DETERMINANTS OF NON-TIMBER VALUE IN NORTHERN HARDWOODS: A FRAMEWORK FOR FOREST RESOURCE ACCOUNTING

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1. Introduction

Conventional measures of economic activity are often interpreted as measure of economic welfare. Changes in natural resource endowments have long been recognized as being poorly represented by these measures (Ahmad *et al.* 1989). Yet, they clearly contribute to the well being of nations. In recent years much work has been done to develop satellite accounts for the purpose of supplementing GDP and NDP. This combined information better accounts for the evolving state of the natural resource base of nations (Hartwick, 1990; Bartelmus and van Tongeren, 1994).

Forests perform important biological and economic functions and many of these, generally referred to as non-timber products, are not priced by a market. Yet full economic accounting requires them to be priced. To solve this problem studies have been commissioned by UN organizations to encourage the adoption of accounting techniques compatible with the exisiting framework (Vincent and Hartwick, 1997). Information concerning forest resources is of varying quality across countries, hence the development of a homogeneous system is bound to be a long process. Many developed countries have much data from periodic forest inventories. Recently, Lee (1997) used these data to derive prices (marginal values) of non-timber characteristics from "revealed preferences" of owners of even-aged forests in the southern United States. The object of the present paper is to derive prices of non-timber characteristics for owners of uneven-aged forests of the northern hardwoods in Wisconsin. These forests cover about one third of the commercial forest in Wisconsin (Smith, 1986). They are, therefore, a salient feature of the local landscape and forest economy and very diverse in terms of species (more than 55) and structure (Lin *et al.*, 1996). The heterogeneity of tree sizes poses an additional challenge for the derivation of non-timber prices.

This paper reports on the magnitude of the non-timber values, and on its determinants. The premise is that the value of diversity and of other forest traits to the owners can be inferred as the difference between what owners actually cut from their stands, and what they could have gotten had they been only after timber-revenue maximization. This difference is measured for USDA Forest Service permanent plots in Wisconsin (Hahn and Hansen, 1985; Hansen *et. al.* 1994), allowing for an assessment of the magnitude and distribution of non-timber value by ownership. Then, hedonic pricing methods are applied to determine the non-timber value of trees by species and size, conditional on other characteristics of the stand and of the owner. The hedonic price equations are applied to compute the non-timber rewards for the owners of the stands measured in the 1966 and 1984 inventories, as an example of non-timber resource accounting.

2. Theory

The decision unit is a forest stand: a homogeneous area typically less than 10 ha. The theory involves two aspects. First, defining the monetary worth of the total non-timber value in a forest stand, based on revealed preference. Second, finding the contribution of each stand characteristic to this non-timber value, by hedonic pricing.

2.1 Harvest choice and timber versus non-timber revenues:

Forest owners are assumed to prefer some combinations of forest stand states and timber revenues. For uneven-aged stands, the state can be represented by the number of trees of different size and species per unit of land. Let $\mathbf{Y}=[y_{ij}]$ be a (1xn) vector representing this tree distribution at the time of the harvesting decision, y_{ij} being the number of trees of species i and size j. Let $\mathbf{H}=[h_{ij}]$ be a corresponding vector of number of trees cut from $\mathbf{Y}$, and sold at the prices $\mathbf{p}=[p_{ij}]$. Then, $\mathbf{S} = \mathbf{Y}-\mathbf{H}$ is left standing to produce current and future timber and other benefits. We assume that owners decide how many trees to cut from each size class to maximize their utility, over an infinite horizon. For each stand, observed over a given time length, this choice results in an actual harvest $\mathbf{H}^o$, and an actual residual stand, $\mathbf{S}^o$.

In the absence of markets for non-timber goods and services, if owners only cared about monetary returns, they would maximize the net present value of timber benefits. The optimal decision would be ($\mathbf{H}^*$,$\mathbf{S}^*$). However, most owners also enjoy non-timber benefits, and the observed vectors ($\mathbf{H}^o$,$\mathbf{S}^o$) accounts for them. In general, for expected utility maximizers who benefit from both timber and non-timber we expect $\mathbf{H}^o < \mathbf{H}^*$, and $\mathbf{S}^o > \mathbf{S}^*$: The cut securing the maximum net present value of timber is higher than the observed, because the latter leaves more standing trees to allow enjoyment of non-timber benefits.

To derive an infinite horizon optimal timber harvesting rule in the context of uneven-aged management, Lin and Buongiorno (1998) define *N* possible stand states. For every state *i* there is an optimal decision k^*, solution of *N* recursive equations (Ross, 1983):

$$V_i^{t+1} = \max_k [r(i,k) + d \sum_{j=1}^{n} p(j|k) V_j^t] \quad i=1,...,N;\ t=1,...\infty \tag{1}$$

where V^t is the present value of the timber income over *t* years, $r(i,k)$ is the immediate timber return from cutting a stand from initial state *i* to stand state *k*, $p(j|k)$ is the probability of the stand moving from state *k* to state *j*, and *d* is the discount factor. Each state *i* corresponds to a tree distribution **Y**. A decision means cutting the stand from state *i* to state *k*, corresponding to **S** = **Y** - **H**. The best decision is unique and depends only on the state. Lin and Buongiorno (1998) give the decision matrix and the corresponding optimum rewards $r(i,k^*)$.

However, the forest owner with utility for non-timber values would not solve problem (1), but a similar one with a reward function that includes timber benefits $r(i,k)$ and non-timber benefits, $r'(i,k)$. Needed is an operational description of the non-timber benefits function $r'(i,k)$. We seek answers to two questions. First, how much are non-timber amenities worth in money terms, for a stand left in state *k*? Second, how does this non-timber value relate to the characteristics of state *k* and to those of the owner?

2.2 Revealed-preference measure of non-timber value:

Let the superscripts ^{o} and * indicate respectively the *observed* post-harvest conditions and the *optimal* solutions to timber-revenue maximization achieved by choosing state k^*. Let $U(\cdot)$ be a quasi-concave utility function monotonically increasing on its arguments. For owners who chose the bundle ($\mathbf{S}^o$,$\mathbf{pH}^o$) when ($\mathbf{S}^*$,$\mathbf{pH}^*$) was available we say that the first was "revealed preferred" to the second. Thus, by definition of the utility function:

$$U^o \geq U^*. \tag{2}$$

The proposed measure of non-timber benefits is the timber revenue foregone for the sake of gaining the non timber benefits associated with leaving $\mathbf{S}^o - \mathbf{S}^*$ standing:

$$NTV = \mathbf{p}(\mathbf{H}^o - \mathbf{H}^*) = \mathbf{p}(\mathbf{S}^o - \mathbf{S}^*) \tag{3}$$

That the state ($\mathbf{H}^o$,$\mathbf{S}^o$) is preferred to ($\mathbf{H}^*$,$\mathbf{S}^*$) implies that:

$$U(\mathbf{S}^o, \mathbf{pH}^o) \geq U(\mathbf{S}^*, \mathbf{pH}^* + NTV). \tag{4}$$

Therefore, the NTV defined as the timber revenue foregone by the owner is a lower bound on the non-timber benefits expressed in monetary terms.

In terms of the decision model (1) the timber-revenue maximizing return obtained by cutting from state *i* to state k^* is $r(i,k^*)$. The NTV of the stand in pre harvest-state *i*, and post-harvest state k^o is then:

$$r'(i,k^o) = r(i,k^*) - r(i,k^o), \tag{5}$$

which is the opportunity cost of choosing state k^o, rather than stand state k^*. It is natural to assume that the non-timber (amenity) value of the stand depends only on the remaining trees, i.e. on the post-harvest state, k^o, so that $r'(i,k^o) = r'(k^o)$, independently of the pre-harvest state, *i*.

Given an operational measure of the aggregate non-timber value of a stand state, the next step is to determine the marginal NTV value of each stand characteristic. Thus, for each variable that determines the stand state, we seek a price defining the contribution of that variable to the non-timber value. In particular, for each tree species and size, we seek a non-timber vector **p**' analog to the timber price vector **p**.

2.3 Determinants of non-timber value:

Post-harvest non-timber benefits of forests are heterogeneous goods tied to a bundle of forest characteristics **X,** defined by the residual stand state, *k*. In general, attributes such as accessibility of the forest, number, size and species diversity of trees may enhance non-timber benefits directly (large trees enhancing the aesthetics of a forest stand), or indirectly (diversity of tree size enhancing wildlife habitat and thus hunting, bird-watching, scenic beauty). Woodland owners are mostly price-takers with respect to stumpage-price so, at the moment of the harvesting decision, they can be thought of as timber suppliers in a competitive environment. Forest owners also have a demand schedule for the forest attributes which includes non-timber benefits. In a competitive environment the observed harvest and the corresponding residual stand will be such that the marginal contribution of each forest attribute to NTV equals the marginal contribution of that attribute to the equivalent foregone timber revenue (the inequality in (4) becoming then an equality). The hypothesis that non-timber benefits depend on a heterogeneous set of attributes allows hedonic pricing of these attributes (Rosen 1974). The hedonic function is a regression of NTV on **X**, that decomposes NTV into the contribution of each variable in the vector **X**.

NTV is also associated with the socio-economic setting (Bockstael, 1996). For instance, other things being equal, in densely populated regions with wealthy households, the demand for recreational services of forests should be comparatively higher, making NTV higher than elsewhere. Especially critical is the ownership of the forest: The NTV on national forests should be much higher than on industry forests, because of markedly different management objectives. There, as on other public forests, the NTV measures how much timber income the public has been willing to forego to maintain the forests in their state. The general hedonic model has the form :

$$NTV = NTV(\mathbf{X},\mathbf{Z}) \qquad (6)$$

where **Z** is a vector of socio-economic indicators. The coefficient of each forest attribute of the vector **X**, in the regression (6) is its hedonic price, while the coefficients of the socio-economic attributes are shifters of the hedonic function.

3. Non-timber value of FIA plots

The data were drawn from 610 one-acre plots representative of the entire maple-birch forest type in Wisconsin, obtained from the USDA Forest Service, Forest Inventory and Analysis (FIA) data base (Hansen *et al.* 1994). Each plot had been measured twice between 1966 and 1984, at intervals between 6 and 16 years (average 13 years) providing detailed data on stand characteristics: number, size and species of trees, and a few data on ownership.

The first step was to estimate for each plot what the owners should have done, had they sought to maximize timber revenues. This was inferred from the timber-optimal decision rule for maple-birch forests described in Lin and Buongiorno (1998). The rule had been developed from an infinite-horizon Markov decision process calibrated on the same data. In Lin and Buongiorno's model, the forest stand states are defined by the basal area (high or low) of trees in each of three size classes (pole, small, and large sawtimber), in each of two groups of species classified by shade tolerance. Altogether there are 64 possible stand states and 2 possible market states (high or low timber price). This makes for 128 stand-market states. For each state the decision rule indicates to which other state, the stand must be cut (or left) to maximize the expected net present value of timber revenues, over an infinite time horizon. Applied to each FIA plot, this rule gave the timber revenue in $/ha/year that would be obtained by an owner acting to maximize timber revenue only, and who placed no value on non-timber benefits as we defined them.

Using information on the trees that were actually cut by the owner between the two inventories, we computed the actual value of the harvest, in $/ha/year, with the same prices used to find the decision that would have maximized the net present value of timber. Because the time of the harvest was unknown, the average price between the two inventories was applied.

Then, the difference between the value of the profit-maximizing harvest and that of the actual harvest gave the non-timber value in $/ha/year: our estimate of the monetary value of the flow of services generated by the stand of trees left after harvest. This is what the owner gave up, presumably to gain the amenity values embedded in the stand state left after harvest.

Figure 1 shows the distribution of forest area, harvest, and non-timber value in the entire maple-birch forest type of Wisconsin, based on the FIA plots weighed by the area that each plot is meant to stand for (its area expansion factor). Nearly half of the total area belonged to non-industrial private forest owners. They contributed more than half of the total harvest, and 35% of the non-timber value. National forests that had 20% of the forest area contributed 40% of the non-timber value, and less than 10% of the harvest. For industrial forest, the situation was reversed, contributing 30% of the timber harvest, and 15% of the non-timber value on less than 20% of the land area. Non-national public lands contributed equally to timber and non-timber values, less than 10% each, on 15% of the land.

The NTVs of ten percent of the plots were negative: the cut was larger than what the net-present value maximizing rule prescribed. However, negative NTVs were clustered near zero, in agreement with profit maximizing behavior. Slightly negative NTVs, or positive ones for that matter, may be due to a profit maximizer's imperfect knowledge, or/and different objective functions (for example, higher discount rates), or errors in trying to maximize net present value. Also, there were stands that were not cut and for which the profit maximizing decision was not to cut. In those cases, 9% of the plots, the NTV was zero by definition, as the decision was consistent with maximizing timber profit. Therefore, the plots with NTV=0 were maintained in the analysis. Still, the 19% of plots with NTV=0 led to heteroskedastic residuals, which had to be recognized in estimating the hedonic price equation.

The hypothesis is that three categories of variables influence the non-timber value of each forest stand represented by an FIA plot: the ecological attributes of the stand, its physical location, and its socio-economic context. This led to the potential explanatory variables summarized in Table 1.

4. Hedonic pricing of non-timber values

The relationship of interest is the conditional mean $NTV|\mathbf{X},\mathbf{Z}$ where **X** and **Z** are the vectors of the stand and socio-economic determinants of NTV described above. The conditional mean was estimated with a linear regression model:

$$NTV|\mathbf{X},\mathbf{Z} = \boldsymbol{\beta}'(\mathbf{X},\mathbf{Z}) + \varepsilon \qquad (7)$$

Where ε is an uncorrelated, homoskedastic and i.i.d. error term with zero expected value. Estimated from the FIA plots, the model was meant to decompose the total expected NTV of a stand into linearly additive parts, measuring the contribution of each stand variable. Each regression coefficient could therefore be interpreted as the marginal contribution to NTV of the variable, that is, the hedonic price of the characteristic that the variable meant to measure (Rosen, 1974).

Model estimation began with a specification that included all of the theoretically relevant, and available, variables in Table 1. This long regression was then "tested down" to a parsimonious model with only statistically significant variables (Kennedy, 1993). As noted above, the distribution of the NTV suggested that the residuals would be heteroskedastic, and this was confirmed by various tests (Glejser 1969, White 1980, Greene 1993), at conventional levels of significance. Although OLS estimates with heteroskedastic residuals are unbiased, they do not have minimum variance. In the following results, the standard errors were estimated with White's estimators (1980), which is robust to a general form of unknown heteroskedasticity[2].

[2] Full generalized least squares was also tried, with the following model of the residuals variance:

The results of estimation of model (7), with all the potential variables, are in Table 2. Among the stand variables, the number of trees of various sizes and species had the highest statistical significance, and most had the expected positive sign. Diversity of species or size did not seem to influence NTV, possibly because the information on diversity was already present in the data on number of trees by species and size. Of the site variables, the timber site index and the distance from road had the expected sign, but all had large standard errors. Among the socio-economic variables, only the dummy variable indicating ownership to a national forest (NAT) seemed to matter. It was highly significant, statistically, and large. A stand in a national forest has an expected non-timber value 22 $/ha/yr higher than stands in other types of ownership. There was no significant difference among the other ownership.

A parsimonious, more efficient, model of NTV was then estimated by eliminating the variables that were not significantly different from zero at the 5% level. The results (Table 3) gave a coefficient of determination about equal to that of the long regression. Moreover, an F-test on the restrictions of the parsimonious model gave F(13,582) = 0.72, P-value=0.75, so that the hypothesis that the omitted coefficients were zero could not be rejected at conventional significance levels. The remaining coefficients were similar in the long and short regressions. The results implied that there was a strong correlation between tree size and non-timber value. For example, the marginal contribution to NTV of a large sawtimber tree of shade-tolerant species was about $1.20 per year, four times that of a small sawtimber tree. At equal size, trees of mid-tolerant species tended to have larger non-timber values than those of other species.

The higher NTV on national forests revealed by the large and highly significant coefficient of the national (NAT) dummy variable suggested that the hedonic price of different trees might also be different. This was tested by estimating two models, separately for the plots in national forests, and for others (Table 3). A Chow test confirmed that the coefficients were significantly different, after allowing for a different constant. The model for non-national forests was slightly better, in terms of goodness of fit than that for the pooled data (Table 2), and it confirmed the strong positive correlation between tree size and marginal NTV. But the model for national forests was significantly worse, with imprecise hedonic prices for three tree categories.

The hedonic price models of Table 3 were applied to compute the contribution of different tree categories to harvest and non-timber value in Wisconsin maple birch forests, during the time between the two inventories used in this study. The first column of Table 4 shows the non-timber value generated by the average hectare of national forests, at the time of the first inventory, circa 1966, net of the harvest taken between the two inventories. Of the NTV of $50/ha/yr, 70% came from the stock of trees, mostly shade tolerant and mid-tolerant, the rest from unidentified sources independent of the number of trees and reflected by the constant in Table 3. On non-national forests, 90% of the NTV of $22/ha/yr could be attributed to the stock of trees. On national forests, the value of the average annual harvest was one-tenth that of the non-timber value. For other forests, it was about half. Between the two inventories, the non-timber value, at constant prices, increased by 30% for national forests, and by 55% for other forests. Most species and sizes of trees contributed to this increase. This illustrates how this approach can be used in forest resource accounting to include NTV in monetary terms.

$$\sigma^2 = \alpha + \beta\, H_{tot} + \gamma\, \text{NAT}. \qquad (8)$$

Which assumed that the variance of the residuals was higher for stands of higher diversity, and on national forests. The results confirmed this expectation. However, the results for the NTV model (7) were very close to the OLS results, although they had smaller variance. OLS with Whiteís heteroskedasticity correction was preferred because it did not require a specific form of the error function.

5. Summary and conclusion

It is generally agreed that timber is only one of the many goods and services provided by forests, and that non-timber values are increasingly important in forest management and natural resource accounting. But little is known about the magnitude of these values. The first part of this paper proposed as an operational measure of non-timber value the difference between what owners, public or private, could have gotten by maximizing timber revenues over an infinite horizon, and what they actually got. At minimum, this revealed willingness to forego timber revenue should be a lower bound of the non-timber value. This definition is in accordance with present value theory and can then be applied to compute the non-timber value of all FIA plots in the Wisconsin uneven-aged maple-birch forest type for the purpose of resource accounting. These values are based on the actual harvest and on the result of a Markovian decision model predicting the decision that would have maximized the timber income. The last part of the paper used a hedonic regression method to determine how the bio-physical characteristics of stands, and the socio-economic setting, influence their non-timber value.

The estimated regression parameters where then used to predict changes in the tree size contribution to NTV. Predictions indicate that NTV increased by 15$/ha/y (30%) in national forests and 12$/ha/y (55%) in other types of forests. This may seem high, but non-timber revenues for non national forests owners can be varied and complex. They include, but are not limited to, the high importance of the good public image that conservative management can bring to corporate owners, and the avoidance of potential litigation, with subsequent constraining legislation, for the preservation of environmental values on all forest lands.

There is growing interest in natural resource accounting to improve environmental and general economic policies (Bureau of Economic Analysis 1994). The assignment of monetary values to single standing trees for their non-timber functions, and as a result the monitoring of a more inclusive economic measure of forests, as sources of both timber and other goods and services, could be useful in building “satellite environmental accounts” to correct the deficiency of existing national accounts centered on the concept of Gross National Product (Cobb and Halstead, 1994). The revealed preference method proposed in this paper could be used in applied environmental accounting to derive forest NTV on a regional, and possibly national scale. The method could be applied to other forest types and regions of the United States, since it uses almost exclusively the FIA data, available nationally, and updated regularly. It does require a model to predict the timber-revenue maximizing decision, given current stand condition. But several models of this kind are available, and the model used here was itself developed from FIA data, so that it could be calibrated for other regions.

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7. Tables and Figures

Table 1. Summary statistics of potential variables determining non-timber value.

Variable		Exp.Effect	Mean	S.D.	Min.	Max.
Trees/ha (post-harvest) :						
Shade tolerant:						
	pole	– / +	185	168	0	849
	small sawtimber	+	25	32	0	200
	large sawtimber	+	2	7	0	64
Mid tolerant:						
	pole	– / +	35	57	0	417
	small sawtimber	+	5	10	0	121
	large sawtimber	+	1	2	0	40
Intolerant:						
	pole	– / +	67	96	0	553
	small sawtimber	+	7	15	0	138
	large sawtimber	+	1	2	0	30
Tree Diversity (proxy for Habitat Diversity Ambuel and Temple 1983, Hunter 1990, Burton *et. al.* 1992):						
H_{sz}	Shannon's index for size diversity	+	0.5	0.4	0	1.7
H_{sp}	Shannon's index for species diversity	+	1.0	0.5	0	2.1
H_{COL}	Shannon's index for color diversity	+	0.8	0.3	0	1.4
Site:						
SITE	Site index (mt at age 50)	+	21	3	12	30
SLOPE	Slope (percent)	–	7.5	8.8	0	65
DWATER	Distance from water (km)	– / +	6.1	8.5	0	96.5
DROAD	Distance from road (km)	–	5.8	5.3	0	40.2
Socio-economic variables (Spatial interactions may affect environmental externalities (Bockstael, 1996):						
NAT	National forest (1=yes, 0=no)	+	0.17		0	1
PUB	Other public forest (1=yes, 0=no)	+	0.16		0	1
OTH	Non-industrial private forest (1=yes, 0=no)	+ / –	0.51		0	1
INCOME	County mean household income ($10,000/yr)	+	3.4	0.8	0.7	6.5
POPDENS	County population density (pers/km^2)	+	12.5	16.7	2.9	180.3

Table 2. Effect of variables on non-timber value ($/ha/yr).

	Long regression		Short regression	
Variables	Coef.	S.E.	Coef.	S.E.
Trees/ha:				
Shade tolerant:				
Pole	0.01	0.01		
Small saw	0.33 ***	0.05	0.32 ***	0.05
Large saw	1.18 ***	0.19	1.18 ***	0.19
Mid-tolerant:				
Pole	-0.00	0.02		
Small saw	0.51 ***	0.10	0.48 ***	0.10
Large saw	2.20 ***	0.34	2.21 ***	0.34
Intolerant:				
Pole	0.04 ***	0.01	0.03 ***	0.01
Small saw	0.23 ***	0.09	0.25 ***	0.09
Large saw	1.17 ***	0.32	1.02 ***	0.34
Diversity:				
H_{sz}	-6.78	4.90		
H_{sp}	-2.79	3.27		
H_{COL}	2.36	5.39		
Site:				
SITE	0.01	0.29		
SLOPE	-0.13	0.11		
DWATR	-0.02	0.24		
DROAD	0.13	0.22		
Socio-economic:				
NAT	21.82 ***	5.01	22.74 ***	4.07
PUB	1.07	3.59		
OTH	-0.52	2.85		
INCOME	-3.73	2.19		
POPDENS	0.08	0.08		
Constant	12.29	12.22	-1.28	1.74
R^2	0.49		0.48	

***,** significant at 1% and at 5% level, respectively. S.E.=standard error. R^2=coefficient of determination, adjusted for degrees of freedom with 610 observations.

Table 3. Models of non-timber value for National and other forests ($/ha/yr).

	National Forests (N=106)		Other Forests (N=504)	
Variables	Coef.	S.E.	Coef.	S.E.
Trees/ha:				
Shade tolerant:				
Small saw	0.53 ***	0.16	0.26 ***	0.04
Large saw	1.59 **	0.81	1.11 ***	0.17
Mid tolerant:				
Small saw	0.89 **	0.42	0.38 ***	0.07
Large saw	0.80	1.45	2.37 ***	0.36
Intolerant:				
Pole	0.01	0.05	0.03 ***	0.01
Small saw	0.02	0.25	0.33 ***	0.08
Large saw	3.62 **	2.82	0.86 ***	0.32
Constant	15.13 ***	2.75	0.05	1.52
R^2	0.40		0.50	

***, ** significant at 1% and 5% level.
R^2=coefficient of determination, adjusted for degrees of freedom.

Table 4. Source of the contribution of maple-birch stands to harvest and to NTV.

	National Forests			Other Forests		
Source:	NTV 1966 ($/ha/y)	Harvest 1966-1984 ($/ha/y)	NTV 1984 ($/ha/y)	NTV 1966 ($/ha/y)	Harvest 1966-1984 ($/ha/y)	NTV 1984 ($/ha/y)
Trees/ha:						
Tolerant:						
Pole	0.0	0.5	0.0	0.0	0.7	0.0
Small saw	15.8	1.2	23.5	4.2	2.0	9.1
Large saw	7.7	2.0	10.4	8.9	4.0	7.7
Mid tolerant:						
Small saw	7.2	0.2	9.1	2.7	0.5	3.0
Large saw	1.5	0.0	2.0	3.0	1.5	4.4
Intolerant:						
Pole	0.5	0.7	0.5	0.0	0.7	2.5
Small saw	0.2	0.2	0.2	0.0	1.5	4.7
Large saw	2.0	0.2	3.7	1.2	1.7	1.5
Total from trees:	34.5	5.4	49.4	20.0	12.6	32.9
Others sources:	15.1		15.1	2.2		2.2
Total:	49.6	5.4	64.5	22.2	12.6	35.1

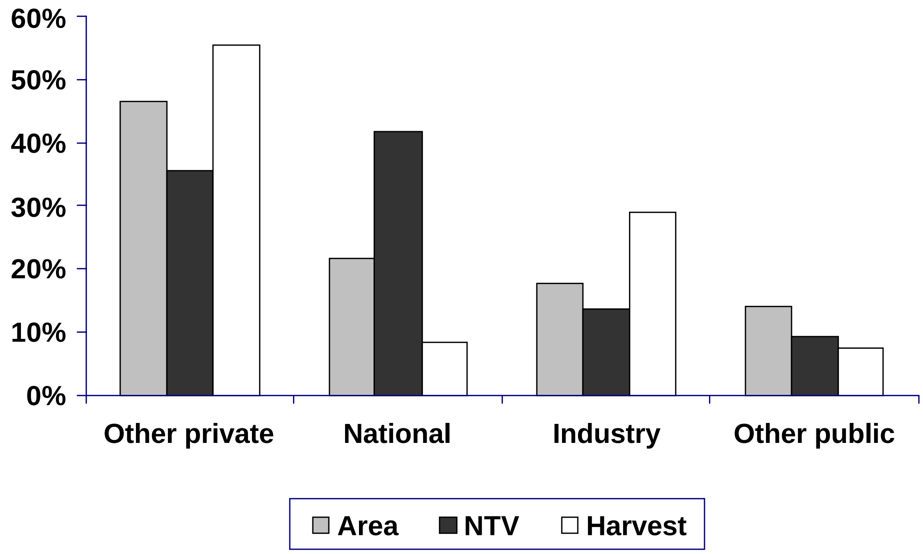

Figure 1. Distribution of non timber value (NTV), area and harvest, by ownership.