

**SHORT ROTATION FORESTRY
USING
SCOTTISH NATIVE ASPEN CLONES**



Eadha Enterprises 2012

Aspen Clones

This report sets out the work Eadha Enterprises (EE) is undertaking around native aspen and its use in productive biomass systems and sets this in the wider context of research being undertaken in this field. EE is taking a clonal forestry approach to tree production. Clones are tested and selected for superior growth qualities. EE now holds the national collection of aspen clones amounting to 180 clones from the full geographical and topographical range across Scotland. This represents a unique resource on which to base continued research and development. Each clone has evolved as a genetically unique specimen with unique growth characteristics and tolerances to different physical conditions.

EE is developing projects in Scotland to trial native aspen in different environments and under different conditions, and to explore how systems can be designed to integrate productive woodland with other community and amenity uses.

Aspen is nationally rare and of conservation concern. EE is working with Local Authorities to develop Species Action Plans (SAPs) for aspen focussing on local clones present in areas as part of their Local Biodiversity Action Plans (LBAPs). SAPs for Renfrewshire, Inverclyde and East Renfrewshire have been developed to date.

EE are also developing a network of arboreta in the west of Scotland to showcase these clones and these trees will also be used to provide propagation material. A dedicated aspen production facility is being developed in Lochwinnoch in 2012 and this will also provide a project hub and training and education facility.

Aspen - The Pioneer

Populus tremula was the first tree to colonise the British Isles following the last Ice Age. It is the pioneer tree and is therefore very tolerant of a wide range of conditions including sites with thin or poor quality soils. It can tolerate wet conditions and even contaminated soil, where it can ameliorate chemical conditions through phytoremediation. As a pioneer tree, it can create topsoil in the long term and neutralise acid soils. Aspen is therefore an ideal nurse crop for a range of native and commercial species.

Aspen are tolerant of a wide range of environmental pollutants such as heavy metals, mercury, PCBs, nitrates, pesticide and herbicide residues, aromatics, wood preservatives, explosives and other waste products. Aspen can absorb zinc and other trace elements which allows it to survive on contaminated land sites and on the spoil heaps of mining operations where it can assist in the reclamation of post-mining landscapes.



Photo 1 : Aspen growing on rock face at 500m aOD on Stob Nan Coinnich; Peter Livingstone, 2009



Photo 2: aspen growing on shingle beach on Torrinch island, Loch Lomond; Peter Livingstone, 2009

Short Rotation Forestry (SRF)

The UK has signed up to the EU Renewable Energy Directive which includes a UK target of 15% of energy from renewables by 2020. This target is equivalent to a seven-fold increase in UK renewable energy consumption from 2008 levels: the most challenging of any EU Member State. While such an increase is ambitious, and will be challenging, biomass will play a key part in its delivery. It will also help to deliver the decarbonisation of the energy sector identified by the Committee on Climate Change's first report as a priority if the challenging greenhouse gas emissions targets set in the Climate Change Act are to be met. (Forestry Commission)

Energy companies are interested in the potential for fast growing tree species to be used to provide a solid fuel for electricity generation. SRF grows quickly and can be harvested at between 5 and 15 years of age offering high yields in a short space of time - potentially giving better energy returns than either traditional forestry, woody crops grown as coppice (short rotation coppice / SRC) or Miscanthus grass - and provides material suitable for conversion to both electricity and heat. (Forestry Commission)

According to the Forestry Commission, however, there is little current knowledge of SRF in the UK. This knowledge gap is recognised in the *Scottish Forestry Strategy* (2007), the *Scottish Government Woodfuel Taskforce Report* (2008) and the *FCS Climate Change Action Plan* (2008 - 2010). The Forestry Commission are currently undertaking a number of SRF trials across the UK including 6 sites in Scotland. The range of species involved include:

- Native Aspen
- Alder
- Silver Birch
- Ash
- Sycamore
- Italian Alder
- Red Alder
- Shining Gum
- Tingiringi Gum
- Cider Gum
- Roble Beech
- Patagonian Southern Beech
- Hybrid aspen

EE exist to promote the use of native species and are against the use of exotic species which can have potentially detrimental environmental impacts, especially when native species can provide high levels of productivity. Furthermore the supply of local provenance native species can create more robust systems which are most suited to local conditions. EE believe that native aspen clones offer the widest benefits of all the native species in particular due to their high biodiversity and conservation value. Aspen also has the advantage of being able to colonise marginal land offering a solution to the debate around the substitution of food crops for energy crops. EE's development of a national clone collection will allow the selection of superior clones together with the genetic range to provide genetically diverse systems which will provide optimal resilience in the face of increasing plant disease risks in the UK. Tables 1 and 2 at the end of this report are provided for comparison purposes.

Eadha Biomass Research and Trials

EE is undertaking growth trials using native aspen on marginal land, researching new methods and approaches to propagation, planting and establishment. EE's Central Scotland Green Network (CSGN) funded Growing Green Energy (GGE) Project in East Ayrshire involved the establishment of a 3 hectare trial plantation of aspen on a former opencast coal mine which has negligible topsoil. No soil amendment was undertaken prior to planting. So far the results appear encouraging with good survival rates. Monitoring of tree growth will continue over the next 5 years.

EE have developed a specific model for aspen SRF based on ecological and sustainability principles which maximises both biodiversity and productivity exploiting aspen's unique properties. Over and above its fast growth potential, the unique characteristic of aspen which sets it apart from other trees and which can lead to superior productivity in successive rotations, is its ability to sucker profusely. Suckering can be viewed as a response mechanism and is promoted by coppicing. Trials in Germany have indicated that where a crop of aspen is planted at 4167 stems per hectare (2.0m x 1.2m spacing), a yield in the region of 70t dry biomass per hectare can be achieved at the first 10 year rotation. Following harvesting, as much as 187,000 stems can regenerate which naturally reduces to about 40,000 stems after 5 years through competition. On average two shoots develop from the rootstocks and three from suckers from each plant potentially producing significantly more biomass in subsequent rotations.



Photo 3: Monitoring Eadha SRF aspen trial at Skares Opencast Site
Peter Livingstone, 2012

SRF Species Comparison Tables

TABLE 1: NATIVE SPECIES

English Name	Latin Name	Native to Scotland	Pest and Diseases	Cold Tolerance	Biodiversity Value No of associated plant-feeding invertebrate species	Soil Requirements	Dry Tonnes/ Ha/yr	Rotation	Conservation Designation
Native Aspen	<i>Populus tremula</i>	Yes	Severely browsed by hares, rabbits and deer; resistant to cankers; most resistant poplar but susceptible to leaf spot	Good	223	Broad tolerance including industrial sites and contaminated land (clonal differences)	5.6 – 10.5* <small>*estimate based on clonal performance in trials</small>	15	Rare
Common Alder	<i>Alnus glutinosa</i>	Yes	Not attacked by hares and rabbits; sensitive to diseases on poor sites;	Good	190	Broad tolerance	5.0	15	Common
Silver birch	<i>Betula pendula</i>	Yes	Severely browsed by hares, rabbits and voles; susceptible to some fungal pathogens including cankers	Good	192	Broad tolerance	5.0	20	Common
Ash	<i>Fraxinus excelsior</i>	Yes	MORATORIUM ON PLANTING DUE TO ASH DIE BACK DISEASE	Frost tender but flushes late	101	Requires medium – good fertility	7.4	20	Common

References

A review of the Potential Impacts of Short Rotation Forestry 2006; P Hardcastle, Review Team Leader; LTS International
 Biological Records Centre (BRC); Database of Insects And Their Food Plants
 Aspen – A Neglected Species in Scottish Forestry, Alan Harrison, Forest Research, 2009
 Aspen Growth Trials, Forest Research
 Energy Forestry Trials, Presentation by Alan Harrison, 2010

TABLE 2: EXOTIC SPECIES

English Name	Latin Name	Native to Scotland	Pest Diseases and	Cold Tolerance	Biodiversity Value No of associated plant-feeding invertebrate species	Soil Requirements	Dry Tonnes/ Ha/yr	Rotation	Conservation Designation
Sycamore	<i>Acer pseudoplatanus</i>	No	Very susceptible to bark damage by squirrels. Often suffers from tar spot in autumn.		99	All but dry and infertile soils and waterlogged heavy clays	7.0	20	N/A
Italian alder	<i>Alnus cordata</i>	No	Not attacked by hares and rabbits; sensitive to diseases on poor sites;		N/A	very tolerant, base-rich - acid, clays - sandy gravels	N/A	15	N/A
Red alder	<i>Alnus rubra</i>	No	Not attacked by hares and rabbits; sensitive to diseases on poor sites;		N/A	very tolerant, base-rich - acid, clays - sandy gravels	N/A	15	N/A
Shining gum	<i>Eucalyptus nitens</i>	No	Relatively unsusceptible to pests and diseases	Particularly susceptible to late spring and early autumn frost	N/A	Broad Tolerance	15.0 (S.England)	10	N/A
Tingiringi gum	<i>E. glaucescens</i>	No	Relatively unsusceptible to pests and diseases		N/A	Broad Tolerance	15.0 (S.England)	10	N/A
Cider gum	<i>E. gunnii</i>	No	Relatively unsusceptible to pests and diseases	Can suffer from late spring and early autumn frost	N/A	Broad Tolerance	9.0	10	N/A
Roble Beech	<i>Northofagus obliqua</i>	No	Relatively unsusceptible to pests and diseases	Can suffer from late spring and early autumn frost	94	Not suited to shallow soils over chalk	11.8	15	N/A
Patagonian Southern Beech	<i>Northofagus nervosa</i>	No	Relatively unsusceptible to pests and diseases	Can suffer from late spring and early autumn frost	N/A	Not suited to shallow soils over chalk	11.8	15	N/A
Hybrid aspen	<i>Populus tremula x tremuloides</i>	No	Susceptible to cankers	Good	N/A	Broad Tolerance	13.6 (est.)	15	N/A