50 years of research endeavour on the future use of Irish industrial cutaways

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Summary

For decades industrial cutaways have been subjected to intensive intrusive management with the objective of growing agricultural, horticultural and forestry crops and latterly bio-fuel crops, all with minimum success and some unsustainable environmental consequences. After more than 50 years of research on the future use of Irish industrial peatlands, where the emphasis has been on trying to transform the complex medium that is industrial cutaway peatland into a productive growing medium, the author argues that it is time to accept the reality that allowing natural processes to proceed is a much more efficient way to rehabilitate the cutaway. Natural revegetation of industrial cutaways has led to the creation of diverse ecosystems which will be ultimately much more sustainable and be of greater long-term ecological and environmental benefit.

Key index words: after-use, cutaway bog, forestry, grassland, natural colonisation

Introduction

Within a decade of the start of the industrialisation of Irish Raised Bogs in the mid 1940s, for the production of 'turf' and 'turf products' the first experiments on the future use of the cutaways were established. The first was the planting of a range of forestry species on T14 at Clonsast in 1955 (Carey and Barry 1975). In 1958 the then Agricultural Research Body set up a field station on industrial peatlands at Lullymore, to examine the horticultural and agricultural potentials of the emerging cutaways.

Clearly there was a belief at that time that the industrial cutaways offered enormous potential for forestry, agriculture and horticulture. In fact on reading Todd Andrews' (the first Managing Director of Bord na Móna), book '*A Man of No Property*' (Andrews, 1982) it is clear that the real objective of the industrialisation of the peatland was to get rid of the 'waste land' that the peatlands were perceived to be at that time and replace them with productive forestry or agricultural land.

As cutaways became available attempts were made to immediately transform them into agricultural lands suitable to grow a whole series of agricultural crops. It was even argued that the peat should not be used for energy production but rather that it should be used *in situ* as a growing medium for horticultural crops and forestry. The fuel crisis of the early 1970s however ensured that these arguments did not hold sway and rather it was an expansion of the use of peat as a source of energy in Ireland that was required. The slow down on the availability of cutaway allowed the focus to become much more research-orientated, and fostered the development of a far greater understanding of the complexity of the emerging medium that is industrial cutaway peatland derived from the milled peat production process.

The peat extraction process

Industrial cutaway peatlands arise obviously as a consequence of the extraction process. The extraction process deployed is that of milling of the peatland surface and gradually over decades dropping that surface in a horizontal manner.

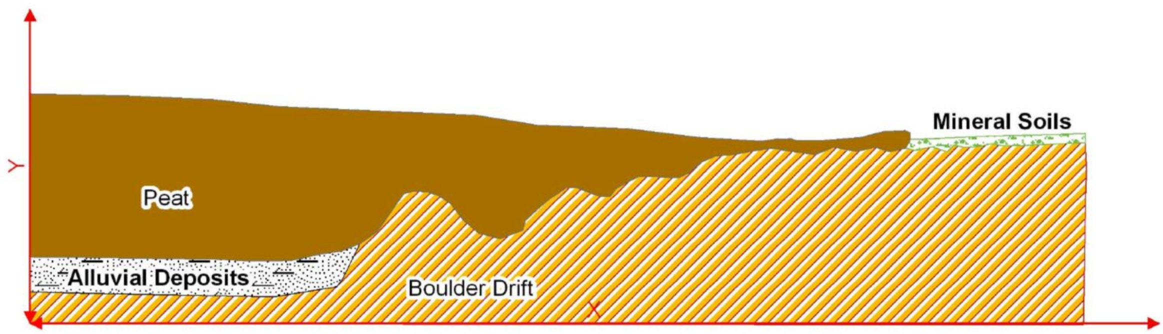

Figure 1. Diagrammatic View of a Raised Bog-Original

This is possibly best understood by looking at a diagrammatic view of a raised bog as illustrated in Fig. 1, which illustrates the typical undulating manner in which the boulder limestone deposits were laid down at the end of the Ice Age. The diagram shows that lacustrine deposits were also laid down subsequently in the lower contours. It is clear from Fig. 1 that there are variable depths of peat within the peatland with the greatest depths being over these lake deposits.

Fig. 2 illustrates the position 25 years into the productive life of the bog. The peat depth close to the periphery of the raised bog has been exhausted as have those areas associated with bog floor uplifts, while significant peat depths remain over the lake deposits, and over the depressions within the boulder drift.

Fig. 3 illustrates the position when peat production has been completed, which is usually 50 years after the initiation of the milling process. An added dimension has however been added to Fig. 3., i.e. the inclusion of the positioning of the gravity drainage line. It is common practice in peat extraction in Ireland to install pumped drainage during the latter decades of peat production. This allows peat production to proceed below the winter flood levels of the arterial drainage channels into which the peatland drainage waters are pumped.

Surveys to date suggest that some 60% of the emerging cutaways (when the peatland is fully exploited) will lie below or at this gravity drainage line. Choices as to how to utilise such areas are severely restricted. For decades now it has been policy to designate such areas as future alkaline wetlands and many good examples have already been created (McNally, 1996).

It is within the cutaway area where gravity drainage has been possible that research effort on transforming the cutaway into productive growing media has concentrated for the past two decades. The lack of uniformity of the residual peat depths within such areas leads to variation in the nature of the planting medium and consequently in the growth of the crop or forest being established (Renou-Wilson *et al.,* 2008).

Fig. 4 illustrates the typical position when peat production ceases. The boulder drift has been deposited in an undulating manner which is totally random. The milled peat process is not capable of following the bog floor contour profile in order to leave a uniform peat depth over the entire area. Consequently, residual peat depths range from practically zero on the uplifts of the bog floor to some 2-3m within the depressions as illustrated.

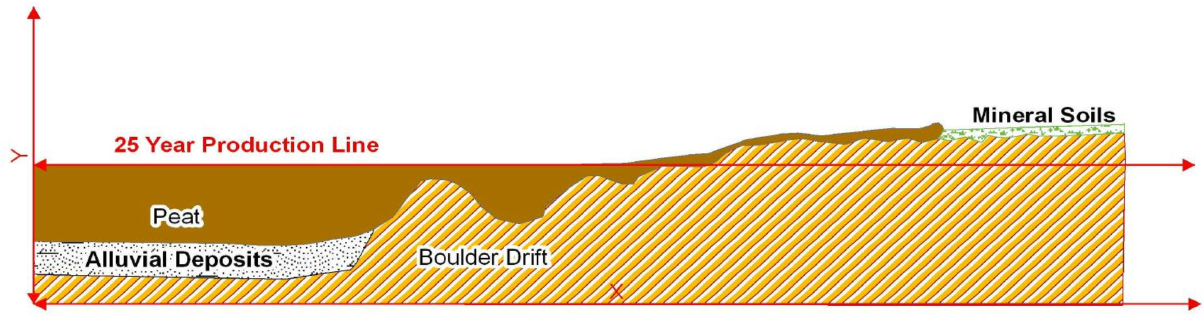

Figure 2. Diagrammatic View of Raised Bog – 25 Years Production

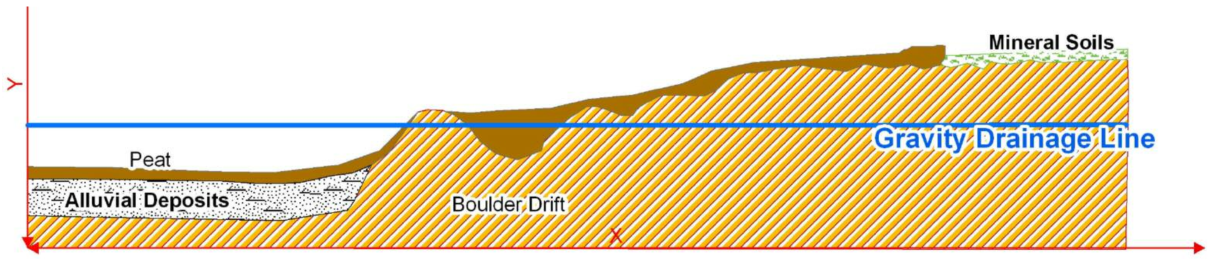

Figure 3. Peat Production Complete (50 Years)

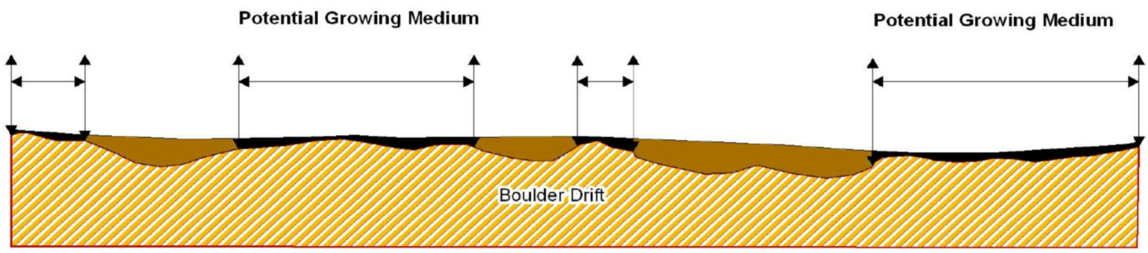

Figure 4. Potential Growing Medium

Explaining the milled peat process and its impact

Peat supplied for power generation must meet strict parameters with regard to ash content (it must not exceed 5%). The ash content will increase if any contamination from the underlying soil is allowed enter the harvested peat. A milled peat bog is laid out in a series of 15m wide production fields, with field length being variable but usually extending to several hundred metres, with many in excess of 1km in length (the average length across all production fields is 1km). The decision as to whether to include or withdraw from peat production is made on an individual field basis. Once a bog floor uplift becomes exposed along a field, either the whole field or the portion from the uplift to the end is withdrawn. As stated earlier, the glacial deposits are laid down in a totally random manner and the extent of the peak of the uplift is also random. It could be only a few metres square or several hectares. The uplift may not even impact on the adjoing field or it could impact over many fields. When cutaway is made available to the after-use planner he or she must deal with this variability.

Impact of residual peat depth variation

Where peat depths do not exceed 1m it is relatively easy to transform the cutaway into a potential growing medium (McNally, 1984) and performance of the subsequent crop can be reasonably predicted. These areas are illustrated in Fig. 4 as those between the arrows on the diagram. However, the deeper peat areas which themselves lie within localised depressions have proven very difficult to transform into growing media.

Firstly, they are generally saturated, with very little downward movement of water. The saturation leads to anoxic conditions and thus poor to zero growth of productive plants. Aerating the residual peat without rectifying the underlying drainage leads very quickly to a reversal to the previous position. It is technically possible obviously to enhance the drainage and thus the aeration of the peat, but is this the right thing to do?

It is only in the last decade that the true complexity of the cutaways has been understood. In hindsight it seems probable there was a presumption that the volume of cutaway with easily manageable peat depths was much greater and that such areas would be in much more sizeable units than is now proving to be the case. While approximately 2,000ha of cutaway have been successfully transformed into productive grassland we now realise that these areas were actually exceptions and only representative of the very best sites.

In the past decade 10 sites were chosen for afforestation trials and demonstrations. Successful establishment and growth has been achieved within a portion of each site but in no site was there 100% success, despite optimum care and maintenance (Renou-Wilson *et al.,* 2008). While some of the sites were greater than 20 hectares in extent there is not a single unit area of 10 hectares growing successfully. This should not have been a surprise as this variability was also reported on in the first plantation in 1975 (Carey and Barry 1975) and has been evident on every plantation since. Obviously, if the productive unit size is less than 10ha then the economic viability is questionable.

Sustainability of transforming anoxic residual peat into a growing medium

The most unsustainable aspect of using a pure *in situ* peat medium to support the growth of a long-term crop is its inability to retain added nutrients, which are essential to support continued growth. As an example, during trials to grow cranberries it was essential to add phosphate fertiliser. Yet, at year end, peat soil samples taken showed deficiencies of phosphate even though the growing crop could not have taken up the volume of phosphate added. Another example is where phosphate and potassium were applied during establishment of forestry demonstration plots. Even though the nutrients were in split applications, at planting and at the two year stage, the tree crops are, within 10 years, exhibiting deficiencies of these nutrients (Renou-Wilson *et al.,* 2008).

The next unsustainable consequence, which has become the focus of ever-increasing attention in recent years, is the release of CO_2. Altering the residual *in situ* peat so that it is transformed into a growing medium leads to oxidation of the peat and thus the release of CO_2 to the atmosphere.

On the other hand, if such areas are left to nature they become colonised, initially with *Juncus effusus*, which is later replaced with typical peatland vegetation that can tolerate saturated growing conditions, such as *Eriophorum angustifolium* with *Molinia caerulea* and *Calluna vulgaris* occupying the drier areas. Initally, as these areas are developing vegetative cover there is release of CH_4. There is an expectation, however, that over time such areas will reach a steady state with regard to carbon fluxes.

Research effort should now concentrate on enhancing the natural rehabilitation processes which will maximise the sustainability of the diverse ecosystem that will evolve.

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