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Minding history and world-scale dynamics in hazards research: the making of hazardous soils in The Gambia and Hungary

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Minding history and world-scale dynamics in hazards research: the making of hazardous soils in The Gambia and Hungary

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Hazards can result from combined social and environmental processes. However, it remains commonplace to treat the occurrence of hazards as if isolated from what happens in other, at times faraway places and as if history did not matter. To illustrate how world-scale interconnections and historical processes impinge on the appearance of current hazards, I discuss case studies of soil acidification from The Gambia and Hungary. In the former, pressures from international financial institutions to raise export-oriented cash-crop productivity resulted in the 1980s construction of large-scale dams for wet rice cultivation and other development projects. The result has been the progressive activation of acid sulphate soils that threaten lowland cultivation and freshwater sources. In Hungary, internal social turmoil and contradictions influenced by the US-USSR conflict led to rapid industrialisation of farming and the intensification of export-oriented agricultural production in the mid-1960s. The consequent increasing reliance on agrochemicals has spread the incidence of soil acidification. Both of these cases demonstrate that localised hazards, entailing long-term deleterious consequences, cannot be fully explained or confronted without addressing historical and multiple-scale social processes.

Keywords: soils; world system; scale

Introduction

Over the past few decades, many have contributed to rethinking hazards as more than just 'natural events' (Wisner et al. 2004, 48), as outcomes involving people, both in causing and bearing the consequences of hazards, besides defining what constitutes a hazard (Cannon 1994; Gaillard, Liamzon, and Villanueva 2007; Green and McFadden 2007; Haque and Etkin 2007; Hewitt 1983; White 1974). Notwithstanding these strides in hazards research, there are two issues that merit much greater attention.

One regards world-scale historical and contemporary social processes behind the social causes involved in at least some hazards (famine, groundwater pollution and the like). Even when related processes like vulnerability are approached through historical contextualisation and wider geographical processes, hazards due to historical human activities are rarely considered (for exceptions, see Gardner and Dekens 2007; Lewis and Kelman 2010). Much less are hazard-contributing human impacts explicitly connected to global social processes, such as investment flows,

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impositions of structural adjustment policies, currency speculation and food and oil geopolitics, to name just a few. Sometimes, international social institutions are analysed or invoked with respect to modifying institutional aims and policies (e.g. Burton, Kates, and White 1993) or to causing vulnerability (Wisner et al. 2004; Lewis 1984), but such work hardly examines the global linkages underlying the devastation wrought by, for instance, the production and siting of hazardous waste (e.g. Adeola 2000) or declining potable water availability resulting from withdrawals by a transnational corporation's factory (Nash 2007; Raman 2007).

Another issue that would benefit research (and policy formulation) on hazards is with respect to soils rendered hazardous through human impact. This latter process, though well-known among soils researchers, seldom figures in more general works on hazards. However, it is arguably no less menacing to people's well-being than earthquakes (whose effects anyway can be magnified by high soil erodibility), especially because damage from hazardous soils can persist for decades, if not longer (Singh 1998). Sometimes what people do to soils, directly or indirectly, can have immediately disastrous consequences, like sudden, deadly landslides, erosion-induced wind-blown dust choking crops and surface waters and toxic compounds showing up in food and water. However, there are more subtle processes that can easily go unnoticed by policy-makers, local inhabitants and hazards experts until an intractable problem emerges. Such is the case with soil acidification. It can reduce crop yields when aluminium and manganese become more abundant in the soil solution with higher acidity levels, hampering root growth and causing drought-like conditions. Surface and groundwater quality can be threatened by enhanced leaching of heavy metals and other toxic (methylated) compounds from soils into water supplies. It can raise pre-existing or introduced heavy metals bioavailability to toxic levels for a variety of species, including humans. Soils should then matter a great deal to those interested in attenuating the impact of hazards, especially as they directly contribute to making places more or less vulnerable (Lewis and Kelman 2010, 193).

The objective of this intervention is to illustrate insights that can be gained by paying more attention to wider historical and geographical social processes and to human impacts on soils. This is accomplished by discussing human-induced soil acidification in The Gambia and Hungary. Both cases indicate the importance of considering long-term and multiple-scale social processes when studying local dynamics to explain and formulate policies to address the making of localised hazards – in this case, the making of hazardous soils.

Soil acidification

Soil acidification refers to the decline in soil capacity to neutralise acids over time (acid-neutralising capacity or ANC) due to a net increase in acids relative to bases, which is usually reflected in decreasing pH values over time.[1] In the absence of human-induced effects, soil acidification results mainly from proton (H+) releases during reduction–oxidation reactions and the biogeochemical cycling of carbon, nitrogen and sulphur, at least in ecosystems, where long-term average annual precipitation exceeds evapotranspiration, as in much of Hungary. Nonhuman atmospheric acid wet and dry deposition, even if prolonged, usually adds negligible amounts of acids. In relatively drier and warmer environments, such as The Gambia, there is more of a tendency for soil alkalinity, but biogeochemical cycling of sulphur in coastal wetlands combined with exposure to oxygen (i.e. a lowering of the water table) is associated with rapid acidification through the activation of acid-sulphate soils (see below). In continental environments, soil ANC mainly results from the interaction of rainfall- and temperature-dependent mineral weathering, the alkalinity of parent material and soil organic matter (SOM) and mineral content. Clay content, clay mineralogy and SOM content are important indicators of potential buffering against acidity as reactive clays and phenolic and carboxylic groups serve effectively to neutralise acids as proton sinks.

Human impacts can accelerate or initiate acidification, depending on environmental conditions and soil type (e.g. some have intrinsically low acid-buffering capacity, like sandy soils). The principal culprits are to be found in the application of industrial nitrogen fertilisers, especially ammonium (due to H^+-releasing nitrification), alterations in carbon cycling (e.g. SOM decline), alkali removals from intensive agriculture and pasture management (e.g. harvesting without returning alkali through organic matter additions), soil amendments (especially additions of sulphate to reduce pH) and, usually to a marginal degree, human-induced acid deposition (Barak et al. 1997; Hill 2003, 197; Sumner 1998). Acidification can also result from mining and from non-sulphidic wetland drainage, which respectively present other associated hazards, with soil removal contributing to greater potential flooding and drainage leading to subsidence.

In environments like coastal wetlands, material that comprises soils is often filled with water-soluble salts. Such salt-affected soils, despite having typically high pH, can actually reach extremely low pH (<4) when exposed to oxidation. This occurs upon changes in drainage conditions that lower water tables, such as when wetland soils are drained for or through construction (dams, residential buildings, etc.). The oxidised pyrite and other sulphur-rich materials in such wetland soils generate sulphuric acid. When this happens, it is said that an acid-sulphate soil has been activated (Dent and Pons 1995). These processes can be linked to nonhuman processes associated with falling sea-levels, for example, which would expose acid-sulphate soils to oxidation. However, the activation of acid-sulphate soils is largely due to human impact on coastal wetlands in a general context (with exceptions) of sea-level rise, itself related to human-induced global warming trends (for The Gambia region, see Marius and Lucas 1991). In any event, phenomena directly linked to human activity, such as the production of mining spoils and overburden will, if sulphidic, cause problems similar to those of acid sulphate soils (Demas et al. 2004; Fanning et al. 2004; van Breemen 1973).

The effects of soil acidification can be dire if no efforts are made to reduce or stop anthropogenic sources or otherwise attenuate environmental processes and introduce, for instance, buffering amendments (e.g. lime) and acidity-attenuating cropping techniques. For most plants, acidification means nutrient deficiency (e.g. in phosphorus, molybdenum, calcium) and elemental toxicity (e.g. aluminium, manganese), leading to hampered growth or propagation and premature death. Acidification therefore directly undermines crop production, but it also affects water supplies if heavy metals are leached into groundwater. Coastal wetland drainage raises acid sulphate levels such that, for instance, even building foundation materials may be corroded (e.g. steel and cement). A major concern with acid-sulphate soil activation is water contamination. Low pH, especially in anoxic conditions, is linked to the microbial conversion of mercury into its neurotoxin form (methyl mercury). Heavy metal concentrations can generally rise in both surface and groundwater, as well as coastal waters, because upon acidification, heavy metals are freed up from soil organic and mineral particles, and so can get into soil water (Sumner and Noble 2003). There are also wider ecological effects, in all affected terrestrial, freshwater and marine ecosystems (Cook et al. 2000; Roos and Åström 2006). These include the disappearance of acid-sensitive taxa, the reduction in microbiological cycling rates (e.g. N fixation), declines in certain bird and mammal populations and consequent increase in some pathogens, all of which eventually have detrimental repercussions for human health (Ljung et al. 2009; Ulrich and Sumner 1991).

Activation of acid-sulphate soils in The Gambia

As stated above, the activation of acid sulphate soils is often directly the outcome of human activity that modifies processes of water flow and storage in soils. This is exemplified in the results of pump-irrigation techniques introduced in The Gambia during the 1960s to increase rice production. Development projects promoted the increase of cash-crop export-oriented farm yields in ways that have undermined the direct fulfilment of local food needs and the functioning of ecosystems that also sustain local food production systems. Under adverse climate change conditions, such agricultural industrialisation schemes have led to lowering water tables and, consequently, the long-term hazard of activated acid sulphate soils. Such outcomes cannot be explained solely by local or regional environmental and social processes. They are directly linked to a history of (neo-)colonialism (e.g. the establishment of cash-crop plantation infrastructure) and sets of relations that are worldwide in character, such as post-independence economic (and military) interference or influence by foreign powers,[2] through development agencies and international financial institutions like the World Bank.

The Gambia is an area characterised by coastal wetlands, tidal flats, marshes, colluvial slopes and uplands along the Gambia River. Rice and other crops are cultivated on all these highly variable environments, with land preparation (including sluices, bunds and ridging) and cropping techniques fine-tuned to soil type, hydraulic conductivity and tidal flows. Rice yields using these methods have ranged from 0.5 on uplands to 2.5 t/ha on freshwater marshland with bi-monthly tidal inundation (Carney 1991; Marius 1982). The upper yield amount is equivalent to the highest productivity achieved in The Gambia as a whole in the mid-1980s, after which rice yields and cultivated area have largely declined. The average yield for 2009 was barely about 1 t/ha, despite a more than three-fold increase in rice-growing area (based on figures from FAO 2010).

Such unimpressive developments seem hardly to justify the displacement of pre-existing irrigation techniques that prevented the activation of acid-sulphate soils and enabled at least adequate yields to satisfy local subsistence needs. To explain what compelled those development projects, it must be recalled that it was a food shortage catastrophe, the Sahel drought of the 1960s–1980s, that was used to legitimise such intervention and mobilise often well-meaning action to the detriment of local food production knowledge and technologies. However, to reduce the problem to drought (a nonhuman hazard)—and the ongoing decline in wet season duration and overall rainfall—would be to miss other major factors at play. As Carney remarks, ‘it was volatile international commodity markets, deepening rice import dependency, and the human suffering induced by food shortages during the Sahelian drought that encouraged the widespread diffusion of pump-irrigation technologies' (1991, 45). Then there is the international debt thereby incurred, the oil and debt crises partly induced by US policies (see below regarding Hungary), the international loans contingent on reduction of farm subsidies and tariff barriers, the continuing subsidisation of rice farming in countries like the US, and an economy largely founded on cash-crop exports (especially groundnut) afflicted by steadily eroding terms of trade, among other outcomes of extremely asymmetrical power relations (Saine 1997). Such international political economic arrangements ensure to this day that The Gambia will neither become agriculturally self-sufficient nor endowed with the necessary infrastructure to confront hazards like acid-sulphate soil activation. To look at the matter from another angle, this can be seen as the creation and maintenance of a permanent potential for water pollution and food-shortage hazards. The latter is linked to food price volatility, which is itself due to international political economic processes, as The Gambia is becoming increasingly urbanised (i.e. in this case, more people are wage-dependent), especially since the 1980s. This situation makes for price fluctuations increasingly determining the degree of people's nutritional level and thereby health (Moseley, Carney, and Becker 2010).

The irrigated rice scheme not only failed (and continues to fail) economically, despite the pouring of aid money and technical assistance (or rather because of those interventions, see below), but it is leaving lasting environmental hazards in terms of activating acid-sulphate soils threatening local food provisioning. Upstream damming of the Gambia River in the early 1980s (to amplify irrigation systems) and pumping in the lowlands have contributed to rising soil salinity through seawater transgression into groundwater. Anti-salinity dams have been built to reduce the transgression problem by blocking tidal flow upstream, but this has opened up the prospect of lowering water tables further and exposing to oxidation even lower layers rich in sulphide minerals within alluvial soils (the likelihood of this eventuality was already known prior to much dam construction; see Dent and Raiswell 1982). This adds to the problems already created by introducing pump-irrigation farming. Mechanised irrigation, by drawing freshwater from lower depths, decreases the amount of saltwater-free time available for rice cultivation along tidal flats and, by reducing the water table in areas upslope from the river, activates acid-sulphate soils (Carney 1991, 42–3). As described above, such acidification impairs plant growth and imperils water quality with the mobilisation and leaching of heavy metals. Relatedly, Galle and Montoroi (1993) have observed high aluminium concentrations in tilapia populations in the Casamance estuary, where the Gambia River reaches the Atlantic Ocean. Traced to acids being flushed from upstream activated acid-sulphate soils, such heavy metal accumulation in edible fish presents yet another hazard to local inhabitants.

Such development project failure and unleashing of acidification and salinisation hazards resulted from a combination of inter-related social processes. One is the high-input and extended working-day requirements (extended year-round) imposed by such projects that are difficult to meet for local inhabitants. Another stems from gender-based conflicts within Mandinka households over rice production that were induced by attempts by government and external agencies to employ men in wet rice schemes, in communities where women have traditionally produced rice. Yet another is related to rising foreign and domestic market demand in the 1980s for vegetable crops that are largely produced by women (Schroeder 1993). These three aspects simultaneously marginalised indigenous expertise and reduced available labour for land preparation applied in flood recession and tidal irrigation farming, most of which involved women (occupying a gender role that emerged in the 1950s). The work of maintaining or renewing irrigation infrastructure was undermined, thereby contributing to the lowering of water table levels. A third process involves a generalised social conflict over access rights generated by uneven capital accumulation associated with irrigated rice production. Problems with land access hampered the building and maintenance of sluices, ridges and other activities that kept acid-sulphate soils in check. Such social processes have been accompanied and exacerbated by the destruction of cultivated wetlands to make room for pump irrigation and the lengthening of the rice-growing season to include the dry season, which can lead to greater water table reduction (Carney 1991; Webb 1992).

Since 1985, matters have become even more untenable, as the IMF and World Bank have strong-armed governments in most of the Sahel to privatise large state farming concerns among structural adjustment programmes. The results have been poorly built and maintained drainage works in small private parcels that are often abandoned after a couple of years. Indigenous production methods, which prevented acid-sulphate activation and allowed for practices sensitised to local environmental diversity, largely continue to be disregarded by policy makers, agronomists and other local and external experts at nearly all levels, who even complain about the lack of farmers' adoption of more industrialised techniques (e.g. Agyen-Sampong 1994; Diack, Diom, and Sow 2010; Guei, Dixon, and Sampong 1997). In part, the intransigent attitude of such experts and officials is traceable to a belief in some sort of modernisation and now neoliberal ideology (often reinforced by personal financial gain through foreign aid programmes) and partly to the fact that indigenous production, mostly involving women, does not generate the necessary surplus to contribute to, among other things, repaying international loans or accumulating capital generally. In fact, much of the farming in local communities is hardly motivated by market exchange, a process often largely imposed by national governments (and prior to them colonial authorities) enmeshed in and pressured by a capitalist world economy (see, for instance, van der Klei 1988).

Looking at the broader set of relations, one could say that the objectives of modernising rice production in The Gambia were actually reached. This is if one thinks in terms of expanding a market for products from and for reproducing financial dependence on large capital from countries like the US, Germany, Japan, the UK and increasingly India and China, and all cloaked in the garb of philanthropy, with a prolonged drought used as an entry point. Capital accumulation is in this way secured for large corporate interests in the banking sector, for example, and expanded to industrial concerns, such as fertiliser and pump manufacturers. At the same time, The Gambia's politically divided ruling classes wrestle over the control of national revenues and external financial support, whereas some smaller landholders and businesses gain from the additional income generated by pump-irrigation rice yield (which, for example, by the 1980s only reached 1/10 of total rice production in The Gambia; Carney 1991). Such international and government interventions, while having localised repercussions, are directly linked to the reinforcement of relations of economic dependence between such countries as The Gambia and countries that dominate decisions in institutions like the World Bank, mainly G-7 governments with the US still having effective veto power (Peet 2007).

Resistance to these policies, which have yielded rising economic disparities, has been increasing especially since the early 1980s, but has been internally divided and focused on the Gambian state, which would be anyway unable to reduce most people's hardships. Discontent has been particularly strong among a mostly rural Mandinka majority and urban-based movements, which in part explains the success of the civilian-military coup that ousted Jawara in 1994. Since then, the Jammeh regime has suppressed political dissent and has attempted to re-orient economic ties to the Persian Gulf states and Libya (this policy is speedily coming apart with current revolts and warfare in those countries), but the high dependency on capital from and trade with the largest economies remains (Nugent 2010; Saine 2008). Such long-term, if shifting, external pressures over The Gambia are crucial factors behind the expansion of ecologically unsound export-oriented cultivation systems that, among other effects, produce hazardous soils, threaten water supplies, pollute edible aquatic species and fail to cover basic nutritional needs for local people.

Acidification of cultivated soils in Hungary

A similar understanding can be brought to the Hungarian case, where decades of agrochemical inputs have steadily expanded acidification-affected cropland area since the 1960s, notwithstanding massive national liming programmes carried out in the mid-1960s and 1980s. It is estimated that 65% of land is severely degraded, 29% due to farming (Bot, Nachtergaele, and Young 2000). A fifth of the degraded land is due to acidification, on par with erosion (van Lynden 2000).

By the 1950s and 1960s, problems of soil acidification began to be recognised as soil science developed more refined analytical techniques. This was, thanks to the postwar expansion of survey, monitoring and mapping efforts, intended to enhance control over agricultural productivity (eventually down to 6 ha resolution). The burgeoning database eventually began revealing anthropogenic degradation problems, especially widespread acidification and erosion. The extent of acidified soils reached 85 kha by the early to late 1960s. Soil conservation policies began to be introduced in the late 1950s with the 1957 establishment of the National Office for Nature Conservation. In 1961, the VI Act on the Protection of Agricultural Land was passed, aiming to restrict loss of farmland to industry. The Act explicitly described measures for the conservation of soils after the fact and extended soil testing capacity across the country. Liming programmes began to be carried out by the mid-1960s in much of the country and at state expense (Bakács 1992; Stefanovits 1982; Enyedi and Zentai 1986).

Nevertheless, soil fertility decline continued and was traceable to acidification and other degradation problems. By the 1970s, the decline in soil fertility became a major issue of productivity that impinged indirectly on the manufacturing sector in terms of producing enough marketable surplus to reinvest in industry. The response was the increase of agrochemical inputs, the introduction of more high-yield varieties, and the intensification of other high-input methods. The end result was the steady reduction of manure application. With that came less OM replenishment, which can play a major role in lowering ANC. These recurring problems affected the ability of farms (mostly large state and cooperative outfits) to increase output, so that in 1976 stiffer laws were enacted regarding soil management along with tackling a wide range of environmental issues (Engel-Di Mauro 2006; Gonda 1983; Stefanovits 1982).

Soil conservation planning intensified, reflected in the 1976 Environmental Protection Bill. This was landmark legislation with an emphasis on soil conservation (it featured explicit environmental planning rather than reactive measures ex post facto). There was the establishment of mandatory soil testing on cooperative and state farms (at least every three years), a national soil monitoring grid and stress on maintaining soil fertility aided by increased budget allocations like the national liming programme. National standards, regulation for agrochemicals and proscription of use of hazardous chemicals were introduced. Lime applications markedly increased in frequency, especially during the 1980s, coinciding with the greatest increase in productivity and fertiliser application. Such an extensive liming programme managed to reduce the affected area by half, at least until the systemic change of the late 1980s and early 1990s. Then, with mass land privatisation and massive budget cuts, liming and monitoring activities sharply declined in both spatial extent and frequency and the capacity of soil hazards detection and mitigation was greatly downsized (Baranyai, Fekete, and Kovács 1987; Murányi 1997; Pálmai 1995).

Hungary is a relatively wealthy industrialised society that was never directly colonised, as in The Gambia's case. It has additionally developed the infrastructure to detect and avoid soil degradation problems, along with cutting-edge research on soils since the 19th century, among other characteristics conducive to developing ecologically sustainable practices. It is a country that presents a paradox of much collective soil expertise combined with soil-destructive practices, much as in the rest of the industrialised countries. The preoccupation with increasing soil productivity and maintaining high levels of input obviously came into direct contradiction with environmental protection policies. The question thus becomes why so much agrochemical input was viewed as necessary, given full awareness of the deleterious consequences.

The answer becomes clearer when one looks at what motivated such actions, which was to maximise crop yields and livestock production as part of a project of domestic pacification through indebtedness, eventually to mainly Western European financiers. The motives, in other words, have to be contextualised socially on multiple scales. The matter cannot be reduced to presumed economic inefficiency of statist dictatorship, as soil degradation happens in more commercially oriented polities. For instance, a third of total land is severely degraded in places like the US, Italy, Spain, Iceland, and Germany. In countries like Belgium, the problem is rampant, with 65% of total land severely degraded (Bot, Nachtergaele, and Young 2000).

So, one must consider other factors that would press Hungarian farming units into producing much greater yields than necessary to feed the country. Placing soil management in a global context can provide some clarification. Briefly, Hungary, by the late 1960s, became a major producer of manufactures and food for the Council for Mutual Economic Aid (CMEA), and hence the Warsaw Pact military establishment (Berend 1996). Hungary was also occasionally and directly involved in Soviet military invasions, for instance by sending troops to squash the Dubcek government in Czechoslovakia. The Hungarian state became increasingly indebted to western powers, starting in the early 1960s, so that improvements in productivity were progressively channeled into exporting manufactures and agricultural products (a third of exports were from the farming sector), especially to Western Europe and North America. This was to secure infusions of convertible currency to repay debts, which became impossible to repay after 1973 (Berend 1996; Melegh 2006). In other words, as Böröcz (1992) has argued, the Hungarian state turned into a comprador state for two major powers after 1956. Politically and militarily, it was dependent on the USSR, and economically it was dependent on the US and allied countries, especially the then European Community.

What enabled the resource mobilisation to foster economic productivity (especially manufacturing) and contribute to military competitiveness was an overhaul of rural gender relations and an intensification of soil use. As farming became a main tool for surplus accumulation to be used to support the industrialisation drive, peasants were forced into cooperatives and compelled to deliver farm goods to the state. Meanwhile, factory workers' discontent rose with decreasing remuneration and worsening workplace conditions. These developments were related to the imposition of an import-substitution policy on Hungary and other countries under Soviet hegemony, in an attempt to insulate the Soviet sphere from US and allied economies' competition. This policy failed by the mid-1950s, a failure that was both a cause and consequence of recurring rebellions that were militarily suppressed. One such mass insurrection, also brutally suppressed, occurred in Hungary in 1956. It eventually directed the Hungarian state into a campaign of pacification. Compulsory farm goods delivery targets were terminated in 1957 and in the following six years, a combination of economic incentives (especially for middle peasants) and some violence eventually convinced the majority of peasants to join cooperatives. In 1968, a major economic policy was introduced, called the New Economic Mechanism (NEM), involving the privatisation of small household plots (1–5 ha) for labour-intensive crops with farming cooperative and state infrastructure support. Managerial bonuses were also increasingly used as incentives to increase production. The NEM succeeded in greatly expanding farm exports (Benet 1988; Swain 1985). This also meant the intensification of production with ever higher agrochemical inputs into soils and greater mechanisation of farming.

However, all this internal pacification and higher export-oriented productivity came with a progressively intractable price. The US and subordinate Western European and Japanese economies began faltering in the late 1960s (with their share of internal social turmoil), leading to a fiscal crisis due both to US corporate capital migration and military spending (Arrighi 1994). The devaluation of the US dollar prompted US deflationary policies (e.g. higher interest rates) that raised loan repayment and fossil fuel prices (since the 1940s, half if not most international transactions in loans and fossil fuels are conducted in US dollars), while strengthening the US economy through currency stabilisation and large corporate financial investments (e.g. attracted by higher returns). Such policies contributed to two oil and several debt crises, which shrunk Hungary's export revenues, leading to import reductions, austerity measures and a spiral of debt. Hungarian farming began to be re-oriented even more towards exports and commercial profitability generally, both for a rising internal consumer market and for imports from and debt repayment to Western European and US financial outfits. In contrast, agricultural exports intensified partly to increase investments in the manufacturing sector and the NEM came to function as a set of economic incentives to increase profitability. By the mid-1970s, despite much diffuse resistance to 'collectivisation', most peasants had been transmogrified into agricultural workers and managers, producing commercially, rather than for subsistence or barter (Berend 1996; Melegh 2009; Swain 1985).

All this also meant an increasing exclusion of women from conventional farming. Cooperative management, agronomists and other decision-makers were more than 90% men. Basically, men largely retained privileged positions as manufacturing workers, but many men also increasingly got jobs in mechanised farming operations, at the expense of mostly women manual workers. Men from both rural and urban backgrounds took advantage of government concessions for private small-scale farming (household plot production), from which they increased their incomes. Women farm workers were displaced by a decreasing number of male workers in increasingly mechanised farms. Women, especially younger women, as a sort of diffuse resistance, began seeking employment in textile and food processing factories (many run by cooperatives), closer to home, but many were also able to find jobs in the services sector (secretaries, bank and postal clerks, etc.). The now more lucrative household plot was increasingly managed by men, often obtaining access to such plots through women's membership to cooperatives. The segmentation of farm management between mainly male-controlled cash-cropping and mainly women-controlled subsistence-cropping was extended to household plots, that is, to even the smallest farming units (Engel-Di Mauro 2006; Fodor 2003; Répássy 1991).

To summarise the answer to the initial question, conflicts between the US and USSR affected Hungary by mobilising vast amounts of raw material production, including food production, which was accomplished through technological changes and the gendered remaking of social relations. This process was punctuated by diffuse, unorganised resistance and a national revolt that led to major policy changes, including the eventual industrialisation of farming. This enabled higher productivity, but displaced many workers, especially women, and caused, among other things, the intensification and spread of soil acidification.

Conclusion

In both The Gambia and Hungary, soils have been turned into crop failure and water pollution hazards through both internal contradictions and external pressures from world powers and general global processes. In other words, to explain local soil acidification, one cannot be satisfied with knowing about the presence of sulphate-rich materials within coastal wetland soils or the different types of soils that are more or less prone to declining ANC. These hazards are also due to what people do in such environments. So, the social context matters a great deal to address why soils otherwise used for centuries to grow rice or other cereal crops have become sometimes unsuitable and even dangerous to those people's livelihoods and potentially their health. However, to explain how such situations come about, the understanding of the social context must be widened geographically. The set of social relations that have led to the gendered displacement of indigenous farming and making alluvial soils into crop-failure hazards stem from a push for higher yield linked to worldwide processes of capital accumulation that are hardly limited to The Gambia, but involve a global network of highly unequal national states and associated large firms. This is the same sort of interconnection that historically pushed Hungarian agriculture towards mechanisation and gendered exclusions at about the same time as The Gambia, even if for different reasons and involving very different social processes. Farming became more export-oriented, increasingly privatised and much soil has succumbed to acidification.

The making of hazardous soils is therefore not just a function of what local inhabitants do in conjunction with pre-existing environmental processes. It is also driven by wider social processes, often on global scales (this holds even for phenomena that have occurred centuries ago). This is not at all to discount local social processes and histories. Farming households' reticence towards adopting rice varieties from extension agents (see Agyen-Sampong 1994, but especially van der Klei 1988) and workers' revolts in Hungary are examples of how local actions shape and even constrain institutional processes on wider scales (see on this score Engel-Di Mauro 2009). However, such considerations still necessitate an understanding of historical processes and power relations on multiple scales to achieve a fuller evaluation of the sources of hazards and a more encompassing formulation of recommendations for hazards mitigation or removal.

The implications of recognising these linkages are manifold, but one is that policies or struggles must also be aimed at institutions that have worldwide reach. Another implication is that actions that are limited to confronting problems only in specific localities will either fail on their own terms or see the turning of solutions into possibly another set of hazards. Positive outcomes can be had, of course, but it is more likely when there is a favourable conjuncture of events at multiple scales. This means that solutions found for one locality are probably inapplicable to another facing similar hazards. The reason is not confined to the irreproducibility of locality-specific environmental and social contexts. It is also due to how a place is affected by what goes on in other places, the type of linkage a place has with other places (e.g. colonial, economic dependence, etc.) and to how such interconnections vary over time, to cite a few variables that are beyond what is often deemed the uniqueness of the local.

The complexity of the issue, however, can make it difficult to see through the details. World-scale processes behind localised hazards are not always as readily traceable as in the case studies discussed above. For instance, the recent activation of acid sulphate soils in Perth, Australia, is mainly due to a coincidence of prolonged drought with residential area expansion (Appleyard et al. 2004). This is at first sight hardly connected in any direct way with global social dynamics. However, one might want to ask why residential expansion has occurred when it did. Then, with a bit more investigation, one could begin to see the connection between developer-led urban expansion in wealthier countries with neoliberal policies generally. This is a worldwide phenomenon enabling, through such means as the freeing up of overseas investment capital and cheaper credit (e.g. monetary policies), the sort of housing speculation witnessed in Perth, among other Australian cities (Gleeson and Low 2000). In this manner, the increasing heavy metal groundwater pollution hazard presented by acid sulphate soil activation cannot possibly be treated as a simple outcome of local urban planners' and developers' misguided actions. By implication, this means that policies aiming at preventing such creation of hazards must also address the wealth inequalities on multiple scales that encourage reckless urban schemes which put people and ecosystems in harm's way. This could involve placing limits on capital flow intended for land speculation, the delineation and enforcement of stricter urban planning standards sensitised to local social and environmental conditions, and ultimately the decommodification of land and housing, so that people's needs are prioritised.

Studying human-induced soil acidification can shed light on hazards otherwise often overlooked in the copious hazards literature. There is ironically plenty of scientific knowledge on this issue and certainly many communities are aware of such a problem. However, perhaps because such indirect or more subtle impacts are usually excluded from discussions on hazards, there has been little work linking these forms of human impact with contamination hazards and certainly not much social mobilisation directed to such issues. Similarly, as discussed above, there is too little work relating historical and wider social processes to current, locality-specific occurrences of hazards. Some of this multiple-scaled linkage, as I have attempted to illustrate, does not necessarily involve deep investigations using multiple methodologies from disparate scientific fields. Much readily comprehensible work has already been done by many researchers and is available for tracing connections between hazards and social processes on multiple scales. The matter is therefore one of becoming aware that such connections are important and formulating questions that bring out such linkages.

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Notes

1. pH is a logarithmic scale from 0 to 14 that refers to the molar amount of H+ (technically, H_3O^+) in a solution. It is measured as $-\log [H_3O^+]$, where brackets denote moles. Each unit difference represents a ten-fold increase or decrease in moles of H^+. A pH of 7 is neutral. Above that value, a solution is said to be alkaline. Below pH 7, a solution is regarded as acid. In other words, the greater the amount of H^+, the lower the pH will be.
2. For example, military assistance and training, especially from the US and the UK (marginally from China), helped prop up the Jawara regime until the 1994 coup. Senegal (and thereby France, indirectly) has also played an important role in sending troops to crush the 1981 attempted coup by part of the political opposition. At the same time, The Gambia has been helpful logistically to Casamance (southern Senegal) secessionists and has been affected by the 1990s war in that region through refugee influx and increasing contraband, among other things (the current president of The Gambia, Jammeh, is actually a Jola from Casamance).

References

Adeola, F.O. 2000. Cross-national environmental justice and human rights issues. A review of evidence in the developing world. *American Behavioral Scientist* 43, no. 4: 686–70.

Agyen-Sampong, M. 1994. Mangrove swamp rice production in West Africa. In *Dynamique et Usage de la Mangrove dans les Pays des Rivières du Sud*, ed. Marie-Christine Cormier-Salem, 185–8. Paris: ORSTOM Éditions.

Appleyard, S., S. Wong, B. Willis-Jones, J. Angeloni, and R. Watkins. 2004. Groundwater acidification caused by urban development in Perth, Western Australia: Source, distribution, and implications for management. *Australian Journal of Soil Research* 42, no. 5–6: 579–85.

Arrighi, G. 1994. *The long twentieth-century: Money, power, and the origins of our times*. New York: Verso.

Bakács, T. 1992. *Magyar környezetjog* [Hungarian environmental law]. Budapest: Springer.

Barak, P., B.O. Jobe, A.R. Krueger, L.A. Peterson, and D.A. Laird. 1997. Effects of long-term soil acidification due to nitrogen fertilizer inputs in Wisconsin. *Plant and Soil* 197: 61–9.

Baranyai, F., A. Fekete, and I. Kovács. 1987. *A magyarországi talajtápanyag-vizsgálatok eredményei* [The results of soil-nutrient analysis in Hungary]. Budapest: Mezögazdasági Kiadó.

Benet, I. 1988. Hungarian agriculture in the 1970s and 1980s. In *Socialist agriculture in transition. Organizational response to failing performance*, ed. J.C. Brada and K.-E. Wädekin, 183–98. Boulder, CO: Westview Press.

Berend, I.T. 1996. *Central and Eastern Europe, 1944–1993, detour from the periphery to the periphery.* Cambridge: Cambridge University Press.

Böröcz, J. 1992. Dual dependency and property vacuum: Social change on the state socialist semiperiphery. *Theory and Society* 21: 77–104.

Bot, A.J., F.O. Nachtergaele, and A. Young. 2000. *Land resource potential and constraints at regional and country levels. World Soil Resources Report 90*. Rome: Food and Agriculture Organization of the United Nations.

Burton, I., R.W. Kates, and G.F. White. 1993. *The environment as hazard*. New York: Guilford.

Cannon, T. 1994. Vulnerability analysis and the explanation of 'natural' disasters. In *Disasters, development and environment*, ed. A. Varley, 13–30. Chichester: Wiley.

Carney, J. 1991. Indigenous soil and water management in Senegambian rice farming systems. *Agriculture and Human Values* 8: 37–58.

Cook, F.J., W. Hicks, E.A. Gardner, G.D. Carlin, and D.W. Froggatt. 2000. Export of acidity in drainage water from acid sulphate soils. *Marine Pollution Bulletin* 41: 319–26.

Demas, S.Y., A.M. Hall, D.S. Fanning, M.C. Rabenhorst, and E.K. Dzantor. 2004. Acid sulfate soils in dredged materials from tidal Comoke Sound in Somerset County, MD, US. *Australian Journal of Soil Research* 42: 537–45.

Dent, D.L., and L.J. Pons. 1995. A world perspective on acid sulphate soils. *Geoderma* 67: 263–76.

Dent, D.L., and R.W. Raiswell. 1982. Quantitative models to predict the rate and severity of acid sulphate development: A case study in the Gambia. In *Proceedings of the Bangkok symposium on acid sulphate soils,* ed. H. Dost and N. van Breemen, 73–96. Wageningen: ILRI publications 31.

Diack, M., F. Diom, and K. Sow. 2010. Managing soil fertility to sustain crop production in the watersheds in Senegal. Paper presented at the 19th World Congress of Soil Science, 1–6 August, in Brisbane, Australia.

Engel-Di Mauro, S. 2006. From organism to commodity: gender, class, and the development of soil science in Hungary, 1900–1989. *Environment and Planning D: Society and Space* 24: 215–29.

Engel-Di Mauro, S. 2009. Seeing the local in the global: Political ecologies, world-systems, and the question of scale. *Geoforum* 40: 116–25.

Enyedi, G., and V. Zentai. 1986. *Environmental policy in hungary.* Pécs: Centre for Regional Studies of the Hungarian Academy of Sciences.

Fanning, D.S., Z.W. Cary Coppock, W.L. Orndorff Daniels, and M.C. Rabenhorst. 2004. Upland active acid sulfate soils from construction of new Stafford County, Virginia, USA, airport. *Australian Journal of Soil Research* 42: 527–36.

FAO. 2010. FAOSTAT. http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor.

Fodor, É. 2003. *Working difference. Women's working lives in Hungary and Austria, 1945–1995*. Durham, NC: Duke University Press.

Gaillard, J.-C., C.C. Liamzon, and J.D. Villanueva. 2007. 'Natural' disaster? A retrospect into the causes of the late-2004 typhoon disaster in Eastern Luzon, Philippines. *Environmental Hazards* 7: 257–70.

Galle, C., and J.P. Montoroi. 1993. Ecological consequence of high aluminum content in acidified estuarian waters: The case of tilapia fishes in lower Casamance (Senegal). *Acta OEcologica* 14, no. l: 87–100.

Gardner, J.S., and J. Dekens. 2007. Mountain hazards and the resilience of social-ecological systems: Lessons learned in India and Canada. *Natural Hazards* 41: 317–36.

Gleeson, B., and N. Low. 2000. Revaluing planning: Rolling back neoliberalism in Australia. *Progress in Planning* 53, no. 2: 83–164.

Gonda, B. 1983. A kemizálás a magyar mezőgazdaság fejlesztésében [Chemicals and the development of Hugarian agriculture]. *Agrár Történeti Szemle* 27, no. 1–2: 255–338.

Green, C., and L. McFadden. 2007. Coastal vulnerability as discourse about meanings and values. *Journal of Risk Research* 10, no. 8: 1027–45.

Guei, R.G., C.A. Dixon, and M.A. Sampong. 1997. Strategies and approaches to mangrove swamp rice varietal improvement in West Africa. *African Crop Science Journal. African Crop Science Society* 5, no. 2: 209–17.

Haque, E.C., and D. Etkin. 2007. People and community as constituent parts of hazards: The significance of societal dimensions in hazards analysis. *Natural Hazards* 41: 271–82.

Hewitt, K. 1983. The idea of calamity in a technocratic age. In *Interpretations of calamity from the viewpoint of human ecology*, ed. K. Hewitt, 3–2. Boston: Allen & Unwin.

Hill, P.A. 2003. Using geographic information systems (GISs) in soil acidification risk assessments. In *Handbook of soil acidity*, ed. Z. Rengel, 189–207. New York: Marcel Dekker.

Lewis, J. 1984. A multi-hazard history of Antigua. *Disasters* 8: 190–7.

Lewis, J., and I. Kelman. 2010. Places, people and perpetuity: Community capacities in ecologies of catastrophe. *ACME: An International E-journal for Critical Geographies* 9, no. 2: 191–220.

Ljung, K., F. Maley, A. Cook, and P. Weinstein. 2009. Acid sulfate soils and human health—A millennium ecosystem assessment. *Environment International* 35: 1234–42.

Marius, C. 1982. Acid sulphate soils of the mangrove area of Senegal and Gambia. In *Proceedings of the Bangkok symposium on acid sulphate soils*, ed. H. Dost and N. van Breemen, 103–36. Wageningen: ILRI Publications 31.

Marius, C., and G. Lucas. 1991. Holocene mangrove swamps of West Africa. Sedimentology and soils. *Journal of African Earth Sciences* 12: 41–54.

Melegh, A. 2006. On the east/west slope. Globalization, nationalism, racism and discourses on central and Eastern Europe. New York-Budapest: Central European University Press.

Melegh, A. 2009. Globalizáció és Magyarország [Hungary and globalisation]. In *A világ az iskolában. Tanulmányok a globalizációról tanároknak* [The world in school. Globalisation studies for teachers], ed. J. Koppány and É.T. Udvarhelyi, 16–24. Budapest: Artemisszió Foundation.

Moseley, W.G., J. Carney, and L. Becker. 2010. Neoliberal policy, rural livelihoods, and urban food security in West Africa: A comparative study of The Gambia, Côte d'lvoire, and Mali. *Proceedings of the National Academy of Sciences of the United States of America* 107, no. 13: 5774–9.

Murányi, A. 1997. Quality and contamination of agricultural soils in Hungary as indicated by environmental monitoring and risk assessment. In *Soil quality, sustainable agriculture and environmental security in Central and Eastern Europe*, ed. M.J. Wilson and B. Maliszewska-Kordybach, 61–77. Dordrecht: Kluwer Academic Publishers.

Nash, J. 2007. Consuming interests: Water, rum, and Coca-Cola from ritual propitiation to corporate expropriation in Highland Chiapas. *Current Anthropology* 22, no. 4: 621–39.

Nugent, P. 2010. States and social contracts in Africa. *New Left Review* 63: 35–68.

Pálmai, O. 1995. Soil conservation information and monitoring system (TIM) in Hungary. In *Conservation tillage for sustaining soil and water quality*, ed. T. Bartalos, R. Lal, and T. Németh. Budapest: Ministry for Environmental and Regional Policy.

Peet, R. 2007. *Unholy trinity: The IMF, World Bank and WTO*. London: Zed Books.

Raman, K.R. 2007. Community–Coca-Cola interface: Political-anthropological concerns on corporate social responsibility. *Social Analysis* 51, no. 3: 103–20.

Répássy, H. 1991. Changing gender roles in Hungarian agriculture. *Journal of Rural Studies* 7: 23–9.

Roos, M., and M. Åström. 2006. Gulf of Bothnia receives high concentrations of potentially toxic metals from acid sulphate soils. *Boreal Environment Research* 11: 383–8.

Saine, A.S.M. 1997. 'Vision 2020' The Gambia's neoliberal strategy for social and economic development: A critique. *Western Journal of Black Studies* 21, no. 2: 92–8.

Saine, A.S.M. 2008. The Gambia's 2006 presidential election: Change or continuity? *African Studies Review* 51, no. 1: 59–83.

Schroeder, R.A. 1993. Shady practice: Gender and the political ecology of resource stabilization in Gambian garden/orchards. *Economic Geography* 69, no. 4: 349–65.

Singh, B.R. 1998. Soil pollution and contamination. In *Methods for assessment of soil degradation*, ed. R. Lal, W.H. Blum, C. Valentine, and B.A. Stewart, 279–9. Boca Raton, FL: CRC Press.

Stefanovits, P. 1982. *Talajtan* [Soil science]. Budapest: Mezőgazdasági Kiadó.

Sumner, M.E. 1998. Acidification. In *Methods for assessment of soil degradation*, ed. R. Lal, W.H. Blum, C. Valentine, and B.A. Stewart, 213–27. Boca Raton, FL: CRC Press.

Sumner, M.E., and A.D. Noble. 2003. Soil acidification: the world story. In *Handbook of soil acidity*, ed. Zdenko Rengel, 1–28. New York: Marcel Dekker.

Swain, N. 1985. *Collective farms which work?* Cambridge: Cambridge University Press.

Ulrich, B., and M.E. Sumner, eds. 1991. *Soil acidity*. Berlin: Springer-Verlag.

van Breemen, N. 1973. Dissolve aluminum in acid sulfate soils and acid mine waters. *Soil Science Society of America Journal* 37: 694–7.

van der Klei, J. 1988. Soil reclamation: A technical or a social-economic problem? Reclaiming the acid sulphate soils in the tidal swamps of Basse Casamance, Senegal. In *Selected papers of the Dakar symposium on acid sulphate soils. Senegal, January 1986*, ed. H. Dost, 229–37. ILRI publications 44. Wageningen: ILRI.

Van Lynden, G.W.J. 2000. *Soil degradation in central and Eastern Europe: The assessment of the status of human-induced soil degradation. Report No. 05*. Wageningen: ISRIC.

Webb, J.L.A. 1992. Ecological and economic change along the middle reaches of the Gambia River, 1945–1985. *African Affairs* 91: 545–65.

White, G.F., ed. 1974. *Natural hazards: Local, national, global*. New York: Oxford University Press.

Wisner, B., P. Blaikie, T. Cannon, and I. Davis. 2004. *At risk. Natural hazards, people's vulnerability and disasters*. 2nd ed. New York: Routledge.