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# How Terms Shape Forests: 'Niederwald', 'Mittelwald' and 'Hochwald', and their Interaction with Forest Development in the Canton of Zurich, Switzerland

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## SUMMARY

Changes in forests are influenced by, and themselves influence, such local conditions as soil, climate and exposure, and also the demands put on the forests by society. Forestry has played a crucial role, since the 19th century at least, in the way these demands are fulfilled through the use and management of forests. This paper describes a regional case study of the history of forestry practices in the north-eastern part of the central plateau of Switzerland during the 19th century, based on an analysis of official documents connected with forestry. The analysis examines, in particular, how the creation of new terms such as 'Niederwald' (i.e., simple coppice forest) and 'Mittelwald' (coppice-with-standards forests) influenced the way in which forestry officials classified forests, which, in turn, influenced how forestry was planned and implemented.

During the 19th century, community authorities increasingly took to transforming coppice forests into high forests. This trend was critically observed by forestry officials, who themselves conducted similar transformations in the cantonal forests directly managed by them. According to a classification of stand descriptions which used definite criteria for the different forest types, most of the decline of coppice-with-standards forests occurred after the middle of the 20th century. This development is discussed with respect to changing demands for the different sorts of timber produced in the different forest types.

## FORESTS AS PART OF THE CULTURAL LANDSCAPE

The present form of most of the forests in central Europe has been greatly influenced by men over the centuries. Therefore, these forests are a part of the cultural landscape. Not only their structure, but also the diversity of their flora and fauna bear witness to anthropogenic influence. Knowledge about the earlier

structure of the forests, and their use and management enables us to gain a deeper understanding of their present biodiversity (Ellenberg 1996: 38; Ewald 1996; DeGraaf and Miller 1996) provided that the elements and aspects under investigation are recorded according to clear and definite criteria. This means that historical ecologists working with natural residues, such as pollen or macro fossils, must take into consideration the durability of the residues and the representativeness of the sample.

Similarly, in studies based on written historical accounts using historical research methods, as is the case in forest- and woodland history, a source-critical approach is required. A core element of such an approach involves considering how the meanings of the terms used in the sources have changed over time.

This paper is based on a regional case study of changes in forests during the 19th and 20th centuries (Bürgi 1998). After introducing the materials and methods, the history of the terms 'Niederwald' and 'Mittelwald' is given and how they are used in the sources is discussed. In a second step the debate among community and forestry officials about converting these forests into high forests is analysed. Differences in the timber assortments produced under different forms of management, and changes in demand for them, were the main factors behind the increase in high forests. Based on a new classification of the stand descriptions, the final section of the paper examines whether and, if so, how this debate influenced the development of the forests in the period under study.

## MATERIALS AND METHODS

The study area of approx. 340 km<sup>2</sup> is situated in the northern part of the Canton of Zurich, in the north-eastern part of the Central Plateau of Switzerland (Figure 1). Today, in the study area more than a third of the land is covered by forest, of which about a third is private property. The other two thirds consist of about 70 public forests owned mainly by the 47 local communities. There are four government forests owned by the Canton of Zurich (i.e., cantonal forests). The cantonal forestry officials are in charge of the management of all public forests. Without human influence, these forests would nowadays consist chiefly of beech. Along the rivers one would find riparian forests, and in some more exposed places, pine and oak/hornbeam forests.

Analyses of forest development are usually limited by the spatial and temporal resolution of the data used. For example, it is hardly ever possible to locate exactly from what area the insects in a collection, or dried plants in a herbarium, were collected, as the information needed is simply not recorded. After evaluating possible source-types for this study, forest management plans were selected as the main source of information. They are full of spatially precise data about forest structure. More than fifty years ago Grossmann (1933) noted that forest management plans would be worth studying and deplored the fact that he did not have the opportunity to evaluate them thoroughly. Other authors have

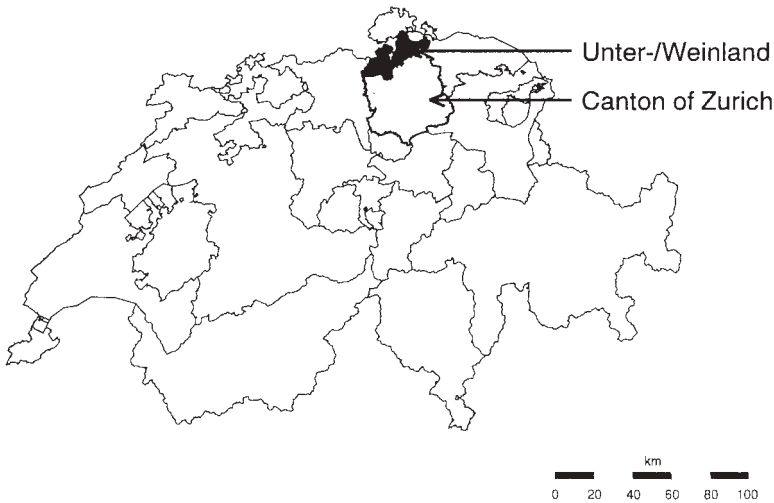


FIGURE 1. Study area (BSF GEOSTAT/Bundesamt für Landestopographie)

also pointed out that these sources would be very helpful for studies of woodland history. For example, Schuler (1981) wrote that forest management plans provide a unique documentation of forest and woodland history, especially if they cover an extended period.

Since 1820, about 590 forest management plans have been issued for the public forests in the study area, drawn up for planning periods of 10 to 20 years (Staatsarchiv Zürich ZAK III-IV 88/07 and 90/21, and various plans in the archives of different forestry offices). These plans were meant to ensure a sustainable forest yield. Every plan refers to the forests of one owner, usually a community or the canton. Some plans run to over 100 pages. Normally, a map of the forest area is also included. The plans were written by forest engineers, usually by those in charge of the forests. The earliest plans, the so-called 'Visitationsberichte' ('visiting reports'), written in 1823, included a description of the forest, a short report about its use and management, and guidelines for future management. After about 1850, the plans became more comprehensive, and increasingly began to include tabulated information describing the stands or the planned felling quantity.

Forest management plans, therefore, contain both quantitative and qualitative information. The latter is difficult to evaluate since the plans are official papers written for community authorities and higher forestry officials. Thus, they are to some extent biased by the interests of their authors and those of the intended readers. Topics such as the so-called minor forest uses were hardly ever accorded much importance despite the fact that many people depended on them.

## HOW CREATING NEW TERMS HELPED TO ORGANISE THE FORESTS IN THE FIRST HALF OF THE 19TH CENTURY

*'Niederwald' and 'Mittelwald': Early references to forest types – late formation of terms*

In Switzerland, forestry as we know it today began in about 1800 (Schuler 1985). Until the foundation of the Forstschule at the Swiss Federal Institute of Technology in 1855 (Krebs 1948b), most of the so-called 'Forstpioniere' ('forestry pioneers') and other graduates in forestry were instructed at universities in Germany (Grossmann in Weisz et al. Vol. 2, 1983: 144). The development of Swiss forestry was therefore strongly influenced by the German cameral sciences (Kaufhold 1993: 580). Lowood (1990) discusses the influence of cameral sciences on the development of German forestry in his article, 'The calculating forester: quantification, cameral science, and the emergence of scientific forestry management in Germany'. An important part of the process of establishing forestry as a discipline involved developing an appropriate terminology. This happened mostly during a period that Koselleck (1972: XV) called the 'Sattelzeit', when many terms obtained new meanings and many new terms were coined.

Examples of fairly recently introduced forest terms are 'Niederwald' (i.e., simple coppice forest) and 'Mittelwald' (coppice-with-standards forests). 'Niederwald' already existed as a German colloquial expression in medieval records written in Latin (Mantel 1990: 334). Nevertheless, it cannot be regarded as a medieval term because it did not become a part of forestry terminology until 1800 (Irniger 1991: 36). Kehr (1964: 78) found the first occurrence of 'Niederwald' as a technical term in a forestry dictionary written in 1809 by Hartig. Johann Heinrich Cotta, who, together with Wilhelm Pfeil, is regarded as one of the first German foresters, worked as a director at the first Academy of Forestry in Tharandt. He had already used the term 'Niederwald' some years before, when he contrasted 'Saamenwald, gewöhnlich Baumwald, oder Hochwald genannt' ('seed forest, usually called tree forest or high forest') to 'Reiner Schlagwald oder Niederwald' ('simple cutting or coppice forest') and 'Vermischter Schlagwald' ('mixed cutting forest', i.e., coppice-with-standards forest) (Cotta 1804: 102).

The term 'Mittelwald' seems to have been created by Cotta (Bühler 1922: 600; Hausrath 1982: 28). In 1817 he wrote:

Out of these forms of cultivation an intermediate form was put together where regrowth occurred through both seeds and shoots. This used to be called a mixed low wood or composite operation. Because the first term also describes a forest made up of many species of wood and the second does not sound German enough, it will not be considered improper to use the expression 'Mittelwald' instead.<sup>1</sup>

It can be seen then, that the terms 'Niederwald' and 'Mittelwald' had become a part of forestry terminology by the beginning of the 19th century. They were core terms because one of the first tasks foresters had to perform was to draw up plans of a particular forest and divide it up into working areas with distinct systems of management.

However, there were many forms of coppice forests in existence long before today's forestry began to play a role. Etymological sources and references in the works of Roman and Greek writers show that coppice forests were already common in antiquity (Trier 1952: 14). In England we can also find archaeological references to coppice forests. According to Peterken (1994: 24), coppices were widespread in parts of England by the turn of the millennium. He assumes that the coppice structure was common before a coppice system existed, meaning that coppice was practised before it was officially planned. According to Rubner (1960: 37), the first case of simple coppicing in France for which we have proof dates from 791, whereas the first description of a coppice-with-standards system dates from the time of the first 'ordonnances' (i.e., regulations) in the 14th century. As an example, Pagenstert (1961: 11) mentioned the 'ordonnance de Melun' dating from 1376. The first written references for coppices in Germany were found by Mantel (1990: 334ff) for the 13th century. Hausrath (1982: 17), however assumes that simple coppices were already around in the 10th century.

For the area of present-day Switzerland the early records of coppice have not yet been compiled. The earliest documents studied so far date from the 16th century (Grossmann 1931; Krebs 1948a: 160; Hagen 1960: 151ff.; Witschi 1981: 87). However, it is questionable whether written management instructions can be interpreted as proofs of a regular management strategy. Schenk (1996a: 294) mentioned, too, that it is important to distinguish between instructions and silvicultural practice, but he gives examples of cases where forestry practice conformed quite strictly with the instructions. Nevertheless, it is clearly impossible to draw any conclusions about how the forests in former times were really structured because they were strongly influenced by other so-called minor forest uses, such as wood pasture and litter-collecting.

Today, too, the terms 'Niederwald', 'Mittelwald' and 'Hochwald' are connected with distinct management rules and forest structures. For example, a modern definition of 'Niederwald', i.e. simple coppice forest, is:

In coppice wood the stand is established by cutting back mostly the younger, not so tall trees (stool, stem and branches) and allowing the shoots to form from the roots. The rotation period is short, 20-40 years.<sup>2</sup>

The central characteristics of simple coppice forests are clear cutting in regulated areas and the regeneration by stool shoots. In the coppice-with-standards forests, the understorey of stool shoots is covered by an overstorey of large trees, the so-called standards (Mayer 1992: 433). Knuchel (1950: 237),

therefore, regards them as a combination of coppice forest and high forest. More precisely, Mayr (1925: 275) added that the overstorey was managed in a group-selection system without crown closure.

Unlike these two forms of forest, 'high forest' mainly consists of tall trees of seedling origin. However, this term is ambiguous because forest owned by the authorities used to be called 'Hochwald' too (Meier and Sauerländer 1995: 59). However, in the period under study, 'Hochwald' was no longer used with this second meaning. The moment the three terms were defined the way we understand them today, a system was created which allowed classification of each stand.

#### *What coppice forests were called in the study area*

Stands of simple coppice were given different names. In an early management plan, the formulation 'Unter Waldung oder Laubholz von Stockausschlag' ('underwood or hardwood from stool shoots') was used (WP Bülach 1819). This corresponds with the terms 'Oberwaldung' and 'Unterwaldung' used by Hirzel in his *Abhandlung über die Forstwirtschaft, in Bezug auf das Forstwesen des Cantons Zürich* ('Treatise on Forestry with reference to Forestry in the Canton of Zurich') dating from 1805 (Weisz 1935). Other terms were 'Schlagholz' (i.e., wood for cutting) (WP Rafz 1819; WP Bülach 1822), later 'Buschholz' (i.e., bush wood) (WP Grossandelfingen 1840; WP Gütighausen 1859) and 'Buschwald' (i.e., bush forest) (WP Kleinandelfingen 1876). Hirzel too wrote about 'Schlagholz' and 'Buschholz' (1809: 33). According to Pfaffhauser (1983: 73) the term 'Buschwald' was mainly used to describe a special kind of coppice management carried out along the rivers Thur and Murg, in the Canton of Thurgau, along the eastern border of the study area.

Sometimes these terms were also used together with the term 'Niederwald'. For example in a management plan from 1819, a stand is described as a 'Niederwald' being managed as 'Buschholz' (WP Rafz 1819).

The term 'Busch' suggests that the understorey was cut as soon as it reached the height of bushes. Therefore, 'Buschholz' denotes a simple coppice forest with a short rotation period (Landolt 1866: 191; Mayr 1925: 273). Hirzel (1809) did not use the term 'Niederwald' but 'reiner Unterbusch' ('pure underbush'). Several times in the data the term 'Niederwald' was also used for the riparian forests along the river Thur. In the second half of the 19th century, the terms 'Wuhrland' and 'Staudenwald' were used for these forests (e.g. WP Flaach 1880). Here, two types of 'Niederwald' should be distinguished: that along the rivers with a rotation period of less than 10 years, and that for producing firewood with a rotation period of more than 10 years. This indicates that a short rotation period does not necessarily mean there is a high demand for wood. For certain applications, for example faggots for stabilising the riverbanks, wood with a large girth was simply not suitable.

During the 19th century, the term 'Niederwald' was also used for forests with only a few standards (WP Rafz 1819; WP Rafz 1864; WP Berg 1849). This means that the criteria for 'Niederwald' listed in the new classification given in the second part of this paper are stricter than those employed by the original forestry officials who used the term in their management plans.

Although the term 'Mittelwald' was not coined until the very beginning of the 19th century, it was already in use in the earliest management plans evaluated in this study. For example, Meister wrote in a plan dating from 1823 that a 'Mittelwald' consisted of standards of oak and beech, with the oldest oak being 200 to 250 years old (WP Feuerthalen 1823). Interestingly, five years later, the same forest official used the word 'Compositionswald', an older term for 'Mittelwald', which was in use before the latter was introduced.

Since about 1960, hardly any 'Mittelwälder' but more and more transformation stands are recorded in the management plans. These were former 'Mittelwälder' on their way to becoming high forests. In plans over the last three decades, the formulation 'ehemaliger Mittelwald', that means former coppice-with-standards forest, occurs often.

Difficulties in classifying the stands as 'Niederwald', 'Mittelwald' and 'Hochwald' are hardly ever mentioned in the management plans by the forestry officials. But the descriptions of the stands indicate that, quite often, the classification does not correspond with the actual stand structure. In a management plan written in 1853 one can read that: (1) parts of the 'Hochwald' were used as coppice forest, (2) parts of the 'Mittelwald' had so many standards that they looked more like high forests, and (3) the 'Niederwald' was partly covered by pine of all ages as in a selection forest system (WP Flaach 1853).

On comparing the stand descriptions with the classifications in the plans made at the same time, it becomes apparent that these classifications were first and foremost expressions of the intentions of the forestry officials regarding the future management of the stands. This is also the case for the plans made in the 20th century. This shows that a new classification of the stand descriptions is needed in order to reconstruct the development of the forest types.

### *Terms shape forests – a hypothesis*

The reports about the use and management of the forests in the 1820s management plans show that, in the early 19th century, many coppice stands were not regularly cleared, but only selectively. This can be seen from the way some reports, such as the one from Raat (WP Raat 1823) were available in two versions. Whereas in the draft version one stand is said to be treated in 'Plänterwirtschaft', i.e., managed selectively, in the second version the same stand was said to be a coppice-with-standards forest. Maybe the selection system of forest management, if the term 'management' is appropriate at all, was already taboo in forestry in the 1820s and was, therefore, not mentioned in the reports as



frequently as it was conducted. Nevertheless, the term 'Plänterwirtschaft' was still quite common (e.g. WP Guntalingen 1823; WP Windlach 1823; WP Wil 1849).

The selection system of forest management was regarded by forestry officials of that time as the complete opposite of clear cutting in regulated areas (WP Flaach 1853). Only the latter was considered to be orderly and under control. Grossmann (in Weisz et al., 1983, Vol. 2: 193) noted that, in the 1830s, the community forests in the Canton of Zurich were usually selectively cut and the trees were felled wherever it was most suitable. This shows that the claim made by Landolt in 1880 that felling in regulated areas had been practised throughout the canton's public forests for more than 50 years (Oberforstamt 1880: 32) reflected an intention more than reality. Rather, it can be said that it was not introduced in many places until as late as the middle of the 19th century. However, in contrast with many other Swiss cantons, no selection system was officially practised in the Canton of Zurich (Plenterwälder 1908).

One can conclude that, until about 1850, the forestry officials often had to classify stands treated by selection cutting: the felling by regulated areas has not been introduced in all coppice stands and clear cutting was not generally applied in all high forests. But these are core features of the management systems propagated by forestry authorities whereby there would be simple coppice, coppice-with-standards or the high forest system. It was the forestry officials' duty to classify the stands according to the intended systems of management. The systems of management were given names which were clearly defined. The terms were newly introduced into forestry terminology, which meant that the forestry officials could use the terms 'Niederwald', 'Mittelwald' and 'Hochwald' as instruments to put the forests in order by classifying the stands. On initial classification, their structure often did not fit the definitions of these terms.

In the first half of the 19th century, the gap between the actual structure of the forests and how the forestry officials classified them with regard to their future management was generally larger than in the second half of the 19th century and in the 20th century. After their initial classification, the stands eventually received the structures associated with the forms of management in the classification. This leads to the claim that, in a certain sense, the forests were shaped by forest terms (Figure 2). At least during the 19th century it was the case that the structure of the forests grew to match the new categories of forest management, namely: 'Niederwald', 'Mittelwald' and 'Hochwald'.

The correctness of this hypothesis is relevant for nature conservation. The first half of the 19th century is taken as a reference period for the red lists (e.g. Landolt 1991: 11) because, at that time, biodiversity peaked. This peak was, presumably, linked to types of habitat that would have been quite different from the types we know today. For example, none of today's few remaining coppice forests are used selectively or managed according to a selection cutting system. From the point of view of nature conservation, the reintroduction of simple coppice and coppice-with-standards management is desirable, because the

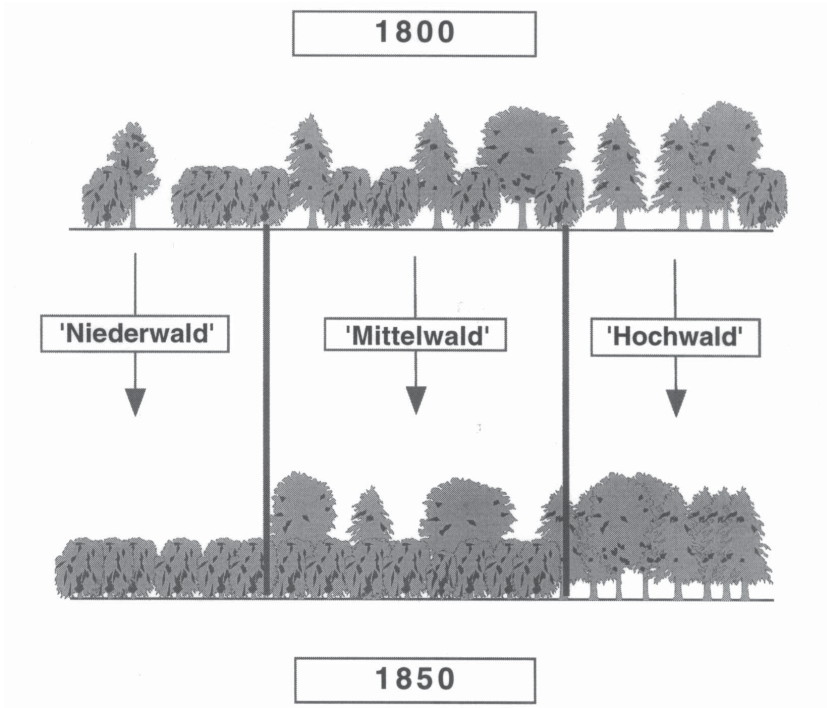


FIGURE 2. How terms shape forests: by the introduction of the terms 'Niederwald', 'Mittelwald' and 'Hochwald', the corresponding forest structures were implemented and became widespread.

resulting forests are very highly structured and are rich in biodiversity (Ellenberg 1996: 58). If the hypothesis is correct, then coppice forests with selection cutting or, more generally, forests that have not yet been subjected to standard forestry practices, should be maintained and their structure, development and biodiversity should be investigated. Such structures may have fostered the peak in biodiversity in the middle of the 19th century.

#### DEBATES ABOUT CHANGING FOREST MANAGEMENT SYSTEMS IN THE 19TH CENTURY

During the 19th century, high forest management became more popular in forestry (Radkau 1996) and wherever the treatment of the forests changed accordingly, coppice stands were transformed into high forests. Every change in resource management is of interest in environmental history because it raises

questions about the driving forces behind such a change. Hence it is worthwhile describing the debates about different forest management systems in the study area and then looking at what really happened in the forests.

In 1856, the Swiss Forestry Society discussed the circumstances under which coppice management should be continued (Meister 1857). Coppice-with-standards management was said to be advantageous for small forest owners because a broader assortment of timber for a variety of purposes could be produced in them. Furthermore, it was said, the value and yield of brushwood would often be underestimated if the financial advantages of high forests were overly stressed (RB RR 1847: 55). Apparently differences in the assortments produced under the different management schemes were very important in choosing between these schemes.

Just how much the timber production differs can be illustrated by looking at the yields from the different kinds of community forests in the Canton of Zurich. The figures for 1827, 1847 and 1885 are available (Table 1). Since there are some

	year	cutting area (ha)	yield (m <sup>3</sup> /ha)	% total	broad- leaved timber	conif- erous timber	fire- wood	other assort- ments
FROM	1837	71	675	57%	7%	93%	60%	40%
HIGH	1847	130	515	64%	19%	81%		
FOREST	1885	129	455	68%			60%	40%
FROM	1837	371	95	43%	92%	8%	80%	20%
COPPICE	1847	335	113	36%	90%	10%		
FORESTS	1885	295	92	32%			82%	18%
Timber	1837		17	18%	63%	37%	0%	100%
from	1847		34	30%	66%	34%		
overstorey	1885		16	18%			0%	100%
Timber	1837		79	82%	100%	0%	98%	2%
from	1847		79	70%	100%	0%		
understorey	1885*		76	82%			100%	0%

TABLE 1. Yields from the different kinds of community forests (excluding the ones owned by the cities of Zurich and of Winterthur) in the Canton of Zurich for 1837 (RB RR 1837: 25), for 1847 (RB RR 1847: 54) and for 1885 (RB RR 1885: 95).

\* includes faggots.

The numbers given in italics are based on the assumption that timber from the understorey is only used as firewood (including faggots) and timber from the overstorey as commercial timber.

uncertainties in converting the different units of measurement, the yields by area given in Table 1 should only be regarded as rough estimates. The proportion of the total cutting area which was in high forests rose from 16% in 1837 to 28% in 1847 and to 30% in 1885. But since there was a greater yield per area in the high forests, it made up a higher percentage of the total timber yield, increasing from 57% in 1837 to 64% ten years later and finally to 68% in 1885. As well as having considerable differences in yield, the high forests produced a higher proportion of coniferous timber than the coppice forests. Moreover, non-firewood lots, such as timber for sawing, structural and commercial use made up a higher proportion of the total timber yield from high forests than they did from coppice forests.

Grossmann (in Weisz et al., Bd. 2, 1983: 209) gives similar figures. He found the yields per area in the different kinds of community forests in the Canton of Zurich after 1850 to be 400 to 500 m<sup>3</sup>/ha for high forests and 90 to 110 m<sup>3</sup>/ha for coppice-with-standards forests. These correspond with the yields for 1847 and 1885 given in Table 1. However, the figure for 1837 is much higher. Maybe it is partly or fully based on different cord-units. Yields should not be compared with growing stock data, because it is normally those areas with the highest yield, which are felled, and not those with an average growing stock. When interpreting the yield of understorey and overstorey, it should be remembered, that the yields from simple coppice forests and coppice-with-standards forests are not separated but taken together.

Hirzel (1809) suggested, as long ago as in the early 19th century, that forests where understorey and overstorey are growing together, i.e. coppice-with-standards forests, should be indirectly transformed by not cutting the understorey into simple coppice forests and high forests. He pointed out that, in coppice-with-standards forests, the overstorey would soon suppress the understorey. On the other hand, it was often claimed in the management plans that too few standards were standing in the coppice-with-standards forests. In some of the early 1820s management plans, the forestry officials recommended, that simple coppice forests should be transformed into coppice-with-standards forests by preserving standards (WP Bülach 1823, WP Oberstammheim 1823, WP Unterstammheim 1823, WP Hüntwangen 1823).

The cantonal Forestry Act of 1837 required that some standards suitably distributed should be preserved in every cutting area in coppice forests (FG 1837, §38). According to a management plan of 1838, all simple coppice forests should be converted into 'Compositionswald', i.e. coppice-with-standards forests (WP Rafz 1838). The cantonal government's annual report of 1848 mentioned, for the first time, transformations of simple coppice to high forests (RB RR 1848: 36). But by 1844 the cantonal forestry officials were starting to deplore the neglect of the coppice forests by the communities (RB RR 1844: 20). It was said that the community authorities preferred conifers because they were easier to cultivate and provided quicker yields. In the second half of the 19th century, Landolt (1866: 340; Landolt 1892; Oberforstamt 1880: 36) repeated that transforming

the coppice-with-standards into high forests was often necessary because they were in a bad state as a result of litter-collecting and insufficient thinning. But he was against a general transformation and pleaded for a better treatment of the coppice-with-standards forests.

Despite the fact that coppices in the cantonal forests owned by the government were transformed much earlier than in the community forests (Bürgi 1997a), until the middle of the 19th century cantonal forestry officials disliked the scale and pace with which community authorities wanted to transform their coppice forests. This attitude seems to have changed in the second half of the century, as indicated by the following two quotations from the cantonal government's annual reports from 1853 and 1854:

Coppice-with-standards and coppice forests are not developing so satisfactorily. Instead of improving these forms of management, the communities are mostly allowing them to develop into high forest. In view of the demand for hard firewood, broad-leaved timber and commercial timber, this should not be allowed. Forestry officials should, therefore, persistently work towards improving the management of coppice forests.<sup>3</sup>

The cultivation of high forests is continuing to make advances, whereas the cultivation of coppice forests is still in a bad way. The communities appear to be totally against improving the latter form of cultivation, even though improvements are essential. It is, therefore, very understandable that forestry officials should, as far as this is permissible and possible, favour the tendency to transform coppice-with-standards forests into high forests.<sup>4</sup>

These quotations show that forestry officials in the second half of the century were no longer resisting the tendency to transform the community forests into high forests. In later annual reports one can read justifications for the transformations which refer to the state of the stands, the soil or the needs of the owner (RB RR 1857: 32).

According to Radkau (1996), high forest policy was influenced by the way the forestry officials gained social prestige when they managed a core resource in such long cutting cycles. In the present study, this hypothesis is not generally confirmed. In the first half of the 19th century, the impetus to transform coppice forests into high forests came from community officials and not from the forestry officials who stood to gain social prestige according to Radkau. One could argue that the forestry officials preferred high forest management in the forests owned by the canton but favoured coppice management in community forests, which would support his hypothesis. But the sources evaluated in this study do not allow one to draw a complete picture of the motives of the participants in the transformation discussion.

It has to be taken into consideration that, in the cantonal forests, the timber assortments required were different from those needed in the community forests.

The yields in the first did not have to meet the requirement of the local people entitled to use the wood from the forest. Therefore, these forests could produce more commercial timber and less firewood, which is just what high forest management of coniferous trees does best. It is likely that forestry officials were happy for the community forests to be managed in a way that satisfied local needs.

Around 1850, the consumption of fossil fuels was still insignificant (Marek 1994). Therefore, the tendency for the community officials to favour high forests and commercial timber production cannot be seen as the result of a decline in the demand for firewood. It probably arose more from a growing demand for commercial timber which produced higher financial returns. Marek (1991: 184), too, interpreted the steadily growing production of commercial timber during the first half of the 19th century as a consequence of the increasing commercialisation of forestry.

It is likely that some community officials were more interested in commercial timber production than in fulfilling their traditional obligations to supply locals with firewood. Were the cantonal forestry officials trying to protect the traditional rights of the people living in these communities when they criticised the community authorities? This question cannot be answered without further investigation. It is just as possible that the forestry officials were trying to prevent excessive production of commercial timber so as to avoid an excessive oversupply which would have led to a drop in its value on the market. So they may have wanted to protect the outlet for timber from cantonal forests. These social and economic aspects need closer examination at the community level.

At the beginning of the 20th century the growing popularity of fossil fuels led to a drop in the price of firewood and faggots, above all in industrialised regions. This meant that the coppice management became unprofitable (Oberforstamt 1900: 47). In a management plan for a cantonal forest dating from 1898, a forestry official wrote that the transformation into high forests was caused by a reduced supply of faggots and the way the income from selling oak bark was declining (WP SW Rheinau 1898). The latter was one of the main so-called minor forest uses in the study area. The annual report of the forest administration in 1926 states:

The transformation into high forests is increasing constantly. Coal, cooking gas and electricity are reducing uses of the less valuable types of wood from the understorey of the coppice-with-standards forests.<sup>5</sup>

The tendency to transform coppice into high forests is here explained by the spread of coal, gas and electricity, which competed with firewood from the understorey of the coppice-with-standards forests. Five years later, a management plan states that the transformation was caused by, again, electricity and gas, and, surprisingly early, oil-heating (WP Höri 1931).

## CHANGES IN THE STRUCTURE OF THE FORESTS IN THE 19TH AND 20TH CENTURIES

Apparently, the question as to which management system was most appropriate was a central issue in 19th century forestry. In order to gain information about how this debate affected the development of the forests, I reclassified all the stands described in the management plans according to three categories: 'simple coppice', 'coppice-with-standards' and 'high forests'. Such a new classification has to be based on clear and simple definitions of the categories used. These definitions have to take into account the features given in the stand descriptions and the questions that should be answered.

Because management plans normally indicate if standards are present, only stands without any standards were called 'simple coppice'. This definition is certainly stricter than that used implicitly by forestry officials. But this is the only way to take into consideration that it was hardly ever possible to find out how many standards were present, which makes it difficult to distinguish 'simple coppice' from the next category.

As soon as a coppice stand has a overstorey, it is counted as a 'coppice-with-standards' forest, irrespective of the amount of growing stock or the distribution of the standards. A stand is also classified in this way if stand descriptions mention that it has the structure of a simple coppice or a coppice-with-standards, since these formulations are clearly referring to the structure of the stands at the time and not to the intended management system.

This means that it is now possible to reclassify all the stands in every management plan into clearly defined categories and to calculate the area covered by every forest type. Because the management plans are irregularly distributed over time, one has to extrapolate from these figures to provide estimates of the areas covered in every forest in the middle of each decade. For every decade it is now possible to estimate the total areas covered by each of the three forest types. The areas resulting from this new classification are given in Figure 3.

At first glance, there seems to be a contradiction between the hypothesis formulated in the first part of this paper and the classification of the stands into categories. Further consideration shows, however, that some of the stands were managed selectively during the first half of the 19th century. The term 'high forest' applies to stands managed in very different ways (e.g. in a clear cutting or selective cutting system) so it can refer to very different kinds of structures. The two types of coppice stands do not, normally, include a selection forest system. After the middle of the 19th century, however, the stands fit the categories better.

In comparison with other European regions, it is striking how the total forested area in the study area remained relatively constant in the 19th and 20th

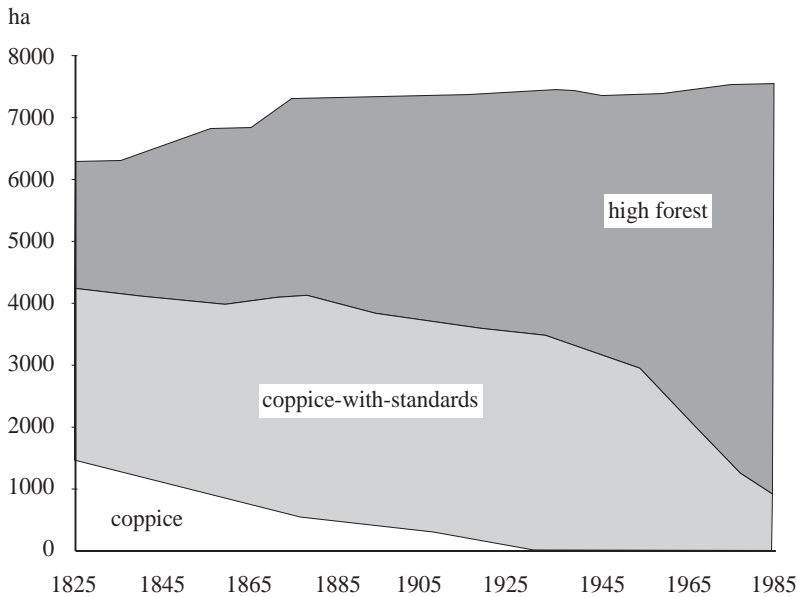


FIGURE 3. Development of forest types in the public forests of the Unter- and Weinland (Canton of Zurich) 1825–1985

centuries. The pattern of forests and open landscape in the Swiss lowlands probably has not changed greatly since late medieval times. This is partly because these quite densely populated regions could rely on the forests of the wooded Pre-Alps and Alps (Grossmann 1972; Schuler 1992).

According to the classification proposed here, 3,270 ha or more than 68% of the forest area in the 1820s was covered by coppice or coppice-with-standards. About 2820 ha (45%) were coppice-with-standards, while 1450 ha (23%) were simple coppice. Simple coppice almost completely disappeared during the 19th century, whereas 45% of the forest area in the 1930s was still covered by coppice-with-standards. But between 1955 and 1975 more than half of the remaining area was converted into high forest. In the 1980s, only about 866 ha or 12% of the forests consisted of such stands. However, the decline of coppice-with-standards has slowed down in the last decade.

The high forests have taken over up to 88% of the forest area by the end of the period under study. As already mentioned, high forests can consist of very different kinds of forest as far as management and species composition are



concerned. In the study area, the clear cutting system was common between 1850 and 1910. Today, group-selection management is generally the norm. Thus, the number of clearings in the forests has decreased during the 20th century as coppice stands have disappeared and been replaced by group selection management in the high forests. High forests are not necessarily monocultures, but can contain a wide variety of species. In the area under study, about 400 ha were covered by oak forests in 1825 (Bürgi 1997b) and, some beech forests also existed. In the 20th century too, only a certain proportion of high forest consists of coniferous trees, as the high (and still increasing) proportion of broad-leaved trees shows (Bürgi 1998).

This three-category classification system probably leads to an underestimation of the proportion of simple coppice in the 19th century and to a slight overestimation of the area of coppice-with-standards in the 20th century. The reason is that it is not always easy to classify the stands while they are in the process of being indirectly transformed into high forests: do they still have the structure of coppice forests or do they have to be regarded as high forests?

It is important to bear in mind that Figure 3 shows the development of forest types and not of management systems. In most communities within the area under study, the coppice technique had already been given up by the 1920s, and the last regular coppice clearing was probably conducted in 1958 (WP Grossandelfingen 1953; WP Grossandelfingen 1964). It is likely that this was the last coppice clearing in the whole canton. In another area, the last coppice clearing was conducted in the 1930s (Krebs 1948a: 258), and, according to Grossmann (in Weisz et al., 1983, Vol. 2: 211), yields from coppice forests are recorded only up to 1945. Thus, the stands identified as coppice-with-standards in the second half of the 20th century were actually remnants in the process of being transformed into high forests.

It is possible to depict the development of every forest in a way similar to that shown in Figure 3, although there is a great deal of variation. Some communities already had hardly any coppice forests in the 1820s whereas others did not have any high forests. Interestingly, no correlation can be found between the number of people entitled to use the wood from a forest and the pace at which this forest was transformed. One might have expected, that communities with an above average use of forest resources would have transformed their forests faster.

The four cantonal forests within the study area, which cover about 450 ha, were transformed much faster into high forests than the community forests (Bürgi 1997a). Since the middle of the 19th century, about two thirds of the forest area has become high forest, while another part has remained coppice-with-standards. In the 1930s, coppice-with-standards were less than 20%, and by the 1980s they covered only 5% of the total forest area.

## CONCLUSIONS

The classifying function of terms, some newly invented, and the effects of the classification on the forests can be illustrated for the Unterland and Weinland region. During the 19th century, the structure of these forests was shaped by the forest terms 'Niederwald', 'Mittelwald' and 'Hochwald'. The functions and meanings of terms used must be studied in order to discover any ecological effect of classifying and ordering attempts on nature itself.

It seems that the growing demand for commercial timber during the 19th century brought about substantial transformations from coppice to high forests only in the cantonal forests. For the forests owned by the communities, this transformation was also widely discussed as a possibility, but was realised only on a much smaller scale. Only when the demand for firewood declined in the first part of the 20th century, did the communities also give up the coppice management in these forests, so that with a delay of some decades, the forest types changed. This delay came about because the transformation took place indirectly.

In order to obtain a better picture of the different resource management strategies adopted in the different communities, further investigation at the community level is needed. This would allow the motivations of forestry officials to be explored together with those of the community authorities and maybe even of the people entitled to use the wood. It would give us an idea of the driving forces behind changes in land-use. Schenk (1996b) claims we should turn to the archives again to determine whether and where there was a 'wood scarcity' in the 18th century. This would also be worthwhile in furthering our understanding of forest transformation.

## NOTES

<sup>1</sup> 'Aus diesen zwei Bewirthschaftungsarten hat man noch ein mittlere zusammengesetzt, wo der Wiederwuchs durch Saamen und Ausschlag zugleich entsteht. Diese wurde bisher vermischter Niederwald oder: Compositionsbetrieb genannt. Weil aber die erste Benennung zugleich auch einen aus mehrerlei Holzarten bestehenden Wald bezeichnet und die zweite zu undeutsch klingt; so wird hier wohl nicht unschicklich der Ausdruck: Mittelwald statt obiger Namen gebraucht.' (Cotta 1817: 5)

<sup>2</sup> 'Im Niederwald wird der Bestand durch Ausschlag (Wurzel, Stock, Ästen) nach einem Hieb von meist jüngeren, niedrigeren Individuen ... begründet; kurze Umtriebszeit, 20-40 Jahren.' (Mayer 1992: 428, based on Dengler 1944)

<sup>3</sup> 'Unvollkommener gestaltet sich zur Zeit noch der Mittel- und Niederwaldbetrieb; statt einer gründlichen Verbesserung dieser Betriebsweise wollen die Gemeinden meistens lieber sich zur Umwandlung des Mittel- und Niederwaldes in Hochwald verstehen. Allein

dies darf mit Rücksicht auf den Bedarf an hartem Brennholz, Laubholz und Nutzholz nicht unbedingt zugegeben werden und deshalb wird von Seite der Forstbehörde auch auf Verbesserung des Niederwaldbetriebes unermüdlich hingewirkt.' (RB RR 1853: 21)

<sup>4</sup> 'Die Hochwaldwirtschaft ist in stetem Fortschritt begriffen, die Mittelwaldwirtschaft dagegen liegt noch immer im Argen und es ist daher sehr begreiflich, dass die Forstbeamten in Berücksichtigung der fast unüberwindlichen Abneigung der Gemeinden gegen die höchst nöthigen Verbesserungen dieser Betriebsart die vorhandene Neigung der Umwandlung der Mittelwälder in Hochwald, soweit dieselbe zulässig ist, möglichst begünstigen.' (RB RR 1854: 19)

<sup>5</sup> 'Die Umwandlungen in Hochwald nehmen beständig zu; Kohle, Kochgas und Elektrizität beschränken je länger je mehr die Verwendungsmöglichkeit der geringwertigen Brennholzsortimente des Unterholzes der Mittelwaldschläge.' (OFA 1926: 8)

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