

Soils and Land - Their Use, Management and Protection

MODULE: SS702/1

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Top soil is one of the small number of essential natural resources in the world, yet it is being lost at alarming rates by erosion. Give reasoned arguments you would present to a national or supra-national body to draw attention to this loss and suggest soil management strategies you would propose to minimise future soil damage and loss.

Introduction.

Given that man is ultimately dependent on photosynthesis for energy and that the majority of primary producers, higher plants, cannot survive without soil; soil must be regarded as an essential component in the world's food chain. This fact has long been recognised; in the national food handbook "Manure's for the War-Time Garden" (Whitehead, 1940) the opening paragraph states, "*it is vitally important that we should not lose sight of the fact that food growing begins with the soil. . . .of the four factors [light, water, air] it is the only one we can, and do, control to any large extent*". The protection and preservation of the soil and its' vitality is therefore an essential component of national and global food security. The control of soil erosion caused by water and by wind is of great importance in the maintenance of crop yields. It is estimated from available measurements that at least 3 billion [10^8] Mg (metric tons) of soil are washed out of fields and pastures of the nation [USA] every year (Schwab et al, 1981). If we assume an avg. bulk density, when in the field, of $1.41\text{g}^{-1}\text{cm}^{-3}$ then every year a one metre depth of soil covering over 14,000ha is lost from the United States alone. With just over 26% of the world's tilled and pasture lands being in the USA (Borgstrom 1969), then if this loss is matched globally over 500 km² of agriculture land is lost annually. Whilst this accounts for only 0.0014% of the world's agricultural land it represents, over the last twenty years, an area the size of Jamaica (10,990 km²) having been lost. The National Resource Inventories of 1977 however provided a statistically valid estimation of only 3 million [$105\text{t}^{-1}\text{an}^{-1}$] tons per year being lost from agricultural land in the USA (Batie, 1986). These statistics also revealed that erosion on cropland was highly concentrated with "*5% of crop land responsible for 36% of total erosion and 66% of the excessive erosion*". These figures should not distract from the fact that whilst "87% of land did not erode at rates considered excessive, over 5 tons per acre per year" ($> 12\text{t}^{-1}\text{ha}^{-1}\text{an}^{-1}$), erosion did take place, and whilst most erosion does not remove soil in its entirety, this occurs only in extreme cases, it instead slowly robs the soil of fertility as vital components are disproportionately removed; "*Not only is soil lost in the process but a proportionally higher percentage of nutrients, organic matter and fine soil particles in the removed is lost than in the original soil*" (Schwab et al, 1981). This process results in soils becoming increasingly impoverished as the finer aspects are washed out whilst the coarser more resistant components remain. It is therefore imperative that the effective development and implementation of strategies and policies to reduce erosion must be or become the goal of legislators; less we suffer further erosion and impoverishment of land.

Erosion and its' Causes.

When looking at strategies to combat soil erosion it is best to start by asking the question why soil erosion. Historically soil erosion has always occurred and can be seen as a natural process; the development of agriculture on the Nile delta, due to the rich alluvial deposits eroded many miles away; the architecture and nature of the landscapes around us, shaped by the constant action of wind and water. But whilst erosion is a natural process it is particularly excessive following or as a consequence of a disturbance event, and in today's world, agriculture is the main cause of such events.

Despite the well documented and recorded evidence of the accelerated erosion that agriculture causes there would appear to be little international effort to address the matter. At the 1992 United Nations Conference on Environment and Development (UNCED) the term "soil conservation" appears only once in the definite document "Earth Summit '92" [cpt.12. Managing fragile ecosystems: combating desertification and drought] and whilst the oceans, the atmosphere and the forests are covered in detail, soil is only mentioned in so much as "*a broader intergravitive view [of land] also includes natural resources: the soils, minerals, water and biota that the land comprises*" [cpt.10. Integrated approach to the planning and management of land resources]. Additionally erosion prevention serves not only to maintain soil health but also to prevent pollution; when soil is removed by water it takes with it nutrients which encourage eutrophication. The resulting increase in the biological demand for oxygen can and often does lead to the death of fish. The problem does not stop there with the particles settling out and choking waterways, increasing the frequency for dredging. Dredging further carries the risk of encouraging further eutrophication as disturbed sediment releases a second flush of nutrients. When soil pollutes the sea it can be equally devastating casting a brown blanket over coral reefs and destroying them. It is somewhat unfortunate that the UNCED delegates overlooked the importance of maintaining the soil resource. This apathy to addressing soil conservation as a real issue is it's self one of the major causes of erosion; it is an attitude that perpetuates throughout society and is sadly reflected in general farming where clearing a ditch or maintaining a hedge is seen as minor task put off in preference of more pressing matters.

Addressing the Apathy.

There prevails an attitude amongst some that erosion is inevitable and that as long as it's effects are not dramatic, it's prevention not worth while. This "minor" neglect is responsible for the 64% of erosion, that occurs on 95% of the agricultural land in the USA, which is regarded as acceptable! It is to this fraction that we must first concentrate our efforts.

Education

Amongst the many reasons why soil conservation measures are not implemented education is perhaps the least controversial. Where farmers are not aware of, underestimate or are unsure of how to prevent the loss steps can be taken. Losses can be due to incorrect use of machinery, working the soil in an unsuitable condition or times of year, leaving land fallow for long periods or at vulnerable times. Equally the maintenance of ditches, hedges and banks if not properly and regularly carried out can lead to greater erosion than if the original measures had never been taken. Livestock too can cause damage and erosion with over stocking leading to over grazing and wet pasture trampled and dislodged. Much of this erosion is preventable with little or no cost to the agronomist or the policymaker.

Land Tenure

Soil erosion is generally perceived to be more problematic on rented land than on owner operated, however whether or not this is the case has yet to be resolved (Ervin 1986). The relationship between landlord and tenant is a complicated one however, made even more so by government policy and taxation. In order to fully understand this problem we must look to the historical events that have led to the current situation. In Britain land tenure and in particular absentee landlords has been the cause of many major political events much of which still haunts us today. The Irish Question has its origin in land tenure. High rents charged by absentee landlords coupled with the Potato famine led to the development of the hatred for English Protestantism that has now evolved into the IRA. Equally in the early part of the 20th century high taxation, following WW1, led to landlords neglecting their duty to maintaining the land and in the words of Viscount Lymington (1932) "Few things have been more harmful than this pre-occupation with the present to the exclusion of real thought". This essentially tripartite relationship delegates responsibility for land conservation on all three parties and in line with human nature each party sees the other as having the greater responsibility. The tenant would argue that responsibility over and above "good practice" lies with the landlord, he cannot be expected to invest in measures which may last a thousand years when his tenure is but for three. The landlord would argue that were he to invest in conservation measures his returns would be diminished, what income currently received from rents could not be increased to reflect his investment. The role of government in this relationship is complex but it could be seen as ensuring that neither of the other two parties exploit one another and the markets and policies are maintained so as not to adversely impact on conservation. Whilst it is a simplified view government should act as the oil that lubricates and maintains this relationship.

Market forces.

It may seem odd to cite the market place as a cause of soil erosion however "High farming is no remedy for Low prices". This traditional dictum of Lawes has been repeated so often that it has almost become proverb. "2000 years ago Pliny wrote: Nihil minus expedire quam agrum optime colere...! ~ Nothing is less profitable than to cultivate land to perfection" (Mansfield 1947). This dictum is as apt today as it was 2000 years ago. Today's farmers face an impossible task with increased competition through a market driven economy lowering prices and putting agriculture in crisis. If there is little profit in produce where does the farmer find the capital to invest in conservation? This situation invites neglect and if society continues to demand "jam today" this neglect will lead to more erosion and greater impoverishment of land.

In summary soil erosion and its control are issues of education, security of tenure and profitability of enterprise. If these three areas can be properly addressed then soil conservation and ultimately national and global food security can be improved.

Addressing Soil Conservation.

Tackling the above causes of soil erosion presents problems of its own. The issue of education, whilst not usually regarded as a controversial one may well prove to be so here. Farmers are a breed apart, the nature of the occupation demands a high degree of autonomy and an ability to take risks. Each year sees a new set of uncertainties; what little continuity exists is steadfastly held onto and practices have evolved to maintain this continuity. A case in point here is the plough; farmers love to plough, they admire a well ploughed field as an artist admires canvas, they have competitions at all levels and were the practice ever to die out commercially its inclusion into the Olympics would be certain! The case for and against the plough is a complex and heated one with both sides having substance to their arguments, the long running debate instigated by E. Faulkner with the publication of "Ploughman's folly" (1945) and its counter argument "Ploughman's Wisdom" (1949) serve to show how deep seated the practice of ploughing is. This entrenched view and the passion it inspires is best summed up by the opening sentence of Ploughman's Wisdom: " If this book is ever published, or having been published succeeds in interesting its readers, then I have to thank that best seller Ploughman's Folly for inspiring me to bestir myself and write."

The issue of tenure, as previously indicated, is a complicated one however at the risk of understatement I believe that it can be summarised as an issue of responsibility or more to the point proportioning responsibility. If we make an analogy with a shared

private road, i.e., a cul-de-sac; communally owned with responsibility for the maintenance also collective. The residents often fail to maintain or plan for the roads replacement only to find in thirty years time that whilst the houses and gardens are well kept and maintained the road is in such disrepair as to be barely passable. One is left asking: why if the owners can maintain their properties can they not also maintain their access? The answer lies in the failure to proportion responsibility properly at the outset and herein lies the problem of soil conservation: who is responsible for its prevention?

The Role of the Executive in Soil Conservation

Government can be seen as having a dual role of facilitating soil conservation, through properly constructed policy, and policing soil erosion through correct legislation. Government must also see the problem as needing to be tackled from too angles; dealing with current problems and planning for future. With the latter government needs to introduce legislation that proportions responsibility equitable between parties in future contracts. That is to say it must lay down in Law what the parties responsibilities are to the land and it's soil with this process only being applicable to future events [the European Convention on Human specifically prohibits the introduction of retrospective legislation (Ipaye-Sowunmi & Szwarc, 2000)]. Where existing arrangements and agreements between parties prevent legislative measures from being implemented government must act as a facilitator, providing financial and professional assistance either as direct aid or linked in with existing schemes so that soil conservation becomes a condition of the assistance.

Summary

The issue of soil erosion and the development of the movement by Hugh Bennett in the USA has been with us for over 60 years (Paarlberg, 1986); yet despite this, and in the light of the development of various control methods, we still see considerable amounts of erosion due to agricultural activity. We must therefore conclude that if the technology exists then other factors must be responsible for the failure to implement this technology. Given this one would aver that in order to tackle soil erosion we must visualise it as a consequence of other determining factors, socio-economic, rather than as a factor on its own. Like a runny nose may be alleviated by a tissue its root cause, the cold, will not likewise be addressed. So as with an infection, in dealing with soil erosion, we must tackle the root cause and not the symptom less we continue to use "technological tissues" instead of addressing the social and economic causes.

