

Annex 1: Seed Requirement Calculations

1. Background

Whilst the main aspects of the *Guidelines* are site selection and implementation of tree planting programmes, an associated activity is to calculate the amount of seed required. However, past experience has found this to be difficult, as seed users, outside the private sector, are not in the habit of planning other than on an annual basis.

2. Past Tree Planting and Seedling Distribution

Records of past tree planting activities and seedling distribution (FA, 2003) were examined, but it has not been possible to assess trends that might indicate future seed requirements, based on this information. Table 1 illustrates that tree planting and seedling distribution by the Forestry Administration has been erratic, perhaps in reflection of the budget allocations, with some years showing no activities at all. In comparison, the private sector, through British American Tobacco (BAT) shows a rapid increase in seedling production, to become the largest in the country.

3. Current and Future Tree Planting Plans

The Forestry Administration has no seed requirement for this year (2004), as its restructuring did not allow people and infrastructure to be in place in time for nursery establishment.

A seed demand assessment (CTSP 2003a) examined seedling production at a number of nurseries and found that whilst records were available of seedling production, it was not possible for nursery staff to convert between these figures and required seed weight. Within this assessment, estimates were calculated for seed demand, but as they were based on a sample survey only, it is not considered appropriate for assessment of future seed demand. However, the same source indicated that major seed users, with budgetary responsibilities, would be able to cover the costs of good quality seed.

Although long-term plans for tree planting have yet to be established, the central level of the Forestry Administration will be responsible for international co-operation and large scale tree planting. Should funding proposals be successful, there will be a huge demand for seeds, and experiences with acacia and eucalypt plantations are beginning to illustrate the importance of sourcing good seed (many have grown multiple stems which are no good for their intended objective). At the local levels, small scale plantations and local tree plantings will be encouraged, and in some areas, demand is likely to be met by BAT rather than the Forestry Administration (eg Kampong Cham, Pursat and Kampong Chhnang).

BAT is the largest seed user within the country, after becoming involved in seedling production due to its need for wood within the tobacco drying process, and its desire to replant trees, whilst at the same time providing wood resources to local people who need them. The nursery at Kampong Cham has capacity for 1.2 million seedlings, and the newly opened one at Pursat can provide another 500,000, and long-term plans and budgetary requirements for their ongoing operation have been developed. Within BAT, the value of using good quality seed has been realized and demonstrated through model farmers using good tobacco seed.

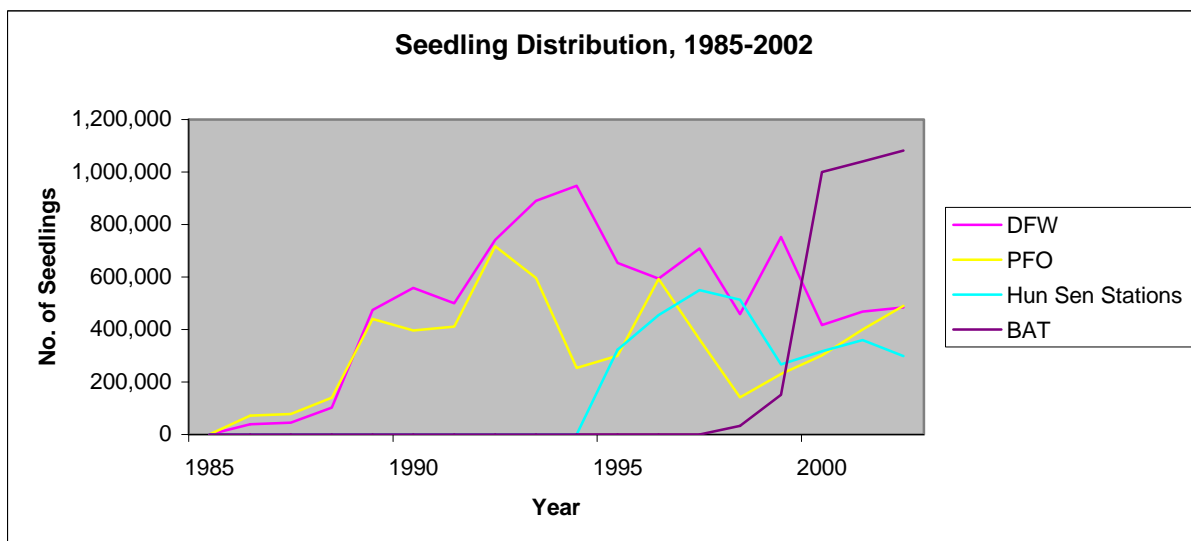
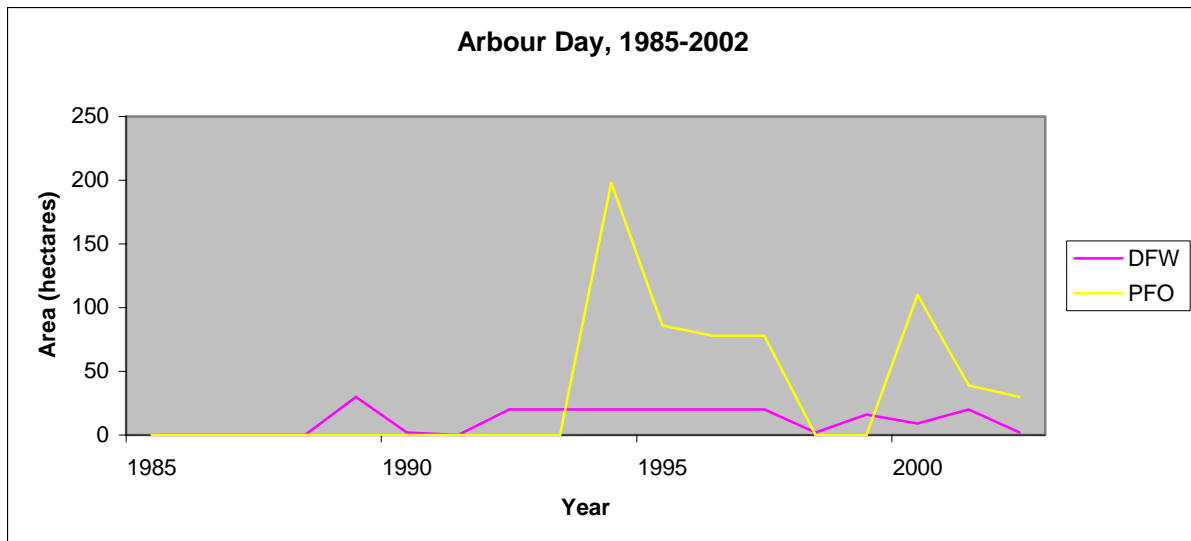
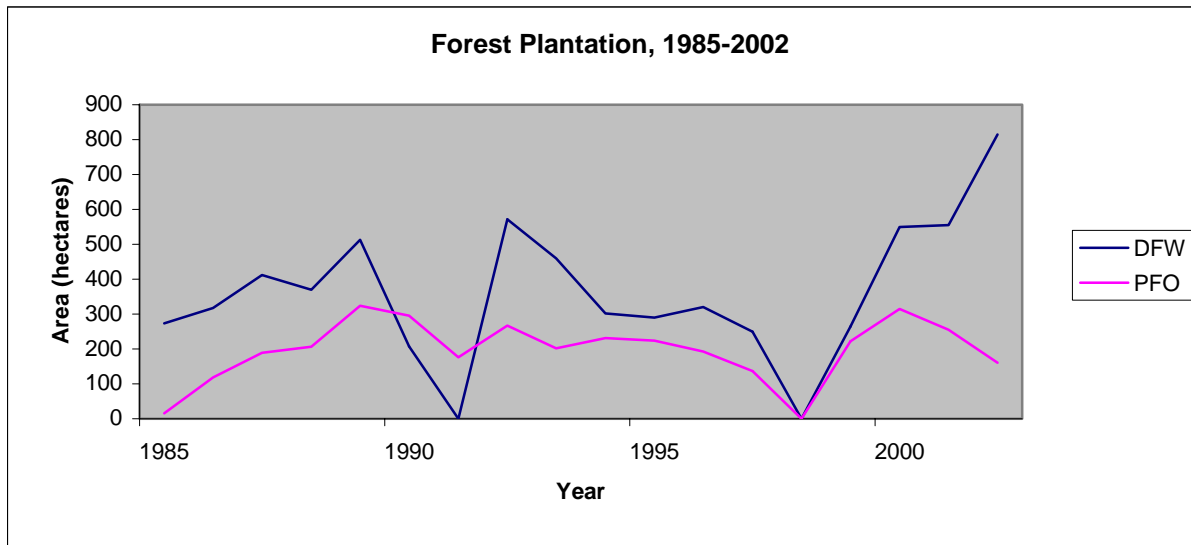
4. Calculations for Seed Requirements

The general lack of planning for tree planting activities, does not allow for an assessment of future seed demand. Instead, Table 2 has been developed to assist seed users to calculate their seed requirements. Currently, it contains 26 species for which information is currently available, but can be updated following further species testing and research. The Table takes loss factors

into consideration, which are explained below, in order to provide the total seed requirement for one hectare of open plantation site.

- ◆ germination rate the average percentage of seed that sprout and grow
- ◆ loss in nursery the average percentage of germinated seed that die in the nursery
- ◆ loss during transport the average percentage of seedlings that die or are damaged during transport from the nursery to the planting site
- ◆ loss in the planting site the average percentage of seedlings that do not survive after planting out
- ◆ purity this refers to the percentage of 'pure' seed in a kilogram, where a lower rate indicates a higher weight of dust, small stones, etc.

Table 4 - Tree Planting and Seedling Distribution, 1985 - 2002



Source: DFW, 2003, Cambodia: Forestry Statistics to 2002

Table 5 - Seed Requirements per Hectare for Open Plantation

Species		No. of Seed per Kg	Planting Spacing (m x m)	Net Seedlings Required per Hectare	In Planting Site	Rate of Loss		Germ in ation Rate (%)	Seed Requirements		Purity (%)	Total Seed requirement (kg)
Scientific name	Local name					In Transit	At the Nursery		No of Seeds Needed	Weight of Seed Required (kg)		
<i>Acacia auriculiformis</i>	Acacia sleuktauch	30 000	2x2	2 500	20% (3 000)	10% (3 334)	20% (4 168)	60	6 947	0.24	90	0.27
<i>Azelia xylocarpa</i>	Beng	100	4x4	625	20% (750)	10% (834)	20% (1 043)	80	1 304	13.04	90	14.49
<i>Albizia lebbeck</i>	Chraiss	9 000	3x3	1 112	20% (1 335)	10% (1 484)	20% (1 855)	70	2 650	0.30	95	0.32
<i>Aquilaria crassna</i>	Chann crassna	4 000	2.5x2.5	1 600	20% (1 920)	10% (2 134)	20% (2 668)	60	4 447	1.12	95	1.18
<i>Azadirachta indica</i>	Sdaov	2 000	2.5x2.5	1 600	20% (1 920)	10% (2 134)	20% (2 668)	80	3 335	1.67	95	1.76
<i>Cassia garettiana</i>	Hai san	25 000	2.5x2.5	1 600	20% (1 920)	10% (2 134)	20% (2 668)	50	5 336	0.22	95	0.24
<i>Cassia fistola</i>	Loeung Reach	7 000	2.5x2.5	1 600	20% (1 920)	10% (2 134)	20% (2 668)	40	6 670	0.96	95	1.01
<i>Cassia siamea</i>	Ang Kanh	40 000	2x2	2 500	20% (3 000)	10% (3 334)	20% (4 168)	40	10 420	0.26	95	0.28
<i>Carypha umbraculifera</i>	Trang	100	2x2	2 500	20% (3 000)	10% (3 334)	20% (4 168)	60	6 947	69.47	95	73.13
<i>Dalbergia bariensis</i>	Neang nuon	5 000	3x3	1 112	20% (1 335)	10% (1 484)	20% (1 855)	50	3 710	0.75	95	0.79
<i>Dalbergia cochinchinensis</i>	Kragnuong	40 000	3x3	1 112	20% (1 335)	10% (1 484)	20% (1 855)	50	3 710	0.10	95	0.11
<i>dipterocarpus alatus</i>	Chheuteal Teuk	300	4x4	625	20% (750)	10% (834)	20% (1 043)	50	2 086	6.96	90	7.74
<i>Eucalyptus sp.</i>	Preng kyal	1 000 000	2x2	2 500	20% (3 000)	10% (3 334)	20% (4 168)	40	10 420	0.01	?	0.01
<i>Fagraea fragrans</i>	Ta Trav	4 000 000	2.5x2.5	1 600	20% (1 920)	10% (2 134)	20% (2 668)	40	6 670	0.002	95	0.003

<i>Hopea odorata</i>	Koki Msoav	3 000	4x4	625	20%	10%	20%	80	1 304	0.44	90	0.49
					(750)	(834)	(1 043)					
<i>Leucaea leucocephala</i>	Kratom Teth (Australia)	15 000	2x2	2 500	20%	10%	20%	80	5 210	0.35	95	0.37
					(3 000)	(3 334)	(4 168)					
<i>Moringa oleifera</i>	Mrum	4 000	2x2	2 500	20%	10%	20%	80	5 210	1.31	95	1.38
					(3 000)	(3 334)	(4 168)					
<i>Pterocarpus macrocarpus</i>	Thnong	1 000	4x4	625	20%	10%	20%	40	2 608	2.61	90	2.90
					(750)	(834)	(1 043)					
<i>Sindora cochinchinensis</i>	Kar koh	400	3x3	1 112	20%	10%	20%	80	2 319	5.80	90	6.45
					(1 335)	(1 484)	(1 855)					
<i>Shorea guiso</i>	Chor chong	1 500	3x3	1 112	20%	10%	20%	70	2 650	1.77	90	1.97
					(1 335)	(1 484)	(1 855)					
<i>Shorea roxburghiana</i>	Popel tauch	1 000	3x3	1 112	20%	10%	20%	80	2 319	2.32	90	2.58
					(1 335)	(1 484)	(1 855)					
<i>Scapium macropodium</i>	Samrang	100	2.5x2.5	1 600	20%	10%	20%	80	3 335	33.35	90	37.06
					(1 920)	(2 134)	(2 668)					
<i>Tarrietia javanica</i>	Daun Chaim	900	4x4	625	20%	10%	20%	80	1 304	1.45	90	1.62
					(750)	(834)	(1 043)					
<i>Tectona grandis</i>	Mai Sac	1 000	3x3	1 112	20%	10%	20%	40	4 638	4.64	90	5.16
					(1 335)	(1 484)	(1 855)					
<i>Terminalia alata</i>	Chhlik	300	3x3	1 112	20%	10%	20%	40	4 638	15.45	90	17.17
					(1 335)	(1 484)	(1 885)					
<i>Terminalia bialata</i>	Popeal khe	2 000	3x3	1 112	20%	10%	20%	50	3 710	1.86	90	2.07
					(1 335)	(1 484)	(1 885)					

Note: The above calculations are estimates and refer to specific conditions of seed, resulting in biases. For example, although the seed weight of *Azelia xylocrpa* and *Scapium macropodium* are shown to be the same, they actually are quite different, reflecting the conditions that ensure viable seed : the weight of *Scapium macropodium* is calculated from the fresh fruit, which contains a high moisture content, whereas that of *Azelia xylocrpa* is from the dry seed. This also applies to other species such as *Pterocarpus macrocarpus* and *Shorea roxburghiana*.