

# Land degradation and climate change: a sin of omission?

The phrase “climate change” was used in more than 80 000 articles published in 2012. Over the same period, only ~10 000 publications referred to “land degradation” or “soil degradation”. While we agree that long-term climate change requires a high level of intellectual and resource investment, we are concerned that this focus is distracting scientists and decision makers from the often equally irreversible effects of land degradation (including desertification). Climate change and land degradation reduce the provisioning of ecosystem services but occur at different temporal and spatial scales and therefore often require different solutions. Although the environmental and social impacts of climate change may exceed those of land degradation at some point in the future, the effects of land degradation are occurring now. Furthermore, while climate-change mitigation requires global solutions, individuals and communities can successfully reduce land degradation at the local level.

Land degradation generally reduces plant-water availability by increasing runoff and reducing the water-holding capacity of soil through erosion, loss of organic matter, and the deterioration of soil structure. This creates “edaphic (soil-related) droughts” during otherwise “normal” years. Similarly, land degradation exacerbates climate-change-related water deficits that result from higher temperatures and the consequent increase in evaporative demand. During large rainfall events, land degradation intensifies flooding, as infiltration is reduced and gullies channel water more quickly to rivers, magnifying peak flows. All of these impacts can be addressed at field-to-watershed scales, but the solutions often require awareness and investments at multiple levels and by various sectors of society, including private, government, and non-governmental organizations.

Farmers, pastoralists, and policy makers around the world now routinely identify climate change as a primary factor driving land productivity declines, and often use this as a justification for disregarding other possible contributing factors. The scientific community is clearly not solely responsible for the lack of awareness of the impacts of poor management practices, but we do play a contributing role. At best, our increasing focus on climate change has an opportunity cost: there is less time available to understand and develop strategies to limit land degradation and to restore degraded lands. At worst, our pursuit of funding and recognition for climate-change research can inadvertently disenfranchise those promoting sustainable land management. When discussing the climate-change mitigation value of soil carbon sequestration, we may minimize the current reality of soil carbon emissions associated with land degradation and the associated impacts of these soil organic matter losses on ecosystem services.

Closing the yield gap is one of the suggested paths toward achieving a sustainable food production system that meets the demands of a growing population. The challenges of bringing current yields closer to potential yields are becoming more complicated as land degrades and the gap widens. A practical understanding of the factors that control land degradation and, more broadly, land potential (including both potential to support multiple ecosystem services and resilience) is necessary to target investments in sustainable land management on productive lands that are at high risk of irreversible degradation. Many of these lands are in semiarid and dry, subhumid regions, areas where frequent drought reduces soil cover and increases erosion. The shallow soils that are common in many of these regions ensure that the impacts of soil losses are greater than they would be in areas with deeper soils.

We also suggest that research designed to improve drought management should clearly distinguish between climatological and edaphic causes. Edaphic droughts can result from reduced water infiltration, decreased soil-water holding capacity, and gully incision. This distinction can often be illustrated by comparing production declines on relatively degraded and undegraded land with similar potential during years with reduced precipitation. Landscape position and relatively static soil profile characteristics – such as texture, mineralogy, and depth – are used to define land potential. Finally, we argue that an improved understanding and use of land potential concepts in research and monitoring will allow scientists, managers, and policy makers to more easily determine when observed differences are due to current management, land degradation, or climate change by ensuring that comparisons are made between similar types of land.

In summary, we offer two recommendations. First, the current focus on climate-change research should be complemented by research on ecological processes associated with land degradation and the development of solutions based on an understanding of these processes. Second, an enhanced understanding of land potential is necessary to target limited resources to increase agricultural production, conserve biodiversity, promote recovery of degraded lands, and adapt to and mitigate the impacts of climate change.



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