

# Calculating Future Value (FV) of a Single Sum

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**Example:** How to calculate the current, pre-merchantable value of a stand of trees.  
 Or, how to find the future value (FV) of a single sum.

Dear Tree Farmer:

On Monday, we visited a three or four year old loblolly pine plantation on your property that had been damaged by a Gramoxone + 2,4-D spray that drifted from the adjacent corn stand earlier in the season. The affected area was estimated (by pacing) to be 800 long and 24 feet deep, representing 0.44 acres. Planting density was 726 trees per acre (6' x 10' spacing), so approximately 320 trees were impacted by the herbicide drift. Damaged ranged from outright mortality, to death of the terminal leader, to needle browning. Trees with loss of the terminals and with needle browning will likely recover. Mortality was most severe (15 to 30 percent) in the portion of the stand on the southeast side of the field. This block was approximately 0.25 acres in size.

The best way to calculate straight replacement cost for a damaged stand like this, that does not yet have merchantable value, is to take all the establishment costs and compound them forward from year one to the current year by an acceptable interest rate. (Once a stand has merchantable wood, you can estimate its value by simulating a clearcut.) To estimate the value of the loss: assume planting costs, seedling costs, management costs, and herbicide costs at establishment carried forward to the present stand age using an expected rate of return on investment. For pine plantations established on agricultural fields, Internal Rate of Return (IRR) to investment of 15 percent is possible. Doing this accurately requires knowing the total stand establishment costs and what the appropriate interest rate would be. After that the math is simple and direct. These per acre costs of establishment are estimated for old-field pine plantation establishment:

Then, other costs could reasonably be added to this base replacement cost, such as the worry factors associated with dealing with the issue (extra trips to order and get seedlings, organizing stand establishment operations for a small acreage, the risk of replanting failure (You figure here.)), and the real economic cost of moving the harvest cycle forward by the age of the damaged trees (\$20-to-\$50/ac./yr., etc. These other reasonable costs may be looked at as points for negotiation and can go in the "Other" blank below.

<u>Items</u>	<u>Our Costs</u>	<u>Your Costs</u>			
Planting	\$45	\$ _____			
Seedlings	\$30	\$ _____			
Fire Protection	\$0	\$ _____			
Management	\$5	\$ _____			
Herbicide	\$35	\$ _____			
Other _____	\$ _____	\$ _____	<u># Years</u>	<u>@ Interest</u>	= <u>Future Value</u>
<b>TOTAL</b>	<b>\$115/acre</b>	<b>\$ _____ /acre</b>			

Using the cost-replacement approach, the formula for Future Value of a single sum invested at establishment (year zero) is  $V_n = V_0 (1 + i)^n$ , where:  $V_n$  is future value,  $V_0$  is present value (year zero),  $i$  is interest rate, and  $n$  is the number of years. In this formula,  $i$  is the appropriate interest rate (we chose 15%), and  $n$  is the number of years since stand establishment to the year we want to determine value. We assumed the stand was 3 or 4 years old. Then, go to the table of factors on page 2, and choose the relevant factor for the time period and interest rate to multiply the value in year zero by. Then:

- The future value of \$115 invested for 3 years at 15 percent is  $\$115 \times 1.52088 = \$174.90/\text{acre} \times 0.44 \text{ acres} = \$76.96$
- The future value of \$115 invested for 4 years at 15 percent is  $\$115 \times 1.74901 = \$201.14/\text{acre} \times 0.44 \text{ acres} = \$88.50$

**Another example:**

Situation - An eight year old loblolly pine stand established on an old-field site is killed by wildfire. To estimate the value of the loss: assume planting costs, seedling costs, and herbicide costs at establishment carried forward to the present stand age using an expected rate of return on investment. For pine plantations established on agricultural fields, Internal Rate of Return (IRR) to investment of 15 percent is possible. These per acre costs of establishment are projected for old-field pine plantation establishment: Planting \$45, Seedlings \$30, Herbicide \$35, TOTAL = \$110/acre in year 0.

Using the cost-replacement approach, the formula for Future Value of a single sum invested at establishment is  $V_n = V_o (1 + i)^n$ , where:  $V_n$  is future value,  $V_o$  is present value,  $i$  is interest rate, and  $n$  is the number of years.. In this formula,  $i$  is the appropriate, chosen interest rate 15%, and  $n$  is the number of years since stand establishment to the year we want to determine value. The stand was 8 years old. Then, go to the table of factors and choose the relevant factor for the time period and interest rate. The Future value of \$110 invested for 8 years at 15 percent is  $\$110 \times 3.05402 = \$335.94$ . Using the cost replacement approach, the value at age 8 is \$335.94. Total present value loss at age 8 is  $\$335.94 \times 3 \text{ acres} = \$1,007.83$ . This might be a good time to consider the value of plowing fire lines for future fire protection..

**Table 1.** Factors for finding the future value of a single sum. Choose relevant interest rate and time period to locate factor in table. Then, multiply that factor by the present value of the single sum in question to calculate the future value at the time period and interest rate chosen.

Yr.	Interest rates (%)																	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1.03000	1.04000	1.05000	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000	1.13000	1.14000	1.15000	1.16000	1.17000	1.18000	1.19000	1.20000
2	1.06090	1.08160	1.10250	1.12360	1.14490	1.16640	1.18810	1.21000	1.23210	1.25440	1.27690	1.29960	1.32250	1.34560	1.36890	1.39240	1.41610	1.44000
3	1.09273	1.12486	1.15763	1.19102	1.22504	1.25971	1.29503	1.33100	1.36763	1.40493	1.44290	1.48154	1.52088	1.56090	1.60161	1.64303	1.68516	1.72800
4	1.12551	1.16986	1.21551	1.26248	1.31080	1.36049	1.41154	1.46410	1.51807	1.57352	1.63047	1.68896	1.74901	1.81064	1.87389	1.93878	2.00534	2.07360
5	1.15927	1.21665	1.27628	1.33823	1.40255	1.46933	1.53862	1.61051	1.68506	1.76234	1.84244	1.92541	2.01136	2.10034	2.19245	2.28776	2.38635	2.48832
6	1.19405	1.26532	1.34010	1.41852	1.50073	1.58687	1.67710	1.77156	1.87041	1.97382	2.08195	2.19497	2.31306	2.43640	2.56516	2.69955	2.83976	2.98598
7	1.22987	1.31593	1.40710	1.50363	1.60578	1.71382	1.82804	1.94872	2.07616	2.21068	2.35261	2.50227	2.66002	2.82622	3.00124	3.18547	3.37932	3.58318
8	1.26677	1.36857	1.47746	1.59385	1.71819	1.85093	1.99256	2.14359	2.30454	2.47596	2.65844	2.85259	3.05402	3.27841	3.51145	3.75886	4.02139	4.29982
9	1.30477	1.42331	1.55133	1.68948	1.83846	1.99900	2.17189	2.35795	2.55804	2.77308	3.00404	3.25195	3.51788	3.80296	4.10840	4.43545	4.78545	5.15978
10	1.34392	1.48024	1.62889	1.79085	1.96715	2.15892	2.36736	2.59374	2.83942	3.10585	3.39457	3.70722	4.04556	4.41144	4.80683	5.23384	5.69468	6.19174
11	1.38423	1.53945	1.71034	1.89830	2.10485	2.33164	2.58043	2.85312	3.15176	3.47855	3.83586	4.22623	4.65239	5.11726	5.62399	6.17593	6.77667	7.43008
12	1.42576	1.60103	1.79586	2.01220	2.25219	2.51817	2.81266	3.13843	3.49845	3.89598	4.33452	4.81790	5.35025	5.93603	6.58007	7.28759	8.06424	8.91610
13	1.46853	1.66507	1.88565	2.13293	2.40985	2.71962	3.06580	3.45227	3.88328	4.36349	4.89801	5.49241	6.15279	6.88579	7.69868	8.59936	9.59645	10.69932
14	1.51259	1.73168	1.97993	2.26090	2.57853	2.93719	3.34173	3.79750	4.31044	4.88711	5.53475	6.26135	7.07571	7.98752	9.00745	10.14724	11.41977	12.83918
15	1.55797	1.80094	2.07893	2.39656	2.75903	3.17217	3.64248	4.17725	4.78459	5.47357	6.25427	7.13794	8.13706	9.26552	10.53872	11.97375	13.58953	15.40702
16	1.60471	1.87298	2.18287	2.54035	2.95216	3.42594	3.97031	4.59497	5.31089	6.13039	7.06733	8.13725	9.35762	10.74800	12.33030	14.12902	16.17154	18.48843
17	1.65285	1.94790	2.29202	2.69277	3.15882	3.70002	4.32763	5.05447	5.89509	6.86604	7.98608	9.27646	10.76126	12.46768	14.42646	16.67225	19.24413	22.18611

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