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Sink or swim: exploring sustainable water management policies in delta regions in the context of climate change

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Given their often highly productive soils and strategic locations, delta regions are often characterized by relatively high levels of economic activity. This is so in spite of the challenges they often bring, like flood risk, salt intrusion etc. These challenges are expected to be compounded by climate change and its effects on, for instance, sea water levels, air temperatures and precipitation patterns. Indeed, when combined with continuing socio-economic growth, the cost of adaptation may sooner or later start to outweigh the benefits these regions bring.

The Dutch peaty meadow areas are no exception. Their peat soils, now mainly used for dairy farming, once provided a valuable source of energy. The peat extraction required created some unique landscapes, some of which are now UNESCO heritage. These 'polders' however, are also costly to maintain. Dairy farming, for instance, requires ground water levels to be kept at least 30-40 cm below surface, which means the low-lying polders need to be drained. Not only is this costly in itself, it also causes soil subsidence, which in turn produces CO2 emission. It also drains ground water from higher areas surrounding these polders, to the detriment of, among others, wet nature and housing.

The question is what exactly the costs and benefits are, and how they may change in the future. This is highly uncertain. High CO2 prices, on the one hand, may warrant drainage to be put to a halt. This would render dairy farming impossible, but would also create opportunities for wet nature and/or reed production, the latter of which may be used to generate 2nd generation biomass. Low CO2 prices, especially when combined with high milk prices and low energy prices, would perhaps favor the continuation of large scale drainage.

This paper introduces a model framework capable of simulating both hydro-physical and land use dynamics. It does so on the local scale of 100 x 100 meter grid cells, allowing the model to take into account the complex interactions of the highly local particularities of soil, hydrology and land use that characterizes the areas at hand. Its potential as a decision support tool is demonstrated by applying it to simulate soil subsidence and land use change under different scenarios. It shows that, if large scale drainage would be stopped, CO2 emission would drop as well. However, its effect would be limited. As expected, much seems to depend on the scenarios, especially regarding technology and the price of milk vs. that of CO2 and energy.