PRUNING TREES: THE PROBLEM OF FORKS

by Christophe Drénou

Abstract. The term “fork” in a tree describes an axis that gives rise to two or more equivalent axes, which together form sharp angles. Forks can appear on the trunk or on the branches at various times in the life of a tree. A fork on a trunk during formation is a potential defect likely to ruin the straightness of the tree, reduce the length of the trunk, and lead to enclosed bark. For these reasons, it is generally advisable to eliminate forks and straighten large branches by formation pruning. Not all tree forks are alike; some require intervention, but others are reabsorbed on their own. We propose classifying forks into four major categories: temporary forks, recurrent forks, main forks, and accidental forks. Each category is the subject of a morphological description, an analysis of the causes of forking, a prediction of the length of life of the forks, and a discussion on the advisability of formation pruning.

Key Words. **T**ree architecture; formation pruning; pruning; forks.

Forks often are considered tree defects, and it is generally advisable to eliminate forks and straighten large branches by formation pruning. The act of systematically and repeatedly removing forks to obtain straight, vertical trunks is a long and stressful procedure. How does one avoid unnecessary pruning and thereby reduce on-site job time? We propose classifying forks into four major categories. Some forking situations require intervention, but others are reabsorbed on their own.

TEMPORARY FORKS

In a forest environment, it is not unusual to encounter young forked plants less than approximately 6 m (20 ft) high, growing like bushes or forming a table. Such trees most often grow in unfavorable light conditions, in particular in dense forests, and are waiting for their environment to improve (Figure 1).

The growth of Castanea sativa is sympodial. Every year, the terminal part of any axis dies and a new axis, called a relay, comes out from an axillary bud to ensure its continuity. When the environment is optimum, the axis arising out of the seed creates, at the outset, a trunk and branches that are clearly differentiated. If, on the other hand, the light is too weak, the young plant does not produce any well-defined relays on each shoot (no apical dominance). The relays form a group of sagging forks. If the plant manages to gain back its vitality, it sends sprouts out from the latent buds on the base, or, less frequently, one of the shoots of this particular year takes on a dominating character. In both cases, the new vigorous axis can make up the future trunk, or fall down again after a few years into a system of temporary forks. Some individual specimens seem irremediably stuck at times in this temporary structure (Bourgeois 1992).

When light is too weak, Fagus sylvatica also takes on its own way of developing. The tree is thin, upright, and practically devoid of branches; it shows a small, flat crown, resulting in sagging of the terminal part of the trunk and of the last lateral axis formed. As with the chestnut tree, this temporary fork can be reabsorbed on its own if the beech goes from a dense forest to a thinly planted forest (Nicolini and Caraglio 1995).

Neither of the preceding examples is an isolated case. Quercus robur, Q. petraea, and even some conifers, such as Cedrus, can show temporary structures (Sabatier and Barthélémy 1995).

RECURRENT FORKS

Some varieties are made up solely of axes with a horizontal direction of growth of which only the basal part is elevated. Each sagging module is inserted in the curved area of the preceding one and forms, along with the preceding one, a fork (Figure 2). This method of growth is quite prevalent (Robinia pseudoacacia, Ulmus spp., Zelkova serrata, Celtis australis, Gleditsia triacanthos, Cercis siliquastrum, etc.), and is characterized by the recurrence of forks superimposed on each other. Only the raised base of the axes is perennial, with the horizontal section playing the role of a branch that is quickly deciduous. Forks are therefore reabsorbed in time and then take on the individual characteristics of a trunk that at first is

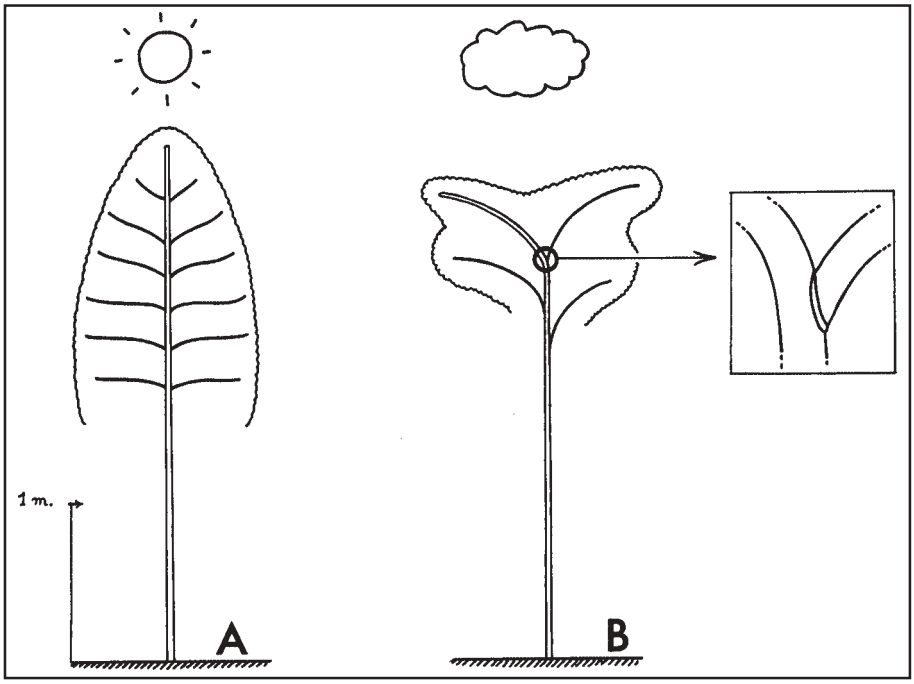

Figure 1. Beeches (Fagus sylvatica) are especially sensitive to light conditions. In open forest, the trunk is straight (A). In dense forest, the tree takes on a temporary architecture, which characterizes itself by a terminal fork and a small flat crown (B).

twisted but becomes perfectly straight as it grows in diameter (de Reffye et al. 1991).

With Quercus robur and Q. petraea, there is a tendency for a fork to form at the end of the trunk each spring. This fork is hereditary, resulting from the conjugated effect of sympodial growth and weak apical dominance. There is an annual abortion of the leading bud, and each time, several oblique lateral axes develop at the same time. These recurrent forks are most often reabsorbed two years after their appearance. One of the shoots of each fork acquires a dominance over the others, straightens itself out, and becomes an extension of the trunk (Drénou 1994).

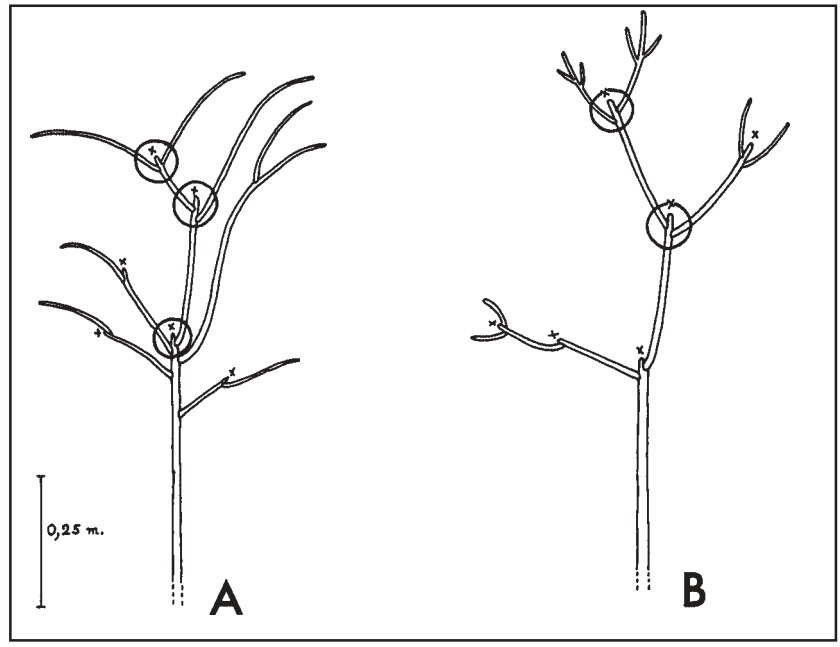

Figure 2. Recurrent forks appear each year at the end of the trunk and reabsorb themselves after two or three years. Zelkova serrata (A) and Quercus robur (B). Forks are circled.

MAIN FORKS

It is advisable to make a clear distinction between a fork on a young tree, on which pruning has barely been started, and a strong fork that is meant to bear the main branches of an adult tree. This main fork marks the end of the trunk's edification, at which time the trunk then goes into an enlargement phase. The appearance of a main fork is the result of a slow, progressive metamorphosis of the branches. Therefore, while a young tree is growing in height, the branches that develop one after the other are gradually straighter and straighter, and end

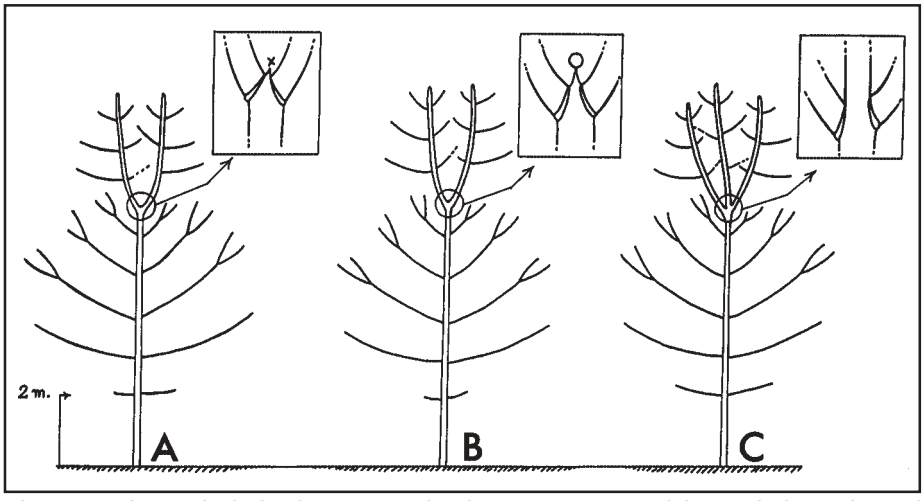

Figure 3. The main fork of a tree marks the appearance of the main branches of the crown. It is the result of a progressive straightening of the trunk's branches and can be expressed later by death of the apex, shown on Populus nigra (A); of terminal flowering, shown on Juglans regia (B); or of a perfect equivalence between the trunk and the main branches, shown on Prunus avium (C).

up acquiring a trunk morphology (phenomenon of reiteration). At this time, an initial main fork is formed (Figure 3).

With Populus spp. that have a monopodial growth (growth is monopodial when the continuity of the axis is provided by the leading bud), the high branches end up competing with the trunk whose apex dies. Prunus avium, which also has monopodial growth, sets up the main fork without prior death of the apex, and the trunk continues growing after the appearance of main branches. Juglans regia, in the absence of trauma, most generally forms the main fork following terminal flowering of the leader (Barthélémy et al. 1995).

The appearance of a main fork generally is preceded by a wave of forks appearing on the branches. These lateral forks grow closer and closer to the trunk, from the low branches toward the top, and end up foretelling the main fork coming into being directly on the trunk. In the field, observation of branches is a means of locating a tree's first main fork ahead of time, the height of which varies considerably according to the environments, the methods of silviculture, and the genetic origin of the trees.

ACCIDENTAL FORKS

During the development of a tree, many things can damage the end of the leader, such as rodents, deer, birds, and insects; climatic accidents (freezing, wind, drought); and other events. The tree tries to restore the missing part, but this regeneration is not always immediate and failproof. Two types of reaction can be observed: straightening of branches near the traumatized end of leader, and formation of one or several new axes in the vertical direction of growth, starting from latent buds (Figure 4).

In both cases, the trunk will show a bayonet-shaped deviation if a single relay is set up, or a fork if two axes acquire an equivalent development. Reabsorption of an accidental fork through straightening and coming into dominance of one of the shoots depends on several factors.

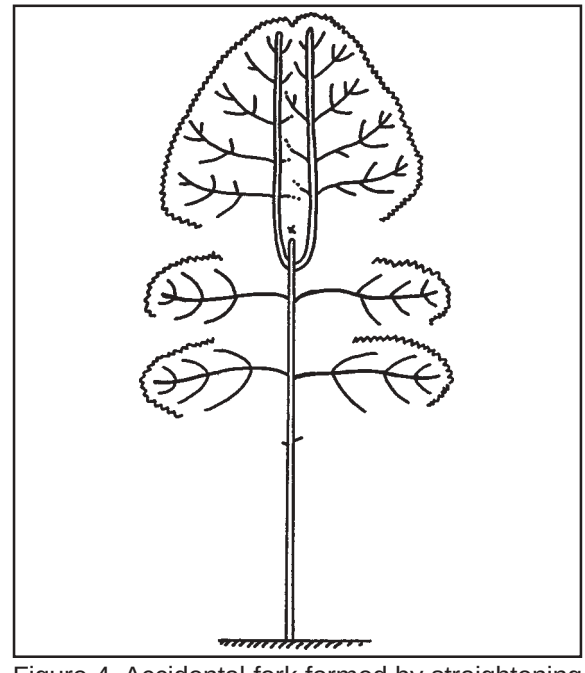

Figure 4. Accidental fork formed by straightening of two branches on a Pinus pinaster.

- Tree age and physiological condition. When a trauma occurs on an old tree, three or four axes often continue on from there, but none of them will have the possibility of actually dominating the others (this frequently occurs with Pinus pinaster, P. laricio, Cedrus spp., and Pseudotsuga menziesii). Likewise, accidental forks appearing on decaying trees will have a tendency to be self-perpetuating (Loup 1990; Drénou 1994; Bastien et al. 1995).
- Tree architecture. The strictly monopodial functioning of some species explains in part their difficulty in reabsorbing traces of accidents occurring on the leading shoot. With species such as Fraxinus excelsior and Prunus avium, some accidental forks may disappear, but often, one straightened branch remains and has to be pruned in the future (Armand 1995; Duflot 1995).
- Species. For trees with opposite buds (Fraxinus spp., Acer spp., Aesculus spp., etc.), the relays caused by accident appear in pairs, forming forks that are extremely difficult to get rid of.

DISTINCTIONS BETWEEN ACCIDENTAL AND MAIN FORKS

The main fork of a tree appears when branches and trunks reach a maximum degree of competition. However, an accidental fork has an unpredictable nature and therefore is not foretold by previous straightening of the lateral branches (Figure 5).

When a fork is self-perpetuating on a trunk, two extreme situations can be observed. In the first situation, the fork gives rise to branches much shorter than the trunk, and these branches themselves fork out, giving rise to still smaller branches, and so on. This case corresponds to edification of a crown by setting up main forks appearing in synchronous

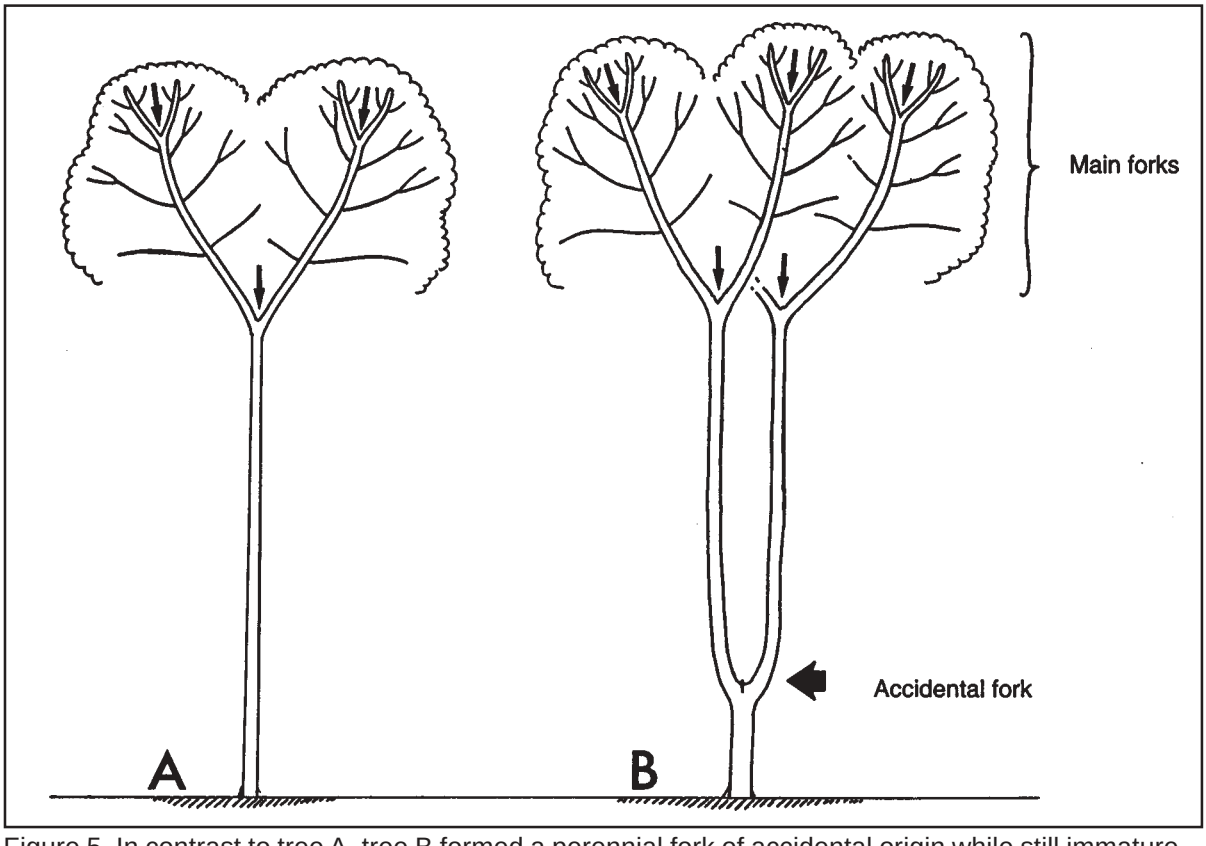

Figure 5. In contrast to tree A, tree B formed a perennial fork of accidental origin while still immature.

waves that are closer and closer together. In the second situation, the fork bears vertical branches that are clearly much longer than the trunk. This most often is caused by a trauma that occurred on the trunk during elongation, an occurrence that reiterated its own structure well before the start of edification of a crown. Neighboring trees that are not traumatized generally make it possible to locate this premature fork.

A main fork results from a slow metamorphosis of the branches, while an accidental fork is provoked by an abrupt loss of apical dominance and the almost spontaneous appearance of several concurrent axes. This difference could have an affect on the probability of there being enclosed bark around the forks, and often seems weaker for main forks than for accidental forks.

WHAT SHOULD BE PRUNED?

For too long now, forks have been considered tree defects to be systematically eliminated. The typology proposed in this article makes it possible to add a considerable number of nuances to this assessment.

Temporary forks more precisely show an abnormal condition in the environment than a defect in the tree itself—the tree trying to adapt to unfavorable conditions in its environment. Reabsorption of these forks can be encouraged by improving the environment in which the tree is growing (too sheltered, for example). However, pruning serves no purpose, and may even be a bad thing, as long as the young tree has not, itself, found an apical dominance.

Recurrent forks are inevitable, hereditary, and perfectly normal for such species as Quercus robur and Q. petraea, and many species from the families Ulmaceae, Fabaceae, and Mimosaceae. These forks generally reabsorb themselves; therefore, formation pruning should not be performed with haste. It is only when a recurrent fork seems to persist after two years of existence that it should be pruned.

Main forks are desirable because they mark the trunk's entering into the enlargement phase. In addition, when the "climbing" of trees to the detriment of the formation of main forks is encouraged by maintaining too high of a density, the result will be skinny trunks covered with suckers emerging as soon as they see the first light. On the contrary, in totally exposed spaces, or in plantings with wide spacing, when the main fork appears below the level of the desired trunk, it is advisable to prune to artificially lengthen edification of the trunk. A main fork is, by its very nature, a perennial fork; only premature pruning procedures can postpone the time of its formation.

In the case of accidental forks, pruning is indeed often required. We note that many species react well to formation pruning and that after removal of forks, the remaining axis, even though strongly lignified, straightens itself out and moves back into the extension of the trunk (Hubert and Courraud 1994).

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Zusammanefassung. In einem Baum wird der Begriff "Gabel" jedesmal verwendet, wenn eine Achsel das Wachstum von zwei oder mehreren gleichberechtigten Achseln vorgibt, die einen Scharfen Winkel zueinander formen. Gabeln können daher am Stamm oder an Ästen zu jeder Zeit im Leben eines Baumes auftreten. Eine Gabel am Stamm während seiner Entwicklung ist ein potentieller Defekt, der möglicherweise die Stabilität des Baumes ruiniert, die Länge des Stamms reduziert und zu eingewachsener Borke führt. Aus diesen Gründen ist es generell ratsam, diese Gabeln zu eliminieren und große Äste durch entsprechenden Schnitt zu stärken. Dennoch sind nicht alle Gabeln gleich. Einige erfordern einen Eingriff, aber andere werden von selbst zurückentwickelt. Wir schlagen vor, die Gabeln in vier Hauptkategorien zu unterteilen: temporäre Gabeln, wiederkehrende Gabeln, Hauptgabeln und zufällige Gabeln. Jede Kategorie ist Gegenstand einer morphologischen Beschreibung, einer Analyse der Gründe für die Gabelbildung, einer Vorhersage der Lebensdauer der Gabelung und einer Diskussion über die Schulungsmöglichkeiten bei Schnittmaßnahmen.

Résumé. Chez un arbre, le terme « fourche » est employé à chaque fois qu'un axe se sépare en deux ou plusieurs axes équivalents et qui ensembles forment des angles aigus. Les fourches peuvent de ce fait apparaître sur le tronc ou les branches à divers moments de la vie d'un arbre. Une fourche sur un tronc durant sa formation est un défaut potentiel qui peut ruiner la résistance d'un arbre, diminuer la longueur du tronc et produire de l'écorce incluse. Pour ces raisons, il est généralement préférable d'éliminer ces fourches et de renforcer les grosses branches par un taille de formation. Néanmoins, toutes les fourches d'arbres ne se ressemblent pas; certaines requièrent effectivement une intervention, mais d'autres sont éliminées d'elles-mêmes. Nous proposons de classifier les fourches dans quatre grandes catégories: fourches temporaires, fourches récurrentes, fourches principales et fourches accidentelles. Chaque catégorie fait l'objet d'une description morphologique, d'une analyse des causes de la création de cette fourche, d'une prédiction de la durée de vie de cette fourche et d'une discussion sur l'opportunité d'une taille de formation.

Resumen. En un árbol, el término "horquilla" es usado cada vez que un eje da lugar a dos o varios ejes equivalentes, los cuales juntos forman ángulos agudos. Las horquillas pueden entonces aparecer sobre el tronco o sobre las ramas en varios momentos en la vida de un árbol. La horquilla sobre un tronco durante su formación es un defecto potencial, arruina el enderezamiento del árbol, reduce la longitud del tronco y permite corteza incluida. Por estas razones es generalmente recomendable eliminar horquillas y enderezar ramas grandes mediante la poda de formación. Sin embargo, no todas las horquillas del árbol son indeseables; algunas efectivamente requieren intervención, peros otras son reabsorbidas por sí mismas. Nuestro propósito fue clasificar las horquillas en cuatro principales categorías: Horquillas temporales, horquillas recurrentes, horquillas principales y horquillas accidentales. Cada categoría es objeto de una descripción morfológica, un análisis de las causas del horquillamiento, una predicción de la extensión de su vida y una discusión sobre la posibilidad de la poda de entrenamiento.