

Styrian Forests as a Basis of Mining Industry during the Middle Ages and Early Modern Times

Bernhard A. Reismann

Graz University of Technology, Technikerstraße 4 8010 Graz; bernhard.reismann@tugraz.at

Received 18 November 2021 | Accepted 24 January 2022 | Published online 16 June 2022

Abstract. At the beginning of the article the geographic determined differences between the forests of Upper- and Southern Styria are discussed. Based on the dislocation of the hammer mills, i.e., of the final production, from the thirteenth century onwards for reasons of the supply with charcoal, the importance of the Styrian forests for the supply of mines, blast furnaces and hammer mills, for pit wood and charcoal is shown. The focus of the discussion is on the early modern period.

The regulatory interventions of the Styrian sovereign by forest consultations, the so-called “Waldberaitungen” from the fifteenth century onwards soon led to the creation of dedication districts for the wood require and to the construction of large river rakes in the rivers Enns and Mur with attached charring sites. The ecological effects based on intensive logging from the seventeenth century onwards are described as well as the planned dedication of the Upper Styrian forests to precisely defined blast furnaces and hammer mills during the reign of Maria Theresia. The first scientifically based and targeted measures to protect forest and reforestation also began during this period. The nationalization of large forest areas for industrial purposes by Joseph II is also mentioned. The big changes, triggered by the industrialization during the 19th century, represent the end and outlook of the article. Due to the use of cheaper fossil coal, the management of the forests for the purpose of mining and iron industry was gradually abandoned from around 1860 onwards. The structural change ultimately led to large forests being owned by former industrialists who sold their factories to larger companies such as Österreichische Alpine Montangesellschaft (ÖAMG) as part of the general economic development and turned to forestry themselves, also shown by the example of the Mayr-Melnhof family.

Keywords: Forest history, mining, iron industry, Styria

Geographic and natural prerequisites

The province of Styria is considered the ‘Green Heart of Austria,’ because of its abundance in forests. Even at present, 61.6 per cent of the province’s area is covered with forest; in the districts of Upper Styria (Figure 1) these percentages are even higher, well over 70 per cent. In 2009, the front-runner was the district of Bruck an der Mur with 77.3 per cent forest cover.¹

1 <https://www.agrar.steiermark.at/cms/beitrag/11845987/100812147/>, requested on 1 10 2021.

The mountainous Oberland, with the eastern districts of Leoben and Bruck-Mürzzuschlag, extends in the south approximately to the town of Frohnleiten, 30 kilometers north of Graz. The western part of Upper Styria consists of the district of Liezen, subdivided into Salzkammergut, the Upper Enns Valley from Schladming to Gröbming, Mitternthal and Gesäuse from the Admont Monastery to beyond the municipality of Hieflau, as well as the districts of Murtal (formerly Knittelfeld and Judenburg) and Murau.



Figure 1 Upper Styria on the so-called Homann map from around 1720 (Reismann collection)

After the river's narrow point of Mur at Badl near Peggau, the Styrian lowlands proper begin. Due to the urban central area of Graz with the Schöckl massif (and the spa resort St. Radegund, that used to be particularly popular in Hungary before 1918, where the child Béla Bartók composed his first musical piece) in the northeast, and the Plesch area near the monastery of Rein in the northwest, this fact is not immediately obvious geographically. However, there is a noticeable change in the climate and the weather, as the southern part of the country is largely influenced by the Pannonian climate.

These climatic conditions led to the formation of four different habitats in Styria. In the south, there is the 'habitat of oak forests', reaching up to an altitude of about 500 metres. Here, wine and maize ripen in abundance. Since the Stone Age, this part of the country has always been populated, during the Roman period very densely.

The adjacent ‘habitat of beech forests’ to the north is not quite extended. Loam, sand, and gravel are predominant, and a wide variety of arable crops or field crops, as well as six million fruit trees are grown, including peaches, apricots, pears, and especially apples.

In the northern parts of Western Styria, Eastern Styria, and Upper Styria, the ‘habitat of coniferous trees’ predominates. There are high precipitation rates and short vegetation seasons. Arable farming is declining in favour of pasture farming, grassland farming and, above all, forestry.

Finally, the ‘habitat of the High Alps’, by and large limited to the Hohe and Niedere Tauern as well as the Styrian - Lower Austrian Kalkalpen, reaches up to an altitude of around 2,000 metres; 200 days of frost and up to 1,200 millimetres of precipitation are not uncommon in this region. The most significant forests in Styria are also found in this habitat.²

From the twelfth century onwards, the Styrian mining industry and its pre-forms were able to draw on these enormous wood and forest resources. Mining and the production of salt in the Styrian Salzkammergut, as well as precious and non-ferrous metal mining, including smelting and, naturally, the mining of iron at the Styrian Erzberg and the numerous other, smaller iron deposits in Upper Styria, required the forests and the wood as a basis for wooden shelters and for lining the mines, but also as a supply with charcoal for the production of iron in the blast furnaces and further processing, as well as the final production in the various hammer mills of the country.

This article intends to reconcile the connections between the development of these economic sectors with the use of forests and their development. The description starts with the twelfth century and the increasing literacy, and then focuses mostly on the period of the Early Modern Period. A look at the changes in the nineteenth century, triggered by industrialization, concludes the presentation.

From the twelfth to the fourteenth century: The first upswing of the mining industry and the first consequences of the more difficult production of charcoal

Styrian mining experienced its first significant upswing during the twelfth century with the expansion of provincial rule. Duke Otakar II of Traungau was the most important figure in this development. In particular, he was able to step up the economic development of the land after Emperor Friedrich Barbarossa had granted him the regalia, meaning actual royal rights, before 1160. These regalia included the

2 Reismann, *Steiermark*, 6–10.

mining rights over silver, iron, and salt, the right to mint his own coins, and thus pursue an independent monetary policy, the right to confer and grant market rights and the right to establish toll stations and customs sites.

The entry of the Erzberg into Styrian, and thus Central European economic history is also closely connected with mining rights. In 1164, Otakar III guaranteed his new monastery foundations of Seiz/Žiče in present-day Slovenia and Vorau near Hartberg the annual purchase of twenty measures of iron in Leuben, i.e., from the Leobental Valley. This refers to the area just south of Vordernberg. Furthermore, Otakar's wife dedicated *mansum unum apud Leuben, ubi foditor ferrum*, meaning a peasant estate near Leoben, where iron was dug, to the monastery of Vorau.³ These mentions of iron mines around the Erzberg, which are close in time, allow the unambiguous conclusion that local ore mining and smelting entered its first phase of prosperity under Otakar III.

Admont Monastery, one of the most important landowners in Upper Styria, already owned an iron mine near the monastery on Mountain Plaberg when it was founded in 1074, as documented in 1130. The large monastery of St. Lambrecht, in turn, received several areas *cum salino et rudere, qui ariz dicitur...*⁴ with the donation of the Aflenzen Valley and the Mariazell area by the Eppenstein family in 1103.

These iron ores were initially melted in small wind furnaces in the actual area where the ore was found. Between 1180 and 1250, they were moved from the mountains to the valleys, and the amount of iron produced in them increased by 250 per cent between 1227 and 1262. The reason was that the blowers of the smelting furnaces in the valley bottoms could be driven by water wheels. A higher air supply and taller furnaces made it possible to melt larger quantities. However, the larger furnaces also required more combustion material and, at the time, this was only made from charcoal.⁵

Parallel to this development, documents make increasingly more frequent mention of blacksmiths who processed the pig iron produced in the furnaces. Here, too, they were initially blacksmiths in the vicinity of Admont Monastery, including the first documented Styrian blacksmith named Otto.⁶ In 1150, a *Lanzo, faber de Swarzinbach* in Schwarzenbach near Trieben was mentioned, and in 1160, 1175, 1180, 1184, 1185, and 1186, further mentions of forges followed, with *Hermannus fabro de Walthe* in Tannebach, today's Donawitz near Leoben featuring in documents in 1186. It is noticeable that from about 1180 onwards, there are more frequent

3 Pirchegger, *Eisenwesen bis 1564*, 10, and Beck, *Die Geschichte des Eisens*, 751

4 Pirchegger, *Eisenwesen bis 1564*, 22–24.

5 Reismann, *Sozialgeschichte der steirischen Hammerarbeiter*, 5.

6 Valentinisch, *Das eisenverarbeitende Gewerbe*, 207–33, esp. 209.

notes of blacksmiths in the country and of the fact that the forges were no longer in the immediate vicinity of mining and smelting sites. It transpires that forges were located exactly where later there had been hammer mills.⁷

Looking for the reason for this development, it is difficult to avoid the question of where the supply of combustion material originated from. It is safe to assume that mining and smelting required so much wood from the immediate surroundings for mine wood and charcoal production that the further processing of iron had to be located to more distant places.

This development continued during the thirteenth and fourteenth centuries. Away from the places where the pig iron was smelted, eventually, small regions developed, where further processing took place. The transport of the iron from the blast furnaces to the hammer mills was easy to manage by using a system of freight and counter freight in the form of food for miners and smelters. On the other hand, the individual hammer mills that soon sprang up throughout Upper Styria, were able to cover their charcoal requirements locally.

Such regions developed until about 1350 in the Rottemann-Triebsen area, between 1300 and 1350 in the Mur Valley around Murau, Obdach, and Judenburg, where there were also small iron deposits, and from about 1350 also around Knittelfeld, Leoben, and Kapfenberg and, somewhat earlier, at Mürzzuschlag in the Mürz Valley. North of the Erzberg, a separate hammer mill region developed on the Enns in the St. Gallen area.⁸

In the following, let us turn briefly to the salt works. As early as 1147, Duke Otakar III had given the monastery of Rein near Graz two salt pans in the Enns Valley near Mahorn and two estates in Mitterndorf. Mahorn refers to the Ahornberg peak near the town of Altaussee in the Styrian Salzkammergut region. Salt extraction in Salzkammergut was already in full swing at the time and probably underwent a significant technical modernization during Otakar's reign, leading to factory-like mining operations and the construction of pumping and sinking works for brine extraction. These technical feats were once again under the direction of the technically skilled Cistercian monks of Rein. It is documented that Abbot Gerlach from Rein gathered experience in 1146 about the technical installations of the spring brine catchments and boiling plants at the saltworks of Reichenhall near Salzburg. The Cistercians of the Harz region in present-day Germany had already obtained the relevant mining knowledge years before. This example is an excellent illustration of how the medieval 'technology transfer' by the Cistercian monks of Rein, laid down in 1129 by Leopold the Strong, the father of Otakar III, permanently changed and modernized forms of the Styrian economy in the twelfth century.⁹

7 Reismann, *Sozialgeschichte der steirischen Hammerarbeiter*, 3.

8 Reismann, *Sozialgeschichte der steirischen Hammerarbeiter*, 5 f.

9 Reismann, *Steiermark*, 59 f.

With regard to salt mining in the Styrian Salzkammergut, the early Habsburg Duke Albrecht I had already tried to expand production to the Gosau Valley in present-day Upper Austria and to oust the Hallein salt from Austria. The sovereign therefore invested in his operation on the Styrian side of the Pötschen Pass. Around 1300, the old salt pans, that had existed already in the twelfth century, were enlarged and moved from Altaussee to Bad Aussee, which had been granted market rights a short time earlier. This happened because the firewood supply at the old location was no longer sufficient. The larger pans required relatively less wood for salt production, and it was easier to take the wood to the new location by drifting. This is the time when skilled workers, the so-called *Hallinger*, started to gain strength and formed their own trade union. In 1334, there were 24 such Hallingers owning their own salt kilns and hereditary labour rights to the salt pans of the Styrian duke. The total revenue from the salt pans in the Styrian Salzkammergut increased fivefold between 1267 and 1335! After the precise regulation of the salt sales area in the last third of the 14th century, salt production in Ausseer Land continued to increase. This, on the other hand, led to an increase in wood consumption.¹⁰

The duke of Styria intervenes from the fifteenth century onwards to regulate trade

In 1425, the duke of Styria limited the number of *Hallingers* in Bad Aussee to sixteen, and finally, at the time of the reorganization of the Styrian iron industry, from 1448 onwards they were gradually eliminated because of their excessive power and influence. This development marked the beginning of the later Austrian salt monopoly. However, the supply of salt pans with sufficient charcoal still had to be regulated.

The upswing during the regency of Friederich III was also significant in the iron industry. In 1449, he issued his own iron ordinance which regulated all matters relating to the sale and taxation of iron, as well as the level of wages and the purchasing areas for livestock and victuals, which supplied the miners and smelters. These regulations came at the right time, for technological development had resulted in tremendous progress in the iron industry. It is in 1439 that the owners of the big furnaces driven by waterwheels, the *Radmeister* are first mentioned. The hammer mills became more modern and efficient and finally migrated from the Erzberg to the valleys of Upper Styria and further, as it had become impossible in the narrower area to provide the necessary combustion material, charcoal, and mine timber, and to cater for the large workforce and their families. In this context, rules had to guide

¹⁰ Mittermüller, *Das Montanwesen*, 89.

a massively expanded and eminently important economic factor. Soon everything in the country depended on the so-called *Bergsegen*, the ‘welfare of the mining industry’, ranging from the farmer who provided the food, the lumberjacks and charcoal burners who secured the combustion supply, to the carter and the innkeeper. If the iron industry flourished, the whole country lived well; if the iron industry was in crisis, the entire population suffered.¹¹

Maximilian, the successor to Friederich III, continued his father’s reforms. As early as 1495, he appointed Hans von Maltitz as the first and highest mining master of the five Lower Austrian provinces, to whom the individual mining judges were subordinated, and in 1499 another attempt was made to centrally regulate iron production and supply. A first order of forestry was also sought, since the forest and the charcoal obtained from it ensured the combustion material in the Styrian mining industry! As early as 1499, the first *Waldberaitung*, a special form of forest inspection, was carried out. In the course of this, in Upper Styria the ‘Black Forest’ and ‘High Forests’, the way the sovereign and private individuals designated the types of forests according to their use, were precisely mapped, and it was determined what type of wood should be used in each area.¹²

Closely connected with these reforms, however, and reinforced by the 1517 ‘mountain ordinance’, was a reorganization of the Styrian duke’s forestry regime. The duke now claimed most of the forests for himself, wherever they were located. This was understood to mean forests that were little or not at all burdened by peasant cultivation, i.e., forests in which the subjects did not obtain wood for the estate or their own domestic needs. This regulation particularly affected the immensely large woodlands and forests of the monasteries of Admont and Göss near Leoben. The beginnings of centrally regulated forestry in Styria are thus closely connected with mining and the mining industry.¹³

As a result of these developments, there was a need for bringing in the required charcoal, mine timber, and pit wood. Wood drifting down mountain streams and rivers was used for this purpose in Styrian forestry from the fourteenth century at the latest. It made it possible to transport wood from distant or impassable areas to places where there was an above-average demand. The oldest record of drifting in Styria is in the 1327 foundation charter of the monastery of Neuberg an der Mürz in the eastern part of Upper Styria (Fig. 2).¹⁴

11 Reismann, *Steiermark*, 100.

12 Reismann, *Steiermark*, 107.

13 Mittermüller, *Das Montanwesen*, 396.

14 Hafner, *Die Holztrift*, 583.



Figure 2 The Mürz rake at Krampen near Neuberg an der Mürz, built by the monastery of Neuberg an der Mürz, used until the 1950s (collection Reismann)

There were three regions where drifting mostly took place. Early on, it happened in Salzkammergut with its salt pans; from the early sixteenth century, with the expansion of the blast furnaces and smelting works and the fatigue of the nearby forests, the greater Eisenerz-Vordernberg area was added, and thirdly, the city of Graz entered as a customer. It had become a royal seat under Friedrich III and was therefore subject to significant growth. The main destination of the *Trift*, however, was the iron industry. In 1627, the nineteen Innerberg blast furnaces needed about 17,000 tons of charcoal annually, and the fourteen Vordernberg blast furnaces about 10,000 tons. In Innerberg, this amount increased to about 28,000 tons by 1784, while in Vordernberg to 23,000 tons.¹⁵

As early as the sixteenth century, the planning and construction of large timber transport systems began in Styria by order of the sovereign. This was carried out by the most experienced timber and enclosure masters in Central Europe. At the beginning, the foresters, most of whom were forest masters of the Styrian duke, usually only had to assess the necessity of such a construction, possibly supervise the construction, and settle the accounts. The construction of the first rake in the Mur in Leoben and a new rake on the Traun near Bad Aussee fall precisely into this phase.¹⁶

¹⁵ Roth, *Trift und Flösserei*, 47 f

¹⁶ Hafner, *Steiermarks Wald*, 179 and 182.

The Leoben Mur rake was used to remove and char the wood destined for the Vordernberg blast furnaces and was brought from the Upper Mur Valley along the drift path. In 1502, the first rake was built on the Enns in Hieflau to secure the Innerberg smelting works, and in 1517 Leoben received a second Mur rake. Specially appointed foresters had to control the forests dedicated to these rakes and ensure that they were managed as regularly as possible. As a result, several new blast furnaces were built, and iron production increased. This iron was sorely needed, because the ever-increasing Ottoman threat necessitated the production of more weapons.¹⁷

The salt pans in the Styrian Salzkammergut also consumed large quantities of wood. The first mention of the construction of rakes in the Styrian Salzkammergut dates from 1499, when Heinrich Wuest was sent from Hall in Tyrol to Aussee to investigate the matter. In 1502, he returned to Aussee with Dr. Fuxmagen and the foreman Hans Telhag from Kempten in Allgäu to build a rake. Where exactly this rake was built is as unclear as the question of which rakes and works were destroyed by a flood in 1505. The restoration of the rakes was carried out by the bailiff and the foreman of the salt pan in Hall in Tyrol.¹⁸

The construction of the first Mur rake in Leoben is closely related to the crisis in the supply of combustion material and charcoal for the Vordernberg blast furnaces around 1489. After the forests in the immediate vicinity had been practically hacked dry, the tradesmen and the owner of the blast furnaces were allowed to exchange a third of the iron they produced for provisions and charcoal. This in turn raised the cost price of the iron to the point of being uneconomical.¹⁹ However, it was not until 1499, in connection with the Styrian duke's *Waldberaitung*, i.e., forestry approval, that the large Mur rake was built in the Mur bend at about the level of today's railway station of Leoben, also according to the plan of the saltworks administrator Heinrich Wuest, who later rose to the position of forest master of the Styrian duke, and was one of the best-known haulage experts in the Alpine region around 1500. From then on, urgently needed coal wood could be transported from the side valleys as far as Weißkirchen near Judenburg, where there were large forest stocks belonging to the Styrian duke, to Leoben the 'Kohlländ' near the rake, where the charcoal was produced. In Weißkirchen itself, corresponding drifting huts and reamers were built as late as 1499.²⁰

17 Reismann, *Steiermark*, 107.

18 Hollwöger, *Ausseer Land*, 71.

19 Pirchegger, *Eisenwesen bis 1564*, 50 ff.

20 Pirchegger, *Eisenwesen bis 1564*, 54.

The rake building in Leoben under the direction of the forest master Sigmund Paumgartner from Eisenerz was completed in 1501.²¹ It existed, together with a second one built before 1517,²² until the nineteenth century (Figs 3 and 4).

From the beginning, the highest authority regarding the maintenance of the Mur rakes, as well as the *Klaus- and Ries-works* at Weißkirchen was the Styrian forest master, who not only determined the quantities of wood to be felled and drifted, but also had to ensure that the drifting works were in good condition. The forest master also was the highest authority in forest management and control on behalf of the sovereign. His influence was so strong that the owners of the blast furnaces had to call him to inspect the forest before they began to cut a new forest they had acquired.

The *Waldberaitung* of the year 1499 also precisely defined the forests assigned to each iron production center of Upper Stryia. Eisenerz, for example, in addition to the wood from the directly surrounding forests obtained wood from the forests of the Liesing Valley, the Tragöss Valley near Bruck an der Mur, and the Enns Valley from Gstatterboden to Landl and Wildalpen, i.e., within a radius of up to fifty kilometres.

No matter how well the forests had been regulated, many were in a deplorable state, particularly due to the temporary recurrence of fire clearing to grow grain, and because the predominant form of timber production was clear-cutting enormous areas. Poor forest management was the most important cause of the floods and inundations that subsequently occurred everywhere, which will be described later.

About drifting wood from the clear cuts, it should be noted that at the end of winter and the melting of the snow, coal wood was first drifted onto the upper Leobner rake, and when it was full, onto the lower one.²³

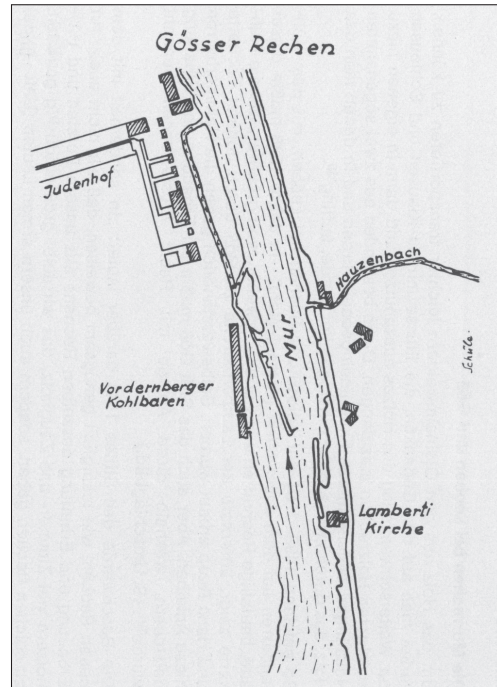


Figure 3 Plan of the Mur rake at Leoben Göss built in 1501 (from: Leobener Strauß)

21 Hafner, *Flößerei, Trift und Schiffahrt*, 82.

22 Pirchegger, *Eisenwesen bis 1564*, 55.

23 Pirchegger, *Eisenwesen bis 1564*, 56.



Figure 4 The remaining stone base of the Mur rake in Leoben Göss.
Photo taken by Bernhard Reismann, February 2012

In connection with the Styrian duke's 1501 and 1502 forest surveys, it was also decided to build the first Enns rake in Hieflau, for which wood was initially drifted from the almost inexhaustible forests of Admont Monastery.²⁴ The commission for the construction of this rake in Hieflau was appointed on 12 June 1502, consisting of Sigmund Paumgartner, the forest master in Eisenerz, and officials in Hallstatt, Aussee, Innerberg (Eisenerz), and Vordernberg. They decided on the river knee in Hieflau as the location of the rake building. It is not exactly known when the first rake in Hieflau was actually built, but an imperial letter of 26 September 1516 to the forester Hans Haug mentions that the rake on the Enns would be cleaned and finished before winter.²⁵ However, within a short time, charcoal from Hieflau was no longer sufficient to supply the Innerberg ironworks with combustion material and charcoal. Emperor Maximilian had already suggested building another, larger Enns rake in Großreifling to collect the drift wood from the Salza catchment area, and this decision again was confirmed in 1535 as a result of a commission of the Styrian duke. In 1538, the bailiff and the owners of the blast furnaces in Innerberg were informed by the government of Graz that it was their strong wish to build a rake on the Enns near Reifling, and that the wood and gravel belonging to Admont Monastery were needed for this purpose.²⁶ The rake on the Enns at Großreifling,

24 Pirchegger, *Eisenwesen bis 1564*, 55.

25 Hafner, *Steiermarks Wald*, 184.

26 StLA, LAA Antiquum, Gruppe XIII, Slipcase 237, booklet *Bau eines Rechens zu (Groß)Reifling 1538*.

however, was finally built on the basis of a commission in April 1565, followed by another one in June 1567, according to the plans of the ingenious Tyrolean hydraulic engineer Hans Gasteiger (1499–1577) (Fig. 5).²⁷



Figure 5 The rake at Großreifling in a depiction by Clobucchiarich from around 1820 (private ownership)

Gasteiger was active in hydraulic engineering from 1538 and was appointed to Vienna in 1554 to clear the Danube between Krems and Vienna of stone blocks and tree trunks. He was ennobled in 1561 and was commissioned to build the rake on the Enns at Großreifling in 1567 (Fig. 6).²⁸ The rake was probably largely completed by 1570. Situated in a bend of the Enns, the rake then stretched to a length of 571 metres from the right bank of the Enns in a wide arc towards its left bank. It consisted of 264 pillars, and by means of their own pulleys, called *Ganauf*, the wood drifted on the Enns could be pulled out of the water and stored on land for subsequent charring.²⁹

27 Hafner, *Flößerei, Trift und Schiffahrt*, 83 f. and StLA, IÖ Hofkammer Sachabteilung, carton 53, booklet. 1, report, dated 12 December 1567, Reifling.

28 Hafner, *Flößerei, Trift und Schiffahrt*, 84.

29 Zitzenbacher, *Landeschronik*, 121 and Hafner, *Flößerei, Trift und Schiffahrt*, 86.

Ecological effects of overexploitation of the forest

The unregulated overexploitation of Upper Styrian forests during the Middle Ages and early modern times, quickly led to ecological problems. The absorptive capacity of the forest soil was lost, and this multiplied flood events along the rivers, especially at their lower reaches. It is noticeable that the early reports of floods up to about 1750 refer mainly to Upper Styria, meaning the parts of the country where the forest was massively logged for producing charcoal and for the steel industry. These floods were certainly felt along the Mur as well.

Around the year 1400, the Mur apparently began to run wild, which was visibly manifested in the shifting of the river. Around 1400, it still flowed directly through the present Abstall Basin (Abstaller Becken) in present-day Slovenia, south between Mureck and Bad Radkersburg. However, from about 1420 onwards, triggered by a landslide near Frattendorf/Vratja vas opposite Mureck, the Mur River began to shift further and further north and to increasingly widen its bed.³⁰ At the same time, extensive protection and regulation work was also started in the area. A definitive diversion of the Mur is mentioned, for example, in June 1446.³¹

From the second half of the sixteenth century, news of protective constructions and bank obstructions on the Mur in the Graz area is more frequent. A Mur flood in 1572 not only swept away the important Mur bridge in Frohnleiten, but also severely damaged the installed bank protections along the right bank of the Mur at Graz. Thus, it is known that, at least in the middle course of the Mur, appropriate bank protection structures were already in place around the middle of the sixteenth century. In the summer of 1634, the floods of the Mur damaged the large protective structures near and below the Karlau castle of the Styrian duke and emperor south of Graz, so that the castle and the duke's nearby animal garden were in great danger.³²



Figure 6 Funerary monument of Hans Gasteiger at the parish church of Landl near Großreifling, (Photo: Bernhard Reismann)

30 Wurzer, *35 Jahre Mur-Abkommen*, 11.

31 StLA, AUR, Urk. Nr. 6.034a, 9 June 1446, Vienna.

32 StLA, LAA Antiquum, Gruppe XIII, Slipcase 150, report, dated 19 September 1634.

Especially at Fernitz, south of Graz, the Mur was constantly raging. In the autumn of 1645 and the spring of 1646, when the peasants were already hard hit by the Thirty Years' War due to overhunting of game, hunting, and soldiers roaming around and begging, the land of the peasants in Neudorf and Thondorf in Fernitzboden south of Graz was affected by severe flooding. The two villages sought assistance from landlords, noblemen, and neighbours and wanted to do some work themselves. They arranged for the necessary carpenters to build a large defence wall and provided the material.³³

Early records of flood damage on the River Enns have survived only in a few cases, especially concerning the middle course of the river between Trautenfels-Neuhaus and the entrance to the Gesäuse, which later became overgrown. For the Haus and Gröbming area, on the other hand, situated on the upper reaches of the river in Styria, it is known that in February 1661, after severe flood damage in the course of 1660, the Salzburg diocese as the landlord requested the Salzburg administrator in Haus and Gröbming to submit a detailed report on the damage and requested a casual estimate of the repair costs.³⁴

The River Mürz, along whose course there were numerous blast furnaces and hammer mills, had the character of a torrent, especially in its upper region up to Neuberg. However, river damage with severe flooding consequences is only known in the middle course and from after 1550, which is probably due to the fact that significant forest areas in the Mürz catchment area were sacrificed to the more intensive and expanding mining and hammer industry from the sixteenth century onwards. The resulting reduced sponge capacity also contributed to the acceleration of water runoff in this region and, thus, to enormous flood peaks, the consequences of which soon appeared below Mürzzuschlag. In 1606, for example, the Neuberg Abbot Caspar informed the provincial parliament in Graz that a flood in August 1605 had ravaged the estates and properties two miles around the monastery, sweeping away houses, barns, and stables.³⁵

In 1643, the lord of Hohenwang near Langenwang, Christoph von Schärffenberg, reported to the provincial parliament in Graz that due to constant rainfall in the summer there had been such significant floods on the River Mürz that hammer mills, mills, bank protection structures, and lordship estates, as well as fish stocks in Langenwang and Kindberg had been destroyed or seriously affected. Schärffenberg was subsequently promised a relief contribution of 3,000 guilders for a period of three years, which was deducted from the tax he had to pay.³⁶

33 StLA, LAA Antiquum, Gruppe XIII, Slipcase 150, file from the year 1646, otherwise undated.

34 StLA, A. Haus und Gröbming, carton 33, booklet 102, report, dated 25 February 1661.

35 StLa, LAA Antiquum, Gruppe III, Slipcase 150, file from the year 1606, otherwise undated.

36 StLA, LAA Antiquum, Gruppe III, Slipcase 150, file from the year 1643, otherwise undated.

Scientific foundations and regulation of forestry under Maria Theresa

Forestry, which was first regulated in the interest of Styrian mining under Maximilian I shortly before 1500, was placed on a new, more modern basis under Maria Theresa from 1743 onwards, following a new forest survey in Upper Styria.

This forest inspection ruthlessly revealed the deplorable state of the Styrian forests. In addition to overexploitation traders practised for the production of charcoal in their own forests or in rented forests, the peasant forests were also found in a pitiful condition. The farmers of Upper Styria had to use the forests in several ways. On the one hand, they themselves also produced charcoal for the blast furnaces and hammer mills in the surrounding area, on the other hand, they had to use them as additional pasture for cattle. Driving of cattle and goats into the forests damaged the tree population, as did the production of chopped spruce branches for bedding in the stables by ‘*Schnaiteln*’, the special economic form of ‘*Brandwirtschaft*’, i.e., growing

corn and barley on previously fire-cleared forest areas, over-felling in the interest of the mining industry and a practically unregulated rejuvenation of the forest.³⁷

But it was not only the farmers’ forests that showed signs of abuse. The forests of large landowners also suffered from the system of clear cutting, and also from some ancestral rights that the farmers enjoyed, such as the right to allow cattle to graze in the forests, the so-called ‘*Bluemsuech*’.

A further legal regulation was finally brought about by Maria Theresa’s new Forest Law passed in the Duchy of Styria in 1767 (Fig. 7), which was only superseded by the Imperial Forest Act of 1852. These Forest Regulations attempted to establish the regulated use of forests according to modern criteria and ordered regular investigations into forest excesses, which were to be

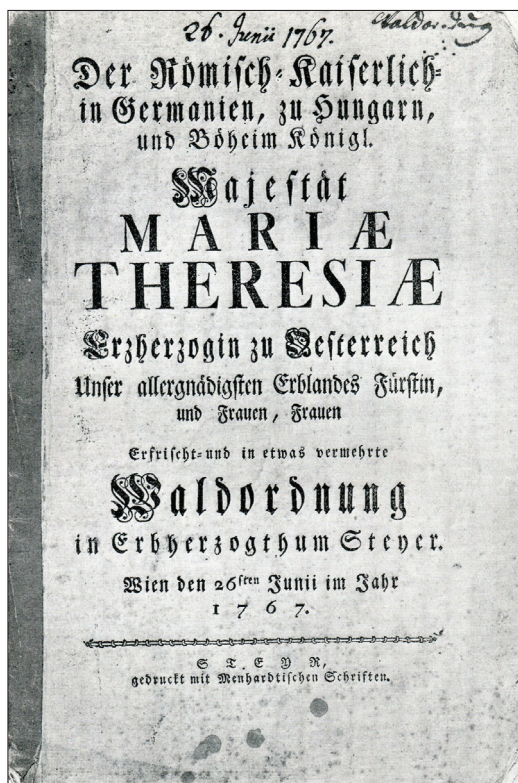


Figure 7 Front page of the Maria-Theresa’s “Waldordnung” from 1767, Steiermärkisches Landesarchiv (Photo: Franz Hafner)

37 Reismann, *Steiermark*, 155, and Hafner, *Steiermarks Wald*, 62 ff.

punished. For the second time after being targeted at the *Vollständige Waldordnung für das Herzogtum Steyr in 1695*—which was actually quite unsuccessful—measures for targeted reforestation were also laid down.

As early as 1755, a survey and inspection of the forests of Upper Styria was begun, which lasted for years and was summarized in 1767 in the so-called *Waldtomus*. In twenty-eight volumes, every forest in Upper Styria was precisely recorded with regard to its owner, its stock and condition and its possible use for the Styrian iron industry within the next hundred years. The property boundaries, forms of use and grazing rights in these forests and on the neighbouring mountain pastures were also noted.³⁸

Fossil coal instead of charcoal and the macroeconomic consequences

From the beginning of the eighteenth century, some attempts were made in the province of Styria to operate the ironworks with mineral coal, then called *Steinkohle* or 'hard coal'. However, unlike in the model country of industrialization, England, iron and coal deposits in Styria were spatially separated.

The Seegraben coalmine near Leoben, the oldest known deposit of fossil coal in Styria, was discovered as early as 1604 by James Camworth, an English-born Carinthian ironworker and watchmaker. However, a first attempt to mine this deposit in 1606 failed. Camworth is also said to have discovered coal deposits in the Kapfenberg area.³⁹

The Schwarzenberg princes, however, found and developed the coal deposit of Fohnsdorf near Zeltweg from 1718 onwards, followed a few years later by the Fürst tradesmen from Thörl near Aflenz with coal mining in Seegraben near Leoben, where coal had first been mined for a few years as early as 1606. Caspar von Lierwald, another mining contractor from Leoben, began coal mining at the neighbouring Münzenberg in 1726, and around 1770 mining began in the coal deposits in Western Styria, as well as near Graz. The mining entrepreneur Jgnaz von Reichenberg, in turn, successfully mined coal in the Mürztal from around 1770.⁴⁰

At first, however, these mines were mainly developed for the purpose of alum production, especially as the sale of fossil coal to the blast furnaces and hammer mills in the immediate vicinity was initially out of the question or, at best, was possible to

38 Hafner, *Steiermarks Wald*, 65–73.

39 StLA, OBA Leoben, Slipcase 128, file 1606 – from 10 June 1606, Application of the Chamber Councillor Hans Harrer zu Adelsbühel for the granting of a mining right to the coal above Leoben (this exciting file has not yet been appropriately scientifically processed).

40 Reismann, *Steiermark*, 162.

a limited extent. The traders' reservations about the high sulphur content of this coal and its alleged negative effects on the quality of their iron and steel products in the hammer mills initially had an extremely inhibiting effect. Charcoal was therefore given unconditional priority for firing. This only changed with the introduction of modern puddling technology in the smelters of Donawitz near Leoben, Kapfenberg, Krieglach, and Neuberg an der Mürz from the 1830s onwards, and with the planned construction of the Mürzzuschlag–Graz–Trieste railway line from 1842.⁴¹

Due to the overall economic development of the province of Styria, no stone was left unturned in this area in the forty years up to 1880.

The main reasons for this development were the headstart in England's industrialization, the ever-increasing momentum of the global market, which made English iron cheaper than Styrian iron in the port of Trieste, and finally a structural change in Styria itself, which started with the construction of the railway lines around 1840. The latter development led in a few years to the establishment of a subcontracting iron industry at the expense of the old hammer mills, and it made it necessary to switch from charcoal to fossil coal.

After the end of the first iron and steel crisis between 1862 and 1864, the *Innerberger Hauptgewerkschaft*, founded in 1625, was sold in 1866 for 14.5 million guilders to private investors around the *Österreichische Creditanstalt*, which had already begun to clean up outdated structures. Many obsolete hammer mills of the main union throughout the Enns Valley were immediately abandoned. Several other large mining companies at the same time merged to form the *St. Ägydi-Kindberger*, the *Neuberg-Mariazeller*, and the *Vordernberg-Köflacher Montanindustriengesellschaft*, which, after another crisis in the iron industry during the 1870s, were united with the help of French capital in 1881 to form the *Alpine-Montan-Gesellschaft* (ÖAMG). Other large private companies were also bought, including the important Friedauwerke in the Vordernberg area and the *Hüttenberger Eisenwerksgesellschaft* in Carinthia. The ÖAMG subsequently closed smaller operating sites. Small, private mining companies decided to give up from 1881 onwards, as they were no longer able to cope with the growing competition from the ÖAMG. In 1901, only five modern blast furnaces were still operating in the entire Styria, which by now were heated with coke instead of charcoal and supplied 350,000 tonnes of pig iron and steel annually, about seven times as much as all the Styrian iron and steel works together in 1850.⁴²

This restructuring of the Styrian coal and steel industry began around 1860 and intensified from around 1875 onwards. One of the consequences, in conjunction

41 Reismann, "Der Kohlenbergbau Urgental/Dürnberg bei Bruck."

42 Reismann, *Steiermark*, 226–28.

with the expansion of the railway network, was that the ÖAMG, which until then had almost entirely covered its needs with charcoal, now relied on mineral coal, therefore its large forest holdings were more of a burden than a bliss. Thus, in a few years, the ÖAMG sold no less than 104,159 hectares of forest property, of which 47,166 hectares went to the Ministry of Arable Farming in Vienna, about 17,800 hectares to Emperor Franz Josef himself for the *'Allerhöchsten Familienfonds'*, and on 1 January 1889 no less than 26,459 hectares of forest landed in one fell swoop to the Province of Styria. These forests were located in the Enns Valley, in the so-called *'Gesäuse'* and near St. Gallen at the River Enns, and formed the basis of today's *'Steiermärkische Landesforste'*. Other institutions, companies, and individuals acquired further forest shares, and in 1979, VOEST Alpine, as the legal successor to the ÖAMG, owned no more than 3,109 hectares of forest in Styria.

The previous protoindustrial charcoal production was replaced by a timber industry with a reduction in the number of trees felled. However, this transition also meant a change from the previously predominant drifting to overland transport. This development was accelerated in Upper Styria by the construction of the Crown Prince Rudolf Railway (1875). As one of the consequences, the end of timber drifting and drift rakes was approaching.⁴³



Figure 8 The Enns rake at Hieflau in 1896 (collection Reismann)

43 Hafner, *Steiermarks Wald*, 300 ff.

Until about 1890, for example, the Hieflau rake was considered a special technical sight (Fig. 8). After that year, it was taken out of service due to the new economic conditions caused by the constantly declining demand for charcoal. No longer maintained, it suffered a devastating breach in 1906 due to an Enns flood, after which its superstructure was removed (Fig. 9).⁴⁴



Figure 9 The Enns rake at Hieflau in 1910, after its devastation in 1906 (collection Reismann)

In 1853, the rake of Großreifling on the River Enns was still described as the largest in the entire Habsburg Empire. However, when it fell victim to a flood in 1862, its restoration was not even considered due to the changing economic conditions.

The so-called *Gamsrechen*, a rake on the River Salza near Großreifling was used for drifting until 1898, although it had been severely damaged by a flood the year before. However, due to the construction of forest roads in the region and the change in the firing of blast furnaces, this rake was no longer necessary either.

The end point of the drift on the River Kainischtraun in the Styrian Salzkammergut for the salt works in Bad Aussee was formed by the Traxel rake, a catchment rake with a swell, sand grid, and rake bar. In 1888, it was 196 meters long and consisted of eleven ashlar pillars, two wooden yokes, and lifting gates. Its capacity was 14,900 cubic metres. After this rake had also been severely damaged by the Traun floods in 1897, the drift in the area of the River Kainischtraun was finally abandoned in 1901.⁴⁵

44 Hafner, *Steiermarks Wald*, 185.

45 Hafner, *Steiermarks Wald*, 195 f.

New large forest estates are emerging: The example of the Mayr-Melnhof family

Parallel to this development, another one was taking place: large private mining entrepreneurs such as the Mayr-Melnhof family in Donawitz near Leoben, who had already started to acquire forests around 1850 in order to cover their own needs of combustion material, invested in the acquisition of further forest property, land, and soil by selling their mining companies and industrial enterprises to the ÖAMG. In this way the Mayr-Melnhof family became probably the largest private forest owner in the country. The Schwarzenberg family in the Murau area was similar, and in a weakened form, also the Seßler family of tradesmen in the Mürztal, who acquired large forests in the Krieglach-Alpl area and in the Stanz Valley near Kindberg in the early years of the second half of the nineteenth century.⁴⁶ The economic rise of the Mayr-Melnhof family as an important member of the Styrian mining industry began with Franz Mayr junior, born in 1810 as the son of the Leoben innkeeper and entrepreneur Franz Mayr. He owned hammer mills near Bruck an der Mur and in 1830 acquired smaller mills in Leoben-Waasen and Kapfenberg, the latter from the estate of the owner Franz Michael Schragl.

Franz Mayr junior had completed courses at the Joanneum's Technical College in Graz and Vordernberg, and furthered his education on study trips through France and England, where he became acquainted with the modern puddling process.

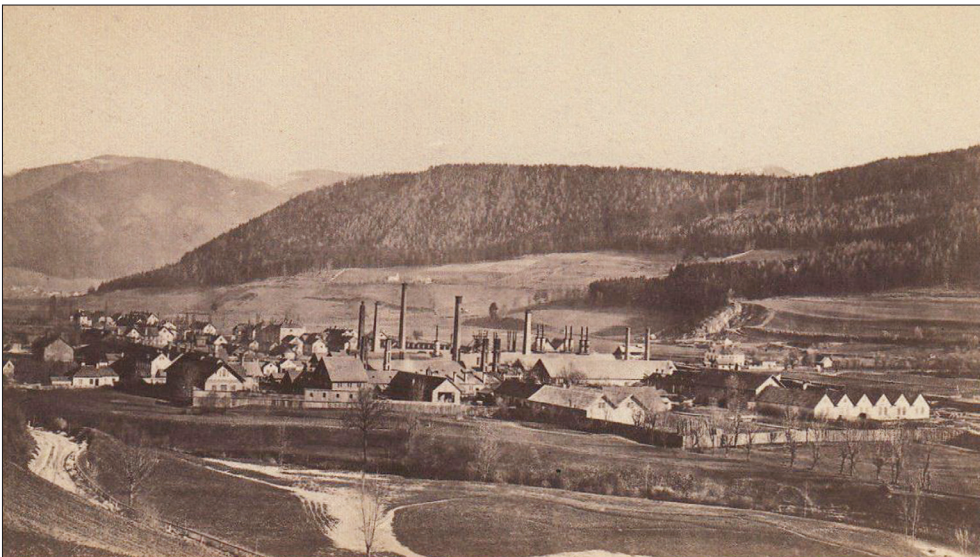


Figure 10 The Donawitz steel factory at Leoben-Donawitz, shortly after being sold from the Mayr-Melnhof family to the Innerberger Hauptgewerkschaft (collection Reismann)

⁴⁶ Reismann, *Steiermark*, 226–28.

Together with his father, in 1836 he built the *Franzenshütte* steelworks in Donawitz near Leoben in the place of an old hammer mill, where he wanted to introduce the puddling process. After producing perfect puddling iron in Kapfenberg, the same year, the puddling process was introduced in Donawitz. As early as 1843, the Donawitz company was extended by the new *Carolihütte*. In 1965, the Styrian historian Anton Adalbert Klein commented on these developments: “Thus, the Mayrian Foundation became the birthplace of the enormous Donawitz plant of today [...] The Kapfenberg plants continued to be the second focal point of their already respectable industrial complex” (Fig. 10).⁴⁷

Raised to the rank of baron in 1872 and awarded the title ‘von Melnhof’, Franz Mayr junior, who correctly interpreted the signs of the times and the overall economic development, sold his company in the same year to the *Innerberger Hauptgewerkschaft*, which was merged into the ÖAMG in 1881. The entire complex was sold for 5.25 million guilders at the best moment, because in May 1873, in the wake of the Vienna stock market crash, there was a global economic crisis that paralysed the iron and steel industry (Fig. 11).



Figure 11 Timber delivery by forest workers of the Mary-Melnhof company at Leoben Gössgraben, postcard from 1905 (collection Reismann)

⁴⁷ Klein, *Franz Mayr-Melnhof*, 5–10.

As early as 1872, the Mayr von Melnhof family made an enormously important purchase in the Frohnleiten area. They acquired the Pfannberg and Weyer estates from the Counts Lobkowitz. The Kogl estate in St. Georgen in Upper Austria was also purchased the same year. The family estate had grown to more than 6,000 hectares by 1872. In 1873 and 1874, properties in the municipalities of Pernegg and Rothleiten north of Frohnleiten, covering more than 1,500 hectares, were acquired, and timber farming was started in that area as well. In 1875, the first property in the province of Salzburg followed, which later came to Friedrich Mayr-Melnhof, the second son of Franz III, together with the Upper Austrian property. Between 1876 and 1887, further properties were acquired throughout Styria, totalling around 10,000 hectares. In 1888, he bought more than 10,300 hectares from the former property of the *Vordernberger Radmeister-Communität*. These forests were in a highly precarious condition, as they had been literally plundered to produce charcoal. They were subsequently reforested in a targeted manner.

Franz Mayr von Melnhof simultaneously invested in the purchase of large forests. Between 1872 and 1889, he acquired 35,000 hectares of land, 28,600 hectares of which was forest land, in addition to his already considerable forest holdings, which he had previously needed for his own supply of charcoal for his industrial companies. This property spread over the greater Leoben area and over the Gößgraben and the Gamsgraben to the south as far as the present-day city of Frohnleiten. There, shortly



Figure 12 Hunting lodge of the Mayr-Melnhof Family at the “Hochalm” near Leoben Göss, postcard from 1914 (collection Reismann)

before his death in 1889, he built a wood grinding mill and a sawmill in Wannersdorf near Frohnleiten, which later developed into an important cardboard factory.⁴⁸

Franz II Freiherr Mayr von Melnhof transferred a total estate of 34,783 hectares, mostly forest, to his son and heir, Franz III Freiherr Mayr von Melnhof. Then only smaller purchases followed. By 1899, the estate had reached the size of 35.591 hectares. Of these, no less than 14,067 hectares came from purchases by the *Innerberger Hauptgewerkschaft*, the predecessor of the ÖAMG founded in 1881 (Figure 12).

These economic developments in the Styrian forestry sector marked the end of a development process that had started in the twelfth century and was always closely connected to the overall economic and political development. For centuries the forests, especially of fast-growing coniferous wood, in Upper Styria supplied mine timber and charcoal for the Styrian mining industry.

However, the Styrian mining industry also had a huge impact on the management of forests and led to their plundering and near devastation. On a more positive note, it also led to the early central, regulatory intervention of the Styrian duke. And finally, it was the full-scale technological conversion of the Styrian iron industry in the nineteenth century that gave a new form of utilisation and management to the forests in Upper Styria and that Styria still forms the 'Green Heart of Austria'.

Sources

Steiermärkisches Landesarchiv (StLA), Graz
 Allgemeine Urkundenreihe (AUR)
 Innerösterreichische Hofkammer (IÖ Hofkammer)
 Landschaftliches Archiv Antiquum (LAA Antiquum)
 Oberbergamt Leoben (OBA Leoben)
 Spezialarchiv Haus und Gröbming (A. Haus und Gröbming)

Literature

Beck, Ludwig. *Die Geschichte des Eisens in technischer und kulturgeschichtlicher Beziehung, erste Abteilung*. Braunschweig: Friedrich Vieweg 1891.
 Hafner, Franz. "Flößerei, Trift und Schiffahrt auf der Enns von den Anfängen bis zum Ende." *Centralblatt für das gesamte Forstwesen* 90 (1973): 161–191.
 Hafner, Franz. "Die Holztrift mit besonderer Berücksichtigung ihrer Ausübung in der Steiermark." In *Siedlung Macht und Wirtschaft. Festschrift Fritz Posch zum*

48 List, *Leobner Taschenbuch*, 64.

70. *Geburtstag*, edited by Gerhard Pferschy, 579–598. Veröffentlichungen des Steiermärkischen Landesarchives 12. Graz: Steiermärkisches Landesarchiv 1981.
- Hafner, Franz. *Steiermarks Wald in Geschichte und Gegenwart. Eine forstliche Monographie*. Vienna: Österreichischer Agrarverlag, 1979.
- Hollwöger, Franz. *Ausseer Land. Geschichte der Gemeinden Bad Aussee, Altaussee, Grundlsee, Mitterndorf und Pichl*. Bad Aussee: Buchhandlung G. Schantin, 1956.
- Klein, Anton Adalbert. “Franz Mayr-Melnhof, ein Pionier der modernen Eisenindustrie.” In “Steirische Unternehmer des 19. und 20. Jahrhunderts.” *Sonderbände der Zeitschrift des Historischen Vereines für Steiermark* 9 (1965): 5–10.
- List, Rudolf. *Das Leobner Taschenbuch*, Leoben: Trofaiach, 1963.
- Mittermüller, Franz. “Das Montanwesen.” In *Die Steiermark im Spätmittelalter*, edited by Gerhard Pferschy, 391–424. *Geschichte der Steiermark*, 4. Vienna–Göttingen: Böhlau, 2012.
- Pirchegger, Hans. *Das Steirische Eisenwesen bis 1564. Mit einem Überblick über das Kärntner Eisenwesen*. Steirisches Eisen. Beiträge zur Geschichte des österreichischen Eisenwesens, 2. Graz: Leykam, 1937.
- Puschnig, Reiner. *Kapfenberg. Alter Markt – junge Stadt*. Kapfenberg: Stadtgemeinde Kapfenberg, 1974.
- Reismann, Bernhard A. “Sozialgeschichte der steirischen Hammerarbeiter unter besonderer Berücksichtigung der Verhältnisse des Brucker Kreises.” PhD-diss., Karl-Franzens-Universität Graz, 2000.
- Reismann, Bernhard A. *Steiermark. Eine Geschichte des Landes*. Vienna–Graz–Klagenfurt: Styria Regional, 2012.
- Reismann, Bernhard A. “Der Kohlenbergbau Urgental/Dürnberg bei Bruck an der Mur.” *Blätter für Heimatkunde*. (Forthcomming.)
- Roth, Paul W. “Trift und Flösserei im steirischen Eisenwesen.” *Ferrum* 62 (1990): 47–51. doi.org/10.5169/seals-378252
- Valentinisch, Helfried. “Das eisenverarbeitende Gewerbe im Umkreis des Steirischen Erzberges.” In *Erz und Eisen in der Grünen Mark: Katalog zur Landesausstellung 1984 ; [Landesausstellung Kammerhof, 12. Mai bis 14. Oktober 1984, Eisenerz]*, edited by Paul W. Roth, 207–33. Vol. 2. Graz: Styria, 1984.
- Wurzer, Emil, ed. *35 Jahre Mur-Abkommen : 1956–1991 : die Bemühungen zweier Staaten um einen Grenzfluß*. Vienna: Bundesministerium für Land- und Forstwirtschaft, 1991.
- Zitzenbacher, Walter, ed. *Landeschronik Steiermark*. Vienna–Munich: Brandstätter, 1988.

