Redesigning afforested western peatlands in Ireland

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Summary

This paper outlines two possible future management scenarios for Coillte-owned forests along the western seaboard of Ireland, on Afforestated Western Peatlands (AWPs). These scenarios represent long-term management strategies, where the redesign potential is either maximised (scenario 1), or minimised (scenario 2) over a rotation of 40 years. Both scenarios represent an ecosystem management approach to forest management, where emphasis on environmental and social enhancement is given priority over commercial management. This approach was developed using a custom built Decision Support System (DSS), and operational redesign plans were provided, detailing the areas for individual redesign management options. The DSS currently estimated the redesign potential of AWPs in the Coillte estate to be between 30,619 ha to 64,548 ha over a 40 year period, or between 712 ha and 1501 ha annually.

Key index words: Afforested Western Peatlands (AWPs), redesign plans, ecosystem management approach, Decision Support System (DSS)

Introduction

Afforested Western Peatlands (AWPs) refers to forests that occur on peat soils along the western seaboard and they correspond to areas identified in the EPA Soil and Subsoil Mapping Project (EPA, 2006) as either blanket, raised, fen or cutaway peat. AWPs are typically found in the western counties from north Donegal to south Kerry, on low-level and high-level blanket bog and contain mainly coniferous lodgepole pine (*Pinus contorta*) forests. The bulk of afforestation of western peatlands in Ireland occurred between the early 1960s to the late 1980s, with a single objective of timber production (Farrell, 1997). Recent national figures for the Republic of Ireland show that the total area of forestry on peatlands is 270,000 ha, with 60% owned publicly and 40% owned privately (Forest Service, 2007). Not all of these forests are economically sustainable. Figures from the Coillte estate suggest that out of their total AWP area of 136,576ha, a total of 34,848 ha (or 25%) are deemed unsuitable for commercial forestry. Today, public support for afforestation on western peats has declined (Renou and Farrell, 2005) and as a result, afforestation on peatlands is no longer grant aided by the Forest Service, effectively curtailing further afforestation. The majority of AWPs are now maturing and concerns about how best to manage them in the future need to be addressed urgently. There is general agreement among the main relevant statutory bodies that an ecosystem management approach be adopted for these areas, where the forests are managed to maximise their social, environmental and economic potential, in the context of a wider shared national sustainable land use for these areas. Research by Coillte into this approach began in 2005, as part of the Western Peatland Project, and the main output from the project was a multiple objective Decision Support System (DSS). This DSS provided decision support to assist in the sustainable future management of all Coillte-owned AWPs. A working prototype of the DSS concluded in 2007. The DSS is a robust tool that can provide both strategic (long-term) and operational (short-term) recommendations, based on best current knowledge, and best available information, to facilitate the move from a commercial approach to an ecosystem management approach.

Project objective

- To develop a nationally acceptable Decision Support System (DSS) for the redesign of Afforestated Western Peatlands (AWPs) in a manner that is economically, environmentally, and socially acceptable with due regard for the unique sensitivity of the surrounding landscape and stakeholder requirements.

Materials and methods

A brief summary of the development of the DSS is presented here. For full details on the DSS development please refer to Tiernan (2007). The DSS was developed using both *Microsoft Access* and *ArcView GIS*. The data used in the model came from a variety of sources, both internally from within Coillte, or externally from the project partners (Fig. 1). The main development in the DSS was the DSS number and the operational decision matrix. The DSS number provided a user-friendly classification scheme to help identify areas with the highest overall sensitivities and redesign potential. The DSS number ranged from 1 to 16, where 1 was the least sensitive, with the poorest redesign potential, and 16 the most sensitive, with the best redesign potential. This number provided the basis for the strategic decisions. The operational decision matrix made individual

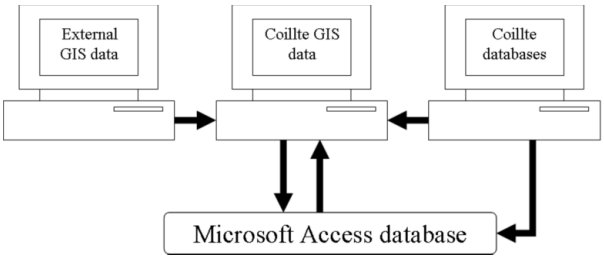

Figure 1. DSS overview

assessments for 10 redesign management options. These evaluations were based on user defined criteria and they determined if the requirements existed for their successful implementation. The 10 redesign management options were: (a) bog restoration i.e. restoration of peatland habitat following felling and/or retention of existing unplanted areas; (b) natural regeneration i.e. renewal by natural seeding; (c) water protection i.e. the creation of planted or unplanted buffer zones along watercourses, which may or not include areas suitable for riparian native woodland; (d) long-term retention i.e. stands retained beyond normal economic felling age (40 - 80 years), which will normally remain unfelled in perpetuity; (e) low impact regeneration (native scrub) i.e. the establishment of a low density scrub native forest using minimal cultivation and fertiliser inputs where feasible; (f) low impact regeneration (lodgepole pine), i.e. the establishment of a low-density lodgepole pine forest using minimal cultivation and fertiliser inputs where feasible; (g) no replanting (visual enhancement) i.e. leaving strategic forest areas unplanted following clearfell, as a means of improving the overall visual aesthetics of the landscape; (h) retain existing unplanted areas i.e. the retention of existing unplanted areas *in situ* (i) fell and no replanting i.e. no replanting following felling; and, (k) replant i.e. restore to commercial forest. The DSS was analysed using 2 scenarios that most likely represented possible future management strategies, for afforested peat soils.

- Scenario 1: maximise the redesign potential
- Scenario 2: limit redesign to priority areas only

Scenario 1 represents a management strategy that maximises the redesign potential for Coillte-owned AWPs, whereas, scenario 2 represents a strategy where the redesign potential of AWPs is limited to priority peatland areas, i.e. areas identified with the highest inherent sensitivities.

Results

The redesign management options recommended by the DSS for scenarios 1 and 2 are outlined in Table 1. The total redesign areas were 64,549 and 30,619 ha, for scenarios 1 and 2 respectively, which on an annual basis corresponded to a redesign programme of 1,501 and 712 ha/year. The remaining areas represented the areas where commercial forestry should continue, and these were 72,032 and 105,961 ha, for scenarios 1 and 2 respectively. The total AWP area deemed suitable for bog restoration by the DSS was 9,298 and 4,650 ha, for scenarios 1 and 2 respectively. On an annual basis this corresponded to a bog restoration programme of 198 and 99 ha/year. The total areas for natural regeneration were 2,668 and 507 ha, for scenarios 1 and 2 respectively. Annually this corresponded to a natural regeneration programme of 57 and 11 ha/year. The total area designated for water protection was 15,064 and 4,311 ha, for scenarios 1 and 2 respectively. Annually this corresponded to a water protection programme of 321 and 92 ha/year. The total area designated for LTR was 5,332 ha for both scenarios, and on an annual basis this corresponded to a LTR programme of 113 ha/year. The total area designated for LIR (Scrub) was 16,027 and 10,589 ha, for scenarios 1 and 2 respectively. Annually this corresponded to a LIR (Scrub) programme of 341 and 225 ha/year. The total area designated for LIR (LPS) was similar for both scenarios (5,259 and 5,231 ha), and on an annul basis this corresponded to a LIR (LPS) programme of 112 ha/year. Two redesign management options had no areas returned by the DSS, and these were; the 'no replanting (visual)' option and the 'fell and no replanting' option. The 'retain existing UP area' option was only selected in scenario 1, where a total of 10,900 ha was designated, and this corresponded to an annual programme of 232 ha/year.

Table 1. The redesign management options recommended by the DSS for scenarios 1 and 2.

Descriptions	*Scenario 1*			*Scenario 2*		
	Maximise redesign on afforested peat soils			**Redesign priority areas on afforested peat soils**		
	Total area redesigned by 2050 (ha)	**% of total AWP area**	**Average annual redesign (ha)**	**Total area redesigned by 2050 (ha)**	**% of total AWP area**	**Average annual redesign (ha)**
Bog restoration	9,298	*(7%)*	198	4,650	*(3%)*	99
Natural regeneration	2,668	*(2%)*	57	507	*(0%)*	11
Water protection	15,064	*(11%)*	321	4,311	*(3%)*	92
LTR	5,333	*(4%)*	113	5,332	*(4%)*	113
LIR (Scrub)	16,027	*(12%)*	341	10,589	*(8%)*	225
LIR (LPS)	5,259	*(4%)*	112	5,231	*(4%)*	111
No replanting (visual)	-	-	-	-	-	-
Retain existing UP areas	10,900	*(8%)*	232	-	-	-
Fell & no replanting	-	-	-	-	-	-
Total redesign areas (ha)	64,549	*(47%)*	1,501	30,619	*(22%)*	712
Replant	72,032	*(53%)*	1,675	105,961	*(78%)*	2,464
Total areas (ha)	**136,581**	***(100%)***	**3,049**	**136,581**	***(100%)***	**3,115**

Discussion

Internationally, there is a growing realisation of the benefits associated with the use of DSSs to support forest management decisions, especially where multiple objectives need to be accommodated (Tiernan and Nieuwenhuis, 2005). This has resulted in an increased need for decision support systems that can incorporate all of these multiple complexities (Nieuwenhuis and Tiernan, 2005). The DSS for AWPs, which used an ecosystem management approach to decision making for redesigning these areas, provided a valuable insight into the multi-objectives and myriad of considerations, sensitivities and practical difficulties associated with this approach to land conflict management. Like all DSS systems, it is important to emphasise that the DSS is not intended to replace the decision-maker, rather, it is there provide support for effective decision making.

The two presented scenarios provided by the DSS, which represent the upper and lower limits for redesigning existing Coillte-owned AWPs, contain significantly large areas, ranging from 22% (30,619 ha) to 47% (64,549 ha) of all AWPs. This redesign is expected to occur over a rotation, which in Ireland is typically 40 years, with the resulting redesign schedule also occurring over a 40 year time period. This rolling redesign is expected to have annual redesign areas of between 712 and 1,501 ha/year, which from a purely practical perspective, is more manageable and desirable than implementing the redesign over a more concentrated time period.

Surprisingly, the area designated for bog restoration was quite low, at between 3% and 7% of AWPs. Analysis indicated that this was a direct result of strict selection criteria used in the DSS, which specifically required that the selected areas were either in a statutory peatland SAC and/or were recommended by an ecologist as a suitable area for bog restoration. Consequently, the DSS provided a very conservative estimate for bog restoration. However, the DSS was built based on best available information available at the time, and it is now expected that these areas designated for bog restoration will increase, as a direct result of Coillte's recent participation in the EU LIFE-Nature project (*Restoring Active Blanket Bog in Ireland*). Once these new findings are included in the DSS, it is expected that the selection criteria can be relaxed somewhat, allowing ultimately for the designation of more areas for bog restoration.

The maximum extent of natural regeneration provided by the DSS was relatively small at 2% of AWPs, and this is consistent with current observations on the ground. The current scientific understanding for natural regeneration in AWPs is quite poor and is largely confined to lodgepole pine crops only. The DSS predictions for natural regeneration were based on best published knowledge, using research by O'Leary (2003), which found that successful regeneration of LPS was typically associated with well drained sheltered sites, where crops were thinned. These conditions are rarely found in AWPs, and as a result the predictions for natural regeneration by the DSS were disappointingly low. Consequently, the areas for natural regeneration provided by the DSS must be viewed as indicative areas only, and further research will be needed if a better more accurate prediction for natural regeneration is to be obtained.

One of the most important redesign options for the western seaboard will be the water protection option. This option includes the creation of planted and/or unplanted buffer zones for all watercourses in AWPs, and this area was estimated by the DSS to be between 4,311 and 15,064 ha. However, the total length of all order streams and rivers in Coillte-owned AWPs is approximately 7,000km, and assuming a 20m buffer zone width (i.e. 40m effective width), this amounts to an area of 28,000 ha. This area is significantly greater than that provided by the DSS, and analysis indicated that this was due to two factors, firstly, the inclusion of all order streams and watercourses in the analysis and secondly, the inclusion of all planted and unplanted areas. Once both of these factors are removed, then the actual AWPs area suitable for water protection measures is expected to approximate the areas as provided by the DSS.

The suitability of peatland areas for broadleaf planting is not clearly known, and more research will be needed. However, the limited research to date suggests that on the better and more fertile peatland sites, certain broadleaf species have the potential to produce a scrub woodland cover. The LIR (Scrub) option was based on selection criteria that specifically targeted the more productive peatland areas, and consequently the areas designated by the DSS for LIR (Scrub) were at acceptable levels, of between 8% and 12% of AWPs. However, this prediction is based on maximum potential and further research will be needed to ascertain how much of this potential can actually be realised. In contrast, the suitability of peatland areas for planting with lodgepole pine is well known, and while the practicalities associated with implementing this option are currently practiced using higher stocking densities, it is expected that moving to lower stocking densities will have no effect on crop establishment. The LIR (LPS) option is in effect a generalist option that is suitable for most sites. Consequently, the selection criteria in the DSS were purposely less restrictive for this option to target the less productive peatlands and areas where other redesign alternatives were not possible. Consequently, the areas provide by the DSS for the LIR (LPS) option were low for both scenarios, at 4% of AWPs. In reality, both the LIR (LPS) and LIR (Scrub) option are similar options, where considerable crossover can be expected. Therefore, while the total area associated with LIR, of either scrub of LPS species will remain the same (at between 12% and 16%), the final ratio between the two is expected to change, subject to the future development of good forest practice for the LIR (Scrub) option.

This LTR option is a direct consequence of past practices of planting areas unsuitable for forestry. As these areas mature, many of these areas will never be harvested, either as a result of access difficulties, or the absence of any merchantable timber. For both scenarios, the areas designated by the DSS for LTR was the same, at 4% (5,333 ha) of AWPs. This was surprisingly low and analysis suggested that further refinement maybe required. The

'Retain existing UP areas' option was only selected in scenario 1, where 8% (or 10,900ha) of AWPs were identified. This suggests that these areas are not located in the most sensitive priority areas for redesign. Analysis indicated that in most cases these areas contain intact bog. While the principle role to retain these areas will be easy, the real challenge will be to realise their secondary role in facilitating spatial connectivity opportunities with other redesign option, in the context of the overall redesign plan.

The 'No replanting (visual)' option requires that areas are left unplanted following felling as a measure to improve the overall visual aesthetics of a landscape. Traditionally, this option is rarely used and it tends to be localised. Consequently, it was no surprise that in all scenarios examined, no area was selected for this option. Analysis indicated, that the requirement to improve visual aesthetics was achieved by the selection of the DSS of other redesign management options, that when implemented also resulted in visual enhancement. The 'Fell and no replanting' option is the least desirable of all the redesign options, as is it results in no replanting following felling. The inclusion of this option into the DSS was to insure that all potential options could be considered. However, at present as there is currently no legislative support for this option, the selection criteria in the DSS prevented the selection of any area for this option.

Future scenario for AWPs?

Responsible forest management in these areas should direct the management emphasis more towards ecological and environmental management regimes. Forestry will continue to occur on western peatlands, but only within the context of an ecosystem management approach that incorporates environmental and social issues alongside timber production. The majority of these areas will become forests where environmental and social values will take precedence over the economic value of timber production. In these areas forest redesign should occur in a manner that enhances their environmental and social contribution consistent with a national sustainable shared land use for western peatlands.

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