



Assessing the socio-economic impacts of soil degradation on Scotland's water environment

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The problem

Having healthy soils is important for many parts of the Scottish economy, for example, they improve crop yields, store more water to help limit the effects of drought and floods and regulate water flows to rivers and lochs. When soils are degraded there are both direct and indirect impacts. These can have significant costs associated with them to both individuals, society, and the wider economy.

To assess the costs of degraded soils to the Scottish economy it is key to know the:

1. Extent soil degradation.
2. Impacts of that degradation.
3. Costs of those impacts and to whom.

The extent of soil degradation in Scotland

Like soils the world over, soils in Scotland are vulnerable to degradation and, from the available measurements we know that many of Scotland's soils are already in a degraded state.

The project has shown that a significant proportion of cultivated soils are compacted and eroded, and degradation is linked to both land use and soil type with some soils more vulnerable than others.

Through mapping we also know that land in Scotland continues to be developed for housing and transport networks adding to the areas of impermeable surfaces (sealed soils).

However, when it comes to soil contamination, we don't know the extent of this due to a lack of data. What we can say is that there are sites in Scotland where soils are contaminated with unknown costs associated with this.

The impacts of degradation

When soils become compacted, they have a lesser ability to absorb water. This leads to less water being available for plants, reducing crop yields and more water running off more quickly to rivers. An increase in runoff both increases the amount of pollutants that are transported to rivers and lochs, and the risk of flooding.

Compacted soils also require more fuel for cultivation with additional costs to farmers, increase greenhouse gas emissions and provide less space for biodiversity than non-compacted soils.

Compaction is one mechanism by which runoff increases with soil sealing being another. When soils are sealed the area of impermeable surfaces increases and the amount of water flowing directly into rivers through the drainage network is also increased.

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To access the outputs for this project, please visit: crew.ac.uk/publication/socio-economic-impacts-soil-degradation

This increase has the potential to cause significant flooding issues.

Beyond compaction soil contamination is another key threat. Contaminated soils can lead to an increase in the amount and diversity of unwanted chemicals being transported to rivers with impacts on the water environment. Contaminants in soils can also lead to uptake by plants and crops, reducing their quality with potential impacts on health.

The costs associated with degradation

Depending on the crop being grown farmers could face additional costs of between £15 to £209 per hectare for land cultivated due to increased fuel usage. Additional costs are not just from increased energy costs but also associated with a potential reduction in yield of up to 15%.

At a national level the costs of a reduction in crop yield range from £16 million to £49 million. The additional fuel costs for cultivating compacted soils are between £9 and £26 million resulting in total costs of between £25 million and £75 million a year when fuel and yield penalty costs are combined.

The increase in runoff from compacted and sealed soils could lead to a 1% increase in costs associated with flooding to local authorities equating to £2.6 million per year. Although a small figure the financial burden would be great.

Additionally, it could increase home insurance claims associated with flooding events with an average claim currently ranging from £57,000 to £76,000 per affected household for each flood event.

Are there other costs?

In addition to those costs outlined already there are likely to be additional costs associated with increases in greenhouse gas emissions from degraded soils or emissions associated with additional fuel use.

In the wider landscape, the degradation of peat and peaty soils has additional costs as does the costs of soil degradation on other land use sectors such as forestry.

Soil compaction can also exacerbate soil erosion and add additional costs to the previous estimates of the cost of soil erosion to the Scottish economy. Further work is needed to calculate this additional cost.

All soil degradation leads to changes in soil biodiversity with the impacts of this on other soil properties unknown. It should be noted that it is likely to escalate degradation and its wider impacts and associated costs.

How do we minimise degradation?

- Timing agricultural operations to minimise trafficking on wet soils reducing compaction potential.
- Limiting compaction through the use of controlled traffic approaches.
- Use of lighter machinery.
- Targeted subsoiling only when necessary, preferably with the incorporation of organic matter.
- Incorporation of deep rooting plants into rotations.
- Reduce development on greenfield sites.
- Assess the impacts of chemicals on soils, crops and waters.
- Co-ordinate monitoring of soil health and impacts so that interventions can be targeted.

How could things change with climate change?

All the impacts of soil degradation are likely to be exacerbated by climate change. For example, droughts in spring will lead to additional yield reductions and increases in intensive rainfall will increase the risk of compaction, flooding, and the runoff of associated pollutants.

Please see the [main report](#) for project recommendations.