In this chapter, reconstruction of long-term forest dynamics will be demonstrated, using the data collected in some of the forest objects under study that have a relatively long history of spontaneous development with minor human interference. Two forest reserves have been selected as examples of reconstruction of cyclic developments in European lowland forest. A third forest gives an example of deviation of cyclic processes under grazing pressure. Present forest structure and species composition, tree measures and architectural codes collected for the individual trees in the core area (Chap. 3) in combination with historical maps and written documents descriptions of former use (Chap. 3) can explain much of its developmental history. Tree rings can be used to reconstruct forest growth. Dead wood and traces of uprooting (Chaps. 3 and 4) sometimes give an indication of forest dynamics that dates even further back than the tree ring information.

7.1 Cyclic Forest Dynamics in the 600 Years’ Unexploited Beech Forest of Fontainebleau (France)

The strict reserve of la Tillaie (34 ha) is part of the 17,000-ha state forest of Fontainebleau. The reserve is situated on a plateau, 135-140 m above sea level, in a hilly country that geologically belongs to the basin of Paris. The climate is of a maritime type with some continental influences. The subsoil of limestone is covered with a sand layer of 0.3 to 2.0 m thick. Dependent on this depth, different soil types have developed, each type carrying its own characteristic vegetation (Lemée 1978).

In the thin sand cover, up to 80 cm, calcareous brown earths occur with a woodmelick-beech forest (Melico-Fagetum) according to Trautmann (1972) and Van der Werf (1989). The Melico-Fagetum is a pure beech forest (Fagus sylvatica) in which Acer campestre and Fraxinus excelsior occur in small numbers in regeneration groups under canopy gaps. The herbaceous layer is dominated by Brachypodium sylvaticum, Melica uniflora, Festuca heterophylla or Ruscus aculeatus. Under canopy gaps Calamagrostis epigejos, Brachypodium pinnatum and Rubus fruticosus agg. occur.

In deeper sandy profiles, leaching of iron and humus led to the development of a podsol. Vegetation on these podsolts can be characterized as a sessile oak-beech forest (Fago-Quercetum). Besides Fagus sylvatica, a small number of Quercus petraea can be found. A thin shrub layer is formed by Ilex aquifolium. Characteristic species for the thin herbaceous layer are Deschampsia flexuosa, Carex pilulifera and Lonicera periclymenum, while characteristic species of the Melico-Fagetum are absent. Clearings are mostly overgrown by a dense vegetation of Pteridium aquilinum.

In 1982 two core areas (70 x 140 m) were charted. Core area I represents the Melico-Fagetum and core area II the Fago-Quercetum. The regeneration mosaic shifts
over 15 years could be retraced by comparison with tree-crown mapping (scale 1:1000) by Bouchon et al. (1973) and were published by Van Baren and Hilgen (1984) and Koop and Hilgen (1987). In 1987, when herbaceous transect area relevés were reassessed, tree rings were sampled in the woody transect area, together with a central square area measuring 40 x 40 m. One hundred trees with Dbh > 10 cm were cored twice at breast height. The results were processed as described in Chap. 6.

7.1.1 Historical Analysis

Unwritten Data

Pollen analyses (Guillet and Robin 1972; Lemée 1981) had revealed that since the eighth century the forest area developed from an open grassy oak forest to the present almost pure beech forest. 14C Dating and species identification from charcoal remnants by Jaquiot et al. (1973) confirmed that La Tillaie was an exploited oak forest during the eighth century. The name la Tillaie refers to Tilia. At the present only few Tilia cordata trees have survived and pollen analysis reveals that since the eighth century Tilia has played only a minor role in species composition of the forest.

Clear-Cut in 1372

In the fourteenth century, the forests of Fontainebleau became part of the heritage of the king's widow. Part of the forest was cut as a source of income (Tendron 1983) including the forest compartment named "Coup des Reines" near the present forest reserve. A document of 1372 mentions the sale of high trees in the compartment of la Tillaie, probably for building purposes in Paris (Grand-Mesnil 1982). In the forest of Fontainebleau old broadleaved high forests have been preserved as a royal hunting field and to provide a scene of ancient woodland around the palace of Fontainebleau. As compensation for the damage caused by the high numbers of deer, local inhabitants gained the right of cattle grazing and collection of dead wood and litter (Tendron 1983).

Management Plan of 1664

The first management plan (Barillon d'Amoncourt, 1664) describes all forest compartments and their subdivisions in great detail. The forest sites "Petite Tillas" and "Grande Tillas" described in this plan can be traced on the map of Mathis (1725). The individual subdivisions of both forest sites can be located quite accurately because embracing forest sites, adjacent roads, the size of areas and sometimes soil conditions are mentioned. As can be seen from Figure 7.1, the present forest reserve is covered by the subdivision D and E of "Petite Tillas" and subdivision B of "Grande Tillas". Plot I is covered by subdivision B and plot II by subdivision E. Part of the management plan (Barillon d'Amoncourt 1664) concerning both plots has been translated below.