The Economics of Soil Degradation

Supporting tool for agricultural policy in Switzerland of the period 2018-21 and after "Initiative für Ernährungssicherheit" and "Intitiative für Ernährungssouveränität“

Soil is considered a renewable resource. However, it takes decades and centuries to actually renew soil. Soil performs a variety of environmental, social and cultural functions (production of food and biomass, storing and filtering of water, storing carbon, hosting habitats, etc).
The health status of soils in Switzerland is decreasing and these services are at risk. Erosion, sealing of soils for urban development and chemical pollution are the main drivers for this deterioration.
A valuation system of soil represents a possible way to improve the decision making and to consider long-term interests. A valuation system is able to account for the multifunctionality of soils and give each stakeholder its appropriate share. It is a great tool to rethink soil conservation and justify the direct payment system for ecosystem services.

- State of the soil -

Soil is a hardly renewable resource (only over thousands of years) and the awareness in society of its important functions and limited availability is generally low. That is alarming, especially in regards to the current societal and environmental changes in Switzerland, which will lead to changes in land use and thus soil quality. Economic and demographic growth raises the demand for intact soils as a source for food production, but also increases the demand for settlements and transport infrastructure with adverse consequences for the soil. The importance of a sustainable management of soils in Switzerland is obvious: the society's demands are rising, but the exploitation is going on at the same time.

-Current Issues-

The way the direct payment system is applied will change dramatically with a budget cut of 800 million CHF for the coming agricultural policy of 2018-2021. Already for 2016 the budget will be reduced as the swiss budget is under pressure from currency change rates. At the same time two initiatives have collected reached enough signatures, which are both focus on agriculture –the "Initiative für Ernährungssicherheit" and "Intitiative für Ernährungssouveränität".

Budget cut vs the will of the people

Drivers of soil degradation

Agriculture and Forestry: Up to 40% of the arable land in Switzerland is exposed to erosion due to wind or water, which wash fertile soil away. The major reason for soil erosion is inappropriate land use, like the fields left bare over winter and fertile soil gets lost. Fertility also gets lost by ploughing as humus (soil organic carbon) layer is exposed to the air and degraded.
Heavy machinery used in agriculture and forestry is compacting the soil which can no longer seek away water, air cannot circulate decomposition processes are restricted. Affected services are therefore the production of food, the storage of carbon and the catchment of rainwater.
Urban development: The sealing of soil due to the construction of roads or settlements compress the soil as well as withdrawing the land for agriculture use and disabling almost all ecosystem services. Due to the high level of sealing in cities, the filter capacity of soils is severely affected and water will directly enter the water bodies. Furthermore, the risk for flood events are increasing.
Pollution: Pollutants (e.g. waste disposal, acid rains, agrochemicals) are either accumulating in the soil or washed out into the groundwater with sometimes unknown impacts onto environment. In the end, highly toxic chemicals like mercury may enter the human body through the food chain and jeopardize human health. Pollutants affect soil organisms and challenge their ability and the soil ability itself to filter.
Moreover, current climate change will most likely cause more frequent and more severe droughts in central Europe with negative impacts on soil water retention mechanisms and in the end, worsening erosion and the loss of fertility.

- Ecosystem services and natural capital -

Soil provides a variety of functions and services, so called ecosystem services, and is the basis of all economic and cultural activities. Soil supports nutrient cycling (supporting service) and provides food or fresh water (provisioning services). Moreover, soil is part of regulating the climate and preventing floods (regulating services) and of course soil has an aesthetic and recreational value (cultural services). Since soil and the accompanied ecosystem services are public goods, the problem is that these services tend to be over-consumed and need to be put under control to prevent a tragedy of the commons.
The concept of natural capital is a tool to make the value of services provided by ecosystems (such as soil) more comprehensible and comparable to manufactured goods (society in general is willing to pay for monetary). Per definition, natural capital is a stock that yields a flow of valuable goods or services into the future, which can be differentiated into renewable and non-renewable natural capital.
Soil functions are a measure of what amount a certain soil is able to contribute to an ecosystem services. In this framework, a soil function is regarded as natural capital.

- The value of soil -

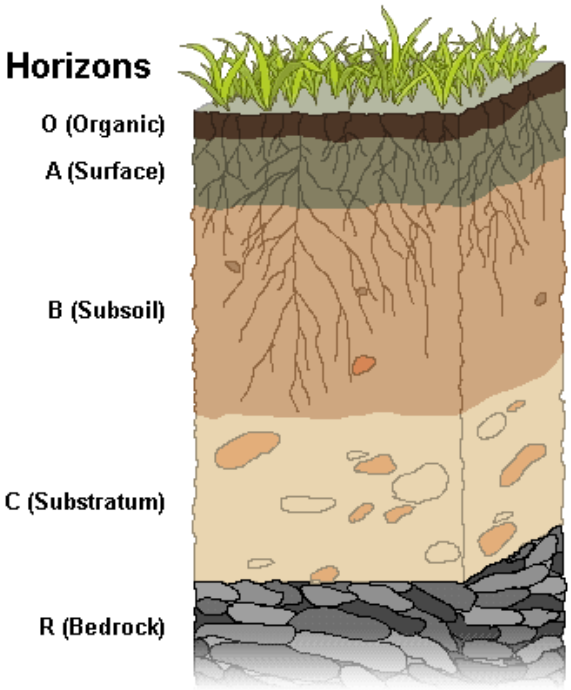
The economic valuation of the soil identifies the monetary value of the different soil functions. There may be no direct economic value but by translating the soil services into, for example, the cost of fertilizers, the cost of cleaning water or the cost of irrigation, there would be an economic impact. Thus, many services can and have been calculated and summarized for each site or soil type. Yet the economic valuation is an instrument and the money values calculated do not need to be translated directly into a

"Economic valuation as an instrument for fair share"

payment scheme. But the values can be used to balance out all factors and visualize the multifunctionality of soils and set them into relation. It may also be possible to calculate an area of land cultivated by legumes, for example, to reach a reduction of nitrate leaching to the groundwater as legumes are able to fix their own nitrogen. As Fisher et al. (1992) state some services have a minimum level at which they start working and this minimum level cannot be put under control and everything has to be done to keep this minimum level.

Furthermore the valuation of the soil and its functions is a good instrument to communicate the ecosystem services of soils and to show the importance of soil protection, especially in Switzerland where soil protection is still insufficient. It can be used either by farmers to justify subsidies or by administration to change subsidies and to evaluate current policies. In the end, society will benefit and the current 3 billions of agricultural subsidies could be spent in Switzerland appropriately.

Hence economic valuation can be used to define obstacles to be regulated by new policies, to evaluate existing policies or to model the change for future policies.



Source: https://en.wikipedia.org/wiki/Soil_horizon

-Uncertainties in service quantification-

Natural capital as such has been defined by Robert Costanza and Herman E. Daly in 1992 ("Natural Capital and Sustainable Development" in *Conservation Biology*, Vol. 6, No. 1.). Since then research has greatly developed, yet research is not able to provide number and quantities for all soil types in Switzerland, furthermore the interrelation of different services is not completely understood and the quantitiy of trade-offs between services needs to be studied.

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