

**Appendix 3.** Action perspectives for the management of bog-related cultural remains, for different types and levels of ecological bog management and restoration. Increased grey shading represents increasing impact levels of the ecological management measure and of the action perspectives for cultural remains, respectively. The colours of the intersecting cells indicate potential positive (green) or negative (orange) effects of ecological measures on cultural remains. Conversely, bold text indicates direct positive effects of the presence of cultural remains on biodiversity/ecological goals.

Type of ecological bog management or restoration measure <sup>1</sup>	Ecological effects of measure	(Action) perspectives for management of (supra-peat) cultural remains			
		Providing room for cultural practices	Sparing cultural remains	Accentuating cultural remains	Excavating/documenting cultural remains
No direct nature management <sup>2</sup>	-				
Grazing (e.g., using sheep or cattle)	Reducing grass cover -> more light and less nutrient deposition from grass litter to promote peat moss growth	Flock grazing with a shepherd refers back to traditional bog usage as grazed common land	By favouring peat moss growth over (possibly deep-rooting) grasses, grazing might reduce water table fluctuations in upper peat layer, which is beneficial to the conservation of intra-peat remains. However, trampling by grazing animals might damage supra and/or intra-peat remains (Hjelle et al. 2012, 335).	Grazing might make supra-peat remains more visible by reducing the grass cover (Hjelle et al. 2012, 321). However, the opposite may occur where grasses grow on slightly elevated (drier) cultural relic structures and hence highlight these by structural and colour contrasts within the vegetation.	This bog management measure is unlikely to entail the risk that cultural remains will have to be excavated to avoid significant destruction.
Mowing species-rich grasslands <sup>3</sup>	Nutrient removal -> maintaining or promoting floristic diversity		<b>These species-rich grasslands do not occur naturally in raised bogs, and are cultural remains of past agricultural usage.</b> This usage is no longer practiced or economically viable, but is simulated by current mowing management. Mowing promotes the conservation and ecological quality of these grasslands; i.e., it contributes to sparing and accentuating this particular cultural remain.		This bog management measure is unlikely to entail the risk that cultural remains will have to be excavated to avoid significant destruction.
Removing trees or shrubs <sup>4</sup>	More light and less nutrient deposition from leaf materials to promote peat moss growth. Visually more open bog landscape (i.e., more resembling the situation on intact western European raised bogs).		Measure may reduce risk posed by deep-rooting shrubs or trees to preservation status of supra-peat or intra-peat remains. On the other hand, removing tree stumps (if needed) to be carried out carefully to avoid disturbing (intra-peat) cultural remains.	Measure may help to better accentuate/visualise the presence of supra-peat remains by clearing trees or shrubs. However, the opposite may occur where trees or shrubs grow on slightly elevated (drier) cultural relic structures and hence highlight these by structural contrasts within the vegetation.	If trees or shrubs are to be removed, we recommend using light machinery (if any is needed) and not removing the stumps in order to not disturb the soil (including potential supra-peat and intra-peat cultural remains). If heavier machinery and/or stub removal is necessary, we recommend that this work be assisted by an archaeologist, allowing professional excavation, documentation and safeguarding of remains.
Small-scale rewetting (e.g., blocking drainage ditches)	Retaining water within the bog, and reducing water table fluctuations within the top peat layer, thus promoting peat moss growth and local bog vegetation recovery.	The measure may potentially have a negative impact in case of small-scale traditional peat cutting demonstrations (as the preservation of a cultural practice by local people). This can be avoided by not implementing this measure near such showplaces for peat cutting, or by replacing showplaces to areas away from the most promising places for bog restoration.	Opt for blocking drains locally rather than filling them completely and thereby making them invisible; also because <b>blocked drains and other man-made depressions such as former peat pits are often important starting points for recovering bog vegetation.</b> This way, ditch patterns may remain visible for decades through distinct vegetation patterns or colours		This bog management measure is unlikely to entail the risk that cultural remains will have to be excavated to avoid significant destruction.
Large-scale rewetting within or around raised bog reserve <sup>5</sup>		Large-scale rewetting may in some cases hamper possibilities for (traditional) cultural practices to be carried out by e.g. local residents. Also, this may involve a sense-of-loss (of cultural remains) by local residents or the general public. However, this can likely be remediated by offering access to rewetted areas through e.g. dikes or boardwalks.	To be carried out carefully to avoid disturbing (intra-peat) cultural remains. Also, this may involve a sense-of-loss (of cultural remains) by local residents or the general public. Wherever possible when compartmentalising raised bogs, use existing structures such as old dikes for reinforcement with sheet piling or wooden bulkheads so as to optimally conserve their integrity and visibility.	Large scale rewetting may help to accentuate certain cultural remains by highlighting slightly elevated structures or relics if these emerge from inundated areas. On the other hand, inundation may obscure lower-lying relics from view. Also, this may involve a sense-of-loss (of cultural remains) by local residents or the general public.	Large-scale rewetting with the aim of increased carbon sequestration or bog recovery requires good quality peat (i.e., poorly mineralised peat). If such peat is available, rewetting may be beneficial to the conservation of intra-peat remains. However, if mineralised peat is present, it will likely have to be removed first before rewetting can be expected to be successful. In such cases, peat removal works will endanger supra- and intra-peat remains and these should be documented and excavated by archaeologists. Also, this may involve a sense-of-loss (of cultural remains) by local residents or the general public.

<sup>1</sup> Based on Jansen, Grootjans, and Van Tooren (2019)

<sup>2</sup> No direct nature management may apply: (a) to active raised bogs (EU natural habitat type 7110), which are stable, self-regulating ecosystems where active conservation management is not needed or (b) to degraded raised bogs still capable of natural regeneration (habitat type 7120). The latter is more common in many Northwest-European raised bog remnants. Here, the (temporary) lack of active management may be due to prioritisation of scarce resources for nature management or pending a raised bog restoration project on site.

<sup>3</sup> These may be found in the periphery of bog nature reserves, for instance on surrounding mineral soils or in the lagg zone on the transition from peat-bog to mineral soil. A typically Dutch case is the species-rich relic grasslands originating from former *bovenveen* culture as found in the Bargerveen area (Jansen et al. 2019).

<sup>4</sup> This primarily involves the removal of scattered trees and shrubs in the (degraded) raised bog itself rather than the clearing of larger parcels of forest around raised bog areas as part of large-scale rewetting measures.

<sup>5</sup> Notably in cases of large-scale rewetting projects around bog reserves, other goals than ecological restoration may be relevant, such as climate mitigation through carbon sequestration on large areas of rewetted peat soil, or paludiculture (wet agriculture or forestry on peat soil).

Reference not listed in main paper: Hjelle, K.L., T. Solem, L.S. Halvorsen, L.I. Åstveit. 2012. 'Human impact and landscape utilization from the Mesolithic to medieval time traced by high spatial resolution pollen analysis and numerical methods', *Journal of Archaeological Science* 39, 1368-1379.