

Sixty-first Annual Study Tour New England 13-24 September 2004

Forty-one Society members assembled on 13 September 2004 at Dublin Airport to begin the 61st study tour to New England and the Society's second visit to the United States of America. The flight to Boston was via Philadelphia with US Airways. Professor Pete Hannah, Professor Emeritus, Silviculture, University of Vermont met and welcomed us at Logan Airport, Boston. Pete was the perfect host and guide for the ten days, and worked tirelessly and efficiently to look after the needs of the group. The Society is deeply indebted to him.

We drove west to our first night's accommodation at the Best Western Yankee Drummer Inn in Auburn, Massachusetts and were met by Kathleen Schomaker, Director of Alumni Affairs, Yale School of Forestry & Environmental Studies who had arranged the contacts for the trip.

Over the next ten days the group visited the states of Massachusetts, New Hampshire, Vermont and Maine. The forests of New England are mostly located on abandoned farmland, originally cleared of tree cover in the late 19th and early 20th centuries. The many abandoned railroads and lumberyards testify to the extent of previous harvesting activities.

One would expect the most heavily forested area in America to be the west coast states, but in fact the most forested state is Maine, with 90% forest cover, followed by New Hampshire (85%), and Massachusetts and Vermont (80%). The group learned a lot about the development of the industry but the one thing that defied everyone was the conversion of board feet to cubic metres! It appears like trying to add apples and pears.

John Mc Loughlin, Tour Convenor

Tuesday 14 September

We left the Best Western and headed for our first stop at Quabbin Reservoir Forest, owned by the Massachusetts Water Resources Authority, where we were welcomed by Bruce Spence, the local forester. Located 100 km west of Boston, the reservoir supplies over 1,100 million litres of water per day to over 2.5 million people, as well as generating hydroelectricity.

The forest area covers some 30,000 ha, with the reservoir covering an additional 10,000 ha. Red pine (*Pinus resinosa*) is the main species, but it is planned to convert these areas to broadleaves (white-tailed deer are posing a problem for regeneration). Further north in New England, white pine (*Pinus strobus*) dominates; it is also the main commercial species – whereas red pine was planted more for soil conservation reasons.

While grey squirrels were numerous they were not causing damage to trees, and this appeared to be the case throughout.

The forest is FSC certified, with 20% of the area being retained for conservation. A 100-year rotation is practised, with natural regeneration the preferred option on one third of the area. Clearfells generally vary in size from 20-25 ha, but some can be as small as 6 ha, while others can reach 40 ha. Red oak is the most valuable timber species, but most income derives from pine, as it is predominant species.

We departed Quabbin Reservoir Forest to arrive at Harvard Forest Museum, where we were welcomed by the Director, John O'Keefe. The museum was established to demonstrate the Harvard Forest approach to environmental science, in which a sound understanding of landscape history provides a basis for interpretation and conservation of nature. It was established in 1907, when the forest was established by Harvard University. This historical/ecological approach has proved applicable to modern environmental issues, as it becomes increasingly apparent that changes in nature can only be assessed through long term perspectives.

The museum comprises of a series of realistic looking miniature trees of various species, each species with its unique features, branching form and bark characteristics. It also includes woodland scenes with the appropriate grouping of vegetation, wildlife and landscape features, such as laneways, stone walls, and farmsteads.

After visiting the museum we travelled to Harvard Forest, and were welcomed by Matt Kieley, Professor of Silviculture, University of Massachusetts.

The forest comprising 1,200 ha is located just over 100 km west of Cambridge, Mass. A range of habitats, typical of those found throughout New England occur, including northern, transition and central forest types, hardwood swamp, conifer bog, forest plantation, as well as a 24 ha pond.

The great storm of 1938, which had wind speeds of up to 130 miles/hour recorded, blew down 70% of the pine. Most was unthinned white pine, growing on abandoned pasture land – a type of forest which is quite susceptible to windthrow. After the storm the wood was harvested, the slash was piled and burned, and no further intervention was made.

Appropriately, the first stop was at a 65-year-old stand that regenerated following the storm. It was comprised of oak, three birch species (black, paper and yellow), and red maple, plus a small number of white pine and hemlock. Paper birch and red oak dominated the overstorey until recently, but the birch is now dying back, having reached the end of its life span. Red oak is now the main species, with the larger trees having dbh's of 30-38 cm.

The second stop was at another mixed stand, located on a moist, finely textured soil, with a hard pan layer at about 60 cm. The history of the area is as follows:

1750	virgin forest cleared to create pasture
1843	pasture abandoned
1908	pine overstorey (age 65) removed after good pine seed fall; broadleaf understorey cut back
1912, 1916, 1919	broadleaves weeded by machete, mainly to free best pine seedlings, but also best hardwoods as well

- 1933 very few co-dominant pine, thinning to favour best red oak and paper birch
- 1940, 1947, 1968 thinning to favour best broadleaf crop trees.

By 2004, the largest red oak had a dbh of 55 cm, at 8 m spacing. Standing volume was about 220 m³/ha.

The next stop was at an unmanaged natural stand, about 150 years old. It had never been cleared for pasture but instead was maintained as a woodlot during the period when agricultural land-use predominated. It was harvested in the mid 1800s, but some smaller hemlock were left uncut. These now form the largest trees, at 90 cm dbh. The stand was typical of other small tracts that had never been cleared of tree cover – some of the hemlock are more than 400 years old.

Dinner and overnight was at the Comfort Inn, Concord, New Hampshire

John Mc Loughlin

Wednesday 15 September

We left the Comfort Inn, Concord and headed north for a one hour's drive to the Hubbard Brook Research Foundation (HBRF), near Woodstock in the White Mountain National Park. As we travelled north to higher altitudes there was a noticeable change in climate and tree species. Hickory, red oak and white pine found on the sandy soil began to give way to sugar maple, spruces, paper and yellow birch, and firs such as balsam fir. Most of the forests we passed though were federally owned.

On arrival at the HBRF, we were met by Steve Wingate, assistant ranger. Ian Halm, site manager and forester, gave an introductory talk.



Tour Convenor John McLoughlin, with Professor Pete Hannah, tour organiser and Mike Bulfin, President of the Society of Irish Foresters.

Hubbard Brook experimental forest consists of 3070 ha, set aside by the US Forest Service in 1955, dedicated to the long-term study of forest and aquatic ecosystems. It is part of the international network of biosphere reserves and provides a standard against which the effects of man's impact on his environment can be measured. The first stream was fitted with measuring devices in 1956. Since then water samples, stream flows, and soil profiles and other scientific measurements have been taken on a weekly basis in all kinds of weather conditions. The average annual rainfall is 1400 mm.

Most of the research work is done by co-operators. The Forest Service acts as a facilitator, overseeing management of the watersheds, providing accommodation to researchers and runs an archive centre. Some 85% of the area is now forested, having been completely cut over pre-1900. People come from all over the world to carry out scientific research.

In 1960 the Hubbard Brook Ecosystem Study was established. The study has involved universities, government agencies; disciplines from botany to geochemistry, limnology to avian biology. One of the most important studies to date is acidity of precipitation in North America. Two excellent reports on the topic have been published:

1. *Nitrogen Pollution: From the Sources to the Sea*
2. *Acid Rain Revisited*

Copies of the reports can be obtained by contacting the Hubbard Brook Research Foundation: hbrook@hbresearchfoundation.org or from the website <http://www.hubbardbrook.org>

Ten watersheds, ranging in size from 11.8 to 76.0 ha have had V-Notch weirs installed, and these have been used in hundreds of experiments and studies over the last 50 years. The most important recent development has been the purchase of a parcel of land on the shores of Mirror Lake, which has also been used for experimentation. Soils in the catchment have depths ranging from 1-3 m and are very acidic.

A range of experimental fellings have been carried out. Ecosystem appraisals to date show that stream pH has increased. Natural disasters, such as fire, are the most serious threat to the forests. Most damage is done where areas are left uncut as part of an experiment.

Cuttings opened up for experimental purposes vary in size from very small coupes to 4 ha clearings. In some experiments all the timber was removed from the site, while in others the felled trees were left in situ. Species recolonisation, water yield, nitrate release, nutrient loss from the soil, are some of the topics that have been investigated. Nutrient addition experiments have also been carried out, and calcium (4-5 t/ha) has been applied to bring stream pH levels to those recorded 50 years ago. Data were collected year-round, with streams being monitored on an almost hourly basis.

Experiments have also been carried out on bird populations, especially songbirds.

We left Hubbard Brook Research Centre to visit a series of sites in watershed 5. The first stop was at an elevation of 490-760 m. No felling had taken place since the

1900s, with the forest now comprised of large sugar maple, yellow birch, American beech and some American ash. Some paper birch was also present, with hemlock near the streams. Beech was badly damaged by beech bark disease. Westerly prevailing winds, coming from an industrialised area, are a source of acid rain. Although sulphur emissions have declined, nitrogen emissions have actually increased. Sugar maple and red spruce are the most susceptible to acid rain. Also the absence of oak from the species mix was very evident. The soil water has a pH of 2.9, the lowest in the area - the objective was to increase this to 5.5. Fish stocks are a very big issue.

An experiment to assess the ecosystem response to whole tree harvesting was carried out during the 1983-4 dormant season, with 180 t/ha of biomass removed. In brief the results were:

1. increase in temperature up to 6°C at the soil surface and in the streams
2. increase in moisture content of the soil
3. increase in stream flow volume of 40% in winter and up 20% in summer
4. increase in nitrification
5. increase in nitrate in soil solution
6. no increase in erosion or sedimentation
7. rapid colonisation by pin cherry, seed of which had remained viable in the soil for decades.

At the second stop water flow data were being collected on weekly basis using a V-notch weir/San Dimas flume. The instrumentation was first installed in 1992.

In the early 1960s, Dr F. Herbert Bormann and others proposed the use of the small watershed approach at Hubbard Brook, to study linkages between hydrologic and nutrient flux, in response to natural and human disturbances, such as air pollution, forest cutting, land-use change, increases in insect populations and climatic factors. As temperature can drop to -20°C in winter a propane gas heating unit was installed to prevent freezing and to allow water samples to be taken. A small coupe had been felled near the gauge in 1983; it is now heavily stocked. Pin cherry, paper and yellow birch, and American beech have all regenerated naturally, with no silvicultural operations being carried out.

Steve Wingate was the tour guide for the afternoon. He is responsible for the management of 3070 ha in the Research Centre. We travelled the Triple I road, which led to the Camp community centre, and was once the old railroad station. The surrounding forest was originally agricultural land. Although silvicultural management was practised, forest recreation was very important in the area - with walking, hunting and skiing the main activities. The silvicultural plan was to fell small 0.2 ha coupes, over 20% of the area at any one time. Restocking was by natural regeneration. By keeping the coupes small it was possible to favour paper birch, American beech, red (sugar) maple, with some aspen.

The next stop was an area that had been settled by white people in 1780, and by 1810 much of the land had been cleared for agriculture. Towards the end of the 19th century there was a rapid decline in farming, and by 1890 most of the farmers had left the land. Some forest industries have, however, survived and flourished, such as maple syrup production and bobbin making (using birch).

As industrial development replaced farming, pollution and silting of waterways increased. The absence of forest cover, fear of damage to water quality, together with the demand for public recreational facilities, forced political action. Conservation laws were implemented for some 300,000 ha. Half of the land was managed for recreation and half for a combination of recreation and timber production. No forest management was carried out on areas set aside exclusively for recreation. Timber sales provided valuable revenue to offset the cost of the consultation process, known as scoping.

Timber harvesting was being carried out at the next stop. The area was managed to demonstrate how timber production could be carried out while still protecting the recreational and ecological value of the woodland. The management plan covered a 15-20 year period. About 25,000,000 board feet were programmed for sale, but a detailed and lengthy consultation process had to be completed before the felling programme was agreed. Whole tree harvesting was not permitted, and everything except the main bole was left on the site. Felling coupes were restricted to 0.3 ha for spruce and up to 0.8 ha for hardwoods. There could be as many as 100 coupes comprising each sale. The objective was to use a 100-year rotation, felling small groups at 3 to 5 year intervals, resulting in a more natural, uneven-aged forest.

Consultation involved seven stages:

1. scoping: compiling a list of stakeholders,
2. 30 days for responses,
3. genuine concerns were taken on board and changes made where necessary
4. analysis and reply to stakeholders – with another 30 days to respond
5. consulting with district rangers
6. deciding on alternatives if necessary
7. allow 45 days for objections to the final plan.

The final stop was at a clearfell of about 2 ha of mainly beech (80%), with some yellow birch. Pin cherry was regenerating prolifically on all open sites – the seed had remained dormant, but viable, in the ground for up to 100 years. All logging slash was retained on the site, which created a high nitrogen supply for the regenerating seedlings. Cherry was fruiting after 5 years, providing valuable food for wildlife. Deer caused very little damage; this was more a moose area. Bobcats and lynx were the main predators of deer. Due to actively growing forest, and a lack of old growth, natural fires were not a problem. Baiting to attract bears was allowed in the woodland at certain times of the year and we saw this procedure in progress nearby. Bait is laid in a clearing and the shooters lie in wait for the bears.

Further on, we walked through woodland managed as shelterwood, where 1/3 of the canopy had been removed. The regeneration was being monitored and when the required level is achieved the canopy will be further opened up. Five to seven years later the canopy will have closed over again. There was a question of manipulating the canopy to favour more commercial species, but this was only done in federal forests where commercial forestry was the main objective.

The day finished with a spectacular drive eastwards, from Lincoln across White Mountain National Forest, through the Kancamagus pass to Conway. Climbing the

pass we passed through different plant zones; every 300 m increase in elevation being equivalent to travelling 470 km north. A boreal forest vegetation of American beech, hemlock, sugar maple, yellow birch and paper birch occurs at the lower elevations. At the higher elevation, sub-alpine zone, the species composition is mountain ash, paper birch, red spruce and balsam fir. Paper birch had been seriously damaged by ice. After a photo call at the viewing point we boarded the coach and travelled to our hotel in Conway.

Overnight, Cranmore Inn, Conway, NH

Michael Doyle

Thursday 16 September

Day four of the tour started as usual at 8 a.m. as we left North Conway and travelled to Bartlett Experimental Forest, New Hampshire. Bartlett is located in the heart of the New England tourist and ski country.

The group was met by William B. Leak, Chief Research Silviculturist, Mariko Yamasaki, Research Wildlife Biologist and later by Chris Costello, Research Wildlife Biologist, all of whom work for the Forest Service, U.S. Department of Agriculture.

Bartlett Experimental Forest is a field laboratory for research on the ecology and management of northern forest ecosystems. Research activities began in 1931, when the U.S. Forest Service set aside 2,600 acres (1,052 ha) in the White Mountain National Forest in New Hampshire for experimental studies, as part of the then Allegheny Forest Experiment Station (1927-45). This particular site was chosen because it was representative of soil, elevation, climate and tree species composition found throughout New England and northern New York. Podzols, with a rich humus layer predominate, and have developed on glacial till derived from granite and gneiss. In many places the soil mantle is very shallow - boulders and rocks are commonplace. The climate in the Bartlett area, where elevation ranges from 210 to 910 m (the summit of Upper Haystack mountain), is characterised by warm summers and cold winters. Annual precipitation is 1300 mm, evenly distributed through the year.

Research at Bartlett includes:

- investigations on structure and dynamics of forests at several levels, and developing management alternatives to reflect values and benefits sought by users of forest lands
- deriving a better understanding of ecological relationships between wildlife habitats and forest management at various levels, in order to integrate wildlife habitat maintenance and improvement with other forest management goals
- preservation of undisturbed areas in the Northeast US to study natural succession and anthropogenic impacts.

Silviculture/ecology research

In 1931-32, a 100 x 200 m grid was laid down comprising 500 permanent, 0.1 ha square cruise plots. After an initial measurement of all woody stems larger than 3.8 cm dbh, a majority of the plots (441) was remeasured in 1939-40 and again in 1991-

92. This 60-year dataset includes areas (55%) that were cut for experimental purposes using single tree selection, diameter-limit cutting, group selection, clearcutting, shelterwood and thinning. The remainder of the forest has not been harvested since at least 1890. There have been no recent fires, but a hurricane in 1938 did substantial damage, particularly at the higher elevations, and the area sustained severe damage from beech bark disease in the early 1940s. Two other natural disturbances may be occurring - red spruce decline associated with acid deposition, and migration of tree species upslope as a result of climate warming.

Wildlife research

Wildlife relies on the array of forest and riparian habitats located on the extensively forested mountain slopes. Non-forested and aquatic habitats are minor components of the overall landscape. At least 15 species of amphibians and reptiles, 90 bird species and 35 mammal species are known to occur in the area. Moose and black bear occur, as do salamanders and wood frogs, as well as a number of raptors (red-tailed hawk, goshawk, barred owl and saw-whet owl), a number of neotropical migratory birds, permanent residents (pileated woodpecker and ruffed grouse), winter residents (crossbills and redpolls); and an array of bats, small mammals, forest carnivores (weasel, fisher, bobcat), snowshoe hare and white-tailed deer.

The most serious problem facing woodland managers is a lack of knowledge about the ecological relationships between wildlife habitat and forest management in northern hardwoods and associated ecosystems. This information is essential for integrating wildlife habitat maintenance and improvement with other forest management goals, including timber production and maintenance of aesthetic qualities.

The primary objectives of wildlife research are:

- refining and expanding the ecological classification to better define vertebrate species concerns
- evaluating silvicultural effects on wildlife species that use the northern hardwood/mixedwood types
- improving and developing silvicultural prescriptions that effectively integrate timber production and wildlife habitat improvements and
- extending wildlife habitat investigations into forested wetlands, riparian and aquatic systems typically associated with the northern hardwood and associated types of the region.

Research has concentrated on amphibians, birds and small mammals, as there is work being carried out elsewhere on traditional game species. Habitat research on forest carnivores and moose is also carried out.

Our first stop was at a 12/13-year-old group patch selection of white ash (*Fraxinus americana*) with an understorey of American beech (*Fagus grandifolia*) and eastern hemlock (*Tsuga canadensis*). Group patch selection is clearcutting on a small scale, usually no more than 1/3 ha, often within the boundaries of younger or older stands. Natural disturbance cannot be counted on to promote regeneration, as fire risk is minimal.

Eastern hemlock and American beech are not high value timber trees but are important for wildlife. All operational costs are paid for through commercial timber sales. The management plan for the area is to integrate timber and wildlife habitat over time, and is drawn up by an ecologist and a forester. The size of opening and age class are important because they influence bird breeding success. The site had a variety of habitats and microhabitats for birds.

Coarse woody debris is left to favour woodpeckers, carpenter ants and mushroom feeders.

Pre-commercial early thinning (at around 25 years of age) is an expensive operation and often the response does not justify the cost. Where it is carried out 50-100 final crop trees per ha are released. Normally, sites are left until a commercial sale is possible.

Work done in the research forest develops standards for work practices. By consulting with foresters who demonstrate and practice on private land the results filter out to the different kinds of ownership. Workshop tours are also held.

A Sustainable Forest Initiative controls industrial forests, with federal forest land, however, everyone has a say. Water quality and cutting near roadsides are controlled by regulation. The agricultural sector is small in the state so there is not as much pressure on farmers in regard to water quality and is not an issue to the same extent as it is for foresters.

The next stop was a 50-year-old paper birch (*Betula papyrifera*) stand. Paper birch is a good wood-turning species and is also used for shoe pegs and toothpicks. The management plan was to let nature do the work. As a result, the site now comprises an admixture of American beech (*Fagus grandifolia*)/red maple (*Acer rubrum*)/yellow birch (*Betula alleghaniensis*)/white ash (*Fraxinus americana*).

Typically, based on a 120-year rotation, only 1% of area is clearfelled at a time. Loggers have complained that it is more costly to harvest smaller lots and are seeking to harvest larger-sized areas. The outturn from group patch selection is usually half-and-half pulp and saw timber. Logging machinery has become more sophisticated and allows greater site accessibility. With full tree felling the slash must be brought back into the forest and spread out to allow coarse woody debris to build up.

Birds utilise different tree species, so diversity needs to be maintained to provide structural and feeding habitats, and to aid fledgling success. An important factor in the management plan, therefore, is the encouragement of a broad array of tree species.

We moved to a 2 ha 'liquidation' clearcut, done 50 years ago. Loggers were allowed to do as they wished and as a result the area was decimated - the motto of New Hampshire is *Live Free or Die*. A sign saying "Poor cutting practice" was put up on the area when it was clearcut, but it had to take down some years later when it became clear this was not the case. The area was allowed to regenerate naturally and now has a mixture of species growing successfully. Ironically, the potential end value of the timber on the site is higher than if the area had been managed.

The next stop was at a deferred shelterwood of yellow birch (*Betula alleghaniensis*) and white ash (*Fraxinus americana*). The management plan is to

leave the area for 30-50 years before going in to open it up to allow species to regenerate. There was a heavy beech understorey and a dense scrub layer, which is good cover for birds, especially thrushes. The area will be left until it can make a good pre-commercial thinning, as it is too expensive to intervene before that time.

Studies of Northern hardwood species have shown that windthrow is not a problem in the area. Overall there is not a lot of natural disturbance as hurricanes are very rare.

The group was joined at the next stop, a 5-year-old clearcut of paper birch/yellow birch and pin cherry (*Prunus pensylvanica*) by Ms Chris Costello. The cherry is used as a nurse species as it has no commercial value, not even as pulp. The area is being used to test different treatment options, using the range of tree species present.

From a wildlife perspective the site provides pre-migratory habitat by birds, with the pin cherry berries providing food. Cherry seed can lie dormant in the ground for 100-150 years before germination, and following germination and growth it can fruit for 20-30 years. Bears and moose occurred in the area.

There is a dramatic increase in bat activity in new open area; nine species occur, one of which is on the Federal endangered list. Three species are migratory while the rest are residents and roost in nearby worked-out mines. Recreational caving during winter disturbs bats' hibernating.

Deer densities are low – just 3 per 400 ha. This is because of the lack of feeding habitat, consequent on low levels of regeneration, and low winter temperatures which militate against survival. Shooting of hinds is not permitted in the White Mountain Area.

We moved to the next stand, managed using a single tree selection system. It was planted as a pure crop of American beech (*Fagus grandifolia*), a shade tolerant species. Interventions were made every 15 years or so, removing between one quarter and one third of the standing volume. Beech is not high value timber. Between 80-90% of stand was affected by beech bark disease (*Nectria coccinea* var *faginata*).

There were nine long-term mammal-sampling points located at the site, where 26 small mammal species have been recorded. Mountain lion (most likely bobcat) is periodically seen. Wolves have been known to move down from Quebec but there is no reproducing population of wolves at present in vicinity. The mountain lion has not been confirmed in New England for several years; recently in persons in nearby Maine claim to have seen mountain lions but no photographic evidence has been produced.

Our final stop of the morning was at a 10 ha clearcut that was now 70 years old. A commercial thinning had been carried out three years ago, removing mature aspen (*Populus tremuloides*) and paper birch. Maples, white ash and yellow birch have been left to mature. The management plan for the site is to leave it for another 50 years; at that stage it may be clearfelled or group patch selection may be carried out. White ash (*Fraxinus americana*) does not show signs of discolouration, which is usually related to early injury. There is no deer problem in the area.

For many years aspen had been discriminated against and was not a focus of management. However, in the opinion of ecologists, who have some influence over

species composition of stands, aspen should be grown more, which will encourage more wildlife. Finally it was noticed that yew (*Taxus*) grows in the area but only as a shrub - Pete Hannah told us that in New England deer love yew, and it is thus seldom seen.

Having completed our visit and after a picnic lunch, the three leaders were thanked for their time and enthusiasm, and were each given a gift on behalf of the Society.

Overnight, White River Junction, Vermont.

Bridgid Flynn

Friday 17 September

We headed for the Green Mountain National Forest, where we were welcomed by Chris Casey and Bill Collpepper.

Chris explained that National forests were set up to provide watershed protection and continual forest resources for the nation. They are managed by the United States Department of Agriculture (USDA) Forest Service. Each national forest is part of a larger National Forest System that includes more than 150 forests from Alaska to Puerto Rico.

Green Mountain National Forest was established in 1932 after uncontrolled logging, fire and flooding had ravaged the state of Vermont. Today, the Green Mountain National Forest has grown to almost 160,000 ha, stretching nearly two-thirds the length of Vermont. The forest is within a day's drive of 70 million people.

Half of the forest is available for multiple use forestry and half for conservation. This makes management difficult, but it is achieved by consultation, preservation orders, settlements, appeals and the courts. Since demands vary greatly, reaching a balance is a constant challenge.

With the decline of farming from the early 1900s forest cover has now reached 80%, mostly through natural regeneration. There is a more open landscape in Vermont, evidence of more glacial activity, unlike New Hampshire which has dense forest interspersed with many rivers.

Deer management is an important element of forest management: since 1975 there has been a shift in emphasis to larger clearfells to provide 3-5% open area for over-wintering deer populations.

Our next stop was the Robert Frost Interpretive Trail; a very popular attraction. Frost spent many summers enjoying the surroundings along the trail. Walkers are reminded of his work by plaques along the trail which carry extracts from his work. His best known poem is Stopping by Woods on a Snowy Evening, which includes the famous lines:

*The woods are lovely, dark and deep.
But I have promises to keep.
And miles to go before I sleep,
And miles to go before I sleep.*

Over the last 50 years in Vermont abandoned farms reverting to forest have more than offset losses of forest cover due to development. It is doubtful, however, if this

will continue over time because of the diminished number of farms and increased development pressure from a growing population.

Population increases also influence how the forest is used. Greater demands are now being placed on forests to produce both traditional and non traditional benefits and values. At the same time, parcelisation of timberlands into smaller holdings has made it more difficult to use the forest in traditional ways. Landowners with small holdings are less likely to manage their forests for timber production, and because many of these small tracts also contain homes, their owners may be reluctant to allow others to use their land.

The period from 1948 to the present has been remarkable for the return of Vermont's forest cover. As these forests are maturing trees are increasing in size, and in terms of species composition. Health surveys are indicating that the forests are in a good condition.

The challenge for the future will be to avoid a reversal of that good fortune, while sustaining the delivery of the variety of goods and services that a growing population expects from the State's valuable resource.

Overnight Bolton Valley Resort Hotel, Vermont

John Mc Loughlin

Saturday 18 September

We had a well earned rest in the morning before heading off to Butternut Mountain Farm, Morrisville to see maple syrup production. Our host was the owner, David Marvin who is also a Consultant Forester.

We expected to see the traditional method of harvesting, with a bucket to collect the raw syrup hanging under where the bark was cut. Instead, what we witnessed was a most sophisticated method of production. Sap is collected by a system of crisscross lines over the 400 ha which surrounds the processing unit. The lines collect every drop of sap from the trees for storage in two 75,000 litre (20,000 gallon) tanks. A combination of slope and a large sugar rush make this possible. Prior to boiling excess water is removed, using a reverse osmosis system, which pushes the sap through membranes at high pressure. As well as concentrating the sap this process reduces boiling time, and the holding space required. The system can process 11,000 litres (3,000 gallons) of liquid per hour, producing about 2,000 litres (700 gallons) of concentrated sap.

More than 100 years ago in Vermont, Charles Jones devised what has become known as the 'the Jones rule of 86'. This works on the simple principle that the number of gallons of sap to produce one gallon of syrup will vary with its sugar content. For example, if the sugar content of the sap is 2%, 86 divided by 2 gives 43 gallons of sap to make one gallon of syrup.

Overnight Bolton Valley Resort Hotel, Vermont

John Mc Loughlin

Sunday 19 September

Sunday morning was free and we drove to Burlington, the largest town in Vermont (with a population of 40,000 people), where we took a boat trip on Lake Champlain. With a length of some 50 miles it forms the boundary between Vermont and New York states, and Canada the north.

Overnight Marriot Fairfield Inn, Burlington

John Mc Loughlin

Monday 20 September

Waterbury Vermont - management on state forest lands

Steve Sinclair, Russ Barrett and Diana Fredrick met the group. Steve Sinclair gave a brief outline of the issues and challenges facing the forest industry in the state of Vermont. Over three quarters (78%) of the state is tree-covered (2 million ha). Ownership is mainly private (80%). The overall health of forest stands in the region is thought to be improving.

Uneven age class spread is a problem for forest management. Another problem is the continuing fragmentation of already small ownerships (average 20 ha), due to road and house building. An additional problem is the falling number of people hunting deer, leading to an increase in deer numbers and the resulting problem of securing successful natural regeneration.

Diana Fredrick led the group through an impressive 70-year-old stand of white pine. Prices for standing timber have been rising for a decade, and are continuing to rise. Sales are made on the basis of dbh and height. Pine sells for \$150/1000 board feet, compared with \$700 for sugar maple. All revenue from sales on state forestlands goes to central coffers.

The local sawmill industry suffers from competition from Canadian mills, which are a short distance (100- 160 km) away. They have a cost advantage due to government support (0% interest, health insurance advantages etc.) and transport costs are low due to backloading on lorries that bring softwood lumber into the US.

Harvesting in the state is moving from grapple skidder and chainsaw felling, to feller buncher and forwarder/grapple skidder.

Beaverbrook (Marshfield)

We visited privately owned woodland in the afternoon, led by Richard Carbonetti (forest consultant) and Russ Barrett. The owner had bought the property mainly for developing it for skiing and orienteering. It would normally attract a land tax of \$114/acre/annum but this was reduced to \$2.50/acre on agreeing to manage the area under a 10-year plan. Together with the owner Richard had drawn up a plan, which had as its main objective to manage the woodland in a sustainable way, compatible with the recreation objectives.

The woodlands comprise areas of spruce and cedar, mixed broadleaf and conifer, and pure broadleaves. An area of 32 ha (80 acres) has been left unstocked, including a small lake. The previous owners had a policy of minimum management with a primary focus on wildlife promotion. The shape and composition of the property has been influenced by the hurricane of 1938 and the ice storm of 1998. The damage and

disruption caused by the 1998 storm had in fact led to an increase in harvesting and regeneration, which allowed the management of the property to be brought up to date.

The return from felling was in the region of \$500-630/ha per harvest period. Each year's increment adds about \$40/ha, on a 15-year thinning cycle.

White pine is harvested using a full tree system, with assortment segregation into veneer and other products taking place at the mill. Harvesting on wet, soft areas is done when the ground is frozen; the maximum skid distance for the property is 400 m. The main aim of thinning is first to enhance recreational value, with a secondary silvicultural objective of removing fir from white pine and cherry stands, and less valuable species from yellow birch and sugar maple stands.

A discussion on the constraints imposed on the forest industry by the green and suburban lobbies highlighted a common complaint heard during the tour. These restrictions thwart the proper and beneficial management of forests in the state; interventions that were badly needed could not be done, especially on state lands, as these offended the sensibilities of the lobbies. Clearfells that would allow valuable species such as yellow birch, sugar maple and red oak to establish were not permitted, and those thinning interventions that were allowed tended to favour less valuable, shade-tolerant species. Additionally, the constraints placed on the processing industry were causing problems in terms of being able to sell small lots – due to distance from mills.

Deer control figured largely management plans; high levels posed problems for regeneration. The problem is being tackled by encouraging hunting.

Overnight Eastgate Motor Inn, Littleton, New Hampshire

Paddy O'Kelly

Tuesday 21 September

As the tour departed Littleton our attention was drawn to the strip shelterwoods found in the area near Goram. These natural stands of white birch established themselves due to the influence of fire on the mountain vegetation. The slash on the ground is often burned by frequent forest fires in the area, and white birch can withstand the impact of fire as it passes. Fires are uncommon these days. In the past during heavy logging in the White Mountains fire was common, and any birch that survived in the clearcut, or birch on the perimeter was the source for natural seeding of birch following the fire. Expanses of white birch merged into areas of pure paper birch - the raw material for a local pulp industry.

We crossed the state boundary at Gilhead and entered Maine. Here the changing leaf colour during autumn is spectacular and is a lucrative tourist attraction. It is widely publicised - visitors are welcomed by signs such as "welcome leaf peepers". Three factors influence autumn leaf colour: pigments, length of night and weather. The timing of colour change and leaf fall is regulated by the increasing length of night - as days grow shorter and nights grow longer and cooler, biochemical processes in the leaf lead to a colour change and consequently a dramatic change to the landscape.

There were two mills in the area, in addition to preparing chips for the paper industry they are diversifying into toys and dowels.

Proceeding through the village of Bethel we crossed the Androscoggan River – used in the past for log transport. Small rivers were dammed up with small logs which were then released to flow at a fast pace down to the lowlands where they were collected and sawn, or transported to other locations. The last log drive on the Androscoggan was in 1976, when the practice ceased due to debris damage to the river and a resultant detrimental effect on fish life.

The main stop of the day was a visit to a natural forest management site, managed by the Seven Island Land Company. The site is part of a 610,000 ha (1.5 million acre) holding which came into the ownership of a family in 1840, and is now extending to the eight generation. We were introduced to John McNulty who is in his twenty seventh year of employment with the family.

The natural forest management system involves no planting. During the thinning operation certain species are selected and left to grow to maturity. Factors such as species' life span and predicted future markets for the species influence the selection process. In this forest balsam fir has a shorter life expectancy than the spruces. Red maple is considered inferior to sugar maple - so the spruces and the sugar maple are retained if possible.

The thinning operation is carried out by a circular saw attached to a long arm on a machine which fells and then tows approximately five felled trees to the loading area on the roadside. Here the trees are debranched by the same machine and crosscut into the required lengths, which are then stacked to await collection by the timber trucks. The first cross cut is made at 20 cm diameter, with the length above classified as pulp and cut at 7 cm.diameter top diameter. Lengths below the 20 cm.diameter point are classified as sawlog.

When the branches build up at the loading area they are dragged back into the thinned – the operation is called 'carry back in' - and are spread over the thinned area.

About 750,000 m³ of roundwood is harvested per year, with 80% being harvested using the method outlined. The haul distance is planned to not exceed 500 m. The mill is 125 km distant, with truck and load weighing 55 tonnes.

The next site had a shallow hardpan soil; some drainage had taken place, which had improved the quality of the hardwoods. The area was regenerated in 1938 and now comprises mainly spruce and fir. Aerial application of herbicides is permitted in Maine; this relaxation of regulation has proved beneficial in managing forests.

We moved to the Rangeley Lake Heritage area of the forest, to an amenity area which is used mainly at weekends for boating and other outdoor pursuits.

Finally, we were taken to an area that had undergone a number of thinnings over a period of time – with stems generally well spaced and a very promising crop of sugar maple and white ash. These will be grown to a breast height diameter of 30-38 cm, when they will be felled for commercial sawlog. The 'carry back in' material was still evident throughout the area, but had decomposed to some extent.

So ended our first day in Maine, a state that has 90% forest cover, and which provides a return on investment of 6-8% real in terms.

The diverse ownership of forest land in Maine has led to it having a distinct forest policy and Forest Act. One manifestation of this policy is the limitation placed on clearfell size: up to 8 ha (20 acres) there are no restrictions, larger areas up to 30 ha (75 acres) require a plan to be submitted, but no permission is required, and for areas up to 70 ha a certain amount of the area must be set aside for a number of years.

Dinner and overnight Lafayette Fireside Inn, Auburn, Maine

Frank Nugent

Wednesday 22 September

We drove to Gray in Maine to visit red oak and white pine forests. We were met Clifton F. Foster, a Consultant Forester for 40 years and also a forest owner, and Steve Chandler the forest owner. Steve owns 1,200 ha of woodland that has been in the family since the 1700s. Urban sprawl is now putting pressure on the forest land.

The main soils in the area are Buxton silt loam and Paxton very stony fine sandy loam. Both of these sites are classified as Class 1 for tree growth.

Hardwood trees require deep, moderately well drained soils for maximum growth. Root penetration is at least 60 cm on these soils, which hold water very well. Of all soil attributes drainage is the most important, as it affects not only the water regime but soil fertility and aeration which are important for tree growth. Tree vigour is also superior, particularly when it comes to resisting insect and disease attacks: these soils provide that vigour.

Soils in Maine are highly variable; a single woodlot can contain 10 or more soil types. However, soils can be grouped by drainage classes and managed accordingly.

Stop 1, white pine was cut in 1910 and re-grew naturally; it has been thinned five times since 1955. The crowns are now suffering from die-back due to ice damage. The crop was pruned which was a costly investment.

Stop 2 was a site that was planted with white pine (*Pinus strobus*) after ripping. Due to competition from red oak the pine was being drawn up, resulting in good height growth.

Stop 3 was a crop of white pine, planted 12 years ago through grey birch, with the pine growing well through the competition.

Stop 4 was at an oak/pine mixture. White pine weevil does not like shade, the oak will be taken out when the pine reaches a sufficient size and the threat of weevil damage recedes.

Stop 5 was at gravel pit, with an adjacent aquifer. More gravel could have been removed but the aquifer had to be considered. Red and white pine will be planted when the extraction ceases at the pit, as they grow well on gravel.

Stop 6 was a stand of 3-year-old white pine planted in mixture with red pine. There is a symbiotic effect which benefits both species. However, ATVs (all terrain vehicles) driven for by townspeople have in some cases destroyed up to 80% of the young trees.

In the afternoon we visited Freeport, Maine and after an al fresco fish meal we bade goodbye to our genial host Professor Pete Hannah for being such a wonderful and informed guide.

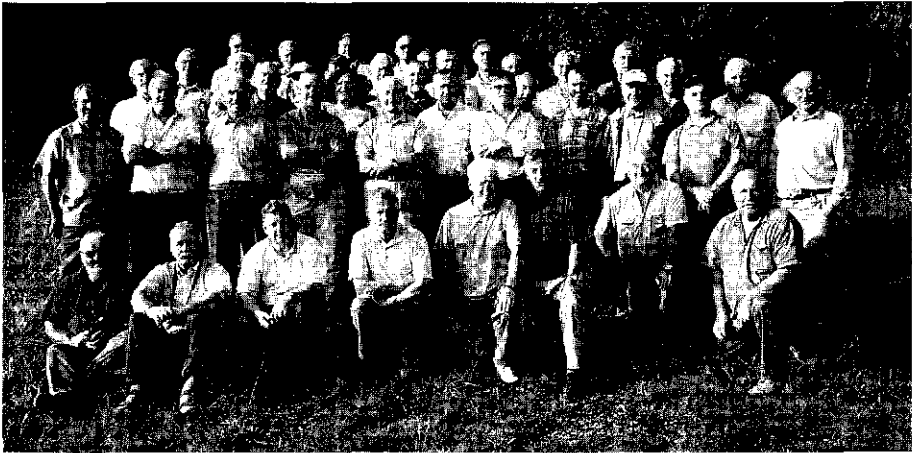
Dinner and overnight Lafayette Fireside Inn, Auburn, Maine

John Mc Loughlin

Thursday 23 September

In the morning we headed south to Boston where we had some time to sample the city before heading to Logan Airport for our departure home.

John Mc Loughlin



Participants:

Peter Alley, PJ Bruton, Michael Bulfin, Michael Carey, Richard Clear, John Connelly, Jim Crowley, Michael Doyle, Ken Ellis, Jerry Fleming, Brigid Flynn, Matt Fogarty, Tony Gallinagh, Sean Galvin, Christy Hanley, George Hipwell, Liam Howe, Larry Kelly, Eddie Lynagh, PJ Lyons, Tony Mannion, Ted McCarthy, Pat McCloskey, Kevin McDonald, Tom McDonald, Michael McElroy, Jim McHugh, John Mc Loughlin, (Convenor), Brian Monaghan, Liam Murphy, Jim Neilan, Frank Nugent, Michael O'Brien, Pat O'Callaghan, Liam O'Flanagan, Derry O'Hegarty, Paddy O'Kelly, Tim O'Regan, Denis O'Sullivan, Joe Treacy, Coleman Young.