"It's very difficult to go back to a natural state after land has been used for farming,' says Professor Alastair Grant of UEA, co-author of the study, which appears in the Journal of Applied Ecology. 'Flooding an agricultural soil doesn't produce a salt marsh soil, even if the land used to be salt marsh. This isn't esoteric stuff that's of interest only to naturalists; many of the species the public values most in salt marshes are almost completely absent in artificial ones. Existing approaches haven't succeeded in creating habitats that are biologically equivalent to natural salt marsh."

Professor Grant argues that farmland reclaimed from the sea is low lying and becomes waterlogged thus making it difficult for new salt marsh plants to flourish:

"Wetlands created through MCR have several problems compared to natural salt marsh, Grant explains. Often the land is too flat and low-lying, because long-term farming of land reclaimed from the sea has caused soil levels to fall steadily over the decades. This means the soil becomes waterlogged, preventing many saltmarsh species from establishing themselves and favouring just a few plants that quickly dominate the landscape. Even where soil levels are higher, stopping farming can often leave behind a hard, dry crust of soil that isn't suitable for most salt marsh plants but perfect for shrubs like sea purslane to take over and shade out competitors."

Professor Grant maintains that raising natural salt marsh plants in nurseries and then planting them in gullies and narrow channels was being explored, to see if this would be effective. Costs of earthworks movement would need to be included in future projects.

Salt Marsh and Mosquitoes

The creation of new salt marsh habitat in the UK, through coastal realignment, will provide new habitat for mosquitos. One species of mosquito, the Anopheline Mosquito has been linked to local malaria transmission. Two species are associated with nuisance and arboviral vector species with associated Public Health risks which need to be taken account of, when considering the creation of new salt marsh habitat.

The journal articles below outline some of the human risks inherent in the creation of new salt marsh habitation including standing bodies of water.

Colonization of UK coastal realignment sites by mosquitoes: implications for design, management, and public health

Medlock, J.M., Vaux, A.G.C.

Journal of Vector Ecology, Vol 38 (1); 23 May 2013, pages 53 – 62.

Journal of Vector Ecology

Free Access

Colonization of UK coastal realignment sites by mosquitoes: implications for design, management, and public health

J.M. Medlock, A.G.C. Vaux

First published: 23 May 2013 | https://doi.org/10.1111/j.1948-7134.2013.12008.x | Citations: 17

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ABSTRACT:

Coastal realignment is now widely instituted in the UK as part of local flood risk management plans to compensate for the loss of European protected habitat and to mitigate the effects of sea-level rise and coastal squeeze. Coastal aquatic habitats have long been known to provide suitable habitats for brackish-water mosquitoes and historically, coastal marshes were considered to support anopheline mosquito populations that were responsible for local malaria transmission. This study surveyed the eight largest managed realignment (MRA) sites in England (Essex and the Humber) for mosquito habitats. The apparent absence of anopheline mosquitoes exploiting aquatic habitats at all of these sites suggests that the risk of malaria associated with MRA sites is currently negligible. However, three of the eight sites supported populations of two nuisance and potential arboviral vector species, *Aedes detritus* and *Aedes caspius*. The aquatic habitats that supported mosquitoes resulted from a) specific design aspects of the new sea wall (ballast to mitigate wave action and constructed saline borrow ditches) that could be designed out or managed or b) isolated pools created through silt accretion or expansion of flooded zones to neighbouring pasture. The public health risks and recommendations for management are discussed in this report. This report highlights the need for pro-active public health impact assessments prior to MRA development in consultation with the Health Protection Agency, as well as the need for a case-by-case approach to design and management to mitigate mosquito or mosquito-borne disease issues now and in the future.

Volume 38, Issue 1
June 2013
Pages 53-62

Figures References Related Information

Recommended

Seasonal dynamics and habitat specificity of mosquitoes in an English wetland: implications for UK wetland management and restoration
Jolyon M. Medlock, Alexander G.C. Vaux
Journal of Vector Ecology

Laboratory evaluation of lactic acid on attraction of *Culex* spp. (Diptera: Culicidae)
Sandra A. Allan, Ulrich R. Bernier, Daniel L. Kline
Journal of Vector Ecology

Colonization of a newly constructed urban wetland by mosquitoes in England: implications for nuisance and vector species
Jolyon M. Medlock, Alexander G.C. Vaux
Journal of Vector Ecology

Public health significance of invasive mosquitoes in Europe

Coastal aquatic habitats are recognised as providing suitable habitat for brackish-water mosquitoes. Historically, coastal salt marshes provided habitat for anopheline mosquitoes which were linked to local malaria transmission in the UK. The researchers surveyed eight (8) of the largest managed realignment sites in the UK for mosquitoes. **Although anopheline mosquito populations were absent, two species were present in three (3) out of the eight (8) of the sites, namely "*two nuisance and potential arboviral vector species, Aedes detritus* and *Aedes caspius*" *(Abstract)*. Design aspects of the new sea wall ("saline borrow ditches" and "ballast") and isolated stagnant pools from siltation or expansion of water into pasture land, were considered to be the main factors that promoted these mosquito populations in the new habitat. Traditionally, management of this problem has mainly focused on the elimination of the created habitat e.g. draining of pools or treatment with a control agent to kill the mosquito larvae**. Open Marsh Water Management (OMWM) is also used which involves creating runnels or small channels to encourage fish in at high tides to eat the mosquito larvae.

Field visits to eight (8) coastal realignment sites in England were conducted. The occurrence of mosquitos was associated with the presence of a subsidiary bank on the sea wall and with isolated pools at the extremes of the flood zone. "*The occurrence of Ae. detritus was significantly associated with brackish sites*" and the presence of a subsidiary bank. It was found in 25% of the sites and was associated with habitats that had smaller water channels and a vegetated substrate. By contrast, *Aedes caspius* was significantly linked to freshwater sites. "*Significantly more anophelines were found in the constructed permanent freshwater habitats outside the main MRA inundation zones*.". **The reduction in Malaria in the UK has been**

associated with the draining of coastal wetlands for agriculture. Concern has been raised that creating new wetlands through managed realignment, will increase the risk of malaria transmission. The authors suggest that mosquito populations should be managed through hydrology and vegetation management and effective design. Coastal grazing marshes would create the ideal conditions for anopheline mosquitoes unless there is regular tidal flooding and other mitigation measures.

In conclusion, the authors recommend that new MRAs should consider mosquito management plans at the design stage. They warn:

"There is likely to be some nuisance biting associated with sites that support flooded habitats that are not regularly flushed by the tide, and a management plan may be needed to deal with these sites if they continue to promote nuisance biting by Ae. detritus and Ae. caspius. Similar controls would also be needed in the future if these species become implicated in disease transmission cycles, particularly as both Ae. detritus and Ae. caspius are identified as possible arbovirus vectors elsewhere in Europe (Medlock et al. 2005, 2007)."

Salt Marsh and Radiation

Recent research has shown how UK salt marsh and estuaries close to nuclear power plants can receive radioactive substances from liquid effluent discharges, which have significant adverse impacts on human health.

A February 2011 report by the Environment Agency on the Ribble estuary near Preston found that it received radioactive substances from liquid effluent discharged from the nearby Springfields Fuels Ltd site, and from the Sellafield Ltd site by means of the Irish Sea. **Radioactive substances were found in the sediment deposits of the estuary and the nearby salt marsh. Spectrometry analysis found that people in boats received 10% of the total maximum public dose limit while anglers and wildfowlers received 1% of the public dose limit**. Half of the dose received was from the Sellafield Ltd site. Significant amounts of radioactive substances were found in sediment.

Measurement and assessment of external radiation dose rates to people on houseboats and using riverbanks - Ribble Estuary case study Project summary SC060080/S4

Environment Agency

https://assets.publishing.service.gov.uk/media/5a7c323240f0b674ed20f75e/scho0211btkg-e-e.pdf

Research on the Irish Sea saltmarshes, 'Potential health risks from radioactive contamination of saltmarshes in NW England', found that the major source of artificial radionuclides in Irish Sea saltmarshes is '*the British Nuclear Fuel (BNFL) low-level waste-reprocessing plant at Sellafield, which has been discharging authorized low-level radioactive wastes into the Irish Sea since 1952, with highest discharged activities in the early 1970's*'.

The movement of sub-tidal sediments with high radionuclides in the estuary has led to high levels of radioactivity in various sediments of Irish Sea salt marshes. They 'easily accumulate in low-energy intertidal environments i.e. salt marshes'.

For salt marsh users, direct exposure and resuspended dust inhalation of highly active radionuclides pose a significant threat to health. The highest estimated total effective dose was 97% and far in excess of this for people using the Dee estuary and Biggar marshes, constituting a clear public health risk.

Potential health risks from radioactive contamination of saltmarshes in NW England

Rubina Rahman [a], A.J. Plater [a], P.J. Nolan [b], B. Mauz [a], P.G. Appleby [c]

Journal of Environmental Radioactivity, Volume 119, May 2013, Pages 55-62

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Potential health risks from radioactive contamination of saltmarshes in NW England

Rubina Rahman [a], A.J. Plater [a], P.J. Nolan [b], B. Mauz [a], P.G. Appleby [c]

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Abstract

The present study focuses on the detection of Sellafield-derived ^{137}Cs and ^{241}Am in contaminated saltmarshes from North-West England, UK, with a view to assessing the radiological impacts from radioactivity stored within the sediment record. The surface activities from these radionuclides were found in the range between 73 and 851 $Bq\,kg^{-1}$ whereas peak activities ranging from 383 to 12690 $Bq\,kg^{-1}$ were found below the surface of the upper marsh at a depth of approximately 5–20 cm. Potential radioactive exposure to humans from these highly active radionuclides comes mainly from direct exposure and resuspended dust inhalation for different saltmarsh users, which may be exacerbated by the remobilisation of radionuclides resulting from saltmarsh erosion. The total annual minimum, maximum and 'best estimate' doses ranging from 11 to 972 $\mu Sv\,y^{-1}$, fall below the ICRP-recommended annual dose limit, but the highest estimated total effective dose (972 $\mu Sv\,y^{-1}$) for a marsh user falls within 97% of the recommended dose limit and the highest 'best estimate' total annual doses of 110 and 307 $\mu Sv\,y^{-1}$ for Dee estuary and Biggar marshes, respectively, are almost 3 and 4 times higher than the estimated doses that are based on existing surface activities.

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