



Sustainable Seed Source Project

**Establishing the Seed Potential of Native
Stands of Small Leaved Lime
December 2016**

**Commissioned and funded by
Woodland Trust**



Executive Summary

Small leaved lime was identified as a priority native tree species for seed production by the Sustainable Seed Source Project, Phase 2 as only one stand was registered for seed collection in Britain. This project has enabled 20 sites in private and public ownership to be assessed for their suitability as seed stands. It has identified six selected seed stands and 10 source identified seed stands considered suitable for Forest Reproductive Materials (FRM) registration. These stands cover five seed zones, are located across 10 counties and total 64.3ha. This substantially increases the potential seed stand area of Small Leaved Lime which currently stands at 15 hectares. It also markedly improves the geographic coverage and likely adaptive and genetic diversity for the species, utilised if the stands go on to be registered and become active seed stands. Assistance with FRM registration has been offered to private woodland owners and Estates.

Objectives

- 1) To assess 18 native stands to establish their potential as seed stands
- 2) To recommend at least six suitable stands that could be registered as selected stands or source identified stands

Background

Small leaved lime (*Tilia cordata* L.) is a native species with a scattered distribution across southern Britain and is an indicator species for ancient woodland. Stands are usually quite small and often occur as coppice. High forest with good quality timber trees is rare. It has considerable biodiversity value with its nectar rich flowers attracting huge numbers of insects.

It has been identified¹ as a priority species for seed production in Britain. Several 100,000s of seedlings are produced annually by the nursery sector. However, British seed can be difficult to source due to climatic factors. Seed viability is highest in southern Britain thus identifying and utilising southern stands i.e. occurring in Regions 30 & 40, are a priority.

Selected seed stands are stands showing superior characteristics, e.g. better form, growth rate and health and thus more sought after for commercial woodland purposes. Source identified stands can be from general or specific locations within a single region of provenance or seed zone altitude band in which no specific superior qualities are recognised. These are typically used for conservation purposes. Currently there is only one selected seed stand located in Hockering Wood, Norfolk included in the Forest Reproductive Materials (FRM) Register. There are no source identified stands in the FRM Register.

This project has been undertaken to identify seed stands of small leaved lime suitable for registration as either selected stands or source identified stands. This is to increase the number of stands potentially available for seed collection and thus improve supply and genetic diversity of seed to the nursery sector.

Approach

Background site information and maps for 24 sites of interest were identified by the Limewoods Working Group, the Woodland Trust, the UK National Tree Seed Project (Royal Botanic Gardens Kew), Essex County Council, SSSI citation reviews and private individuals. A visit was made to each site to survey and verify the area(s) of the potential seed stand(s). In some larger woods, more than one potential seed stand was assessed. As the only registered small leaved lime site, Hockering Wood was also visited to enable comparison and ensure consistency of seed stand type assignment.

Using a slightly modified version of Future Trees Trust's Seed Stand Audit worksheet², data and images were collected for site and stand characteristics. The presence of seed was also noted for each site. Discussions with the site manager/owner were undertaken as to the desirability and suitability of the

¹ Sustainable Seed Sources Project, Phase 2, 2015.

² Sustainable Seed Sources Project, Phase 1, 2014.

stand becoming a registered stand and its classification, i.e. source identified or selected stand, and likely management requirements. Information was compiled and is presented as a series of tables, maps and images. The area of the seed stands are outlined in pale blue on the maps.

Results

a) Location and ownership

A total of 21 sites rather than 18 sites, including Hockering Wood, were visited between October and December 2016. This was because some sites were located close to each other and thus it was timely to survey all sites where this occurred. The 20 new sites surveyed (Table 1) were located across 12 counties and covered five seed zones (402, 403, 404, 405 & 406). Nine sites were owned by private individuals or Estates, seven by the Forestry Commission and three by Trusts including two by the Woodland Trust.

Table 1: Small leaved-Lime Woods: Sites Visited and Ownership

Ref	Site	County	Seed zone	Listed in National Inventory Database	Initial point of contact	Ownership
1	Bishop's Enclosure	Hampshire	405	No	Limewoods Working Group (LWG)	Private
2	Bovingdon Wood	Essex	405	Yes	SSSI review	Private
3	Chalkney Wood	Essex	405	Yes	SSSI review	Forestry Commission
4	Cheddar Wood	Somerset	404	Yes	UKNTSP site	Private
5	Cranborne Copse	Dorset	404	No	LWG	Private
6	Enborne Copse	Berkshire	404	Yes	LWG	Private
7	Flaxley Wood	Gloucestershire	404	No	LWG	Forestry Commission
8	Garnetts Wood	Essex	405	Yes	Essex CC	Essex County Council
9	Groton Wood	Suffolk	406	Yes	UKNTSP site	Essex County Council
10	Hazel Wood	Suffolk	406	Yes	Rod Pass	Private
11	Hope Wood	Gloucestershire	404	No	LWG	Forestry Commission
12	King's Wood (Bedfordshire)	Bedfordshire	402	Yes	LWG	The Greensand Trust
13	King's Wood (Somerset)	Somerset	404	Yes	UKNTSP site	Private
14	Lady Park Wood	Monmouthshire /Gloucestershire	404	Yes	LWG	Forestry Commission
15	Mugglewort Wood	Gloucestershire	404	No	LWG	Forestry Commission
16	Old Wood	Lincolnshire	402	Yes	SSSI review	Woodland Trust
17	Parkhall Wood	Essex	405	Yes	SSSI review	Private
18	Piles Coppice	Warwickshire	403	Yes	WT officer	Woodland Trust
19	Shrawley Wood	Worcestershire	403	Yes	LWG	Forestry Commission
20	Welshbury Wood	Gloucestershire	404	No	LWG	Forestry Commission
21	Hockering Wood	Norfolk	406	Yes	LWG	Private

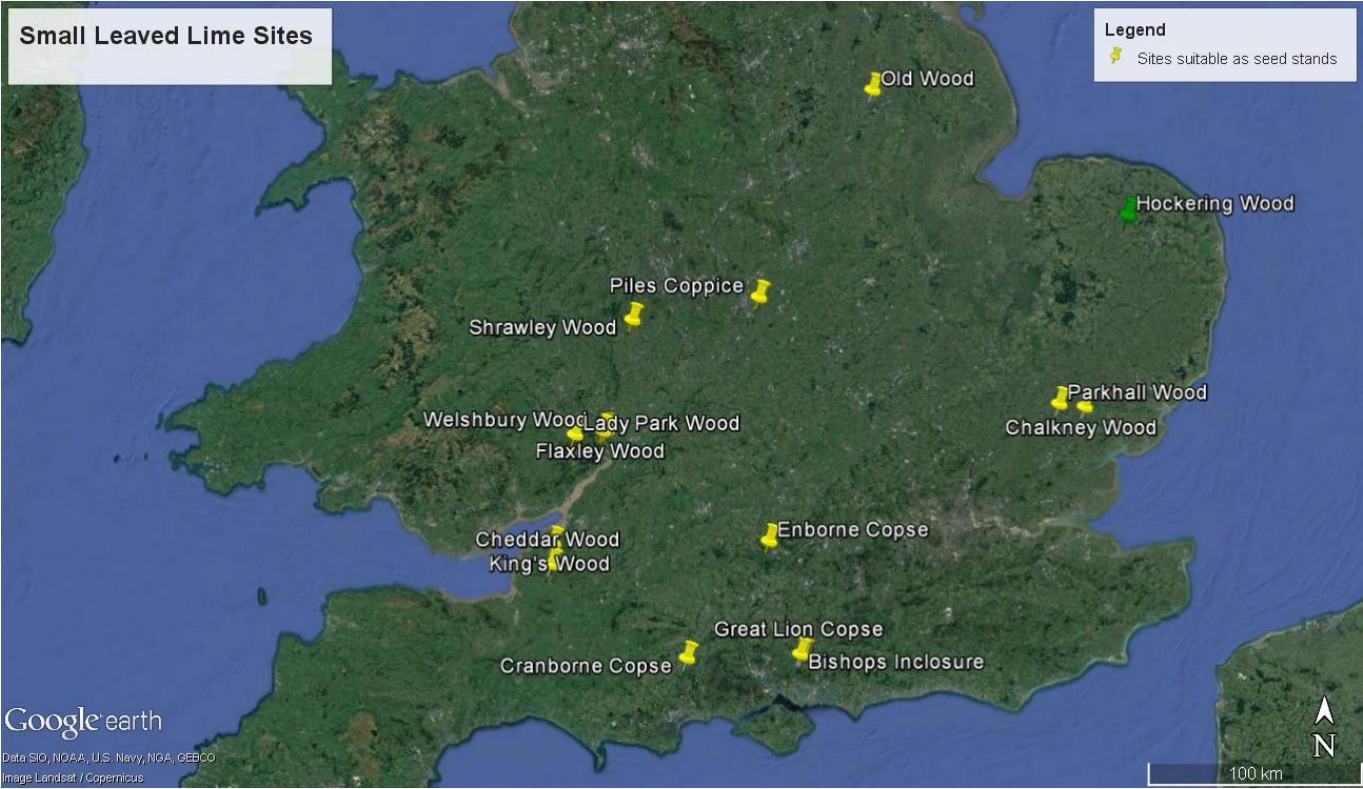
b) Site and stand details plus seed stand assignment

Individual site and stand information including central grid references for the potential seed stands is provided in Table 2 with the associated key for descriptors being Table 3. As expected, the majority of the stands were from predominately coppice origin with only the stands at Flaxley Wood and Mugglewort Wood being from maiden trees. With the exception of King's Wood, Bedfordshire, which was a young stand, all sites were either a combination of semi mature and mature trees, or semi mature stands. At only two sites, Lady Park Wood and King's Wood, Somerset were Large leaved lime or hybrids thought to be present. Lady Park Wood interestingly straddles the Welsh/English border.

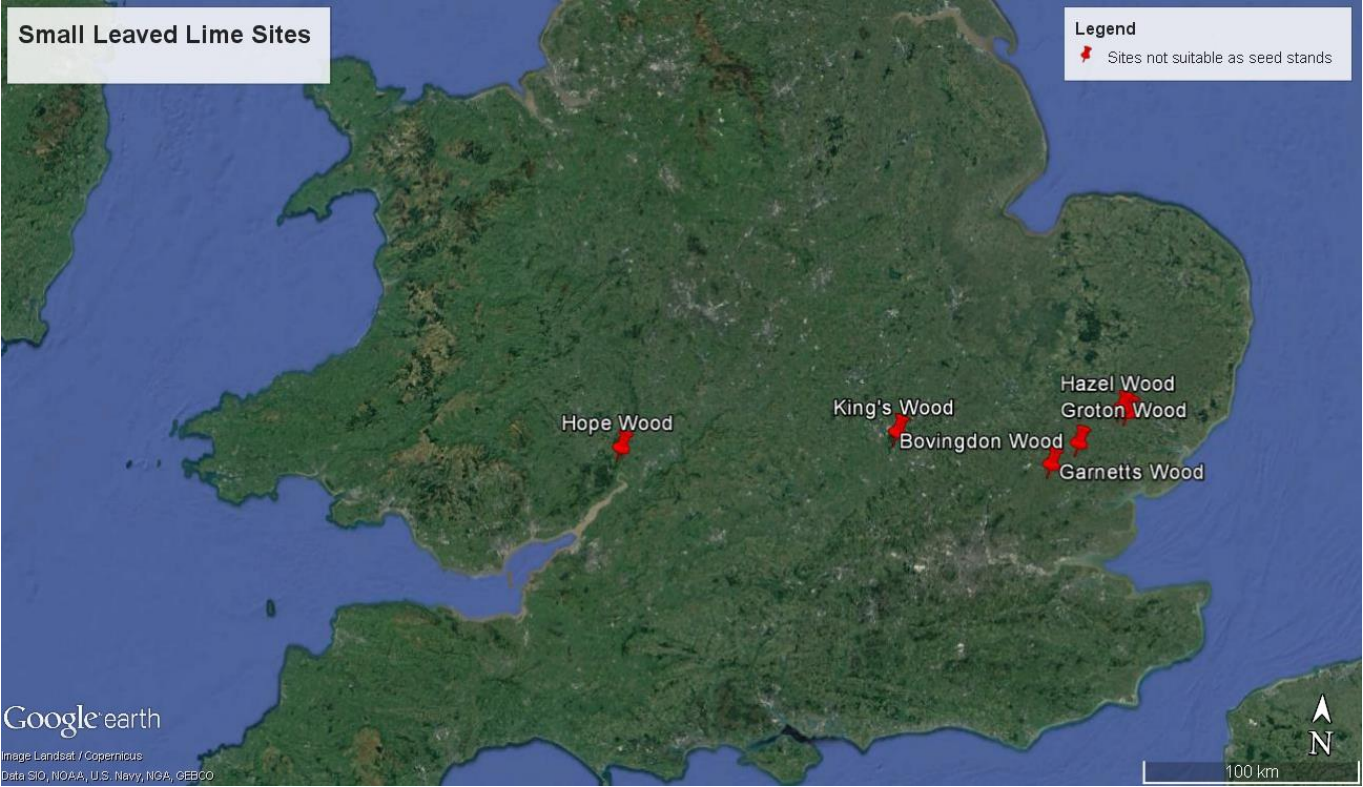
Six sites were either not of large enough size and/or had insufficient semi mature and mature small leaved limes to be suitable as a seed stand. At both Cheddar Wood and Flaxley Wood, a separate source identified stand and a selected stand were identified. At all other sites, stands were either assessed to be a source identified stand or a selected stand. Thus the total number of selected potential seed stands was 16 comprising of 10 source identified stands and six selected stands (Table 4). The locations of the sites are shown in Maps 1 and 2.

Map 1: Distribution of Small Leaved Lime Sites Recommended for Registration As Seed Stands.

NB: Hockering Wood is already registered. Welshbury Wood is located close to Flaxley Wood – pin not shown.



Map 2: Distribution of Small Leaved Lime Sites Not Suitable for Registration.



Of the 16 stands, the smallest was Bishop's Inclosure at 1ha and the largest was Welshbury Wood at 18.2ha. Eight were between 1ha and 3ha in size, five between 3.1ha and 7ha in size and only one over 7ha. The total area of new potential seed stands identified was 64.3ha. This is a substantial increase on the current 15ha (Hockering Wood) on the FRM Register. Images and maps for these 16 stands plus King's Wood Bedfordshire which has future potential as a seed stand, are provided in Appendix 1.

c) Seed Stand Registration and Interaction with Owners and Managers

The outcome of the site visits has been relayed to the site owners and managers with maps provided as appropriate. Whilst registration of the seed stands has been encouraged, it cannot be assumed. Further assistance with seed stand registration has been offered to the private landowners and Estates – it is expected that four will confirm interest in further support. It has been assumed that other parties have resources to take registration forward if it is desired. This has been confirmed by the Woodland Trust for their sites. The Forestry Commission have confirmed their intention to review the recommended stands located on FC sites in 2017 and undertake their registration if appropriate.

Concluding remarks

This project has built upon the work on Small leaved lime undertake within the Sustainable Seed Source Project, Phase 2. It has enabled the identification of six selected seed stands and 10 source identified seed stands covering five seed zones and located across 12 counties. The total of 64.3ha of new seed stands substantially increases the potential seed stand area of Small Leaved Lime suitable for FRM registration. It also for the species markedly improves the geographic coverage and likely adaptive and genetic diversity utilised if the stands go on to be registered and become active seed stands.

K Russell Consulting Ltd

On behalf of Future Trees Trust
December 2016

Acknowledgements

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Forestry Commission
Forest Enterprise
Forestart Ltd.
Limewoods Working Group, especially Hugh Milner
UKNTSP, Royal Botanic Gardens Kew
Woodland Trust

Along with private woodland owners and Estates.

Table 2: Assessment of Small Leaved Lime Stands for Seed Stand Potential

STAND CHARACTERISTICS														RECOMMENDATIONS						
Site Name/ Seed Stand Name	Grid Ref	Seed Zone	Area (Ha)	Slope	Vegetation	Drainage	Site Access	Security	Predators	Collection Methods	Tree Density/Ha	Est No Of Target Trees/Ha	Crown Size	Other Species	Species removal	Thinning	Vegetation Removal	Access Improvements	Reassess Boundary	Other Comments
Bishop's Inclosure	SU580145	405	1.0	2	3	2	2	2	n/a	N/T	500	400	2 & 3	SCH/POK	N	Y	N	N	N	Small, quite dense, drawn up, semi mature stand of high quality Small leaved lime (SLI) from coppice and maidens. Trees are straight, clean stemmed and with a light branching habit. Sweet chestnut scattered through with oak. SLI along ride margin have medium to very large crowns. SLI seedlings present on site along with seed. Would benefit from a thin to favour the best SLI to enable crown development. ASNW. Recommend registration as a selected stand.
Bovingdon Wood	TL757281	405	n/a	1	1	2	3	1	n/a	n/a	70	20	3 & 4	POK/HBM	N	Y	N	N	N	Wood was surveyed but insufficient number of large, semi to mature lime present to warrant inclusion as a seed stand. ASNW.
Chalkney Wood	TL873277	405	3.0	2	1 to 4	2	2	2	n/a	N/T	200	120	2	SCH/AH/POK/HBM	N	Y	N	N	N	Semi mature and mature SLI forming pure species groups in places and interspersed with other tree species in others. Overall quality is average. Largest crowns tending to be in SE half. Amount of ground vegetation highly variable depending on tree cover but often light or absent. Excellent site access. Immediately adjacent to SE margin is fine stand of semi mature sweet chestnut - potential select stand. ASNW/SSSI. Recommend as source identified stand.

Cheddar Wood A	ST440551	404	2.2	4 to 5	2	1	3	1	n/a	N/T	250	100	1 to 3	AH/HOM/POK	N	N	N	N	N	Narrow belt of SLI following the woodland margin and including adjacent field edges which have large crowned trees present. Wide range of age classes but most are semi mature coppice stools. Several very large crowned trees especially in western half. Seed present. ASNW/SSSI/SAC/Nature Reserve. Quality is highly variable thus recommend as a source identified stand.
Cheddar Wood B	ST443549	404	5.4	4	2	1	3	1	n/a	N	400	300	2 to 4	AH/POK	N	Y	N	N	N	Good to excellent quality stand of SLI most of coppice origin. Good uniform form generally. Several plus trees present. Largest crowned trees towards woodland edge. Seed present. Would benefit from thinning to favour SLI. Privet locally strong in eastern third. ASNW/SSSI/SAC/Nature Reserve. Recommend registration as a selected stand.
Cranborne Copse	SU061121	404	1.2	2	1	2	3	1	n/a	N/T	200	50	1 to 3	POK/AH/BE/HOL	N	Y	N	N	N	Sparse semi mature and mature SLI scattered through open grown oak and beech. SLI stools of good quality and some fine stems are present. There are some massively crowned stools including one of great size but most are medium to large sized. Very little ground vegetation present. Seed present on trees. ASNW. Recommend registration as source identified stand.
Enborne Wood	SU434661	404	4.6	2	2	2	2	1	n/a	N	300	280	2 & 3	BI/AH/POK	N	Y	N	N	N	High quality, mature, almost pure SLI stand from maidens and singled coppice stems. Form is good to excellent with plus trees present. Unmanaged for many years. Some large crowns are present and bearing good quantity of seed. Seedling regeneration present. Flat to moderate slopes. Light grass and bramble in places otherwise little vegetation - heavy deer browsing. Would benefit from a light thin to favour best SLI trees. SSSI/ASNW/RPG. Recommend for registration as a selected stand.
Flaxley Wood A	SO683160	404	2.5	3	2	2	2	2	n/a	N/T	120	80	1 & 2	SCH/SY/AH/WCH	N	Y	Y	N	N	Mature high forest stand of very high quality dominated by mainly lime with some chestnut and sycamore. Clumps of small yew in understorey along with recent sycamore regeneration could hinder placement of nets in places. ASNW. Recommend registration

																				as a selected stand.
Flaxley Wood B	SO689160	404	1.2	2	3	2	2	2	n/a	N	250	180	2 & 3	POK/AH/HOL	N	Y	N	N	N	Promising semi mature stand of good quality lime with some oak and ash forming high forest. Some limes are forming large crowns. If thinned to favour the lime, it has potential to become a select stand in time. ASNW. Recommend registration as source identified stand.
Garnetts Wood	TL634182	405	n/a	1	2	2	3	2	n/a	n/a	80	5	2 & 3	POK/HBM/AH	N	N	N	N	N	Wood was surveyed but insufficient number of large, semi to mature lime present to warrant inclusion as a seed stand. ASNW.
Groton Wood	TL976431	406	n/a	1	3	3	3	2	n/a	n/a	150	60	2 to 4	POK/AH	N	Y	N	N	N	Wood was surveyed but insufficient number of large, semi to mature lime present to warrant inclusion as a seed stand. ASNW/SSSI.
Hazel Wood	TL949448	406	n/a	1	2	2	3	3	n/a	N	300	70	2 to 4	AH/HBM/POK	N	N	N	N	N	Wood was surveyed but insufficient number of large, semi to mature lime present to warrant inclusion as a seed stand. ASNW/SSSI.
Hope Wood	SO682174	404	n/a	4	4	3	3	2	n/a	n/a	120	20	2	AH/SCH/POK	N	N	N	N	N	Wood was surveyed but insufficient number of semi to mature lime present in groups to warrant inclusion as a seed stand. Recent felling undertaken along eastern margin.
King's Wood: Bedfordshire	SP930300	402	n/a	2	2	2	3	2	n/a	N	400	300	4	POK	N	Y	N	N	Y	Young stand (3.8ha) of good to excellent quality SLI from maiden trees and coppice stools. Crowns small in size and no evidence of seed production. If thinned, then has potential in time to be a select stand. Owned by several parties but managed by the Greensand Trust. Recommend thinning to favour in short to medium term to favour SLI and crown development. NNR/SSSI/ASNW. No registration at present as trees too small to produce useful quantity of seed.
King's Wood: Somerset	ST456647	404	1.8	2	2 to 4	2	2	2	n/a	N/T	150	80	1 & 2	POK/BE	Y?	N	Y	N	N	Small mature stand of mainly open grown, large SLI adjacent to stone access track and paths. Large crowned trees especially in northern half which includes small fenced off areas (old mines). Ground vegetation varies from heavy bramble and woody regeneration to very little depending on density of overstorey. Suckers present at the base of some trees. Seed present. ASNW/PAWS/SSSI/SAC/Nature Reserve.

																				Recommend registration as a source identified stand.
Lady Park Wood	SO548140	404	3.8	3	2	2	3	2	n/a	N	120	60	3	BE/AH/BI	Y	Y	N	N	N	Good quality mixed, uneven aged stand with some very good SLI - singled historically. Most trees are young to semi mature. Stand would benefit from thinning to favour better SLI. Bound to west by deer fence. Noted a large leaved lime just outside eastern boundary. NNR/SSSI/ASNW. Recommend registration as a source identified stand.
Mugglewort Wood	SO693163	404	1.1	3	3	2	3	2	n/a	N/T	100	70	1	POK/AH	N	N	N	N	N	Very large mature limes forming narrow band along PROW. Average quality. Some small yew and some young trees in understorey. Steep slope on eastern side. Recommend SLI as a source identified stand.
Old Wood	SK902719	402	1.3	1	2 & 3	2	3	2	n/a	N/T	350	250	2 to 4	AH/POK/BI	N	Y	Y	N	N	Good quality stand of semi mature SLI comprising of tall trees with good to very good form. Some plus trees present. Most SLI have small to medium crowns but some large crowned trees are present, especially along ride margins - rides bound stand on three sides. Hazel and bramble frequent but weak. It would benefit from thinning to favour the best SLI to encourage crown development. ASNW. Recommend registration as a selected stand.
Parkhall Wood	TL760288	405	6.7	1	1	2	3	1	n/a	N/T	300	50	1 & 2	POK/HBM/SCH/BI	N	Y	N	N	N	Scattered mature trees of SLI throughout mixed high forest stand bit more concentrated in eastern half. Most SLI of coppice origin and generally of good quality and a few of high quality. Large crowned trees with good seed production evident. Area includes mature POK stand of good to excellent quality - would be suitable as a select stand. ASNW/SSSI. Would benefit from a thin. Recommend SLI as a source identified stand.
Piles Coppice	SP385768	403	3.4	2	2	2	2	2	n/a	N	150	120	2 & 3	POK	N	Y	N	N	N	High quality, uniform, mature stand of SLI mainly from coppice origin. Trees at wide spacing and quite open grown. Very good stem form and tree height. Plus trees present. Seed evident. Good quality SLI elsewhere in the wood but frequently with holly and heavier vegetation. ASNW.

																				Would benefit from a light thin to favour best SLI. Recommend registration as a selected stand.
Shrawley Wood	SO810662	403	6.9	3	3	2	3	2	n/a	N	300	270	2	SCH/BI/POK/YEW	N	Y	N	N	N	Singled, semi-mature to mature SLI high forest of average to good quality on gently sloping to moderately steep ground. Crowns developing well. Suppressed, very weak bramble present. Potential select stand if thinned again. ASNW/SSSI. Recommend SLI as a source identified stand.
Welshbury Wood	SO677153	404	18.2	3	2	2	3	2	n/a	N	200	140	2	SCH/POK/BI	N	Y	N	N	N	Semi-mature to mature SLI forming high forest from coppice origin intermixed with chestnut and oak. Limes with larger crowns are concentrated mainly in southern half. Overall quality is quite high - potential select stand if thinned. Significant earthworks and Iron Age Fort present. SAM/ASNW. Recommend SLI as a source identified stand.
Hockering Wood	TG069142	406	15.0	1	2	2	2	1	n/a	N	200	150	1 & 2	POK/SCH/BI	N	Y	N	N	N	Registered SLI stand: tcoST40-01SE. Good quality stand of mature and semi mature SLI including some very large trees. Tree height is impressive. Fluting on main stems quite frequent - not seen to same degree in other stands of SLI - may be due in part to old age. Some plus trees present. Younger trees in western half. A lot of seed evident. Hazel locally strong in understorey. Would benefit from thinning. ASNW/SSSI.

Table 3: Key for Descriptors and Abbreviations used in Table 2.

Key

Slope	1 Flat 2 Slight 3 Moderate 4 Steep 5 Very steep
Vegetation	1 None 2 Grass/ sedges/ little vegetation 3 Grass/ weeds/ bracken 4 Significant woody species including Rubus Rosa etc. Rhododendron = R. 5 Item 4 plus significant volunteers trees preventing commercial collection
Drainage	1 Dry 2 Average drainage unpassable in prolonged wet weather 3 Poor drainage 4 Some surface water 5 Surface water throughout site
Site Access	1 Excellent access throughout site 2 Good tracked access to site for vehicles 3 Limited access for agricultural machinery and 4 wheel drives 4 Poor - no gateways or tracks to site or too steep to access with vehicles 5 Access denied by landowner
Security	1 Isolated no issues 2 Public footpaths 3 Public access or roadside 4 Urban fringe 5 Unsafe - serious security issues
Predators	P Pheasants PP Pheasant pens or feeders D Deer WB Wild Boar
Collection Methods	C - Cherry picker N - Nets H - Hand picking T - Tree Climbing L Livestock GS Grey Squirrels Suffix H to above indicates exceptionally heavy infestation N/A Not applicable
Tree Density	Figure is for all large semi mature and mature trees per hectare not just target species
Est No Of Trees	Estimated number of target species trees per hectare in stand that can be harvested
Crown Size	1 Very Large 2 Large 3 Healthy 4 Small 5 Diseased or dead branches

Other Species	AH Ash	
	BE Beech	
	HAZ Hazel	
	HBM Hornbeam	
	HOL Holly	
	HOM Holm oak	
	POK Pedunculate oak	
	SCH Sweet chestnut	
	SY Sycamore	
	YEW Yew	
Recommendations	Species removal	Y/N
	Thinning	Y/N
	Vegetation removal	Y/N
	Access improvements	Y/N
	Reassess boundary to enlarged stand through selective thinning	Y/N
	Other comments includes:	
	Description of seed stand	
	Designations	
	Source identified	
	Select stand	
	Not suitable as a seed stand	

*Taken and adapted from FTT Sustainable Seed Sources Project, Phase 1

Table 4: Small Leaved Lime Project: Summary of Seed Stand Recommendations

Ref	Site	County	Seed zone	Recommendation
1	Bishop's Enclosure	Hampshire	405	Selected stand
2	Bovingdon Wood	Essex	405	No seed stand potential
3	Chalkney Wood	Essex	405	Source identified stand
4	Cheddar Wood	Somerset	404	Selected stand (B) + second source identified stand (A)
5	Cranborne Copse	Dorset	404	Source identified stand
6	Enborne Copse	Berkshire	404	Selected stand
7	Flaxley Wood	Gloucestershire	404	Selected stand (A) + second source identified stand (B)
8	Garnetts Wood	Essex	405	No seed stand potential
9	Groton Wood	Suffolk	406	No seed stand potential
10	Hazel Wood	Suffolk	406	No seed stand potential
11	Hope Wood	Gloucestershire	404	No seed stand potential
12	King's Wood (Bedfordshire)	Bedfordshire	402	No seed stand potential at present
13	King's Wood (Somerset)	Somerset	404	Source identified stand
14	Lady Park Wood	Monmouthshire /Gloucestershire	404	Source identified stand
15	Mugglewort Wood	Gloucestershire	404	Source identified stand
16	Old Wood	Lincolnshire	402	Selected stand
17	Parkhall Wood	Essex	405	Source identified stand
18	Piles Coppice	Warwickshire	403	Selected stand
19	Shrawley Wood	Worcestershire	403	Source identified stand
20	Welshbury Wood	Gloucestershire	404	Source identified stand
	Hockering Wood	Norfolk	406	Registered stand

Note

6 stands recommended for registration as selected seed stands

10 stands recommended for registration as source identified seed stands

6 stands not considered suitable as seed stands - either too small total area and/or insufficient trees in proximity to each other

Appendix 1: Location Maps and Images for the Potential New Small Leaved Lime Seed Stands