

**Timber Supply Analysis
For Management Plan #9 on TFL35**

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“This plan is the start of a never ending fact-finding job which, as time progresses, will gradually bring details into sharper focus for more efficient selection of logging areas, for revision of inventory estimates, for intensification of planning and for a stronger basis of predicting growth and yield. From this may evolve revisions of the sustained yield estimated, refinements in procedure, modifications of cutting methods, etc., for incorporation in future working plans”

Quote from:

**Initial Management Working Plan for the BC Interior
Sawmills Limited Management License Reserve Area
(TFL 35), December 1955**

EXECUTIVE SUMMARY

This report summarizes the results of a comprehensive series of timber supply analyses completed as a part of Weyerhaeuser Company Limited's Management Plan 9 for TFL 35. The analyses form the basis for a recommended harvest level for the period November 1, 2001 to October 31, 2006. The report covers two different options and numerous sensitivity analyses, designed to demonstrate the relationship of current management practices and provincial policy to the stability of short, mid and long-term harvest levels.

INTRODUCTION

The Timber Supply Analysis (analysis) is a key component of Weyerhaeuser Company Limited's (Weyerhaeuser) Management Plan 9 submission for Tree Farm License #35 (TFL 35). The analysis is characterized by several elements:

- Weyerhaeuser's desire to increase the harvest level, as a result of continued investment, and commitment to our forestry programs
- Interpretation and incorporation of the Kamloops Land and Resource Management Plan

The Timber Supply Analysis Information Package prepared for TFL35 is attached as Appendix 1, and contains relevant data, inventory summaries and management assumptions that document input data and modeling procedures. When Weyerhaeuser deviated from the Information Package, specific notation and rationalization is included in the analysis.

GENERAL DESCRIPTION OF LANDBASE

TFL 35 is located about 25 kilometers north of Kamloops, west of Highway 5 and is characterized by mid-elevation plateaus and gently rolling slopes. The total TFL area is 36,563.6 hectares, of which 96.8% (35,428.7 hectares) comprises the productive forest landbase.

The tree species distribution is shown in Figure 1 below. The coniferous and

deciduous percentages are 98% and 2% respectively.

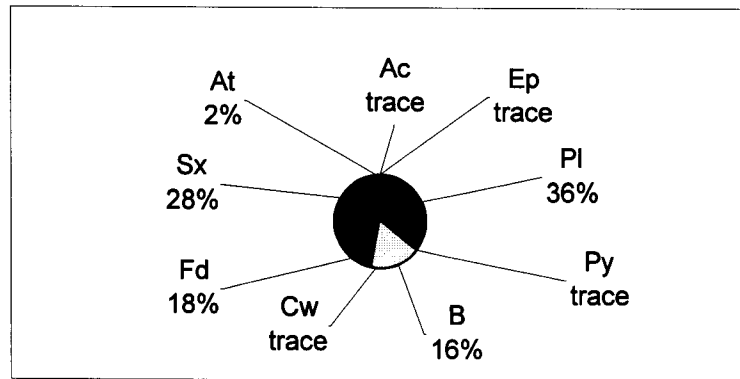


Figure 1: Species distribution

Continuous forest management since mid-1950 has created approximately 10,455 hectares of second growth. The current harvest level is set at 125,600 m³/yr.

MANAGEMENT ZONES

Four zones are recognized in this analysis, each highlighting a particular resource value. They are the General Management Zone and Critical Deer Winter Range identified in the Kamloops LRMP, a Visual Landscape Management Zone identified in the 1999 Landscape Inventory for the Kamloops District and Special Wildlife Management Area identified in the 1991 Weyerhaeuser's Fish and Wildlife Plan. The area distribution is shown in Figure 2.

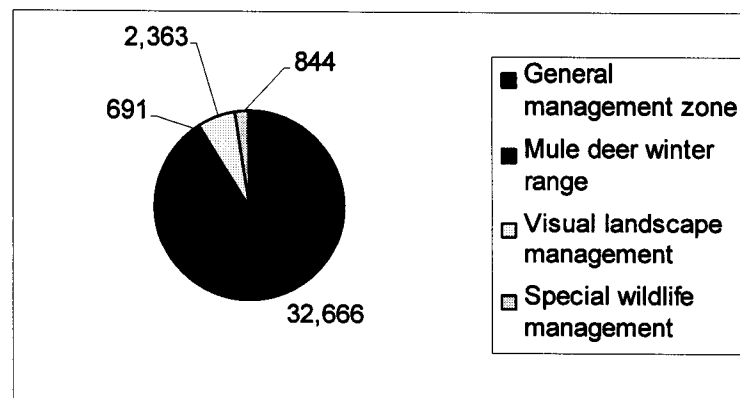


Figure 2: Management zone areas

General management zone

This is the largest zone and is managed primarily for timber production. Resource constraints were factored into WOODSTOCK as follows:

1. To model a green-up height of 3 meters and a three-pass harvesting sequence WOODSTOCK was constrained to maintain a maximum of 33% of the gross forested area less than 3m in height.

Visual landscape management zone

This is the second largest zone and is managed primarily for timber production and to maintain the visual quality of the landscape. Visual quality is managed through the use of visual quality objectives, percent disturbance and green-up. Three main visual quality objectives were identified: Retention, Partial Retention and Modification. Appendix 8 from the Kamloops LRMP provides guidance on maximum percent disturbance and visually effective green-up for various silviculture regimes. A copy of this table is in Appendix 2. To model resource constraints the following three conditions were incorporated into WOODSTOCK:

1. To model a visually effective green-up height of 3.9 meters and a maximum denudation area of 20% in the Partial Retention unit, WOODSTOCK was constrained to maintain a maximum of 20% of the gross forested area less than 3.9m in height.
2. To model a visually effective green-up height of 3.9 meters and a maximum harvest area of 15% below this height in the Retention unit, WOODSTOCK was constrained to maintain a maximum of 15% of the gross forested area less than 3.9m in height.
3. WOODSTOCK tracks the percent area less than 3.2 meters in height in the Modification unit. The ceiling for this unit is 28%.

Mule Deer Winter Range

This management zone was identified in the LRMP to ensure that habitat values are maintained for Mule Deer. Two strategies from the LRMP are incorporated into the Timber Supply analysis:

1. To model a minimum 25% of forested landbase in thermal cover, a minimum of 25% of the Mule Deer Winter Range must be greater than or equal to 20m.
2. To model the maximum size of clearcut (5 hectares), WOODSTOCK was constrained to keep a maximum of 20% of the area less than or equal to the green-up height of 3 meters.

Special Wildlife Management Areas

Weyerhaeuser identified eleven Special Wildlife Management Areas in the 1991 Fish and Wildlife Plan and will continue managing these areas to maintain 25% mature and over-mature timber. This is defined as greater than 80 or 100 years of age for pine and other species respectively.

TIMBER SUPPLY ANALYSIS METHODS

The linear optimizing program WOODSTOCK was used to determine the harvest level and sensitivity analysis for TFL35. Land classification is accomplished by the use of development types. A development type is a specific group of stands based on developmental characteristics without differentiation for age. The combination of management zones, biogeoclimatic variants, watersheds, land class, natural disturbance type, status, and existing and future yield curves are combined into unique development classes.

Stipulating interventions or activities (harvest, tending, operability and stand mortality) controls management choices or natural processes. In this formulation, silvicultural activities are specified outside the model in relationships between existing and future stands. Stand death was stated within the model and WOODSTOCK was allowed to choose when to harvest given the operability criteria supplied.

Measuring management success was accomplished through the use of numerous outputs. The indicators used are identified below; specific values are discussed in the relevant sections below.

Table 1: Criteria and Indicators

Criteria	Indicator
Timber Supply	Harvest level Composition of projected harvest volume Average volume per hectare harvested Harvest age minus forest-level culmination age Current, future and total growing stock Area harvested Age class distribution
Old Seral	Percent area meeting old seral criteria by biogeoclimatic variant
Visual quality objectives	Percent area below maximum disturbance and height criteria
Maximum cutblock size and green-up	Percent area below maximum height criteria
Thermal cover in mule deer winter range	Percent area above minimum height criteria
Old requirements in special wildlife management area	Percent area above minimum age criteria
Hydrological green-up	Percent area below minimum height criteria

Specific targets were identified for some of the indicators above, while others were monitored for behaviour. Planning goals for the forest estate were incorporated into the model using a combination of the indicators above, specific targets and the objective/constraint capability of WOODSTOCK. The model was used to determine the optimum level of activities necessary to attain the planning goals.

Actions within WOODSTOCK occur at single points in time and interpolation does not occur. The planning period used was five years, so all actions and activities occur every five years. Because of this, height-based indicators (e.g. green-up) were translated to age-based values. These values were calculated for specific zones/constraints using area-weighted height age relationships. The planning horizon used was 200 years. In all cases, except where noted, the objective function was to

maximize the total harvest over the 200-year planning horizon.

OPTION 1: BASE CASE

The base case reflects the direction in the December 20th letter from Tony Buckley (District Manager, Kamloops Forest District), to Bob Helfrich (Manager, Forest Administration and Planning). The letter states "It is my interpretation that the KLRMP guidance as taken from the Biodiversity Guidebook recommendations is that three thirds OGMA development be the standard unless a timber supply impact is demonstrated. Three thirds development is the OGMA management practice in effect and therefore should be used in any base case timber supply analysis."

In addition Weyerhaeuser's current performance will be reflected in the base case. This includes requirements from the Forest Practices Code (FPC), new growth and yield data, current silvicultural practices, current practice regarding rehabilitation of all in-block roads and landings and appropriate forest-cover, green-up and maximum allowable disturbance and cut block size limitations. Reductions for the identified wildlife strategy are not included explicitly.

Results

Table 2 below summarizes the values used for each indicator and how they were incorporated into WOODSTOCK. Some values were modeled as constraints; others were modeled as output variables while harvest level was incorporated into the objective function. To determine which values were constraints and which were outputs, a series of iterations were run to identify those values that constrain harvest levels and those values that do not.

The constraint values for the partial retention and retention VQO units were exceeded at the start of the planning horizon. This was due to the incorporation of a new VQO inventory, and new disturbance and visually effective green-up values from the LRMP. The phased-in values indicated below were developed through a separate series of iterations, once all the other constraints were determined.

Table 2: Criteria, indicators, values and modeling techniques

Criteria	Indicator	Value	How incorporated into WOODSTOCK
Timber Supply	Harvest level	Not specified	Used objective function and maximization capability
		5 Weyerhaeuser TFL35 MP9 Timber Supply Analysis	

Criteria	Indicator	Value	How incorporated into WOODSTOCK
	Composition of projected harvest volume Average volume per hectare harvested Harvest age minus forest level culmination age Current, future and total growing stock Area harvested Age class distribution	Not specified	Modeled as output variables
Old Seral	Percent area meeting old seral criteria for NDT3 (ESSFxc, ESSFdc2, MSdm2, ICHmk2)	Must be at least 14% of the gross forested area greater than 140 years	Modeled as constraint and in effect immediately
	Percent area meeting old seral criteria for NDT4 (IDFdk2, IDFxh2)	Must be at least 13% of the gross forested area greater than 250 years	Modeled as output variable. Amount exceeding minimum age monitored. Recruitment strategy developed.
Visual quality objectives	Percent area below maximum disturbance and height criteria for modification unit	No more than 28% of the gross forested area will be less than 3.2 meters (10 years of age)	Modeled as output variable. Amount below maximum age monitored
	Percent area below maximum disturbance and height criteria for partial retention unit	No more than 20% of the gross forested area will be less than 3.9 meters (15 years of age)	Modeled as constraint. Gradually introduced because initial conditions exceed maximum. 30% period 1, 25% period 2, 20% period 3

Criteria	Indicator	Value	How incorporated into WOODSTOCK
	Percent area below maximum disturbance and height criteria for retention unit	No more than 15% of the gross forested area will be less than 3.9 meters (15 years of age)	Modeled as constraint. Gradually introduced because initial conditions exceed maximum. 25% period 1, 20% period 2, 15% period 3
Green-up and maximum cutblock size	Percent area below green-up height in the general and special wildlife management zones, and maximum block size less than 40 hectares	No more than 33% of the THLB will be less than 3 meters (15 years of age)	Modeled as constraint and in effect immediately
	Percent area below green-up height in the mule deer winter range, and maximum block size less than 5 hectares	No more than 20% of the THLB will be less than 3 meters (15 years of age)	Modeled as constraint and in effect immediately
Thermal cover in mule deer winter range	Percent gross forested area in mule deer winter range above minimum height criteria	No more than 25% of the area can be less than 20 meters (75 years of age)	Modeled as constraint and in effect immediately
Old requirements in special wildlife management area	Percent gross forested area in special wildlife management zone above minimum age criteria	No more than 25% of the area can be less than 85 years of age	Modeled as constraint and in effect immediately
Watershed integrity (hydrological green-up)	Percent area below disturbance threshold and hydrological green-up equivalents for Whitewood watershed	No more than 30% of the area will be less than 4.8 meters (20 years of age)	Modeled as constraint and in effect immediately
	Percent area below disturbance threshold and hydrological green-up equivalents for Jamieson, and Skull watersheds		Modeled as output variable. Amount below maximum disturbance monitored

Old Seral Strategy

The amount of old seral for NDT3 was met by constraining the WOODSTOCK model to maintain 14% old seral at all times. There was insufficient area to meet 3/3 old seral targets for the IDFdk2 at the start of the planning horizon so a recruitment strategy was developed. The landbase supplying the old seral within the NDT4 was determined using the process set out in the Landscape Unit Planning Guide (April 1999). Draft OGMA's were used first followed by age class 9 and 8. Table 3 below shows the areas involved.

Table 3 : Old seral recruitment strategy

BEC variant	Gross area (ha)	Forested area (ha)	Old seral target area (ha)	Old seral in draft OGMA	Old seral need	Recruitment strategy			
						Age class 9		Age class 8	
						NTHLB	THLB	NTHLB	THLB
IDFdk2	1,788.8	1,724.1	224.1	154.5	69.6	0	0	52.5	17.6
IDFxb2	381.6	374.1	48.6	49.9	0				

Timber supply

A harvest level of 125,200 m³/yr is achievable. Figure 3 shows the contribution to total harvest of three categories of wood; existing mature, existing regeneration and future regeneration. The transition through the existing mature and existing regeneration to future regeneration (transition period) starts in 2045 and is essentially complete by 2065. Portions of both existing mature and existing regeneration contribute to the total harvest throughout the remainder of the planning horizon.

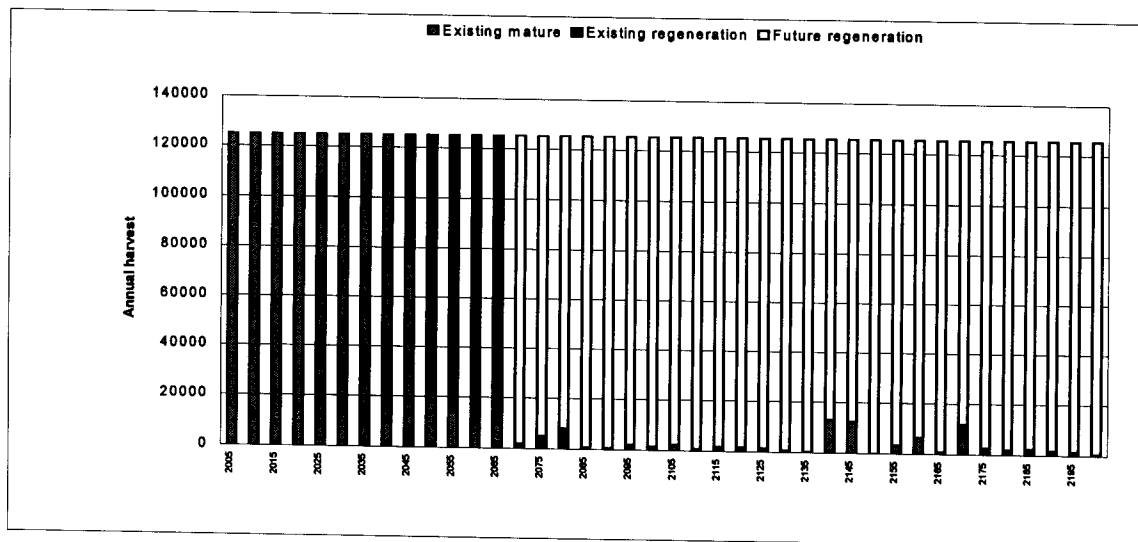


Figure 3: Harvest composition

The effects on average harvest volume, area and age are shown in Figure 4 and 5. Area harvested increases up to a peak of approximately 540 hectares in 2065, which corresponds to the end of the transition period. The corresponding average volume per hectare of 230 m³ /ha exceeds our minimum volume threshold of 150 m³ /ha.

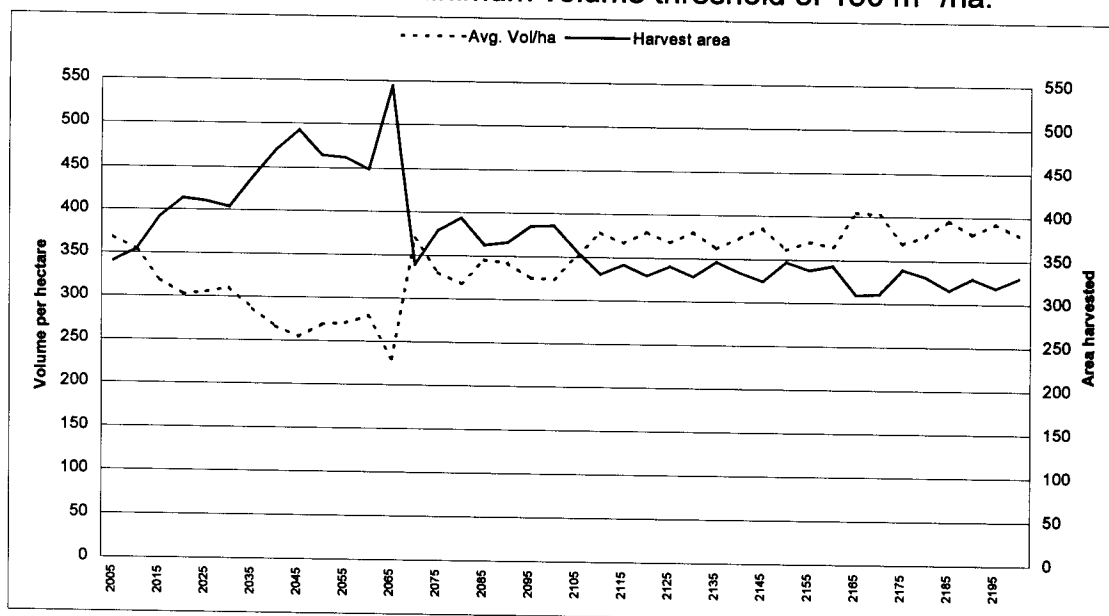


Figure 4: Average volume and area harvested

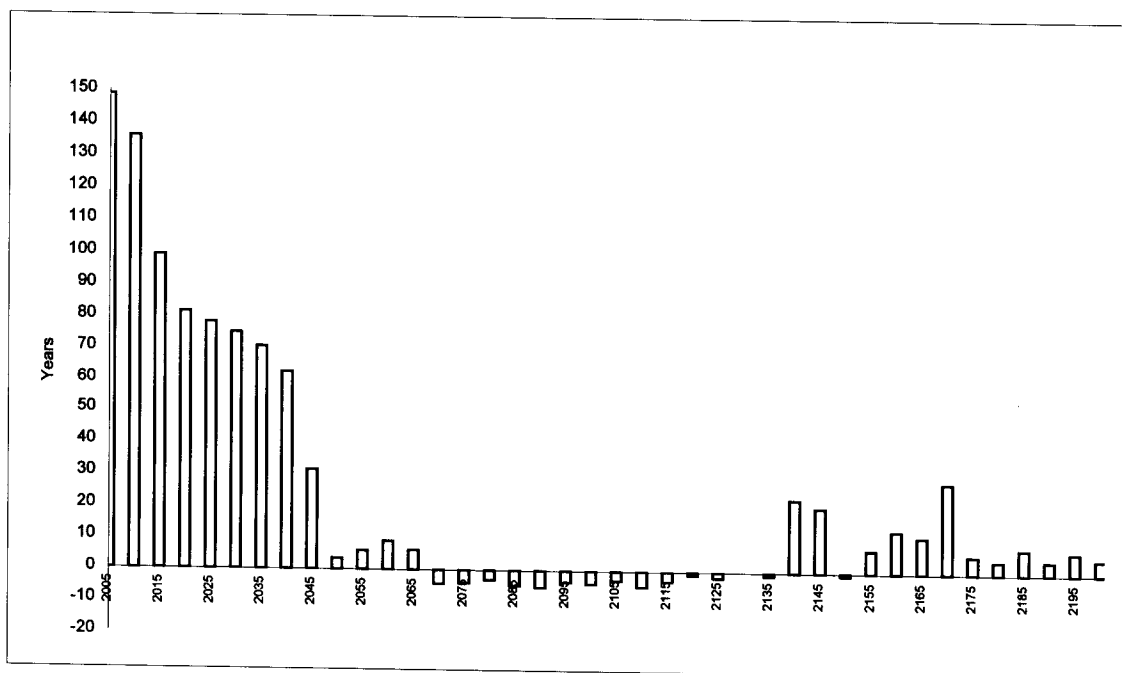


Figure 5: Average harvest age minus forest-level culmination age

Existing, future and total growing stock levels are shown in Figure 6. The existing growing stock beyond 2065 is the area reserved as old seral on the THLB. As NTHLB reaches either 140 or 250, then an equal area of THLB is eligible for harvest. This is shown as a slight downward trend in the existing growing stock line and in the

harvest contribution graph.

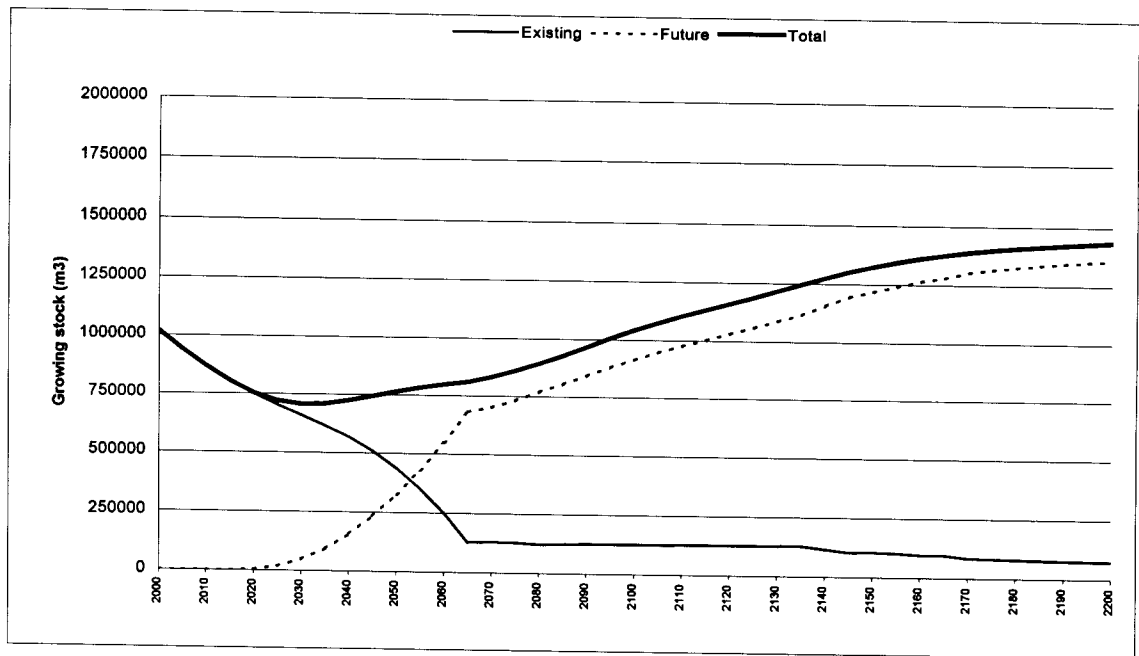


Figure 6: Growing stock

Three meter green-up is not constraining at any point in the planning horizon for the general management zone or the special wildlife management areas (Figure 7).

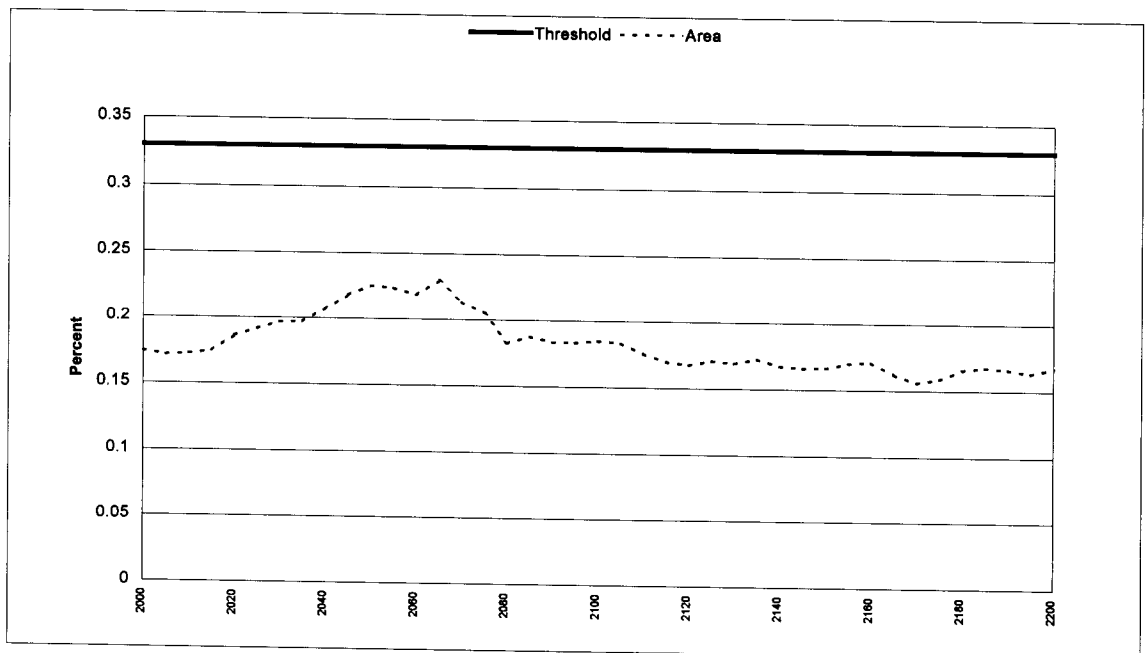


Figure 7: Area below 3m green-up height for the general management zone and special wildlife management areas

Old Seral

NDT3 old seral (percent area greater than 140 years of age) values are shown in Figure 8. The 14% threshold significantly constrains harvest at 2045, at which point the first harvest of existing regeneration commences. The increase in the amount of old seral at the end of the planning horizon is due to the accumulation of growing stock that the model is unable to harvest because of the even-flow harvest policy. The NDT4 patterns (Figure 9) are from the aging of OGMA's, WTP's and riparian reserves.

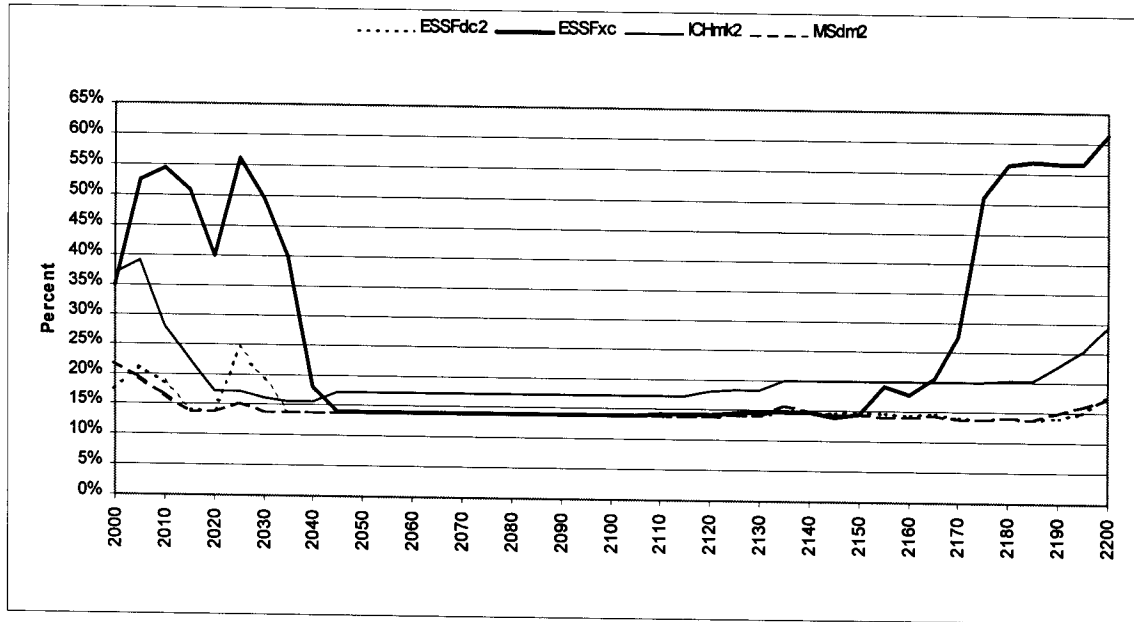


Figure 8: NDT3 Old seral patterns

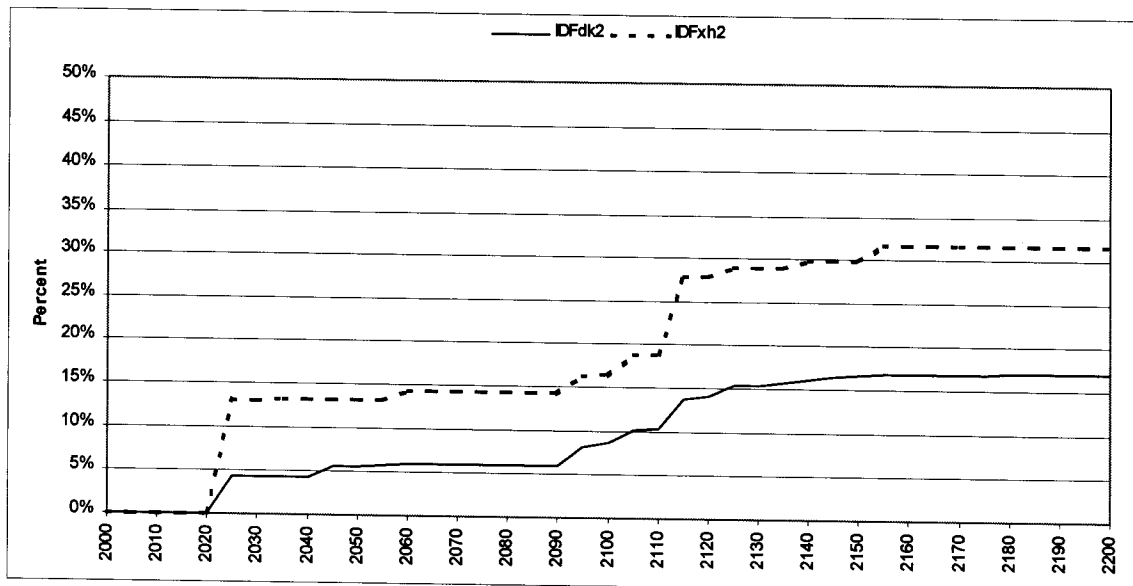


Figure 9: NDT4 Old seral patterns

Landscape management zone

Green-up and harvest disturbance limits in the visually sensitive areas do not have a significant impact. Both the VQO modification (Figure 10) and partial retention (Figure 11) criteria are not constraining at any point during the planning horizon. The VQO retention (Figure 12) criteria are shown as meeting the threshold during most of the planning horizon, however the total area in this zone is 207.6 hectares or 0.59% of the TFL forested area. The phased-in values described in Table 2 can be seen in the first 3 periods in Figure 11 and 12.

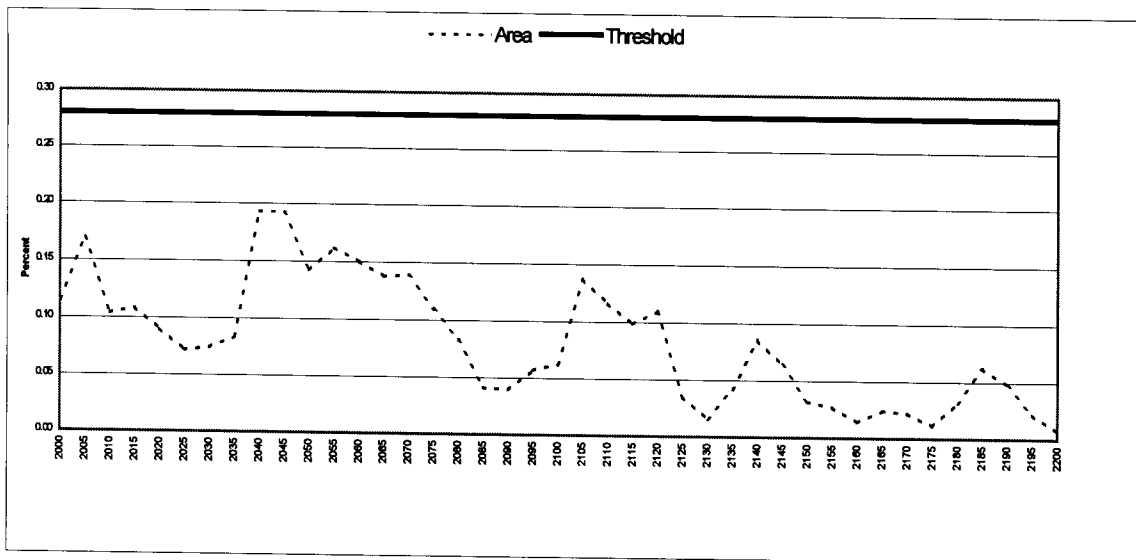


Figure 10: Area below 3.2m green up height, modification VQO

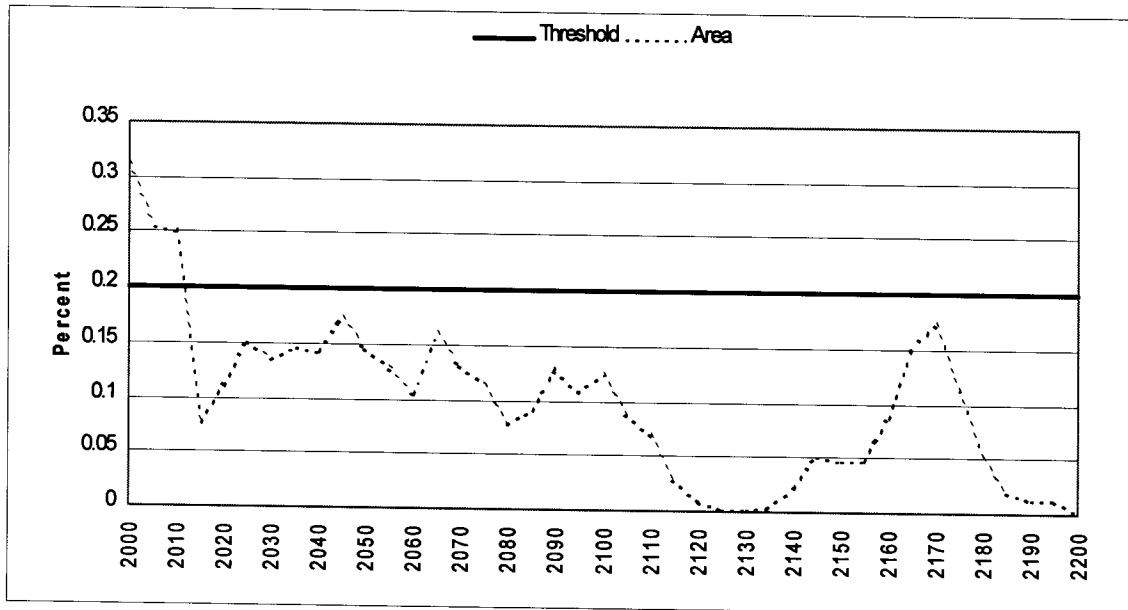


Figure 11: Area below 3.9m green-up height, partial retention VQO

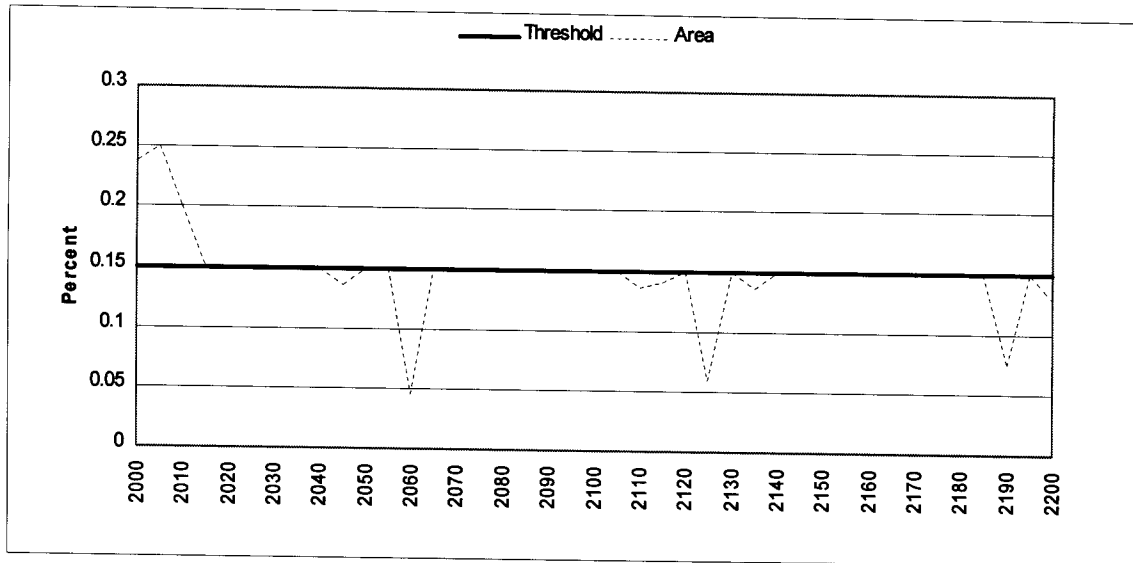


Figure 12: Area below 3.9m green-up height, retention VQO

Mule deer winter range

The amount of thermal cover in the Mule Deer Winter Range is not constraining (Figure 13), although the available thermal cover does come close to the threshold in 2055.

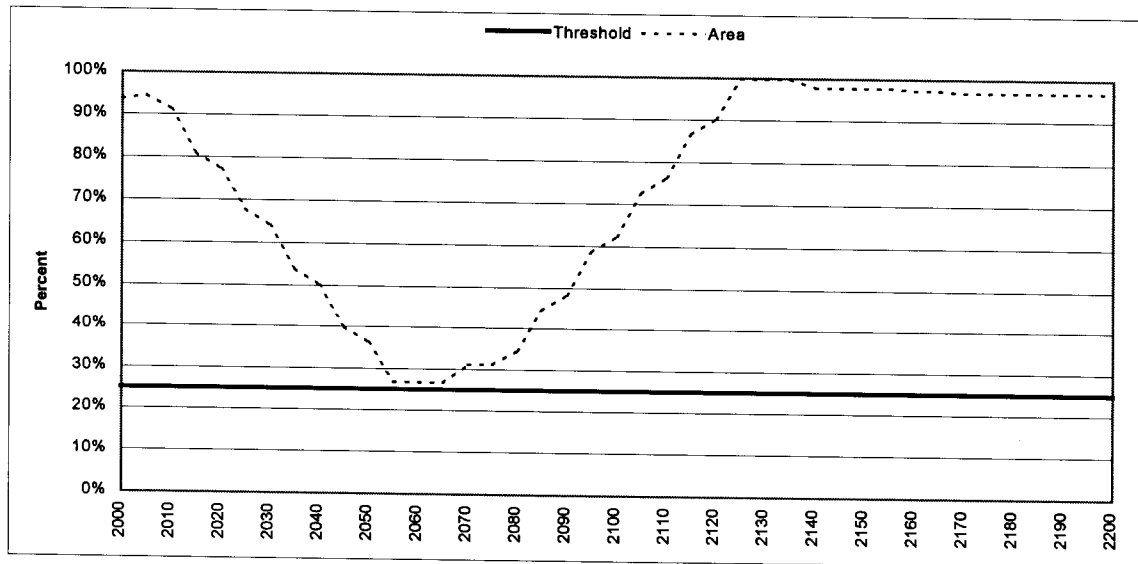


Figure 13: Area above 20m thermal cover requirement

The area below the green-up height for the Mule Deer Winter Range is shown in Figure 14. The threshold is met and is constraining harvest from this zone for 30 years between 2020 and 2050. It subsequently drops off and is not limiting any more.

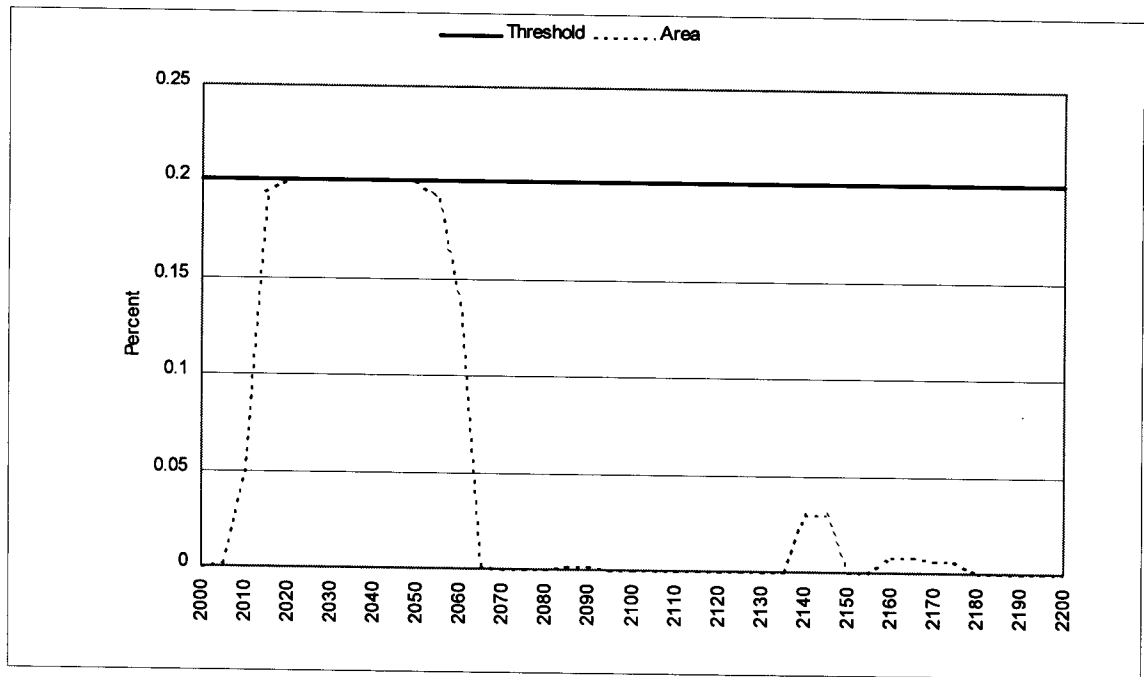


Figure 14: Area below 3m green-up height

Special wildlife management areas

The area above the old seral minimum age threshold is shown in Figure 15 and constrains the harvest in a couple of periods.

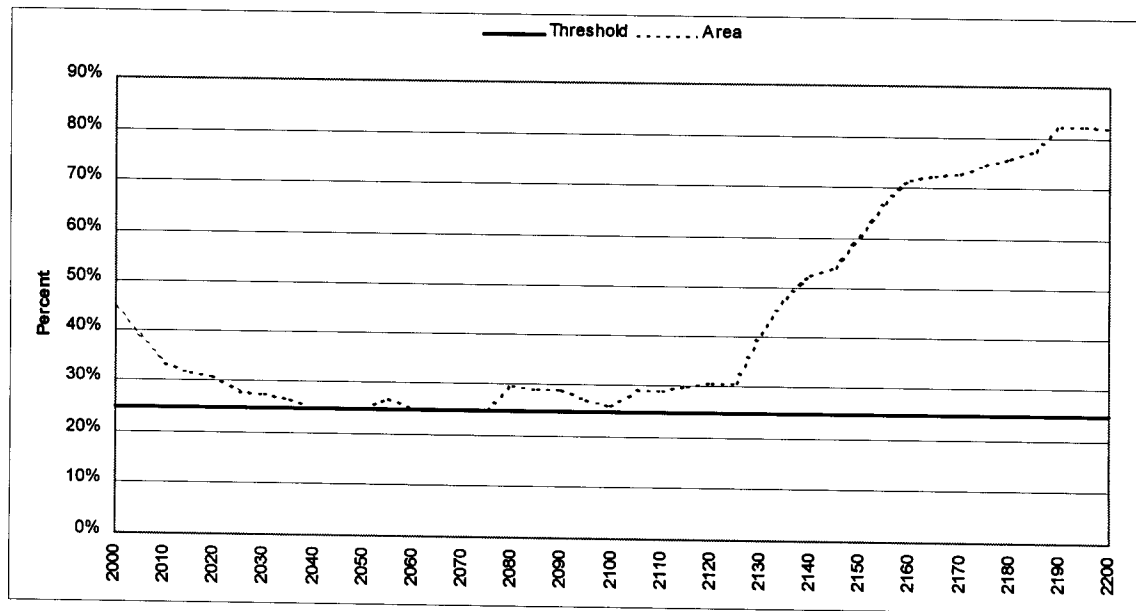


Figure 15: Area above the old seral minimum age in the special wildlife management areas

Watersheds

Hydrological green-up patterns are shown in Figure 16. The harvest in the Whitewood watershed is constrained at the 30% level between 2055 to 2080. The

undulating patterns in the graph are a result of the harvest shifting across the TFL.

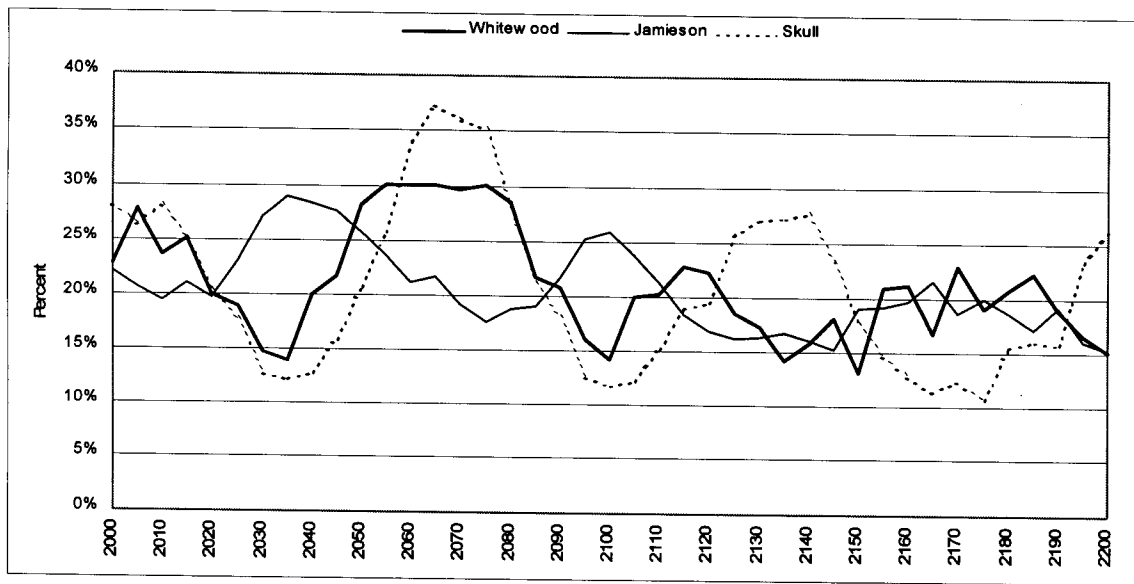


Figure 16: Area below hydrological green-up of 4.8 m

The base case age class distribution is shown on the next page in Figure 17.

Sensitivity Analysis

The degree of certainty with data, assumptions and procedures was measured through the sensitivity analyses outlined below. The list below is different than that submitted with the data package for several reasons.

1. Changing the percent old seral cover requirements $\pm 5\%$ was mirrored by the 1/3, 1/3, 1/3 and mule deer winter range thermal cover constraints, so to test the impact of immediate 3/3 old seral, the minimum age was lowered by 20 years.
2. Changing the regeneration volume $\pm 10\%$ was deemed to be redundant with the site index $\pm 3m$.
3. Given the stability of the green-up height monitoring in other sensitivity analyses, changing the green-up height $\pm 1m$ was not done.
4. Changing regeneration delay ± 2 years would have less of an impact than varying site index $\pm 3m$.

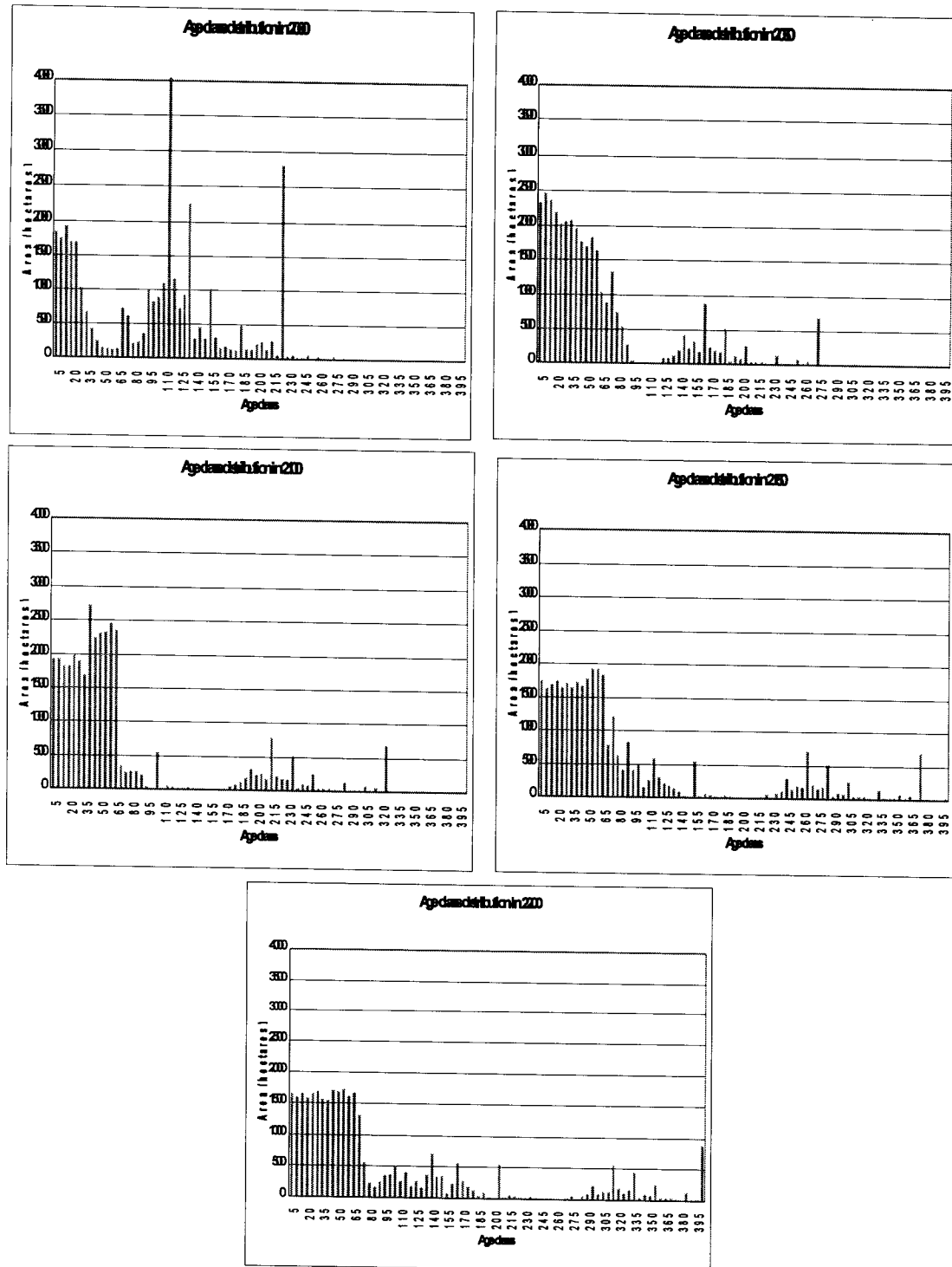


Figure 17: Age class distribution for the planning horizon

Table 4: Sensitivity and harvest flow analyses descriptions

Change	Rationale
Maximum initial level harvest	Test stability of a maximum short-term harvest level constrained by a maximum +/-10% per decade change
Forest cover constraints +/- 5%	± 5% in forest cover requirements for Mule deer winter range
1/3, 1/3, 1/3 old seral ¹	To demonstrate the impact of the 1/3 (draft OGMA's), 1/3, 1/3 implementation guidelines ² , with full WTP requirements
Mature plus old seral, on/off	Demonstrate the impact of applying mature and old seral stage guidebook values immediately
Minimum old seral ages	Lower minimum old seral age in the NDT3 from 140 to 120
Standing volume +/- 10%	To determine the impact on the harvest forecast of reducing and increasing standing mature volume by 10%
Site index +/- 3m	To determine the impact on the harvest forecast of changing the regenerated site index values for all species

Maximum initial level harvest

The alternative harvest flow tested in the base case mirrors the MoF policy of sustaining the short-term harvest level for as long as possible, allowing a decline of no more than 10% per decade, and slowly increasing to a long-run sustained yield. The changes made to WOODSTOCK are shown in the table below.

Table 5: Criteria, indicators, values and modeling techniques

Criteria	Indicator	Value	How incorporated into WOODSTOCK
Timber Supply	Harvest level	Maintain short-term harvest for at least 20 years	Harvest in periods 1 through 4 must be $\geq 125,200\text{m}^3/\text{yr}$
		Harvest decline must not be greater than 10% per decade	Harvest decline in one period must not decline more than 5% to the next
		Reach stable long-term sustained yield	Harvest level could vary +/- 5% around the average harvest level in the remaining periods

¹ Memo from Gary Townsend, Director Timber Supply Branch, Incorporating Biodiversity and Landscape Units in the Timber Supply Review, February 6, 1998.

² Biodiversity Guidebook, Chapter 2b. www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/chap2b.htm

Figure 18, below shows the harvest level and composition.

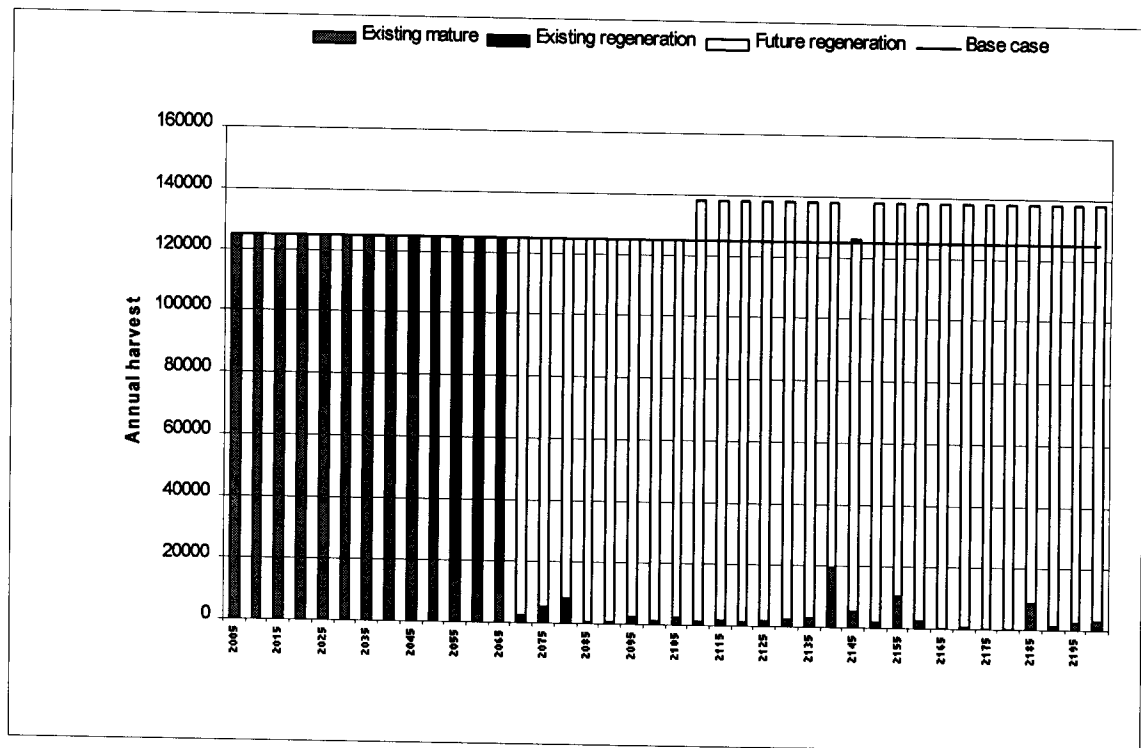


Figure 18: Harvest composition

The increase in harvest level in the later portion of the planning horizon changes some of the indicators relative to the base case. The graphs are in Appendix 3.

Mule deer winter range forest cover constraints +/- 5%

To model a 5% change in forest cover requirements, the constraints within WOODSTOCK were changed to the values specified below. The results are shown in the following graphs, with the base case displayed for reference.

Table 6: Mule deer winter range forest cover constraint sensitivity

Forest cover constraint	sensitivity
25% Mule deer winter range at $\geq 20\text{m}$	30% $\geq 20\text{m}$
	20% $\geq 20\text{m}$

Figure 19 shows the harvest level and composition when the Mule deer winter range thermal requirements are increased 5%. There is a slight change as harvest level drops $22\text{m}^3/\text{yr}$ to $125,262\text{m}^3/\text{yr}$.

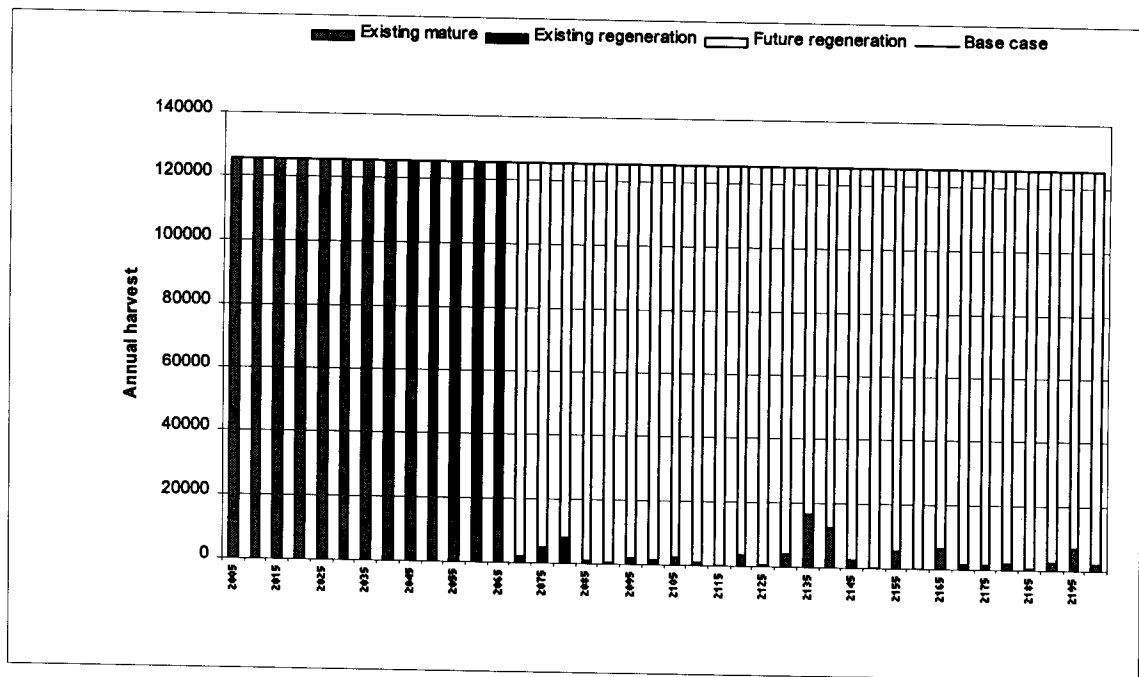


Figure 19: Harvest composition

There is a slight change in the other indicators, resulting from a shifting of the harvest sequence. These graphs are in Appendix 3.

Figure 20 shows the harvest composition with a 5% decrease in mule deer winter range thermal cover. There was no impact on total harvest; the composition later in the planning horizon was slightly different.

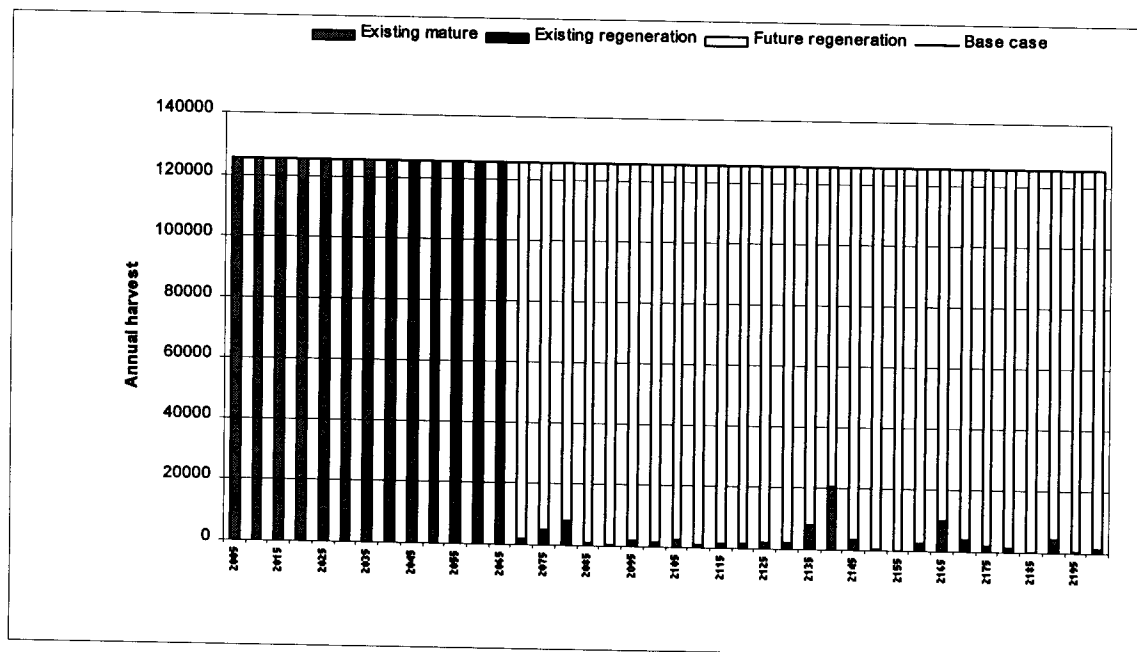


Figure 20: Harvest composition when Mule deer winter range thermal cover is decreased 5%

The remaining graphs are in Appendix 3. Reducing the amount of thermal cover required in the mule deer winter range has no impact on harvest levels because the most limiting factor is the immediate 3/3 old seral constraint.

1/3, 1/3, 1/3 old seral

The letter April 22 1999 and attachment (Timber Supply Review Base Case Modeling Assumptions for Biodiversity and Landscape Units) from Gary Townsend to the TSR Timber Supply Analysts and TSR Committee outlines the process to use for incorporating biodiversity into the TSR. The document states that "The deputies' letter calls for application of this seral stage constraint in forest development planning if there is no timber supply impact (non-constraining). The definition of non-constraining is "no impact on the projected harvest flows over the entire period of the timber supply analysis, over the TSA or TFL".

The letter goes on further to state "As per the BGB and the deputies letter, it is possible to initially set the old seral stage constraint to one third of the guidebook value. This reduced constraint should be used whenever applying the full old seral stage constraint will be constraining on timber supply". The letter then reviews the process for a 1/3, 1/3, 1/3 old seral implementation.

To model a 1/3, 1/3, 1/3 old seral recruitment strategy for NDT3, old seral constraints were introduced gradually. No changes were made to the area file to add back in the 17.6 hectares of NDT4, removed for the old seral recruitment process. The table below shows the phase-in for NDT3.

Table 7: 1/3, 1/3, 1/3 NDT3 phase-in strategy

Amount	Period	Time
4.62% >= 140	1 to 13	0 to 65
9.38% >= 140	14 to 27	70 to 135
14% >= 140	28 to 40	140 to 200

The 1/3, 1/3, 1/3 strategy increases the harvest level 5% to 131,116 m³/yr, with significantly less harvest of existing mature and regeneration later in the planning horizon. Figure 21 below shows the harvest composition.

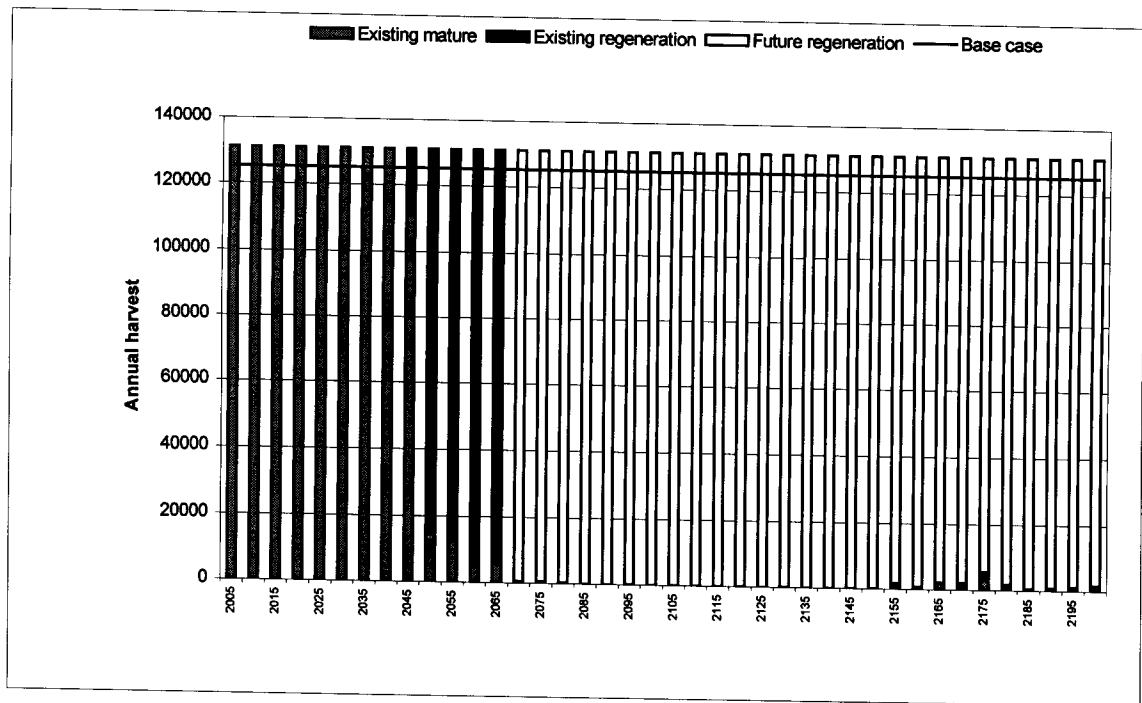


Figure 21: Harvest composition

The NDT3 old seral trends (Figure 22) are different than the base case and step up to the required levels stated in Table 7 above.

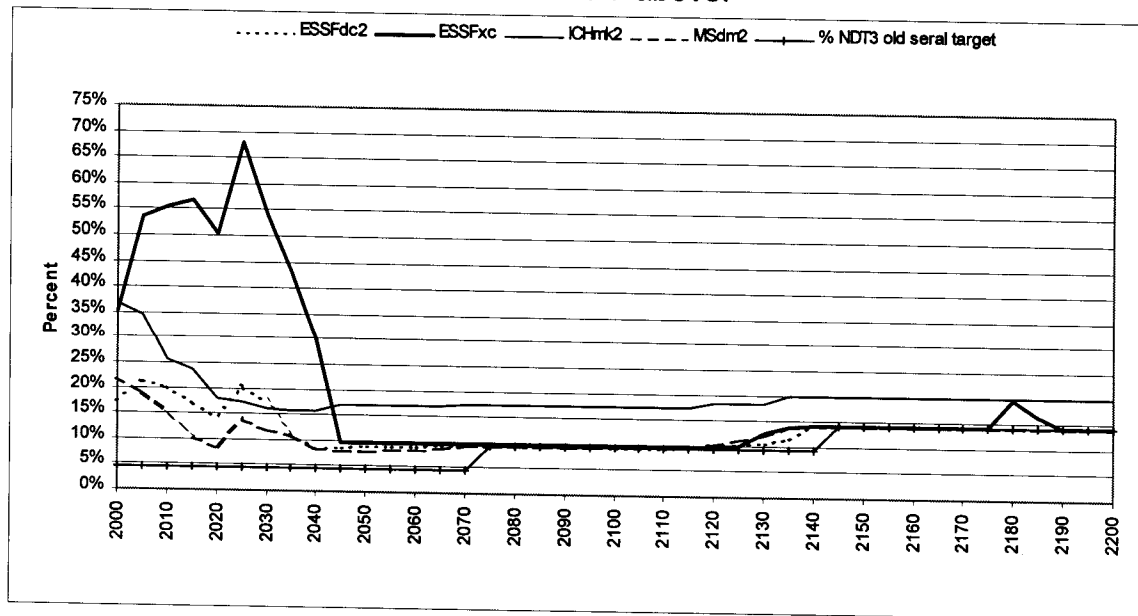


Figure 22: NDT3 old seral

The other indicators are not significantly impacted by the old seral phase-in. Comparisons are shown in Appendix 3.

Mature plus old seral, on/off

The biodiversity guidebook states that the percent mature plus old for NDT3 is 14% and NDT4 is 17%. Because the old seral requirement for NDT3 is 14% and this is already met in the base case, only the NDT4 requirement was assessed. Inspection of the base case NDT4 old seral graphs indicates that no old seral exists for 25 years into the planning horizon. To ensure that 17% mature plus old was available, WOODSTOCK was constrained to provide an additional 4% of the NDT4 landbase greater than 100 years of age for the first 25 years only. The constraint was then removed. Figure 23 shows the results.

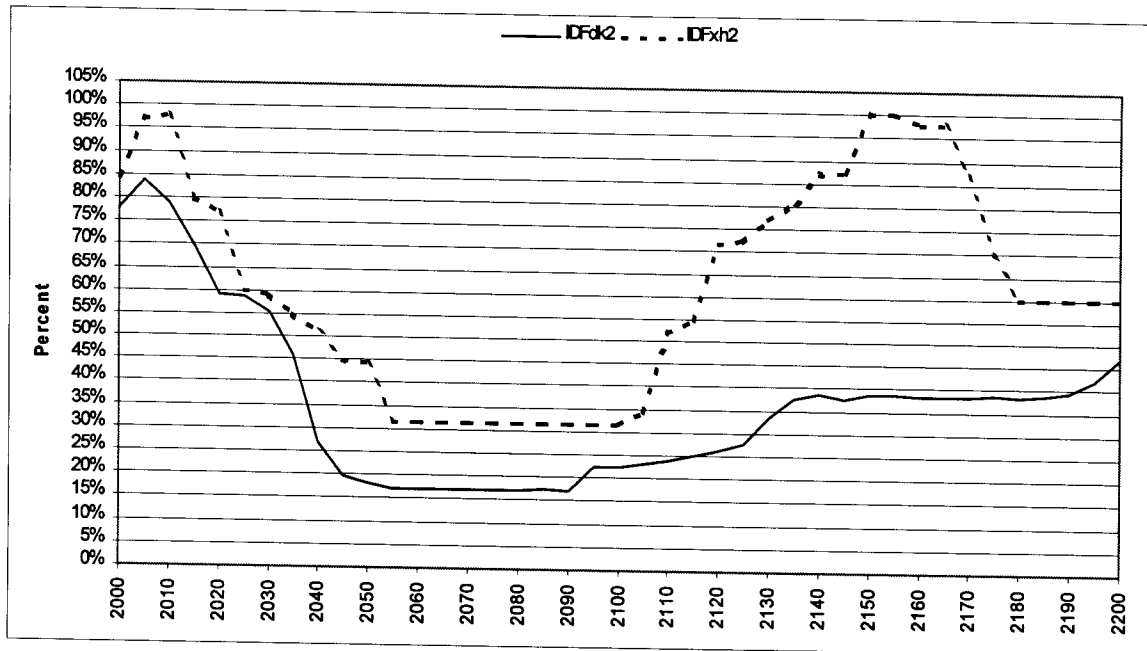


Figure 23: NDT4 mature plus old

There was no impact on harvest levels and only slight changes in all other indicators, due to some sequencing changes. These graphs are in Appendix 3.

NDT3 minimum old seral age lowered to 120

To model a lower minimum old seral age, the minimum age threshold was reduced 20 years to 120. The impact was to increase harvest by 0.7% to 126,258m³/yr.

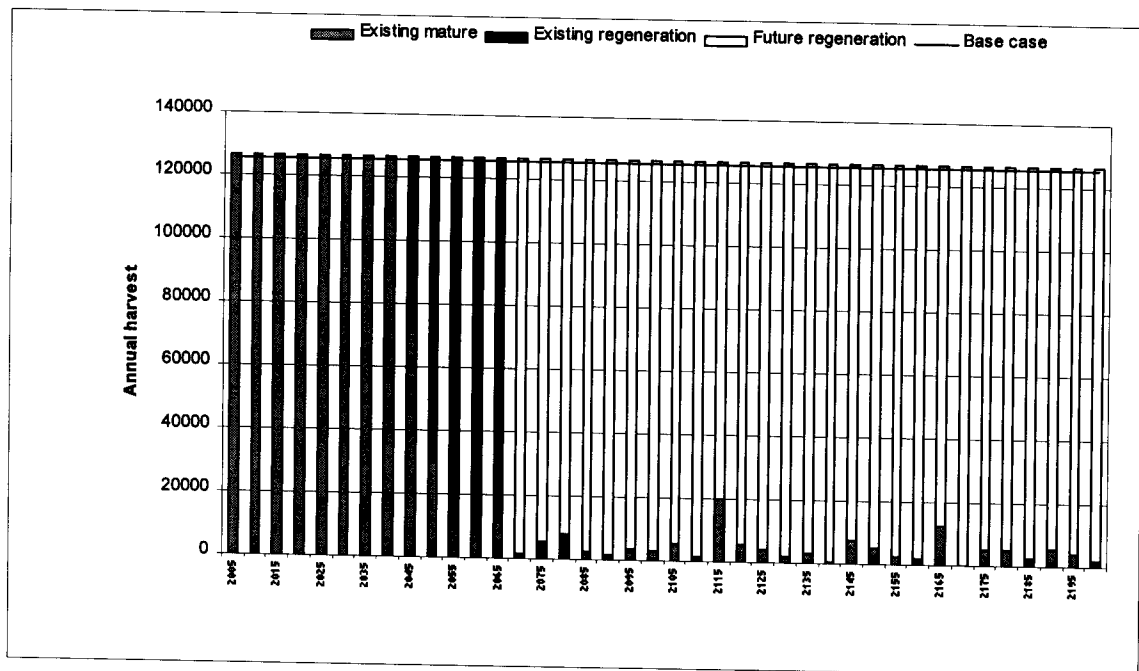


Figure 24: Harvest composition

Migration of the old seral from the THLB to the NTHLB is stretched out over a longer period of time as can be seen in Figure 24. The additional old seral in NDT3 changes the distribution (Figure 25), and produces slight shifts in all the other indicators (Appendix 3).

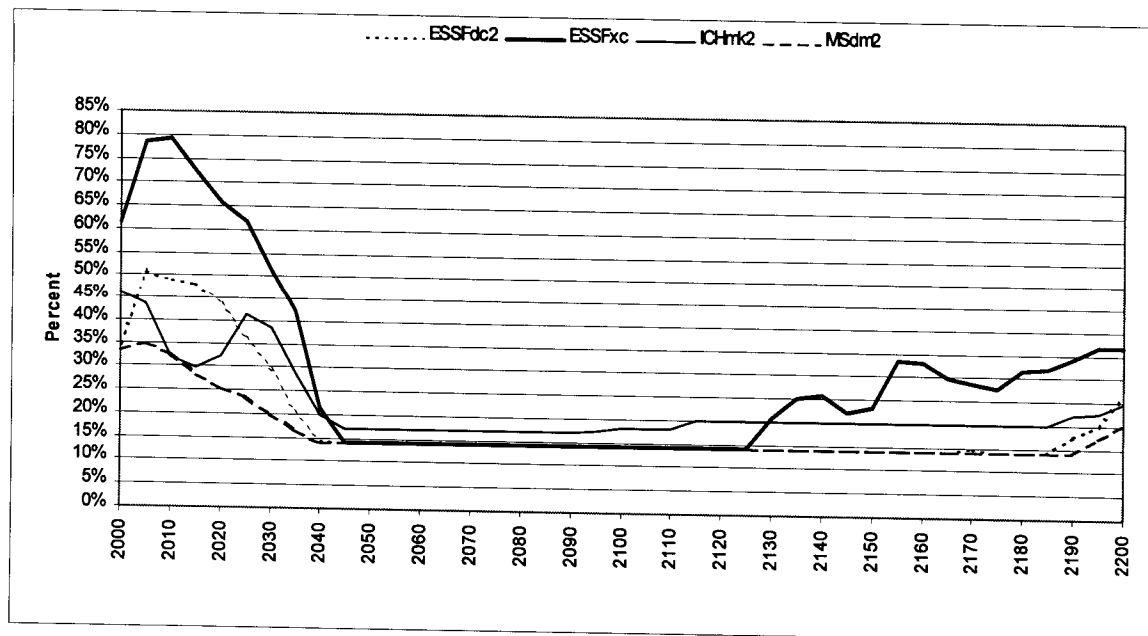


Figure 25: NDT3 old seral

Standing mature volume +/- 10%

To model a 10% change in standing mature volume, each mature yield curve in WOODSTOCK was scaled up and down 10%. A 10 percent increase in standing mature volume increased harvest levels 6.9% to 133,898 m³/yr (Figure 26).

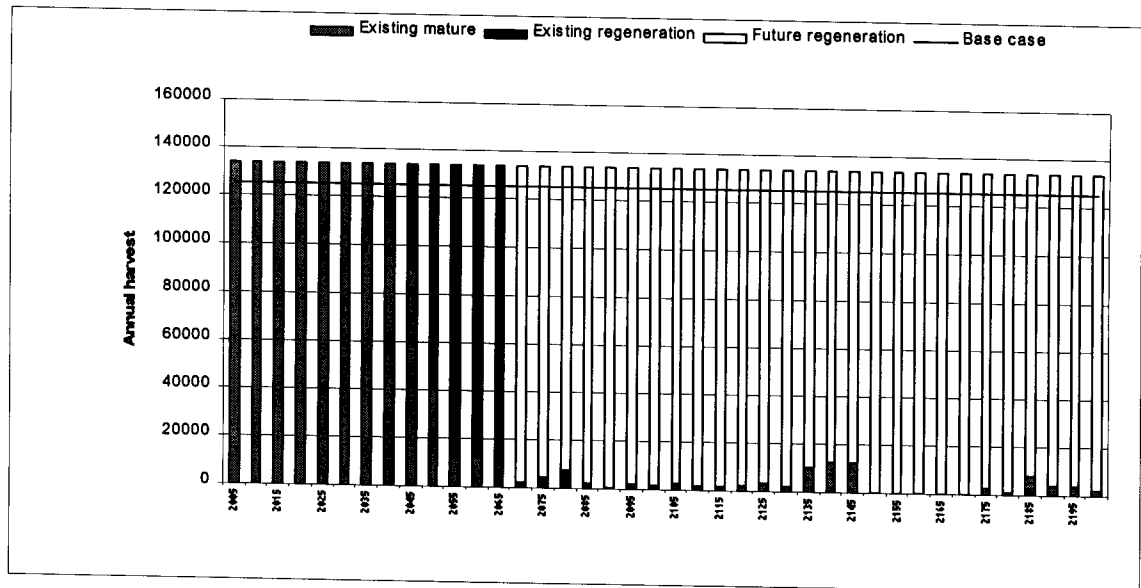


Figure 26: Harvest composition

The indicator patterns shifted to reflect the increased standing volume and harvest, however no new constraining points were identified. The remaining graphs are in Appendix 3. A 10 percent decrease in standing volume, decreased harvest levels 7.5% to 115,809 m³/yr (Figure 27).

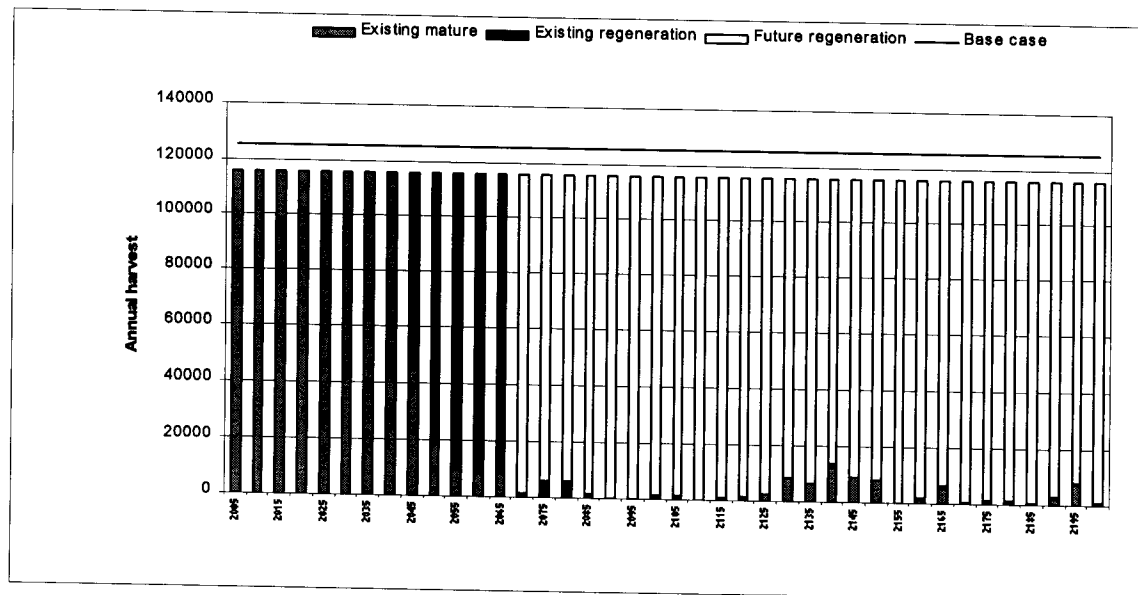


Figure 27: Harvest composition

The transition period starts 5 years earlier and the patterns of the other indicators

are similar. Differences are evident later in the planning horizon and are due to the higher levels of growing stock (Figure 28) from the lower harvest level. The remaining graphs are in Appendix 3.

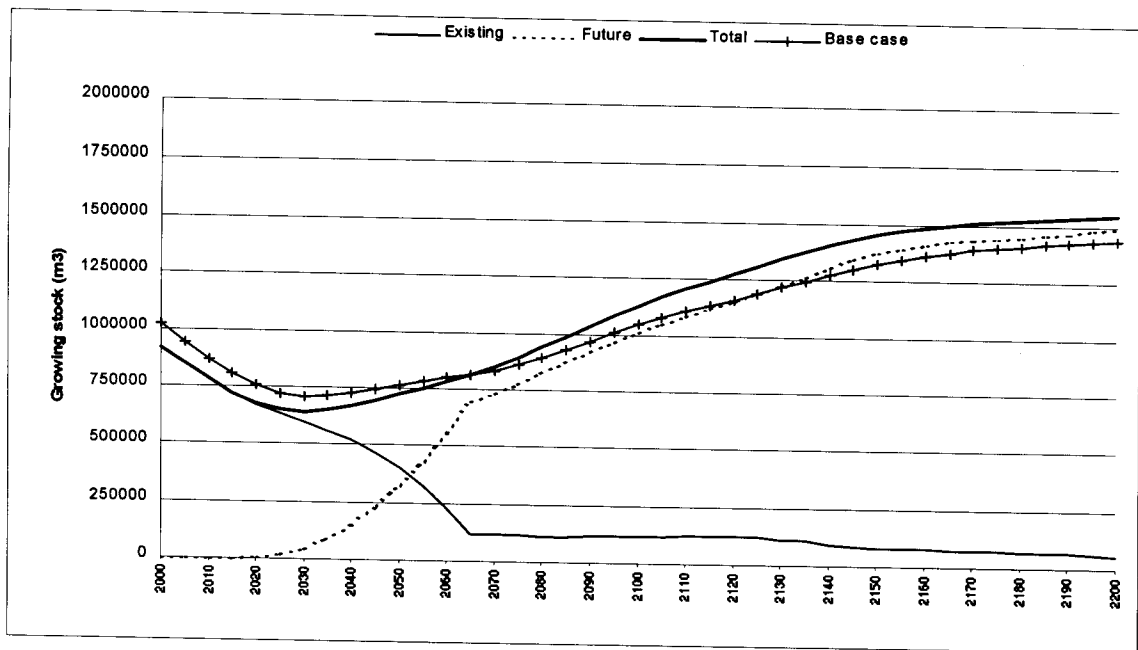


Figure 28: Growing stock

Site index +/- 3m

To model a 3m change in site index, the future regeneration yield curves were rerun using revised site indices in TIPSy. The graphs are on the following pages and the revised site indices are in the table below.

Table 8: Site indices used for +/-3m sensitivity analysis

Yield table	Original site index	+3m site index	-3m site index	Yield table	Original site index	+3m site index	-3m site index
1_f5p5_21	21	24	18	2_p9f1_18	18	21	15
1_f7p3_21	21	24	18	2_p_18	18	21	15
1_p8s2_21	21	24	18	2_p5f5_18	18	21	15
1_p9f1_21	21	24	18	2_p8s2_18	18	21	15
1_Pl_Plant_21	21	24	18	2_p9f1_18	18	21	15
1_s5f5_22	22	25	19	2_s_19	19	22	16
1_s8p2_22	22	25	19	3_f_16	16	19	13
2-f7p3_17	17	20	14	3_p_15	15	18	12
2_f_17	17	20	14	3_p7s3_15	15	18	12
2_f7p3_17	17	20	14	3_s_15	15	18	12
2_p_18	18	21	15	4_p7s3_10	10	13	7
2_p5f5_18	18	21	15	5_f_16	16	19	13
2_p8s2_18	18	21	15	5_f7s3_16	16	19	13

When the regeneration site indices were lowered 3m the harvest level dropped 6.4% to 117,192 m³/yr. While the transition period starts at the same time as the base case, the duration is stretched out much longer (Figure 29).

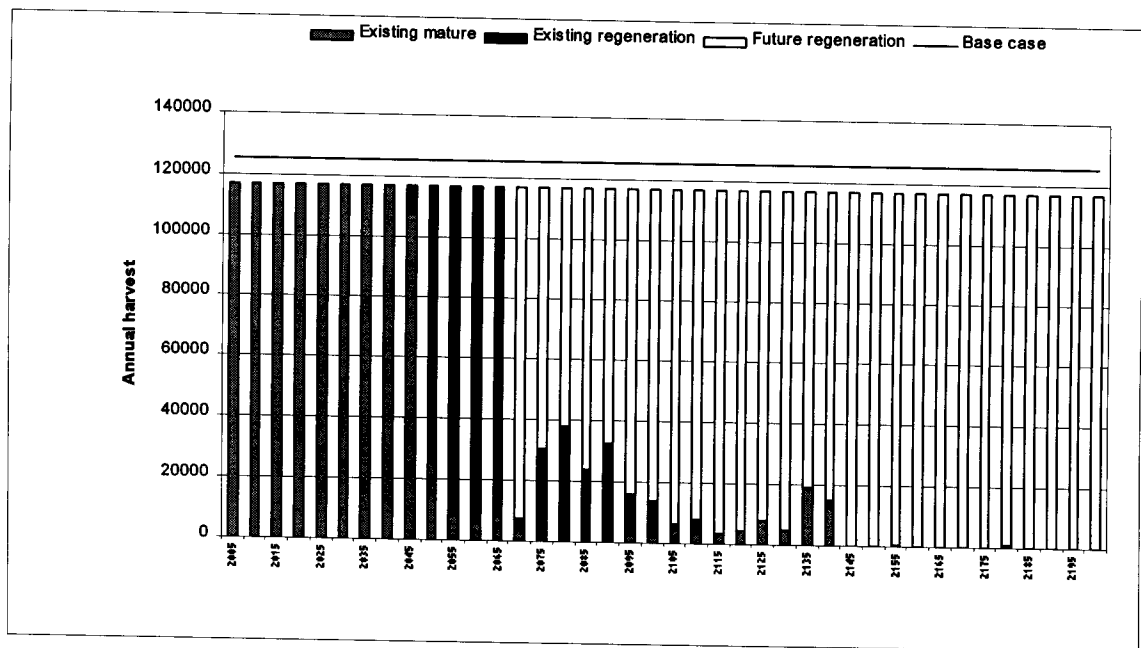


Figure 29: Harvest composition

The existing growing stock is being harvested over a longer period of time until the future regeneration attains the minimum merchantability limits. The lower regeneration site indices will generate less volume and this can be seen in Figure 30.

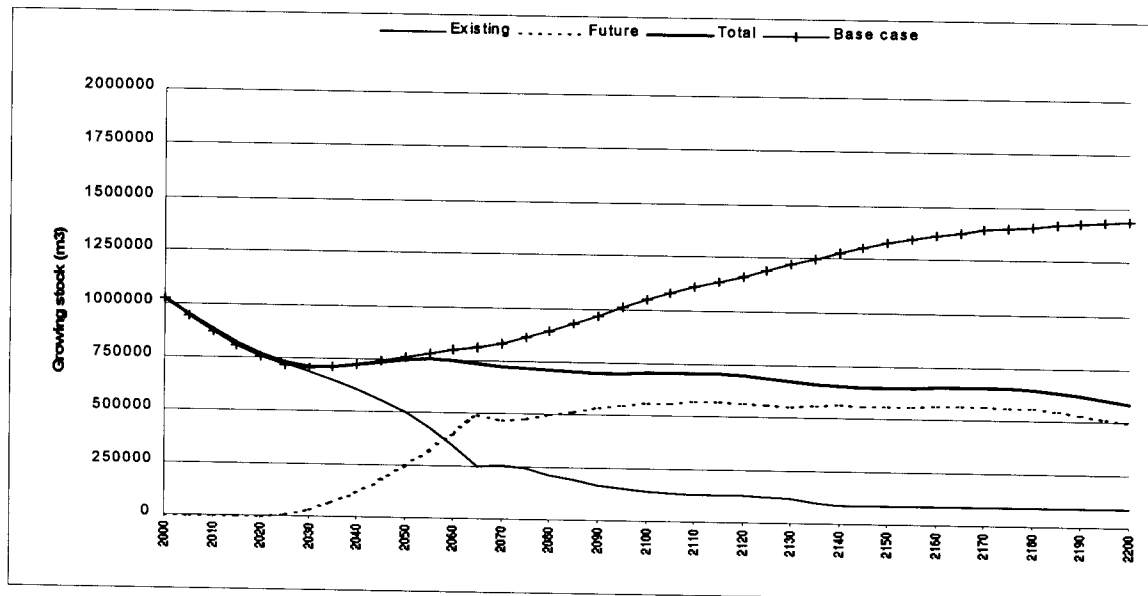


Figure 30: Growing stock

The lower site indices impact the harvest age/forest level culmination age

relationship (Figure 31) and average harvest volume and area (Figure 32) relative to the MoF base case.

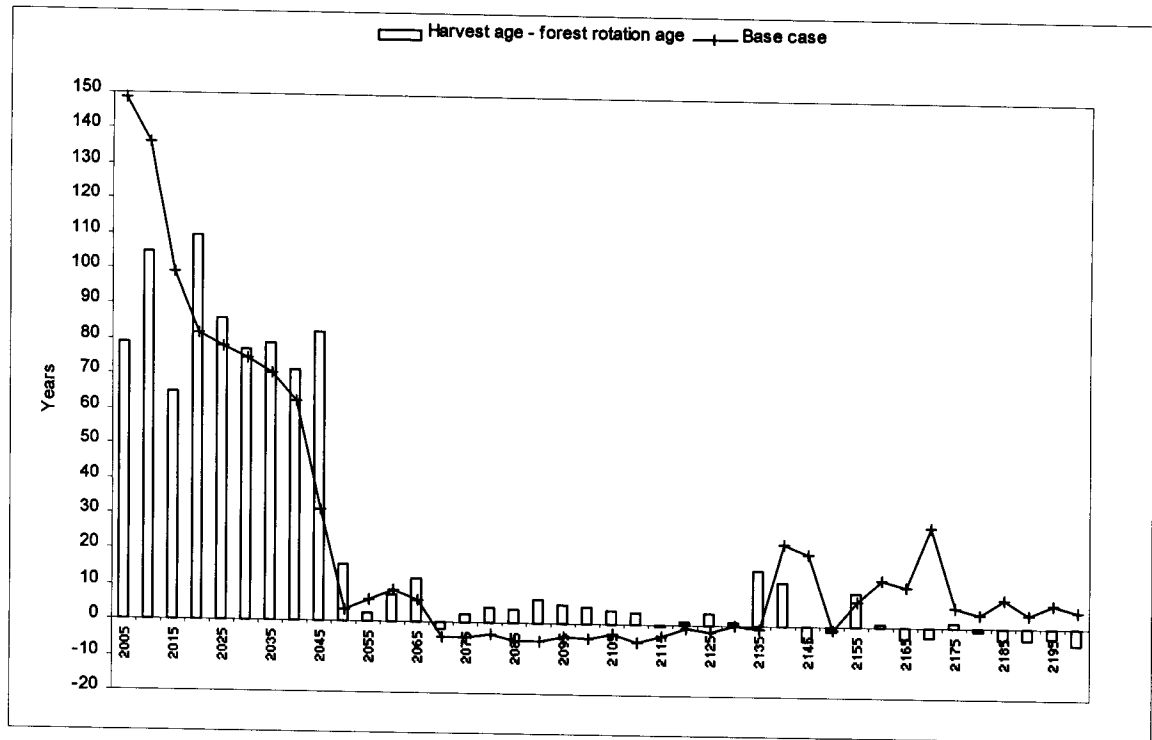


Figure 31: Harvest age - forest level culmination age

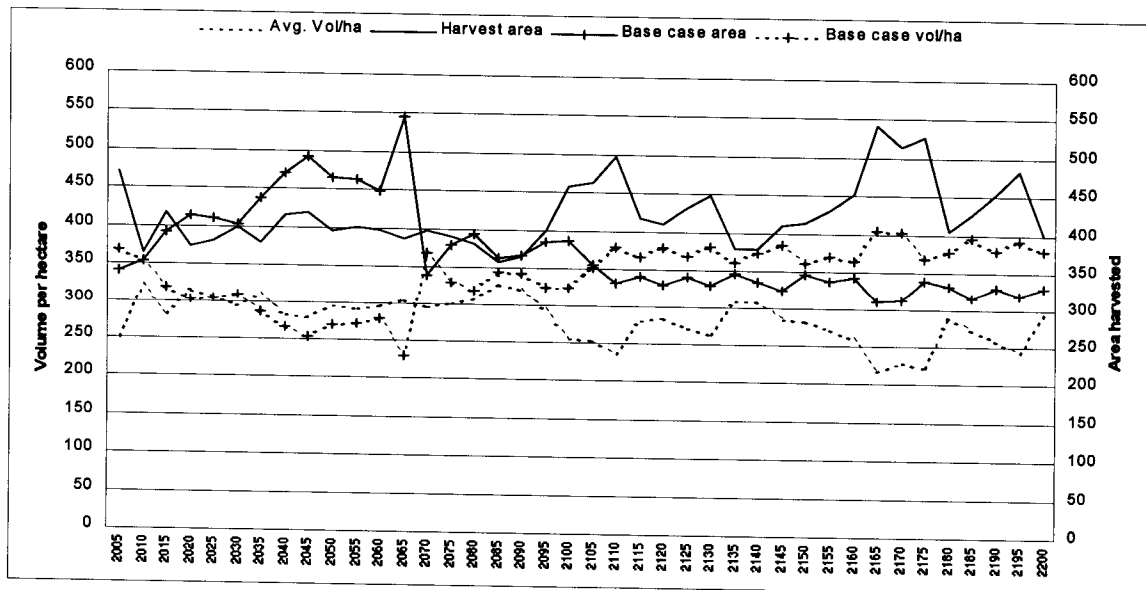


Figure 32: Average harvest volume and area

The lower site indices generate more activity across the TFL and as a result, the patterns of the remaining indicators are different relative to the base case. Appendix 3 contains the remaining graphs.

When the regeneration site indices were increased 3 meters, the harvest level increased slightly to 125,368 m³/yr.

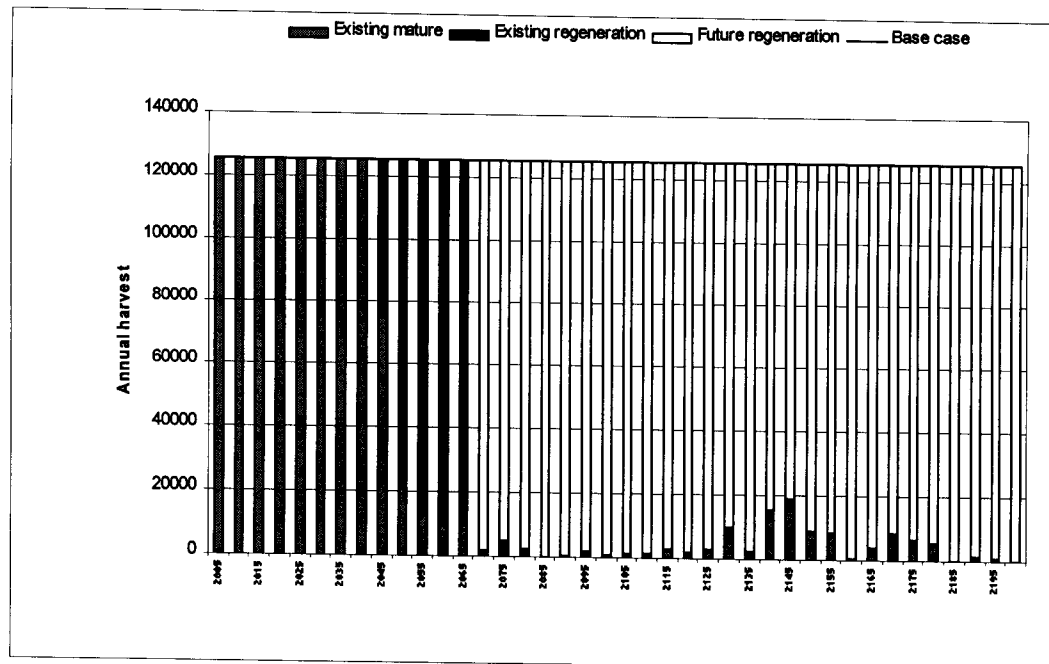


Figure 33: Harvest composition

The additional regenerated growing stock is unable to mitigate the effects of the old seral constraints on harvest levels and the mature growing stock is unable to bridge the transition period when sufficient future regeneration volume is available. This is evident on the growing stock graph, and on the NDT3 old seral graphs.

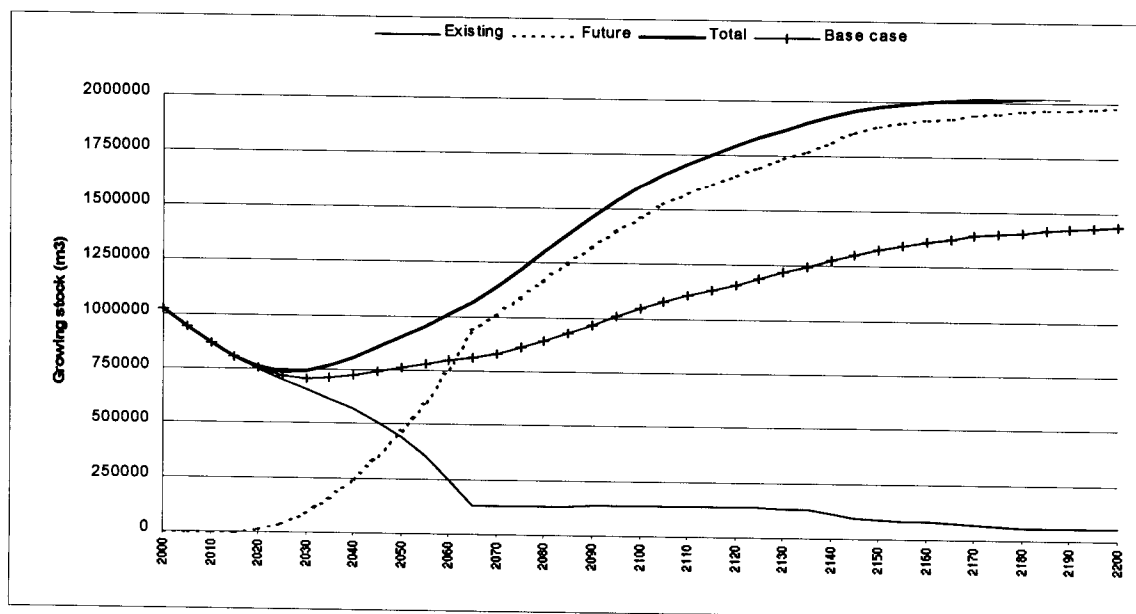


Figure 34: Growing stock

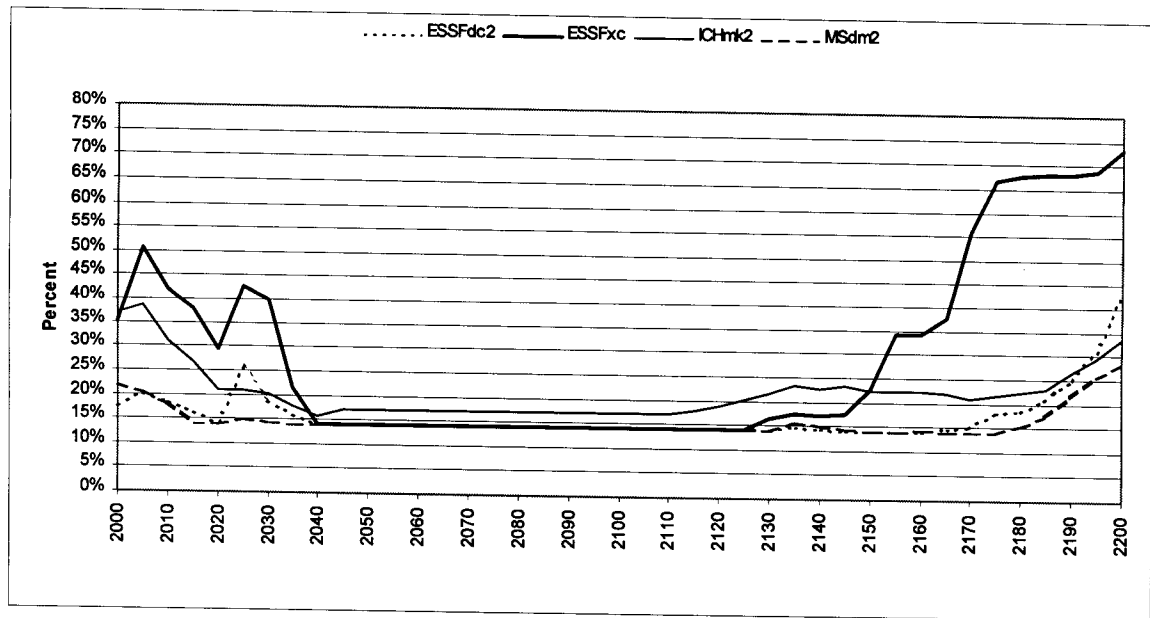


Figure 35: NDT3 old seral

The trends of the other indicators are influenced by the additional growing stock, and the graphs are in Appendix 3.

OPTION 2: BASE CASE WITHOUT BIODIVERSITY CONSTRAINTS

A series of analyses determined the impact to short and long term harvesting levels attributable to draft landscape unit biodiversity emphasis options stated in the Kamloops LRMP. This scenario reflects the harvest level available without old seral and WTP requirements while meeting all other constraints. The Kamloops LRMP specified the objective:

“To conserve the diversity and abundance of native species and their habitats throughout the Kamloops LRMP, following upon direction provided by the forest practices code biodiversity guidebook.”

It then specified a sequence of strategies to be followed to meet this “desired future state¹.” One of these strategies is:

“Limit the impact of landscape unit biodiversity emphasis options to no more than 4% of the level of timber harvesting in the LRMP over the short or long term.”

This option is the foundation upon which the impact on TFL35 can be measured.

Weyerhaeuser's current performance will include requirements from the Forest Practices Code (FPC), new growth and yield data, current silvicultural practices, current

¹ Kamloops Land and Resource Management Plan Monitoring Framework, August 1999 page 5

practice regarding rehabilitation of all in-block roads and landings and appropriate forest-cover, green-up and maximum allowable disturbance and cut block size limitations. Reductions for the identified wildlife strategy were not included.

Results

Option 2 is similar to the base case, except that 3/3 old seral is not modeled, WTP requirements are not included. Table 9 below summarizes the differences between Option 1 and 2.

Table 9 : Criteria, indicators, values and modeling techniques

Criteria	Indicator	Value	How incorporated into WOODSTOCK
Old Seral	Percent area meeting old seral criteria for NDT3 (ESSFxc, ESSFdc2, MSdm2, ICHmk2)	Gross forested area greater than 140 years	Modeled as output variable and amount exceeding minimum age monitored
	Percent area meeting old seral criteria for NDT4 (IDFdk2, IDFxh2)	Gross forested area greater than 250 years	Modeled as output variable. Amount exceeding minimum age monitored.

Timber supply

The harvest level for Option 2 is 142,141 m³/yr (Figure 36), with a transition period between the existing forest and the future forest from 2045 to 2065.

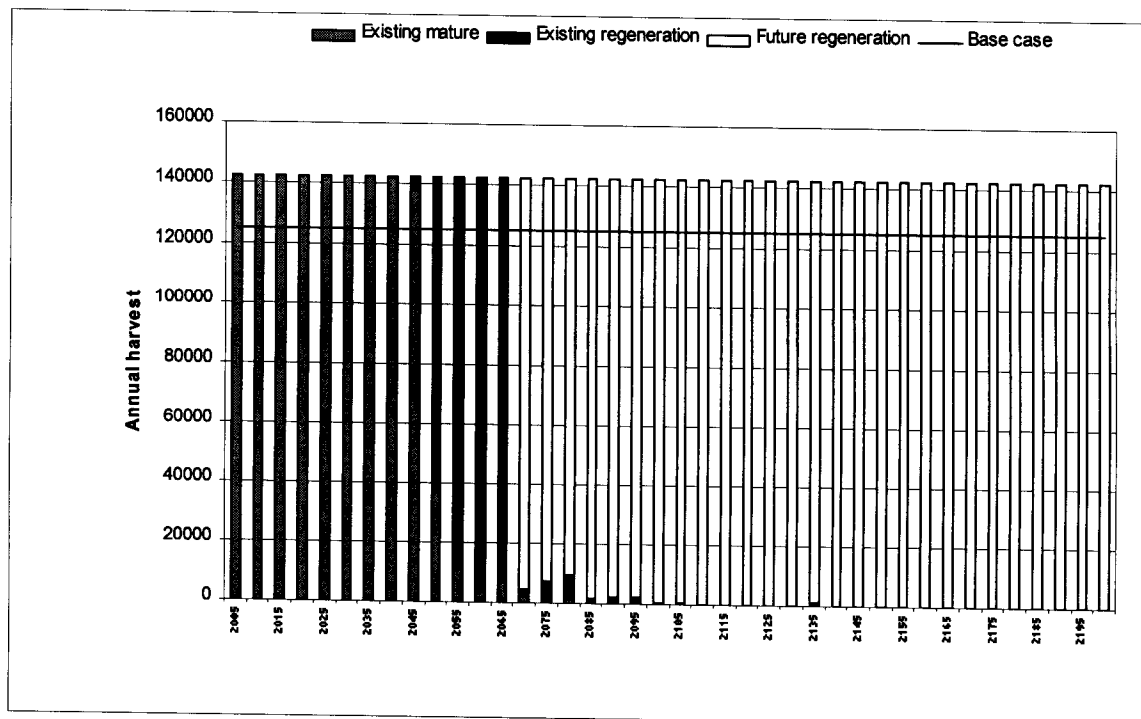


Figure 36: Harvest composition

The majority of the harvest from 2070 is from future regeneration with small mixes of existing forest being harvested out to 2135. The minimum average volume per hectare is 236 m³/ha (Figure 37) and coincides with an average harvest age of 76 in 2060.

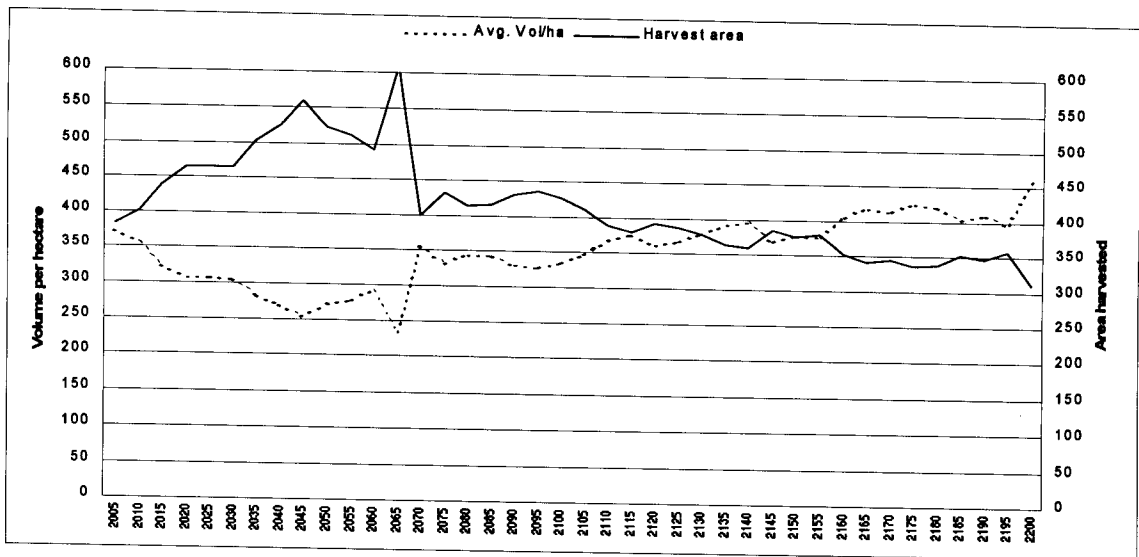


Figure 37: Harvest volume and area

The growing stock low point is 717,701 at 2035 (Figure 38). The difference in growing stock relative to the base case is because the 1/3 draft OGMA's are not identified in Option 2.

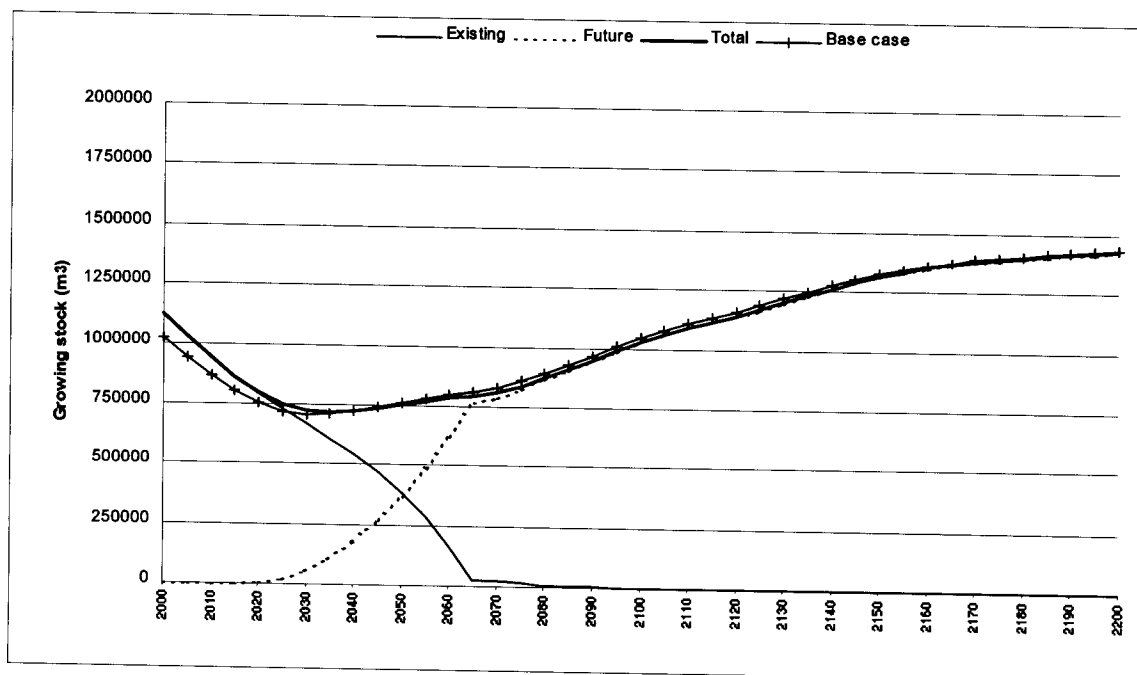


Figure 38: Growing stock

There were no concerns with green-up (Figure 39), or adjacency issues in the general management or special wildlife management areas.

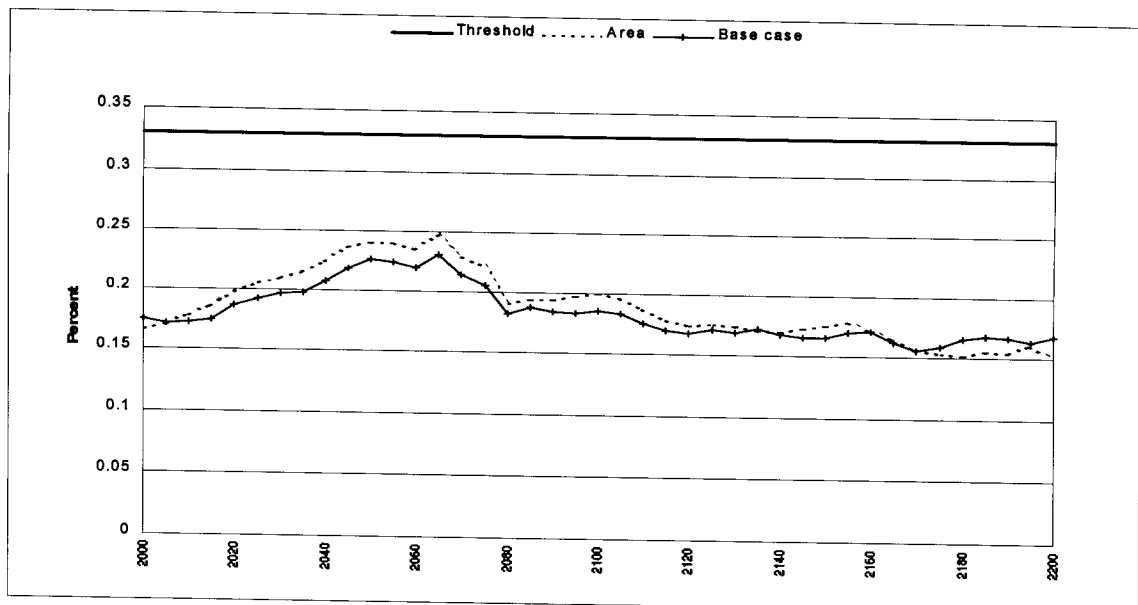


Figure 39: Area below 3m green-up height, general management and special wildlife management areas

Old Seral

Old seral is maintained throughout the planning horizon in the NDT3 (Figure 40). Minimum and maximum levels vary by Biogeoclimatic variant. Old seral in the NDT4 (Figure 41) does not exist until 2025 because the oldest stands are 225 at the start of the planning horizon. The stands comprising the old seral are from the non-timber harvesting landbase. The difference in percent old seral relative to the base case is because 1/3 draft OGMA's are not identified.

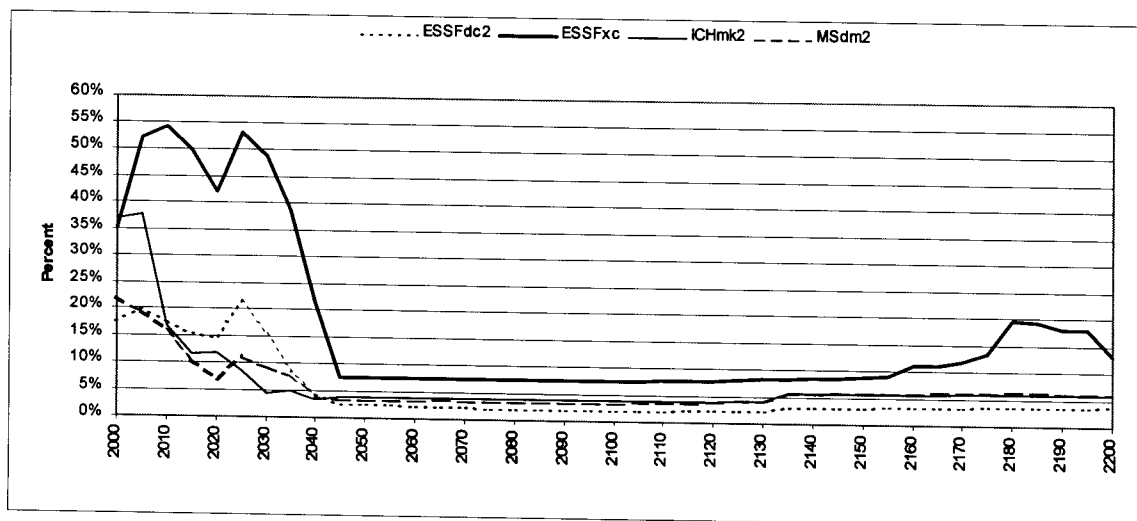


Figure 40: NDT3 old seral

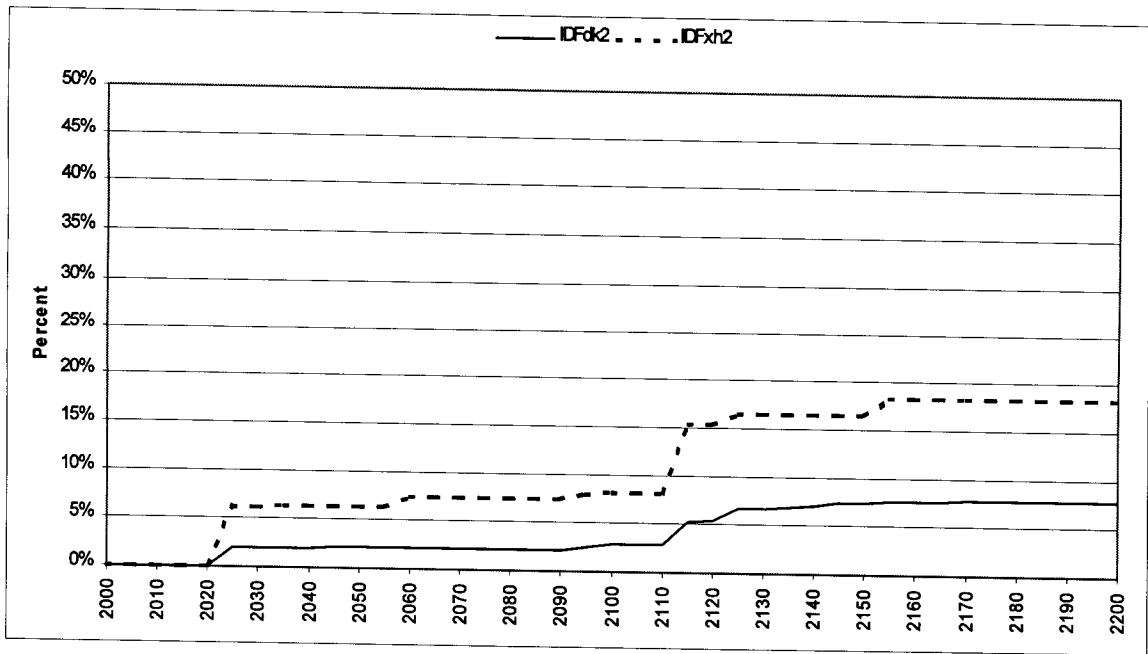


Figure 41: NDT4 old seral

Landscape management zone

Figure 42 shows that those areas with a modification VQO (893.4 hectares), green-up and maximum harvest area criteria are not constraining the harvest.

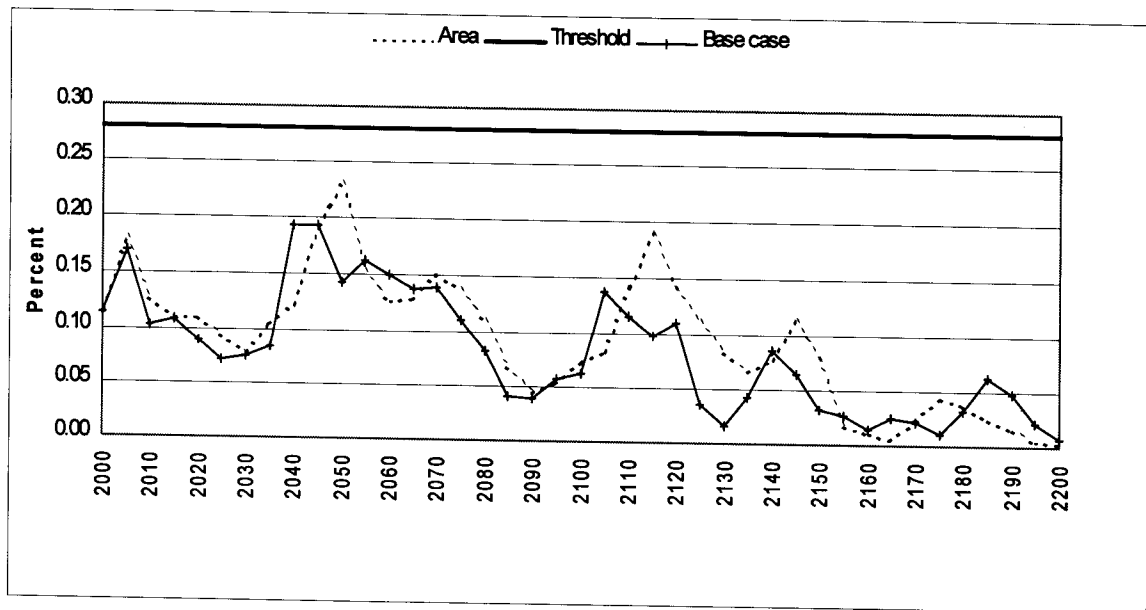


Figure 42: Area below 3.2m green-up height, modification VQO

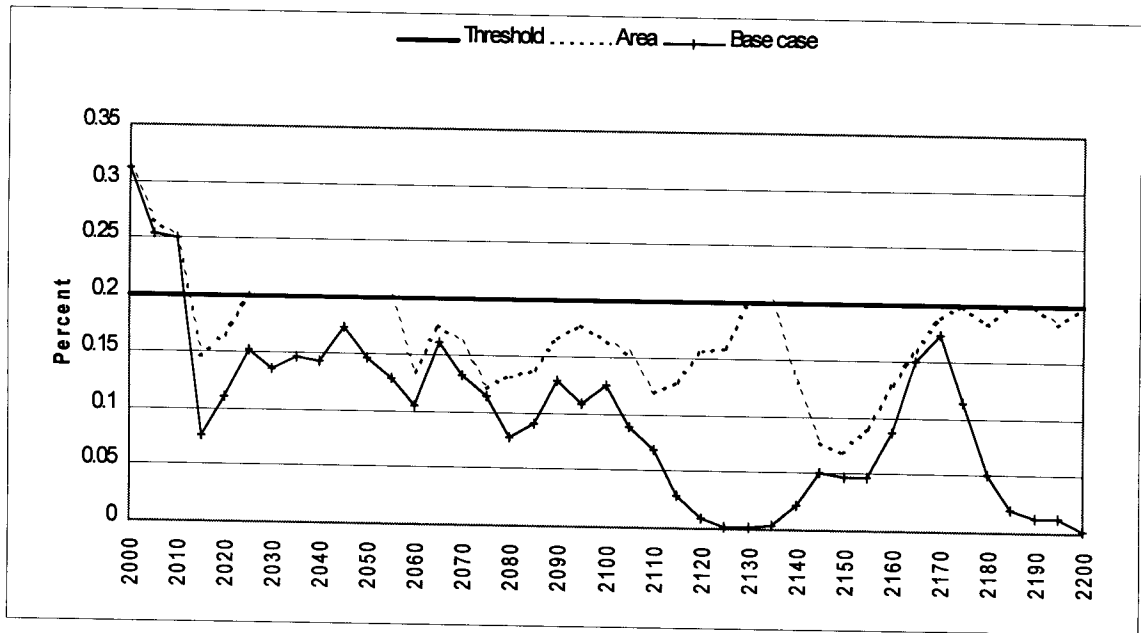


Figure 43: Area below 3.9m green-up height, partial retention VQO

In the partial retention VQO areas (1,033.3 hectares), the percent area disturbance maximums and green-up thresholds become slightly constraining at several points in the planning horizon (Figure 43).

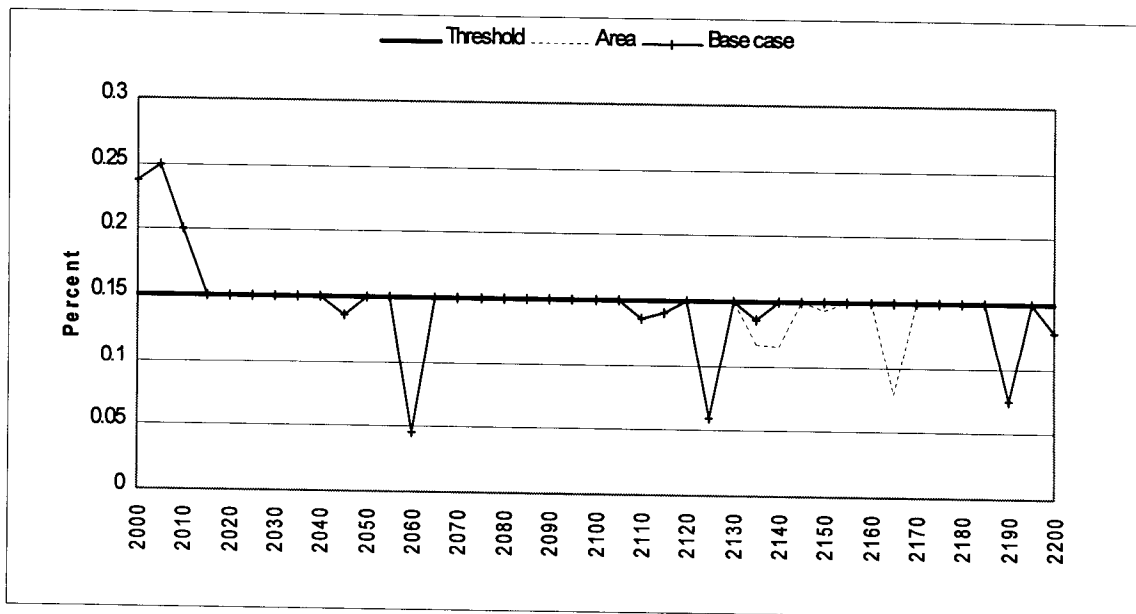


Figure 44: Area below 3.9m green-up height, retention VQO

In the retention VQO area (207.6 hectares), the percent area disturbance maximums and green-up thresholds are reached almost continuously throughout the planning horizon (Figure 44).

Mule deer winter range

Mule Deer thermal cover is shown in Figure 45. Threshold levels of thermal cover occur between 2050 and 2085. This occurs at the onset of the transition period and continues for the first 15 years of harvest of the future regeneration.

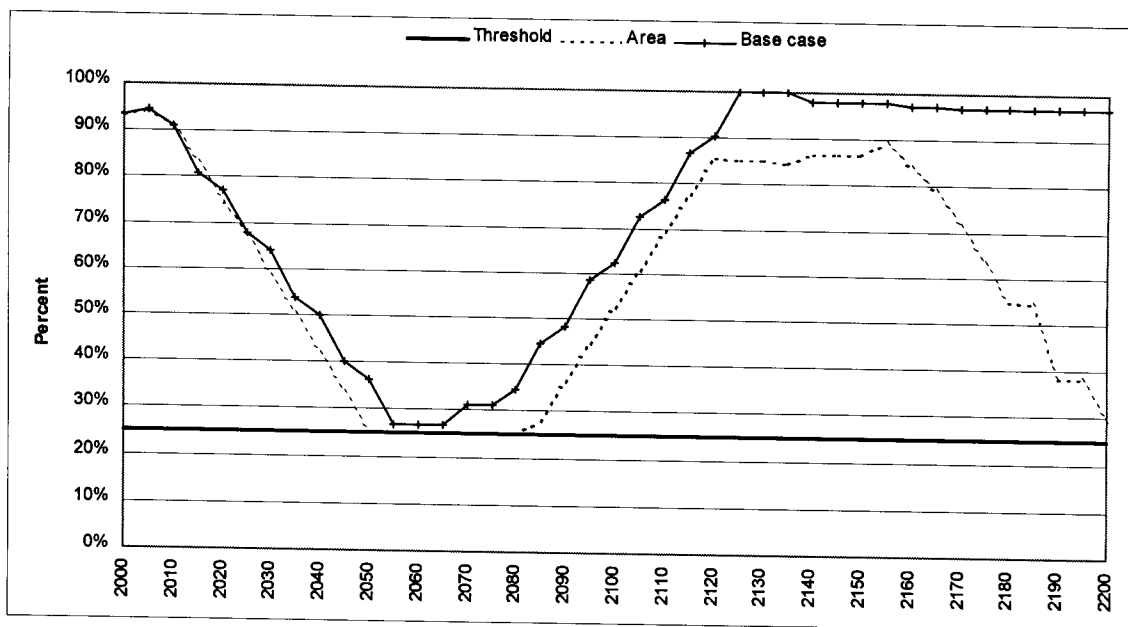


Figure 45: Area above 20m thermal cover height, mule deer winter range

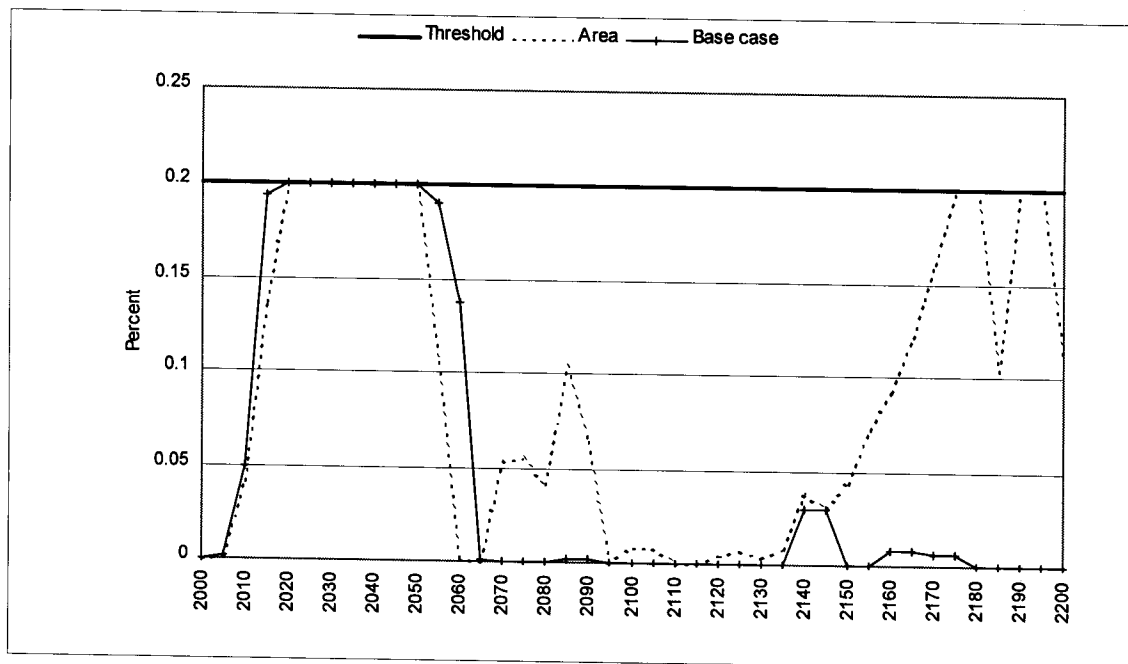


Figure 46: Area below 3m green-up height, mule deer winter range

Block size and green-up (Figure 46) are constraining early and towards the end of the planning horizon (2020).

Special wildlife management areas

Figure 47 shows the amount of mature stands (85 years +) within the special wildlife management areas. These thresholds Weyerhaeuser set are constraining throughout most of the planning horizon.

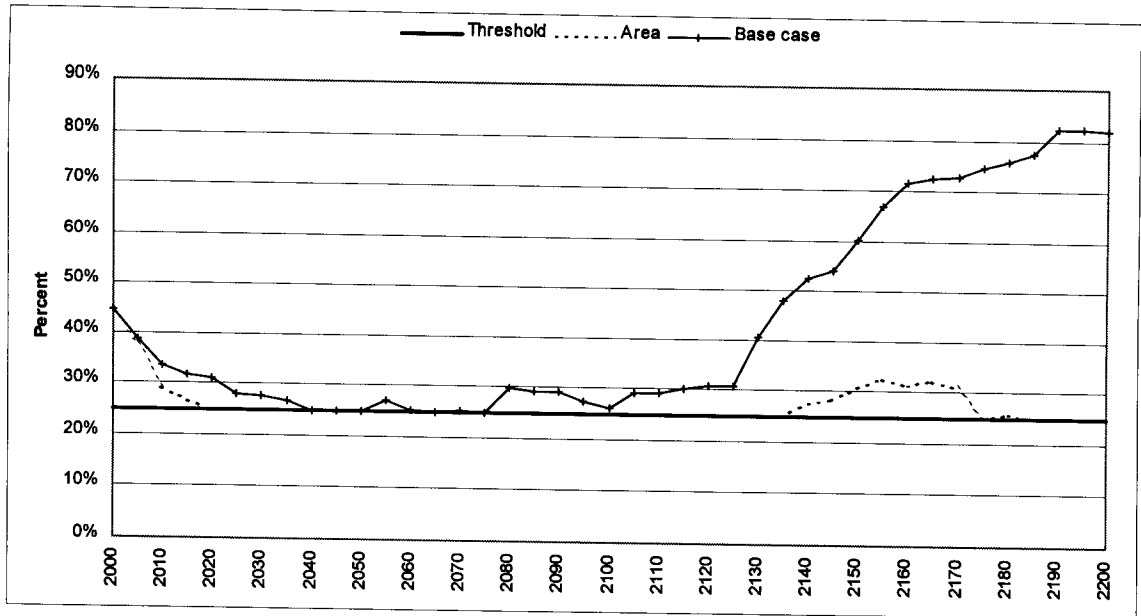


Figure 47: Area above minimum old seral age, wildlife special management areas

Watersheds

Figure 48 shows the area of stands less than or equal to 4.8 meters. Whitewood creek was constrained to not exceed 30%.

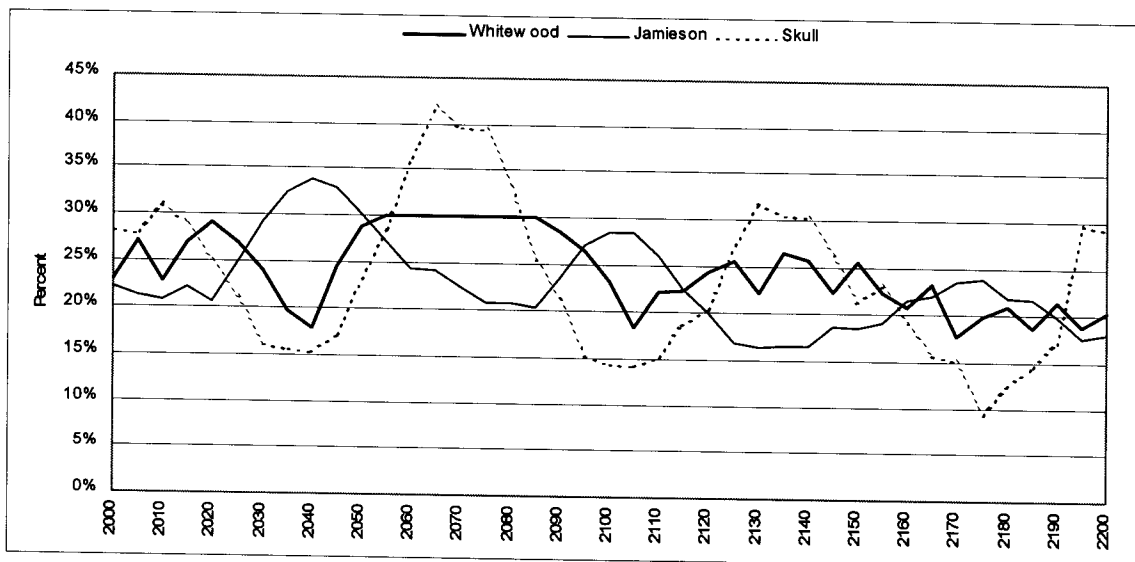


Figure 48: Area below 4.8m hydrological green-up

Figure 49 shows the age class distribution throughout the planning horizon.

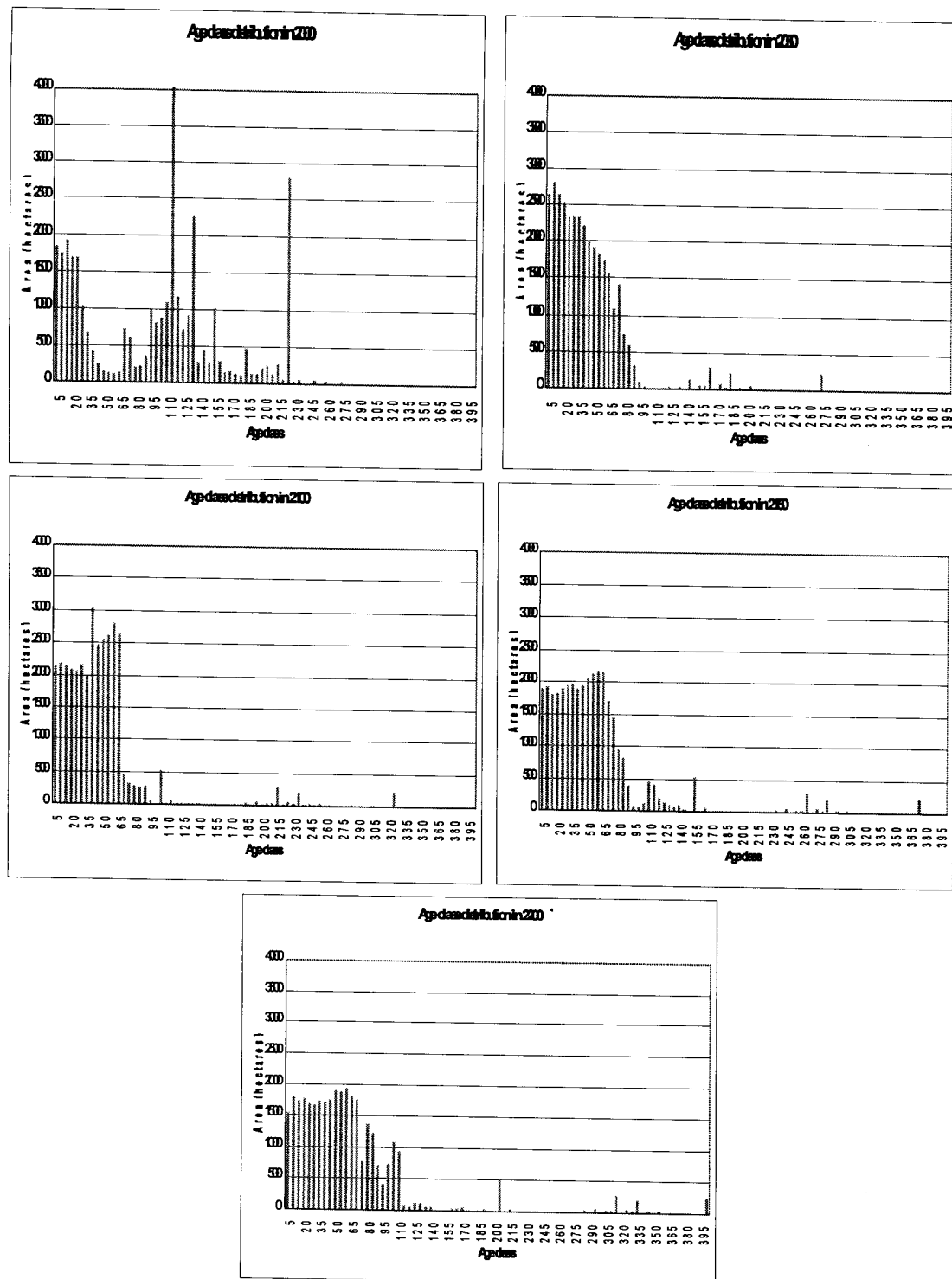


Figure 49: Age class distribution over the planning horizon

RECOMMENDATIONS

Two harvest levels have been analyzed. Through Option 1: Base Case, the Kamloops District Managers' direction that;

"Three thirds OGMA development be standard unless a timber supply impact is demonstrated"

was incorporated giving a harvest level of 125,200 m³/yr. Option 2: Base case without Biodiversity Constraints shows that the harvest level without biodiversity is 142,141 m³/yr. The difference between these two levels is 16,941 m³/yr, or 11.9% which exceeds the 4% limit stipulated in the Kamloops LRMP.

Weyerhaeuser recommends that the new harvest level be 136,455 m³/yr (142,141 * 0.96) which meets the maximum impact of 4% strategic direction of the Kamloops LRMP.

Appendix 1: Timber Supply analysis data package

Appendix 2: Visual Quality Guidelines from the Kamloops LRMP

Appendix 3: Additional graphs

Maximum initial level harvest

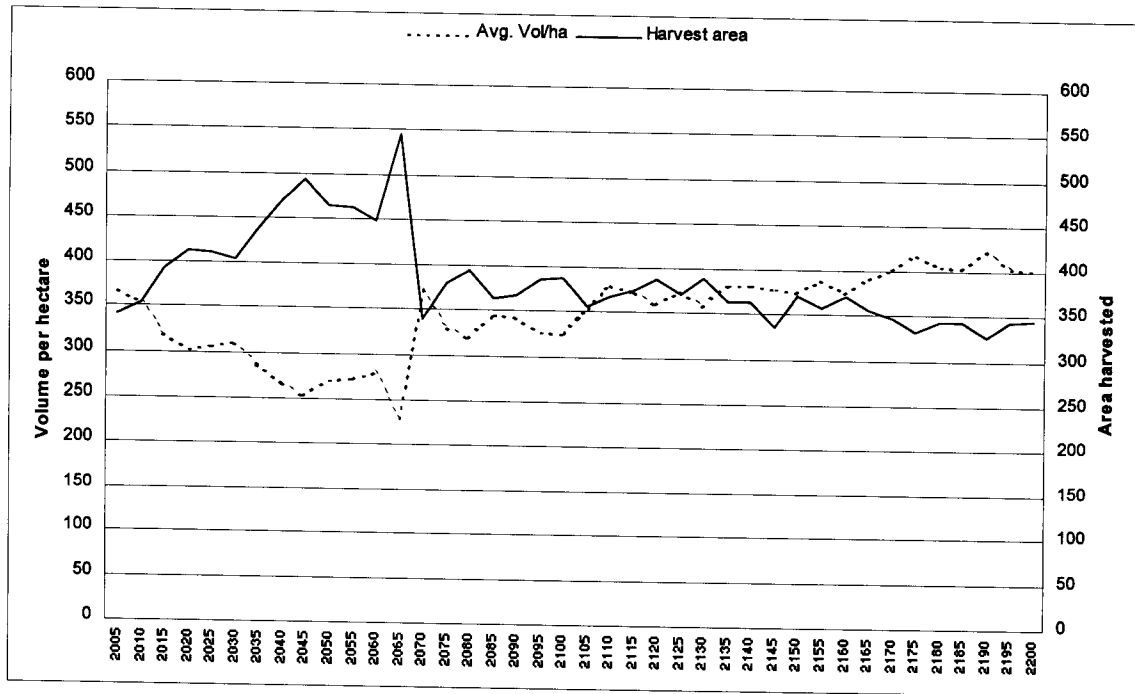


Figure 50: Harvest area and volume

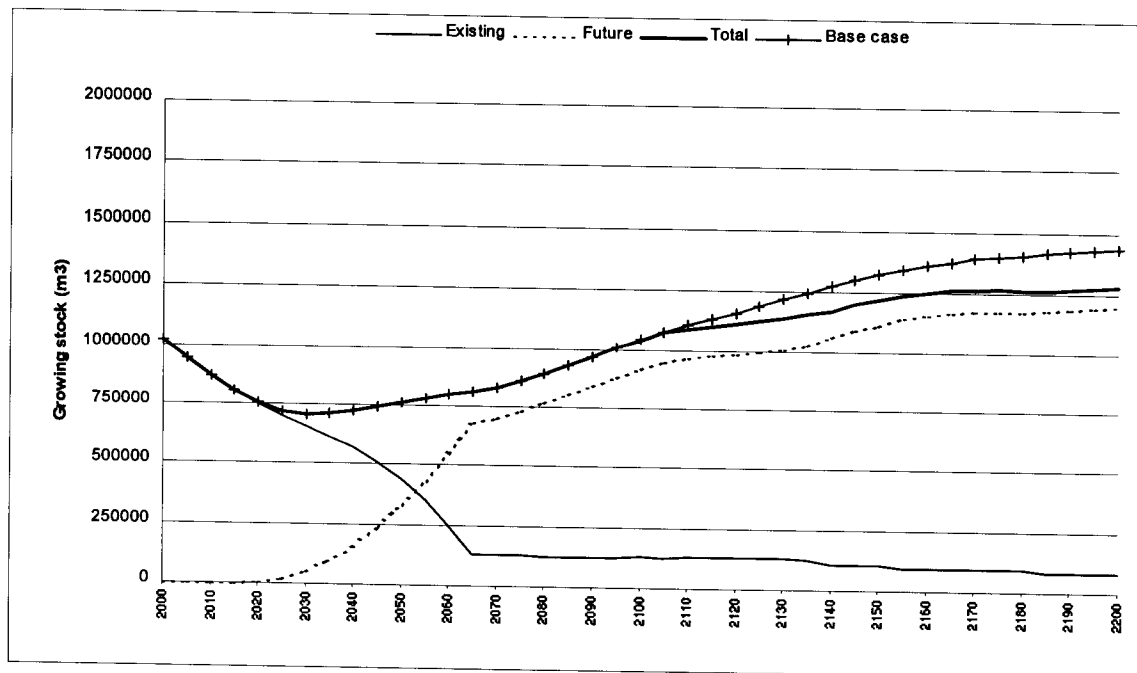


Figure 51: Growing stock

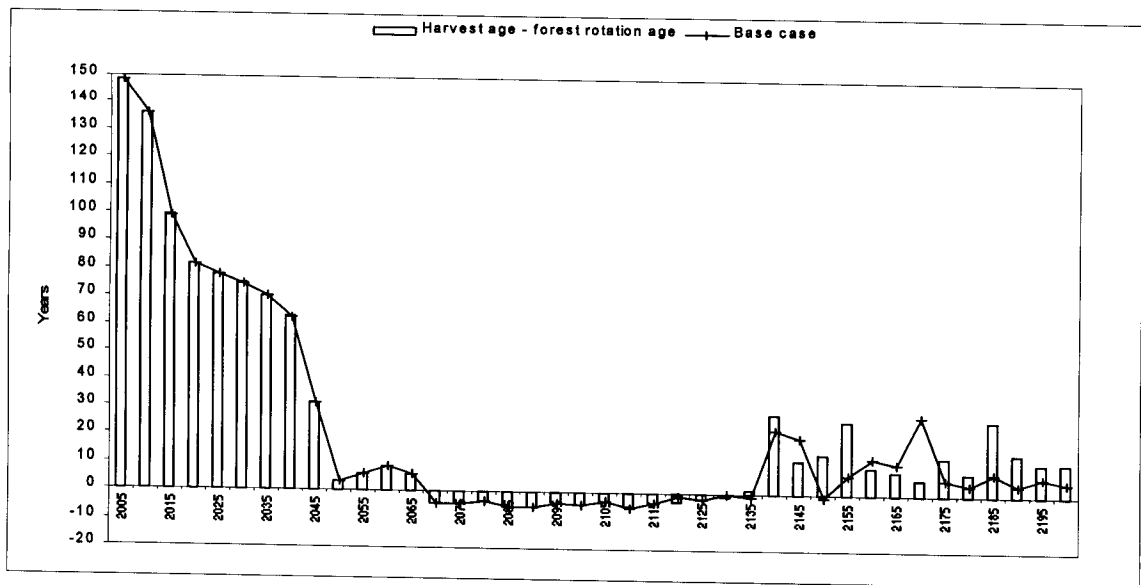


Figure 52: Harvest age minus forest level culmination age

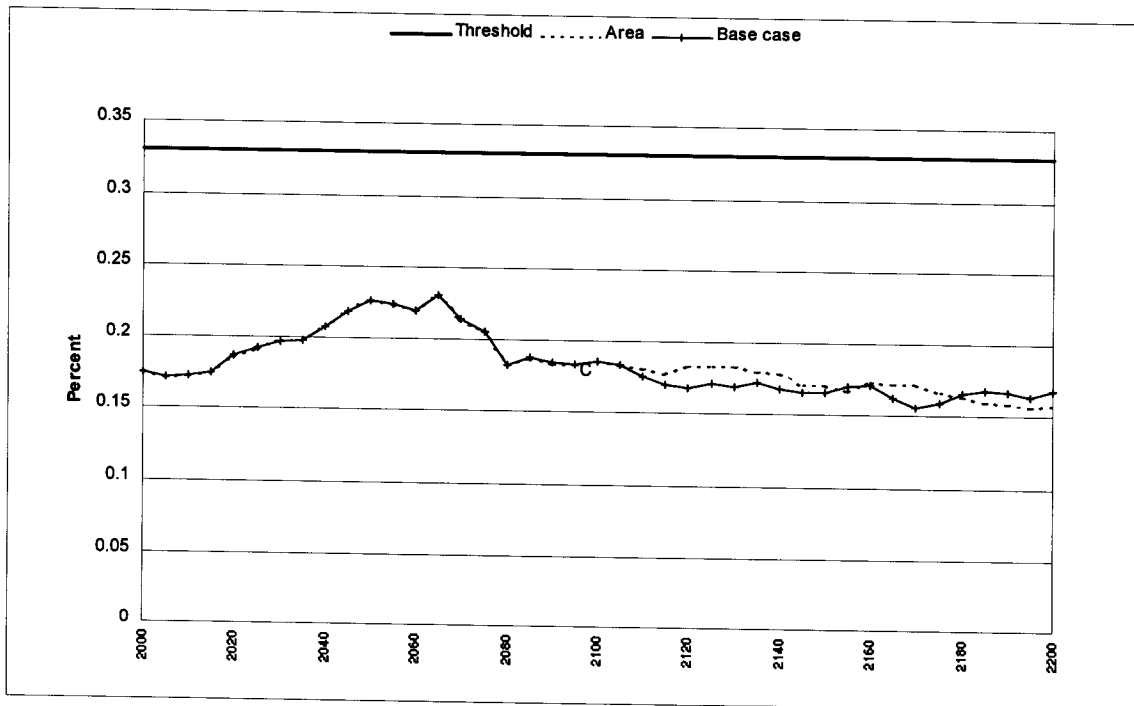


Figure 53: Area below 3m green-up height, general management and special wildlife management zones

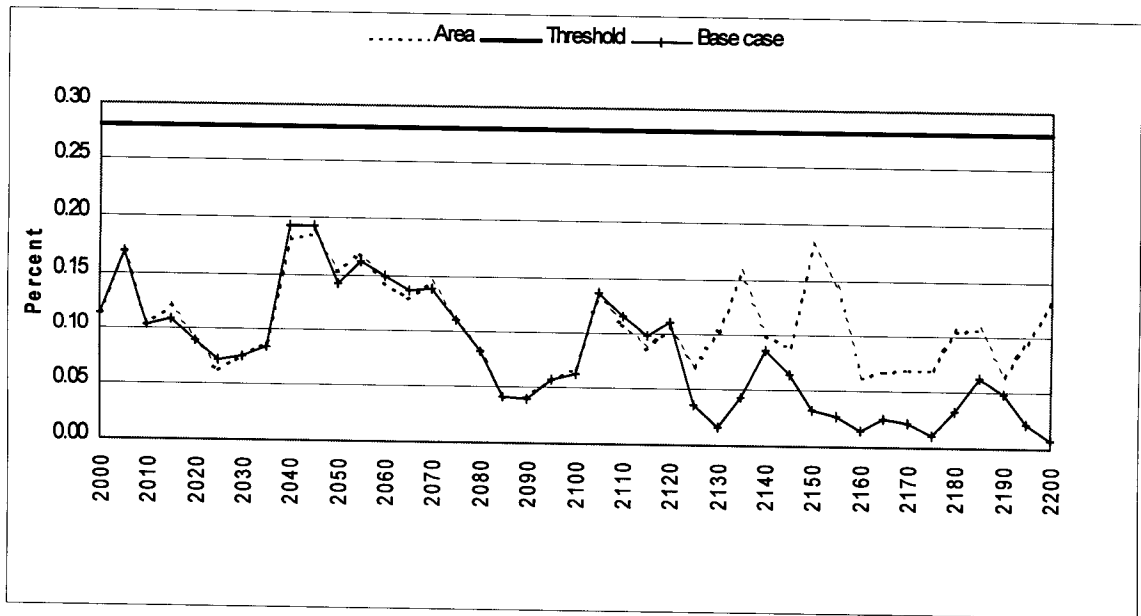


Figure 54: Area below 3.2m green-up height, modification VQO

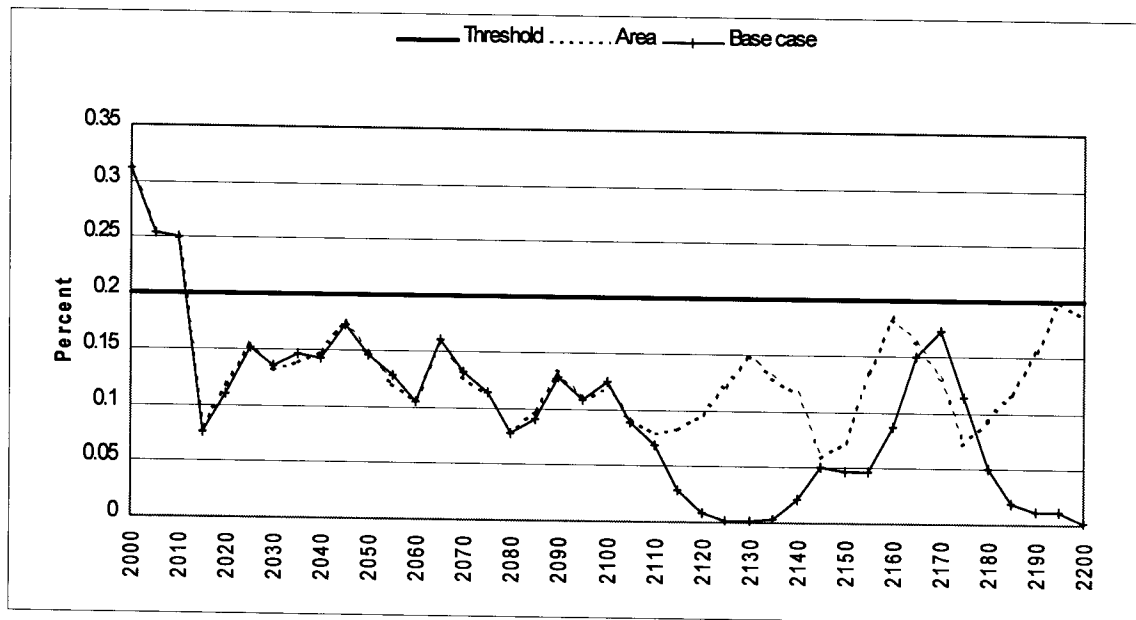


Figure 55: Area below 3.9m green-up height, partial retention VQO

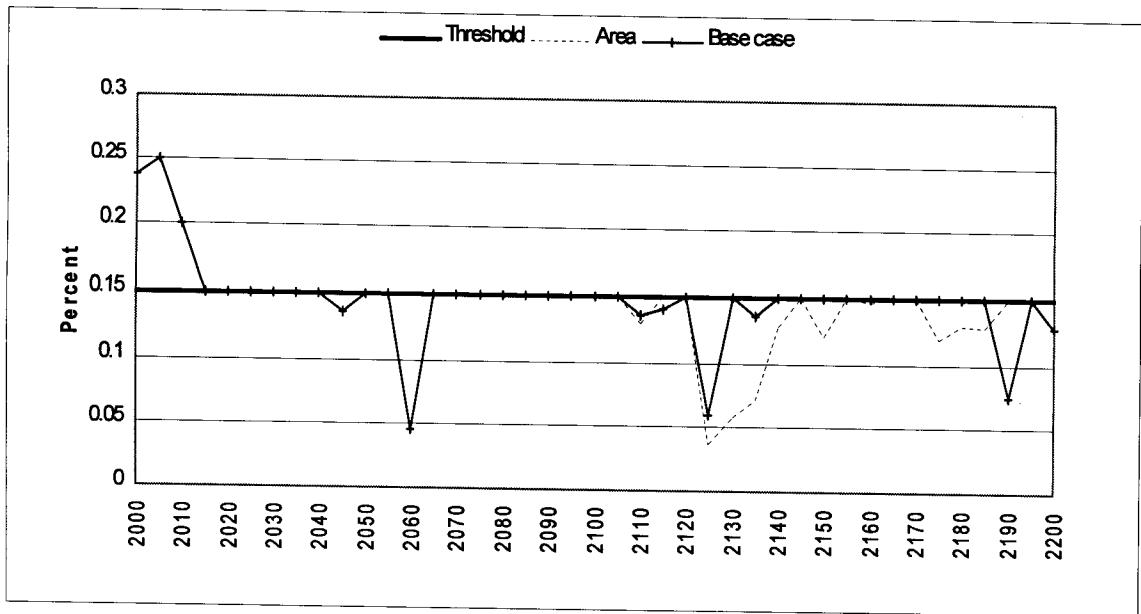


Figure 56: Area below 3.9m green-up height, retention VQO

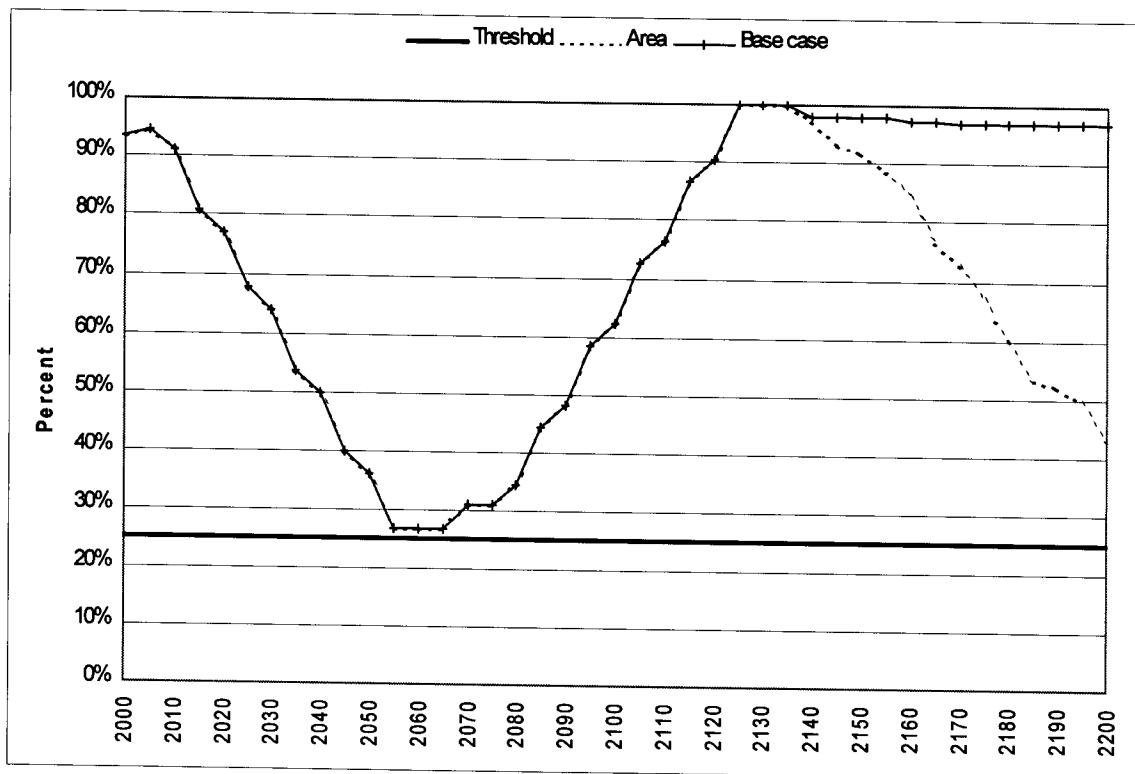


Figure 57: Area above 20m thermal cover, mule deer winter range

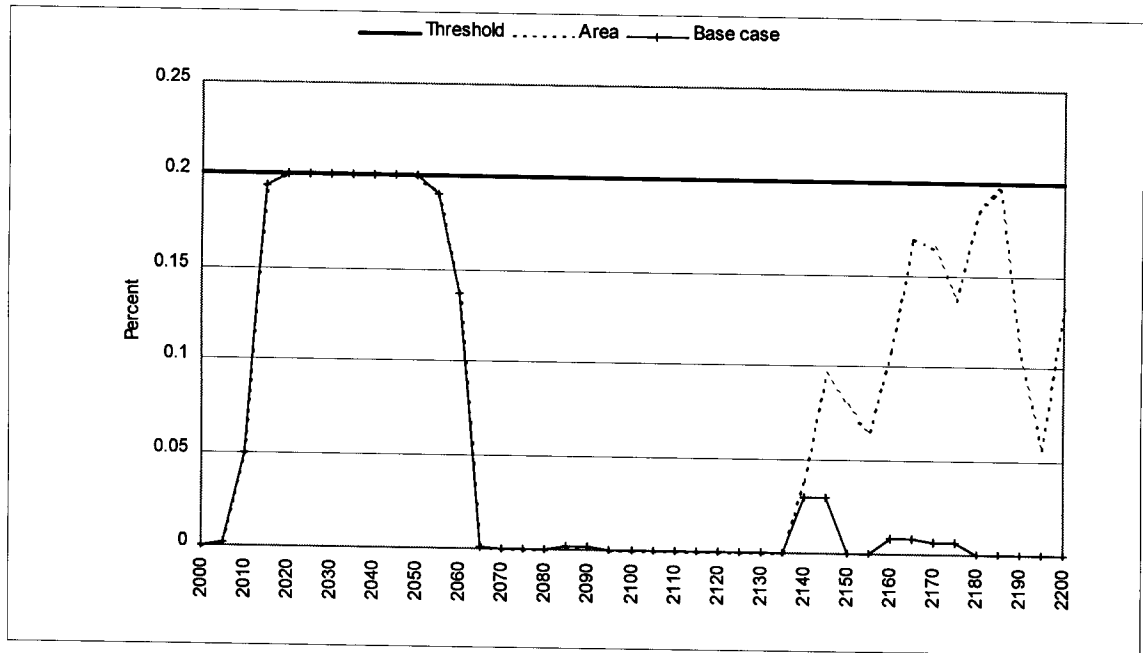


Figure 58: Area below 3m green-up height, mule deer winter range

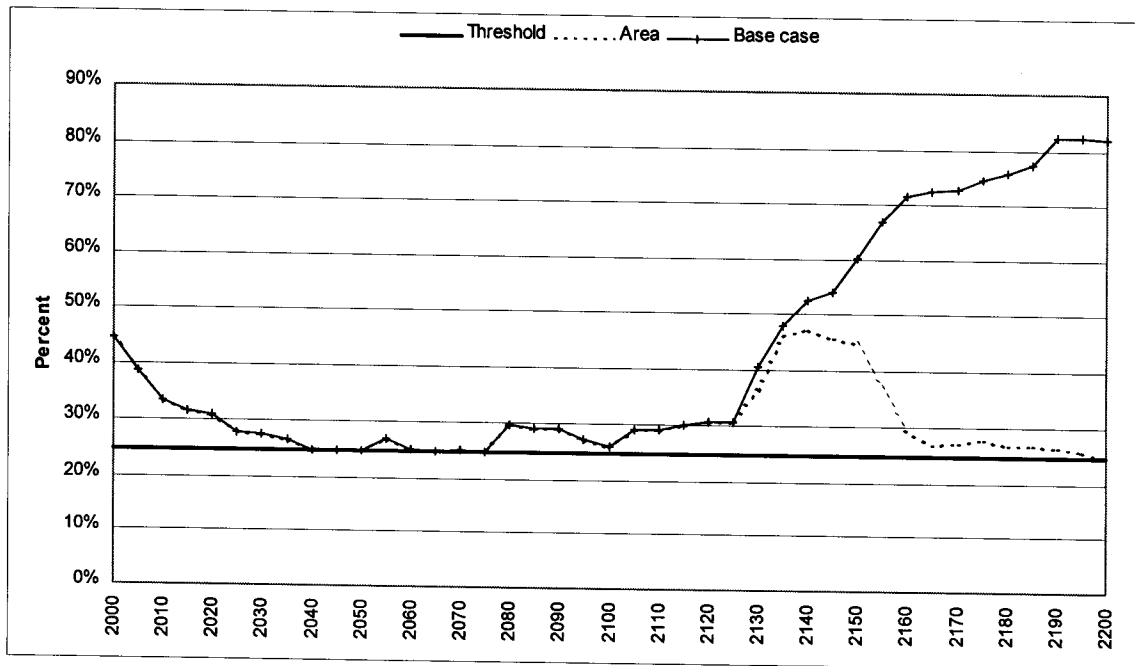


Figure 59: Area above minimum old seral age, special wildlife management areas

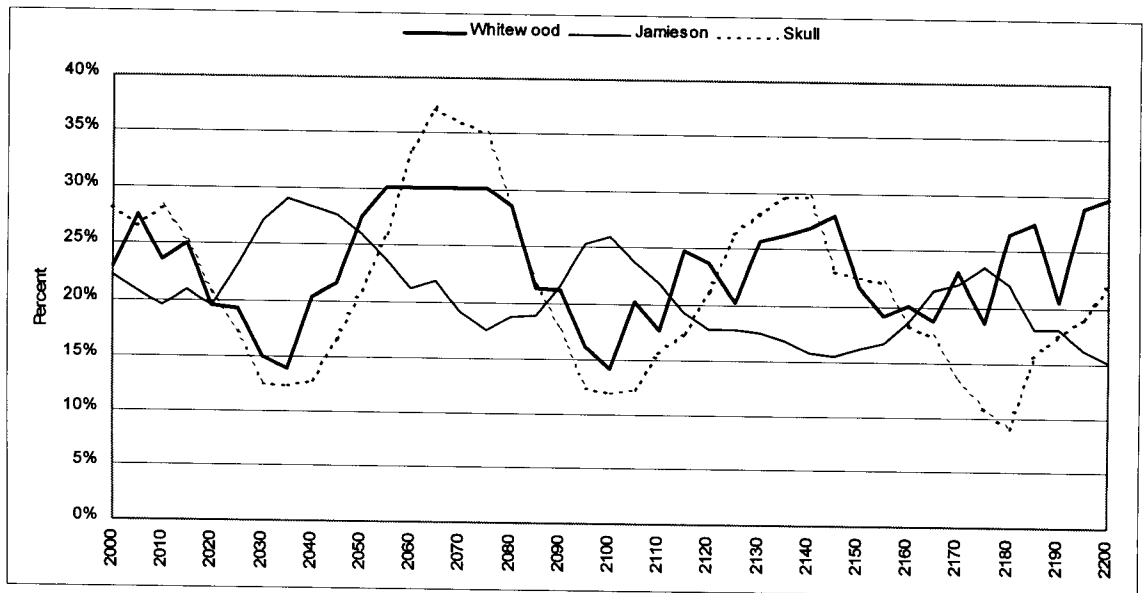


Figure 60: Area below 4.8m hydrological green-up

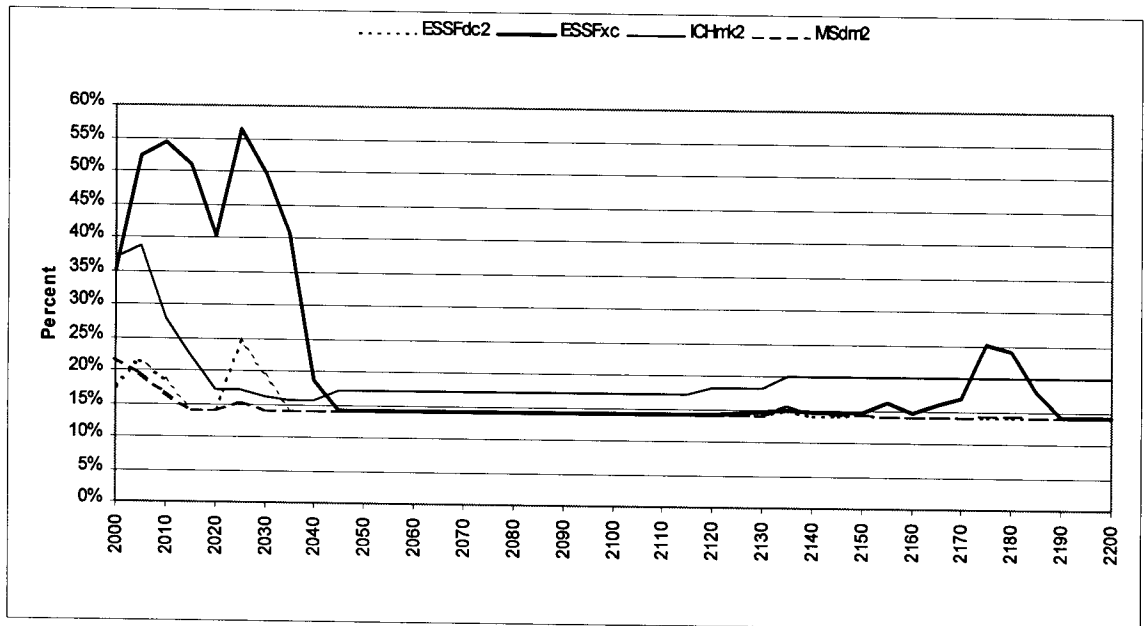


Figure 61: NDT3 old seral

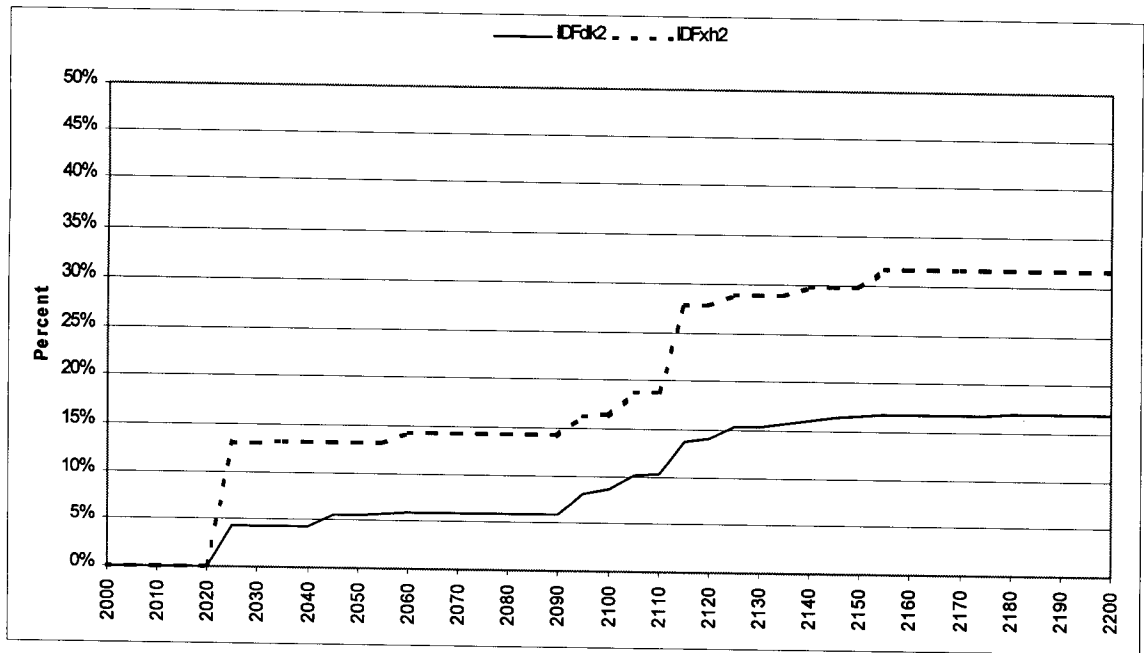


Figure 62: NDT4 old seral

Mule Deer winter range thermal cover up 5%

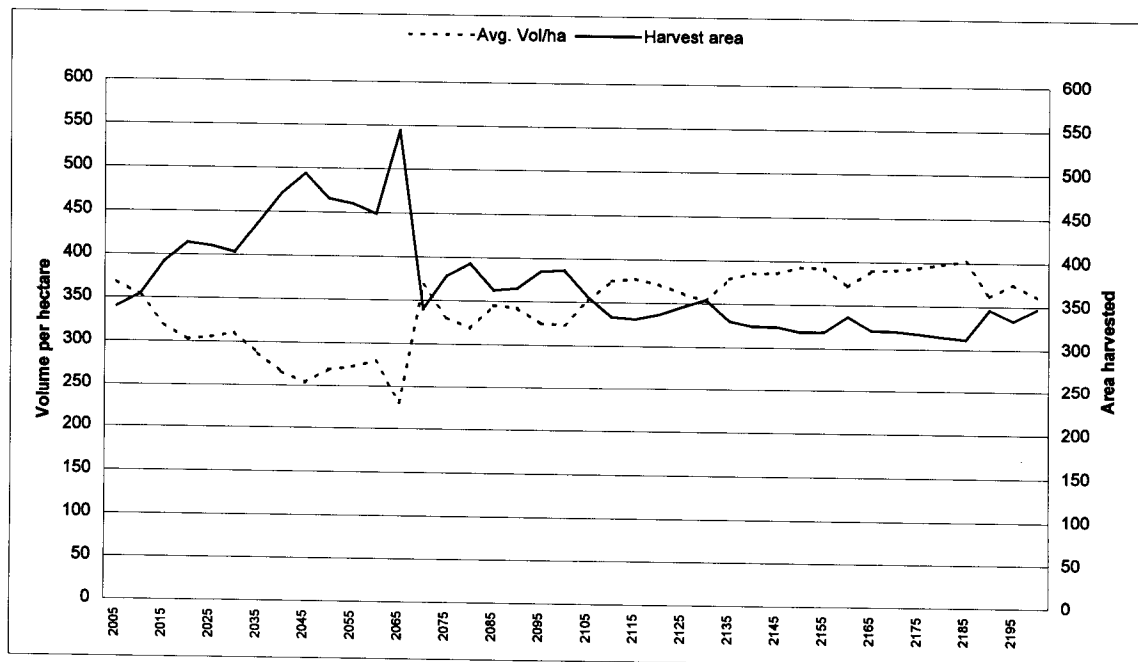


Figure 63: Average harvest volume and area

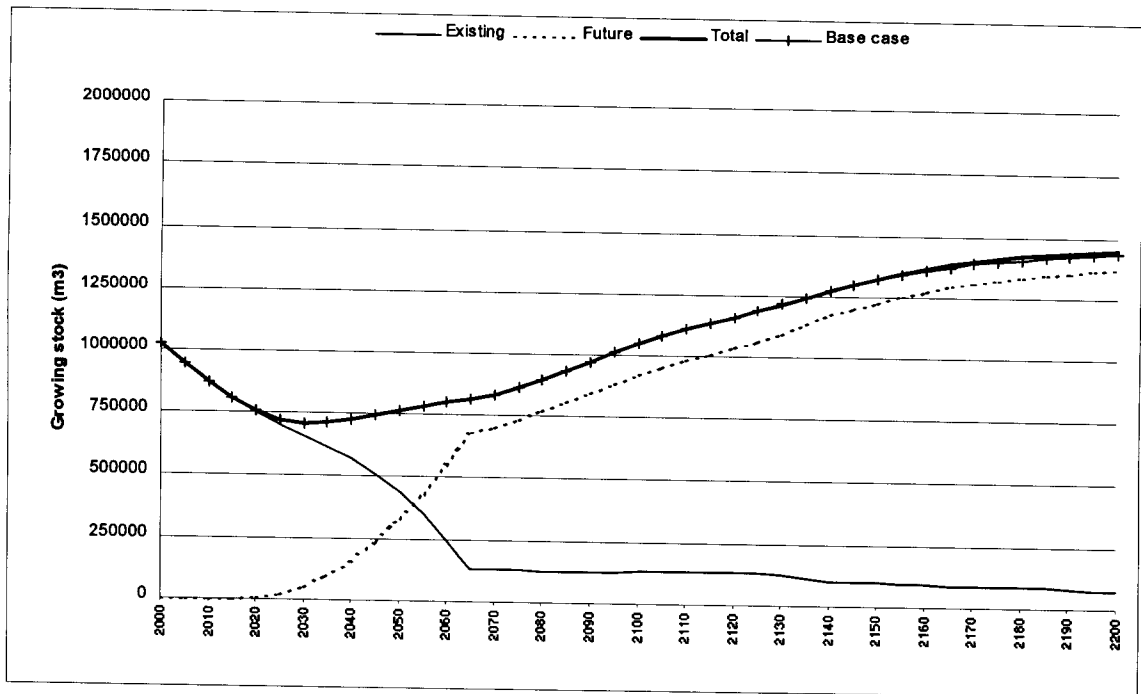


Figure 64: Growing stock

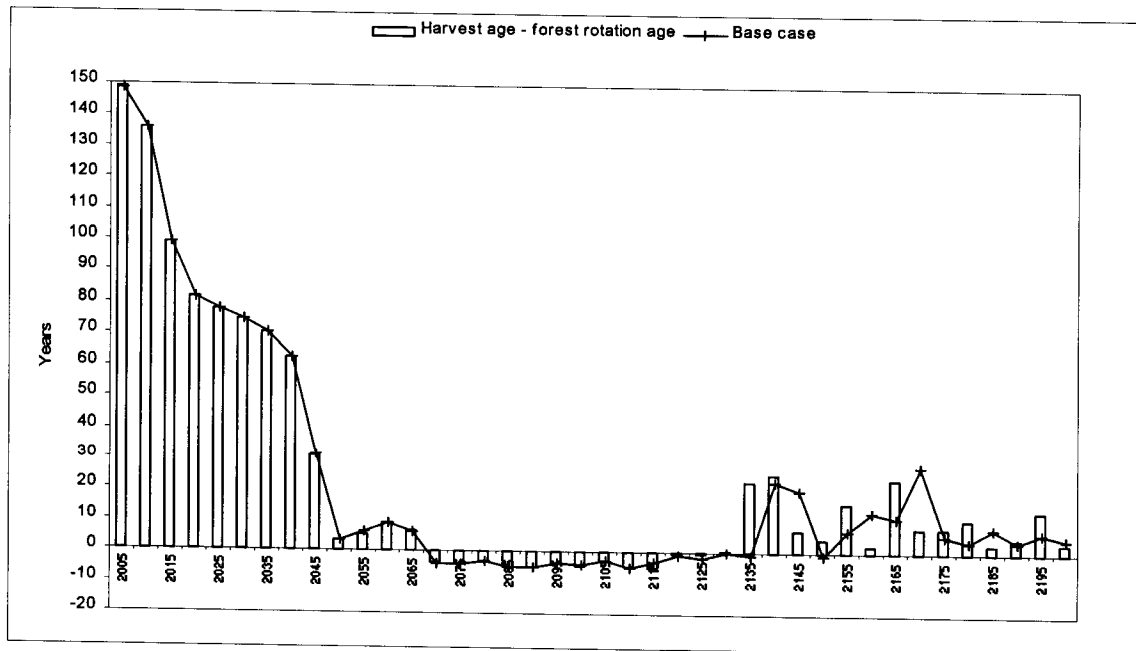


Figure 65: Harvest age minus forest-level culmination age

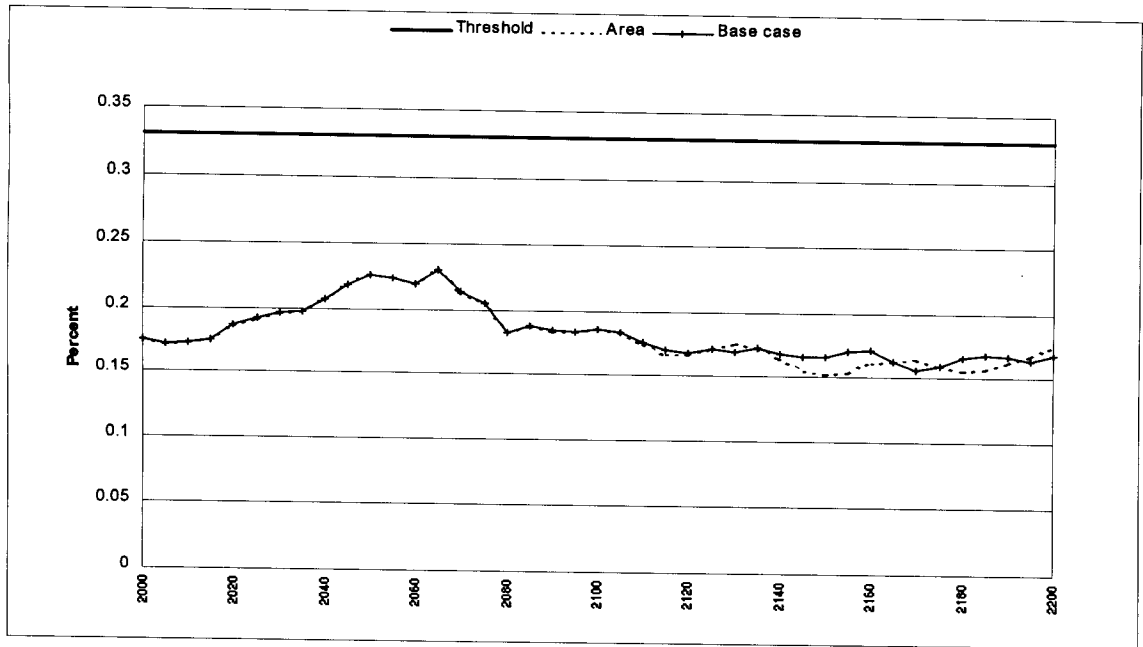


Figure 66: Area below 3m green-up height, for general management and special wildlife zones

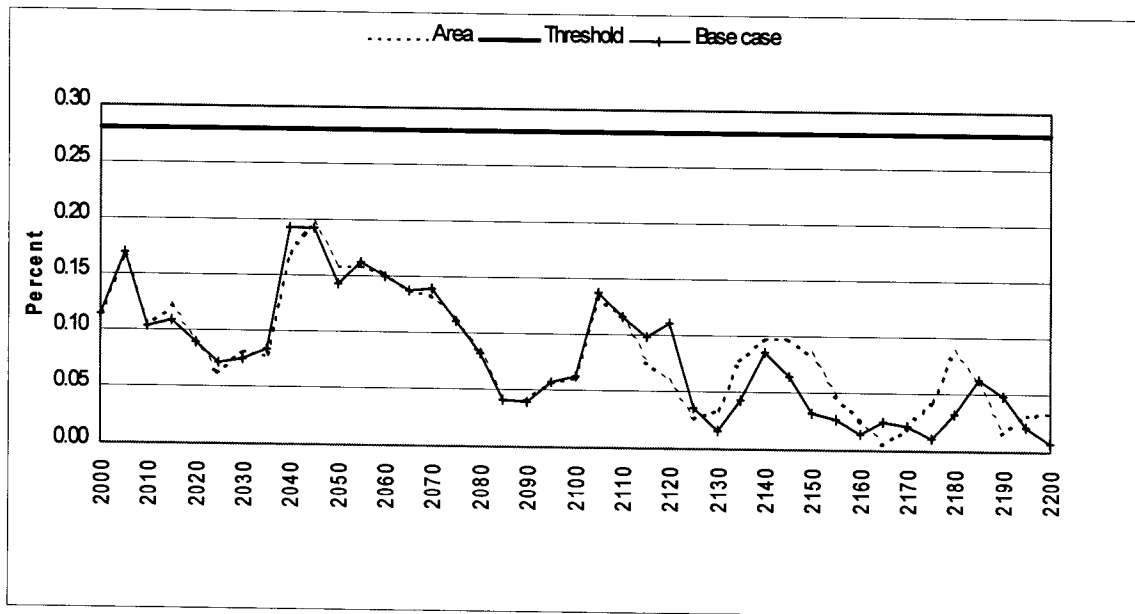


Figure 67: Area below 3.2m green-up height, modification VQO

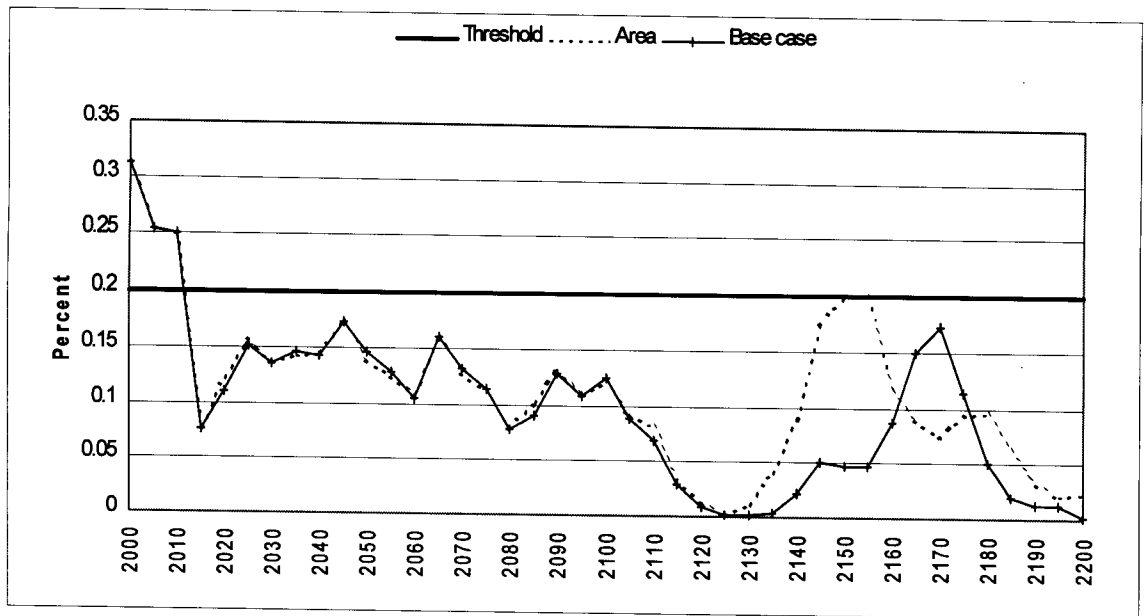


Figure 68: Area below 3.9m green-up height, partial retention VQO

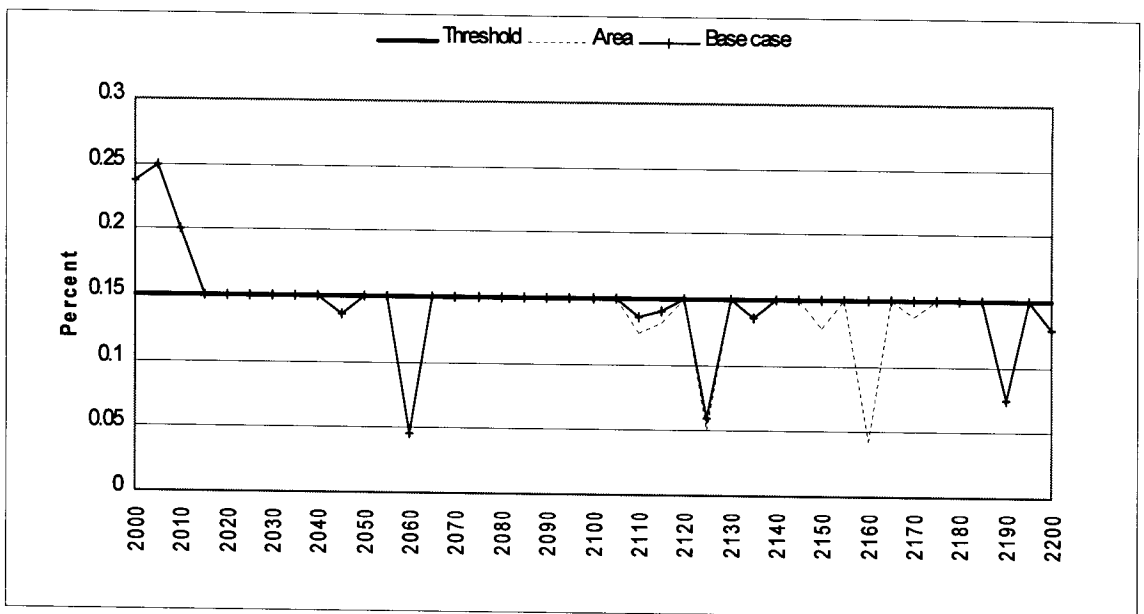


Figure 69: Area below 3.9m green-up height, retention VQO

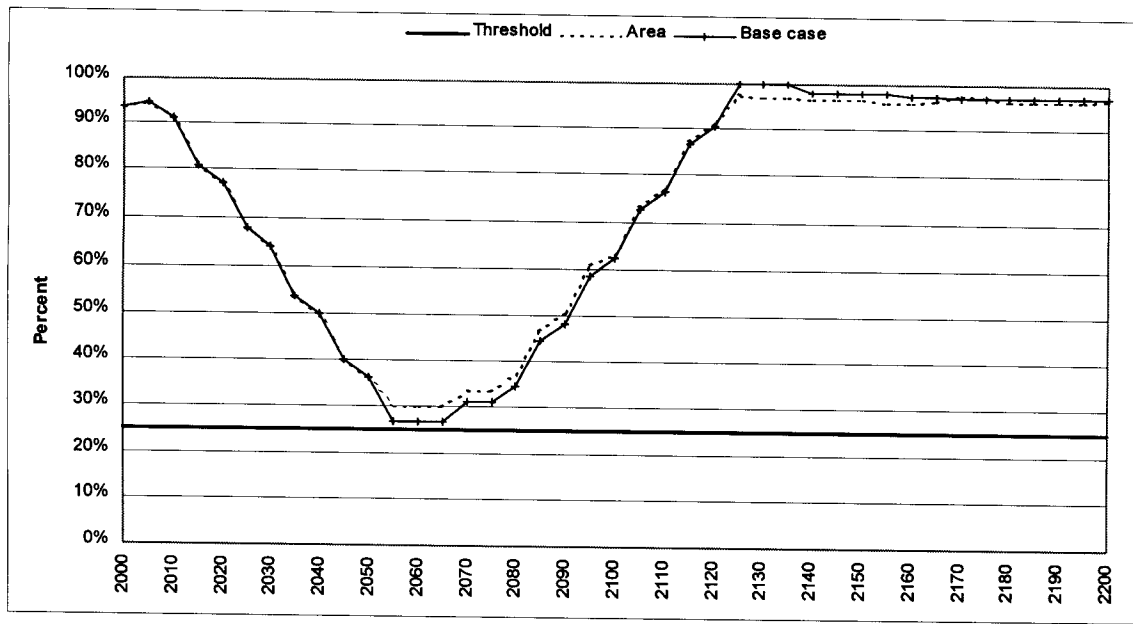


Figure 70: Area above 20m thermal cover height, mule deer winter range

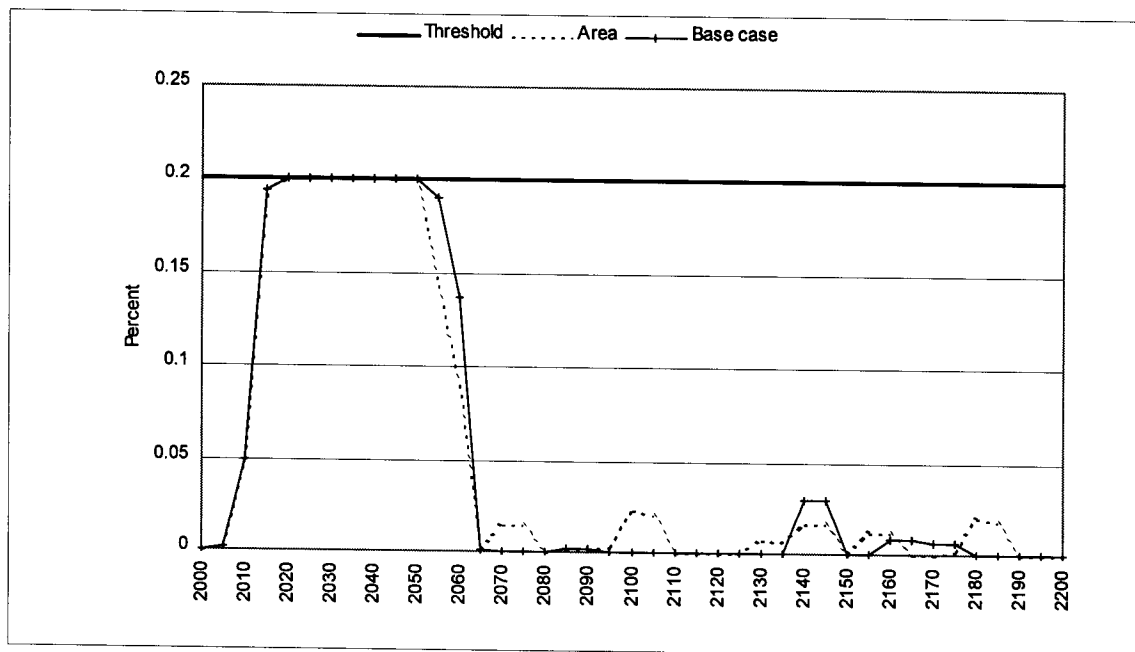


Figure 71: Area below 3m green-up height, mule deer winter range

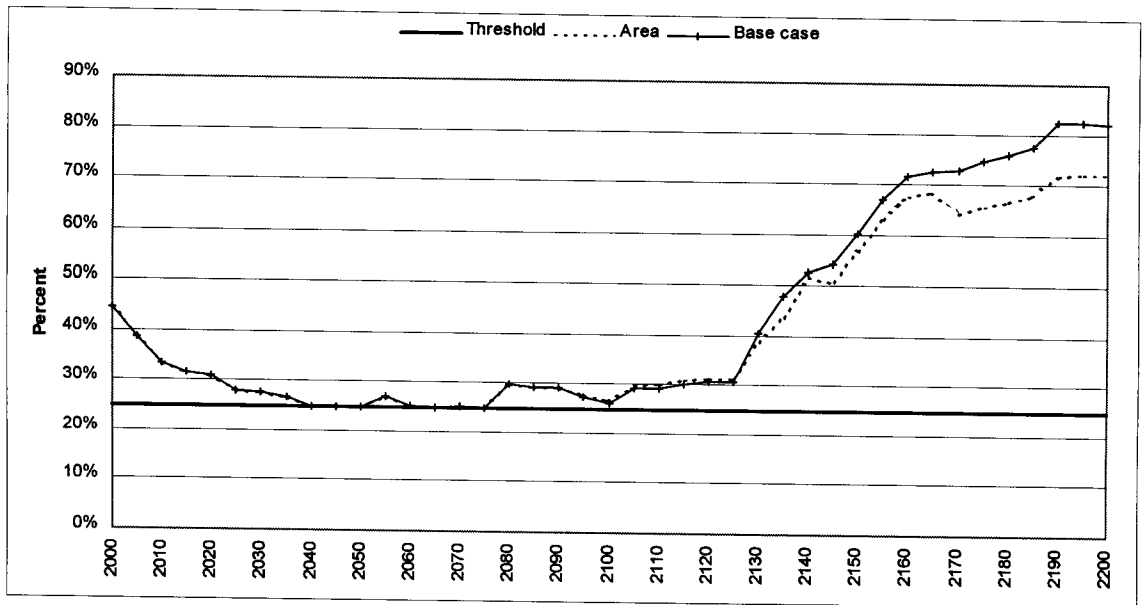


Figure 72: Area above minimum old seral age, special wildlife management areas

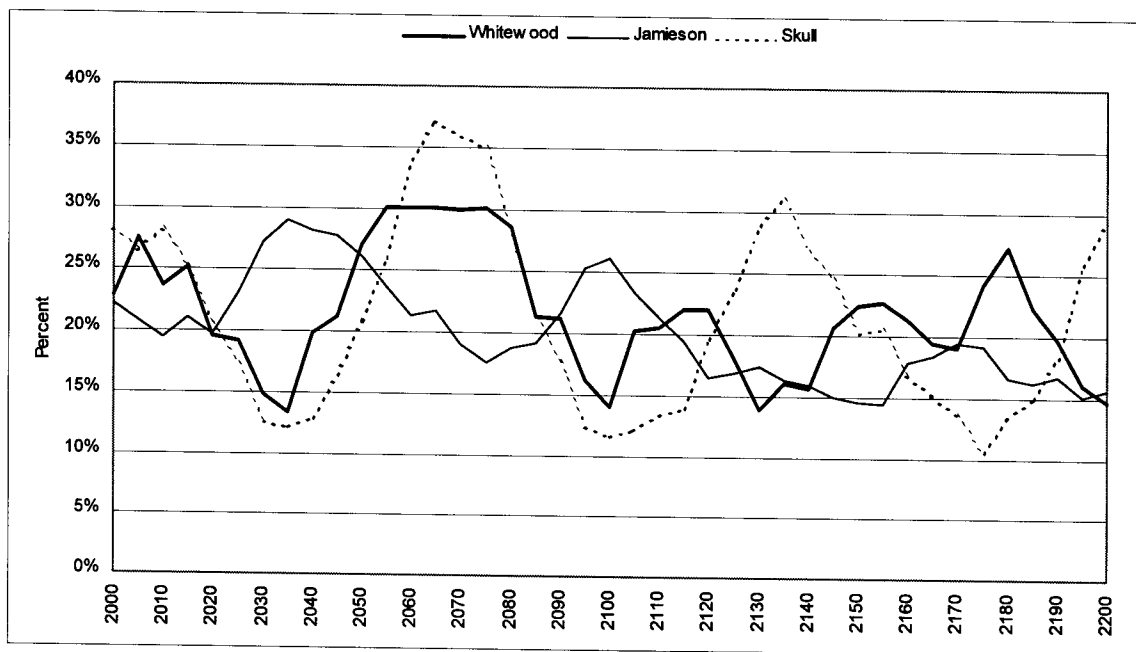
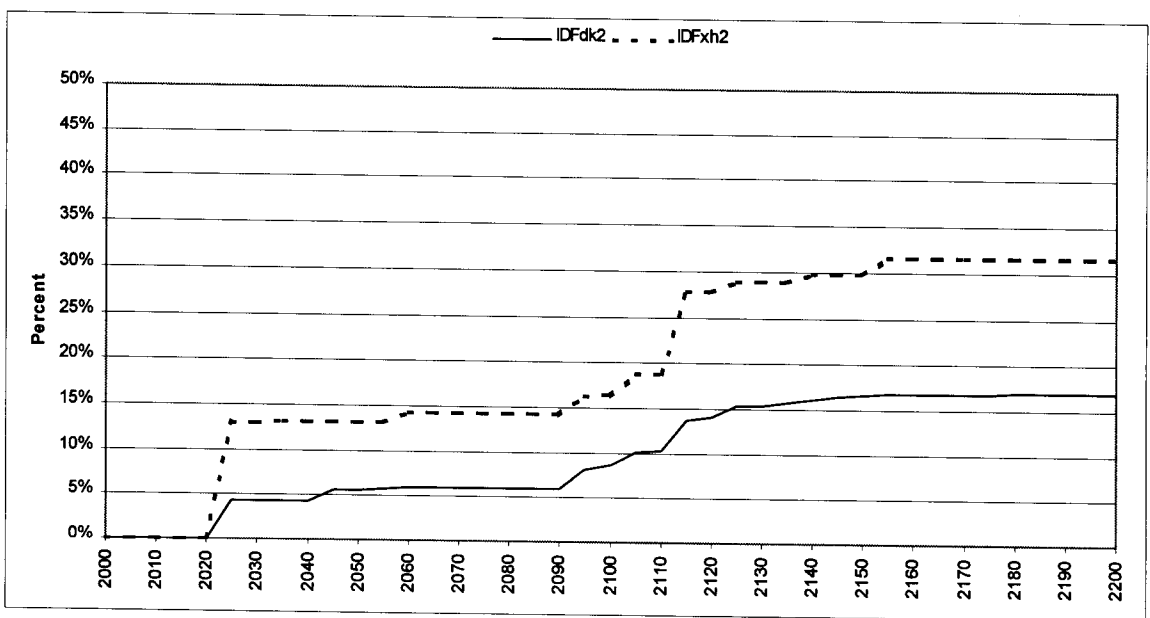
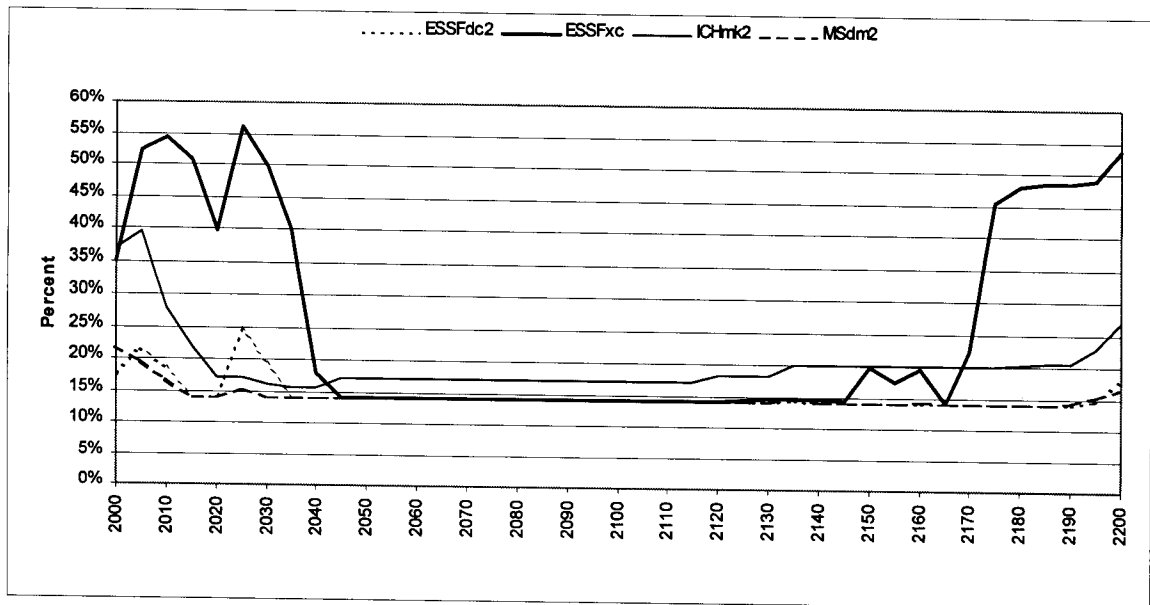


Figure 73: Area below hydrological 4.8m green-up height



Mule Deer winter range thermal cover down 5%

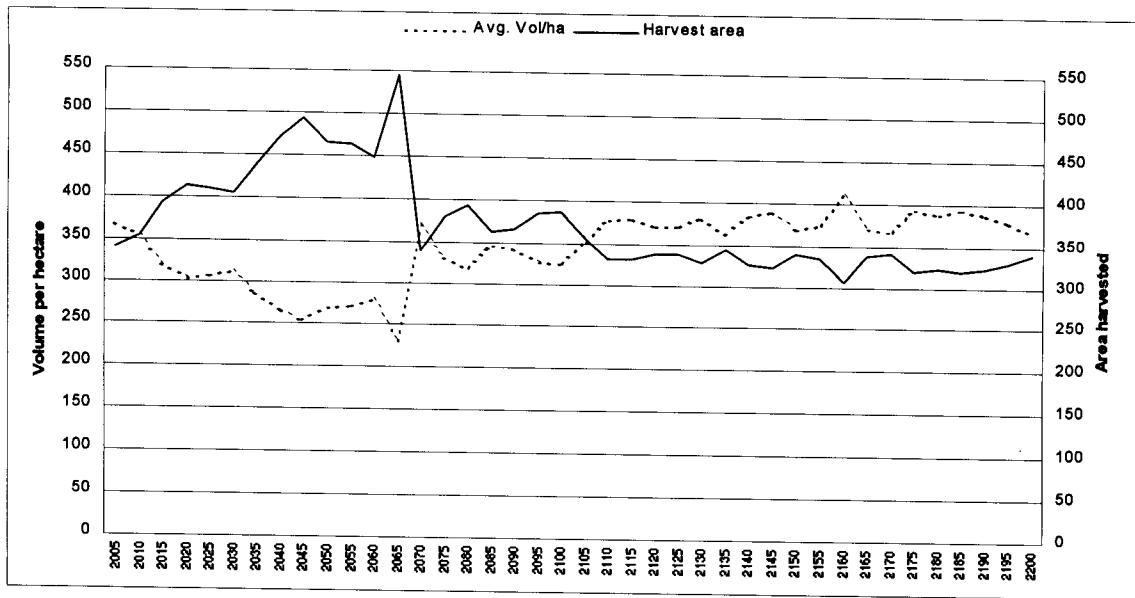


Figure 76: Average volume and harvest area

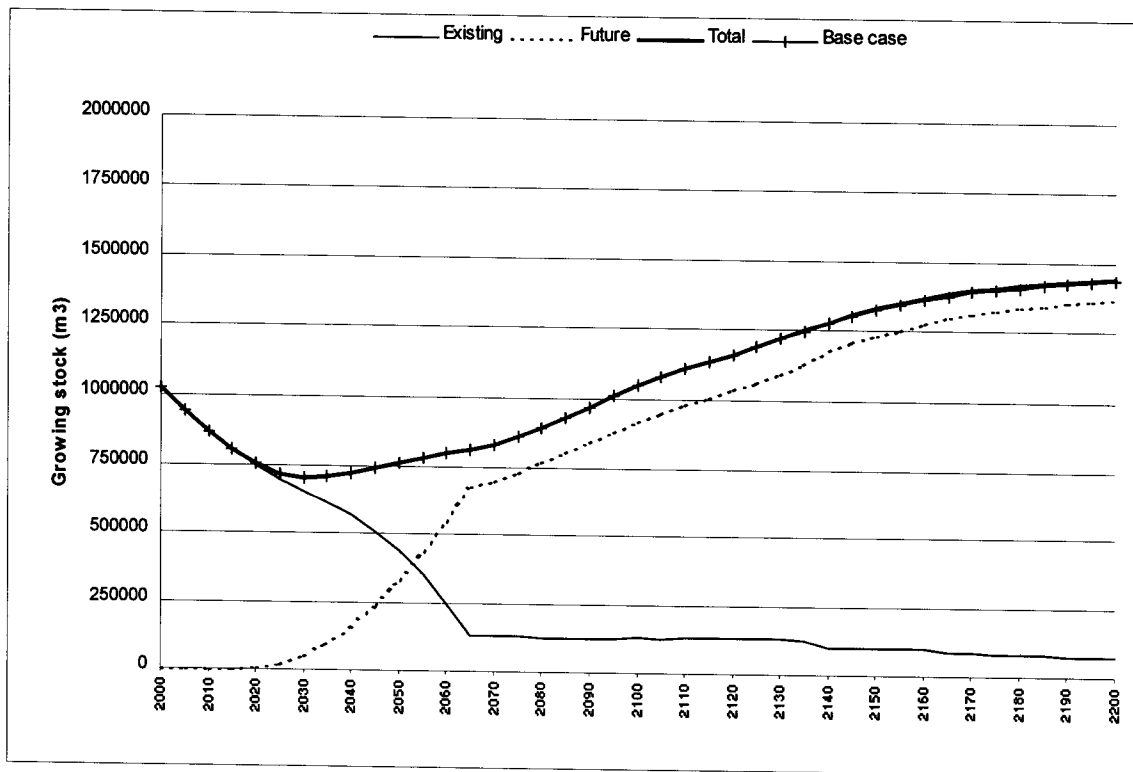


Figure 77: Growing stock

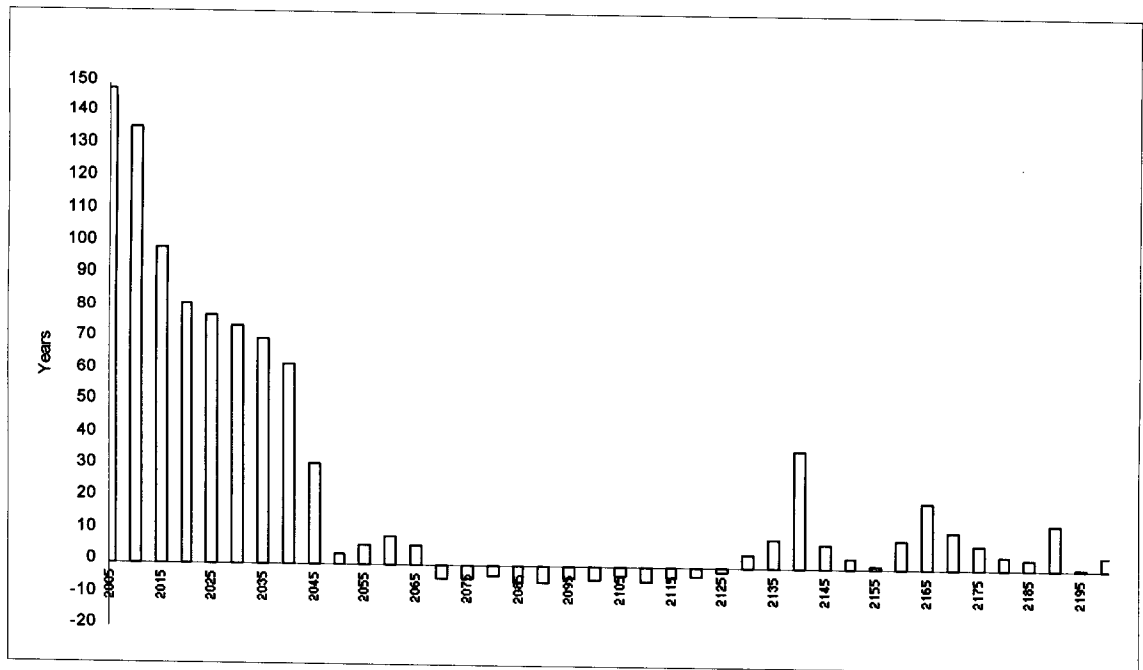


Figure 78: Average harvest age minus forest-level culmination age

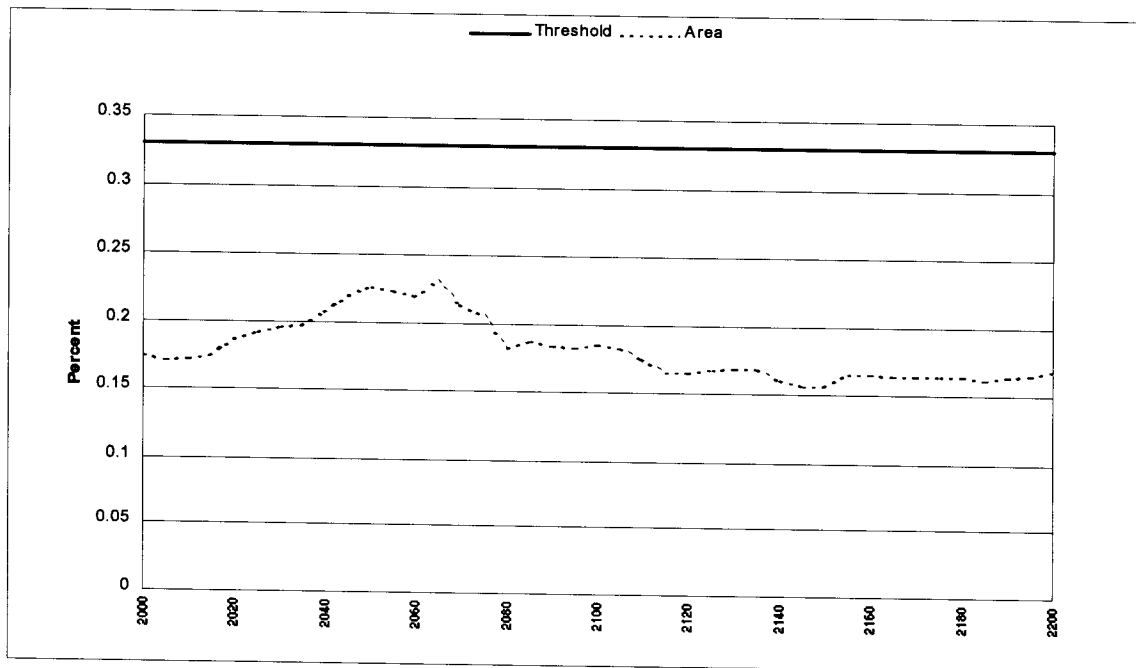


Figure 79: Area below 3m green-up height for the general management and special wildlife management zones

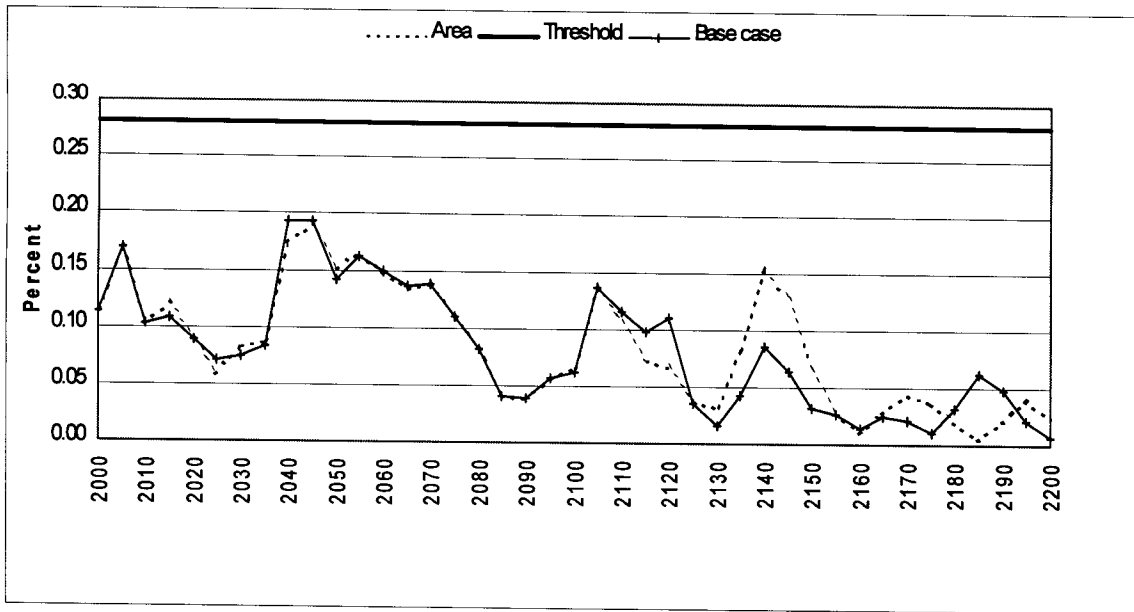


Figure 80: Area below 3.2 m green-up height, modification VQO

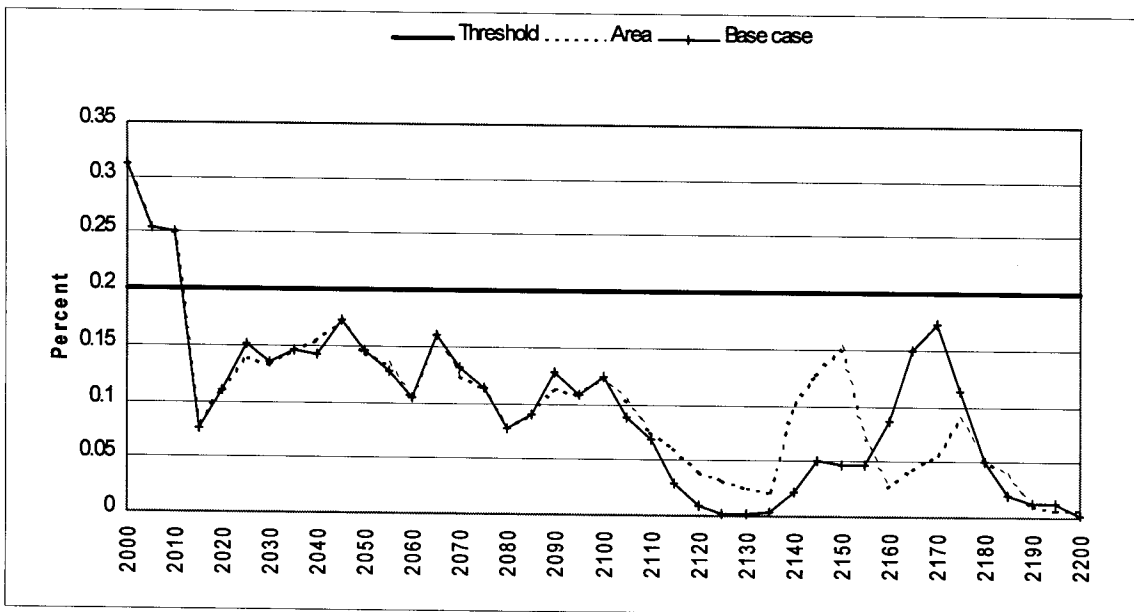


Figure 81: Area below 3.9m green-up height, partial retention VQO

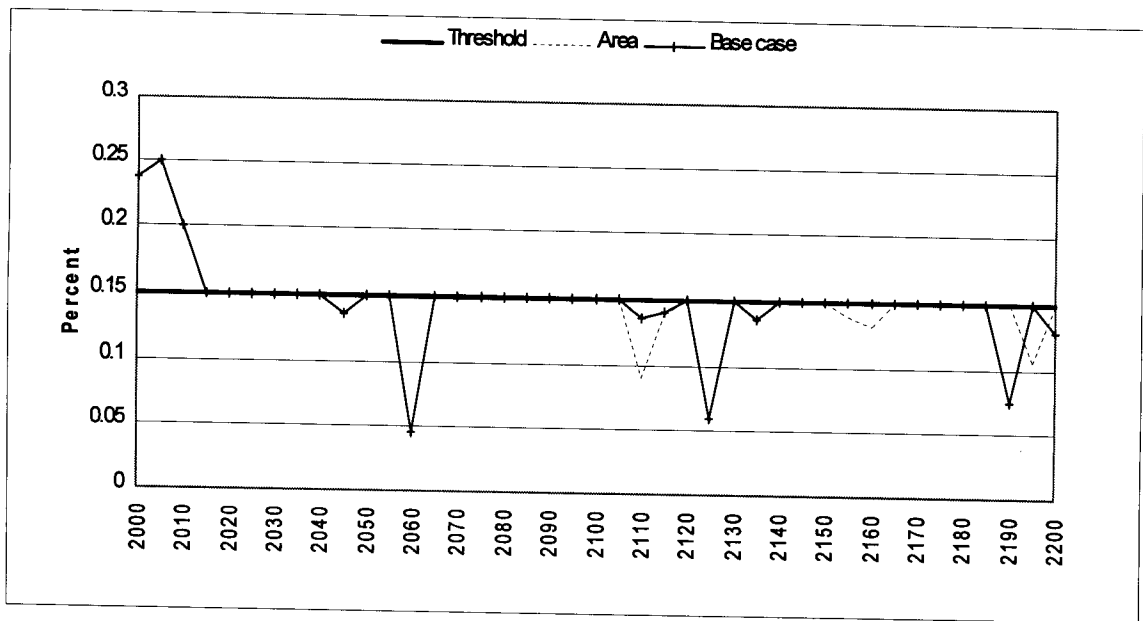


Figure 82: Area below 3.9m green-up height, retention VQO

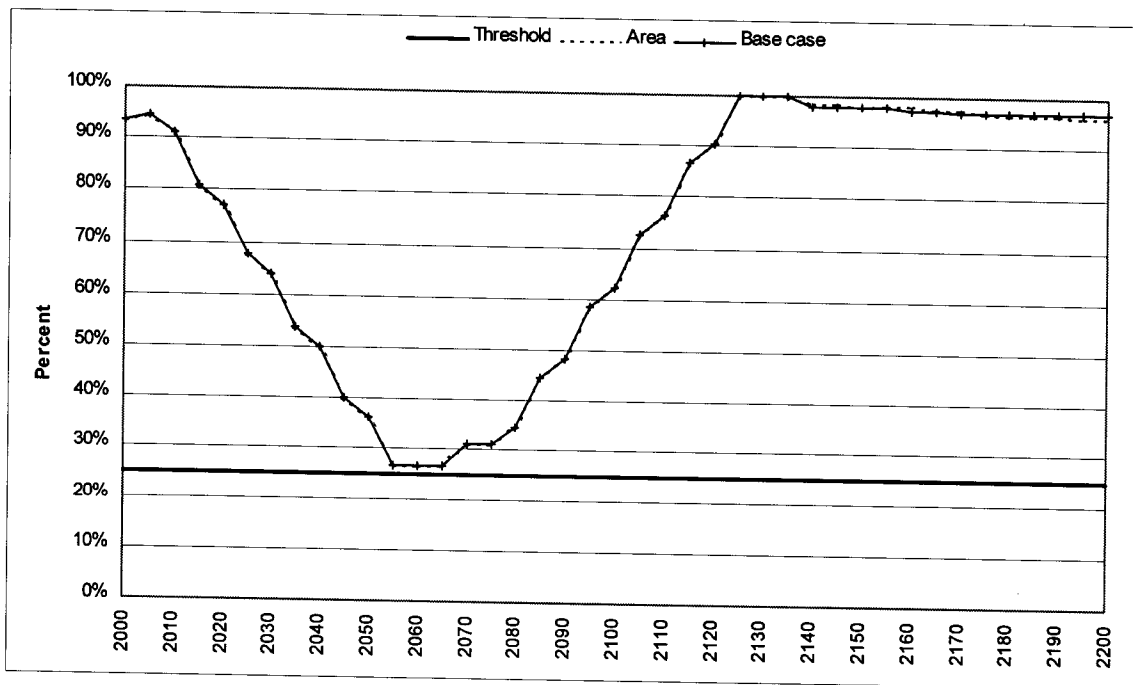


Figure 83: Area above 20m thermal height requirement

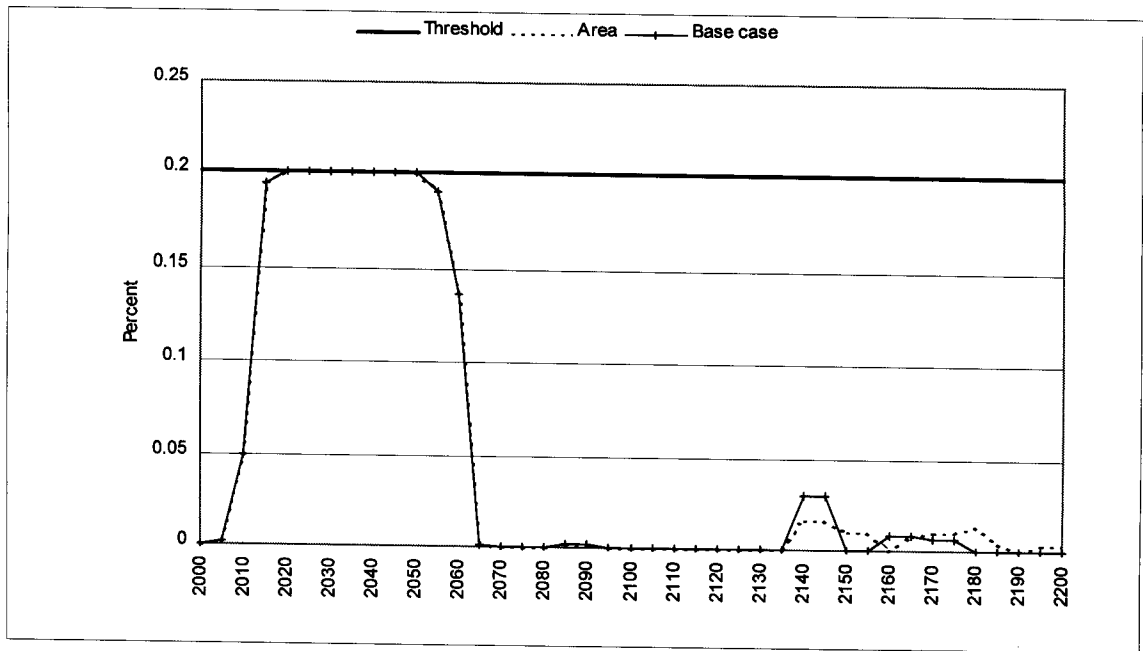


Figure 84: Area below 3m green-up height, mule deer winter range

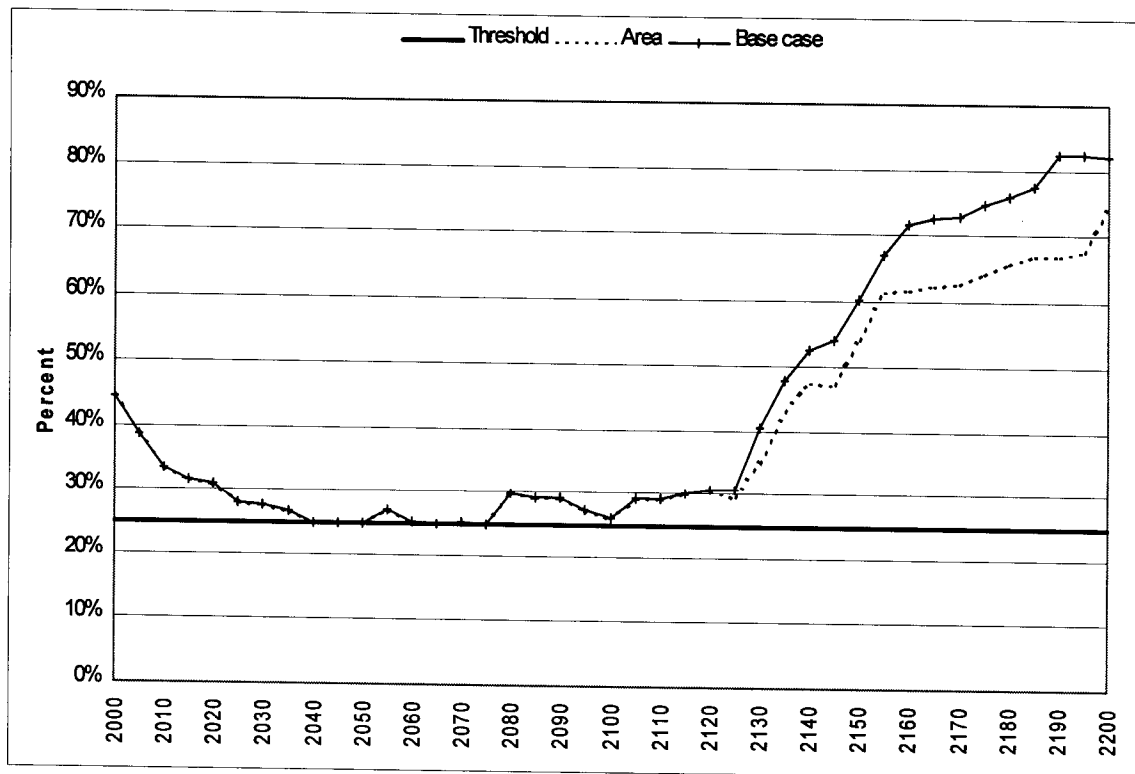


Figure 85: Area above old seral minimum for special wildlife management areas

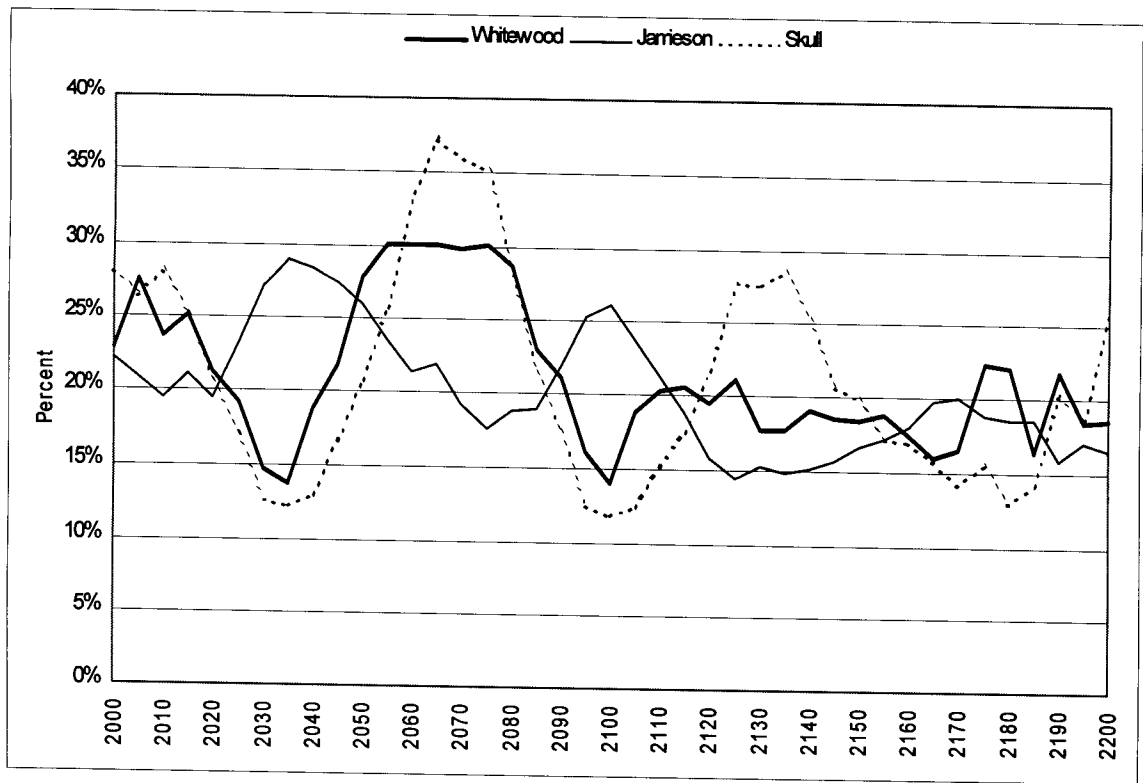


Figure 86: Area below hydrological green-up of 4.8 m

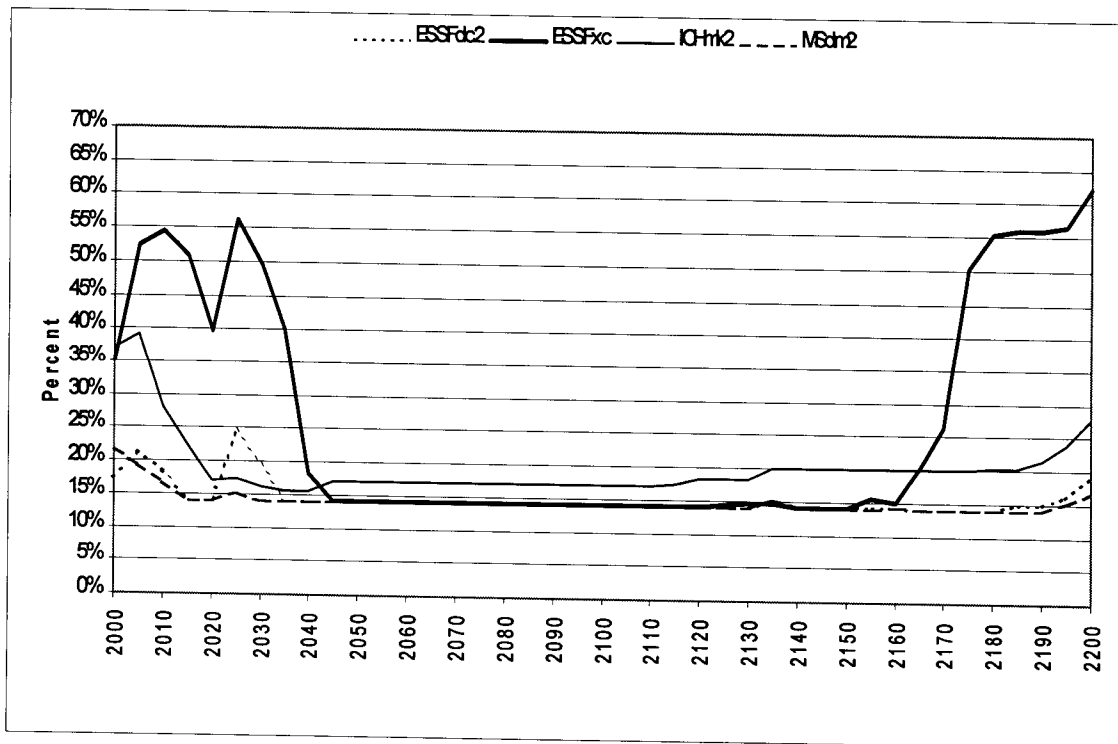


Figure 87: NDT3 Old seral

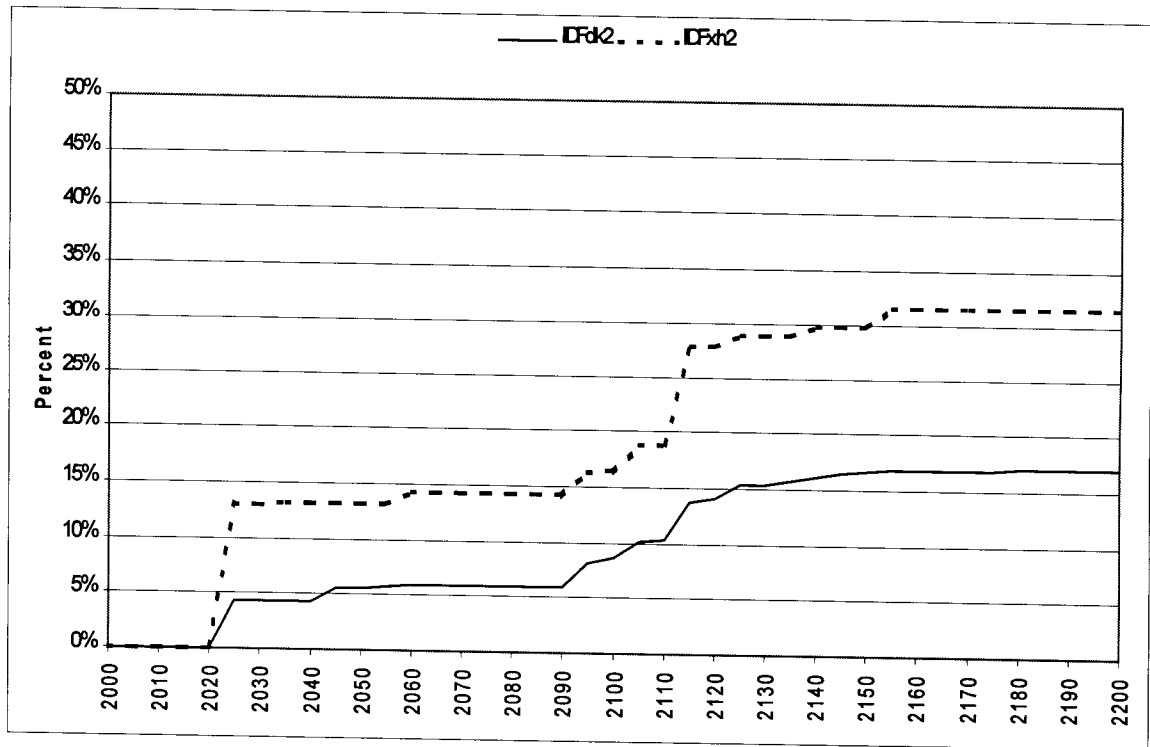


Figure 88: NDT4 Old seral

1/3, 1/3, 1/3 Old seral strategy

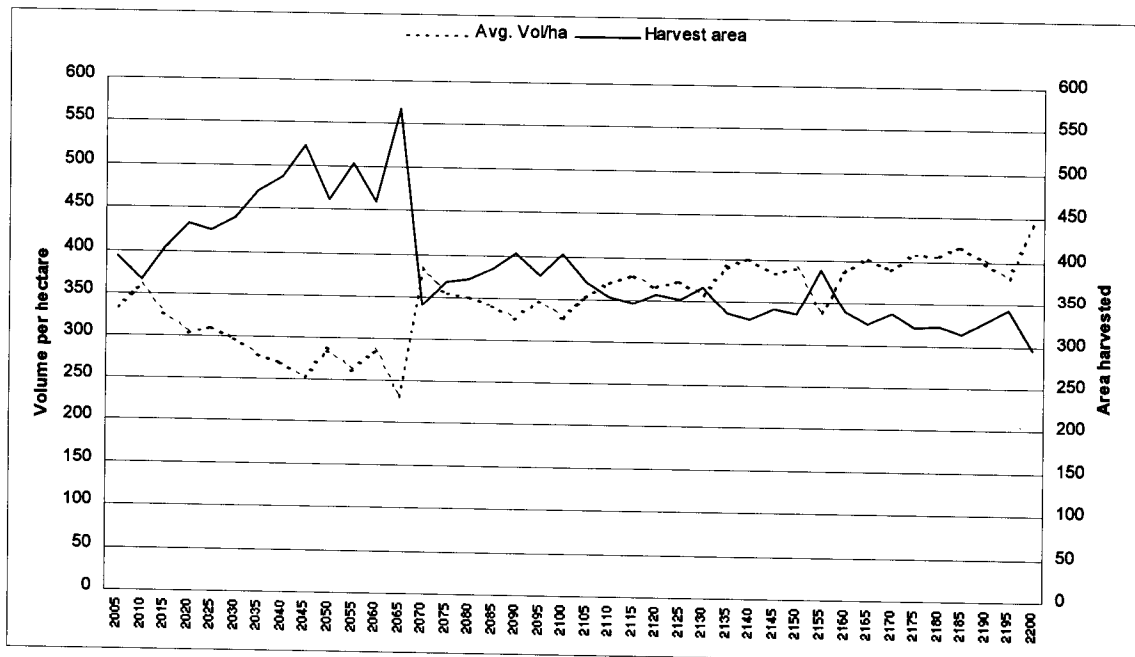


Figure 89: Average volume and harvest area

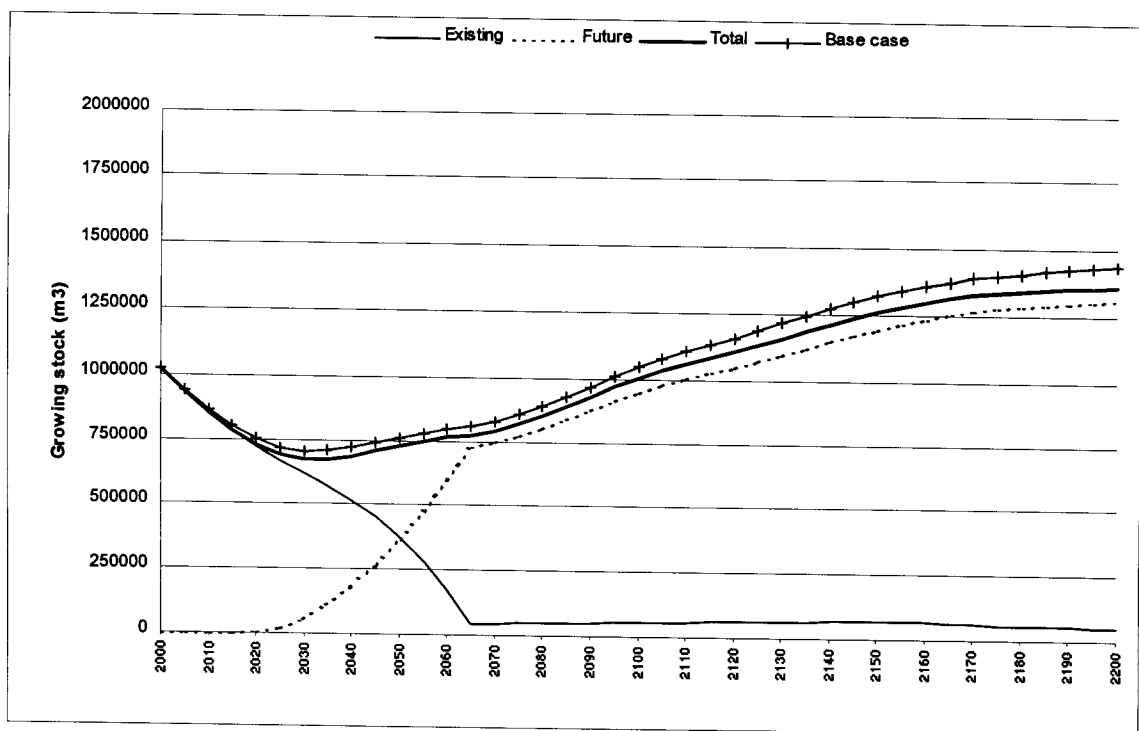


Figure 90: Growing stock

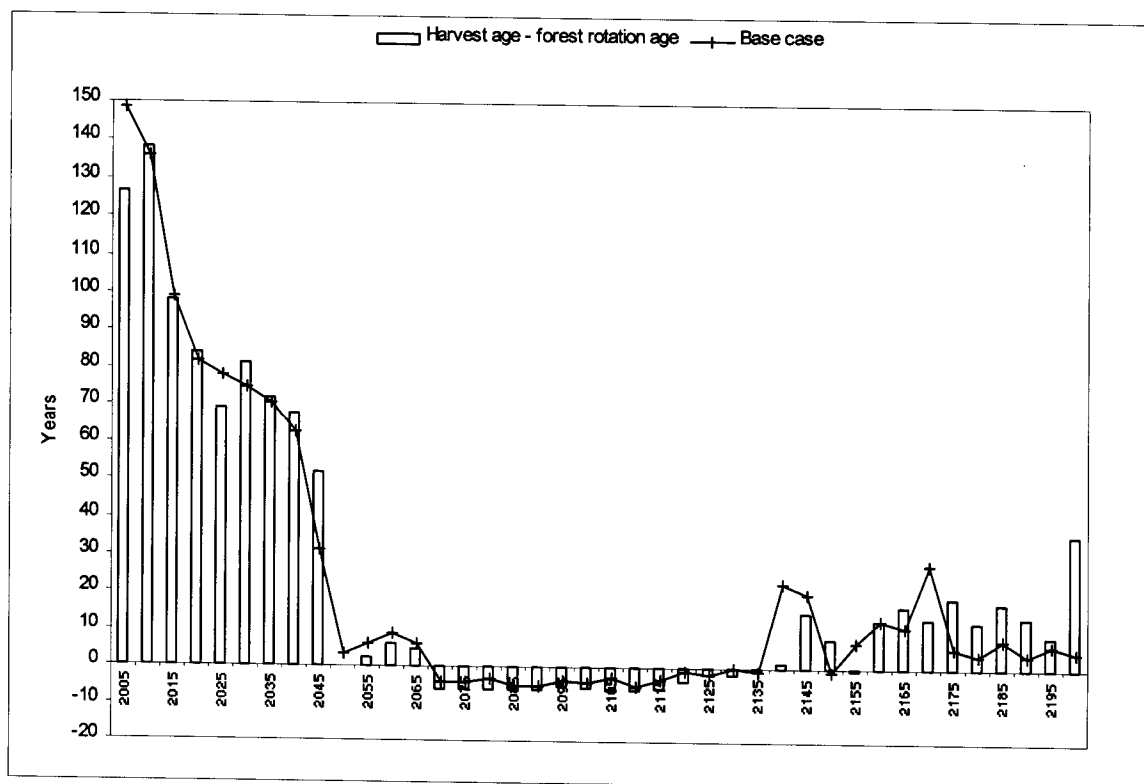


Figure 91: Harvest age relative to forest-level culmination age

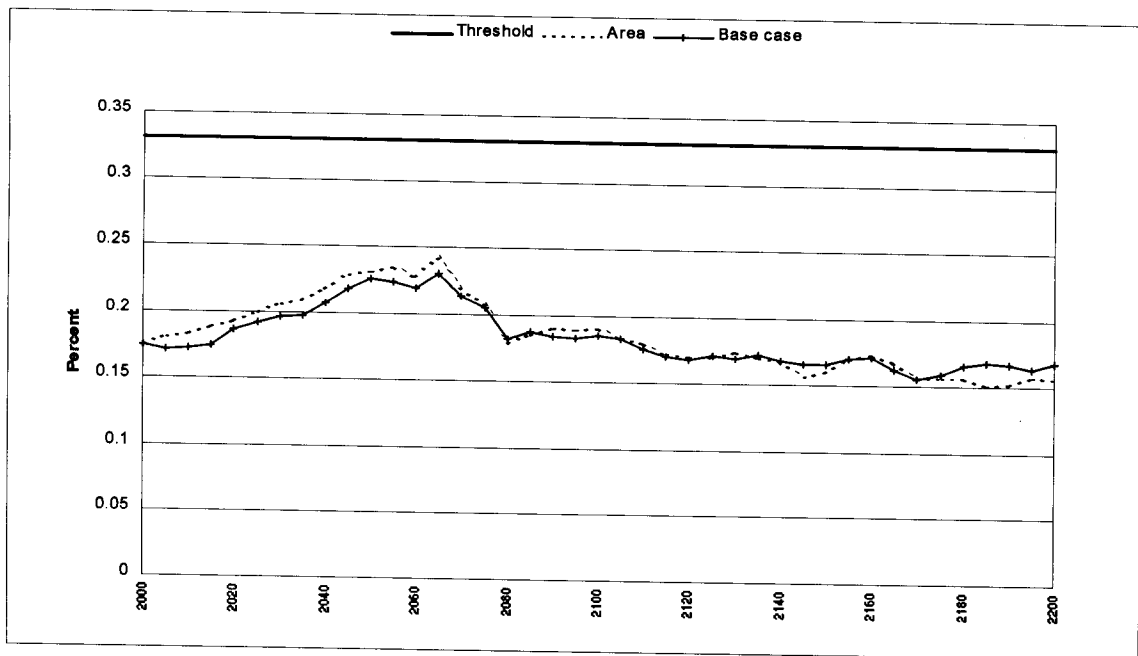


Figure 92: Area below 3m green-up height, general management and special wildlife management zones

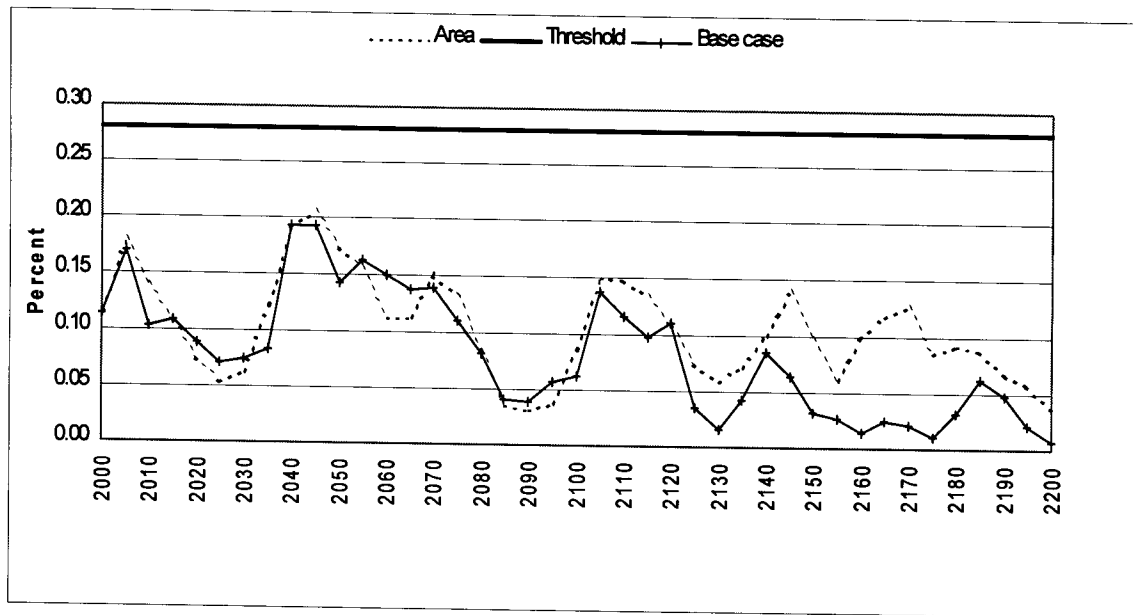


Figure 93: Area below 3.2m green-up height, modification VQO

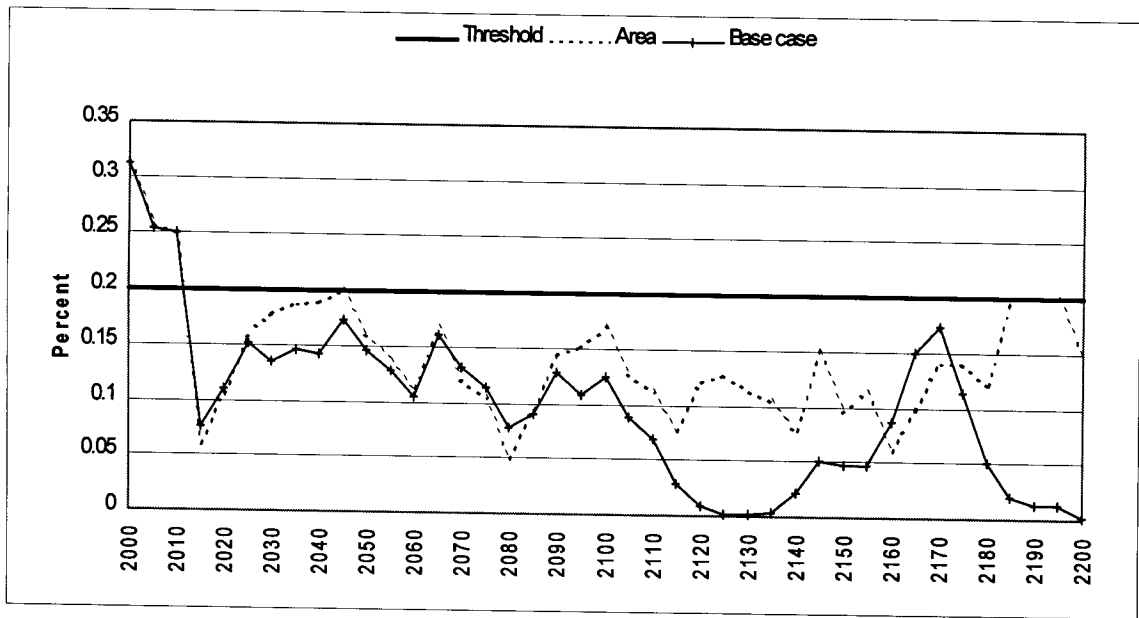


Figure 94: Area below 3.9m green-up height, partial retention VQO

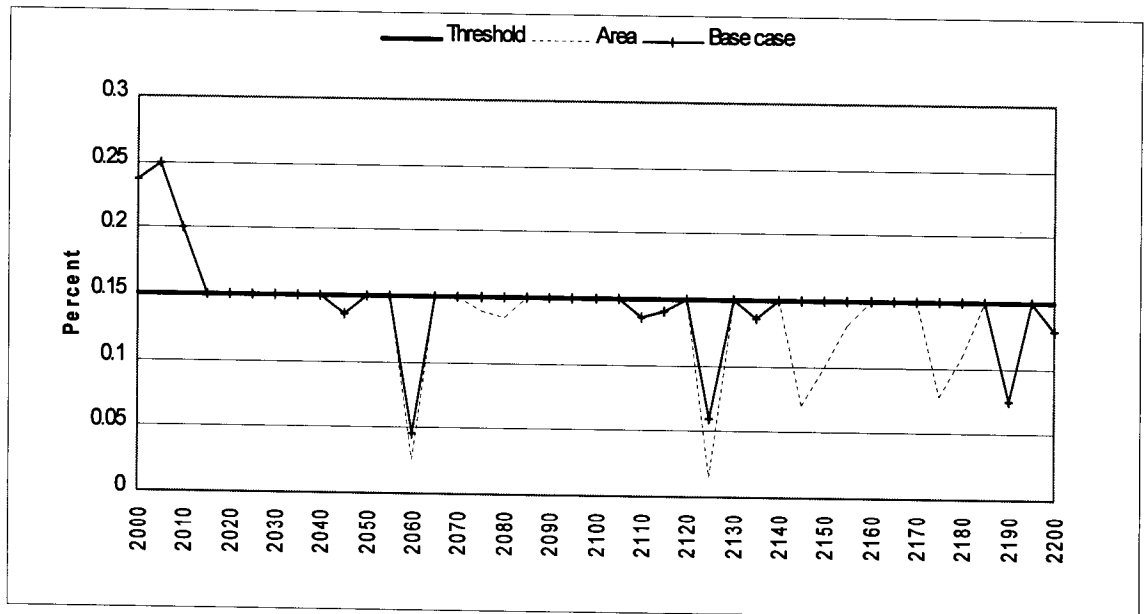


Figure 95: Area below 3.9m green-up height, retention VQO

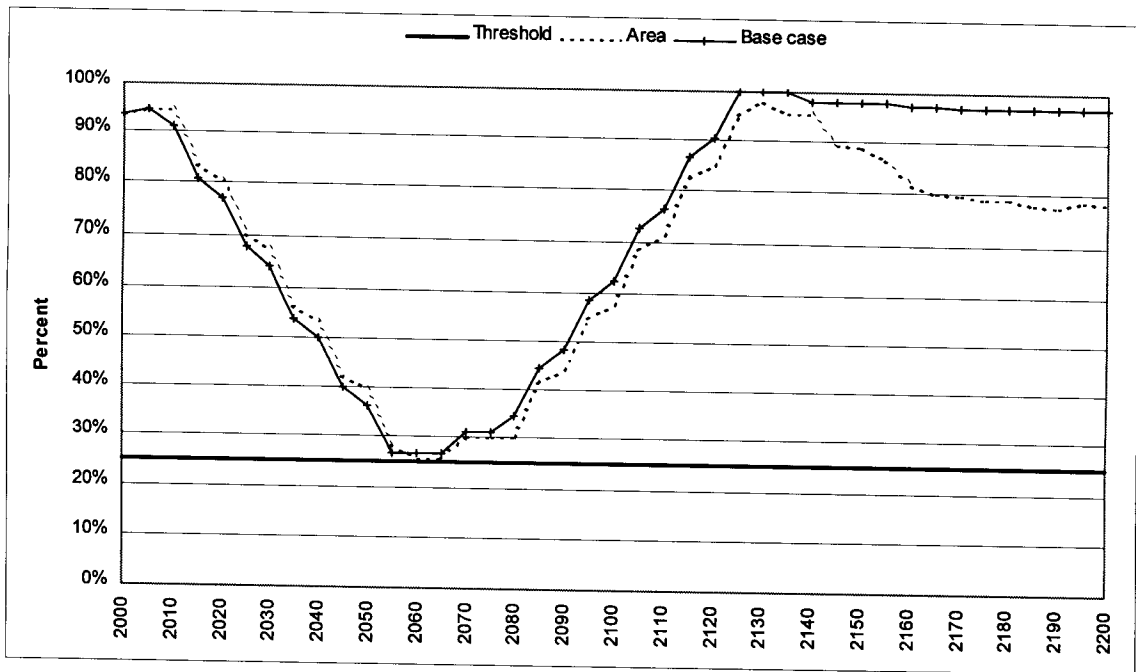


Figure 96: Area above 20m thermal cover, mule deer winter range

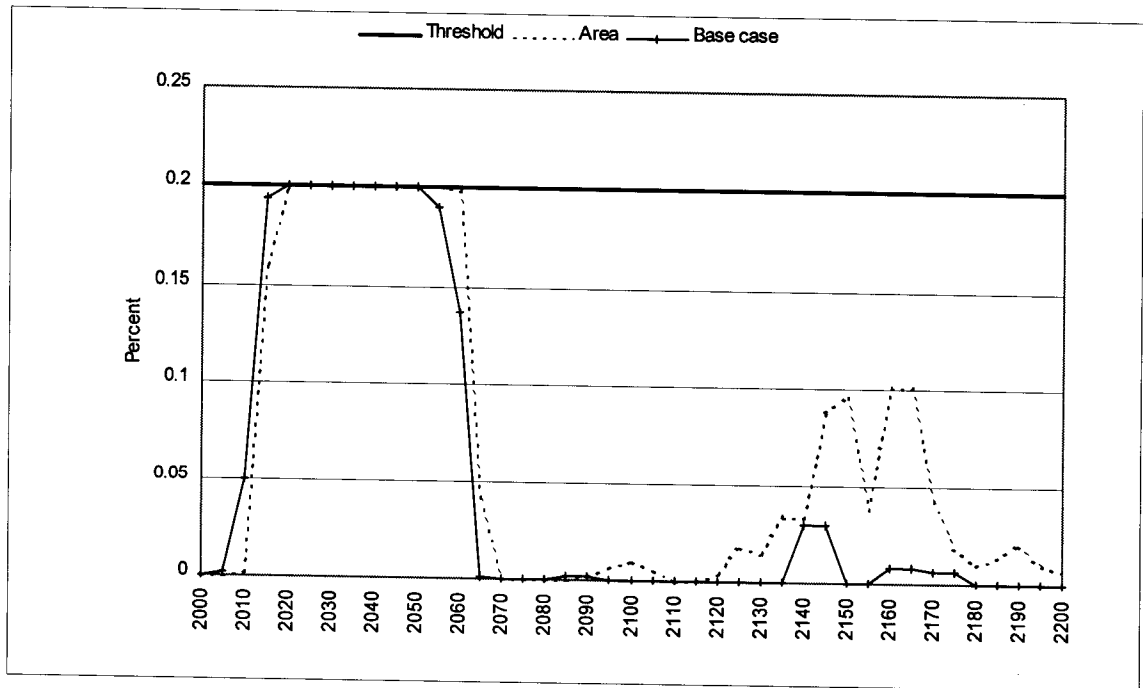


Figure 97: Area below 3m green-up height, mule deer winter range

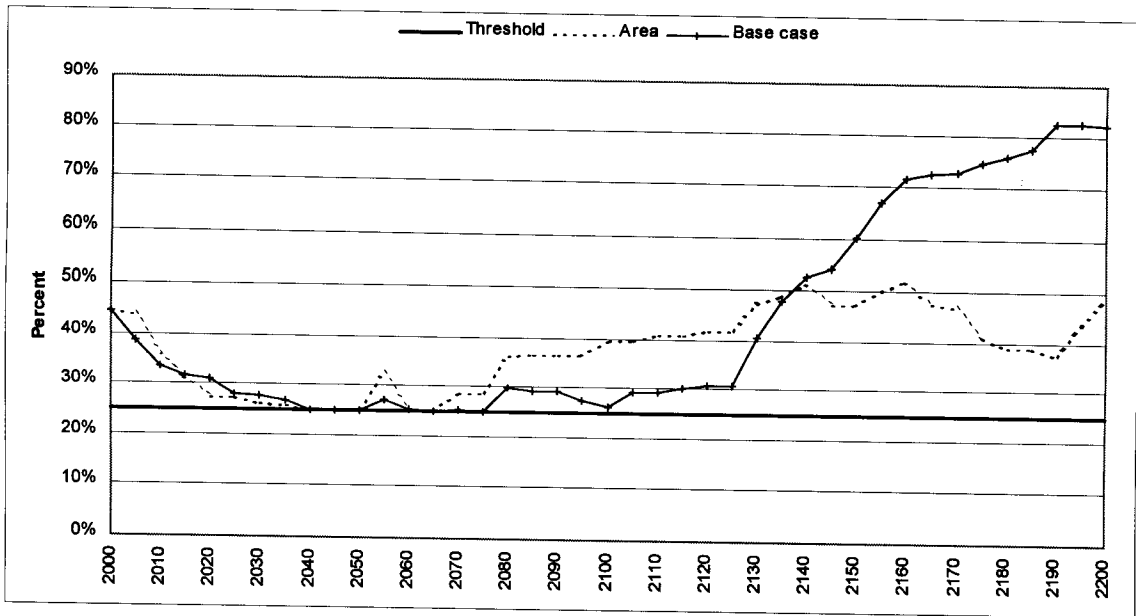


Figure 98: Area above old seral minimum age, special wildlife management area

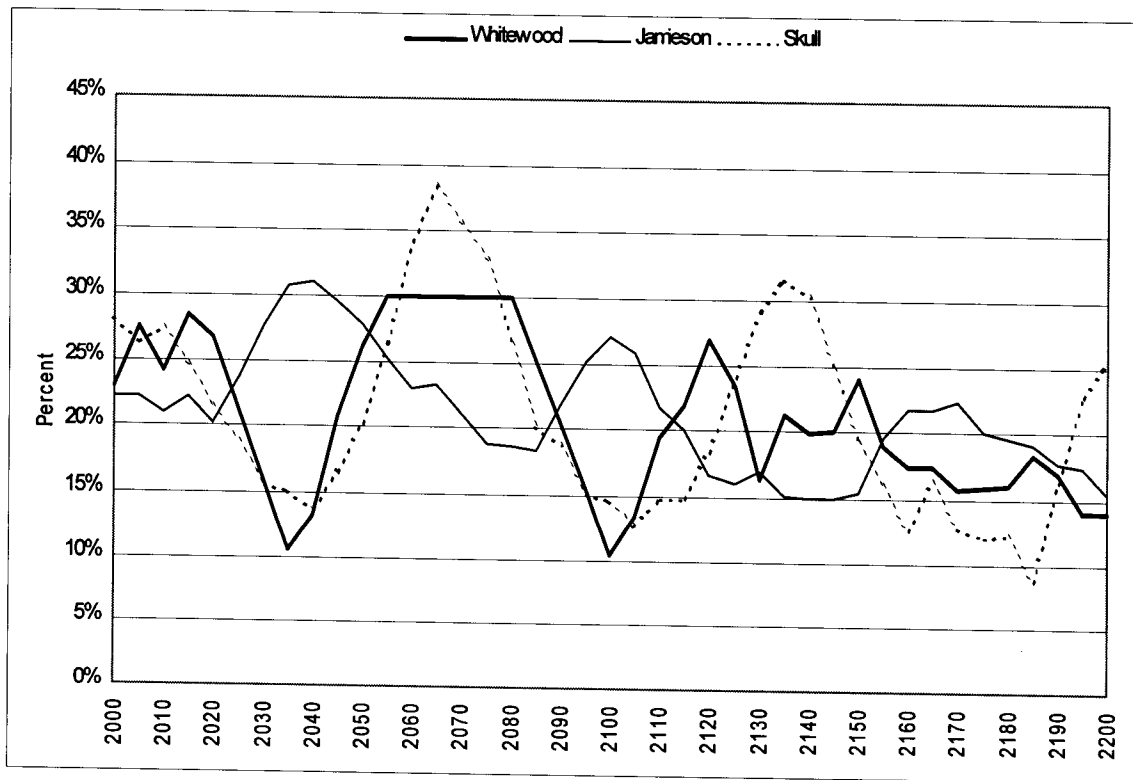


Figure 99: Area below 4.8m hydrological green-up

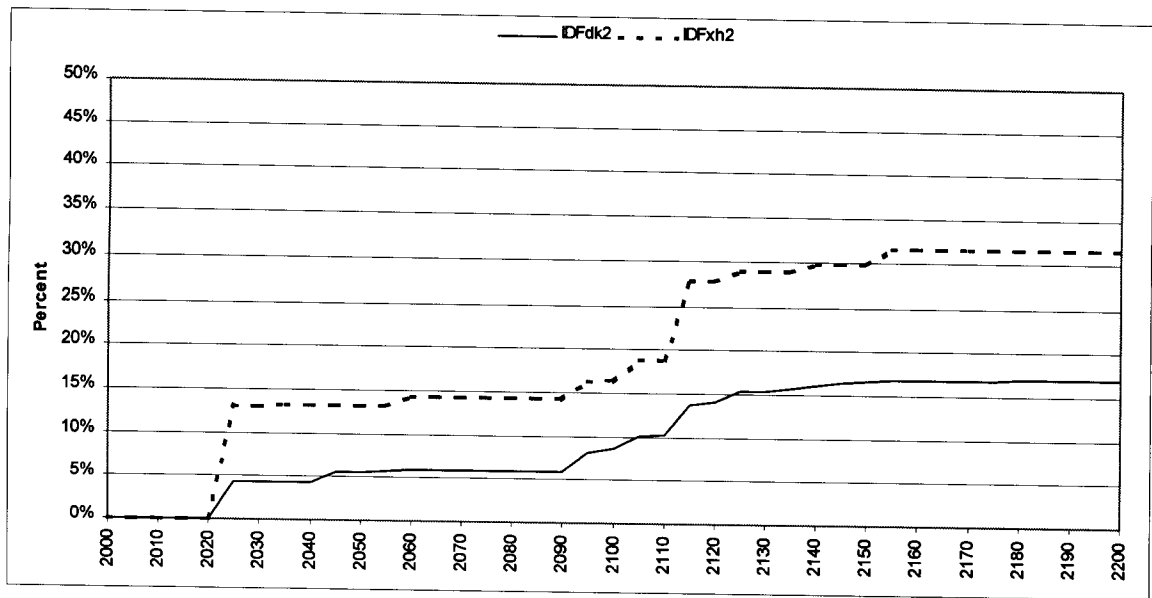


Figure 100: NDT4 Old seral

Mature plus old seral, on/off

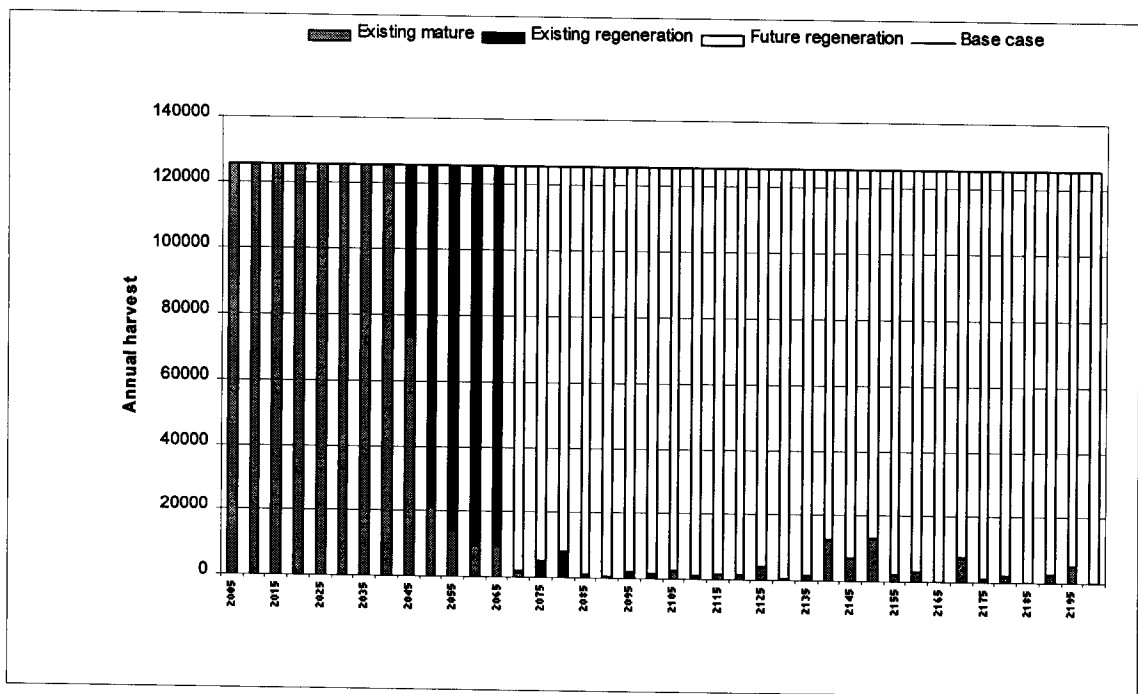


Figure 101: Harvest level and composition

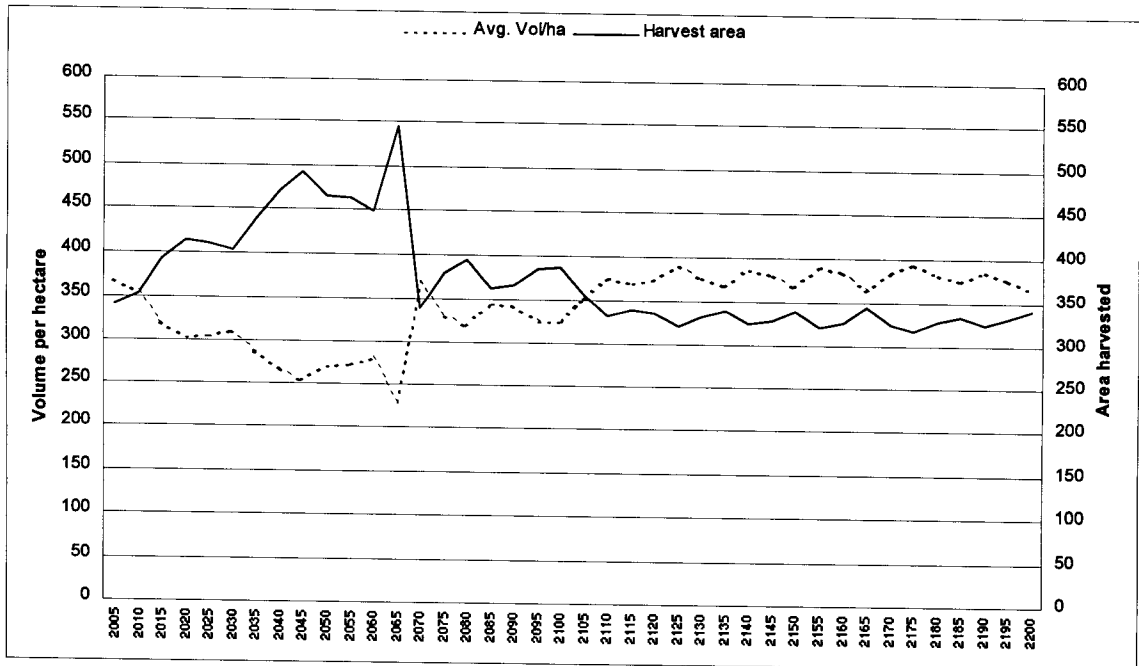


Figure 102: Harvest area and volume

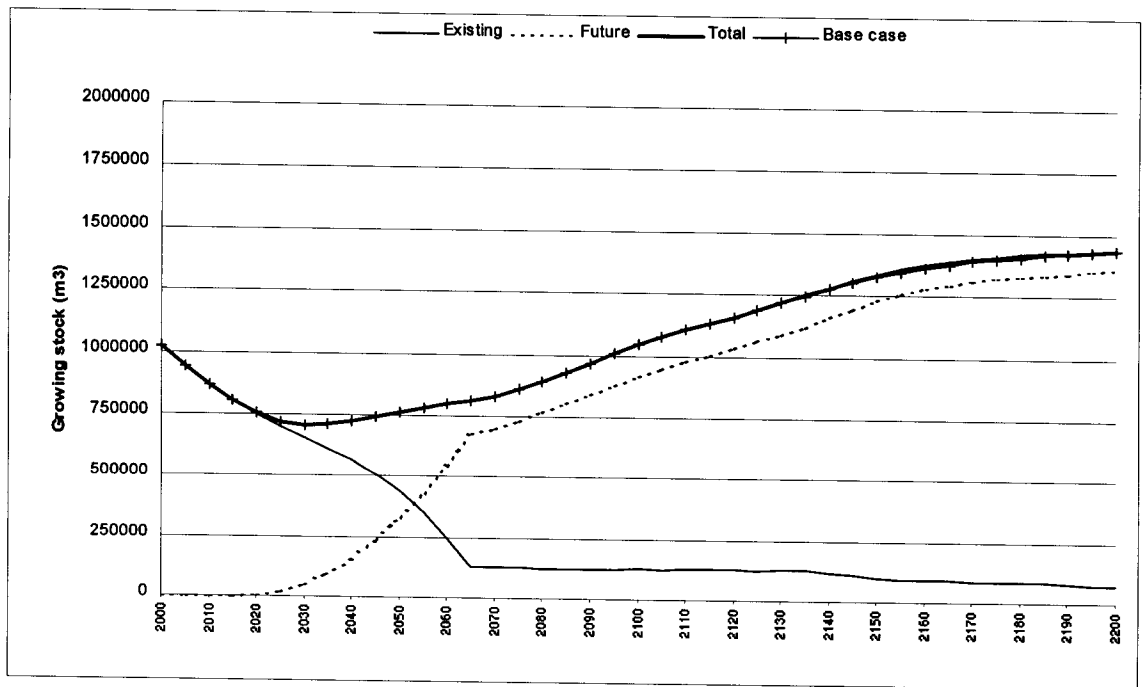


Figure 103: Growing stock

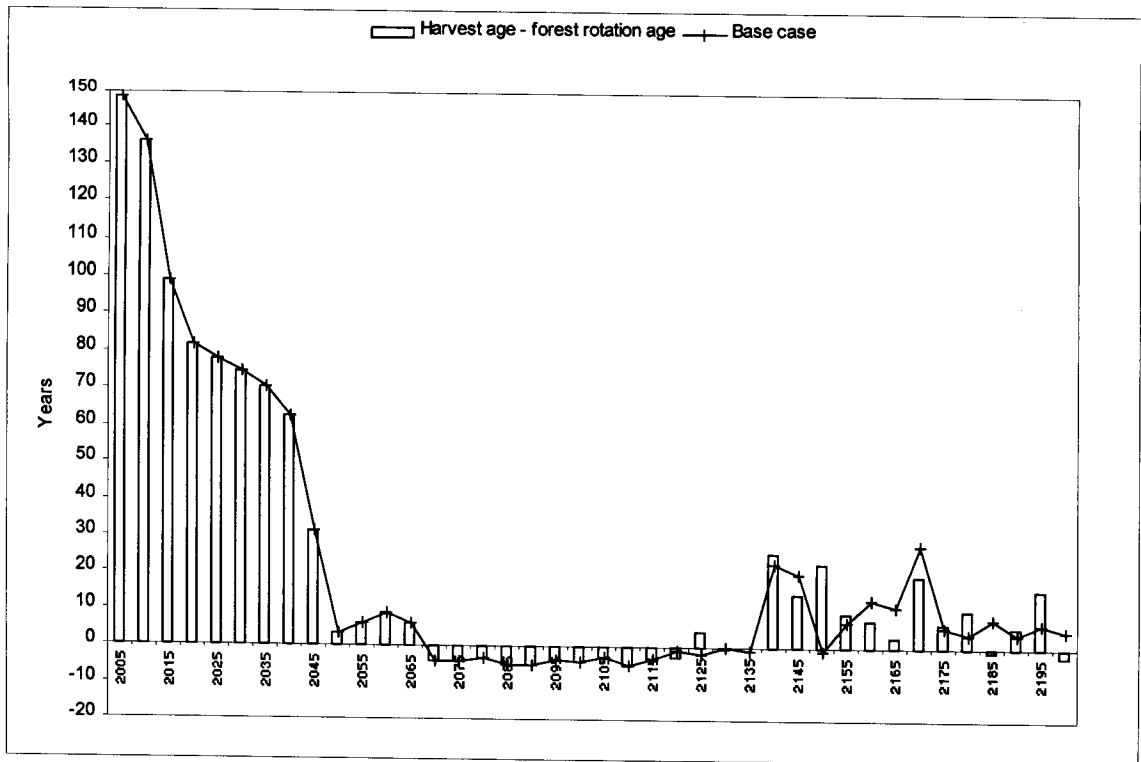


Figure 104: Harvest age minus forest level culmination age

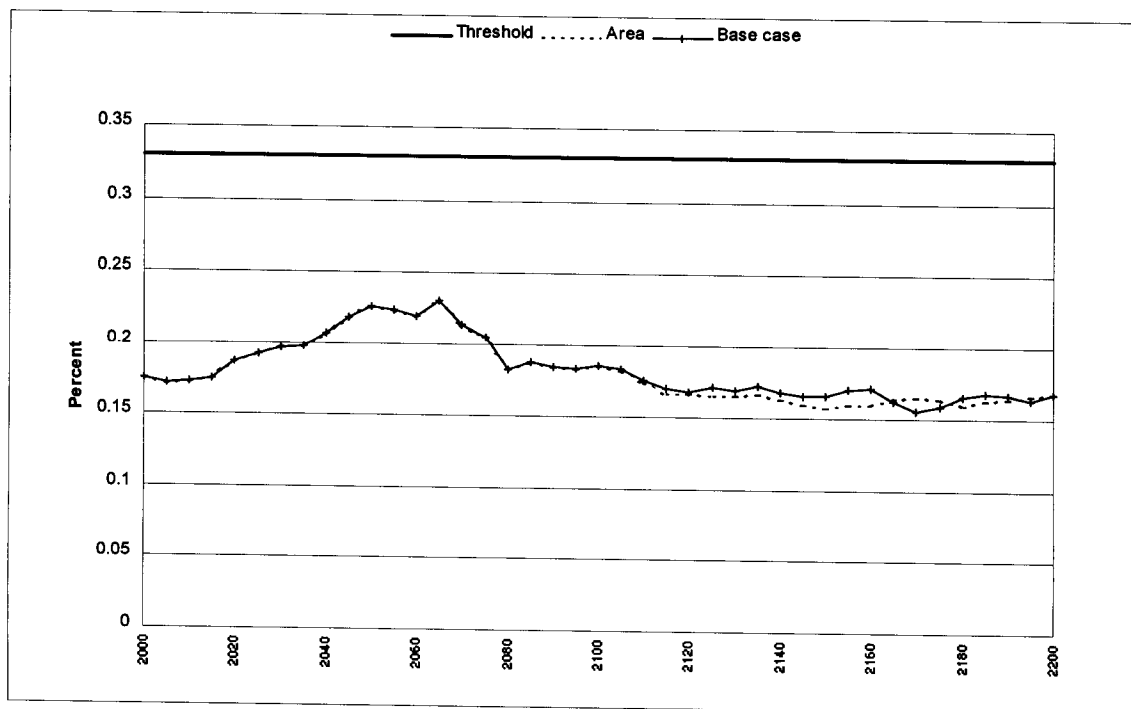


Figure 105: Area below 3m green-up height, general management and special wildlife management zones

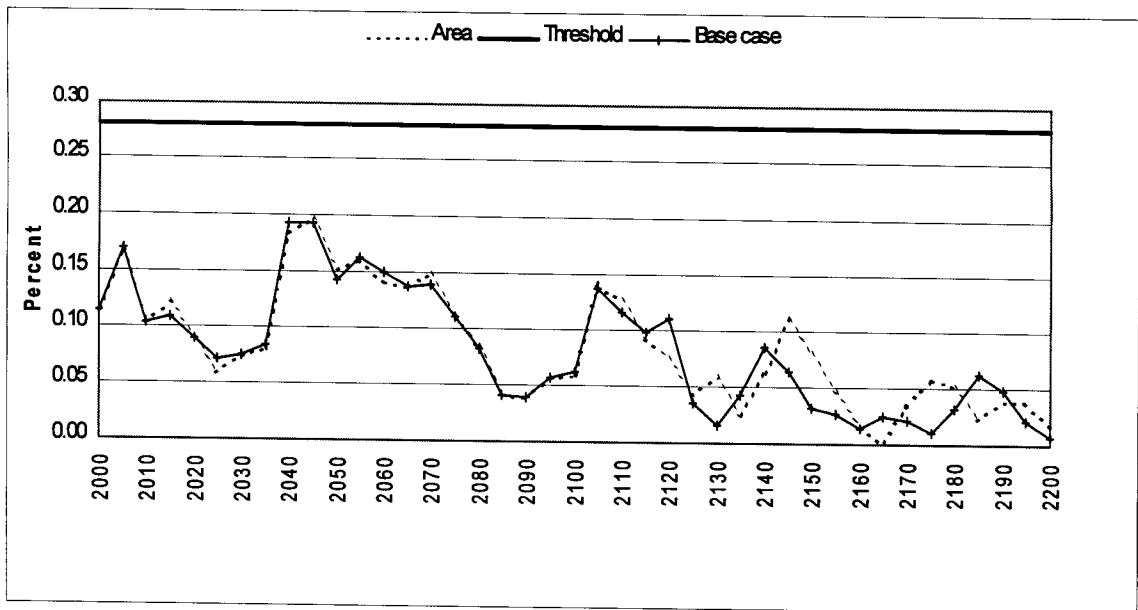


Figure 106: Area below 3.2m green-up height, modification VQO

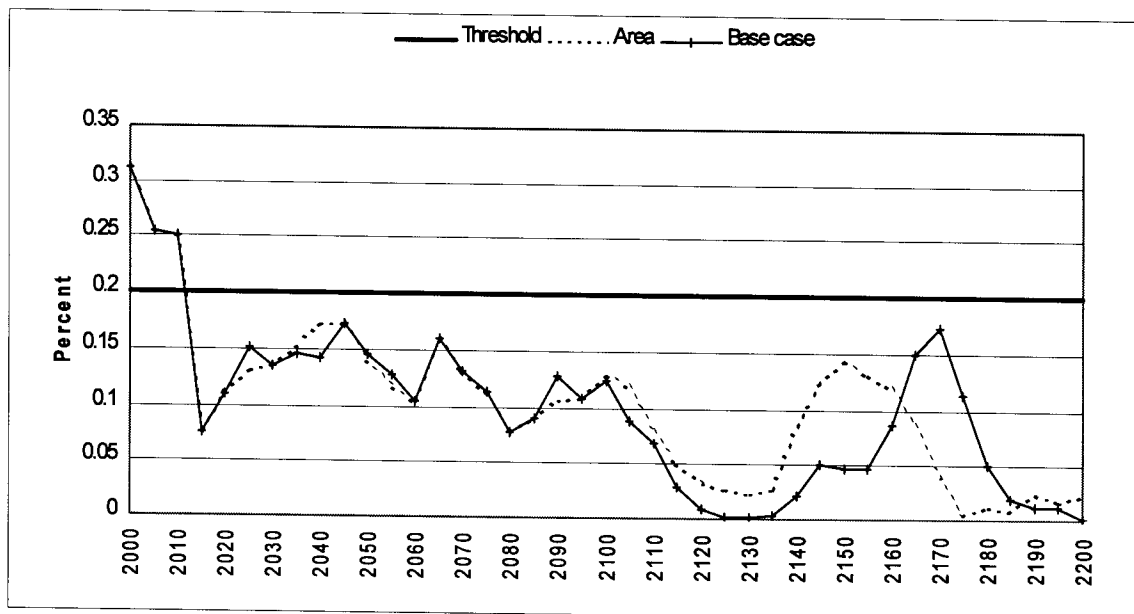


Figure 107: Area below 3.9m green-up height, partial retention VQO

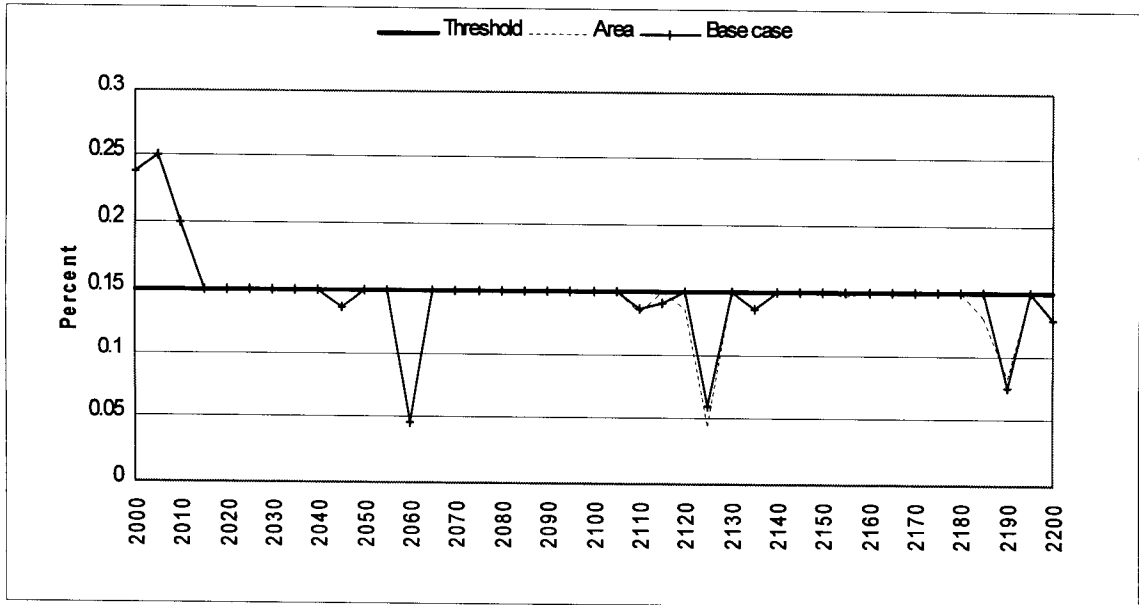


Figure 108: Area below 3.9m green-up height, retention VQO

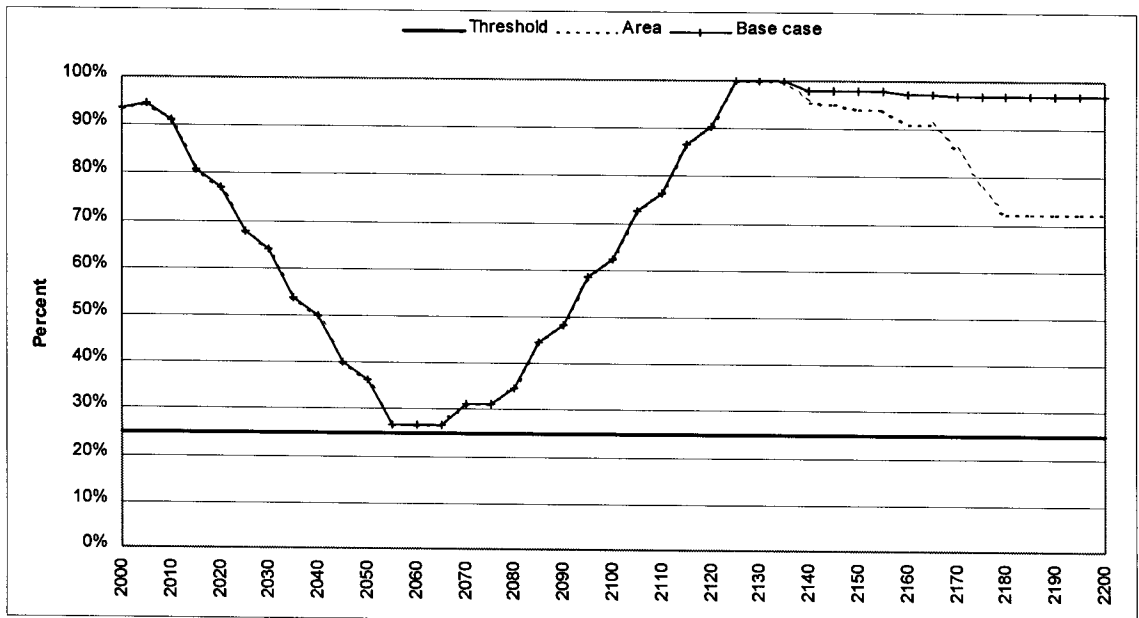


Figure 109: Area above 20m thermal cover requirement, mule deer winter range

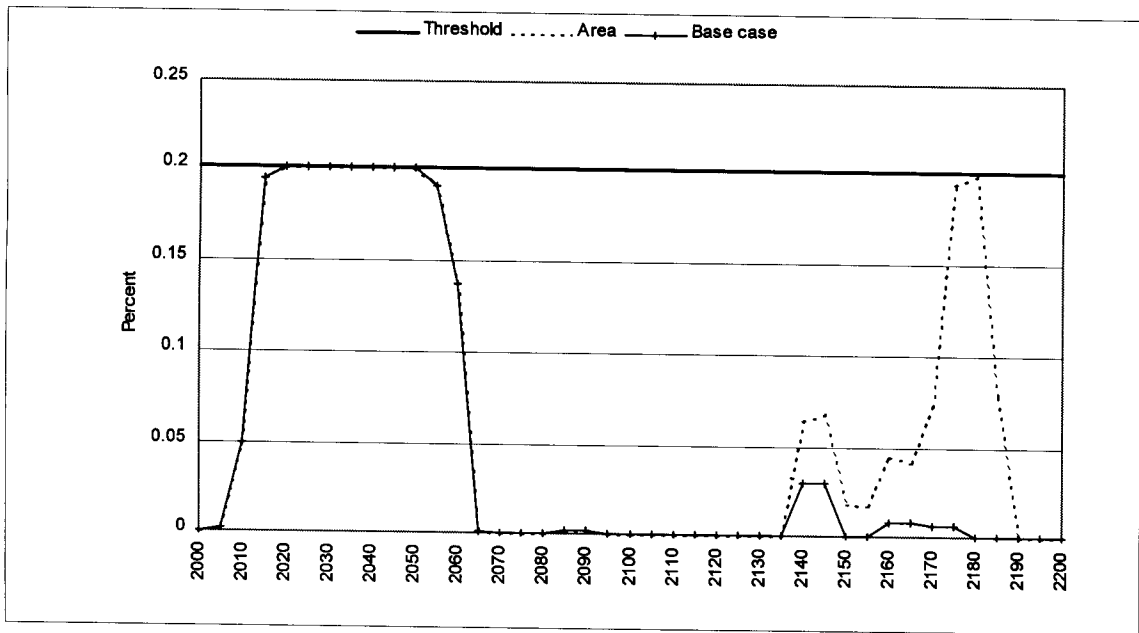


Figure 110: Area below 3m green-up height, mule deer winter range

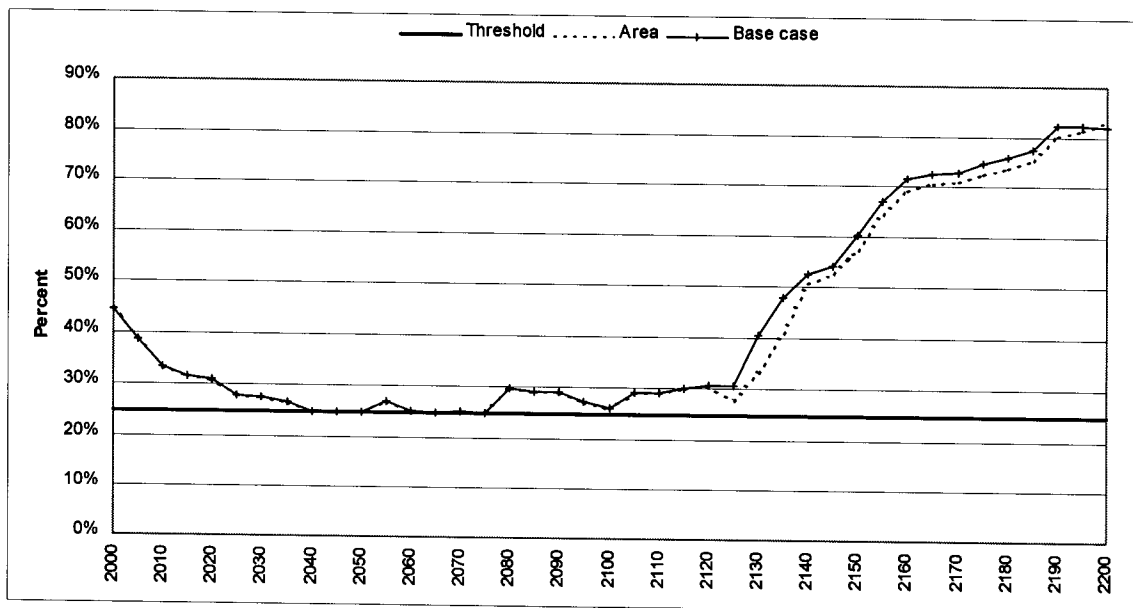


Figure 111: Area above minimum old seral age, special wildlife management areas

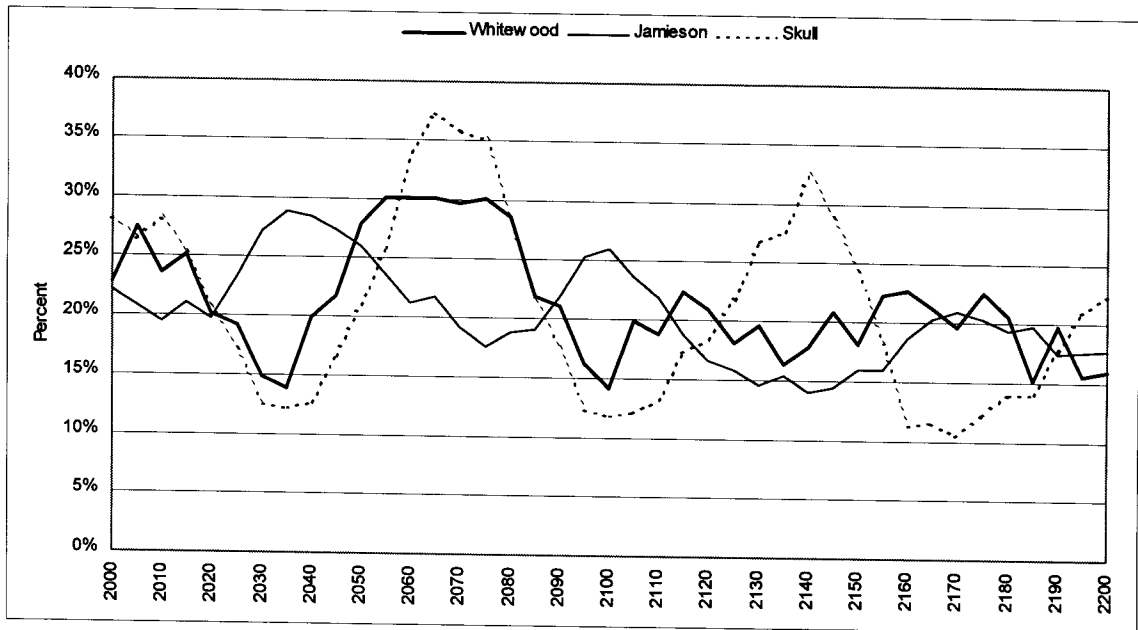


Figure 112: Area below 4.8m hydrological green-up

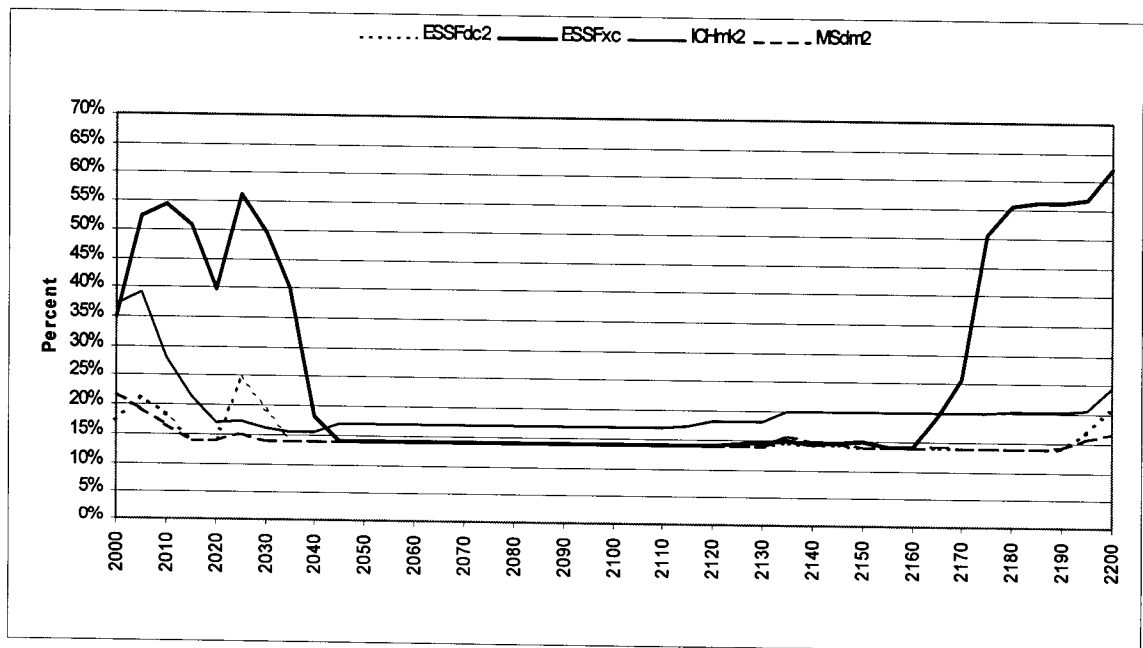


Figure 113: NDT3 old seral

NDT3 minimum old seral age lowered to 120

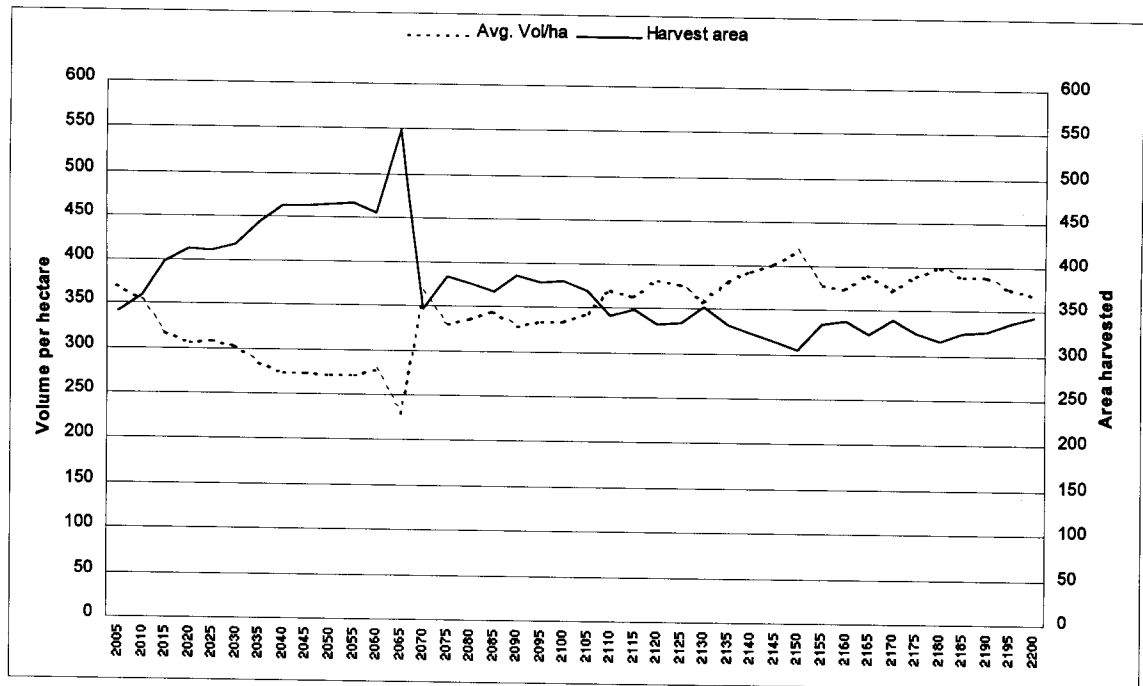


Figure 114: Harvest volume and area

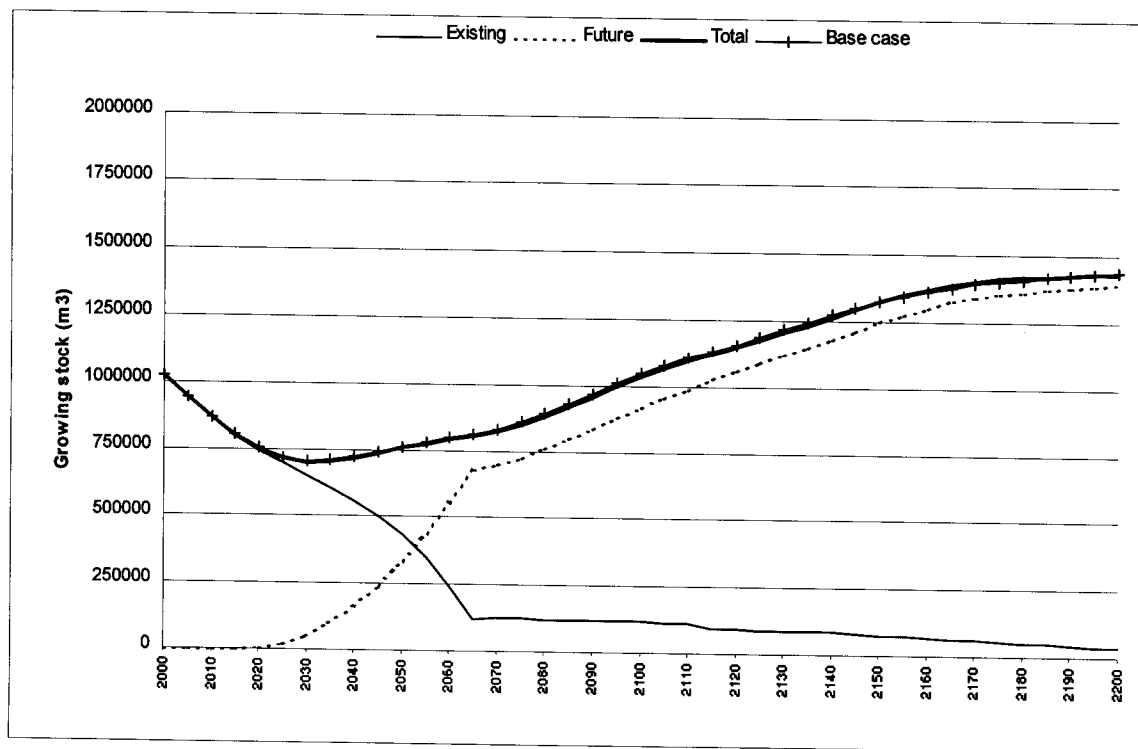


Figure 115: Growing stock

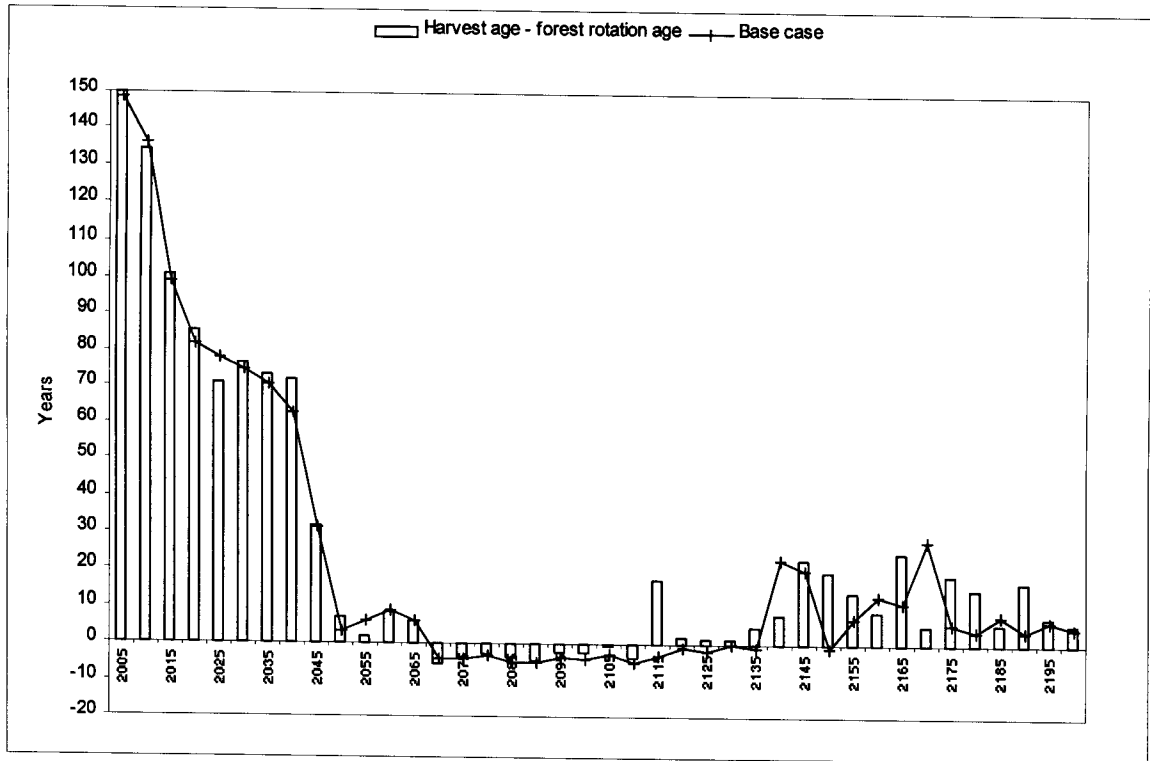


Figure 116: Harvest age - forest-level rotation age

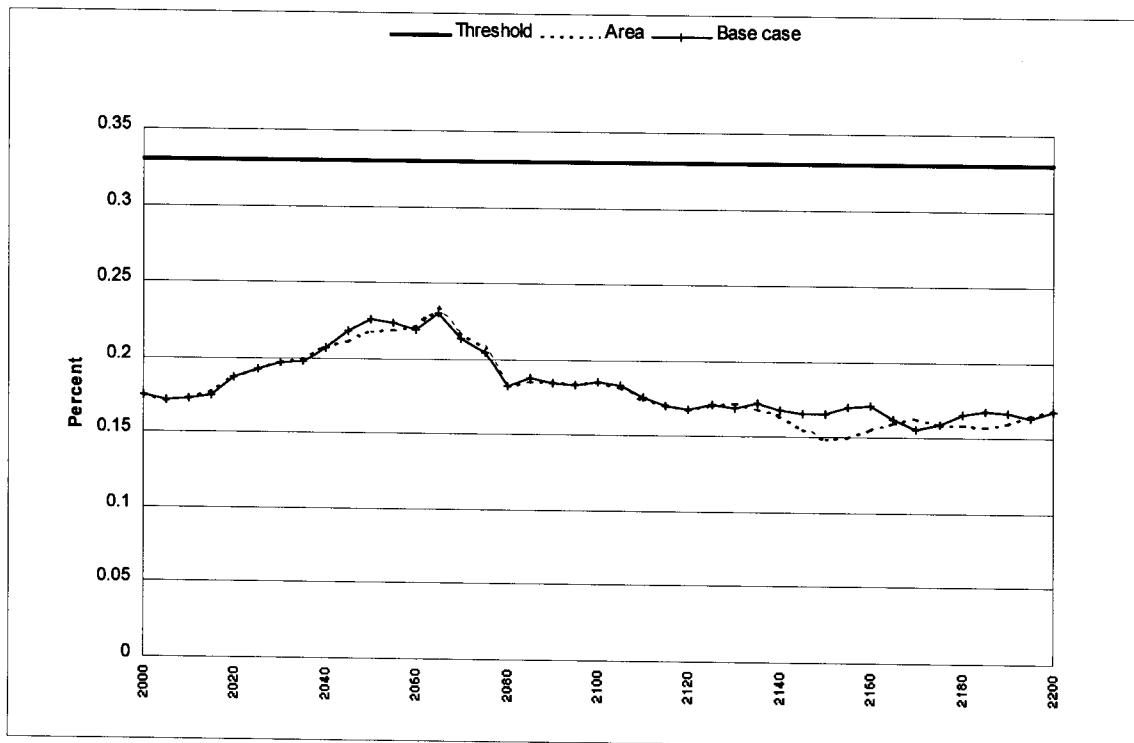


Figure 117: Area below 3m green-up, general management and special wildlife areas

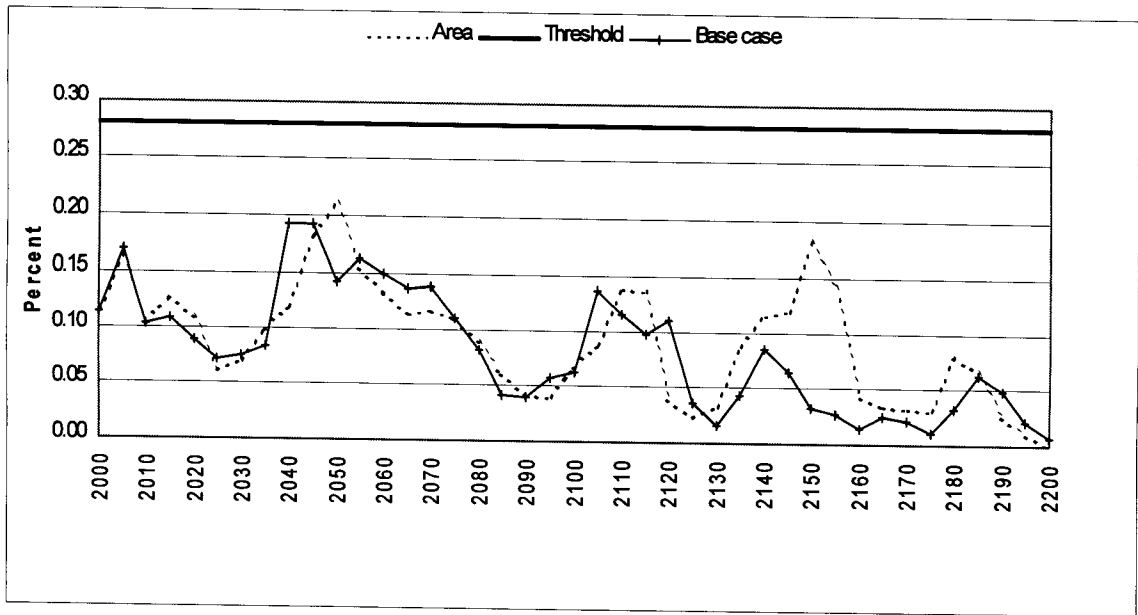


Figure 118: Area below 3.2m green-up height, modification VQO

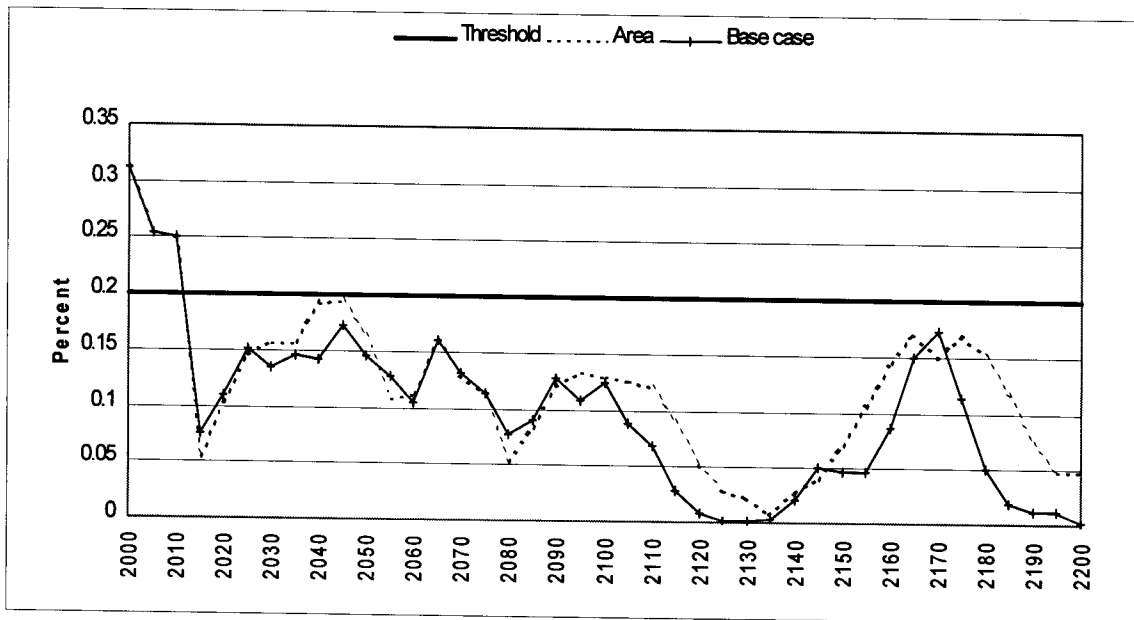


Figure 119: Area below 3.9m green-up, partial retention VQO

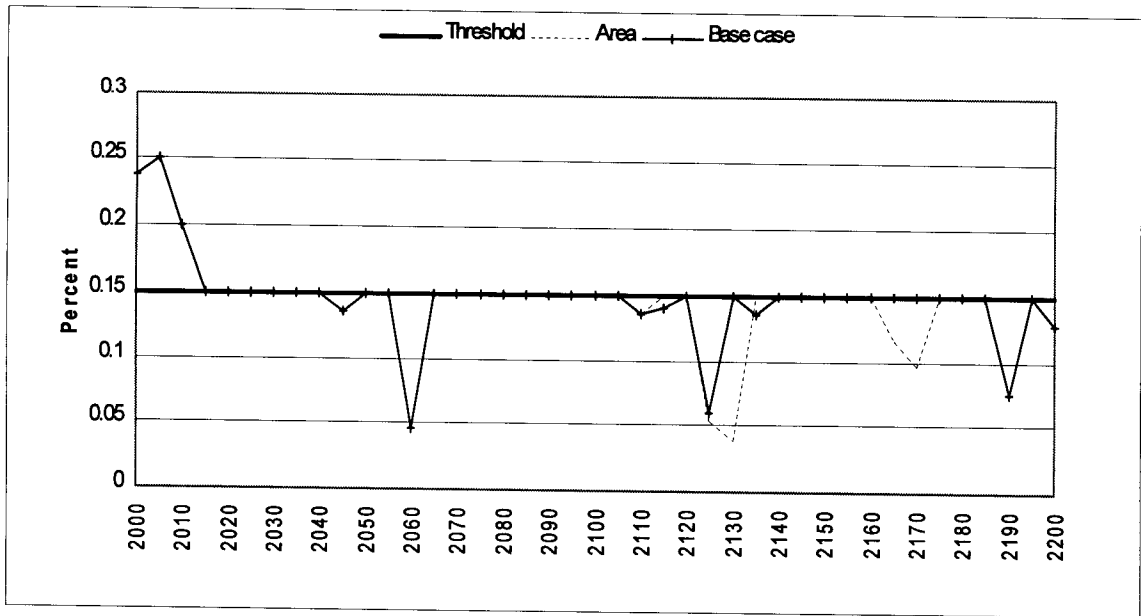


Figure 120: Area below 3.9m green-up, retention VQO

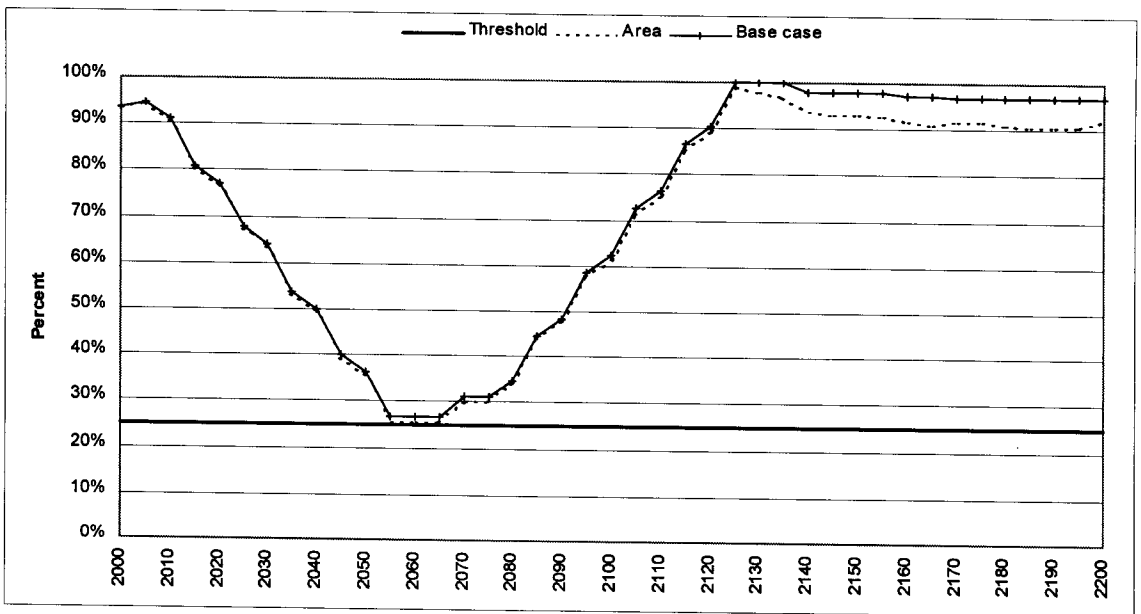


Figure 121: Area above 20m thermal cover height, mule deer winter range

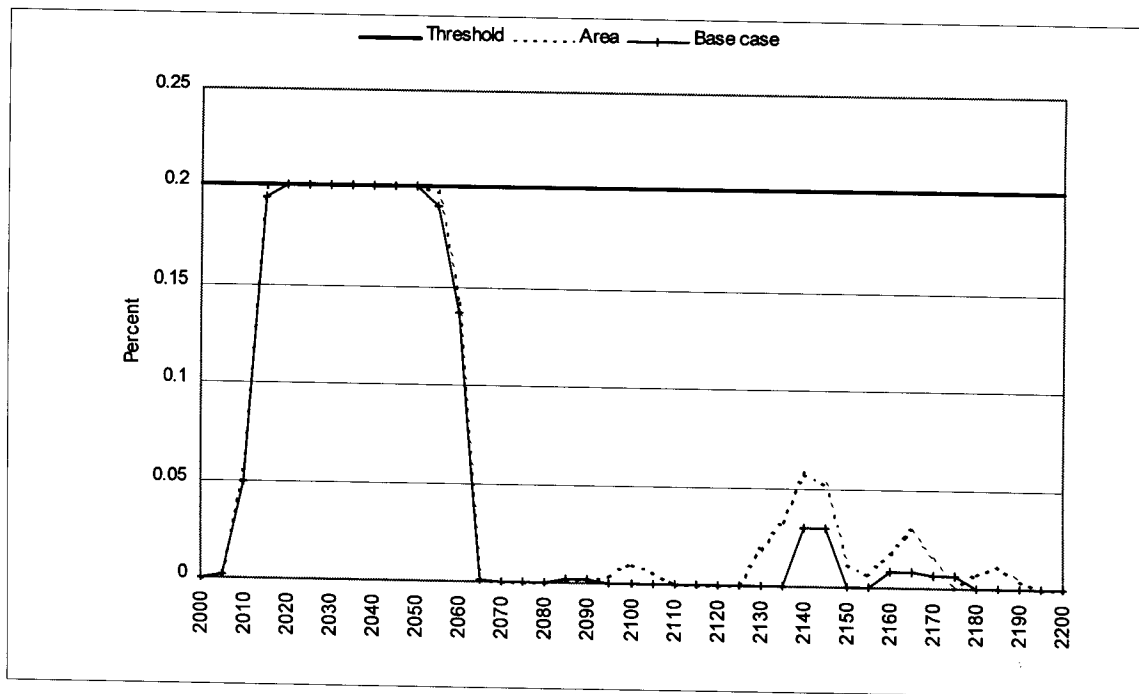


Figure 122: Area below 3m green-up, mule deer winter range

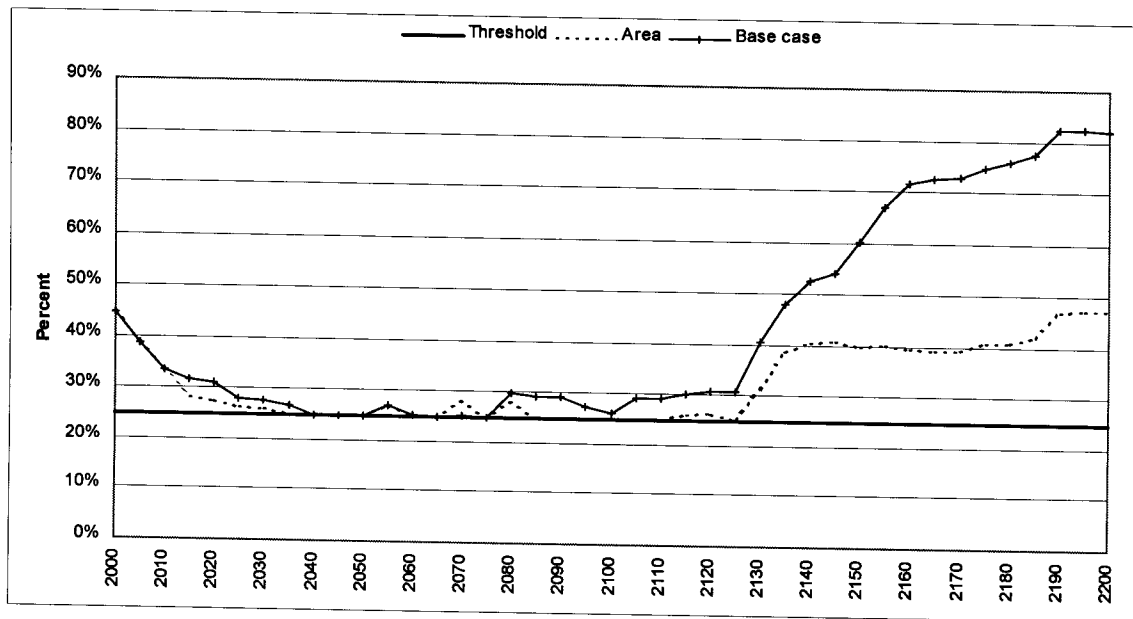


Figure 123: Area above minimum old seral age, special wildlife management areas

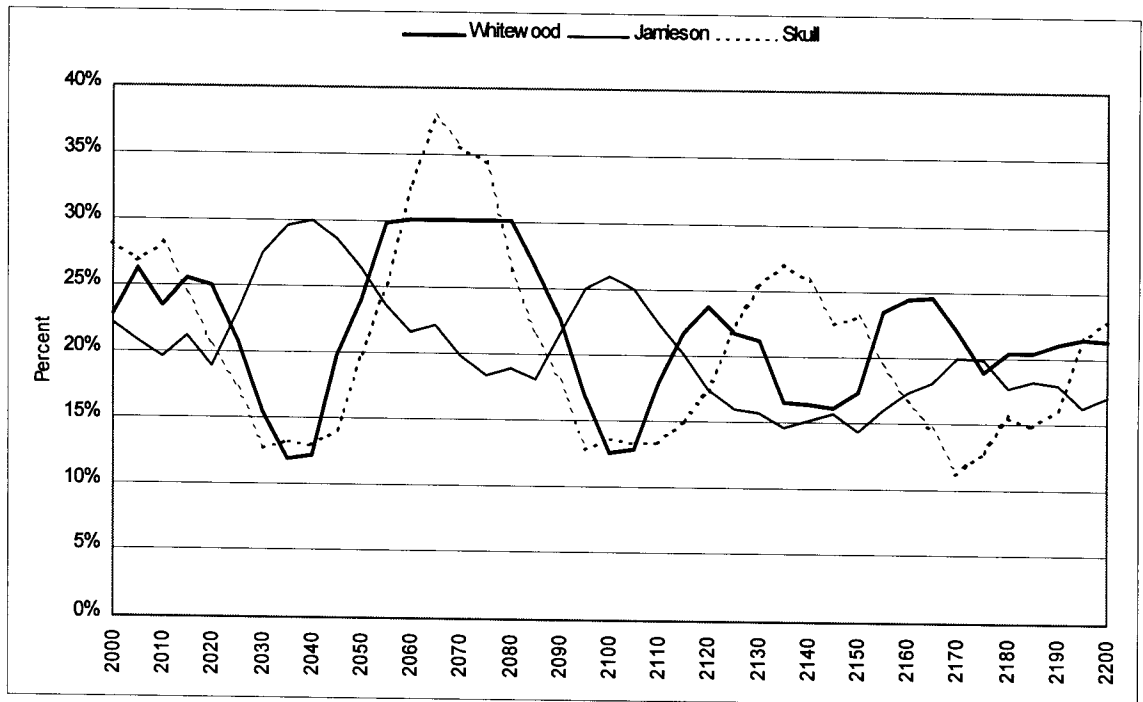


Figure 124: Area below 4.8m hydrological green-up

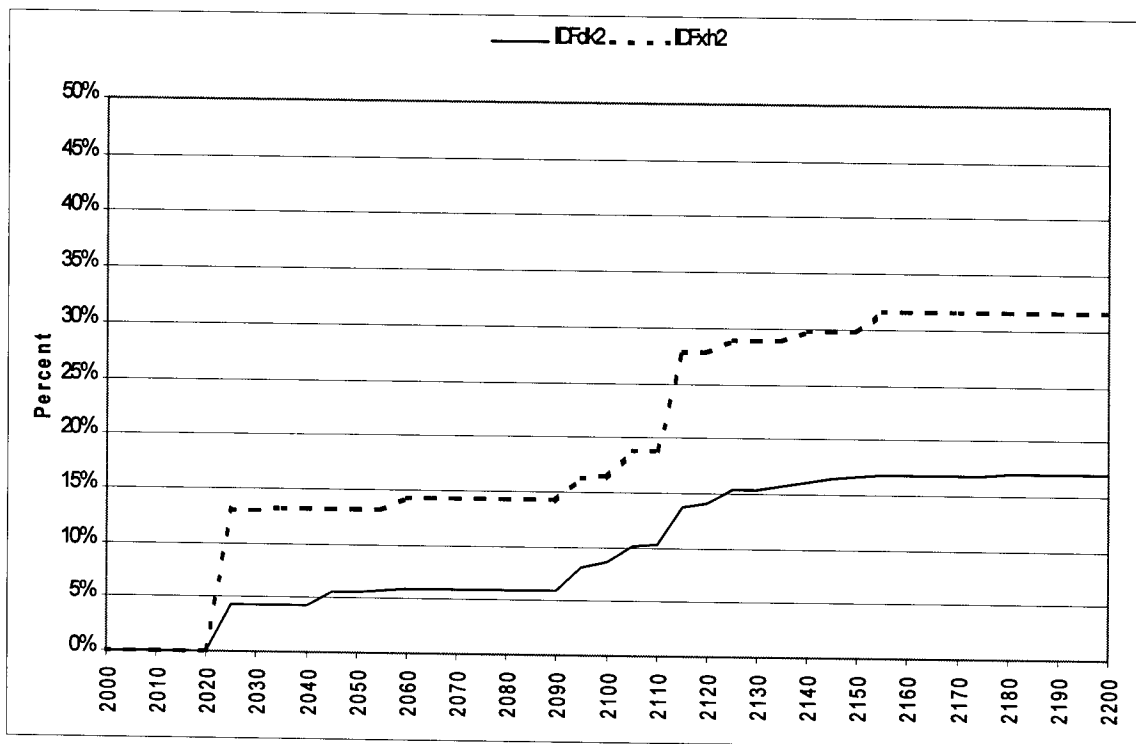


Figure 125: NDT4 old seral

Mature volume up 10%

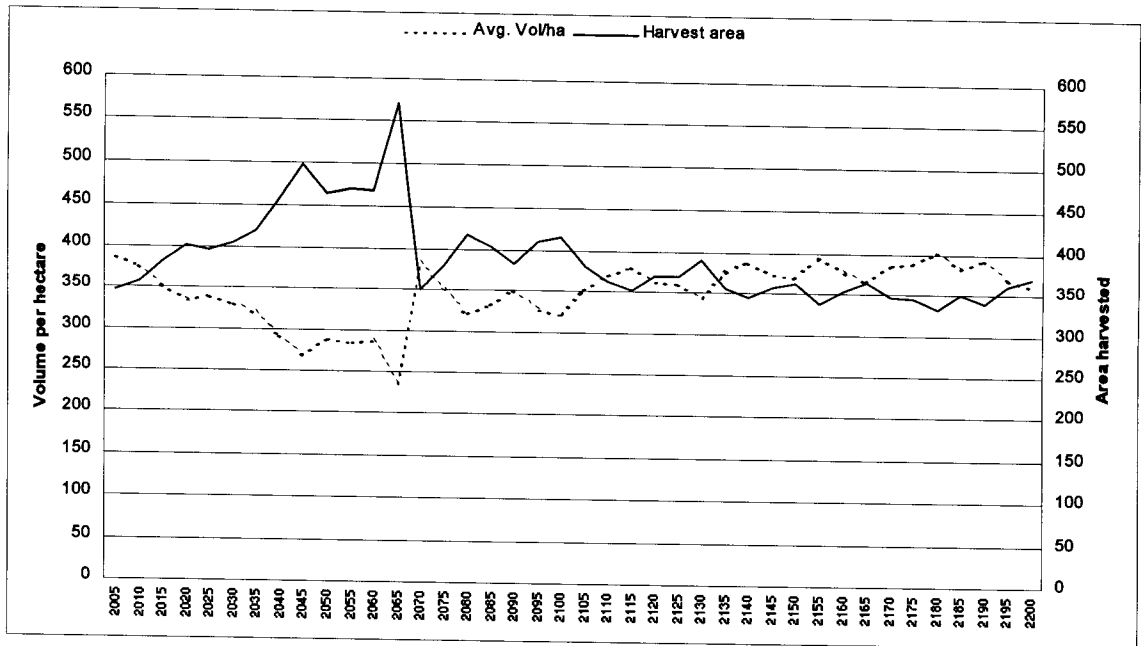


Figure 126: Harvest volume and area

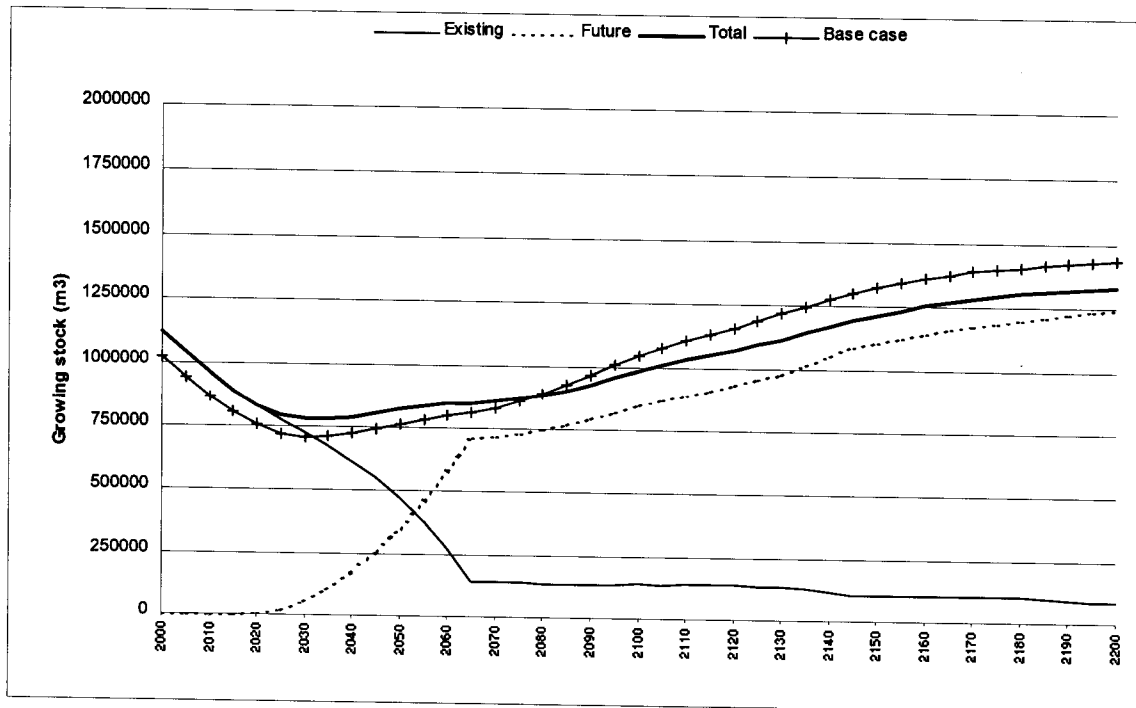


Figure 127: Growing stock

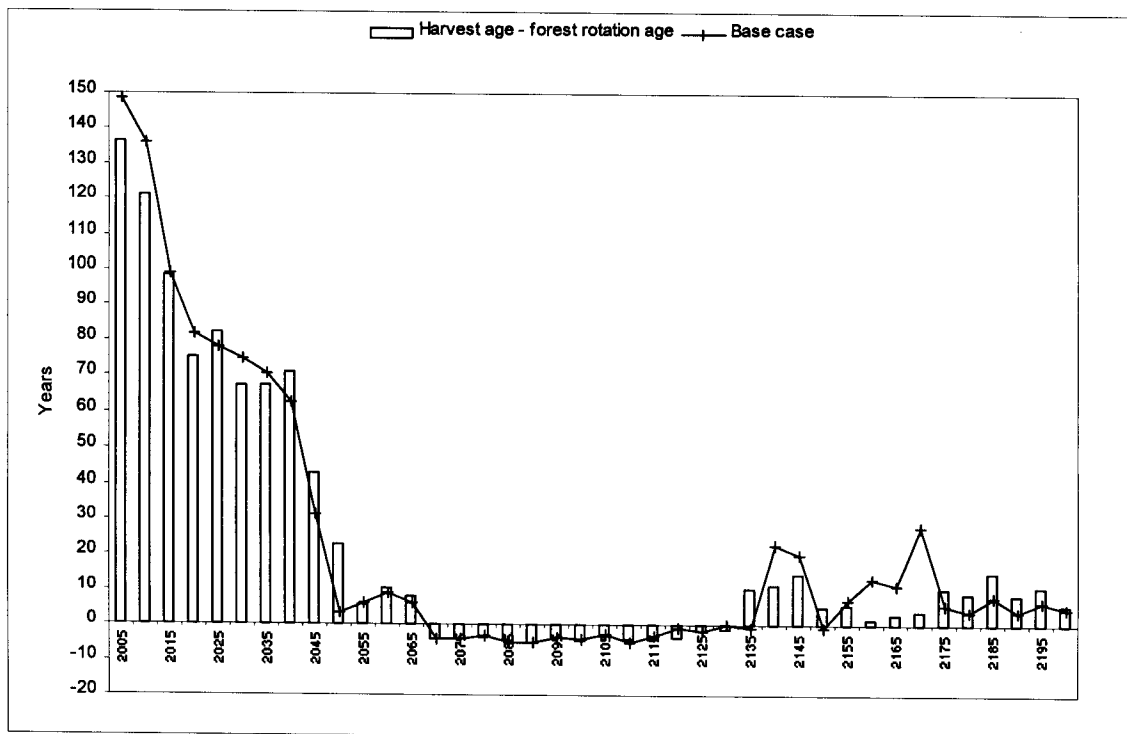


Figure 128: Harvest age - forest-level culmination age

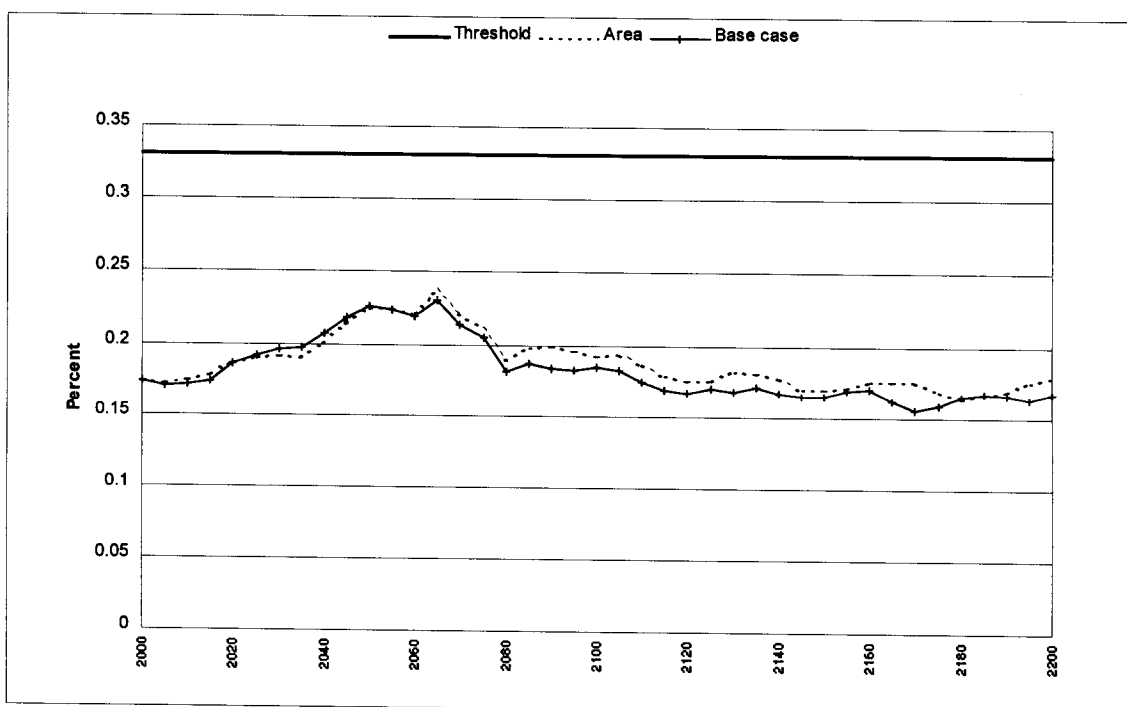


Figure 129: Area below 3m green-up height, General management and special wildlife zones

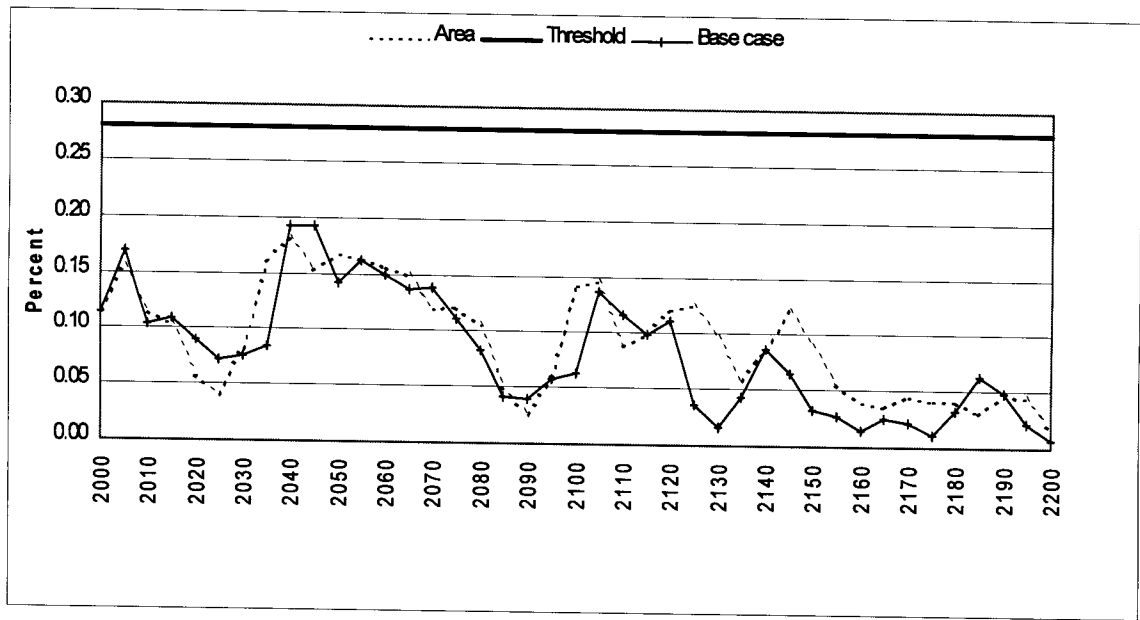


Figure 130: Area below 3.2m green-up, modification VQO

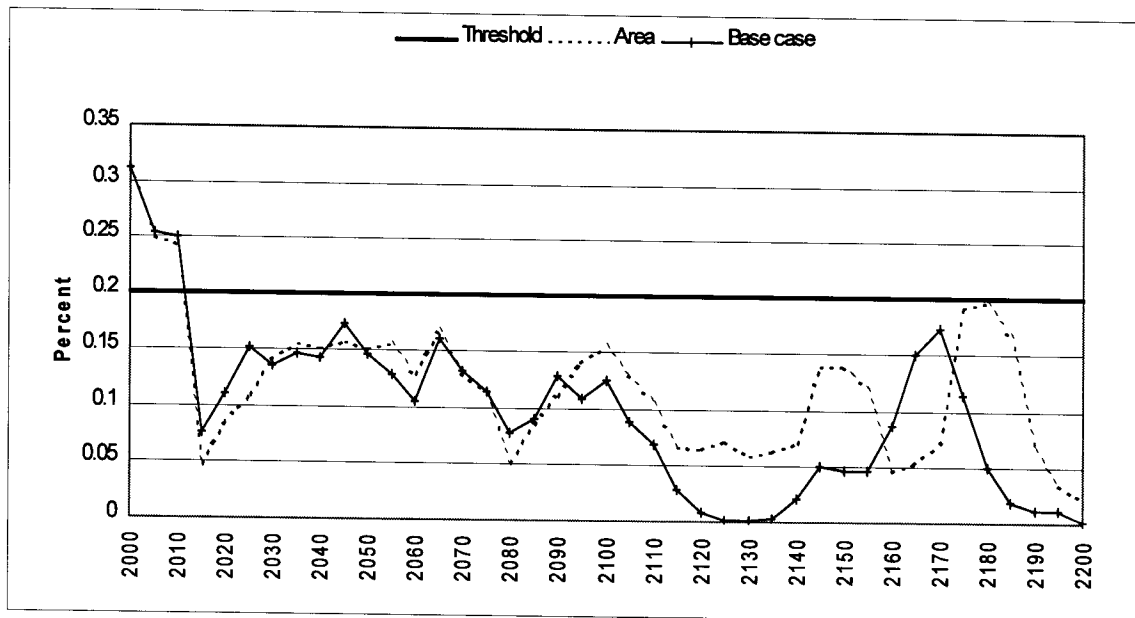


Figure 131: Area below 3.9m green-up height, partial retention VQO

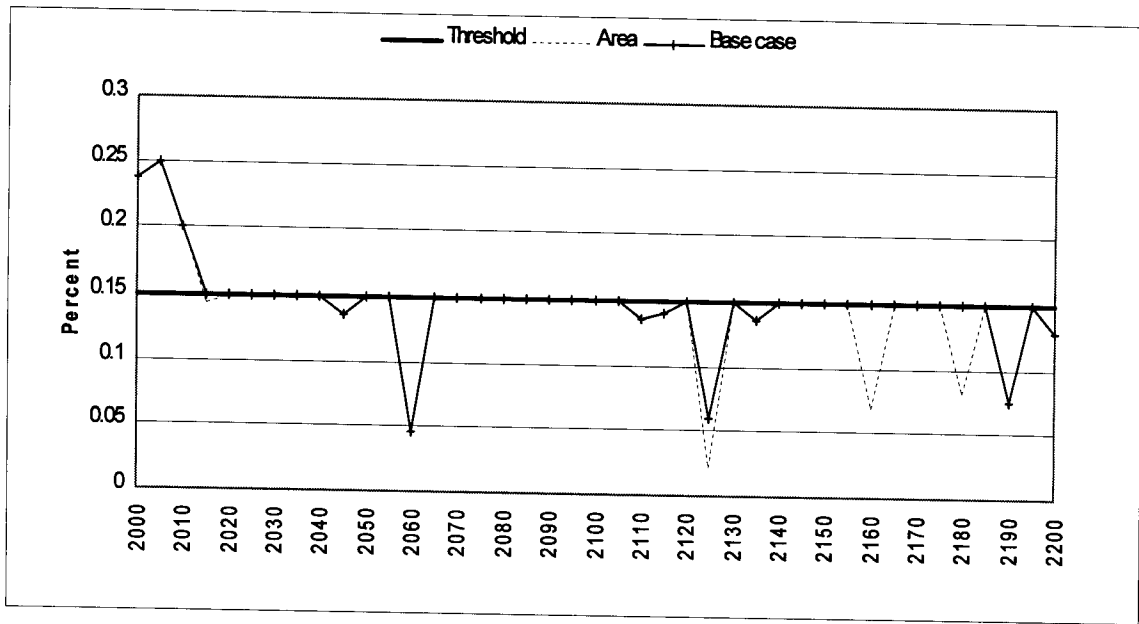


Figure 132: Area below 3.9m green-up height, retention VQO

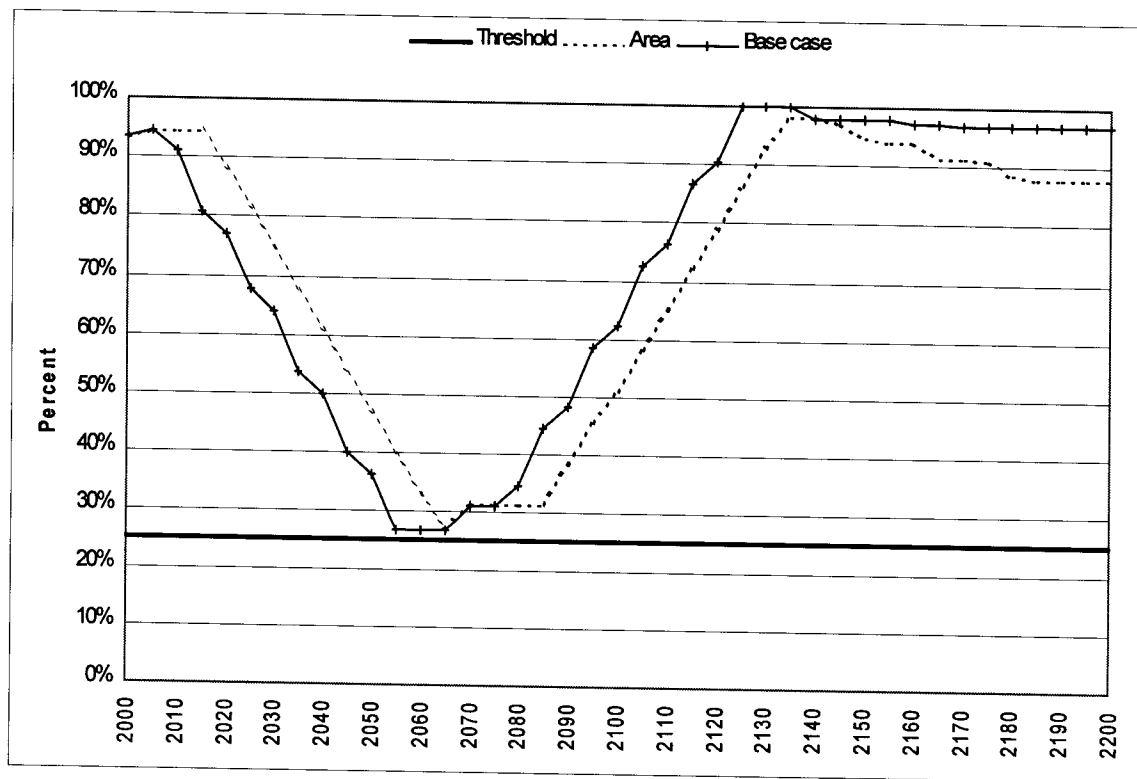


Figure 133: Area above 20m thermal height, mule deer winter range

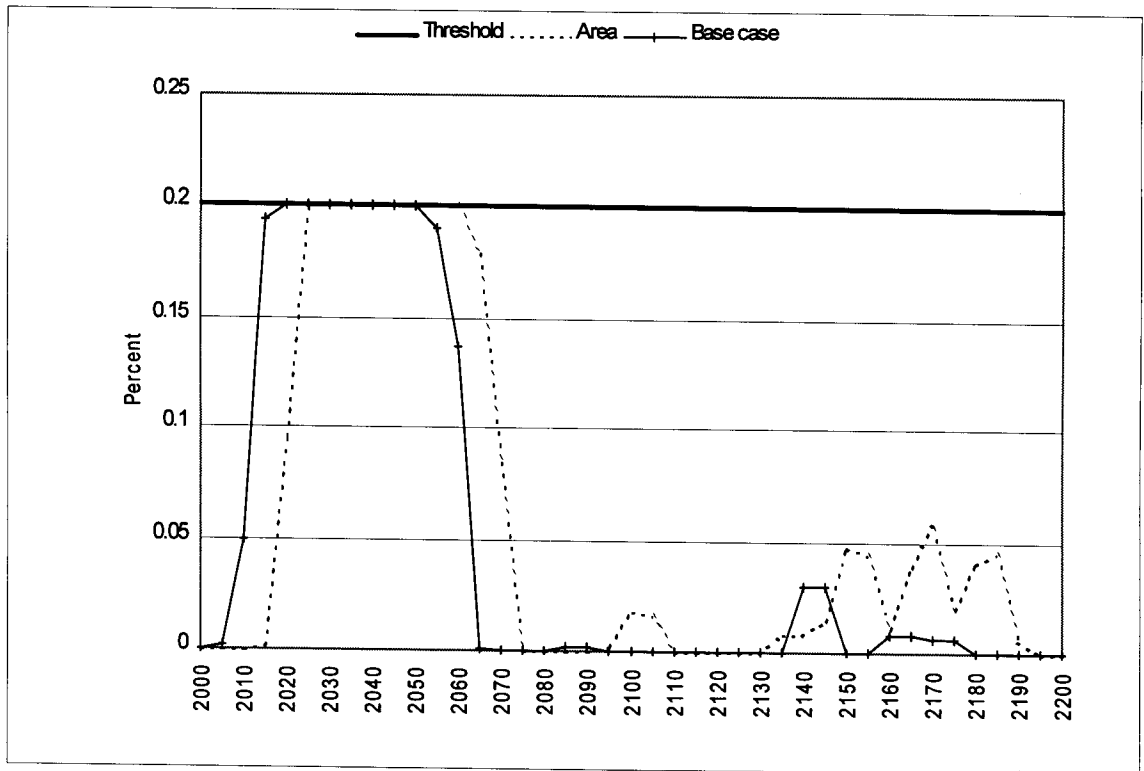


Figure 134: Area below 3m green-up mule deer winter range

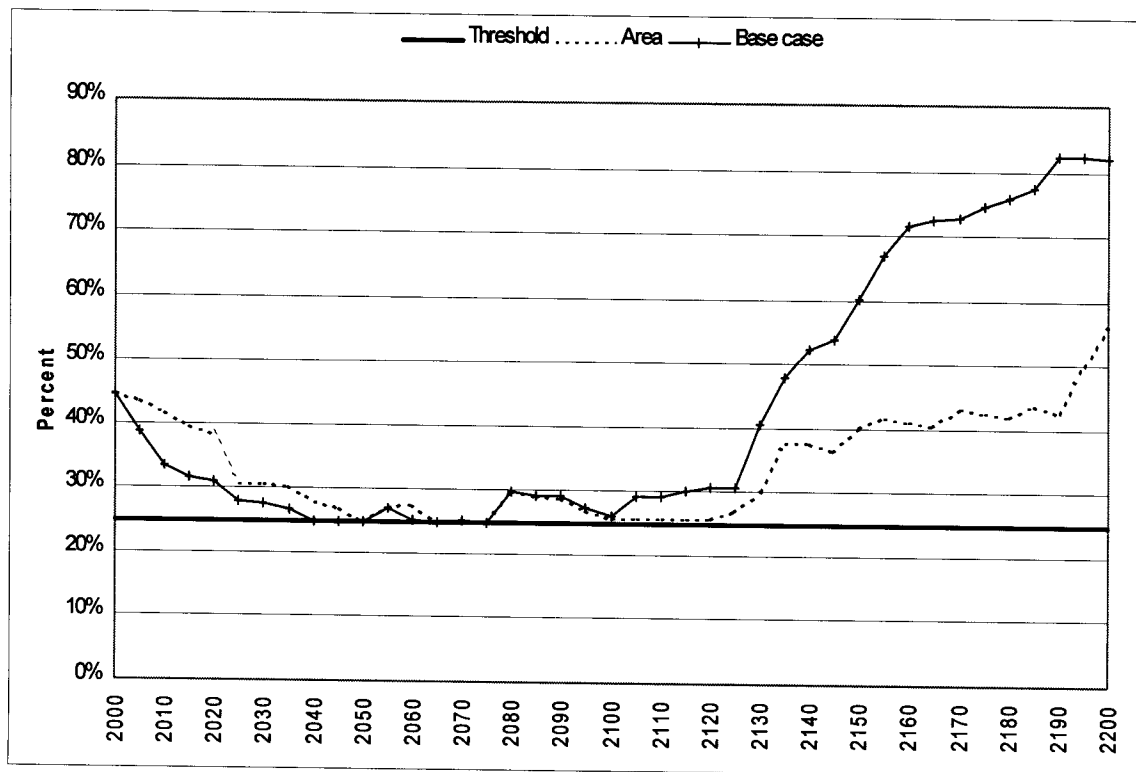


Figure 135: Area above old seral minimum age, special wildlife management area

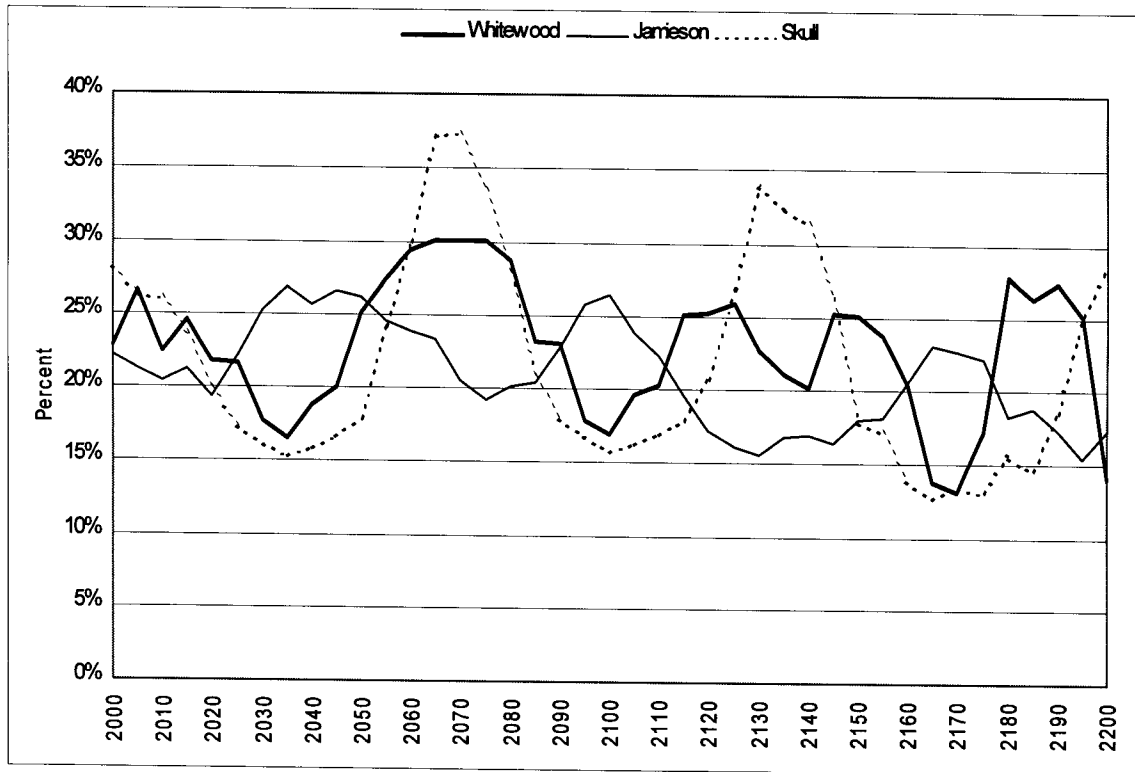


Figure 136: Area below 4.8m green-up hydrological green-up height

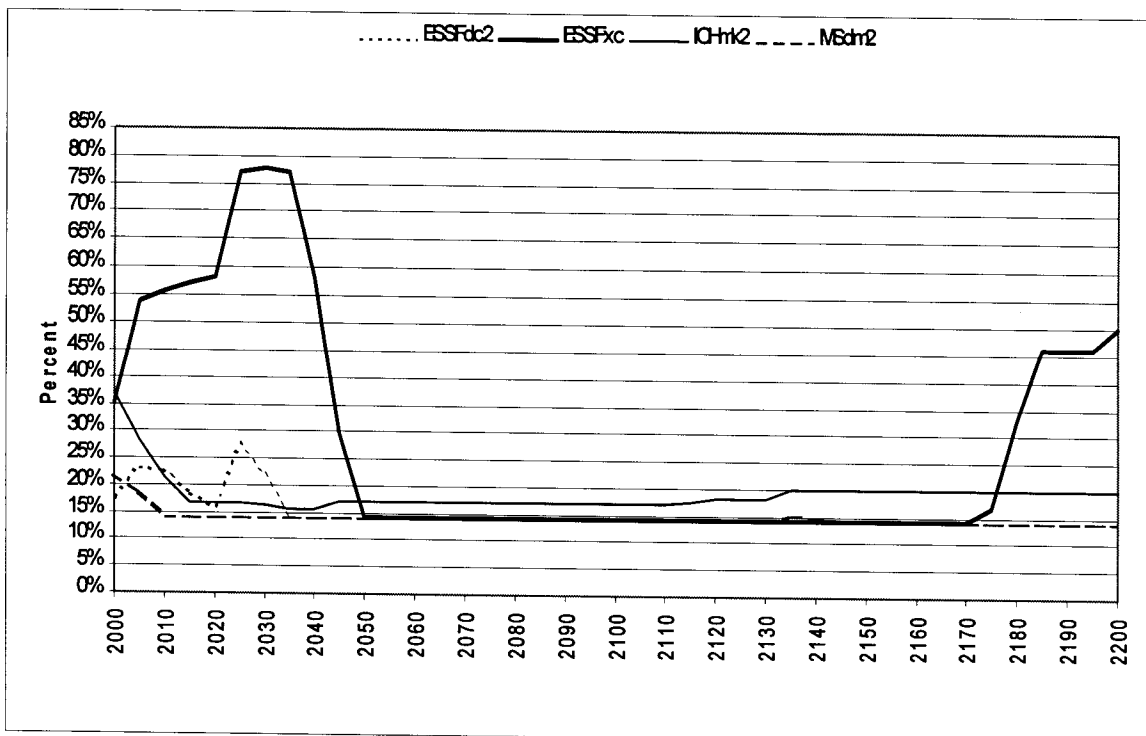


Figure 137: NDT3 old seral

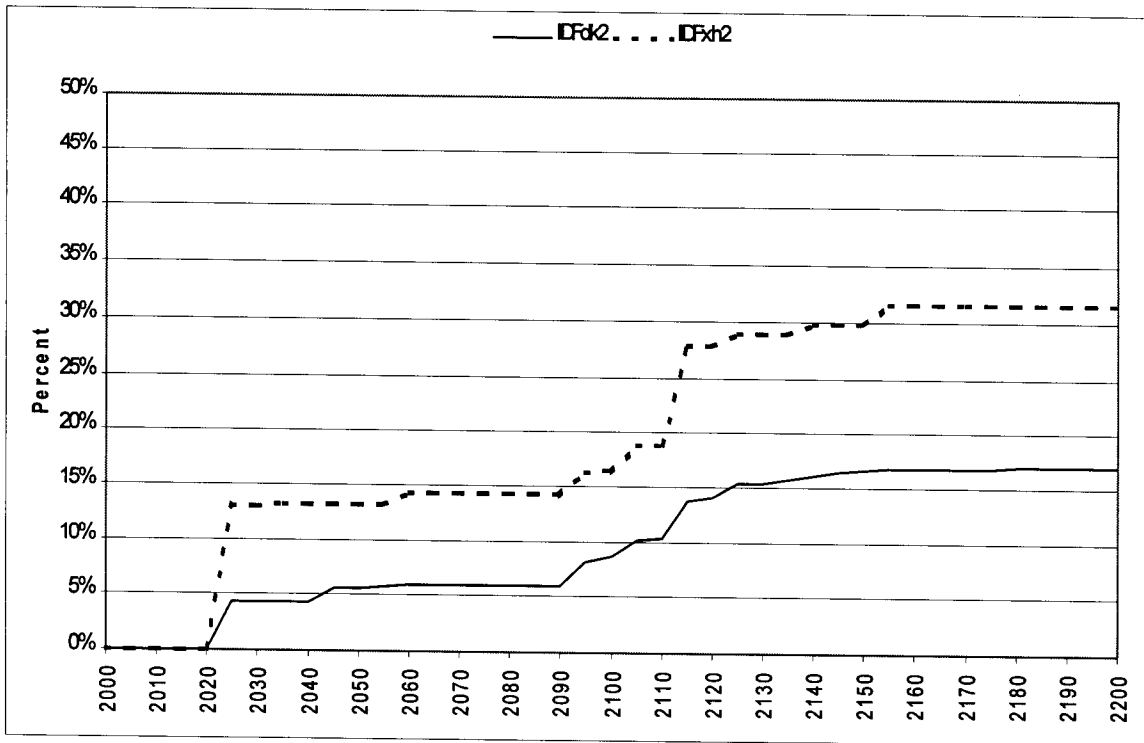


Figure 138: NDT4 old seral

Mature volume down 10%

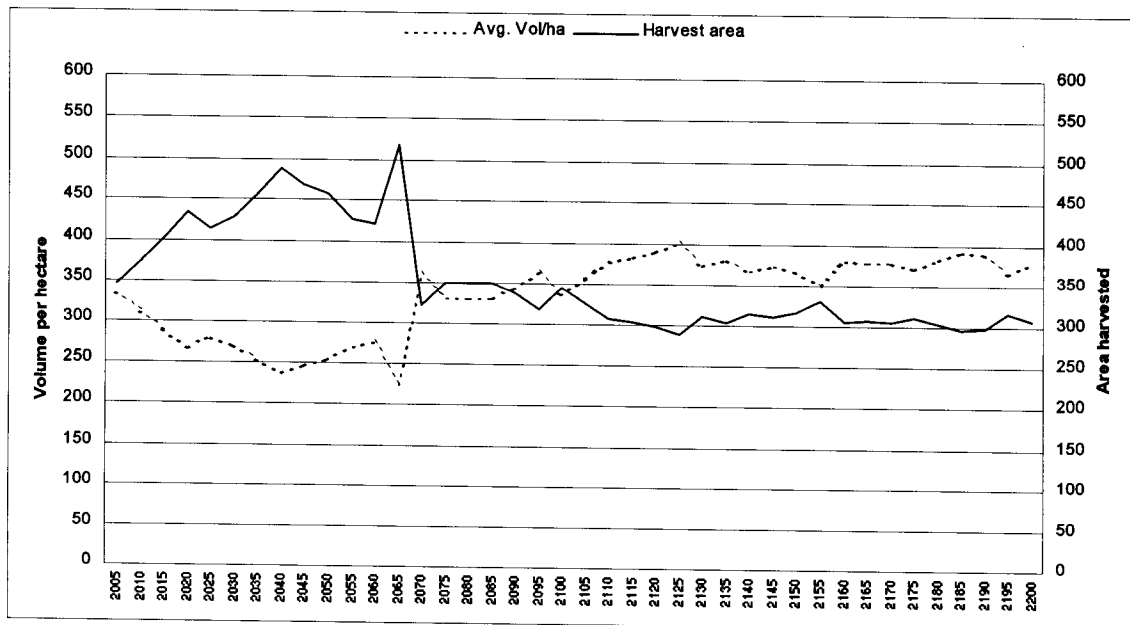


Figure 139: Harvest volume and area

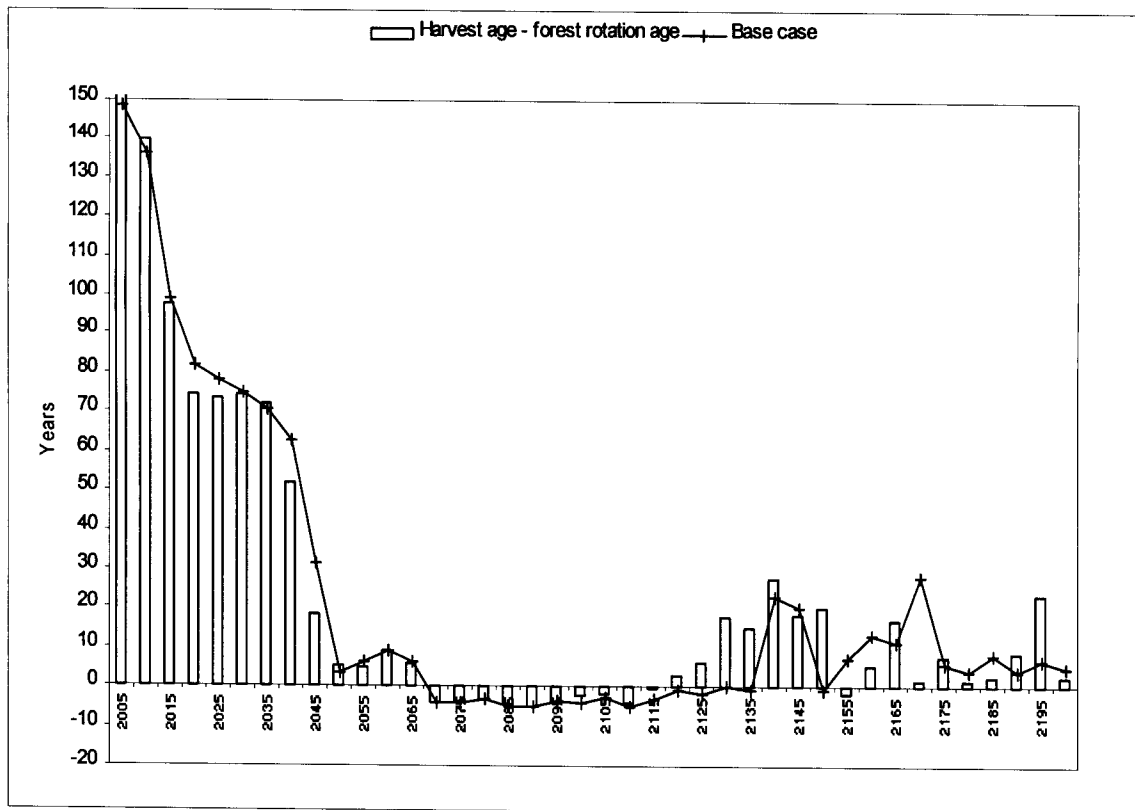


Figure 140: Harvest age - forest-level culmination age

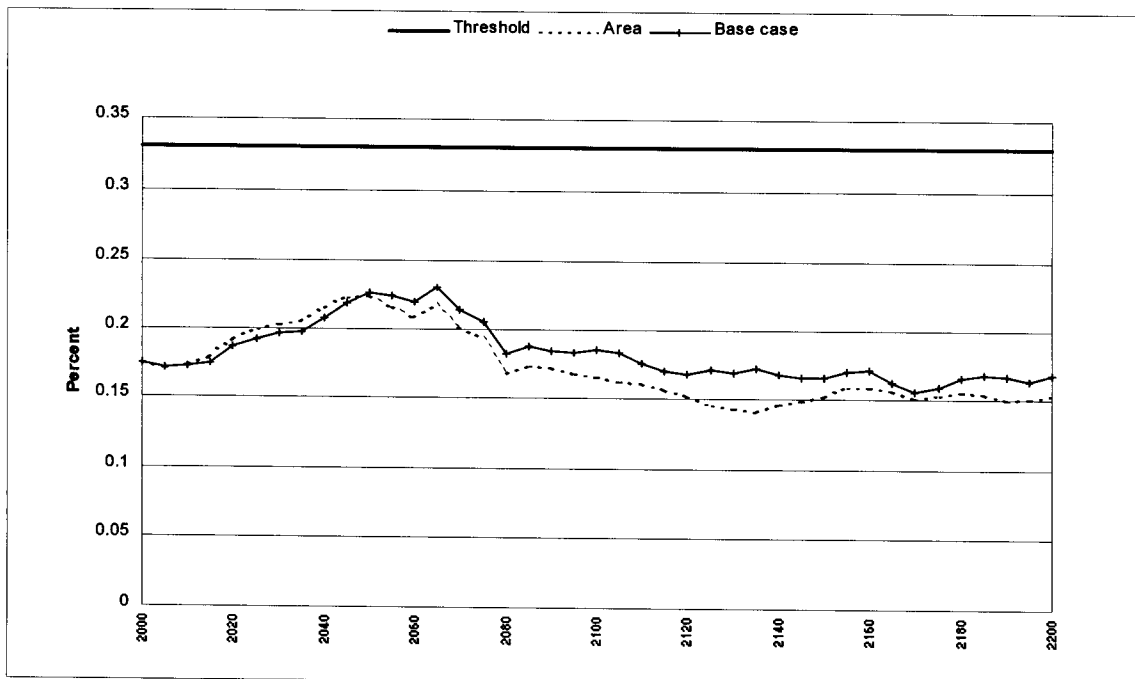


Figure 141: Area below 3m green-up height, general management and special wildlife zones

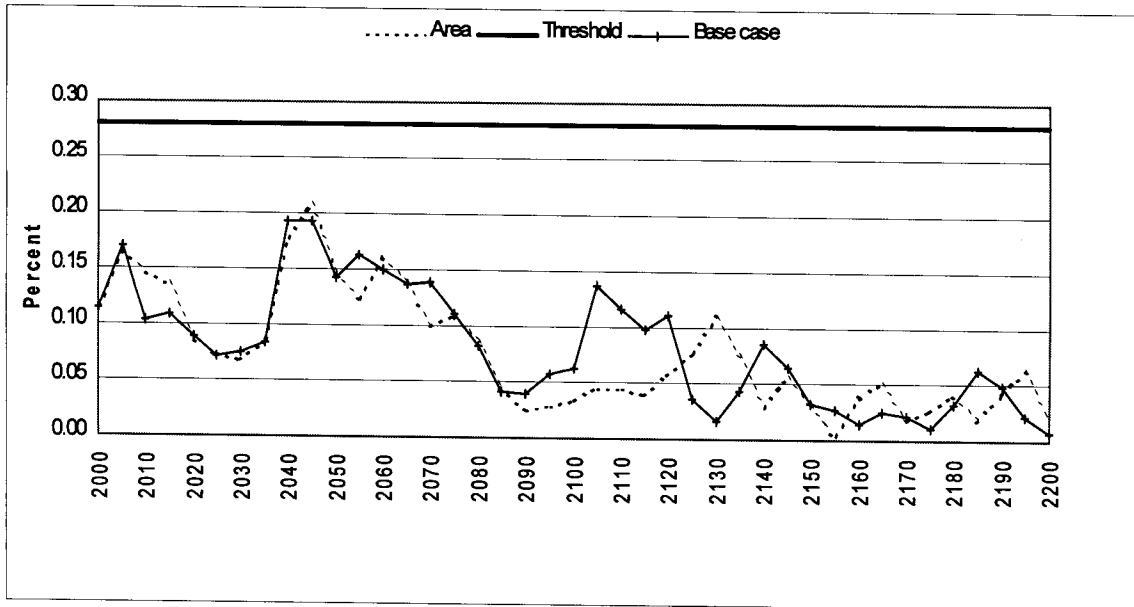


Figure 142: Area below 3.2m green-up height, modification VQO

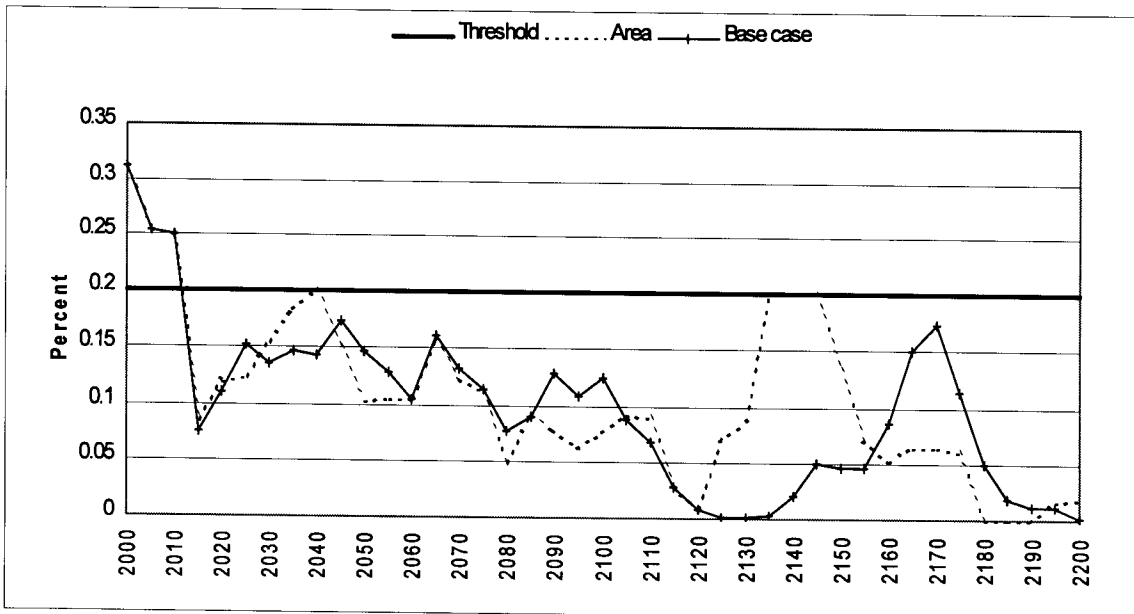


Figure 143: Area below 3.9m green-up height, partial retention VQO

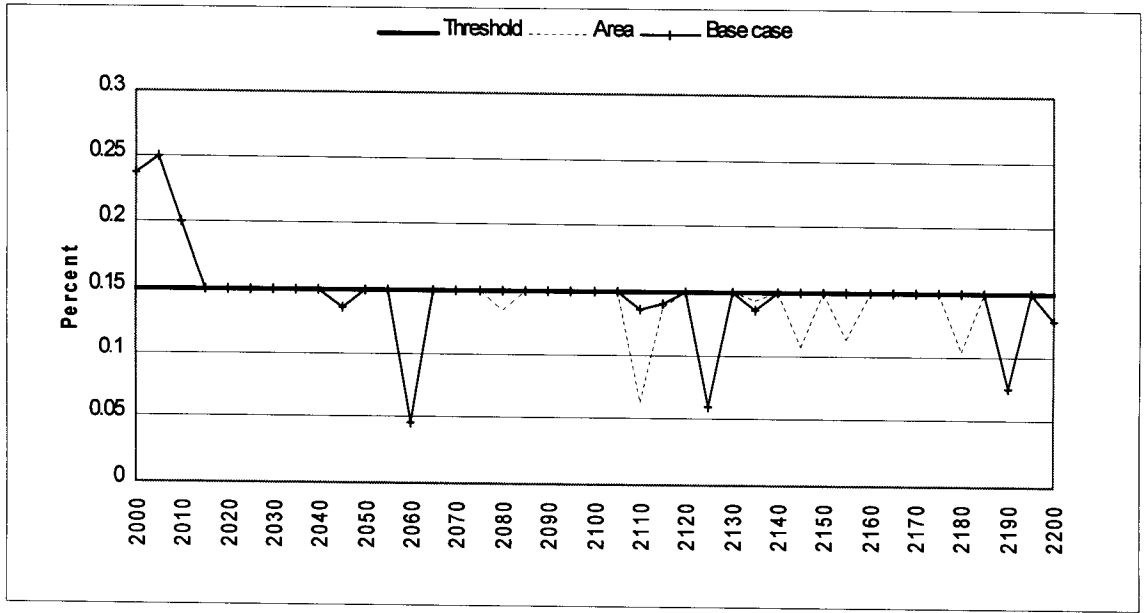


Figure 144: Area below 3.9m green-up height, retention VQO

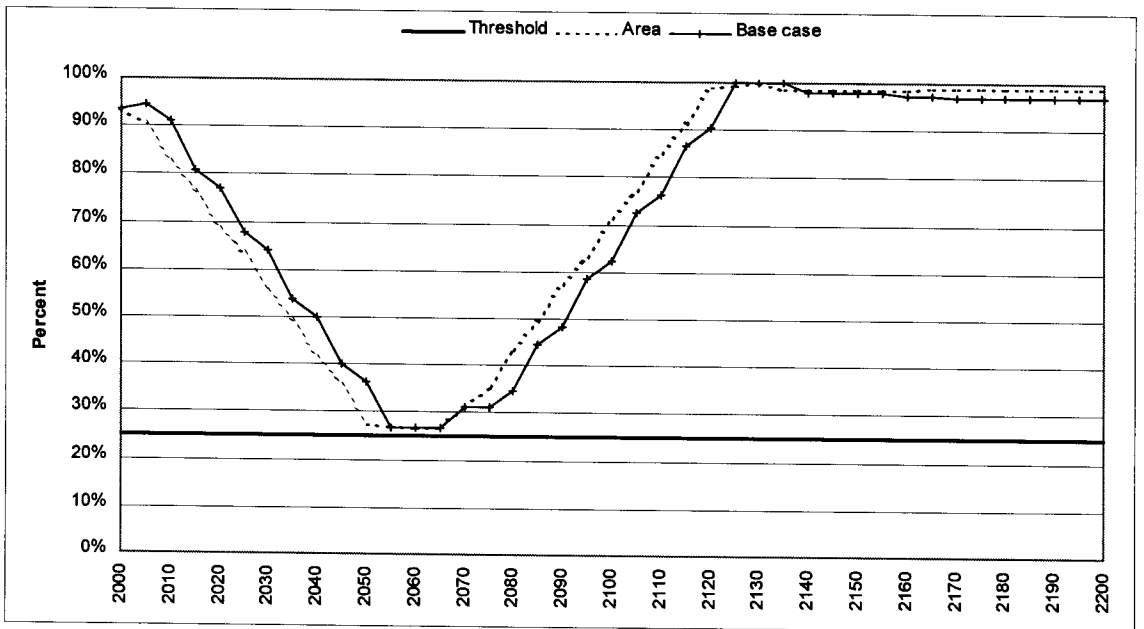


Figure 145: Area above 20m thermal cover height, mule deer winter range

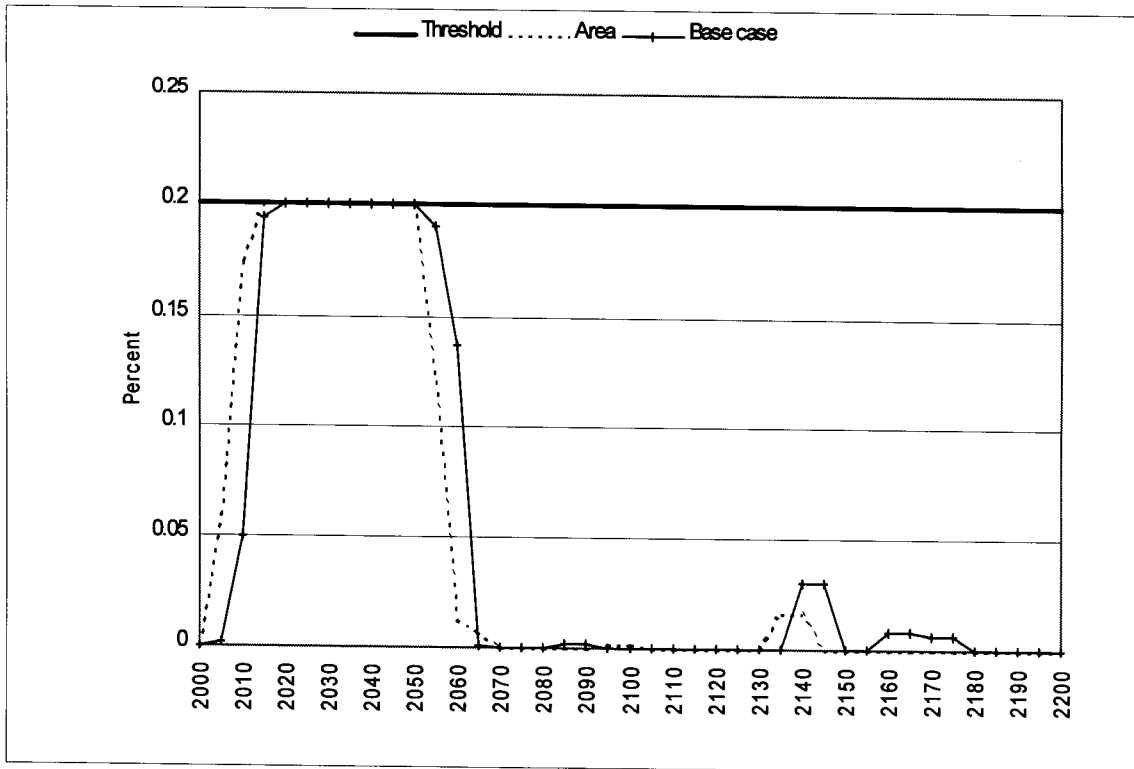


Figure 146: Area below 3m green-up height, mule deer winter range

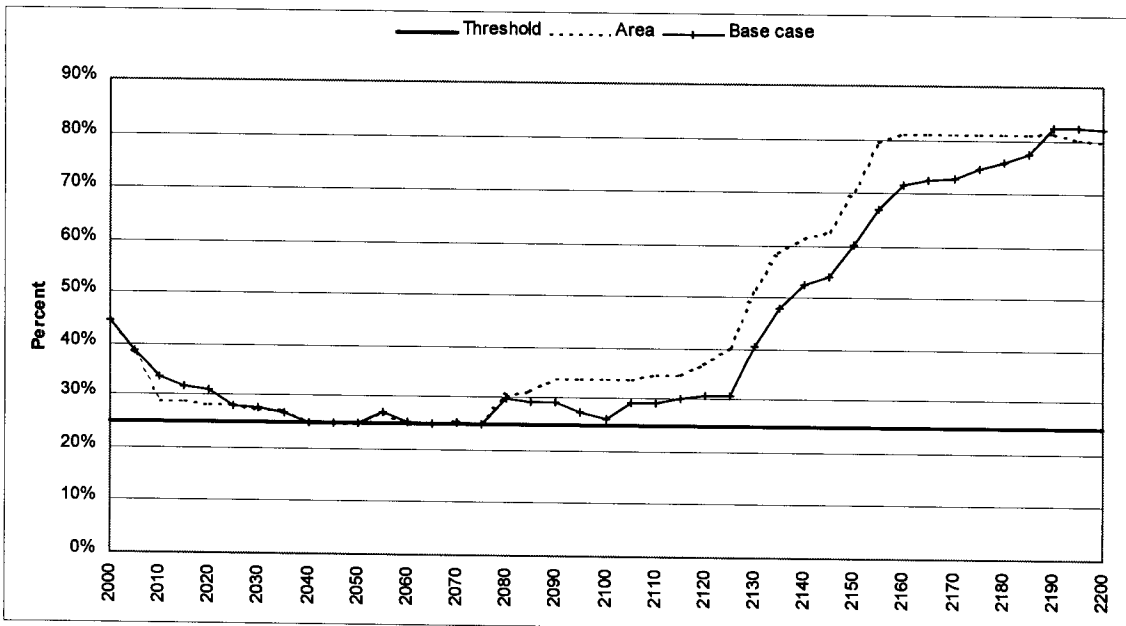


Figure 147: Area above old seral minimum age, special wildlife management area

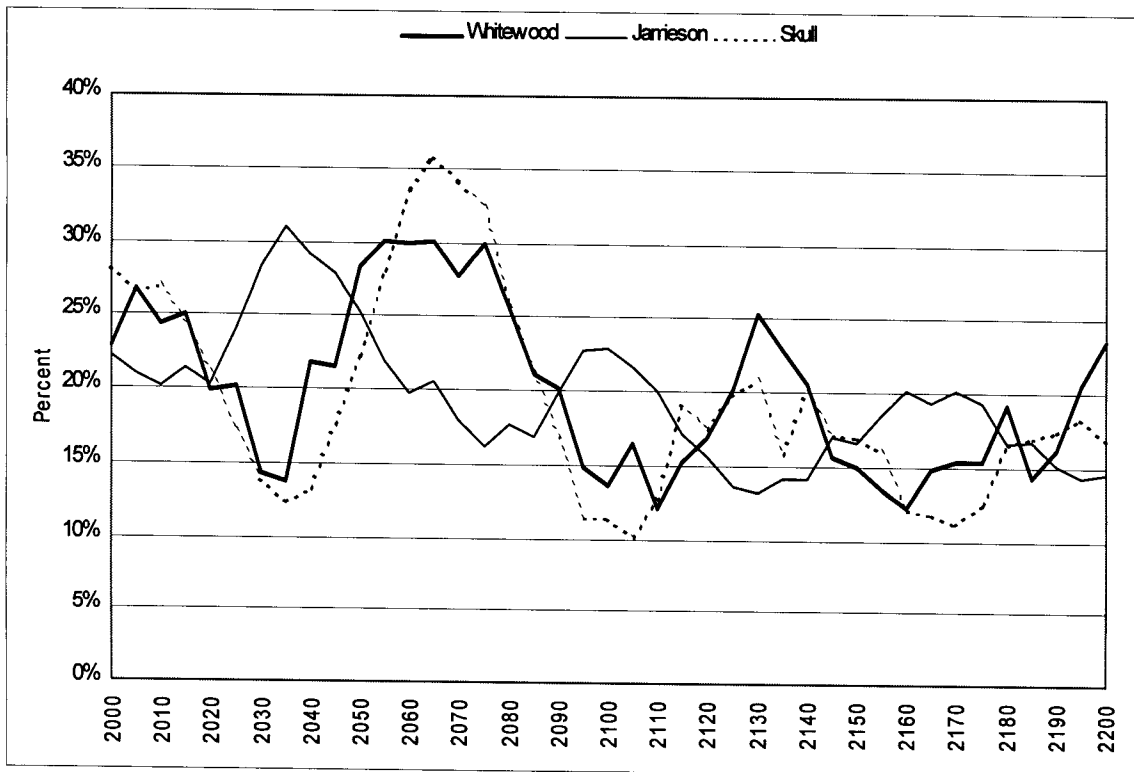


Figure 148: Area below 4.8m hydrological green-up

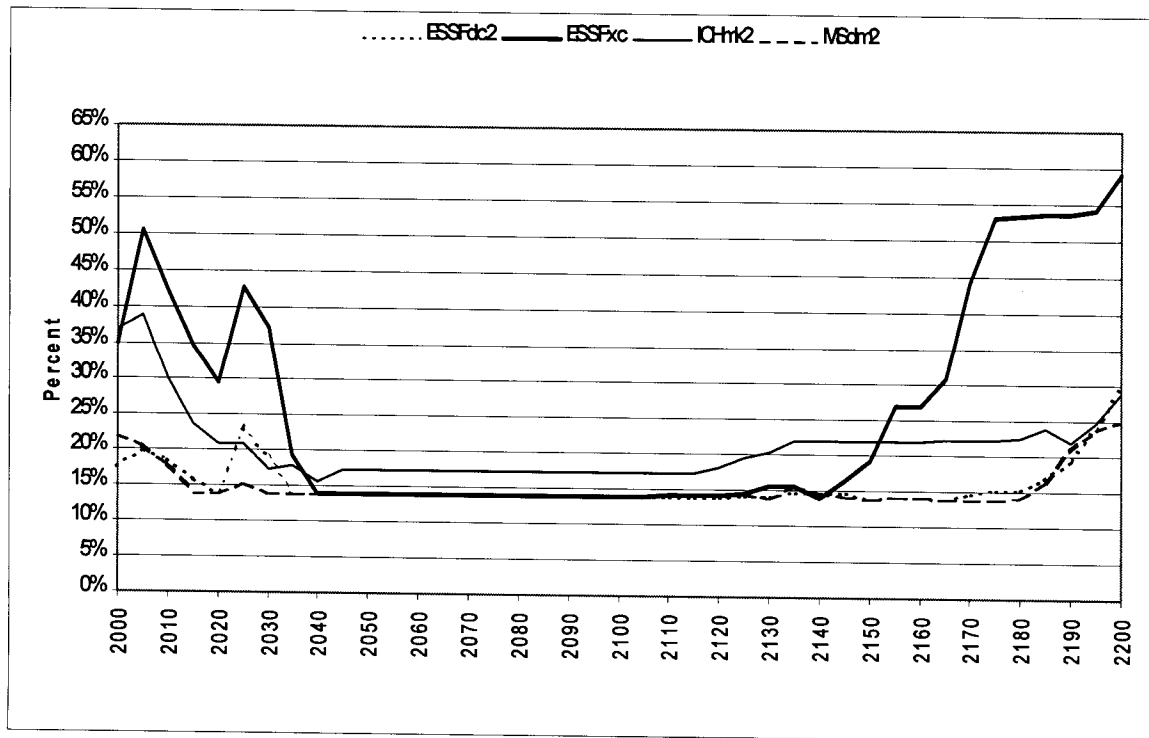


Figure 149: NDT3 old seral

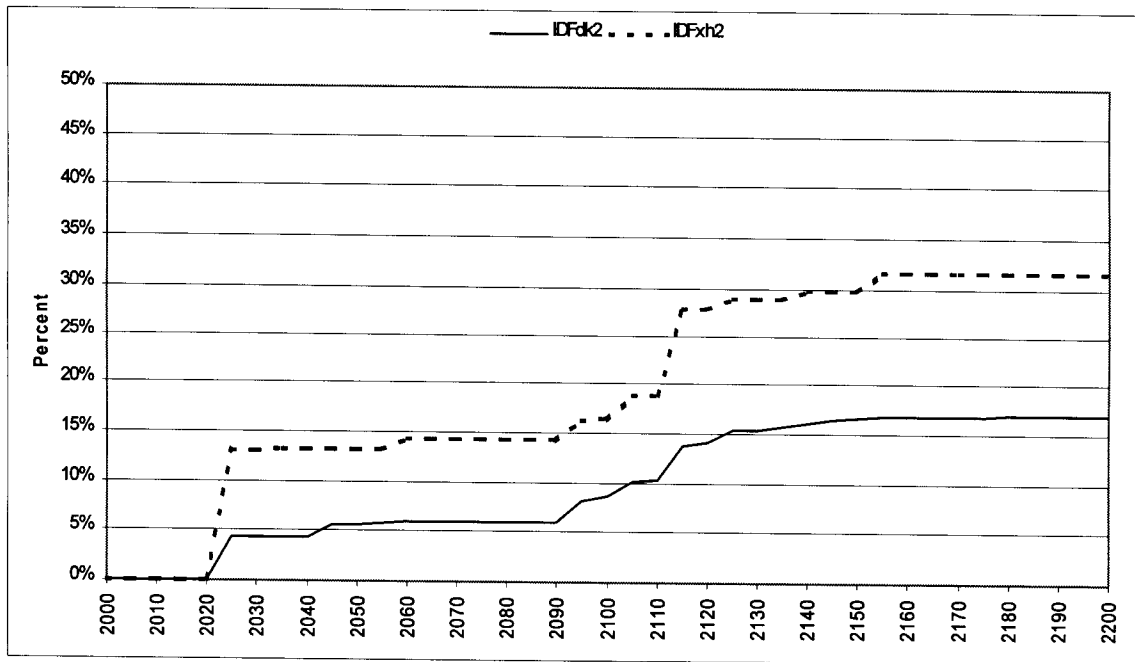


Figure 150: NDT4 Old seral

Regeneration site indices down 3m

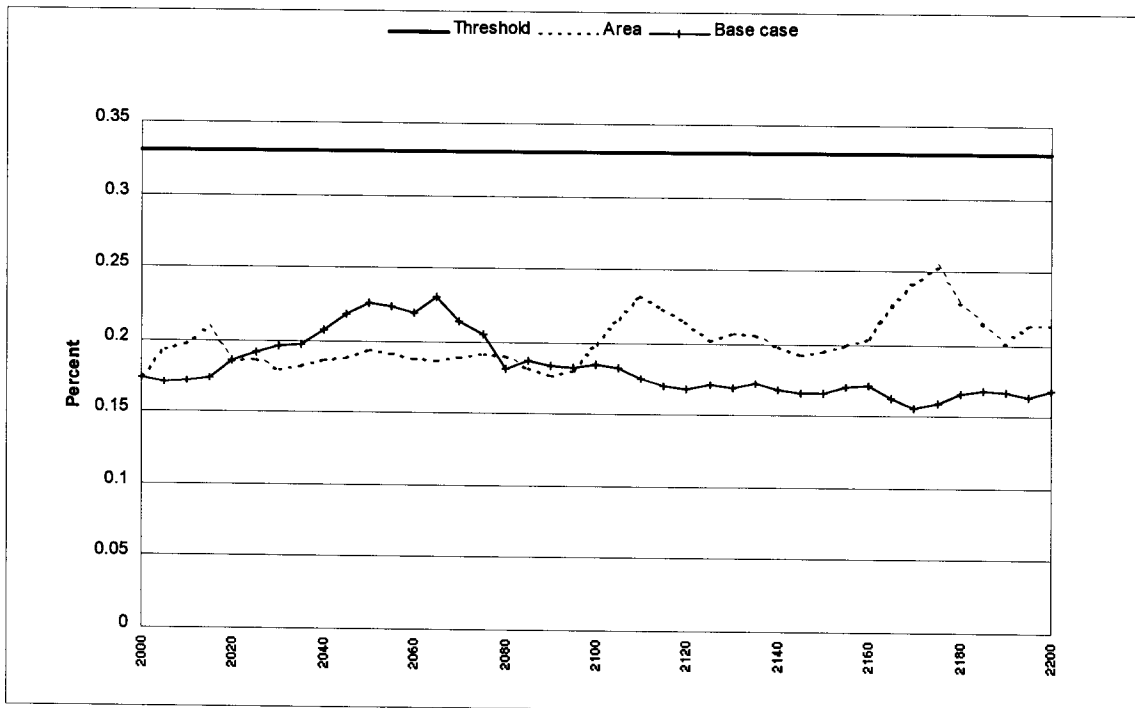


Figure 151: Area below 3m green-up height, general management and special wildlife zones

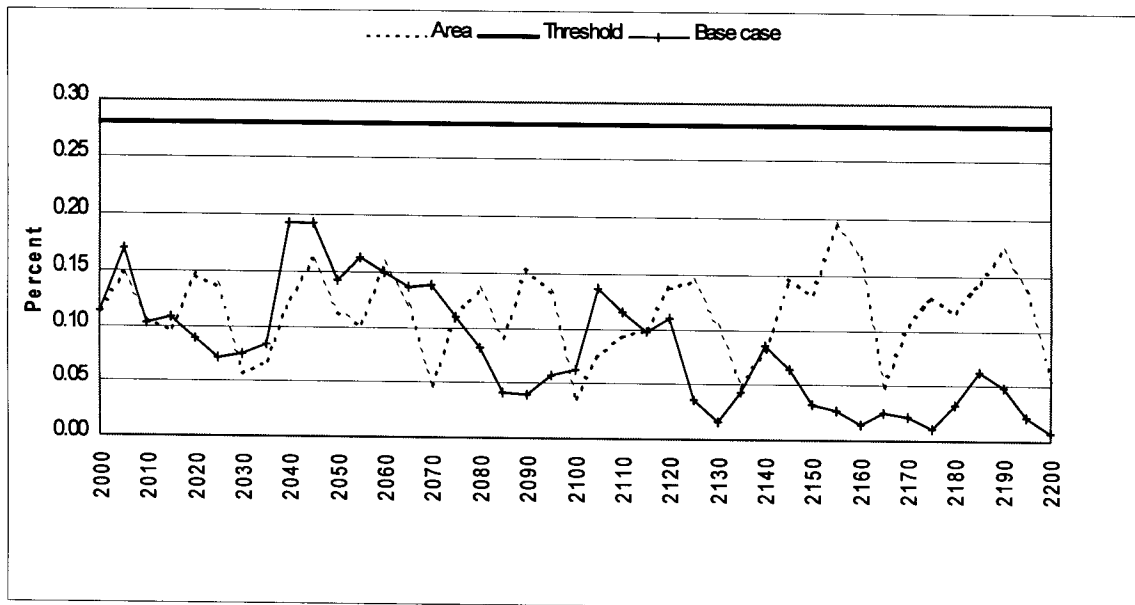


Figure 152: Area below 3.2m green-up height, modification VQO

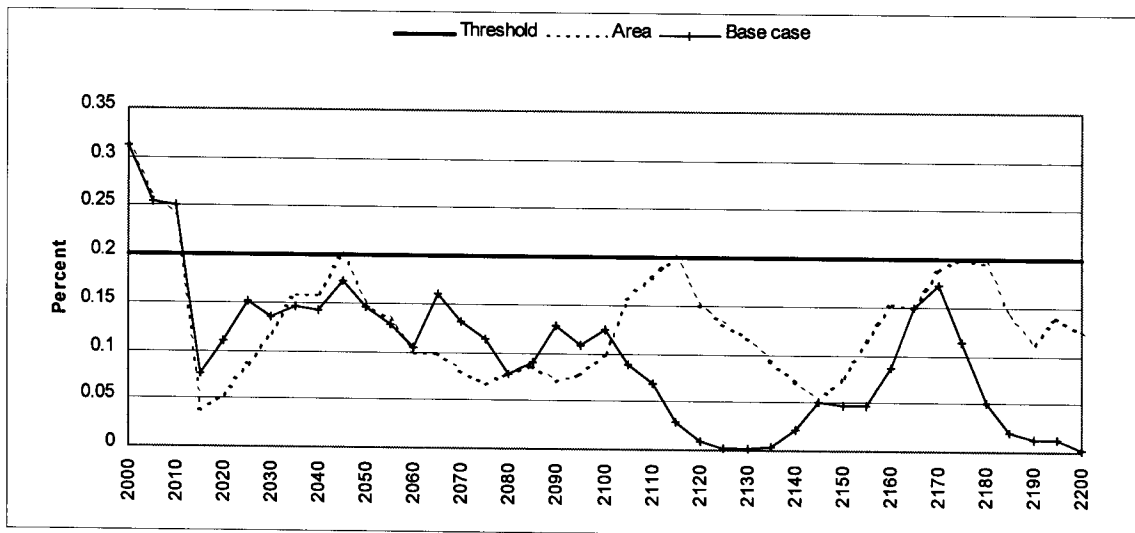


Figure 153: Area below 3.9m green-up height, partial retention VQO

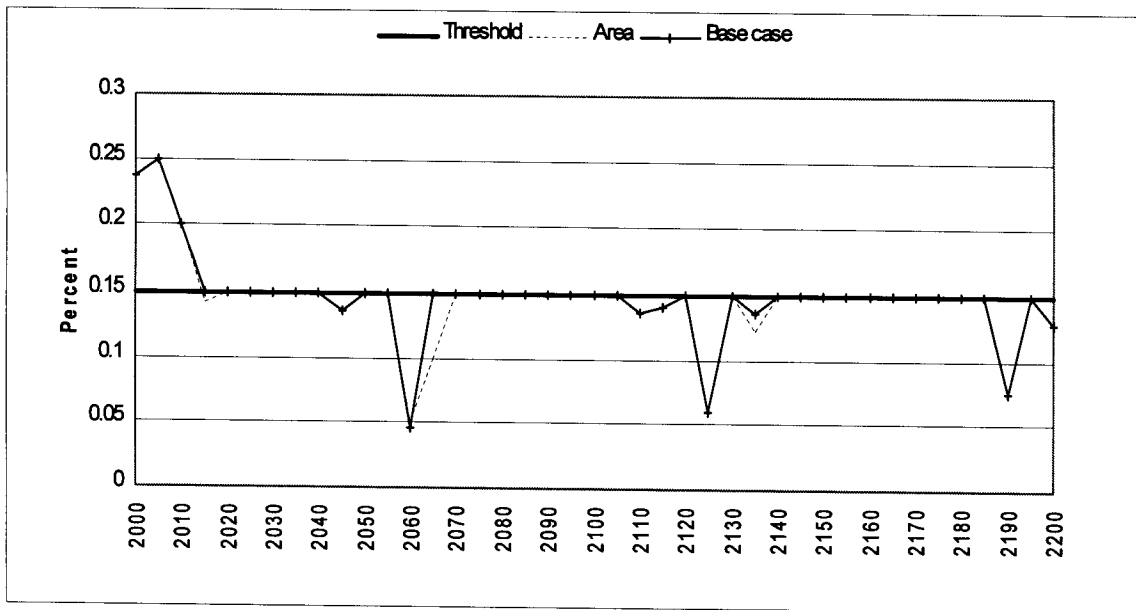


Figure 154: Area below 3.9m green-up height, retention VQO

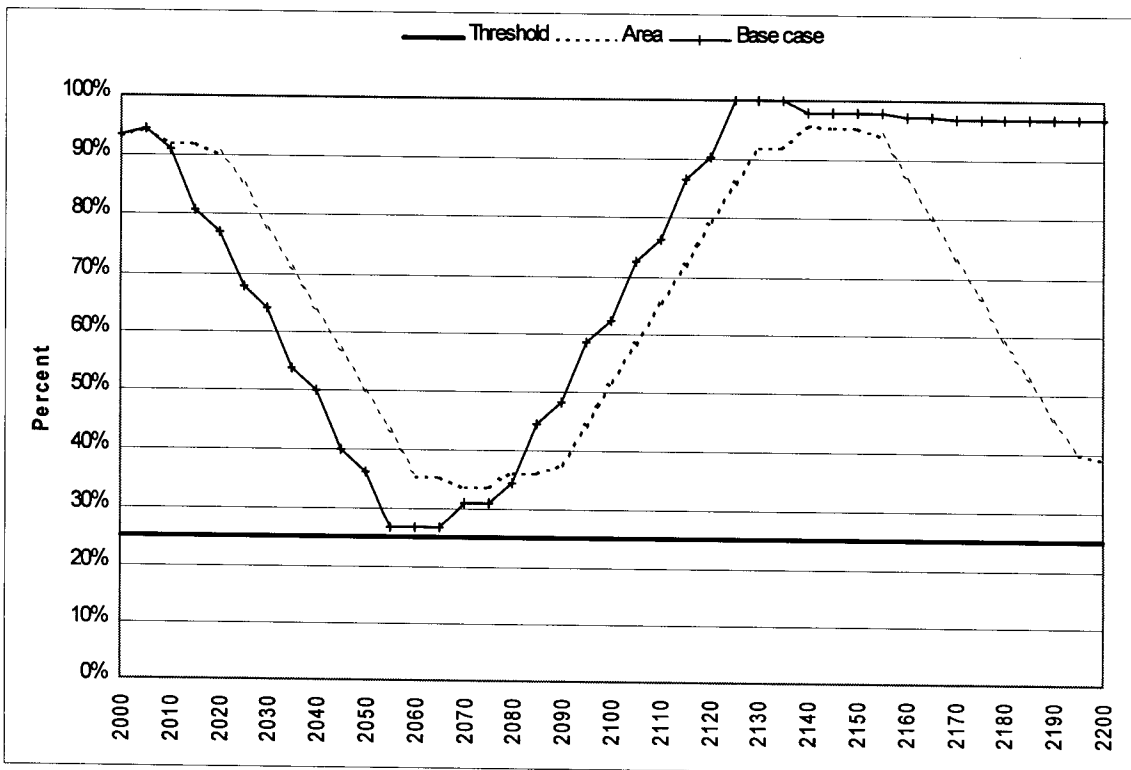


Figure 155: Area above 20m thermal cover, mule deer winter range

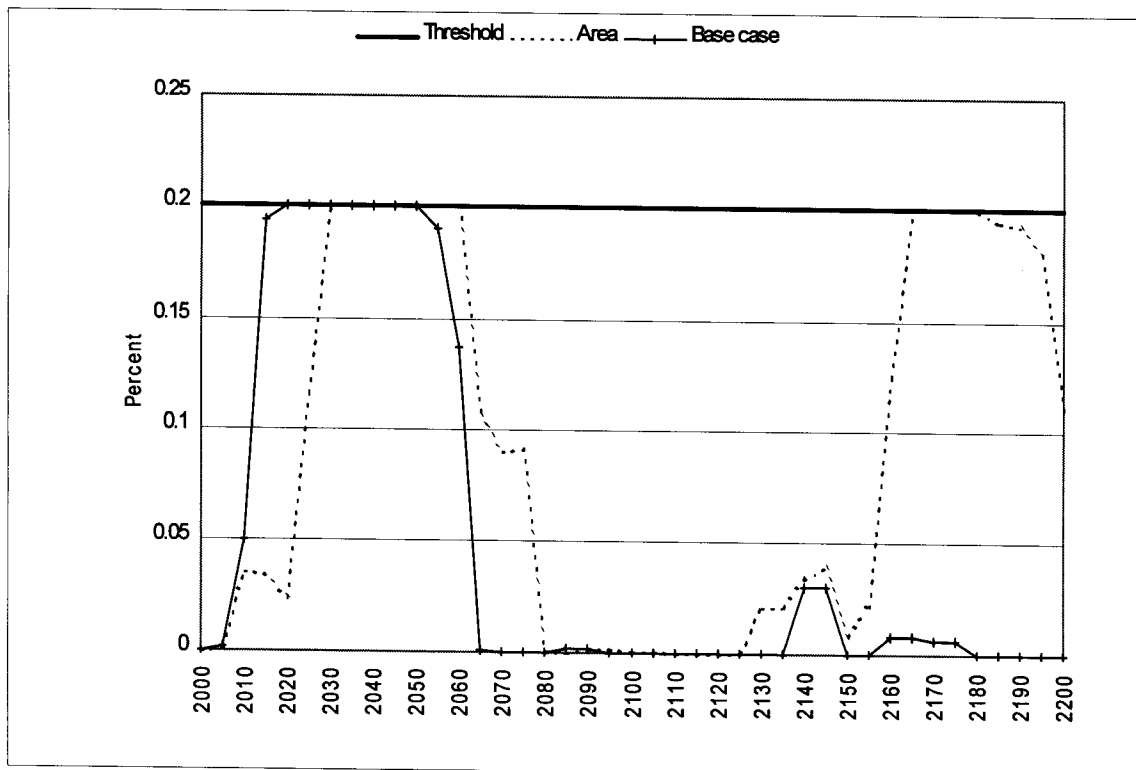


Figure 156: Area below 3m green-up height, mule deer winter range

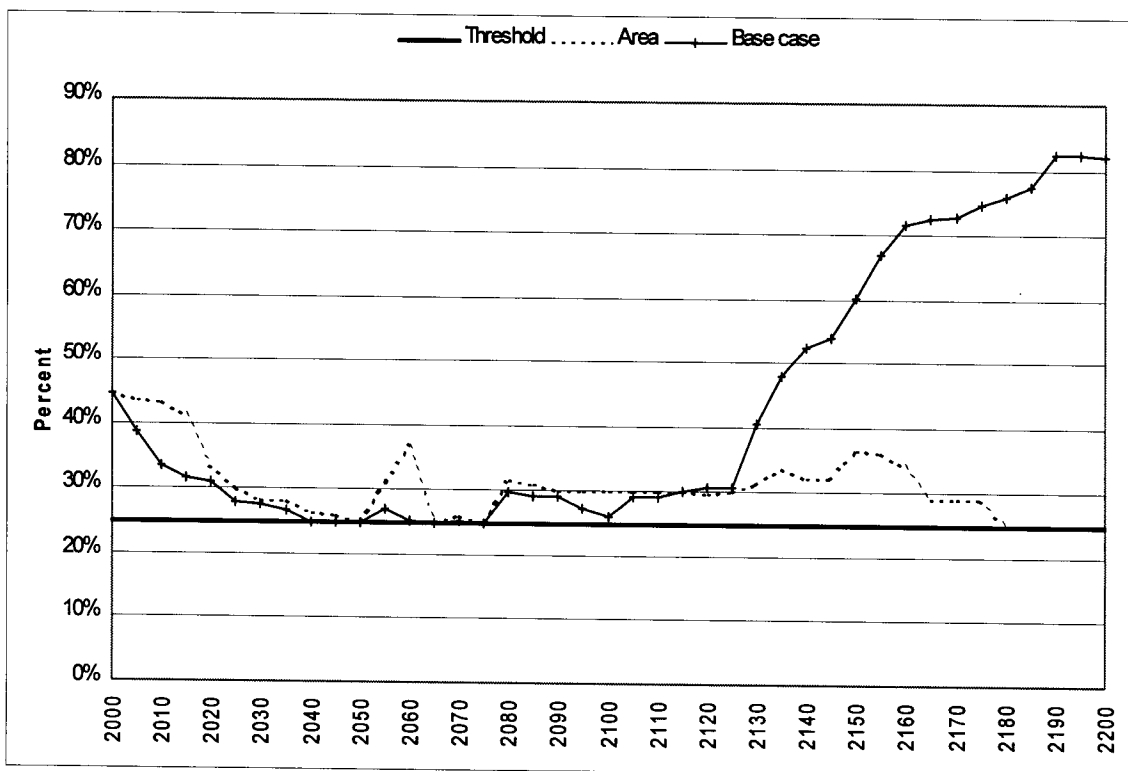


Figure 157: Area above minimum old seral age, special wildlife management areas

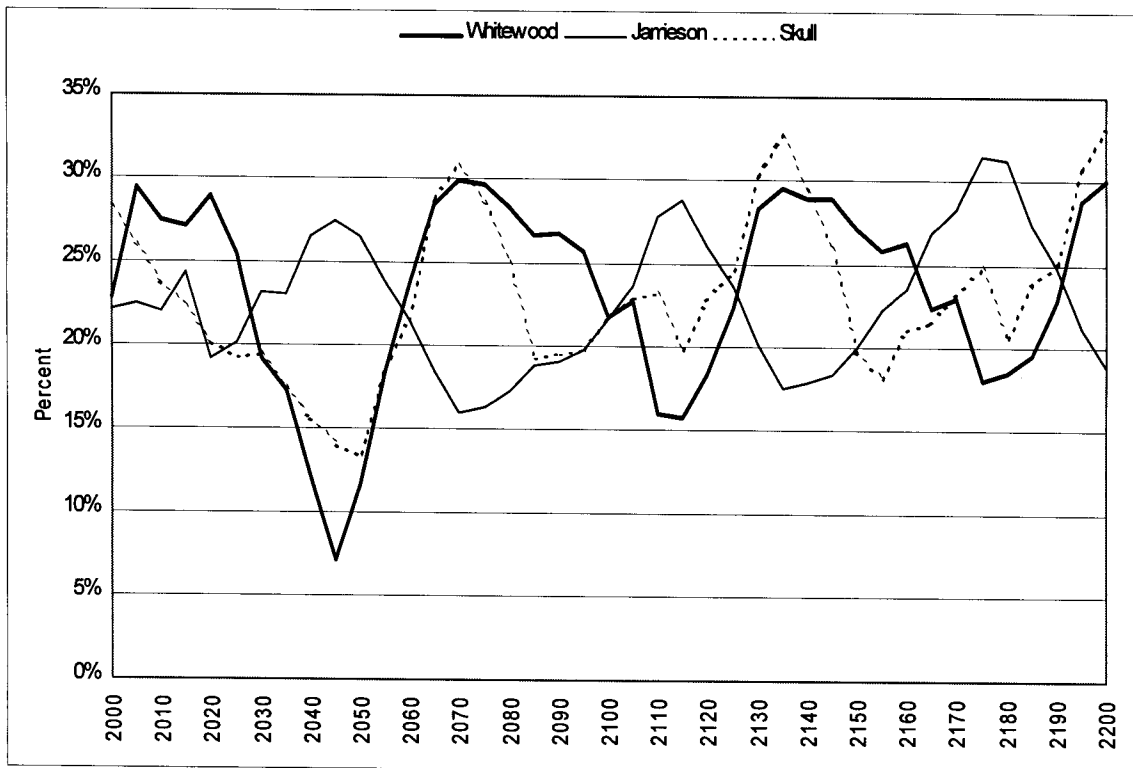


Figure 158: Area below 4.8m hydrological green-up

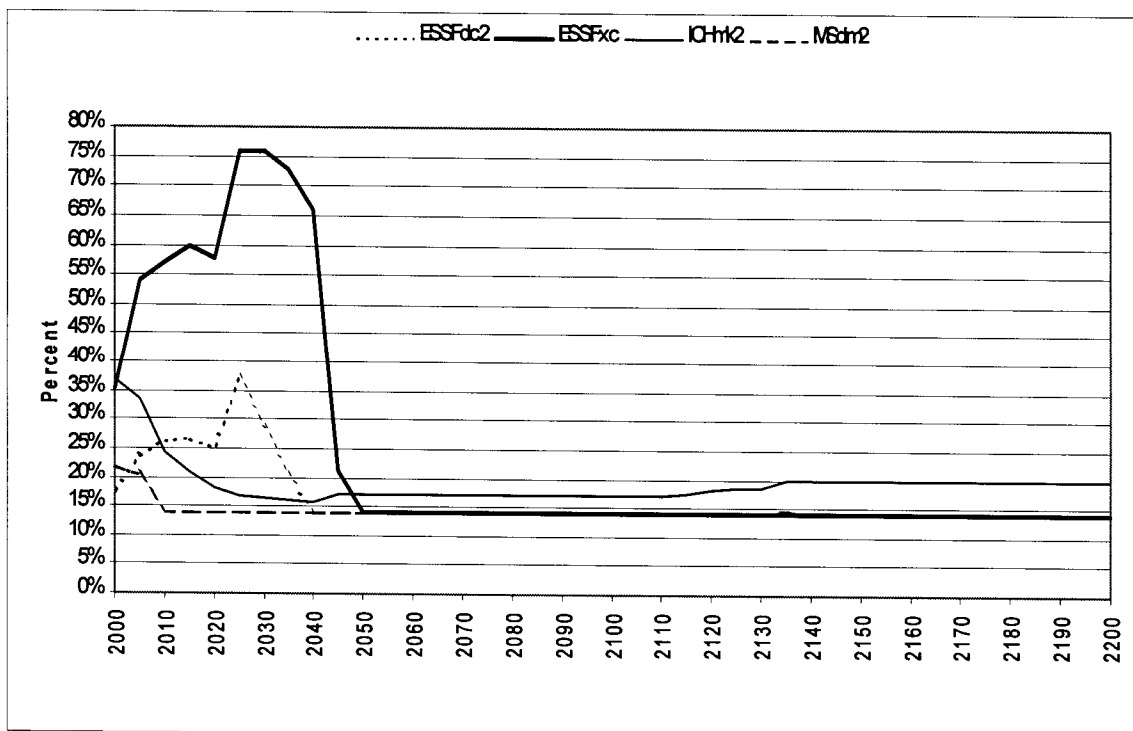


Figure 159: NDT3 old seral

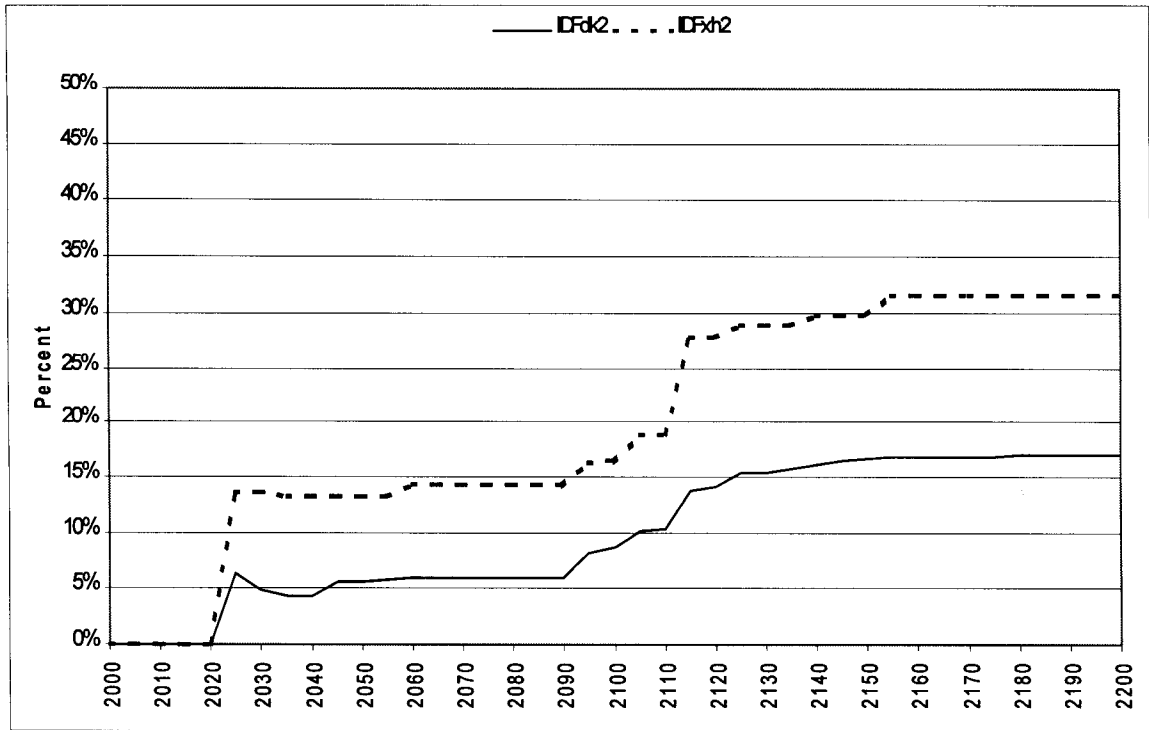


Figure 160: NDT4 old seral

Regeneration site indices up 3m

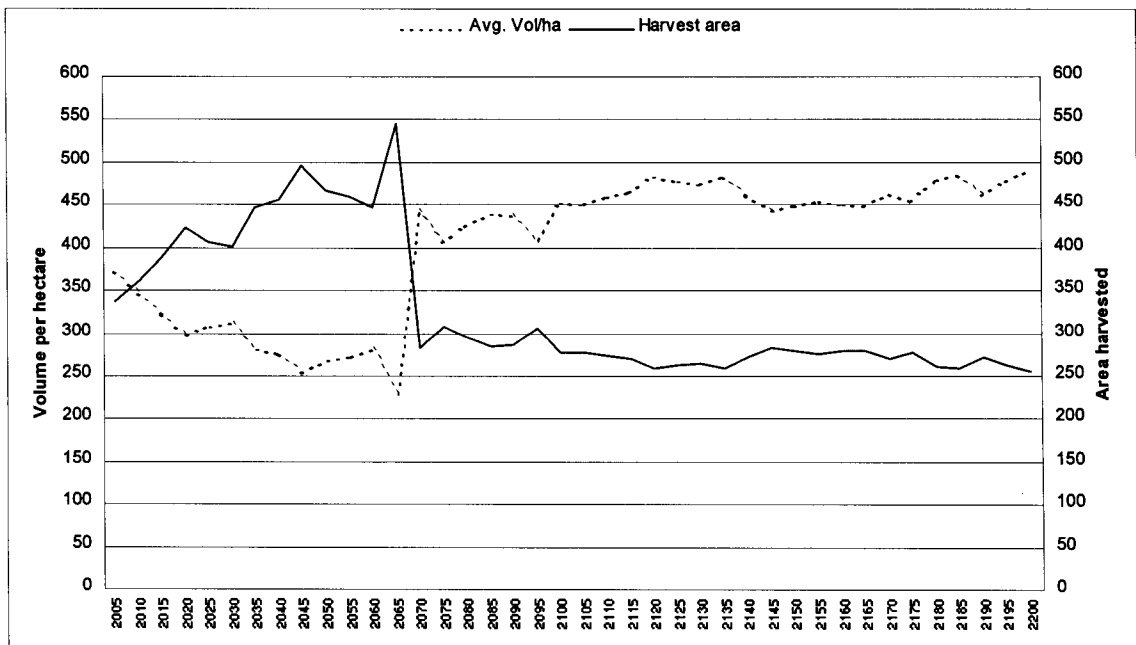


Figure 161: Harvest volume and area

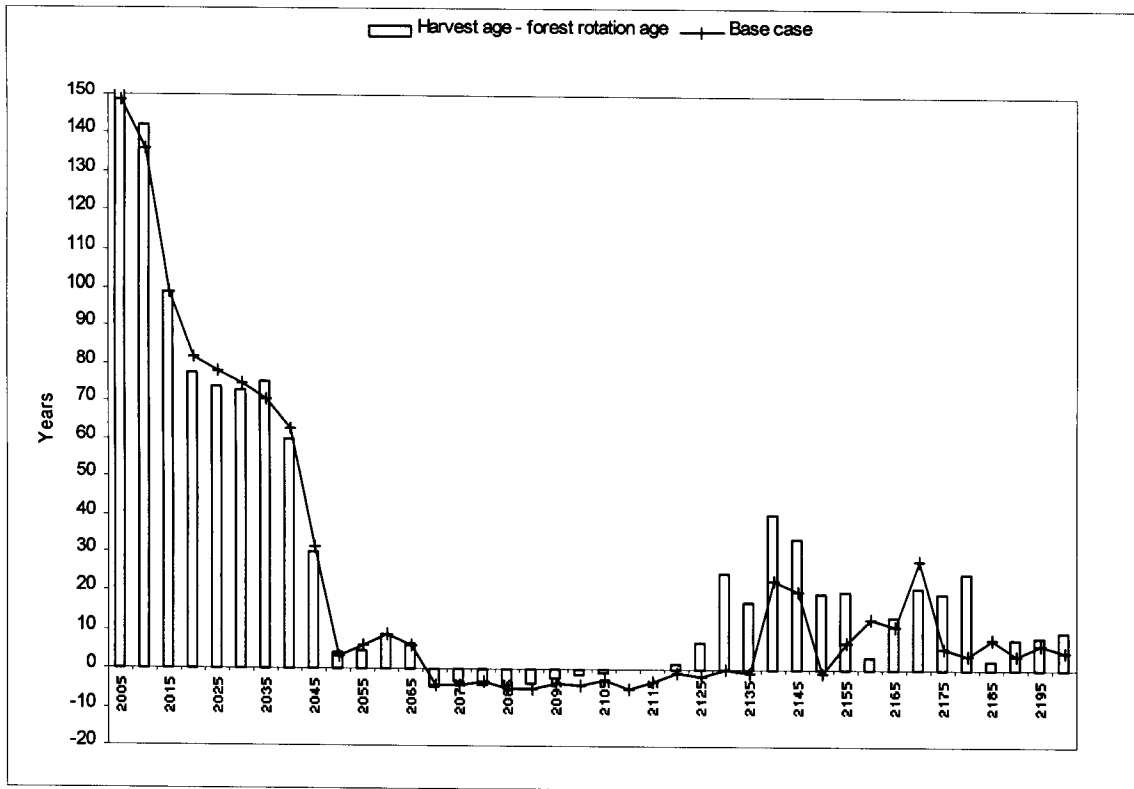


Figure 162: Harvest age minus forest-level culmination age

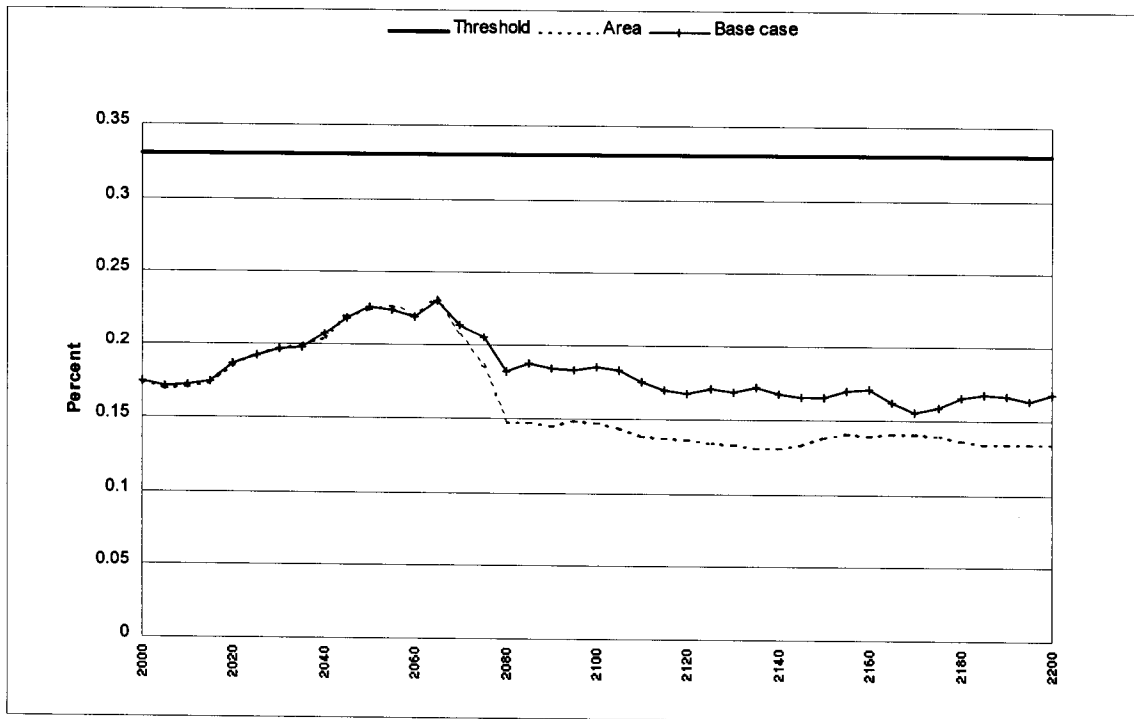


Figure 163: Area below 3m green-up height, general management and special wildlife management zones

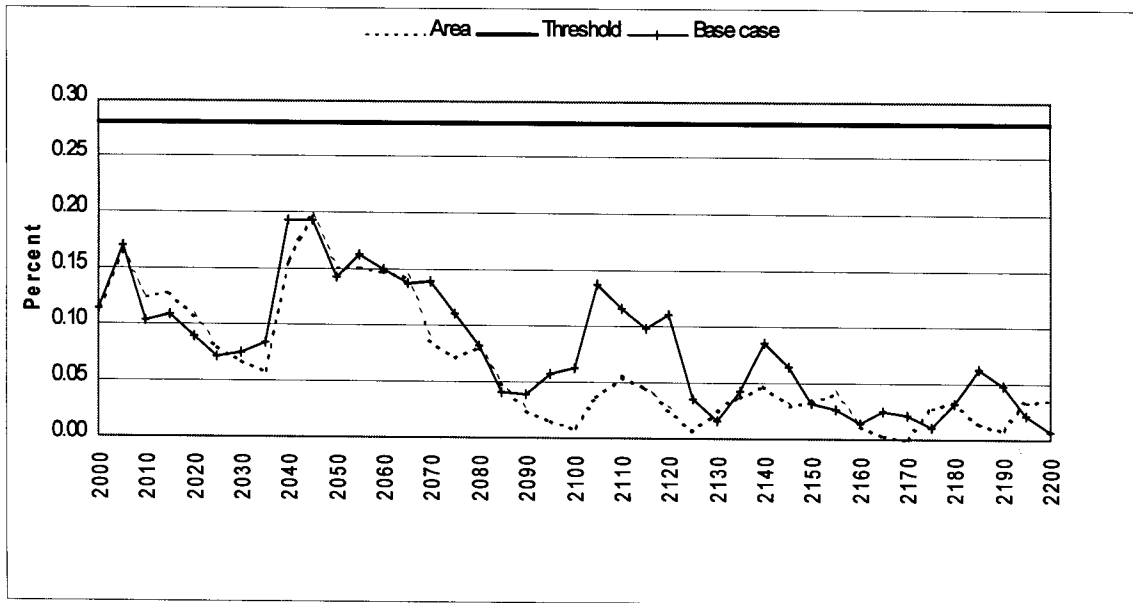


Figure 164: Area below 3.2m green-up height, modification VQO

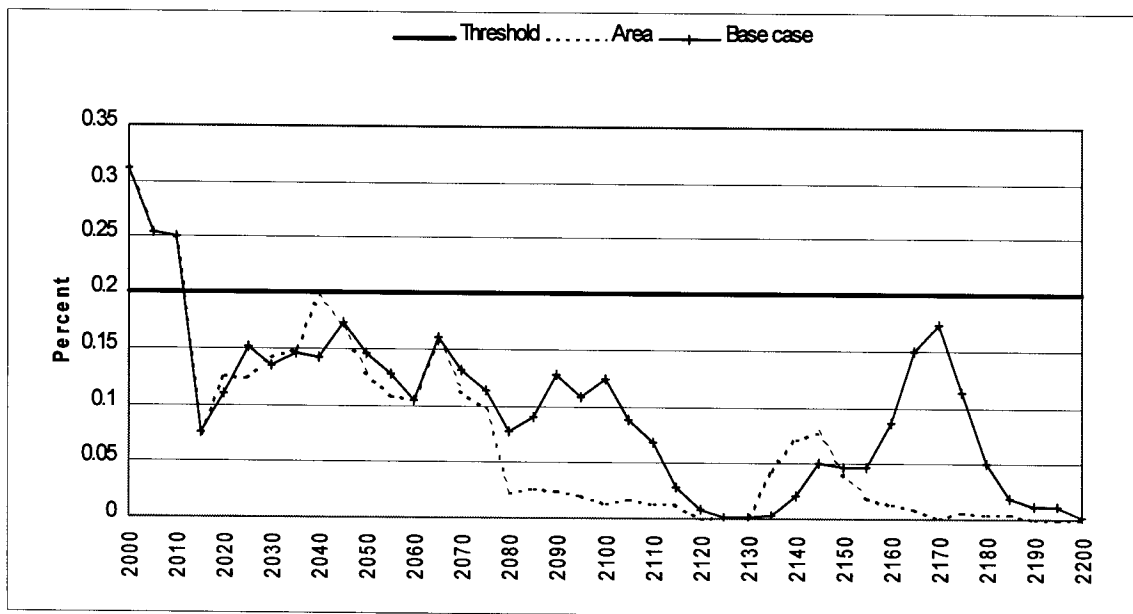


Figure 165: area below 3.9m green-up height, partial retention VQO

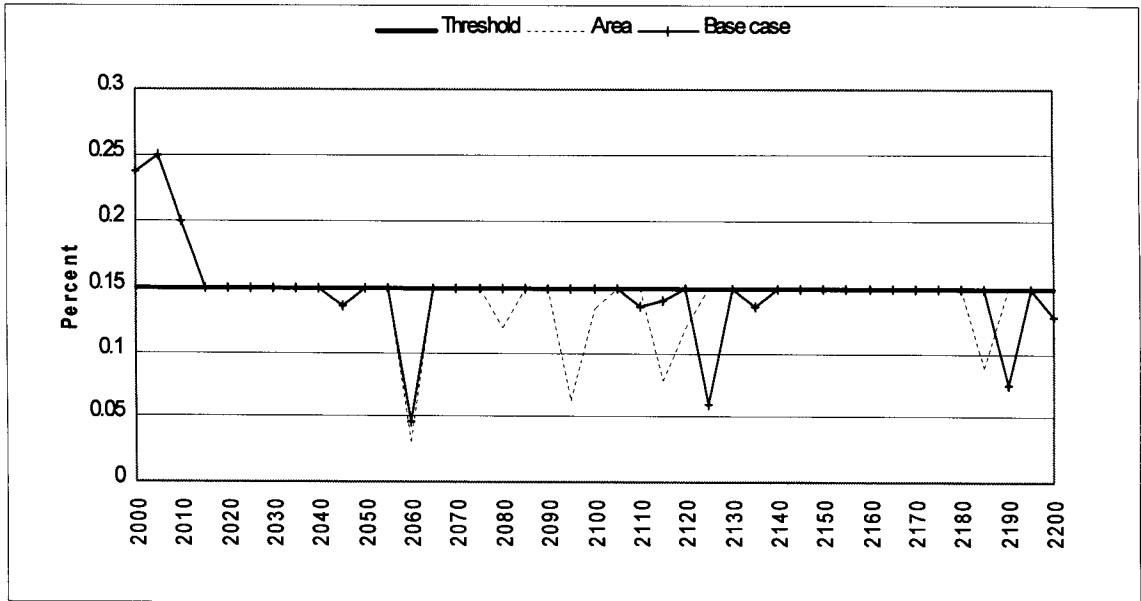


Figure 166: Area below 3.9m green-up height, retention VQO

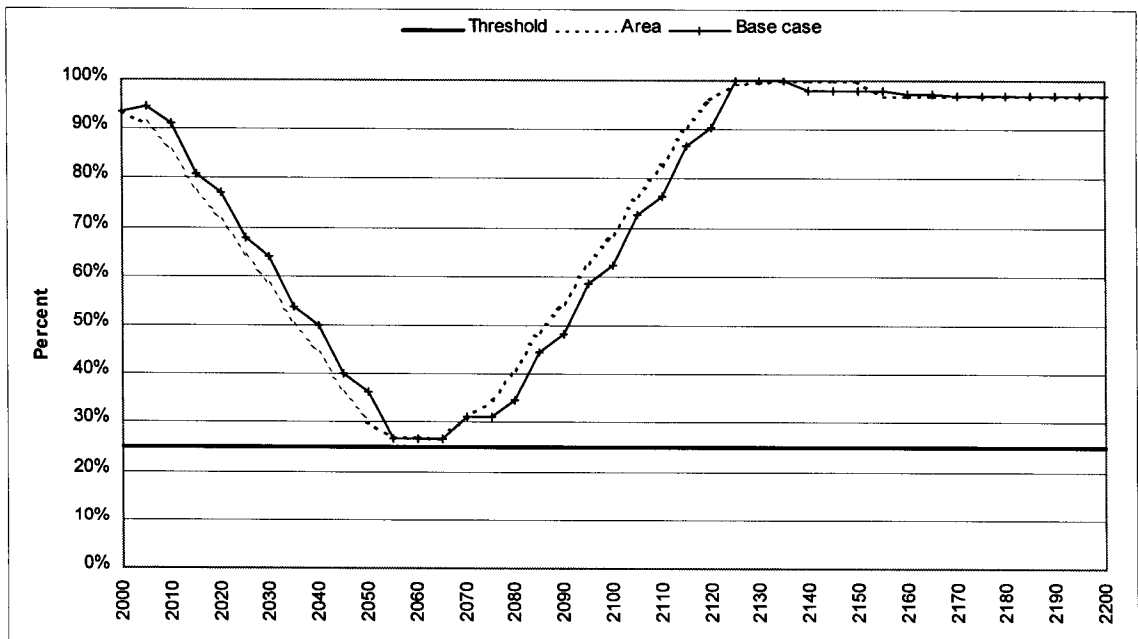


Figure 167: Area above 20m thermal cover, mule deer winter range

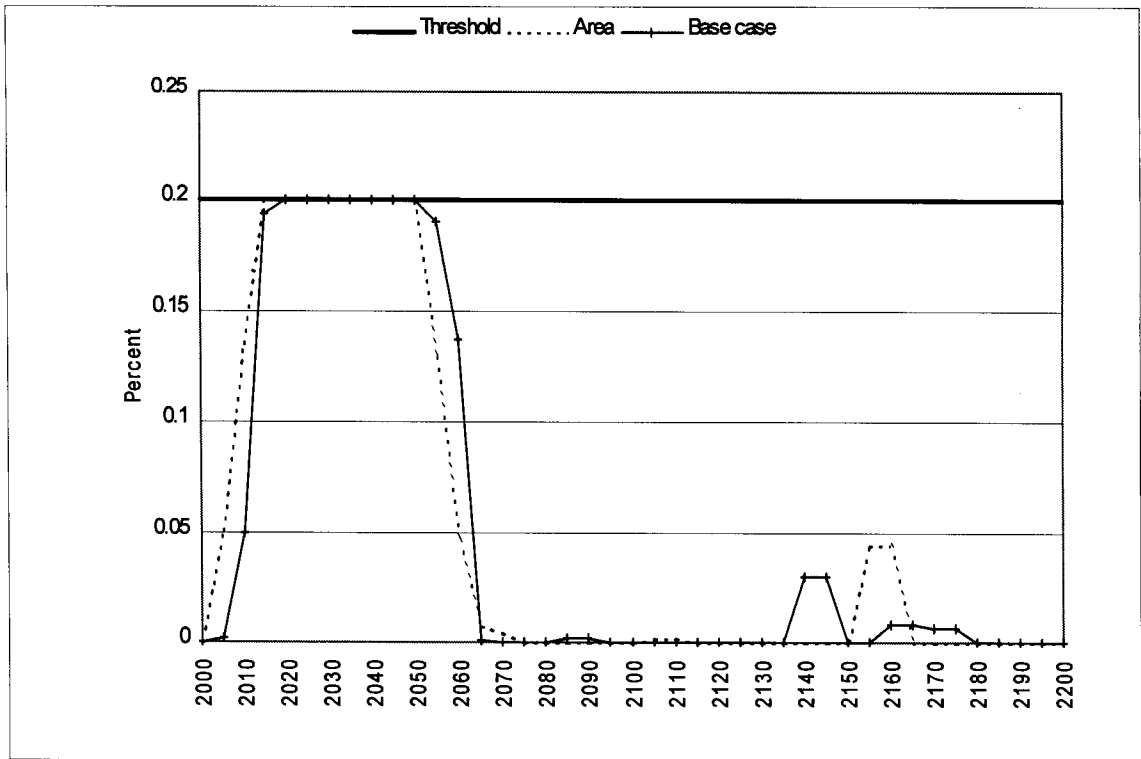


Figure 168: Area below 3m green-up height, mule deer winter range

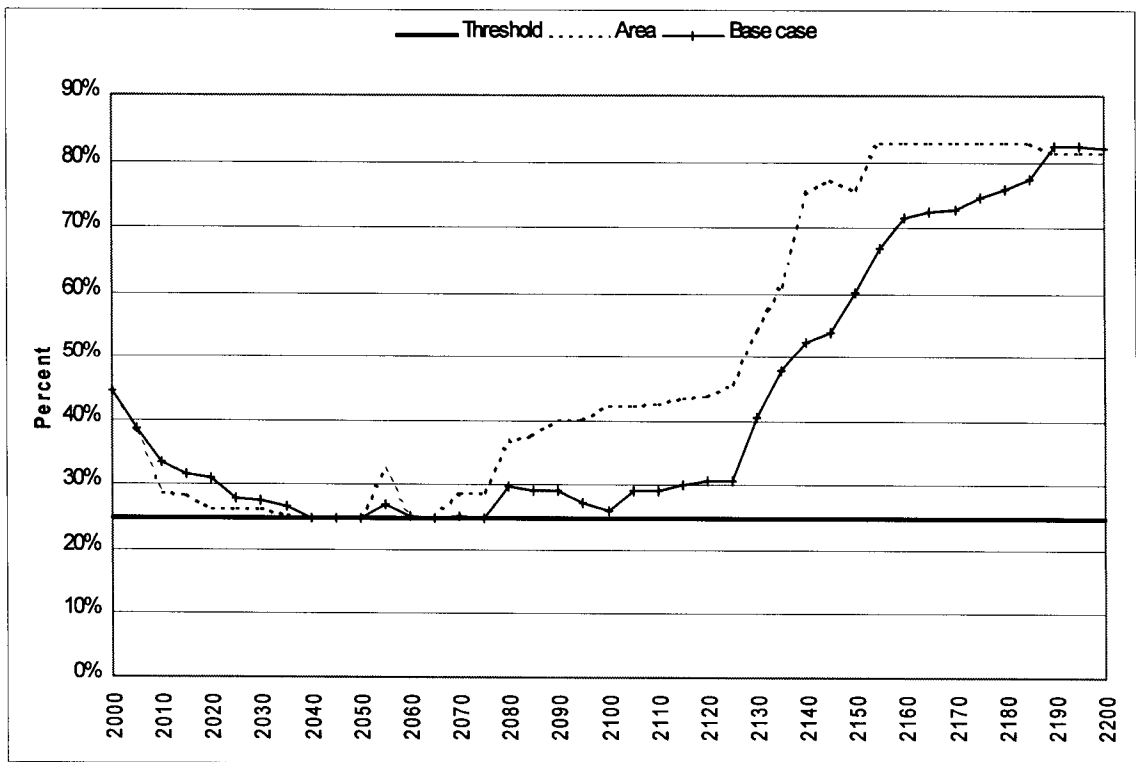


Figure 169: Area above old seral minimum age, special wildlife management areas

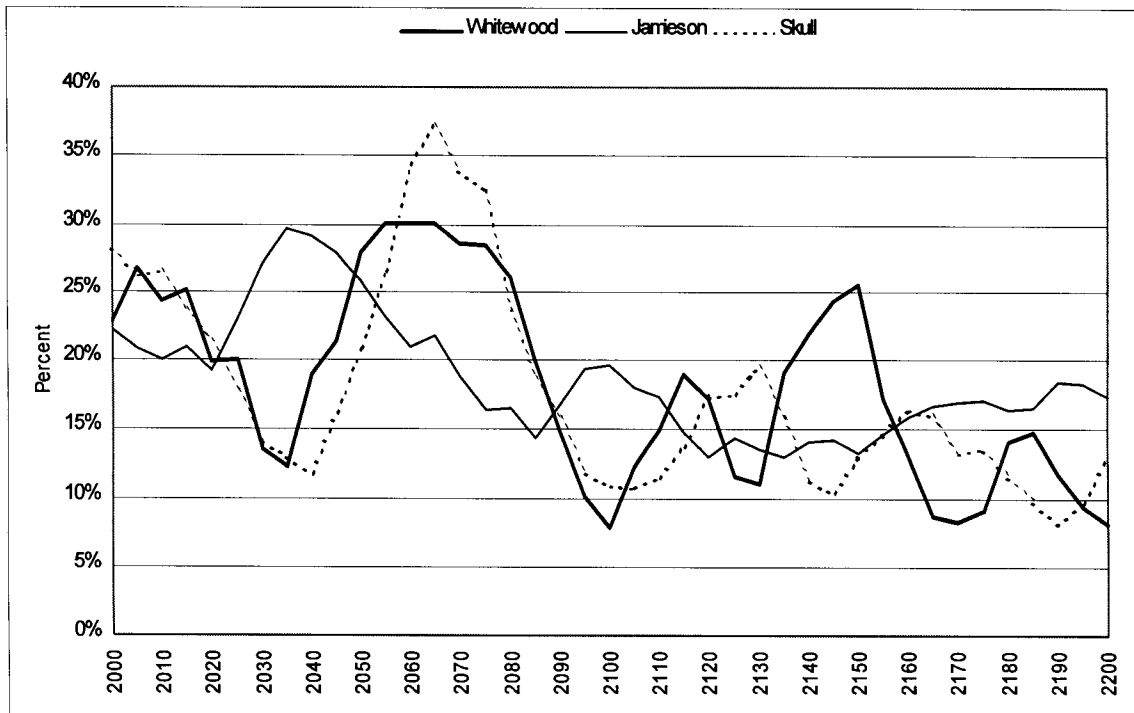


Figure 170: Area below 4.8m hydrological green-up

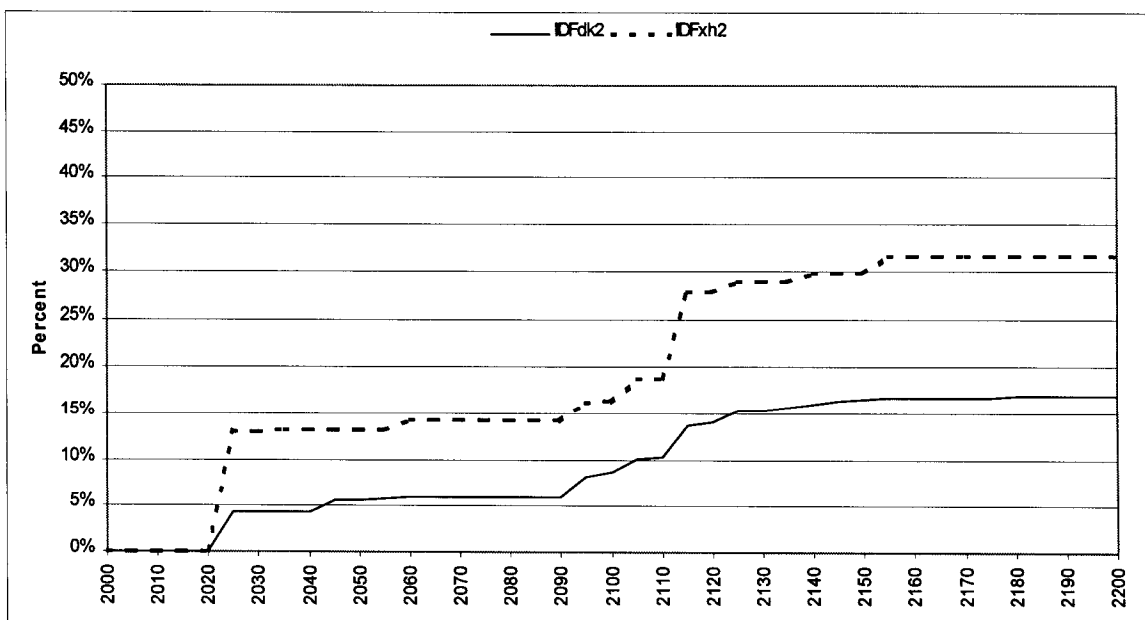


Figure 171: NDT4 old seral