

# Calculating Forest Values

## *Summarizing timber value by stand type and accessibility*

—by Glen Jordan

## Introduction

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### Problem

How valuable is the Woodlot's standing timber, and how is that value distributed across types of stands and between accessible and inaccessible stands?

To answer these questions, you'll analyze the Woodlot's inventory of stands, looking for amounts of sawlogs (pine, spruce, hemlock, white birch, tolerant hardwood) and pulpwood (spruce, fir, tolerant hardwood, intolerant hardwood). You'll use recent market prices for these products in compiling a summary of the value of broad stand types (softwood, hardwood, mixedwood).

### Location

A small, 1,400-hectare (ha) woodlot in the Acadian-New England forest region of North America

### Time to complete the lab

Three hours

### Prerequisites

A basic working knowledge of ArcGIS® software and GIS data, including use of a geodatabase, and a basic working knowledge of Microsoft Excel, including pivot table calculation; some knowledge of computer programming, Visual Basic (VB) in particular, and some familiarity with forest inventory data and terminology helpful but not essential

*Keywords: timber value; forest products; stand types; characterizing by a single number and a numerical distribution; selecting features by attribute and location; using VB code in Field Calculator; summarizing an attribute*

## Data used in this lab

- Feature classes and rasters for a forest woodlot (personal geodatabase)
- Geographic coordinate system: NAD 1983 CSRS New Brunswick Stereographic
- Datum: NAD83 datum
- Projection: New Brunswick Double Stereographic Grid (unless otherwise stated)

# Student activity

Standing timber values in a forest are often measured in terms of prevailing market prices for primary wood products, such as pulpwood and sawlogs.

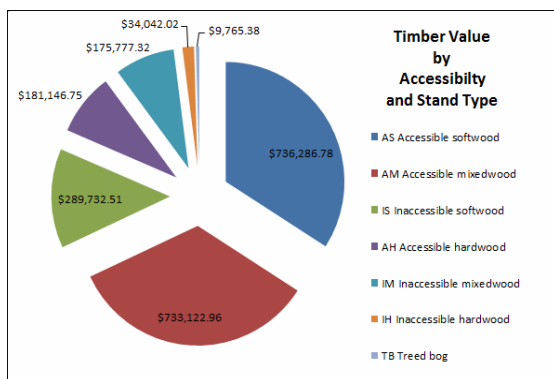
Pulpwood is cut from smaller trees between 10 and 20 centimeters (cm) in diameter and delivered in 2 to 2.5 meter (m) lengths to mills for debarking and processing into pulp and eventually paper products. Sawlogs, on the other hand, are cut from larger trees in lengths exceeding 2 m for delivery to sawmills where they are debarked and processed into dimension lumber, such as two-by-fours. Any slab material is chipped and sent to a pulp (and paper) mill.

Market prices for primary products vary by type of product and species of tree. For example, pine sawlogs usually fetch a higher price than spruce sawlogs and certainly more than hardwood pulpwood.

Not all standing timber in a forest is necessarily accessible, however. In assessing the value of standing timber in the Woodlot, you'll consider spatial distribution as well as product distribution, and then summarize your findings.

## Results expected

An Excel summary table and chart summarizing Woodlot timber values by accessibility and broad stand types



	B	D	E	F
1	Access	Dollar Value	Area (ha)	Mean Yield (m3/ha)
2	AS	\$ 736,286.78	366.30	87.18
3	AM	\$ 733,122.96	525.43	55.35
4	IS	\$ 289,732.51	120.50	122.78
5	AH	\$ 181,146.75	166.25	64.74
6	IM	\$ 175,777.32	98.44	64.06
7	IH	\$ 34,042.02	24.89	64.48
9	TB	\$ 9,765.38	95.53	2.52
10				

## Data available

- Cover types feature class: *cover*
- Stand volumes table: *volumes*
- Secondary roads feature class: *roads*

## Solution steps

1. Calculate gross stand timber values.
2. Calculate accessible timber values.
3. Classify stands by type and access.
4. Summarize timber values.

### CALCULATE GROSS STAND TIMBER VALUES

Your initial task is to calculate an overall timber value for the Woodlot, regardless of accessibility.

To begin with, you'll need a dollar estimate of timber value in each stand, which can be calculated by summing the product of stand area (ha), volume yields ( $\text{m}^3/\text{ha}$ ), and market prices ( $\$/\text{m}^3$ ) for each species or product type present. Where do you find these hectare, cubic meters per hectare, and dollars per cubic meter amounts?

The *volumes* table in the *Woodlot* geodatabase provides cubic meters per hectare amounts by species and product type for each Woodlot stand, while the *cover* feature class provides stand areas in square meters. On the other hand, dollars per cubic meter amounts depend on prevailing market demand for the various species products.

This means you have several things to do before you can compute stand timber values and then an overall Woodlot value: you'll join the *volumes* and *cover* tables; convert square meter amounts to hectares; and finally, incorporate market prices (dollars per cubic meter).

### RELATED CONCEPT: CHARACTERIZING BY A SINGLE NUMBER

- 1 Start ArcMap™ and, if you haven't already done so, use *Environment Settings* to set the *Woodlot* geodatabase in both the *Current Workspace* and *Scratch Workspace* boxes.
- 2 Add the *cover* feature class as a layer.

Why is it useful to join the *volumes* table to the *Cover Types* attribute table? The *volumes* table contains, among other things, volume amounts ( $\text{m}^3/\text{ha}$ ) by species and three product types

(pulpwood, sawlog, and veneer) for each of the Woodlot's 533 stands. Attributes  $S_P$ ,  $S_S$ , and  $S_V$  indicate the volume yields ( $m^3/ha$ ) of spruce pulpwood, sawlog, and veneer, respectively.

- By way of the  $STAND\_ID$  and  $Stand\#$  fields, respectively, join the *volumes* table to the *Cover Types* attribute table.

Figure 1. Joining the *volumes* table to the *Cover Types* attribute table.

Now you're ready to calculate a dollar estimate of timber value in each Woodlot stand.

As noted previously, you can determine a stand's timber value by summing the product of its size (ha), volume yield ( $m^3/ha$ ), and market price ( $$/m^3$ ) for each species and product type.

With the *volumes* and *Cover Types* tables joined, the first two measures for each stand are available, but you must refer to table 1 for the third, the current market prices ( $$/m^3$ ) for the various species products.

Product description (volumes query expression)	Market price (\$/m <sup>3</sup> )
White pine sawlogs <i>(Ewp_s and Ewp_v &gt; 0.0)</i>	\$48.00
Red pine sawlogs <i>(Rp_s and Rp_v &gt; 0.0)</i>	\$46.00
Jack pine sawlogs <i>(Jp_s and Jp_v &gt; 0.0)</i>	\$37.00
Spruce species sawlogs <i>(S_s and S_v &gt; 0.0)</i>	\$37.00
Tolerant hardwood species sawlogs <i>(Yb_s, Yb_v, Be_s, Be_v, Sm_s and Sm_v &gt; 0.0)</i>	\$45.00
Hemlock sawlogs <i>(Ehe_s and Ehe_v &gt; 0.0)</i>	\$39.00
White birch sawlogs <i>(Wb_s and Wb_v &gt; 0.0)</i>	\$40.00
Spruce-fir-Jack pine pulpwood <i>(S_p, Bf_p, Bf_s, Bf_v and Jp_p &gt; 0.0)</i>	\$30.00
Tolerant hardwood species pulpwood <i>(Yb_p, Be_p, and Sm_p &gt; 0.0)</i>	\$25.00
Intolerant hardwood species pulpwood <i>(Rm_p, Rm_s, Rm_v, Wb_p, A_p, A_s, and A_v &gt; 0.0)</i>	\$25.00
No commercial value	\$0.00

Table 1. Market prices by product type

- In the *Cover Types* attribute table, add a new *Float* field named *Dollar\_Value* with alias *Dollar Value*.

Recall that spaces and a number of other special characters are not permitted in field names, but you can always assign an alias that includes spaces or special characters.

- Use *Field Calculator* to calculate timber values for each Woodlot stand using the following expression. (Note how at the end of this expression, stand areas in square meters are converted to hectares by dividing by 10,000.)

```
((([volumes.S_S] + [volumes.S_V]) * 37) + (([volumes.S_P] + [volumes.BF_P] + [volumes.BF_S] + [volumes.BF_V] + [volumes.JP_P]) * 30) + (([volumes.EWP_S] + [volumes.EWP_V]) * 48) + (([volumes.JP_S] + [volumes.JP_V]) * 37) + (([volumes.RP_S] + [volumes.RP_V]) * 46) + (([volumes.EHE_S] + [volumes.EHE_V]) * 39) + (([volumes.SM_S] + [volumes.SM_V] + [volumes.YB_S] + [volumes.YB_V] + [volumes.BE_S] + [volumes.BE_V]) * 45) + (([volumes.WB_S] + [volumes.WB_V]) * 40) + (([volumes.SM_P] + [volumes.YB_P] + [volumes.BE_P]) * 25) + (([volumes.A_P] + [volumes.A_S] + [volumes.A_V] + [volumes.RM_P] + [volumes.RM_S] + [volumes.RM_V]) * 25)) * [cover.Shape_Area] /10000
```

**Question 1:** What purpose do brackets ( ) serve in a Field Calculator expression like the one above?

In a few seconds, timber values are calculated for each of the Woodlot's 533 stands.

Total Volume	Volume Yield	Shape_Length	Shape_Area	Dollar Value	OBJECTID*	STAND_ID	S_P	S_ ^
182.6	80	671.608562	22826.794088	4174.3359	1	101	0	
0	0	332.890088	4841.569268	0	2	102	0	
177.9	96	652.757179	18535.155801	3149.7717	3	103	31.9	
214.4	74.9	916.911192	28625.115606	2637.2319	4	104	0	
88.3	24.4	820.834548	36188.131011	2654.3994	5	105	24.4	
139.9	66	896.048792	21200.393814	2349.4277	6	106	24.7	
4171.5	380.2	3818.472664	109718.098262	28185.482	7	107	59.5	8
4240.1	613	1598.911178	69169.467828	55488.785	8	108	0	
66.2	78.4	1012.450246	8449.417831	793.90729	9	109	0	
0	0	1773.59554	136338.881836	0	10	110	0	
14.8	12.6	538.633375	11779.501817	369.58188	11	111	0	
158.2	57.5	902.708371	27517.570171	4190.3755	12	112	6.7	
153.8	79.2	688.137127	19413.738192	3275.583	13	113	0	
401.2	126.6	801.977188	31692.961265	10534.106	14	201	11.2	52
2754	173.5	2185.536389	158734.419111	78371.945	15	202	14.8	86
261	125.9	959.129132	20727.350407	6194.7832	16	203	2.1	33

Figure 2. Computed timber values (*Dollar Value* field).

Values range from zero for recently cutover stands to several thousand dollars for higher-yielding stands composed of highly valued tree species. What's the timber value of the entire Woodlot?

- Right-click the *Dollar Value* field and select *Statistics*.

The report reveals a wealth of summary information about the *Dollar Value* field, plus a histogram showing the distribution of values.

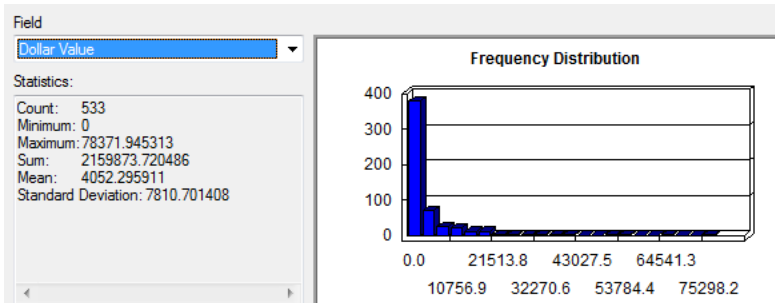


Figure 3. Summary of dollar value of standing timber in the Woodlot.

Most stands are valued at less than \$10,000. The *Sum* statistic, however, tells you that the overall timber value in the Woodlot is \$2,159,873.72. That's pretty good.

On the other hand, the *Maximum* statistic tells you that the stand of highest value is worth \$78,371.94. Why is it so valuable?

- 7 Close the statistics report.
- 8 Sort the *Dollar Value* field in descending order.

Shape_Length	Shape_Area	Dollar Value	OBJECTID *	STAND_ID	S_P	S_S	S_V	BF_P	BF_S	BF_V	EW
2185.536389	158734.419111	78371.945	15	202	14.8	86.2	0	2.7	0	0	
2542.129232	169898.556553	66931.539	45	302	11.4	50.7	0	10.3	0	0	
1598.911178	69169.467828	55488.785	8	108	0	0	0	141.63	0	0	
970.827511	28591.94564	51322.398	195	608	567	9	0	0	0	0	
3337.670534	97833.912053	41046.551	324	829	9.74	14.2	0	15.783	2.266	0	
2436.528373	88880.705384	40137.965	335	841	5.36	29.8	0	9.98	0	0	1
2269.355475	86847.100749	37240.906	111	444	48.7	57.6	0	2.8	0	0	
1251.204025	62420.490266	33647.766	133	511	23.5	83.6	0	2.7	0	0	
3326.107434	109931.048539	32213.238	263	721	13.7	7.35	0	9.158	0	0	
2124.7902	88767.252983	32073.385	72	401	6.4	9.2	0	11.8	0	0	
3818.472664	109718.098262	28185.482	7	107	59.5	8.8	0	0	0	0	
1654.968684	60749.462751	25427.695	383	918	20.6	32.0	0	5.704	0	0	
2530.417519	66947.220176	22872.518	81	413	0	3	0	31.9	1.7	0	
1755.076184	47479.094906	21350.803	289	748	19.8	57.8	0	1.94	0	0	3
2827.10667	71123.173923	21314.904	95	428	2.7	14.8	0	18.7	0	0	
2553.342096	86042.20168	20606.246	134	512	16.9	19.3	0	5.1	1.4	0	

Figure 4. The highest valued stand is number 202 at \$78,371.95.

Stand number 202 (*Stand\_ID*) appears at the top of the table with the highest value. Scanning the stand's fields explains why it's valued so highly. It's a 16 ha stand (*Shape\_Area*) with significant spruce sawlog content (86.2 m<sup>3</sup>/ha) recorded in the *S\_S* field.

Now you can move on and tackle the issue of accessibility. If a stand isn't accessible, it's less valuable than one that is, all other things being equal.

## CALCULATE ACCESSIBLE TIMBER VALUES

How many Woodlot stands are not adjacent to or intersected by a road? In other words, how much of the timber value of the Woodlot, which is upward of \$2 million, is inaccessible?

ArcMap can easily locate features that are intersected by or adjacent to other features in the same or another layer using *Select By Location*. In this case, you want to isolate Woodlot stands intersected by or adjacent to at least one road to facilitate your reassessment of timber value.

You find Woodlot roads in two feature classes in the *Woodlot* geodatabase. Main roads, with rights-of-way, exist as polygon features in the *cover* feature class with a *TYPE* value of *RD*. All lesser, or secondary, roads exist as line features in the *roads* feature class with *CLASS* values of *C2*, *C3*, and *C4*.

Identifying road-accessible stands is a two-step process: find stands accessible by main road, and then add those accessible by secondary road.

Since you already have *cover* added as a layer in ArcMap, start with main roads.

### RELATED CONCEPT: CHARACTERIZING BY A SINGLE NUMBER

- 1 Remove the *volumes* join.

It's not mandatory to remove a join. However, when working with a large feature class that has hundreds of features, removing a join when it's no longer needed improves efficiency in subsequent processing.

- 2 In *Cover Types*, select the main road features (`TYPE = 'RD'`).

You should see 15 main roads in the map display and selected in the table.

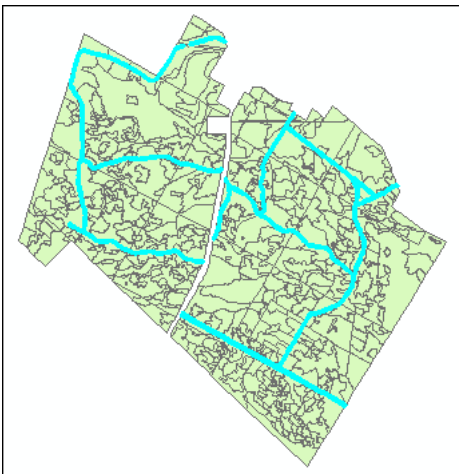


Figure 5. Main road rights-of-way features (15).



- Use *Select By Location* to select stands that are adjacent to (or intersect) the 15 main roads.

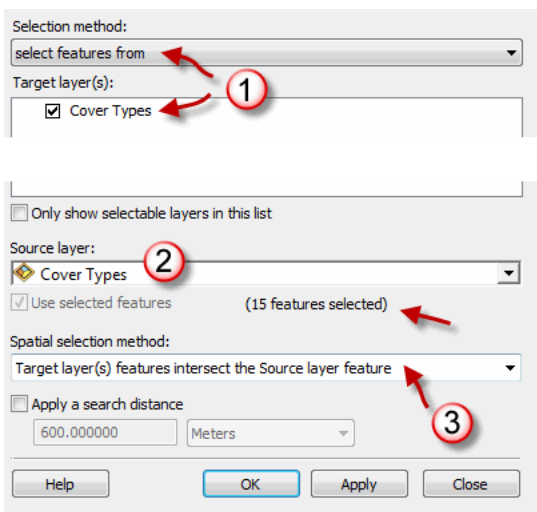


Figure 6. Selecting features adjacent to main road rights-of-way.

This adds all features adjacent to the 15 main roads originally selected. You should now have 211 of 569 Woodlot features selected.

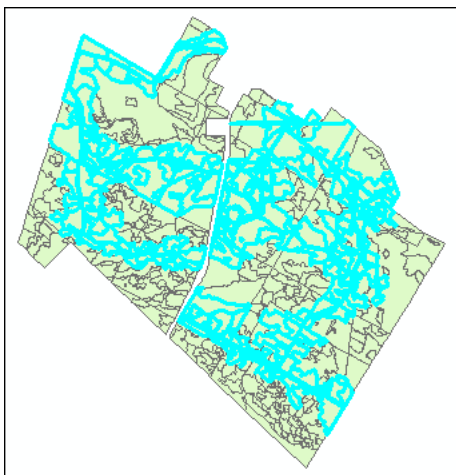


Figure 7. Main road rights-of-way and adjacent features selected (211).

It's easy to miss, but main road features are part of the 211 currently selected features.

- Using *Select By Attributes*, click *Remove from current selection* to drop main roads from the selected set, if you want to.

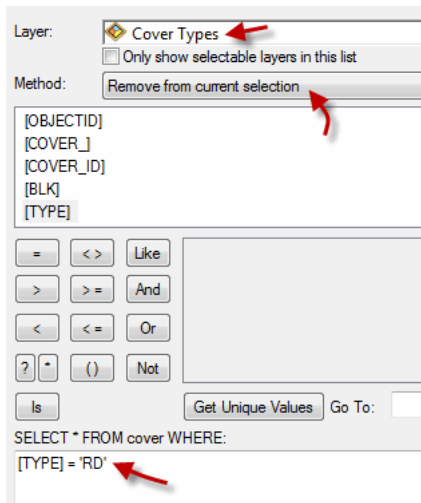


Figure 8. Removing main road rights-of-way features.

You are left with 196 features.

Bear in mind that even with main roads removed, some of the 196 features are nonforested features, such as ponds or gravel pits. Don't worry about excluding nonforested features at this point; you can do that once you have added features accessible by secondary roads.

Locating stands accessible (intersected by) secondary roads involves using essentially the same *Select By Location* procedure you used to locate stands accessible by main roads.

**5** Add secondary road features, *roads*, as an additional ArcMap layer.

Turning off *Cover Types* makes it obvious there's no shortage of secondary roads in the Woodlot.



Figure 9. The Woodlot's secondary road network.

How many additional stands will these secondary roads access?

- Using *Select By Location*, with the *add to the currently selected features in* option selected, add stands adjacent to or intersected by secondary roads.

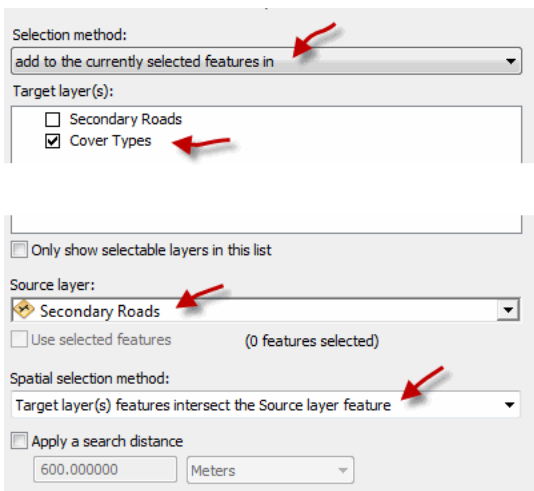


Figure 10. Adding features intersected by secondary roads to those adjacent to main roads.

Opening the *Cover Types* attribute table shows that you've gone from 196 to 374 features selected.

- Use *Select By Attributes* to remove nonstand features,  $[AGE] = -99$ .

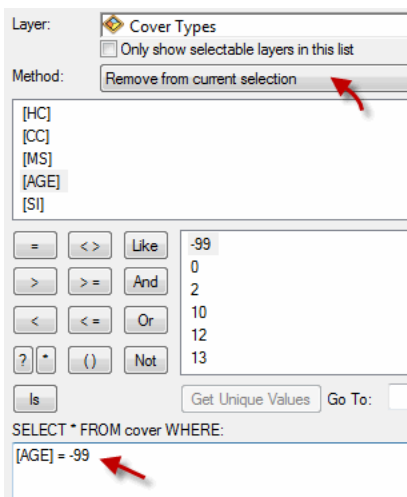


Figure 11. Removing nonstand features from the selection.

In the Woodlot, 353 stands are now selected. These are the ones accessible by main or secondary roads. Considering the Woodlot's total of 533 stands, this means that 180 stands are inaccessible. What effect does that have on your estimate of Woodlot timber value?

- In the *Dollar Value* field, recalculate statistics for a new timber value estimate that includes only accessible stands.

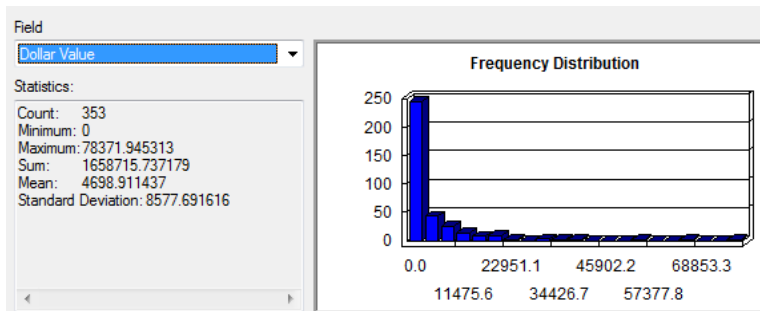


Figure 12. Summary of dollar value of accessible timber in the Woodlot.

Excluding inaccessible stands reduces the gross value of the Woodlot (\$2,159,873.72) by 23 percent (\$501,157.98), leaving the timber value of the Woodlot now at \$1,658,715.74. Such a reduction is larger than would be predicted on casual inspection.

For more detailed insight into timber value in the Woodlot, you can refine your analysis even further. What if you wanted to compare timber values by types of stand, still taking accessibility into account?

## CLASSIFY STANDS BY TYPE AND ACCESS

To break down timber values by accessible and inaccessible softwood, hardwood, and mixedwood stands and by treed bogs, how would you proceed?

The solution involves reclassifying stands using a nominal attribute. You'll label stands with labels, such as *AS* for accessible softwood, *AH* for accessible hardwood, and *AM* for accessible mixedwood; and likewise for *IS*, *IH*, and *IM* for inaccessible stands; and finally, *TB* for treed bog and *NF* for nonforested.

After classifying stands in this manner, you can summarize timber values (*Dollar Value*) by the seven categories.

## RELATED CONCEPT: RECLASSIFY USING LOCATIONAL AND THEMATIC ATTRIBUTES TO LABEL

- 1 Add a new text field of width 2 named *Access*.
- 2 Assign the alias *Access Types*.

Before using *Access Types* to label stands by accessibility and type, you'll need to rejoin the *volumes* table to *Cover Types*. The *volumes* table records softwood and hardwood percentages for each Woodlot stand in fields *SW\_* and *HW\_*, respectively.

- 3 Join *volumes* to *Cover Types* via their shared stand identifiers. Keep only matching records.

Now you can label stands using your *Access Types* field.

- 4 Use *Field Calculator* to label all accessible stands (the 353 you already selected in *Cover Types*) with an "A" in the *Access Types* field. **Make sure you use double quote marks around the "A", or you will get an error message.**
- 5 Switch the selection, and in the *Access Types* field, label inaccessible stands with an "I".

You are ready to begin refining the labels to distinguish among softwood stands, hardwood stands, mixedwood stands, and treed bogs, as detailed in table 2.

Operation	Query	Label
1 Separate treed bogs	Type = 'BG'	Access = "TB"
2 Separate nonforested features	Age = -99	Access = "NF"
3 Label accessible softwood stands	Access = 'A' and SW_ >= 70	Access = "AS"
4 Label inaccessible softwood stands	Access = 'I' and SW_ >= 70	Access = "IS"
5 Label accessible hardwood stands	Access = 'A' and HW_ >= 70	Access = "AH"
6 Label inaccessible hardwood stands	Access = 'I' and HW_ >= 70	Access = "IH"
7 Label accessible mixedwood stands	Access = 'A' and SW_ < 70 and HW_ < 70	Access = "AM"
8 Label inaccessible mixedwood stands	Access = 'I' and SW_ < 70 and HW_ < 70	Access = "IM"

Table 2. Labeling stands by accessibility and type

The process could require several well-choreographed operations of querying and calculating. On the other hand, a little Visual Basic coding in *Field Calculator* would get the job done much faster. Try that instead.

- 6 Clear selected features.
- 7 Right-click *Access Types* to open *Field Calculator*.
- 8 In the dialog box, select *VB Script* and *Show Codeblock*.
- 9 Enter the VB statements that follow (figure 13).

If you've never coded in VB before, the logic of the code here might be a bit hard to follow, but it follows the manual procedure provided in table 2.

- 10 Calculate `Access = Res.`

Copying and pasting the code into *Field Calculator* will work only if you build the code in Notepad.

```
Dim Res
'          label treed bogs
If [cover.TYPE] = "BG" Then
  Res = "TB"
' classify nonforested features
ElseIf [cover.AGE] = -99 Then
  Res = "NF"
' classify stands by type
' accessible and inaccessible
softwood
ElseIf [volumes.SW_] >= 70 Then
  If [cover.Access] = "A" Then
    Res = "AS"
  Else
    Res = "IS"
  End If
' accessible and inaccessible
hardwood
ElseIf [volumes.HW_] >= 70 Then
  If [cover.Access] = "A" Then
    Res = "AH"
  Else
    Res = "IH"
  End If
' accessible and inaccessible
mixedwood
Else
  If [cover.Access] = "A" Then
    Res = "AM"
  Else
    Res = "IM"
  End If
End If
End If
```

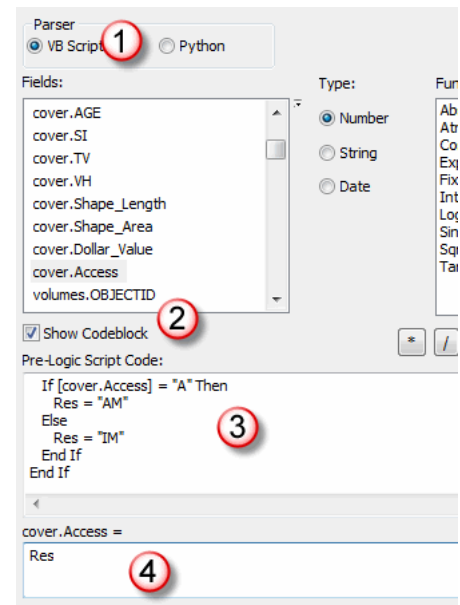


Figure 13. Labeling stands by accessibility and type using VBScript.

*Field Calculator* very quickly calculates *Access Types* values, but how long did it take you to assemble the VB code? Would manually calculating *Access Types* values have taken less time?

Now you can summarize the *Access Types* field to compute *Dollar Value* totals for each access type: AS, AH, AM, IS, IH, IM, TB, and NF.

## SUMMARIZE TIMBER VALUES

What summary *Dollar Value* stats would be the most useful?

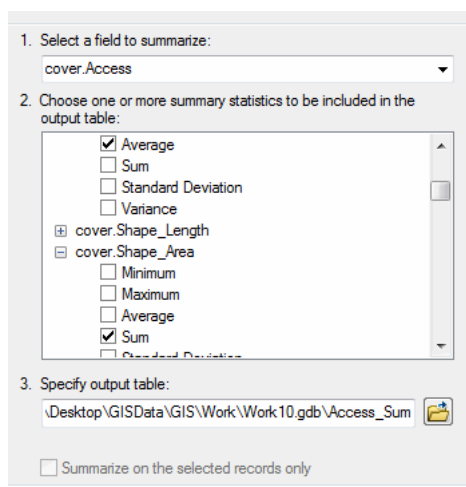
You could compile the minimum, maximum, average, sum, standard deviation, and variance of *Dollar Value* values for each unique *Access Types* value—*AH*, *AM*, *AS*, and so forth. Values for the sum of *Dollar Value* is the obvious choice.

But you might also include the sum of stand areas (*Shape\_Area* field) and average volume yields (*MEAN\_VH* field) for each *Access Types* value. This would show you how dollar values are distributed across the seven categories as well as, in each case, how dollar value is influenced by volume yields and location. For example, dollar value in an accessible category might be high, but if its stands are low yielding and distributed across a large area, harvest operations would be expensive.

### RELATED CONCEPT: CHARACTERIZE USING NUMERICAL DISTRIBUTION

- 1 Summarize the *Access Types* field by *Dollar Value Sum*, *Shape\_Area Sum*, and *VH Average*.
- 2 Name the resulting table *Access\_Sum*.
- 3 Save the table inside your *Woodlot* geodatabase (rather than outside as a DBF file).

Watch out. You may have records still selected in *Cover Types*. If *Summarize on the selected records only* is checked, the summarizing function is applied to just those records, and not all records.



*Using the Summary Statistics tool (Analysis Tools > Statistics), instead of the summarizing function accessible via the attribute table, can result in some different output field names.*

Figure 14. Summarizing the *Access* field by *Dollar Value Sum*, *Shape\_Area Sum*, and *VH Average*.

From what your summary table reveals about timber value distribution across inaccessible and accessible stands, decision making about harvesting can begin. For example, significant timber value resides in softwood stands that are accessible. But individual softwood stands are relatively low yielding (87 m<sup>3</sup>/ha) when compared with the inaccessible softwood stands (123 m<sup>3</sup>/ha). This would increase the cost of harvesting operations. A decision to earmark softwood for harvesting across the board could hike the cost of operations more than it is worth.

	OBJECTID *	Access Types	FREQUENCY	SUM_Dollar_Value	SUM_Shape_Area	MEAN_VH
	1	AH	55	181146.75412	166.247064	64.743636
	2	AM	166	733122.95816	525.425925	55.349398
	3	AS	129	736286.776852	366.296199	87.181395
	4	IH	23	34042.019676	24.890472	64.478261
	5	IM	73	175777.318695	98.43708	64.064384
	6	IS	72	289732.514717	120.50283	122.775
	7	NF	36	<Null>	42.615998	0
	8	TB	15	9765.378265	95.531743	2.52

Figure 15. Dollar value, area (m<sup>2</sup>), and mean volume yield (m<sup>3</sup>/ha) by accessibility and stand type.

To make tables that are produced by ArcMap presentation ready, you can control various display characteristics. You can hide fields, substitute aliases for field names, and set the format of field values.

In this case, hide a couple of fields in *Access\_Sum*, and then format and substitute aliases for others.

- 4 Double-click *Access\_Sum* to access its properties.
- 5 In the dialog box, click the *Fields* tab and edit field parameters as shown in figure 16.

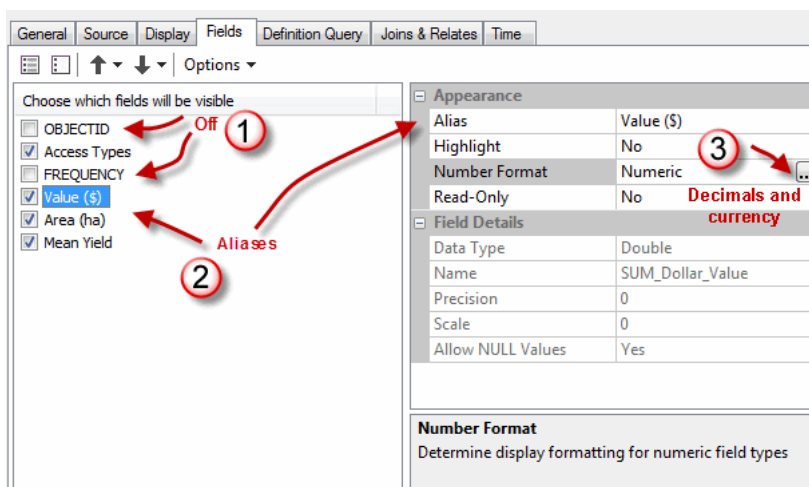


Figure 16. Formatting the summary table: hiding fields, adding field aliases, and setting number type and decimal places.

This is better, but you need to convert those square meter area values in *SUM\_Shape\_Area* to hectares.



- 6 Use *Field Calculator* to convert square meter values in the *Area (ha)* field to hectares by dividing by 10000.
- 7 Sort timber values (*Value (\$)*) from largest to smallest.

	Access Types	Value (\$)	Area (ha)	Mean Yield
	AS	\$736,286.78	366.3	87.2
	AM	\$733,122.96	525.4	55.3
	IS	\$289,732.51	120.5	122.8
	AH	\$181,146.75	166.2	64.7
	IM	\$175,777.32	98.4	64.1
	IH	\$34,042.02	24.9	64.5
	TB	\$9,765.38	95.5	2.5
	NF	<Null>	42.6	0

Figure 17. Summary table ready for presentation.

Another option for table formatting and presentation is Microsoft Excel.

- 8 Start Excel.
- 9 Open the *Access\_Sum* table in the *Woodlot* geodatabase (*Data > From Access*).

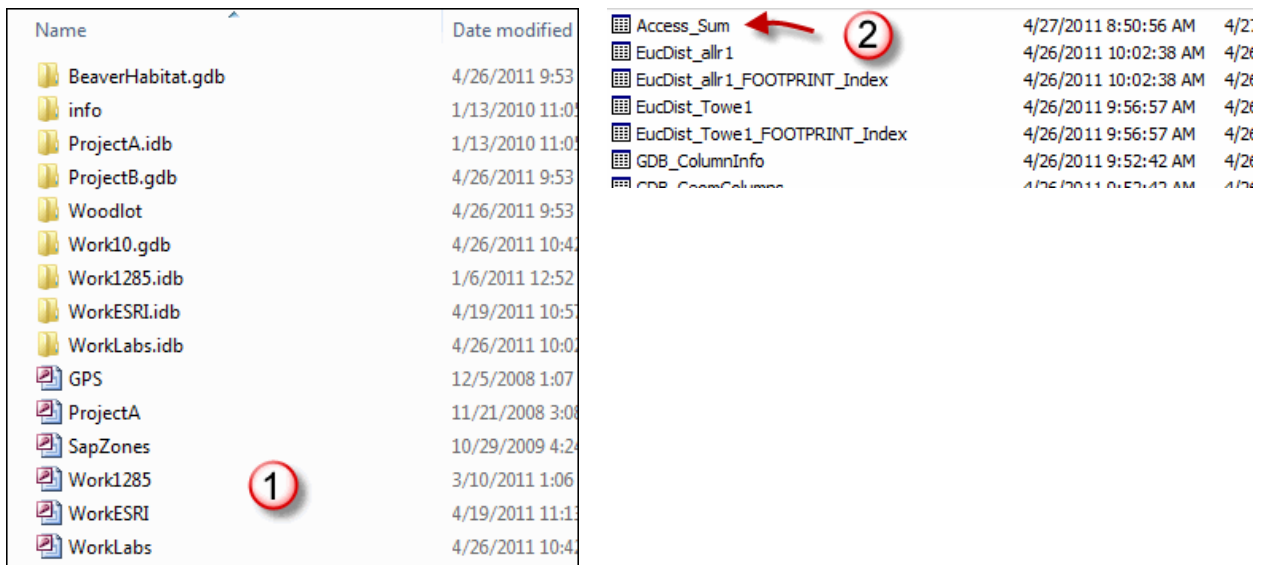


Figure 18. Opening the *Access\_Sum* table using Microsoft Excel.

You now have the *Access\_Sum* table open as an Excel spreadsheet to edit for final presentation.

	A	B	C	D	E	F
1	OBJECTID	Access	FREQUENCY	SUM_Dollar_Value	SUM_Shape_Area	MEAN_VH
2	1	AH	55	181146.7541	166.2470636	64.74363636
3	2	AM	166	733122.9582	525.4259252	55.34939759
4	3	AS	129	736286.7769	366.2961995	87.18139535
5	4	IH	23	34042.01968	24.8904721	64.47826087
6	5	IM	73	175777.3187	98.43708042	64.06438356
7	6	IS	72	289732.5147	120.5028297	122.775
8	7	NF	36		42.61599811	0
9	8	TB	15	9765.378265	95.5317426	2.52
10						

Figure 19. Access\_Sum table imported as an Excel spreadsheet.

- 10 Drop the *NF* row.
- 11 Hide columns *A* and *C* and relabel other columns.
- 12 Sort *DollarValue* largest to smallest.
- 13 Reduce decimal places to just 2 for all.
- 14 Choose a table format similar to the one in figure 20.

	B	D	E	F
1	Access	Dollar Value	Area (ha)	Mean Yield (m3/ha)
2	AS	\$ 736,286.78	366.30	87.18
3	AM	\$ 733,122.96	525.43	55.35
4	IS	\$ 289,732.51	120.50	122.78
5	AH	\$ 181,146.75	166.25	64.74
6	IM	\$ 175,777.32	98.44	64.06
7	IH	\$ 34,042.02	24.89	64.48
9	TB	\$ 9,765.38	95.53	2.52
10				

Figure 20. Formatted summary spreadsheet.

A chart of one or more of the table variables might also be useful. That's also easily done in Excel.

15 In Excel, compose a pie chart of *Dollar Value by Access*, similar to the one in figure 21.

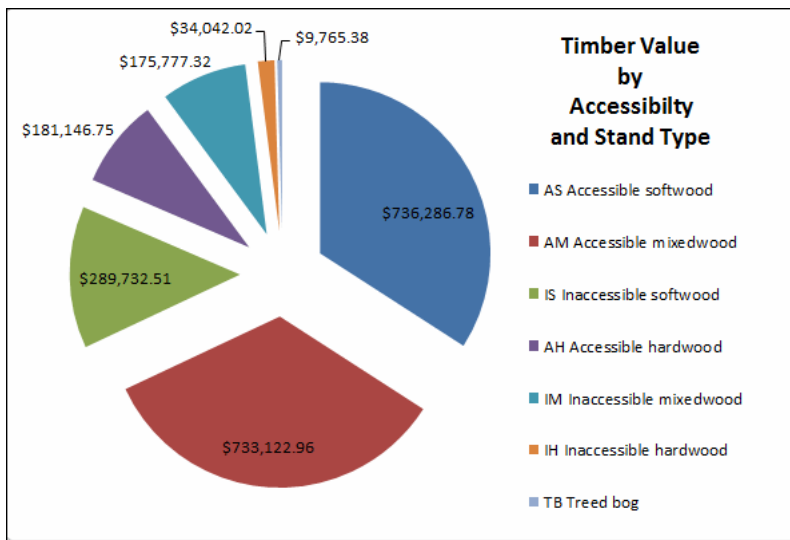


Figure 21. Excel pie chart of timber value in the Woodlot.

The chart makes the relative dollar values of the different stand types much more obvious. For example, it's immediately apparent that accessible softwood and mixedwood types account for the lion's share of the Woodlot's timber value.

However, you can't tell how the more than \$736,000 of accessible softwood is distributed by product type—sawlog versus pulpwood, for example. That would require further analysis using *volumes* table attributes.

The chart also doesn't tell you how timber values are distributed geographically across the Woodlot, except to indicate that much more timber value exists in accessible stands than inaccessible ones. But are higher-valued accessible stands more concentrated in one area than another?

A map of the *Dollar Value* field for accessible stands might answer that.

16 Use *Definition Query* to limit *Cover Types* to just accessible stands with the query expression `Access LIKE 'A*'`, and then use a graduated color scheme to map *Dollar Value*.

**Question 2:** *What purpose does the asterisk (\*) serve in query expressions like this one?*

Your map should look something like the following, where timber values for the 350 accessible stands increase from light to dark green. Do you see any patterns?



Figure 22. Map of stand timber values (\$) for accessible stands—least valuable (light green) to most valuable (dark green).

## Conclusion

Your analysis began where most analyses begin—with a question. Sometimes answers are found with simple or complex queries. Most of the time, some form of reclassification and quantitative summary proves more informative, and that was the case here.

In this exercise, you used locational attributes of proximity (*Select By Location*), as well as thematic attributes, to reclassify stands. Visual Basic programming in the *Field Calculator* proved helpful in the latter.

Based on your analysis results, what's your assessment of the economic value of the Woodlot?

## Submit your work

---

- Summary table of timber values by accessibility and stand type categories—market value (\$), area (ha), and average stand yield ( $\text{m}^3/\text{ha}$ ); a pie chart of timber values by accessibility and stand type
- Based on lab results, a paragraph detailing an assessment of value in the Woodlot from an economic perspective (Is it good news or bad?)
- Answers to the questions posed in the exercise:
  1. What purpose do brackets serve in a Field Calculator expression?
  2. What purpose does the asterisk serve in query expressions?

- A summary of the exercise, indicating where and how the related reclassify and characterize concepts and analysis techniques are used (Your summary could take the form of a table that checks off each of these elements.)
- Calculation of timber value in another forest property using techniques similar to those used in this exercise

## Credits

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### Sources of supplied data

#### *Course Data*

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