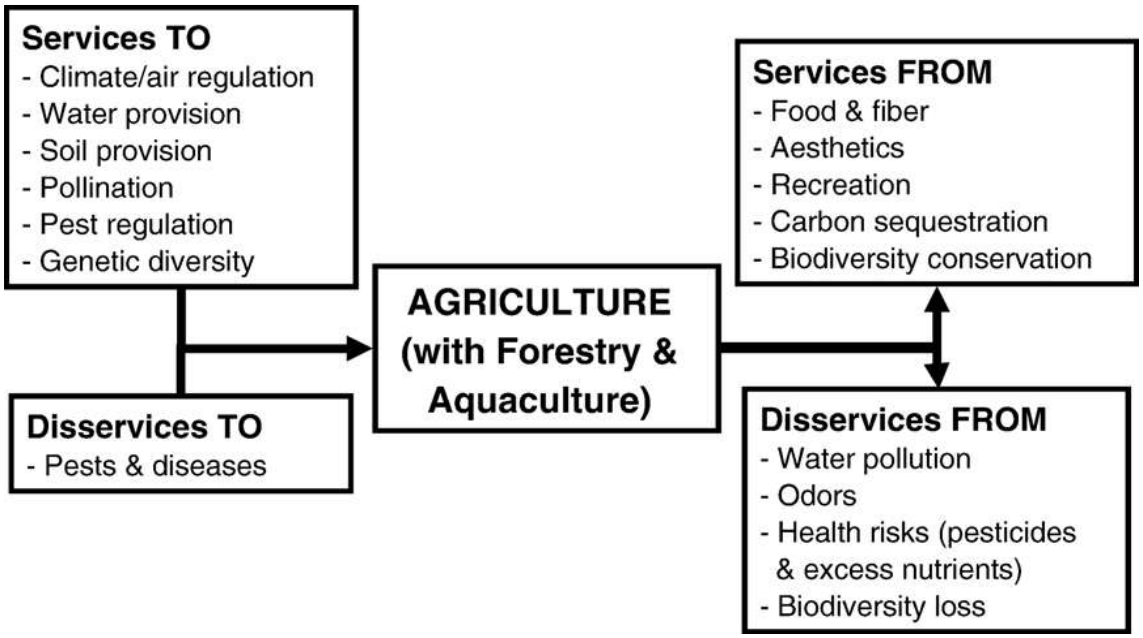


**Figure 1**: Provision and receiving ecosystem services from agriculture. (Swinton et al., 2007, p. 246).

Since these human activities were intensified along the years, they represent a significant factor to global changes. For instance, "land use can disrupt the surface water balance and the partitioning of precipitation into evapotranspiration, runoff, and groundwater flow" (Foley et al., 2005, p. 571). Freshwater sources can be greatly affected with water removal, when the need for water is connected to land-use practices. Therefore, big rivers are having its flows diminished as a consequence of global consumptive, particularly in semiarid regions (Rosegrand et al., 2002, Postel, 1999, as cited in Foley et al., 2005, p. 571).

Furthermore, loss of biodiversity, alteration of habitats, soil and water damages, and threatening of species have been caused by inappropriate use of soil. Land mismanagement also affects local temperatures through changes in surface energy and water balance; as a result, this inappropriate practice can represent 35% of CO2 produced by humans (Foley et al., 2005, p. 570), which indicates a great impact on the environment.

Pimentel et al. (1995) state that erosion is also a problem in croplands that can be greatly increased with loss of vegetation and affect productivity and water availability. As a result, the food supply per

person has greatly decreased since the last 10 years, affecting nutrients, soil biodiversity and organic matter (Pimentel et al., 1995, p. 1118).

Clark et al (1986) (as cited in Ojime, Galvin & Turner II, 1994, p. 300) revealed that most of biomes areas were globally affected due to land transition to croplands, which represents a conflict for traditional communities and environmental impacts. As a consequence, tropical forests have suffered alterations on its floristic and animal composition (Ojima et al., 1994, p. 300-301). Moreover, 180 gig tons of soil carbon loss can be estimated because of land conversion (Houghton et al. 1983, as cited in Ojima et al. 1994, p. 301).

Atmospheric chemistry has been also changed due to modification by land use, affecting inputs of energy, water and nutrients (Ojima et al., 1994, p. 302). Climate change and rainfall distribution can also modify these sources, together with human activities like wood extraction, fertilizers, burning, irrigation and others (Ojima et al., 1994, p. 302). In addition, ecosystem composition (diversity of species and stability of food chains), gas exchanges (through greenhouse gases), water and carbon fluxes are affected by these changes (Ojima et al., 1994, p. 302), bringing imbalance for an entire ecosystem.

One of the social-economic factors for land-use change is politics that can stop fast social adaption to diseases outbreaks and lack of water (Talbot, 1989, Whitehead, 1989, as cited in Ojima et al., 1994, p. 301). Complex political and economic structures can affect industrialized countries directly through climate and environmental changes, due to high population growth, changes of resource-related decisions, power changes from local to state and increasing economy (Ojima et al., 1994, p. 301-302), which could be crucial for use of inappropriate soil. Thus, the environment is suffering pressures from these conflicts with unprecedented consequences for humans.

## Conclusion

Science community will have to make an effort to seek solutions for those issues. Therefore, impacts on natural resources, rising population rate and global economy development will mold humans' resilience. However, it is not easy to foretell whether how social-economic factors will affect land management and how decisions will be made. People's ability to change and adapt will be tested in the next decades, requiring policies and research to work together through these alterations. Finally, optimal use of these

natural resources would not only ensure continued availability of the basic human, but also improve the overall environment.

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**References**

BOYD J & BANZHAF S. (2007). What are ecosystem services? The need for standardized environmental accounting units. Ecological Economics, 63, 616-626.

FOLEY JA, DEFRIES R., ASNER G.P, BARFORD C, BONAN G, CARPENTER SR, CHAPIN FS, COE MT, DAILY G.C, GIBBS HK, HELKOWSKI JH, HOLLOWAY T, HOWARD E A, KUCHARIK CJ, MONFREDA C, PATZ JA, PRENTICE IC, RAMANKUTTY N, SNYDER PK. (2005). Global Consequence of Land Use. Science, 309, 570-574.

HILSON, G. (2002). An overview of land use conflicts in mining communities. Land Use Policy, 19, 65-73.

KLIMPT J, RIVERO C, PURANEN H, KOCH F. (2002). Recommendations for sustainable hydroelectric development. Energy Policy, 30, 1305-1312.

NATURAL RESOURCE STEWARDSHIP AND SCIENCE. (2011). Soil Resources Inventory. Retrieved from: http://science.nature.nps.gov/im/inventory/soils/

OJIMA DS, GALVIN KA, TURNER II BL. (1994). The Global Impact of Land-use Change. BioScience, 44(5), 300-304.

PIMENTEL D, HARVEY C, RESOSUDARMO P, SINCLAIR K, KURZ D, MCNAIR M, CRIST S, SHPRITZ L, FITTON L, SAFFOURI R, BLAIR R. (1995). Environmental and Economic Cost of Soil Erosion and Conservation Benefits. Science, 267, 1117-1123.

SWINTON SM, LUPI F, ROBERTSON GP, HAMILTON SK. (2007). Ecosystem services and agriculture: Cultivating agricultural ecosystems for diverse benefits. Ecological Economics, 64, 245-252.

THORNTON I. (1996). Impacts of mining on the environment: some local, regional and global issues. Applied Geochemistry, 11, 355-361.