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A sensitivity analysis of the high risk threshold. Comparing "30% of total" versus "30% of natural". Implications to the Ecological Basecase results.

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Rationale

The CIT approach to setting risk levels was based on the principle that thresholds or targets should be linked to the natural disturbance drivers of individual ecosystems. This philosophy has lead to targets and risk thresholds based on a 'percent of the natural expected level of old forest' (abbreviated here to '% of natural'). However, an analysis of science literature has suggested an absolute minimum level of habitat may be required to prevent significant loss of functioning in ecosystems – leaving them at high risk (see Price et al. 2007 for discussion of literature and conclusions), and that review recommended use of this absolute threshold for high risk that reflects '30% of the total area of the ecosystem' (abbreviated here to '% of total').

In the project E103, a the '30% of natural' threshold was used to identify SSS at high risk over time, a threshold based on the original CIT Handbook 2004 example. Although the uncertainty associated with use of '30% of natural' was discussed as being potentially significant, the analysis did not directly take into consideration the newer information that high risk may be better described by '30% of total' of an ecosystem.

This addendum to the E103 report provides a sensitivity analysis to specifically identify the implications of using the proposed high risk threshold of '30% total', rather than '30% natural'. Note that only the risk threshold, and not the targets themselves were changed in this sensitivity[1].

Methods

The methodology used in the E103 is based on estimating a 'deviation from natural' levels of old forest. Because there are a number of issues with forest cover (discussed at length in the appendices of E103) a number of methods were employed in the original analysis in order to avoid systematically over or under-estimating risk. This included changing the age for some low productivity SSS from AC8 to AC9 where it has been recognised that forest cover is systematically incorrect[2]. In addition, where the Forest Cover data appears to under-estimate age class 9, but over-estimate age class 8, these two categories were combined and compared with the predicted amount of forest > 140[3]. This 'shift' of the threshold for some SSS (i.e. using the percent expected greater than 140 rather than 250 as the comparison to reflect uncertainty in FC) is an effective way to avoid deciding about the verity of the age data.

However, in order to test whether a 30% of total threshold is met requires an analysis that decides whether to count AC 8 as AC9 or not (because the target cannot be adjusted to account for this uncertainty in the age data). For this analysis, for all SSS where this data issue appears to occur (see Appendix 4), a conservative decision[4] was made to assume that all forest >140 was in fact meeting the old growth threshold.

[1] The targets remain based on a 30% of natural in all scenarios.
[2] Note that this change reduces apparent risk for a large area of the coast.
[3] As explained in the appendices (E103), taking this approach avoids the need to 'decide' whether AC 8 is really 9 or vice versa, instead it assumes only that everything AC 8 and AC9 is > 140. It is a more conservative approach to interpreting the FC data that reduces the error associated with having to be sure whether a particular polygon tagged as AC 8 or 9 meets, or does not meet, the >250 age definition. Taking this approach significantly reduces the apparent risk level, compared with simply taking the AC9 data at face value in all situations.
[4] This decision, as with all the others above, reduces apparent risk for SSS to which it is applied.

Results

The use of 30% of total compared with 30% of natural as the high risk threshold results in additional SSS being tagged as at high risk now and into the future (Table 1).

Table 1. A comparison of the number of SSS considered at high risk using the '30% of natural' and the '30% of total' thresholds, over four time periods (0, 50, 100, 250 years).

Scenario	Time 0		Time 50		Time 100		Time 250	
	% Natural	% Total	% Natural	% Total	% Natural	% Total	% Natural	% Total
Basecase	45	50	55	67	46	59	34	58
3b	45	50	45	56	38	51	11	23
4b	45	50	42	49	33	42	8	12

The number of SSS in the high risk category increases in all situations when using 30% of total habitat as the high risk threshold. Considering only the time periods presented, as examples[5] (Figure 1): At time 0, an additional 5 SSS move into the high risk category (relevant to all scenarios). Under the Basecase scenario, up to an additional 24 SSS are at high risk (maximum number at year 250). Under the Current Land Use Objectives, up to an additional 13 SSS are at high risk (maximum number at year 100), and under Full EBM, up to an additional 9 SSS are at high risk (year 100) compared with an analysis using '% of natural'.

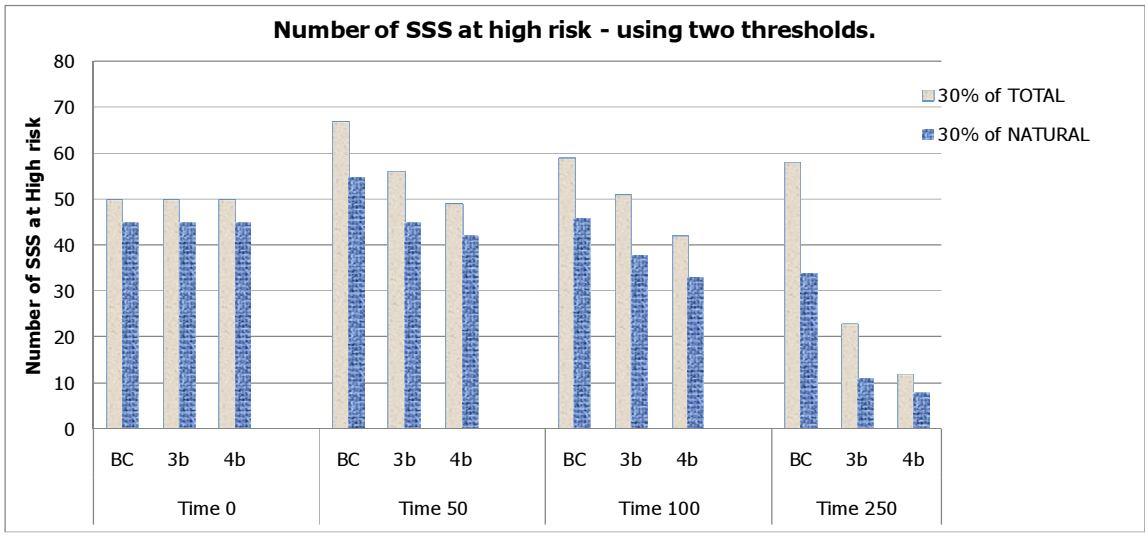

Figure 1. Number of SSS at high risk, using two thresholds – 30% of natural and 30% of total habitat. Figure shows three scenarios Basecase (BC), current LUO (3b) and Full EBM (4b), over three four time periods (time 0, 50, 100 and 250 years into the future).

Which Ecosystems are Affected and When?

Currently (time zero – all scenarios), the alternate thresholds show a difference in 5 SSS at high risk, representing about 8,000ha (Table 2). Under the Current LUO's scenario, after 250 years, the number and area of SSS at high risk has increased by 12 – from 11 predicted using 30% of natural threshold to 23 when using the 30% of total threshold. This represents an increase in area at high risk of 28,000 ha over this longer timeframe. Under Full EBM, the number at high risk also increases using the 30% total threshold – by a number of 4 and an area of around 7,000ha after 250 years.

[5] The exact number and area affected can change at every time period.

Table 2. The number and area of SSS that CHANGE into high risk zone using 30% total. It is NOT a full list of those at high risk. At time zero (all scenarios), and year 250 under the current LUOs and Full EBM.

All Scenarios		Current Land Use Scenario (3b)		Full EBM (4b)	
Time Zero (now)		250 years		250 years	
SSS	Area (ha)	AU	Area (ha)	AU	Area (ha)
Fir-moderate in CWHds2	4863	Cedar_Good in CWHvh1	2675	Cedar_Poor in CWHds2	584
Fir-moderate in CWHmm1	197	Cedar_Good in CWHws2	86	HemBal_Poor in CWHds2	4048
Fir-poor in CWHxm2	1643	Cedar_Good in CWHxm2	258	S_Poor_Pl in CWHms2	2092
Fir-poor in MHmm2	555	Cedar_Poor in CWHds2	584	S_Poor_Pl in CWHxm2	427
S-Poor_Pl in CWHwm	701	Fir_Good in CWHdm	1903		
		Fir_Good in CWHmm1	263		
		Fir_Good in CWHvm1	4413		
		Fir_Good in CWHxm2	2627		
		Fir_Moderate in CWHxm2	3269		
		HemBal_Good in CWHdm	7566		
		HemBal_Poor in CWHds2	4048		
		S_Poor_Pl in CWHxm2	427		
	7,959		**28,119**		**7,051**

A more detailed identification of SSS that change risk status in the two scenarios is shown in Table 3. Here, 31 SSS change risk status (moving into high risk when 30% of total habitat is used) in at least one time period in either the 3b or 4b scenario.

There is a tendency for particular SSS types to be affected by the threshold uncertainty – the SSS tend to be good productivity SSS (28,000ha), fir leading SSS (32,500ha) or biogeoclimatic variants occurring primarily in the southern part of the region (e.g. 12,700ha in the CWHdm and 6000ha in the CWHds2, 8000ha in the CWHxm2 and 20,000ha in the CWHms2 are affected). For full list see Table 3 below.

Interpreting 'thresholds' is always difficult because it focuses attention on a single point. If all the cases are far under or over the threshold the specific threshold level becomes less relevant. However, it becomes less relevant if many cases are close to the threshold: in those circumstances summaries of how many SSS 'cross the threshold' can be misleading (if 30% is the threshold, how do we really interpret 29 or 31%?). The threshold issue does not affect some SSS because a number (around half of those at high risk currently) have so little old forest that a threshold level is irrelevant (e.g. many SSS have zero, or close to zero old forest today), whereas for others they hover close to one or other threshold and ***proximity to the high risk zone*** may be the most relevant issue.

What's happening?

Whether a particular SSS is affected by a change in the high risk threshold is dependent on a number of factors:

- Whether the percent total of % natural numbers are very different from one another (e.g. 30% of natural in the LUO results in targets as low as 12% and as high as around 28% of total area). Clearly in a case there its 28 versus 30 then little would change. Alternatively, 12 to 30 represents a large change.
- Some SSS always have more reserves (and have sufficient old forest to meet them) than required by the '% total' target (as a result of other constraints) and so their risk level doesn't change irrespective of threshold.
- Some SSS do not have sufficient old forest to meet either threshold now and into the future, so are at high risk irregardless of threshold used. For example, for fir-moderate in the CWHds2 there is so little old forest remaining that the SSS remains at high risk right until the last time period when sufficient has recovered to old growth that it moves out of the high risk zone with both thresholds
- Some SSS (e.g. Cedar_Good in the CWHds1) is hovering around the minimum level allowed by the % natural threshold and so becomes at high risk using the % total threshold. For these, the old

forest target level is the driver for the level of retention and so these SSS are more directly affected by using the % natural as the target.

Conclusion

It has been recommended that science suggests an absolute minimum target of 30% of total area is appropriate be used as a high risk threshold for ecosystems (Price et al. 2007; Old Growth Workshop 2007). The original E103 report highlighted that this recommendation raised an area of considerable uncertainty for the results of the E103 baseline assessment.

This sensitivity analysis demonstrates that using this 30% total threshold results in an increase in the number of ecosystems apparently at high risk over time. Currently, 5 SSS (8,000ha) change risk category but after 250 years under the Current LUOs, an additional 12 SSS (28,000ha) change risk category.

The increase in apparent risk occurs non-randomly to SSS, and does not occur at all time periods: The largest difference is observed under the Basecase Scenario, followed by the Current LUO scenario, with the smallest difference seen under Full EBM. However, even under Full EBM additional ecosystems remain at high risk using the % of total threshold. The list of SSS being affected however is of concern since these types are typically associated with high biodiversity (good productivity types) and are known to be poorly represented both in and outside the region in protected areas (e.g. fir-leading types and drier biogeoclimatic variants – A. Mackinnon pers. comm.).

It should also be remembered that considering only whether a value surpasses, or does not surpass, a particular threshold can be misleading if many cases remain close (just under, or just over) the threshold. Consideration of being 'close to the high risk zone' may be the most relevant factor to consider. Similarly, moving further away from the high risk zone (irrespective of specific thresholds) is the most certain and effective way to lower overall risk.

The implications of the uncertainty around high risk may have significant implications for SSS that change class, and some that apparently do not. The uncertainty appears to be more relevant to SSS in the southern extent of the coastal planning region, primarily because more SSS are close to either threshold in that region.

Table 3. Site series surrogates that change risk status using the two different high risk thresholds (%Total and % Natural). H signifies crossing the into the high risk zone using the 30% of TOTAL threshold or using the 30% of NATURAL threshold. A '.' signifies being above the high risk threshold. Greyed combinations of cells highlight where the risk level increases when using the % of total threshold. Note: only SSS where a *difference* is observed at some time period are shown – the full list of SSS at high risk is not shown here.

	Scenario	3b								4b							
	Year	0		50		100		250		0		50		100		250	
AU	BEC	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural
Cedar_Good	CWHdm	.	.	H	.	H	.	.	.	.	.	.	.	.	.	.	.
Cedar_Good	CWHms2	H	H	H	H	H	.	.	.	H	H	H	.	H	.	.	.
Cedar_Good	CWHvh1	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Cedar_Good	CWHws2	H	H	H	H	H	H	H	.	H	H	H	.	.	.	.	.
Cedar_Good	CWHxm2	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Cedar_Good	MHmm1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cedar_Poor	CWHds2	H	H	H	H	H	H	H	.	H	H	H	H	H	H	H	.
Fir_Good	CWHdm	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Fir_Good	CWHmm1	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Fir_Good	CWHvm1	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Fir_Good	CWHxm2	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Fir_Moderate	CWHds2	H	.	H	.	H	.	.	.	H	.	H	.	H	.	.	.
Fir_Moderate	CWHmm1	H	.	H	.	H	.	.	.	H	.	H	.	H	.	.	.
Fir_Moderate	CWHms2	.	.	H	.	H	.	.	.	.	.	.	.	.	.	.	.
Fir_Moderate	CWHws2	.	.	H	.	.	.	.	.	.	.	H	.	H	.	.	.
Fir_Moderate	CWHxm2	H	H	H	H	H	H	H	.	H	H	H	H	H	H	.	.
Fir_Poor	CWHvm1	H	H	H	H	H	H	.	.	H	H	H	H	H	.	.	.
Fir_Poor	CWHvm2	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.	.
Fir_Poor	CWHxm2	H	.	H	.	H	.	.	.	H	.	H	.	H	.	.	.
Fir_Poor	MHmm1	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.	.
Fir_Poor	MHmm2	H	.	H	.	H	.	.	.	H	.	H	.	H	.	.	.
HemBal_Good	CWHdm	H	H	H	H	H	.	H	.	H	H	H	H	.	.	.	.

	Scenario	3b								4b							
	Year	0		50		100		250		0		50		100		250	
AU	BEC	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural	Total	Natural
HemBal_Good	CWHms2	H	H	H	H	H	.	.	.	H	H	H	H	.	.	.	.
HemBal_Moderate	CWHdm	H	H	H	.	.	.	.	.	H	H	.	.	.	.	.	.
HemBal_Moderate	CWHmm1	.	.	H	H	H	.	.	.	.	.	.	.	.	.	.	.
HemBal_Poor	CWHdm	.	.	H	.	H	.	.	.	.	.	.	.	.	.	.	.
HemBal_Poor	CWHds2	.	.	.	.	H	.	H	.	.	.	.	.	H	.	H	.
HemBal_Poor	CWHws1	.	.	.	.	H	.	.	.	.	.	.	.	H	.	.	.
Spruce_Poor_Pine	CWHms2	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	.
Spruce_Poor_Pine	CWHwm	H	.	.	.	.	.	.	.	H	.	.	.	.	.	.	.
Spruce_Poor_Pine	CWHxm2	H	H	H	H	H	H	H	.	H	H	H	H	H	H	H	.