

# Drayton Valley FMA

## Stand Level Retention Monitoring Report: 1999-2004

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*Drayton Valley FMA – Block # 0533 – Summer 2004*

## Executive Summary

Retention of structure within harvest sites is intended to provide stand conditions more analogous to those created by natural disturbance events. This is meant to increase the structural diversity of a stand and it is an important element of ecologically based forest management. In 1998, Weyerhaeuser Company in Alberta produced Stand Level Ecological Guidelines to assist in the implementation of in block structure retention within its operations. Structure retention in cutblocks is now incorporated into Environmental Management System (EMS) practices and is part of the Weyerhaeuser CSA Sustainable Forest Management Plans. In 1999, a monitoring program was initiated in the Drayton Valley Forest Management Agreement area (FMA) to assess the implementation of structure retention and to determine the amount of merchantable trees left on site. Every summer, from 1999 to 2004, all cutblocks harvested during the previous harvest season were classified using oblique aerial photography and a sample of those cutblocks was surveyed on the ground.

The results of the retention monitoring program from 1999 to 2004 showed that the implementation of the Stand Level Ecological Guidelines in the Drayton Valley FMA was very effective and is meeting its objective of retaining variable amounts of structure across the landscape. Of the total number of blocks classified in 6 years (615), the majority (66%) retained 1 to 5% standing vegetation cover, while 24% had between 10 and 20%. The percentage of cutblocks with greater than 25% retention ranged between 0% and 13% and blocks with no standing vegetation cover increased from 0% of those classified in 2000 to 7% in 2004.

The structure of retention (single, clumps and patches of trees) was variable. The proportion of cutblocks containing single tree retention decreased over 6 years, while the occurrence of patches increased. The vegetation composition of structure retained also varied from year to year. Between 1999 and 2004, 39% of all classified cutblocks were found to contain retention composed mainly of coniferous species. Deciduous species and mixedwood assemblages were the most common type of retention in 36% and 21% of the blocks, respectively.

Every year from 1999 to 2004, a sample of harvest blocks were ground surveyed (n=83; total area surveyed was 1,266.7 ha). Merchantable volume retention, (as a percent of total merchantable volume) present in these blocks averaged 8.40% over six years. This percentage is close to Weyerhaeuser commitments outlined in the Drayton Valley DFMP and reflects the company's commitment to maintain biodiversity and other social values while practicing forest management.

**Introduction**

The retention of trees, snags and woody debris in harvest areas is a key component of ecologically based forest management. The retention of standing structure within harvest sites is intended to produce future forest stands that more closely mimic conditions following a natural disturbance event. Tree retention, tree patches and clumps, and snags increase the structural diversity of the regenerating stand, retain some later seral conditions such as a multi-layered canopy, provide a future supply of large snags and down logs, and increase microsite variability for a more diverse plant understory. This structural diversity provides habitat opportunities for wildlife species that would not be otherwise available. In addition, retention of structure in a cutblock provides ecological sites from which unaffected plant and animal species can disperse onto the surrounding cutblock.

In 1998, Weyerhaeuser Company in Alberta developed Stand Level Ecological Guidelines to assist all FMAs in the province (Grande Prairie/Grande Cache, Drayton Valley and Edson) in implementing stand level structure retention. Structure retention in cutblocks is now part of Weyerhaeuser Environmental Management System (EMS) practices and is an essential component of Weyerhaeuser SFM CSA certification in Alberta.

The Stand Level Ecological Guidelines have been in effect for six years. Their operational implementation posed numerous challenges to Weyerhaeuser planners and contractors, from the need to minimize windthrow to ensuring that the appropriate and ecologically significant amount of canopy cover was retained.

**The Structure Retention Monitoring Program**

In the summer of 1999, Weyerhaeuser initiated a systematic monitoring program in the Drayton Valley FMA aimed at assessing the implementation of the Stand Level Ecological Guidelines and determining the amount of merchantable trees left in harvest sites.

The objective of this report is to outline Weyerhaeuser's stand retention monitoring approach and to document stand structure retention in the Drayton Valley FMA.

**Sampling design**

The amount of stand structure retained in cutblocks was assessed through two different approaches: oblique aerial photography of the majority of cutblocks harvested during the previous harvest season and ground surveys of a sample of those cutblocks. The amount of retention measured through ground surveys was used to calibrate the classification obtained through oblique aerial photography. Ground surveys were also used to assess the amount of merchantable trees retained.

**Aerial photography**

Oblique aerial photographs were used to assess the percentage ground cover attributable to vertical structure retention. Every summer, from 1999 to 2004, all of the cutblocks harvested during the previous harvest season were photographed. More than one photograph was frequently taken of each cutblock.

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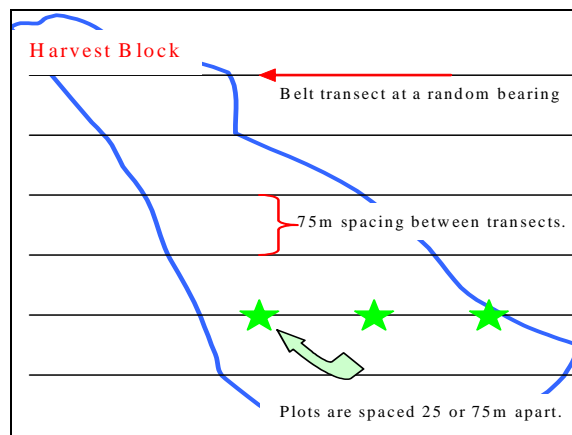
The blocks were classified by projecting the photographs onto a large screen. The percentage of the area of a cutblock still covered by standing vegetation was assessed using broad categories (1-5%, 10-20% and greater than 25%), following the categories developed by Beckingham et al. (1996) and Corns and Adams (1986) in estimating vegetation cover for Forest Ecosystems and Ecosites in West-central Alberta. The type of vegetation (conifer, deciduous or mixedwood) and the structure retained (single, clumps or patches of trees) were also classified.

### Ground surveys

Systematic ground surveys of 10 - 15% of all cutblocks harvested in each FMA during the previous harvest season were conducted every summer between 1999 and 2004. For the purpose of the field-monitoring program, this proportion of all harvested blocks was deemed sufficient to capture the variability across each individual Forest Management Agreement area and to capture the amount of merchantable trees that were retained.

Parallel belt transects within each cutblock were spaced 75 m apart. Their orientation was determined prior to fieldwork through the random selection of a common bearing.

Sample plots were laid out along each transect at 25 or 75m intervals, depending on the survey design used that year. The interval between plots was considered necessary to maintain separate identities and characteristics for each of the measure plots. Each of the measure plots was 25 m long and 10 m wide (5 m on either side of the transect line). If the edge of a block did not allow the establishment of a plot 25 or 75m from the previous one, the remaining distance was measured from the block boundary along the next transect until the full interval was attained (see figure).



From 1999 to 2002, 10% of the harvest blocks were ground surveyed, and sample plots were laid out at 25 m intervals. Beginning in 2003, 15% of harvest blocks were surveyed, with sample plots at 75 m intervals.

The number of plots within each block varied based on block size, shape and the orientation of the belt transects. Within each measure plot, the following data was recorded: tree species, dbh, live or dead, blowdown, snag (greater or less than 20 cm dbh), and height (the height of every fifth tree was measured). Only trees with a dbh of 7 cm or greater were measured.

## RESULTS

Between 1999 and 2004, oblique aerial photography was used to assess the amount of structure retention on more than 11,000 ha of harvested land. In total, 615 cutblocks were classified: 49 cutblocks in 1999, 128 in 2000, 100 in 2001, 107 in 2002, 104 in 2003 and 127 cutblocks in 2004. Of the classified blocks, 83 were further sampled on the ground. In all years, the data collected through field surveys was used to calibrate the stand retention classification from aerial photography and to assess the relative amount of the merchantable and unmerchantable components.

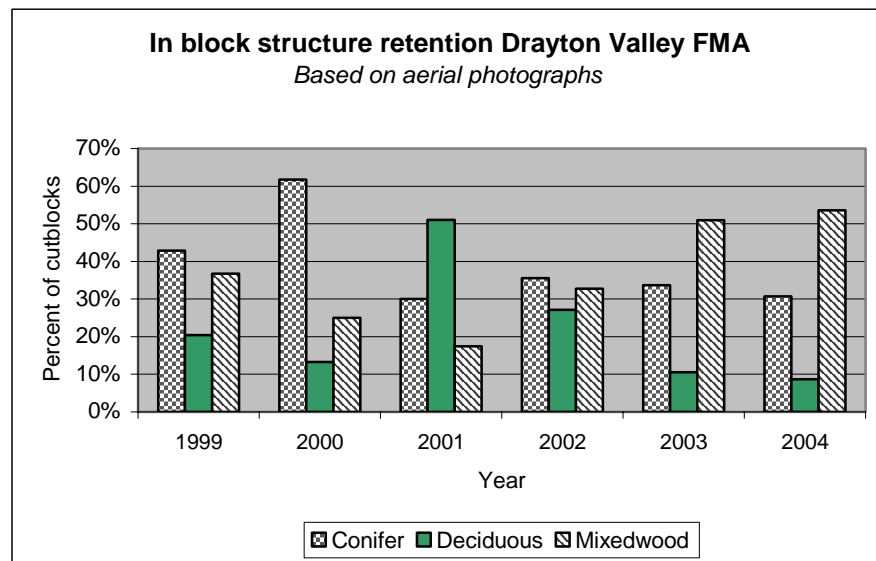
### Aerial photography

#### Dominant Retention Species

The composition of the vegetation retained was dominated by conifer species in 39% of the total cutblocks (615) classified between 1999 and 2004. Mixedwood assemblages dominated the retention in 36% of the cutblocks and deciduous species made up the majority of retention in 21% of all classified blocks.

Results varied from year to year. In 2000, the majority of blocks (62%) had retention consisting mainly of coniferous species (Figure 1; Appendix: Table 1). In 2001, deciduous species were the most common type of retention in 51% of the classified blocks, and mixedwood assemblages dominated the retention in 51% and 54% of the blocks in 2003 and 2004, respectively.

**Figure 1. Percentage of cutblocks dominated by coniferous, deciduous or mixedwood retention structures based on oblique aerial photographs.**



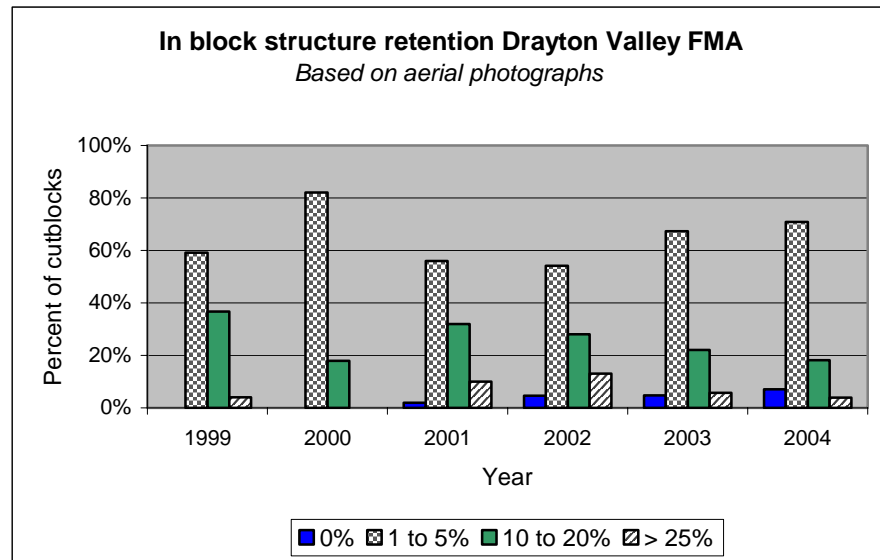
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### Percentage of Retention

Of the 615 blocks classified between 1999 and 2004, 3% had no retention, 66% had between 1 and 5% retention, 24% had 10-20% retention and 6% had greater than 25% cover remaining. The percentage of retention refers to the proportion of the area of a cutblock still covered by vegetation.

Variations in results are apparent between survey years. The proportion of cutblocks with 1 to 5% cover remaining fell from 82% in 2000 to 54% in 2002, increasing to 71% by 2004 (Figure 2; Appendix: Table 2.). Over 6 years, the proportion of blocks containing 10-20% retention ranged from 18% to 37%. Blocks with greater than 25% retention increased from 0% in 2000 to 13% in 2002. This percentage fell to 4% by 2004. The proportion of blocks without retention increased from 0% in 1999 to 7% in 2004.

**Figure 2. Proportion of cutblocks with different amounts of retention based on oblique aerial photographs.**



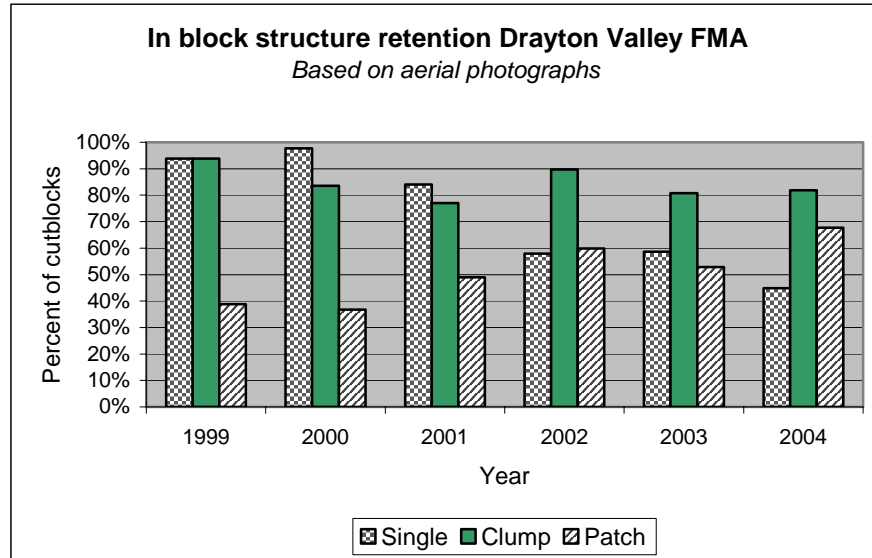
### Type of Retention

Between 1999 and 2004, 71% of all blocks (615) had single tree retention, 84% contained clumps and 52% were found with patches. A clump is a small group of trees, usually 3 to 4, and a patch is a larger group consisting of more than 10 trees. Each block can have more than 1 type of retention.

The proportion of blocks containing single tree retention in the Drayton Valley FMA decreased from 98% in 2000 to 45% in 2004 (Figure 3; Appendix: Table 3). Between 77% and 94% of the blocks classified each year retained clumps and the proportion of blocks containing patches increased from 37% in 2000, to 68% in 2004.

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**Figure 3. Percentage of cutblocks containing various types of retention based on oblique aerial photographs.**



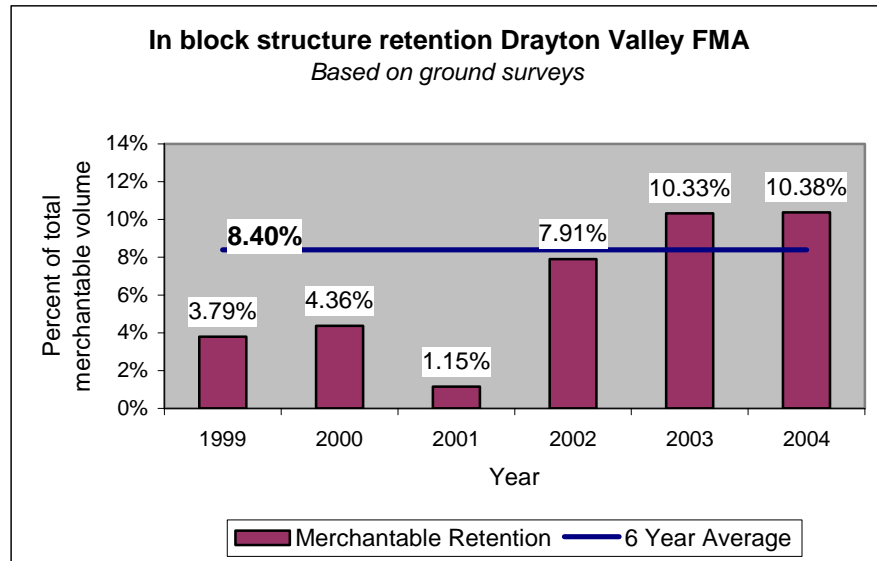
**Ground surveys** Between 1999 and 2004, 83 blocks were surveyed on the ground. A total of 1727 plots, ¼ ha each, were established along a cumulative total of approximately 130 km of belt transects. The results of the ground surveys are summarized in Table 4. On average, the total number of stems/ha (merchantable and unmerchantable, greater than 7 cm dbh) ranged from 28.5 stems/ha in 2001 to 147.7 in 2003. The proportion of the total stems/ha composed of merchantable stems also varied, from 70% in 1999 to 47% in 2003.

#### Merchantable Volume

The percentage of total merchantable volume retained increased in the Drayton Valley FMA from 3.77% in 1999 to 4.33% in 2000 (Figure 4). This proportion fell to 1.14% by 2001, but increased to 10.38% by 2004. The average amount of merchantable volume retained between 1999 and 2004 was 8.40%. The total merchantable volume retained is presented as a percent of total merchantable volume (hauled + retained).

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**Figure 4. Merchantable retention as a percent of total merchantable volume based on ground surveys.** (The yearly data should be looked at with caution. The large differences between years may be due to the small yearly sample size).



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**Table 4. Amount of merchantable and non-merchantable trees retained in cutblocks based on ground surveys. (The yearly data should be looked at with caution. The large differences between years may be due to the small yearly sample size).**

#### Drayton Valley Summary of Ground Surveys 1999 - 2004

<b>Non-Merchantable Retention</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>
Average Non-merch Stems/ha	14.8	12.1	13.83	31.3	78.79	50.63
Average Non-merch Volume (m <sup>3</sup> /ha)	4.06	1.16	1.02	2.01	4.67	3.14
<b>Merchantable Retention</b>						
Average Merch. Stems/ha	34.6	24.3	14.71	34.18	68.95	61.43
Average Merch. Volume (m <sup>3</sup> /ha)	9.82	9.76	2.72	15.53	26.69	23.65
Total Merch. Retention (as a % of total volume)	3.77%	4.33%	1.14%	7.83%	10.33%	10.38%
<b>Total Retention</b>						
Total Retention (Merch + Non-Merch) (as a % of total volume)	5.25%	4.85%	1.57%	8.85%	12.14%	4.85%
Total Volume (Hauled + Retention)	35 952 m <sup>3</sup>	19 744 m <sup>3</sup>	18 223 m <sup>3</sup>	28 857 m <sup>3</sup>	84 949 m <sup>3</sup>	92 633 m <sup>3</sup>
Average m <sup>3</sup> of retention volume per block	157.3	63.8	28.66	212.75	766.47	639.62
Average m <sup>3</sup> per hectare of retention	13.82	10.92	3.74	17.55	31.36	26.79
Average Tree Volume (m <sup>3</sup> /stem)	0.257	0.402	0.254	0.455	0.387	0.385
Average Merch. DBH (cm)	24.28	24.24	18.6	24.13	25.32	22.69
Snags < 20 cm DBH (Stems/ ha)	-	-	-	-	6.64	2.22
Snags > 20 cm DBH (Stems/ ha)	-	-	-	-	10.13	7.93
Total Blocks Ground Surveyed	12	15	10	12	15	19
Total Area Ground Surveyed	136.6 ha	87.7 ha	76.6 ha	145.5 ha	366.61 ha	453.7 ha

\* Retention of snags was recorded in 2003 and 2004 only.

**DISCUSSION**

The Stand Level Ecological Guidelines, which are part of Weyerhaeuser Alberta EMS Planning Guidelines and Work Instructions, are intended to provide *guidelines* and not standards or rules. The aim of the guidelines is to assist forest planners and contractors in retaining stand level structure to address biodiversity conservation. The Stand Level Ecological Guidelines were designed to be used with flexibility depending on site conditions, while attempting to retain as much in block structure as possible. Although the Guidelines do provide specific target amounts, those amounts are expected to vary depending on operational, aesthetic or silvicultural considerations.

The results of the retention monitoring program from 1999 to 2004 showed that the implementation of the Stand Level Ecological Guidelines in the Drayton Valley FMA was very effective and met its objective of retaining variable amounts of structure across the landscape. Of the total number of blocks classified in 6 years, the majority (66%) contained 1 to 5% retention, while 24% had between 10 and 20% cover remaining (Figure 2). The percentage of cutblocks with retention greater than 25% increased by 9% between 1999 and 2002 and decreased by the same amount between 2002 and 2004. Between 1999 and 2004, the proportion of blocks with no retention increased from 0 to 7%. The structure of retention (single, clumps and patches of trees) was also variable. Patches were found in 37 to 68% of the blocks classified each year and the percentage of blocks containing clumps ranged from 77 to 94% (Figure 3). The proportion of cutblocks with single tree retention decreased from 98% in 2000 to 45% in 2004.

With regard to the amount of merchantable volume left unharvested, from 1999 to 2004, the average percent of merchantable volume retained was 8.40% (based on a sample size of 83 blocks). This percent merchantable retention is close to the Weyerhaeuser commitment in the submitted Drayton Valley DFMP. The yearly data presented in Table 4 should be looked at with caution since the large differences between years may be due to the small yearly sample size. Ground surveys showed a decrease in merchantable retention from 2000 (4.36%) to 2001 (1.15%), but this number increased significantly to 10.38% by 2004 (Figure 4). The numbers are based on the total volume removed from survey blocks in that particular year. For example, in 1999, total volume removed was 34,064 m<sup>3</sup>, while in 2004, total volume removed was 92 633 m<sup>3</sup>. Other units of measurement to compare the amount of merchantable retention include the average volume of retention/block, the average m<sup>3</sup> per hectare, or the volume per stem (Table 4). All of these units show lower amounts of merchantable retention in 2001 compared to previous years, but values increase in 2002. It should be noted that some of the merchantable conifer trees were left unharvested not for ecological but for silvicultural reasons.

The intent of this monitoring program was not to assess whether the type or amount of retention meets the objective of providing habitat for wildlife species. In this regard there is an ever-increasing body of scientific knowledge that shows the value and importance of retaining structure within cutblocks. Additional research underway aims at identifying threshold amounts below which retention may not be ecologically effective.

**Acknowledgments** Two summer students, Laurie Jenkins (2000) and Paul Knaga (2001) provided valuable support during field surveys and in the photo interpretation process. Also providing invaluable support were Weyerhaeuser personnel, and both site contractors and summer students. Mark Messmer, Neil Stevens and Darren Lapp helped in the determinations of the volume retained within cutblocks through the use of an SAS program, which incorporated Shongming's taper functions (by NSR) and Shongming's height-dbh relationships (by NSR).

## APPENDIX 1

### Drayton Valley Block Classification 1999 - 2004

**Table 1. Dominant Retention Species**

Year	Conifer		Deciduous		Mixedwood	
	Total	Percent	Total	Percent	Total	Percent
1999	21 / 49	43%	10 / 49	20%	18 / 49	37%
2000	79 / 128	62%	17 / 128	13%	32 / 128	25%
2001	30 / 100	30%	51 / 100	51%	17 / 100	17%
2002	38 / 107	36%	29 / 107	27%	35 / 107	33%
2003	35 / 104	34%	11 / 104	11%	53 / 104	51%
2004	39 / 127	31%	11 / 127	9%	68 / 127	54%
<b>Total</b>	242 / 615	39%	129 / 615	21%	223 / 615	36%

**Table 2. Percentage of Cutblocks with Various Amounts of Retention**

Year	0%		1 to 5%		10 to 20%		>25%	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
1999	-	-	29 / 49	59%	18 / 49	37%	2 / 49	4%
2000	0 / 128	0%	105 / 128	82%	23 / 128	18%	0 / 128	0%
2001	2 / 100	2%	56 / 100	56%	32 / 100	32%	10 / 100	10%
2002	5 / 107	5%	58 / 107	54%	30 / 107	28%	14 / 107	13%
2003	5 / 104	5%	70 / 104	67%	23 / 104	22%	6 / 104	6%
2004	9 / 127	7%	90 / 127	71%	23 / 127	18%	5 / 127	4%
<b>Total</b>	21 / 615	3%	408 / 615	66%	149 / 615	24%	37 / 615	6%

**Table 3. Type of Retention**

Year	Single		Clump		Patch	
	Total	Percent	Total	Percent	Total	Percent
1999	46 / 49	94%	46 / 49	94%	19 / 49	39%
2000	125 / 128	98%	107 / 128	84%	47 / 128	37%
2001	84 / 100	84%	77 / 100	77%	49 / 100	49%
2002	62 / 107	58%	96 / 107	90%	64 / 107	60%
2003	61 / 104	59%	84 / 104	81%	55 / 104	53%
2004	57 / 127	45%	104 / 127	82%	86 / 127	68%
<b>Total</b>	435 / 615	71%	514 / 615	84%	320 / 615	52%

*Clump: A small group of trees, usually 3 or 4.*

*Patch: A larger group of trees (more than 10)*