

In general, it can be said that the institutional framework (legislation and regulations, planning procedures and administrative bodies) must be designed in such a way that the options, as formulated above, can easily be applied and encouraged in practice. This contribution can form a first step to this greater goal.

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6. Is saline farming a shape shifter? Review of the debate on and policies for climate adaptation at the Flemish coast (2005-2017) - Jeroen De Waegemaeker

Is saline farming a shape shifter? A review of reports on and plans for climate adaptation at the Flemish coast (2005-2017)

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1. Introduction

1.1 Climate adaptation through saline farming

As we have entered the age of global warming, coastal regions need to adapt to multiple climate challenges, including the salinization of low-lying areas. Both natural drivers, such as droughts and sea-level rise, and human drivers, for example an unsustainable management of surface water and groundwater, exacerbate the saline conditions at the coast (Oude Essink, 2001; Daliakopoulos et al., 2016; De Waegemaeker, 2019). Hence, the question rises how agricultural activities can be adapted to this saline future.

One pathway, amongst many others, is the cultivation of salt-tolerant crops in farmland that is subjected to salinization, a strategy known as saline farming. The international presence at this conference illustrates how saline farming is researched and debate throughout the world.

1.2 The study of climate adaptation policies, a growing field of research

The development and implementation of policies on climate adaptation are challenged by a wide array of constraints. At the start, research on climate adaptation focused primarily on biophysical and technical constraints. Today, there is a growing call for research on the societal and governmental constraints (Wolf 2011). This requires practice-oriented research that comprises an interactive engagement of policy makers in order to fully understand the complexity of policy work on climate adaptation (Moser 2010, O'Brien 2012).

2. A review of the debate on climate adaptation at the Flemish coast

As a first exploration of the complexity of policy work on saline farming, this paper studies the public debate on and the policy work for climate adaptation in the coastal area of Flanders, the northern region of Belgium. Since 2005 reports on climate challenges have questioned the coastal region's future development, including the local agricultural sector. Within the policy domain of spatial planning, more than twenty unique proposals for a 'climate-proof' coast have been developed by various design offices, policy departments and civil society organizations. Likewise, the agricultural community has drafted several reports on strategies for climate adaptation at the Flemish coast. This research lists and summarizes all proposals and analyzes their vision on climate adaptation in the agricultural sector at the Flemish coast.

3. Results

3.1 Growing policy attention for salinization and saline farming in Flanders

In the coastal region of Flanders the salinization challenge is often forgotten, at least until recently. The aggravating storm surges and the resulting need to revise the coastal defense infrastructure dominated the local debate on climate adaptation. In contrast, the future freshwater floods, droughts and salinization were frequently overlooked. Recent shortages of freshwater resources, however, are gradually creating awareness about the need to revise water management in the low-lying coastal region. The case study showcases an alarm reflex (see Moser, 2010) at the Flemish coast: the attention of policy makers is drawn to the most recent extreme weather event, and subsequently, they concentrate on a single climate challenge.

Whenever salinization is part of the equation, saline farming is often acknowledged as a possible climate-proof strategy for agricultural activities at the coast. The research found that a high number of reports on and plans for climate adaptation at the Flemish coast include sections on saline farming. There are, however, remarkable differences in the potential that is attributed to saline farming. In general those reports and plans that concentrate on climate adaptation at the long term, e.g. time horizons up to 2050 or 2100, accord greater importance to the strategy of saline farming than the policy work that focusses on the short or mid-term. Moreover, this case study research indicates that the agricultural community is less eager to develop saline farming than the policy workers in the domain of regional development and spatial planning. Reports and plans on climate adaptation drafted from an agriculture perspective are hesitant about the potential of saline farming.

To clarify, there are up-to-date no saline farming activities nor experiments with saline farming in the Flemish coastal region. In other words, the attention for saline farming in policy documents still needs to be transposed into actions on the ground.

3.2 Saline farming as a 'shape shifter'

The review highlights that saline farming is a 'shape shifter': a concept that repeatedly emerges in policy work for climate adaptation, yet every time in a modified form. The research uncovers three types of differences.

Firstly, the acknowledgements of saline farming vary greatly with respect to the **agricultural crops**. Some reports and plans interpret saline farming rather narrowly: the cultivation of halophytes such as Sea Aster, Salicornia and Sea Lavender. Hence, saline farming is conceptualized as a radical alternative to conventional agriculture that produces a completely new type of food. On the other hand, this particular conceptualization -*inevitably*- classifies saline farming as a niche within the

agricultural sector since there is only limited demand for these halophytes. According to other reports and plans, however, saline farming entails the cultivation of salt-tolerant cultivars of conventional agricultural crops such as cabbages, tomatoes, potatoes and oats. Building on this conceptualization, saline farming is within reach and requires only small adjustments of the existing agricultural activities.

Secondly, there is a variation in the **types of agriculture** that are part of saline farming. Most reports and plans limit saline farming to horticulture and arable farming. As such saline farming is restricted to the production of plant-based food, used for direct human consumption. Other reports and plans, however, broaden the scope of saline farming. Here the acknowledgements of saline farming include the cultivation of mussels and oysters, the production of seaweeds for human consumption as well as animal feed, and sheep or cattle grazing on saline environments.

Thirdly, the **rationale for the development of saline farming** at the Flemish coast varies greatly. All reports and plans conceptualize saline farming as a strategy for climate adaptation at the coast, yet the underlying argumentations vary. Sometimes saline farming is seen as a way to reduce freshwater consumption by the farming community.

The development of saline farming allows for the use of brackish water as an alternative source of water for agricultural irrigation. Consequently, saline farming alleviates the pressure on the scarce freshwater resources at the coast. Building on this conception, saline farming competes with other water saving strategies such as drought-resistant farming and precision irrigation. Some reports and plans, on the other hand, underline that saline farming is a pathway to customize agriculture to the coastal hydrology, and the local presence of a saline groundwater layer to be precise. Within this perspective, saline farming opposes strategies that concentrate on the sustainable use of the phreatic freshwater aquifer at the coast. These opposing strategies include a wide range of interventions in the domains of surface water management and groundwater management (Oude Essink, 2001; De Louw et al., 2015). Finally, sometimes saline farming is seen as a way to use land where conventional farming is unviable due to flood risks. Building on the IPCC framework on adaptation responses at the coast (Dronkers et al. 1990, Nicholls et al. 2007), saline farming can be conceptualized as an accommodate strategy: rather than fighting against aggravating flood risks, local land uses are prepared for an occasional or even frequent flooding. Such embracement of the possible calamity sharply contrasts with protect strategies such as dyke reinforcement and dune nourishment.

4. Discussion and conclusion

As highlighted in section 3.1, saline farming in Flanders is currently limited to theoretical discussions about climate adaptation. With regards to the necessary transposition from theory into practice, we argue that the capacity of saline farming to shift its' shape is a barrier rather than an opportunity. As saline farming can take many shapes, there is a great risk for confusion about saline farming. Today there is no unequivocal answer to the questions 'What types of saline farming must be tested? And why?'. Consequently, there is no clear ownership of saline farming. Therefore we argue that in Flanders, and probably everywhere else, the strategy of saline farming needs to be specified. The agricultural activities need to be pinned down, and the area for saline farming needs to be pinpointed. We advocate that this process of specification involves all stakeholders, e.g. the agricultural community, the managers of surface and groundwater and the coastal safety engineers. Each of these stakeholders bring different sets of knowledge to the table. What is more, their engagement in the process of specification is important to spark the idea of ownership about the strategy of saline farming.

5. References

Daliakopoulos, I.N., Tsanis, I.K., Koutroulis, A., Kourgialas, N.N., Varouchakis, A.E., Karatzas, G.P., Ritsema, C.J. (2016) The threat of soil salinity: A European scale review, in: *Science of the Total Environment*, 573, pp.727-739

De Louw, P., Oude Essink, G.H.P., Eeman, S., Van Baaren, E., Vermue, E., Delsman, J., Pauw, P., Siemon, B., Gunnink, J., Post, V. (2015) Dunne regenwaterlenzen in zoute Geografie, Fysische Bodemfysica, in: *Landschap*, (32), pp. 5–15

De Waegemaeker, Jeroen (2019) SalFar framework on salinization processes. A comparison of salinization processes across the North Sea Region, a report by ILVO for the Interreg III North Sea Region project Saline Farming (SalFar)

Dronkers, J., Gilbert, J.T.E., Butler, L.W., Carey, J.J., Campbell, J., James, E., McKenzie, C., Misdorp, R., Quin, N., Ries, K.L., Schroder, P.C., Spradley, J.R., Titus, J.G., Vallianos, L., von Dadelzen, J. (1990) *Strategies for Adaptation to Sea Level Rise*, report of the IPCC Coastal Zone Management Subgroup, Geneva

Moser, S.C. (2010) Communicating climate change: history, challenges, process and future directions, in: *Wiley interdisciplinary reviews. Climate change*, 1, pp. 31–53

Nicholls, R.J., Wong, P.P., Burkett, V.R., Codignotto, J.O., Hay, J.E., McLean, R.F., Ragoonaden, S., Woodroffe, C.D. (2007) Coastal systems and low-lying areas, in: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Workinggroup II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, pp. 315-356, Cambridge University Press, Cambridge

O'Brien, K. (2012) Global environmental change II: From adaptation to deliberate transformation, in: *Progress in Human Geography*, 36(5), pp. 667–676

Oude Essink, G. H. P. (2001) Improving fresh groundwater supply - problems and solutions, in: *Ocean and Coastal Management*, 44, pp. 429–449

Wolf, J. (2011) Climate Change Adaptation as a Social Process, in: Ford, J.D., Berrang-Ford, L. (eds) *Climate Change Adaptation in Developed Nations: From Theory to Practice*, pp. 21–32, Springer, Dordrecht

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7. A vision and a strategy for mitigating and adapting to salinization of highly productive clay soils in the Netherlands - Mindert de Vries

A well-structured multi partner program for mitigating and adapting agriculture of low-lying coastal areas to increasing salinization