

**Effects of Timberland Parcelization and Regulatory Restriction on Annual Harvest  
Volumes  
Humboldt County, California**

An analysis Prepared for the North Coast Regional Land Trust  
by  
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**Introduction**

Within California there are approximately 13 million acres of privately owned forestland, 10 million of which is owned by nonindustrial, private landowners (Butler 2008). Of the 8 million acres of family forestlands, approximately 1 million acres were subject to harvest in the past 5 years (14%) and slightly fewer acres (967,000) are planned for harvest in the next 5 years. Thus, on average in California 2.8% of non-industrial, privately owned forestlands are subject to harvest annually.

While 2.8% is the average rate of harvest for private lands, larger ownerships harvest at a higher rate than smaller ownerships. Butler (2008) found that nationwide (data were not available only for California) as ownership size increased so did percent of area that has been harvested by the current owner in each size class of ownerships, ranging from 30% of the cumulative area of parcels <10 acres to over 80% for parcels >1,000 acres.

Generally, the more commercial forestland that is owned by a single landowner the more likely they are to conduct a timber harvest in any given year or decade. This is due to a number of factors. The first is that the more timberland one owns the more efficient it is to harvest due to economies of scale in both permitting and harvesting. Second, the more timberland one owns the more likely it is that timber harvest is a viable business for the landowner and is viewed as such. Whereas, landowners with smaller amounts of timberlands may only harvest once or twice in a lifetime, if at all, and therefore timber harvest is opportunistic and may not be desired at all. Butler (2008) found that for landowners with 10-49 acres only 13% rated timber production as an important or very important goal whereas for landowners with 1,000+ acres, 51% rated timber production as an important or very important goal.

The following analysis was conducted in order to understand the relationship between ownership size and harvest intensity in Humboldt County. A secondary component of this analysis compared the relative impact of parcelization to regulation on timber harvest volumes.

**Methods**

Data on ownership size were compiled based on 2008 Assessor Parcel Number (APN) layer data from Humboldt County GIS. The total number of acres owned by a single landowner in adjacent and non-contiguous parcels was summed up for each landowner in the county. The ownerships were then divided into the following size classes: 5-160 acres, 161-640 acres, 641-2,500 acres, >2,501 acres. Non-industrial Private Forestland (NIPF) landowners were separated from Forest Industry landowners (industry).

Timber Harvest Plan (THP) and Notice of Timber Operations (NTO) data were then downloaded from the CALFIRE website for the 1997 to 2008 time period. The data were in the form of GIS shapefiles with attribute data regarding the acres filed by year for each landowner, silviculture and yarding type.

The number of acres of merchantable timberland on each ownership were calculated using vegetation type data from the 2005 LCMMP GIS layer downloaded from the CALFIRE Fire and Resource Assessment Program (FRAP) website. The vegetation data were derived from LandSat TM remotely sensed information using 2.5 acre mapping units. For this analysis merchantable forestland was defined as any polygon labeled as Douglas-fir (DFR) or redwood (RDW) dominated in any of the following size classes: size class **3** (6-11" diameter at breast height or dbh), **4** (11-24" dbh) or **5** (>24" dbh). The California Wildlife Habitat Relationships (CWHR) classification system was used.

The acreage of merchantable timberland on each ownership was derived by intersecting the vegetation type GIS layer and the ownership layer.

The ownership size class from which each harvest plan (THP or NTO) originated was derived by spatially selecting each harvest polygon based on which ownership class polygon it was located within. There is some error with this method due to the fact that the harvest polygons occurred during the years 1997-2008, while the ownership layer used was from 2008. The 2008 owner and size class were used, even though in some cases the landowner had changed since the harvest plan had been filed. In most cases where the ownership had changed, the ownerships currently classified as 5-160 acres or 160-640 acres were formerly held by large ownerships (>640 acres) such as Eel River Sawmills or Barnum Timber. In these cases the name of the applicant for the THP was used to attribute which property the harvest came from rather than the name of the current owner as listed on the APN layer.

## **Results**

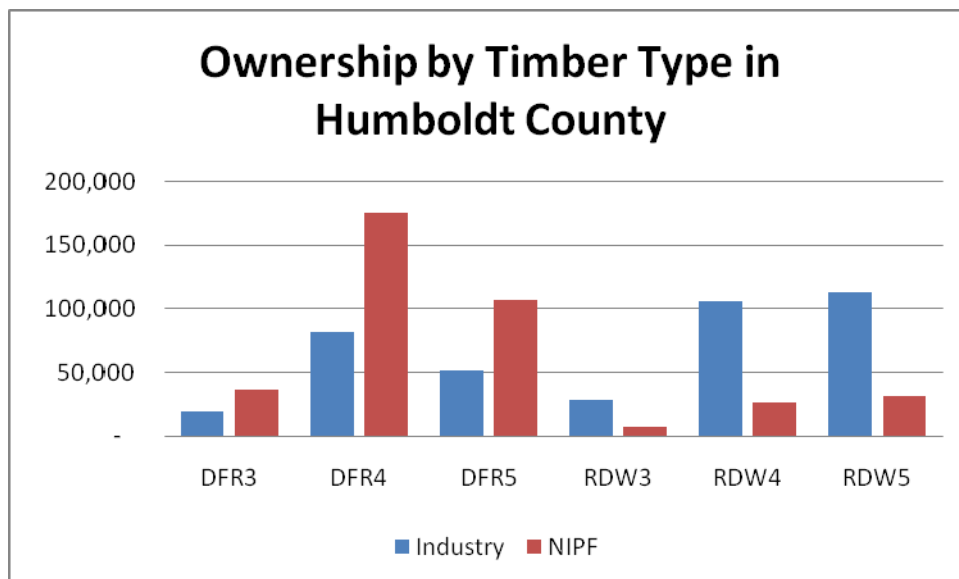
There are approximately 1.5 million acres of privately owned lands in Humboldt County that exceed 5 acres in size (Table 1). Approximately half of the total acreage is occupied by tree species and size classes considered to be merchantably viable. The proportion of merchantable timberland is highest on land owned by the timber industry (Humboldt Redwood Company, Green Diamond Resource Company, Sierra Pacific Industries, Soper-Wheeler, Barnum Timber and Eel River Sawmills) at 64%. On non-industrial private forest lands (NIPF) the proportion of merchantable timberland is approximately 40% of total ownership, regardless of size class (Table 1).

Percent of each Ownership Size Class Occupied by Commercial Timber

Ownership Size Class	NIPF				Industry	Total
	5-160 ac.	160-640 ac.	640-2,500 ac.	2500+ ac.		
Timber Acres Owned	96,464	70,689	73,420	140,383	397,687	778,643
Total Acres Owned	225,457	168,747	175,364	363,501	625,191	1,558,260
<b>Percent Timbered</b>	<b>43%</b>	<b>42%</b>	<b>42%</b>	<b>39%</b>	<b>64%</b>	<b>50%</b>

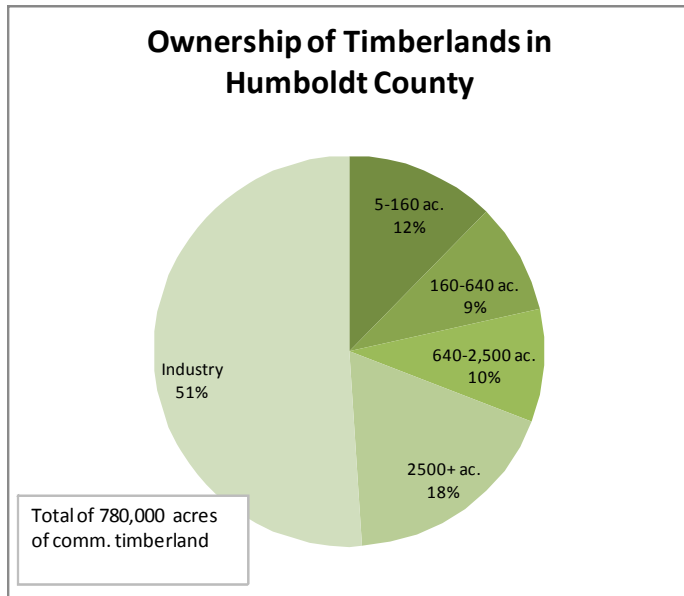
**Table 1. Total acres and acres of merchantable timberland on private lands in Humboldt County.**

The distribution of timber species on merchantable timberlands amongst NIPF and industry lands is shown below (Figure 1). Of the 780,000 acres of timberlands in Humboldt County 469,000 acres is Douglas-fir dominated and 311,000 is redwood dominated. NIPF’s own 68% of the Douglas-fir timberland and 21% of the redwood timberland. Industry owns 32% of the Douglas-fir timberland and 79% of the redwood timberland. The timber types are fairly evenly distributed amongst the ownership size classes, for example the size class 3 (6-11” dbh) timber is not concentrated on small ownerships (Appendix A).



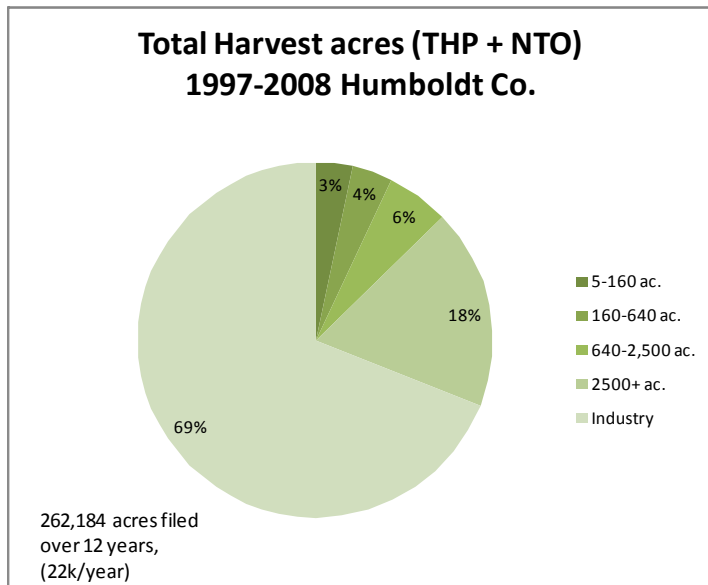
**Figure 1. Distribution of timber species on Industry and NIPF lands.**

The timber industry owns approximately 40% of the total acreage of private land in Humboldt County and 51% of the lands dominated by merchantable timber species. NIPFs own 60% of the total private lands and 49% of the lands dominated by merchantable timber species (Figure 2).



**Figure 2. Distribution of merchantable timberlands amongst ownership size classes.**

For the 1997 to 2008 time period 235,034 acres of THPs were filed and 27,150 acres of NTOs (the notification of harvest for NTMPs) were filed- for a total of 262,184 acres of harvest plans in a 12 year period- about 22,000 acres per year. Of these harvest plans filed, 69% of the acres occurred on industry land (Figure 3). Another 18% of harvest plans were filed on NIPF lands >2,500 acres, for a total of 87% of plans filed originating from private ownerships >2,500 acres. Approximately 7% of harvest plans were filed on ownerships less than 640 acres.



**Figure 3. Distribution of harvest plans amongst ownership size classes.**

There was a relationship between size of ownership and the likelihood of filing a harvest plan during the 12 year study period. The total number of acres of merchantable timberland in each ownership size class was calculated and compared to the total number of harvest plans originating from that size class. The data indicate that as ownership size class increases a greater percentage of merchantable timberland in that size class group has a harvest plan filed for it. For example 9,000 acres of harvest plans were filed on the 96,000 acres of merchantable timberlands that occurred on ownerships <160 acres, or approximately 9% of the merchantable timberland during the 12 year period; or 0.8% annually (Table 2). Whereas on NIPF lands >2,500 acres, approximately 2.8% of the merchantable timberlands were planned for harvest each year (Table 2).

Ownership Size Class	NIPF				Industry	Total
	5-160 ac.	160-640 ac.	640-2,500 ac.	2500+ ac.		
Timber Acres Owned	96,464	70,689	73,420	140,383	397,687	778,643
THP acres	6,507	6,935	7,700	33,002	180,890	235,034
NTO acres	2,513	2,529	7,291	14,817	-	27,150
Acreeage of plans filed over 12 year period	9,020	9,464	14,991	47,819	180,890	262,184
<b>% of Timberland Planned for Harvest per year</b>	<b>0.8%</b>	<b>1.1%</b>	<b>1.7%</b>	<b>2.8%</b>	<b>3.8%</b>	<b>2.8%</b>

**Table 2. Relationship between ownership size class and percent of merchantable forestland planned for harvest annually, based on THP and NTO data from 1997-2008.**

During the period from 1997 to 2007 the average annual net volume of timber harvested in Humboldt County on private lands was 387,562 thousand board feet (MBF) according to Board of Equalization data (Table 3). During approximately the same time period the average annual number of acres planned for timber harvest was 21,848 acres. Thus, on average 17 MBF per acre were planned for harvest annually during this time period<sup>1</sup>. On industry lands where site quality is higher and clearcuts are more common the harvest volume per acre is likely to be higher, whereas on NIPF lands it is likely to be lower- but determining this difference would take additional analyses and unpublished BOE data. Two extrapolations to potential volume harvested from each Ownership class were made to explore this potential disparity in harvest intensity, one assuming harvest intensity on Industry and NIPF lands is the same and the other extrapolation assuming harvest intensity on Industry land is higher than on NIPF lands<sup>2</sup> (Table 3).

<sup>1</sup> Acres harvested declined from 27,000 in 1997 to 16,000 in 2008, while volume declined from 520MMBF to 297MMBF. The annual volume/acre harvested remained approximately the same at 17-19 MMBF.

<sup>2</sup> A phone interview with BOE staff indicated that a rough estimate of harvest intensity on Industrial lands was 20 MBF/acre and 5MBF/acre on non-industrial lands or a 4:1 ratio. Table 3 (below) uses a 2.5:1 ratio so as not to over emphasize the quantity of timber originating on industrial lands.

	Ownership Size Class	NIPF				Industry	Total
		5-160 ac.	160-640 ac.	640-2,500 ac.	2500+ ac.		
	ave. annual harvest (ac.)	752	789	1,249	3,985	15,074	21,849
	percent of total acres	3.4%	3.6%	5.7%	18.2%	69.0%	100.0%
Assume 17 MBF/Acre NIPF and Industry	ave. annual harvest (volume MBF)	13,380	14,038	22,237	70,932	268,320	388,906
	percent of total volume	3.4%	3.6%	5.7%	18.2%	69.0%	100.0%
Assume 22 MBF/Acre Industry and 8.5MBF/Acre NIPF	ave. annual harvest (volume MBF)	6,355	6,668	10,562	33,690	331,632	388,906
	percent of total volume	1.6%	1.7%	2.7%	8.7%	85.3%	100.0%

**Table 3. Estimate of average annual harvest acreage from 1997-2008 and two extrapolations to corresponding average annual volume from each land ownership class. The first extrapolation assumes that the volume of timber harvested per acre (intensity) was equal between Industry and NIPFs at 17 MBF/Acre. The second extrapolation assumes that average harvest intensity was higher for Industry at 22 MBF/Acre and lower on NIPF at 8.5 MBF/Acre.**

**Scenarios**

Using the harvest intensity values described in Table 2 facilitates crude projections of land use change effects on county wide harvest volumes.

Example 1- Recent Parcelization:

A rough estimate of parcelization over the past 12 years is that approximately 35,000 acres from ownerships in the >2,500 acre range were broken down and sold into smaller parcels, let’s assume it went to 5-160 acre parcels for this example. For those 35,000 acres that were parcelized the data from Table 2 (above) indicate that there was a corresponding drop in harvest intensity from 2.8% per year (on >2,500 ac size class) to 0.8% (5-160 ac. size class). This decrease in harvest intensity due to sub-division is predicted to have reduced average annual harvest by 13 MMBF per year or 3.3% during this time period<sup>3</sup>.

However, BOE data indicates that during this same time period (1997-2008) harvest volumes in Humboldt County have gone from over 500 MMBF in 1997 to under 300 MMBF in 2008, which is a 43% decline. Based on the Example 1, if parcelization were the only factor affecting timber production in Humboldt County we should have seen a 3.3% decline in harvest volume. The disparity between predicted and observed declines is nearly 40%, suggesting that the effects of parcelization alone were relatively minor compared to other factors.

<sup>3</sup> If the 35,000 acres of timberland had not been parcelized and decreased harvest volume, the additional 13 MMBF of timber would have been subject to the Timber Yield Tax. This estimate assumes that all acres were harvested at the average rate of 17 MBF/Acre. At an average stumpage value of \$500/MBF (Douglas fir and Redwood) this tax would have equaled \$188,500 in 2008.

Example 2 – Long Term Parcelization:

Conversely, in order to gain perspective on the impacts of parcelization to harvesting in Humboldt County over the last 40 years, let us assume that the 167,000 acres currently in NIPF ownerships < 640 acres had instead remained as ownerships >640 acres. The harvest intensity would be roughly double its current rate (2% vs. 1% annually) on those acres. This would result in an approximately 37 MMBF per year increase or 10% of average total harvest volume in the county compared to status quo.

BOE data indicate that average annual harvest volume has declined from over 1,000 MMBF in 1968 to less than 300 MMBF in 2007, or 75%. The effects of parcelization alone account for approximately 10% of this decline in harvest intensity. The depletion of old growth timber, advent of harvest regulation and many other factors account for the other 65% of the decline in timber harvest over the past 40 years.

**Effect of Regulation**

Along with parcelization, increased regulatory restrictions are often cited as reason for the decline in timber harvest in Humboldt County. Regulatory restrictions have direct and indirect effects on harvest intensity. Indirect effects include changes in landowner behavior due to the increased cost of obtaining permits and implementing the required practices. Some landowners harvest more intensively than they would prefer to in order to pay for the additional costs of regulatory compliance, while others choose not to harvest at all because the expense of the permits cannot be met through harvest of small quantities of timber.

The direct effects of regulation include actual decreases in lands available for harvest due to regulatory restrictions such as stream buffers, owl buffers, steep slope restrictions, etc. An informal poll of local foresters in Humboldt County indicates that on average approximately 10-15% of any harvest plan is not feasible to log because of things like landslides, inner gorges, rock outcrops, poorly stocked areas, etc. In addition to the areas that are infeasible to log another 5-15% of a harvest plan area is restricted only by regulations such as stream buffers, owl buffers, slope instability restrictions, etc. The foresters indicated that most of the regulations that restrict harvestable acres have been developed since the 1990's; listing of Northern spotted owls, Coho, expanded stream buffers, etc.

So, the direct effect due to regulation appears to be restricted harvest on about 5-15% of the merchantable timber land base; or 40,000 to 120,000 acres. The average harvest rate on the merchantable timber base is 2.8% (Table 2), which includes restricted and un-restricted lands. So, it is likely that the harvest rate on regulatorily restricted lands is currently about 0.5% and the harvest rate on un-restricted lands is about 3.0%. In the absence of regulations, theoretically, the harvest rate on regulatorily restricted lands could increase from ~0.5% up to ~ 2.5%.

A 2% increase in harvest rate on 40-120k acres per year would mean an additional 800 to 2,400 acres harvested each year. At an average harvest volume of 17MBF/acre this would result in a 14 to 40 MMBF increase in harvest volume each year, or 4 to 11%.

**Conclusions**

Size matters, from 1997 to 2008 ownerships with >2,500 acres filed plans to harvest timber at rates 3 to 4 times higher than landowners with <160 acres (Table 2). Private landowners with ownerships >2,500 acres own 69% of the merchantable timber lands and filed plans representing 87% of the yearly total acreage during the 12 year study period. Ownerships in the size classes that are generally the result of parcelization (less than 640 acres) account for 21% of the merchantable timber lands and are only responsible for filing about 7% of the harvest plan acreage in Humboldt County. And the reason that harvest is lower on smaller parcels is not simply due to smaller parcels having smaller timber or fewer acres of merchantable timber. Data from Appendix A indicate that timber in the larger size classes (>11 inches dbh) is present in approximately the same proportions on small as well as large parcels.

The argument is often made that when timberlands are broken into smaller pieces the timber is still there and could be harvested at some point, however the data indicate that although the timber is still there on small parcels the probability that it will be harvested decreases as the parcel size decreases.

During the past 10-15 years the estimated effect of parcelization was to reduce average annual timber harvest by about 13MMBF or 3%. During approximately this same time period the effects of regulatory restriction on the timber harvest area were estimated to have reduced average annual timber production by about 14-40MMBF or 4 to 11%. Thus it appears that the past 10-15 years of regulatory restrictions have had an equivalent or greater impact on timber production as the past 10-15 years of parcelization (Scenario 1).

The analysis of the amount of land that is off limits due to regulatory restrictions is less robust than the analysis of timber harvest by ownership size class. Further research should be devoted to accurately characterizing the effects of regulation on harvest volumes. In the interim, the estimates made in this paper should be seen as a reasonable approximation.

## References

Butler, Brett J. 2008. **Family Forest Owners of the United States, 2006**. Gen. Tech. Rep. NRS-27. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 72 p.

### Appendix A- Distribution of Timber Types

The distribution of timber types across NIPF lands seems relatively even, however the overwhelming trend is the proportion of redwood timber types on industry lands, represented as 10K+ ownerships (Table 4).

Ownership Size Classes	Timber Types												Total acres
	DFR3		DFR4		DFR5		RDW3		RDW4		RDW5		
	acres	percent	acres	percent	acres	percent	acres	percent	acres	percent	acres	percent	
5-160	8,536	15.54%	40,803	15.93%	21,093	13.38%	2,713	7.77%	10,867	8.25%	13,394	9.35%	97,406
160-640	7,681	13.99%	33,101	12.92%	18,217	11.55%	1,181	3.38%	4,612	3.50%	4,956	3.46%	69,748
640-2500	7,046	12.83%	32,564	12.71%	17,663	11.20%	1,852	5.31%	6,700	5.08%	7,596	5.30%	73,420
2500-5000	6,149	11.20%	25,019	9.77%	18,635	11.82%	352	1.01%	1,750	1.33%	3,200	2.23%	55,104
5000-10k	3,812	6.94%	21,416	8.36%	13,111	8.32%	369	1.06%	795	0.60%	443	0.31%	39,947
10K+	21,690	39.50%	103,216	40.30%	68,962	43.74%	28,429	81.47%	107,046	81.24%	113,608	79.34%	442,951
Grand Total	54,913	100.00%	256,119	100.00%	157,681	100.00%	34,896	100.00%	131,769	100.00%	143,197	100.00%	778,576

**Table 4. Distribution of timber types *across* ownership size classes, from 2005 LCMMP dataset, so for example 9.35% of the RDW5 timber type is on ownerships in the 5-160 acre size class.**

Size Class	Timber Types						Total
	DFR3	DFR4	DFR5	RDW3	RDW4	RDW5	
5-160	8.76%	41.89%	21.65%	2.78%	11.16%	13.75%	100.00%
160-640	11.01%	47.46%	26.12%	1.69%	6.61%	7.11%	100.00%
640-1000	11.91%	46.64%	21.15%	1.62%	9.61%	9.08%	100.00%
1000-2500	8.71%	43.48%	25.17%	2.87%	8.94%	10.83%	100.00%
2500-5000	11.16%	45.40%	33.82%	0.64%	3.18%	5.81%	100.00%
5000-10k	9.54%	53.61%	32.82%	0.92%	1.99%	1.11%	100.00%
10K+	4.90%	23.30%	15.57%	6.42%	24.17%	25.65%	100.00%

**Table 5. Distribution of timber types *within* each ownership size class, so for example 13.75% of total land base in 5-160 acre parcels is Timber Type RDW5.**

**Appendix B- Milling Capacity of Humboldt County (Based on citation)**

Humboldt Milling Capacity (2007)	Total annual production capacity (MMBF)	Industry Production own lands (estimate)								
SPI	85	85								
Schmidbauer	120	0								
Korbel	140									
Orick	48									
HRC	160	40								
Total	553									

	Net Volume Harvested (MMBF)	Equiv. Lumber production (CA Avg. Overrun = 1.53)	% milling capacity used in Humboldt	Acres Harvested - Industry	Acres Harvested - NIPF	Total	% Acres Harvested - Industry	% Acres Harvested - NIPF	Approximate Volume Harvested- Industry (MMBF)	Approximate Volume Harvested- NIPF (MMBF)
2007 Humboldt Harvest Volume (BOE)	297	454.41	82%	13,000	3,000	16,000	81%	19%	241	56
2000 Humboldt Harvest Volume (BOE)	435	665.55		18,000	4,000	22,000	82%	18%	356	79
1994 Humboldt Harvest Volume (BOE)	560	856.8								
State wide volume production = 36% NIPF, 48% Industry										
Timber imports in CA average 6% of total after year 2000										
Approximately 1/2 of NIPF 2007 harvest came from 3 ranches (Cottrel, Stover, Russ)										

