

The Management of the Forests of the Dukes of Arenberg from 1600 until 1820⁽¹⁾

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The importance of forests for early modern communities cannot be understated. Forests provided energy, construction material and – to a lesser extent – food for early modern communities. In most of North-Western Europe, wood became scarce during the 17th-18th centuries due to a rising demography and urbanization⁽²⁾. As a result, wood-prices increased, making commercial forestry an attractive investment for those with sufficient capital and patience. Next to investing capital over a long period of time, forest owners also had to make the right economic decisions with respect to forestry techniques and labour remuneration to take full advantage of the rising prices. This was a daunting task in light of the several challenges early modern forest management was faced with: severe difficulties in communication between the owner or his central organisation and the forest managers⁽³⁾, the non-alignment of the interests of owners and stewards⁽⁴⁾, the lack of a sound scientific base for forestry (especially in the 17th century)⁽⁵⁾ and the ambiguity of property rights⁽⁶⁾. Those forest owners who successfully tackled these challenges were assured of well-maintained and optimally exploited forests and enjoyed a corresponding boost in revenues.

The Arenberg family, a leading noble family with origins in the German Eifel

(1) The author would like to thank the anonymous referees and Prof. dr. Erik Thoen, Prof. dr. Thijs Lambrecht, Prof. dr. Koen Schoors and dr. Lies Vervaeet for their constructive remarks.

(2) Sander BERGHMANS & Lies VERVAET, “Hout als energiebron in vroegmodern Vlaanderen”, in *Wereldgeschiedenis van Vlaanderen*, Antwerpen, Polis, 2018, p. 251-257; Chris VANDENBROEKE, “De problematiek van de energievoorziening in de Zuidelijke Nederlanden en inzonderheid in Vlaanderen (15^{de}-19^{de} eeuw)”, in *Revue belge de Philologie et d'Histoire*, vol. 73, 1995, 4, p. 967-981.

(3) Robert C. ALLEN, “Agriculture During the Industrial Revolution”, in *The Economic History of Britain since 1700*, Cambridge, Cambridge University Press, 1994, vol. 3, p. 96-100; David STONE, *Decision-Making in Medieval Agriculture*, Oxford, Oxford University Press, 2005, p. 190-200.

(4) Peter ROEBUCK, “Absentee Landownership in the Late Seventeenth and Early Eighteenth Centuries: a Neglected Factor in English Agrarian History”, in *The Agricultural History Review*, vol. 21, 1973, 1, p. 1-17; Jonathan THEOBALD, “‘Distant Lands’: The Management of Absentee Estates in Woodland High Suffolk, 1660-1800”, in *Rural History*, vol. 12, 2001, 1, p. 1-18.

(5) Pierre-Alain TALLIER e.a., “State Forestry in Belgium since the End of the Eighteenth Century”, in K. Jan OOSTHOEK & Richard HÖLZL, eds., *Managing Northern Europe's Forests. Histories from the Age of Improvement to the Age of Ecology*, New York-Oxford, Berghahn Books, 2018, p. 94-102.

(6) Guido TACK, Paul VAN DEN BEMT & Martin HERMY, *Bossen van Vlaanderen. Een historische ecologie*, Leuven, Davidsfonds, 1993, p. 193-195.

area, drew a large part of their income from their forestry estates⁽⁷⁾. Scattered across different Western-European countries (modern-day France, Belgium, Luxembourg and Germany), these properties presented a real challenge in terms of management due to their size, dispersion and complexity⁽⁸⁾. During the 17th, 18th and 19th centuries, the dukes and duchesses were able to develop an efficient organisation that generated a vast amount of money for the family, especially by the sale of wood. In this paper I investigate how the Arenberg family managed their forests, in relation to the early modern price evolution and forestry problems.

Literature and theoretical background

To write this ‘analytically structured history’ – a historical analysis employing both historical narratives and analytic schemes – about forest management, a historical case was carefully selected. I first had to identify a case where the analytical concepts related to forestry management were well documented in the archives.⁽⁹⁾ In this respect, the case of the dukes of Arenberg presents an apt example. The dukes of Arenberg – with roots in the Eifel region – belonged to the highest ranks of the nobility in Western Europe. Though still holding several estates in the German Rhine area and France⁽¹⁰⁾, a successful marriage and acquisition policy would shift the centre of gravity of their properties to the Southern Netherlands from the 17th century onwards⁽¹¹⁾. After the bloody transition from the 17th to the 18th century, with the Nine Years’ War (1688-1697) and the War of the Spanish Succession (1701-1713), the 18th century was a period of relative peace and prosperity providing a fertile ground for the Western-European economy to flourish. The Arenberg family managed to increase its income substantially during this period⁽¹²⁾. During the 19th century the focus of the family shifted

(7) Nicolas DE VIJLDER & Sander BERGHMANS, “Van gemeenschapsgoed naar privaat bezit? Bosbeheer in de zeventiende en achttiende eeuw: Casus De Arenbergs”, in *Tijdschrift. Heemkunde en Lokaal-Erfgoedpraktijk in Vlaanderen*, dl. 4, 2014, 2, p. 43-55; Peter NEU, *Die Arenberger und das Arenberger Land. Band 4: Das 19. Jahrhundert. Vom Souverän zum Standesherrn*, Koblenz, Landesarchivverwaltung Rheinland-Pfalz, 2001 (Veröffentlichungen der Landesarchivverwaltung Rheinland-Pfalz, 91); Peter NEU, *Die Arenberger und das Arenberger Land. Band 5: Das 19. Jahrhundert. Adelsleben-Besitz-Verwaltung*, Koblenz, Landesarchivverwaltung Rheinland-Pfalz, 2001 (Veröffentlichungen der Landesarchivverwaltung Rheinland-Pfalz, 92).

(8) Jean-Pierre TYTGAT, “Van rentmeesters en intendanten. Het beheer van de Arenberggoederen”, in Jan ROEGERS & Mark DEREZ, eds., *Arenberg in de Lage Landen: een hoogadellijk huis in Vlaanderen & Nederland*, Leuven, Universitaire Pers Leuven, 2002, p. 132-146.

(9) Michael ROWLINSON, John HASSARD & Stephanie DECKER, “Research Strategies for Organisational History. A Dialogue between Historical Theory and Organisation Theory”, in *Academy of Management Review*, vol. 39, 2014, 3, p. 260-270.

(10) Mark DEREZ, “Arenberg na de Revolutie”, in J. ROEGERS & M. DEREZ, eds., *Arenberg in de Lage Landen*, op. cit., p. 81-111; J.-P. TYTGAT, “Van rentmeesters en intendanten”, op. cit.

(11) M. DEREZ, “Arenberg na de Revolutie”, op. cit.; J.-P. TYTGAT, “Van rentmeesters en intendanten. Het beheer van de Arenberggoederen”, op. cit.

(12) Sander BERGHMANS, “Woods and Polders. The Arenbergs as Landholders”, in

towards the Rhine area, the core industrial region of Germany, where they capitalized on the mining rights they owned in that region⁽¹³⁾. The family flourished financially and purchased additional estates in Germany⁽¹⁴⁾, next to some smaller transactions in France, Belgium and the Netherlands⁽¹⁵⁾. The increased investments in both mining activities and land resulted in the accumulation of an impressive patrimony. In the 19th century (see map), the properties of the Arenberg family covered some 39.000 hectares⁽¹⁶⁾, the majority of which consisted of woodland. For instance, in their domain in Edingen (Hainaut/Brabant), more than half of the revenues could be traced back to forest activities during the 17th and 18th centuries. In 1750, the surface of forest owned in Edingen was approximately 1060 hectares versus 371,55 hectares of leased- out pasture and agricultural lands⁽¹⁷⁾. In Bierbeek (Brabant), up to 96,8% of the revenue was generated from the sale of wood in 1790⁽¹⁸⁾. An anonymous account dating from the late 18th century describes the forests of the dukes of Arenberg as one of the best-maintained forests in the whole of the Southern Netherlands⁽¹⁹⁾. In the 19th century the share of income from industrial activities expanded substantially, but even then wood remained a key resource as it was consumed in large quantities by the industry. Forests therefore remained an important and valuable asset for the Arenberg family throughout the 20th century⁽²⁰⁾.

Marc DEREZ, Soetkin VANHAUWAERT & Anne VERBRUGGE, eds., *Arenberg. Portrait of a Family. Story of a Collection*, Turnhout, Brepols, 2018, p. 54-62.

(13) Peter NEU, *Die Arenberger und das Arenberger Land*. Band 6 : *Das 19. Jahrhundert. Wirtschaft und Kultur*, Koblenz, Landesarchivverwaltung Rheinland-Pfalz, 2001 (Veröffentlichungen der Landesarchivverwaltung Rheinland-Pfalz, 93), p. 53-60.

(14) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 6. *op. cit.*, p. 53-80.

(15) S. BERGHMANS, "Woods and Polders. The Arenbergs as Landholders", *op. cit.*, p. 54-62.

(16) *Ibid.*; M. DEREZ, "Arenberg na de Revolutie", *op. cit.*, p. 81-100.

(17) S. BERGHMANS, "Woods and Polders. The Arenbergs as Landholders", *op. cit.*, p. 54-62; Pierre-Alain TALLIER, "Les biens immobiliers des ducs d'Arenberg dans les anciens Pays-Bas (de la fin du 18^e siècle au début du 20^e siècle)", 2006, p. 1-17 in <https://www.yumpu.com/fr/document/view/17354323/les-biens-immobiliers-des-ducs-darenberg-dans-les-anciens-pays> (12 December 2020); Kris VANDEKERKHOVE *et al.*, "Bakermat van duurzaam bosbeheer. «Pour le plus grand profit de son excellence»", in *Miradal. Erfgoed in Heverleebos en Meerdaalwoud*, Leuven, Davidsfonds, 2009, p. 146-179.

(18) Frank SCHEELINGS, "Het bosbestand van de heerlijkheden in de nieuwe tijd: constant (of) verkleinend?", in Claire BILLEN & André VANRIE, eds., *Les sources de l'histoire forestière de la Belgique. Bronnen voor de bosgeschiedenis in België*, Brussel, Algemeen Rijksarchief, 1994 (Archief-en bibliotheekwezen in België, 45), p. 236.

(19) *Essai sur l'état de la culture Belgique et sur les moyens de la perfectionner*, London-Nivelles, 1784, p. 87-88.

(20) S. BERGHMANS & L. VERVAET, "Hout als energiebron in vroegmodern Vlaanderen", *op. cit.*, p. 251-257; P. NEU, *Die Arenberger und das Arenberger Land*, vol. 6, *op. cit.*, p. 48-55.

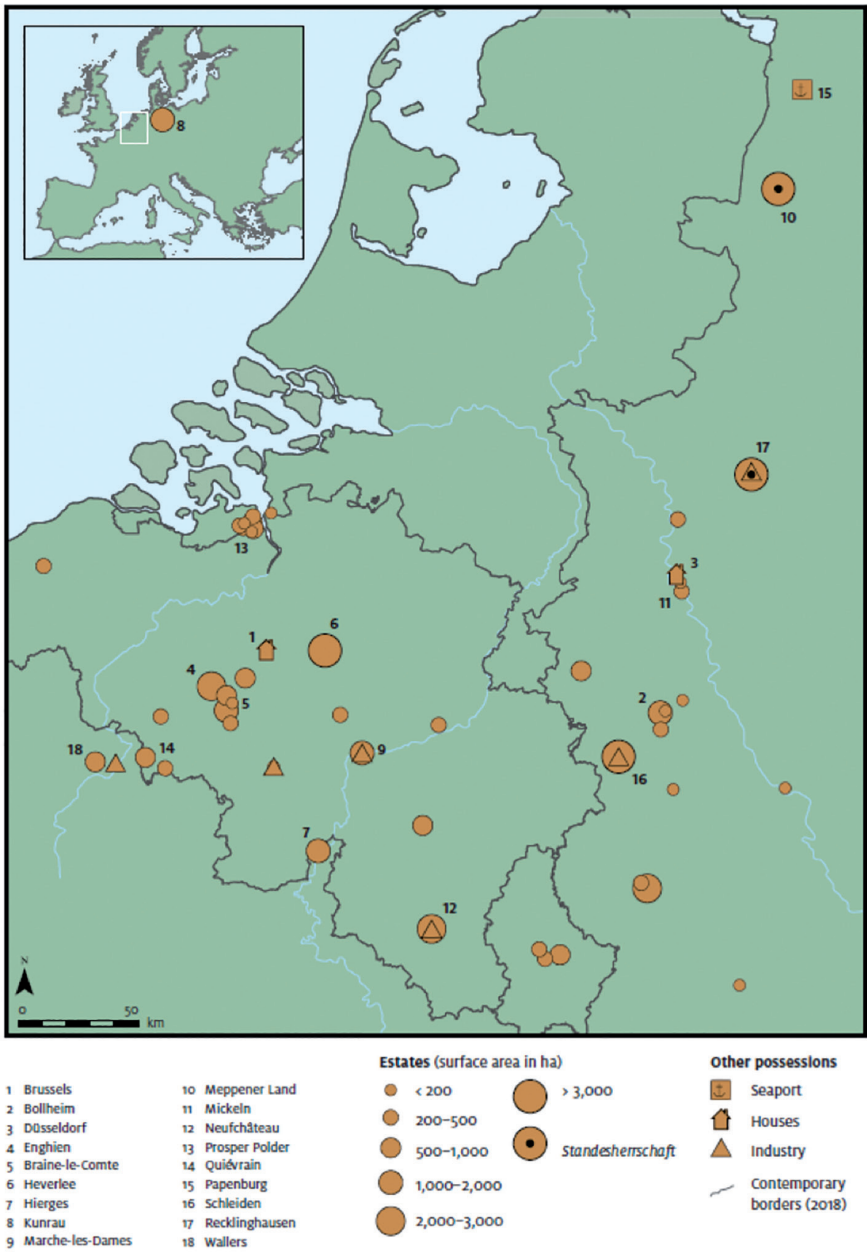


Figure 1. Property of the dukes of Arenberg 1840-1860⁽²¹⁾

(21) This map was published earlier in S. BERGHMANS, “Woods and Polders. The Arenbergs as Landholders”, *op. cit.*

My research question is why and how the administration of the dukes of Arenberg improved its forestry management practices in response to the changing value of their forests during the 17th, 18th and first quarter of the 19th century. To do so, I study forestry from a managerial perspective, because I believe managerial decisions are crucial to the survival and the success of any organisation. Drucker described this assertion as follows:

“In a competitive economy, above all, the quality and performance of the managers determine the success of a business, indeed they determine its survival. For the quality and performance of its managers is the only effective advantage an enterprise in a competitive economy can have”⁽²²⁾.

A long-term view on management – our view spans several centuries – is quite relevant, as most organisations have to deal with inertia. Rather than a lack of change, inertia can be defined as a very slow change affecting especially managerial strategy, structure⁽²³⁾ and culture⁽²⁴⁾. This slow pace of change may be even more pronounced in conservative, old or large industries⁽²⁵⁾ – like agriculture⁽²⁶⁾ or forestry. Such organisations or companies (large, old and conservative) will only be inclined to change if they can no longer reliably produce collective action or account rationally for its activities, i.e. if the organisation faces a crisis⁽²⁷⁾. To avoid missing the crucial process of slow incremental change over time while still capturing occasional periods of very fast changes, a time frame of several centuries is most appropriate for this study.

Forestry in the early modern period

The decision to focus on exploiting its forests was not taken lightly by the Arenberg family and its administration. They tried to capitalize on an important development in the Southern Netherlands and neighbouring areas: the shortage of wood. This shortage was caused mainly by the growth in population but also by the rise in shipbuilding activities in harbours like Ostend or the needs of wandering armies. Consequently, firewood prices quadrupled during the 17th and 18th centuries, in comparison, wheat prices remained relatively stable over time, making forestry an increasingly profitable activity (Graph 1)⁽²⁸⁾. In West Germany, where the dukes also owned several forests, a similar economic development took place⁽²⁹⁾.

(22) Peter DRUCKER, *The Practice of Management*, Abingdon, Routledge, 2012, p. 3.

(23) Michael T. HANNAN & John FREEMAN, “Structural Inertia and Organizational Change”, in *American Sociological Review*, vol. 49, 1984, 2, p. 149-151.

(24) Edgar H. SCHEIN, “Organizational Culture: What it is and How to Change it”, in *Human Resource Management in International Firms*, New York, Springer, 1990, p. 56-60.

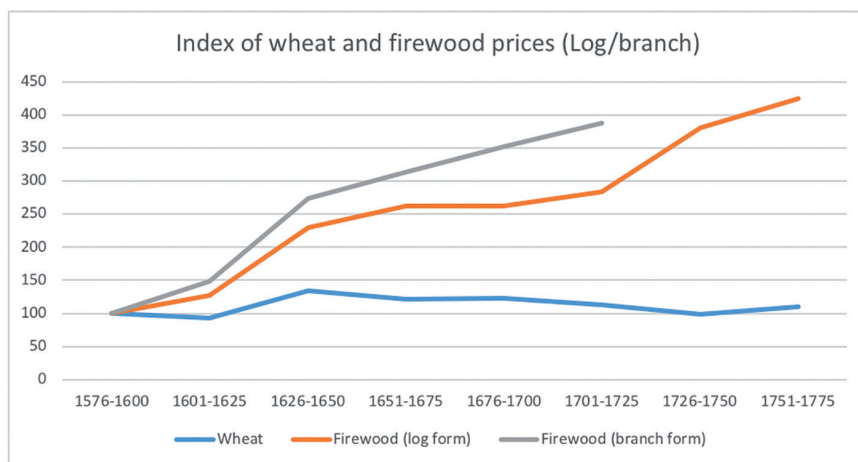
(25) M.T. HANNAN & J. FREEMAN, “Structural Inertia and Organizational Change”, *op. cit.*, p. 148-152.

(26) *Ibid.*, p. 161-163.

(27) *Ibid.*

(28) C. VANDENBROEKE, “De problematiek van de energievoorziening in de Zuidelijke Nederlanden”, *op. cit.*, p. 970-975.

(29) Joachim RADKAU, “Holzverknappung und Krisenbewußtsein im 18. Jahrhundert”, in *Geschichte und Gesellschaft*, vol. 9, 1983, 4 p. 533-535.



Graph 1. Price index wheat and firewood (log and branch form)⁽³⁰⁾

It became increasingly profitable to invest time and money into developing commercial woodland. Still, capitalizing on this evolution remained the privilege of wealthy (noble) families and institutions, who could afford to invest capital into their forests and wait several years before reaping the benefits. In contrast, small landowners could only plant trees and bushes on a subsistence rather than a commercial scale. For a smallholder, investing in forest exploitation implied forgoing all revenues from the invested capital for several years, a luxury they could usually not afford. As a result, smallholders preferred the yearly revenue of crops and animal farming over risky and long-term investments in forestry to meet their needs⁽³¹⁾.

Despite an advantageous price development, it was not that easy to increase the output of forests. It is crucial to understand that early modern forestry practices were very different from contemporary practices. Most of the forestry practices were largely dependent on tacit, experience-based knowledge developed within an organisation⁽³²⁾. From the 18th century onwards, forestry – and agriculture in general – was subject to scientification. Odd and mistaken theories were still common in these early days of scientific exploration. For example, some scientists claimed that soil fertility was based on the amount of ‘fire’ to which a soil was exposed, rather than on the components of the soil itself⁽³³⁾. It was only by the end of the 18th and especially the beginning of the 19th century that serious scientific progress was made⁽³⁴⁾.

(30) C. VANDENBROEKE, “De problematiek van de energievoorziening in de Zuidelijke Nederlanden”, *op. cit.*, p. 973.

(31) S. BERGHMANS & L. VERVAET, “Hout als energiebron in vroegmodern Vlaanderen”, *op. cit.*

(32) P.-A. TALLIER e.a., “State Forestry in Belgium since the End of the Eighteenth Century”, *op. cit.*, p. 94-102.

(33) Philippe C. BAVEYE, “Jean-Baptiste De Beunie (1717-1793). Unsung Pioneer of the Study of Soils”, in *Soil Science*, vol. 178, 2013, 2, p. 56.

(34) *Ibid.*

Another issue which early modern forest owners were faced with, was the scarcity of economic information⁽³⁵⁾. This rendered the world opaque and highly unpredictable, making it difficult for forest owners and their agents to make quick and informed decisions⁽³⁶⁾. Due to the advancement in transportation and postal services, information streams improved during the early modern period⁽³⁷⁾. This allowed big landowners to implement a market-oriented style of management and make well-informed and balanced economic decisions⁽³⁸⁾. The increased availability of prices and market information, however, did not mean that wood markets and other kinds of rural markets were fully integrated or globalized. Transportation remained expensive, which hampered the trade in bulk products like wood. Only with the advance of steamships and railways in the 19th century did transportation of bulk products on a large scale become possible⁽³⁹⁾. Until then, demand and market prices for wood may have differed substantially across localities, impacting investment decisions and the resulting composition of forests (especially the coppice to standard trees ratio)⁽⁴⁰⁾.

Gathering information was not only necessary to make the right decisions about forestry, it was also needed to monitor local agents. Unruly stewards focusing on their private profits were very common⁽⁴¹⁾. Gathering more information was quite pricey, but it could help a landowner to assess how the steward behaved and how to best align the private interests of the steward with his own, to avoid overexploitation and damage to his forests⁽⁴²⁾.

The final problem faced by early modern forest owners related to the property rights they could exercise over their forests. These rights were not always 'full'. The local population often held some type of usufruct rights in the forests: in one way or another, a share of the forests' production ended up in the hands of the local communities. Moreover, locals could also commit crimes in these forests, violating the property rights of the forest owner. An appropriate property rights management by the owner was necessary to control potential losses (il)legally caused by the local population⁽⁴³⁾. There also existed co-managed forests in which two or more owners had stakes. Differences in the amount of investment made by each owner could lead to

(35) David STONE, *Decision-Making in Medieval Agriculture*, Oxford, Oxford University Press, 2005, p. 190-200.

(36) R.C. ALLEN, "Agriculture During the Industrial Revolution", *op. cit.*, p. 96-97.

(37) D. STONE, *Decision-Making in Medieval Agriculture*, *op. cit.*, p. VII-VIII.

(38) *Ibid.*, p. 193-196.

(39) Frank W. GEELS, "Technological Transitions as Evolutionary Reconfiguration Processes: a Multi-Level Perspective and a Case-Study", in *Research Policy*, vol. 31, 2002, 8-9, p. 1269-1270.

(40) F. SCHEELINGS, "Het bosbestand van de heerlijkheden in de nieuwe tijd: constant (of) verkleinend?", *op. cit.*

(41) David Roger HAINSWORTH, *Stewards, Lords and People: the Estate Steward and his World in Later Stuart England*, Cambridge, Cambridge University Press, 1992; Mikolaj TURZYNSKI, "Bookkeeping in Manor Farms of Polish Gentry in 17th Century", in *Eurasian Journal of Business and Economics*, vol. 4, 2011, 8, p. 71-86.

(42) P. ROEBUCK, "Absentee Landownership", *op. cit.*; J. THEOBALD, "'Distant Lands': The Management of Absentee Estates in Woodland High Suffolk", *op. cit.*

(43) G. TACK, P. VAN DEN BEMT & M. HERMY, *Bossen van Vlaanderen. Een historische ecologie*, *op. cit.*, p. 193-195.

serious discussions about the distribution of forestry revenue among them⁽⁴⁴⁾.

Therefore, the dukes of Arenberg had to develop an organisation that was able to tackle these issues, in the context of rising prices. After investigating the archives and available literature, I was able to reconstruct the highly profitable forestry activities of the dukes of Arenberg, which is discussed in the next section. I also identified several strategies deployed by the dukes' organisation to successfully deal with the above-mentioned problems. Firstly, I discuss why and how the Arenbergs changed their structure and regulations on various occasions over time in order to ensure that experienced foresters, rather than local stewards, determined how the forests were to be organised. Secondly, I analyse how the Arenberg administration tried to entice the local stewards to act for the benefit of the organisation by changing remuneration policies. Thirdly, I investigate how the dukes and their administration increasingly took control over their own woods by limiting the property rights and usufruct rights of third parties. Lastly, I discuss how new scientific insights percolated through the organisation and affected the Arenberg family's forestry activities.

Forestry revenues of the dukes of Arenberg

This section examines whether/how far the dukes of Arenberg were able to adapt their forestry practices to the changing economic conditions. In this regard, I have various indications that the Arenberg family was financially very successful during this period of increasing wood prices. For example, an increase in wood production was noticed in the forest of Meerdaal ('Meerdaalwoud') located near the university town of Louvain. The shift occurred especially during the 18th century, when the Arenbergs succeeded in substantially increasing the productivity of standard tree production (used for construction and sometimes as firewood). Sale parcels of standard trees contained 10 trees in 1760, as opposed to just 5 to 7 trees in 1693. According to Vandekerkhove e.a., this was achieved in response to increased market demand. At the same time the coppice wood parcels could still produce sufficient firewood for the local market. The combination of larger sale parcels of standard trees, without negatively affecting the coppice wood production, hints at an increase of total wood production of the Meerdaalwoud through increased productivity⁽⁴⁵⁾. A similar evolution took place in the German Arenberg estates, where an increase in net revenue was observed after the first quarter of the 18th century (e.g. Kerpen first half 18th century 6000 Reichstaler vs 8000 Reichstaler in the second half of the 18th century). In the case of the German estates, it seems that revenues of the forestry-oriented estates underwent a substantial production and hence productivity increase in the period 1730-1740⁽⁴⁶⁾.

(44) Guy LERNOUT, "Een bos met een verleden", in *Hallerbos*, Sint-Pieters-Leeuw, Natuurpunt Halle, 2018, p. 20-22.

(45) Kris VANDEKERKHOF e.a., "500 Years of Coppice-With-Standards Management in Meerdaal Forest (Central Belgium)", in *Forest-Biogeosciences and Forestry*, vol. 9, 2016, 4, p. 509-514.

(46) Peter NEU, *Die Arenberger und das Arenberger Land*. Band 3 : *Wirtschaft, Alltag*

The most convincing data available for the Arenberg estate is related to 'the land of Edingen'. As can be seen in table 1, higher net revenues were generated and a higher wood production per square meter was achieved (table 2). Over the 18th century, there was an increase of about 31,6% in forestry revenues, while the forest surface only increased by approximately 5%. The importance of forestry as part of the revenues moved from 55% (1650-1669) to 67% (1700-1719)⁽⁴⁷⁾. In Rebecq (part of the land of Edingen), the forest increased its coppice-output significantly (table 2)⁽⁴⁸⁾. One can thus conclude that the estates of Arenberg adapted themselves to the increasing wood prices, by producing more wood.

Period 1	Liters (wheat)	Livres Tournois	Period 2	Liters (wheat)	Livres Tournois	Period 3	Liters (wheat)	Livres Tournois
1650			1700	268744	39123	1750	498084	57921
1651			1701	553314	59459	1751	712506	74264
1652			1702	710053	69115	1752	771866	75132
1653			1703			1753	829350	75369
1654			1704	540894	55678	1754	713362	64675
1655			1705	479923	52812	1755	660645	60322
1656			1706	380215	45361	1756	693981	66355
1657			1707	402684	56973	1757	746023	74705
1658			1708	451412	69020	1758	699157	74529

und Kultur im 17. und 18. Jahrhundert, Koblenz, Landesarchivverwaltung Rheinland-Pfalz, 2001 (Veröffentlichungen der Landesarchivverwaltung Rheinland-Pfalz, 68), p. 322-326.

(47) The purchasing power of the forestry income increased on average from 450.814,8 liters to 593.561,1 liters of wheat. National Archives of Belgium (hereafter NAB), Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715).

(48) NAB, Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715).

1659			1709	334778	51908	1759	632752	67041
1660	380340	59955	1710	331423	53672	1760	636778	66919
1661	328289	52245	1711	283168	45491	1761	532199	55241
1662	329230	51827	1712	395371	57812	1762	542711	58553
1663	352470	52450	1713	512894	66713	1763	519051	57565
1664	365954	44132	1714	471531	59403	1764	460718	51989
1665	350646	38888	1715	646300	76827	1765	446202	52273
1666	353915	36355	1716			1766	402950	50677
1667	154487	15869	1717			1767	432582	53937
1668	51892	5297	1718			1768	457867	58175
1669	510354	53304	1719			1769	482438	62232
Average period	317758	41032	Average period	450847	57291	Average period	593561	62894
Index (100 = period 1651-1669)	100	100	Index (100 = period 1651-1669)	142	140	Index (100 = period 1651-1669)	187	153

Table 1. Wood revenues estate of Edingen in liters of wheat and livres Tournois

Period	Wood (average)	Leases (average)	Other (average)	Leasing pasturing rights (average)	Copy-hold (average)	Total (average)	Part of forestry in total revenue
1650-1669	41032,2	22100,44	910,3	727,7	10520,5	74471,9	55%
1700-1719	57291,1	17506,16	285,4	403,7	9922,1	85180,2	67%
1750-1769	62893,7	22602,2	190,8	0	9012,7	94699,3	66%

Table 2. Dominial revenues for the duke of Arenberg in the estate of Edingen in livres Tournois

Structuring the management and exercising control

Organisational structure and processes are key in achieving operational effectiveness. When both fit the organisational strategy, they foster success⁽⁴⁹⁾. When discussing structure and processes, a main distinction is made between centralized and decentralized organisations. A centralized organisation is an organisation in which most of the decisions take place at the upper level of the company. Centralized organisations are often perceived as conservative, constraining innovation due to overly strict processes in the company⁽⁵⁰⁾. At the same time though, the centralization of a given task improves the effectiveness of its execution, provided the task is routine and repetitive. In this case, the task environment is stable and noncomplex and performance can be easily and accurately assessed, leading to repeating processes of control⁽⁵¹⁾. Depending on shifts in the strategic preferences and the environment of an early modern forest owner, forest management might have benefited from changing the organisational structure and processes⁽⁵²⁾.

The management of the dukes of Arenberg was originally structured in a rather classic way consisting of two layers: a local layer and a more centralized upper layer. Such a simple structure was commonly used to manage rural estates in Western Europe, as it was deemed efficient⁽⁵³⁾. It allows owners with a vast amount of property to manage their estates with as few layers as possible, avoiding too much noise during communication between them⁽⁵⁴⁾.

In the Arenberg case the most important actor of the upper layer was a general administrator (also acting as general receiver), who held headquarters in the town of Edingen (number 2 on Figure 1)⁽⁵⁵⁾. The Arenberg family required local agents with executive powers who could monitor and manage the local layer, like stewards and bailiffs, who were responsible for the jurisdictional representation of their lord. Before 1700, a ducal council, an extra layer which assisted the general administrator, probably existed at some points in time, but only with a limited impact⁽⁵⁶⁾.

(49) Raymond E. MILES e.a., "Organizational Strategy, Structure, and Process", in *Academy of Management Review*, vol. 3, 1978, 3, p. 557.

(50) Wei ZHENG, Baiyin YANG & Gary N. MCLEAN, "Linking Organizational Culture, Structure, Strategy, and Organizational Effectiveness: Mediating Role of Knowledge Management", in *Journal of Business Research*, vol. 63, 2010, 7, p. 765.

(51) Robert W. RUEKERT, Orville C. Jr WALKER & Kenneth J. ROERING, "The Organization of Marketing Activities: a Contingency Theory of Structure and Performance", in *The Journal of Marketing*, vol. 49, 1985, 1, p. 18.

(52) R.E. MILES e.a., "Organizational Strategy, Structure, and Process", *op. cit.*, p. 547.

(53) Carol BEARDMORE, "Landowner, Tenant and Agent on the Marquis of Anglesey's Dorset and Somerset Estate, 1814-44", in *Rural History*, vol. 26, 2015, 2, p. 181-199; Sarah WEBSTER, "Estate Improvement and the Professionalisation of Land Agents on the Egremont Estates in Sussex and Yorkshire, 1770-1835", in *Rural History*, vol. 18, 2007, 1, p. 47-69.

(54) Henri FAYOL, *General and Industrial Management*, London, Pitman, 1972, p. 34-35.

(55) Nicolas DE VIJLDER & Sander BERGHMANS, "Van gemeenschapsgoed naar privaat bezit? Bosbeheer in de zeventiende en achttiende eeuw: Casus De Arenbergs", in *Tijdschrift. Heemkunde en Lokaal-Erfgoedpraktijk in Vlaanderen*, vol. 4, 2014, 2, p. 46-48; J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 132-146.

(56) J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 134-137.

Below these two levels of management, I can identify a small group of employees who had to carry out the orders of their superiors. This group consisted largely of secretaries, foresters, game masters, and in some estates – where the duke owned certain rights – local police officers⁽⁵⁷⁾.

The steward was responsible for the local management and represented his lord⁽⁵⁸⁾. In comparison with other stewards at that time⁽⁵⁹⁾, the stewards of the dukes were relatively autonomous in deciding how to generate revenue for their masters⁽⁶⁰⁾. For example, they could decide independently on investments, on sale agreements, on who could be exempted from certain payments, and so forth. Apparently, this autonomy could lead to serious problems and conflicts of interest regarding the forest management. Stewards could decide how much wood was to be sold and how much was to be invested in forests. At the same time, most stewards received a variable wage that was calculated on the basis of the net cash flows⁽⁶¹⁾. Especially at the end of their contracts, stewards were

(57) Arenberg Archives Edingen (hereafter AAE), Instruction pour François Le Comte (1625), Heverlee 54/18; Règlement pour l'amélioration et entretien 1730, 54/18 SEM 18.

(58) J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 132-146.

(59) C. BEARDMORE, "Landowner, Tenant and Agent on the Marquis of Anglesey's Dorset and Somerset Estate", *op. cit.*, p. 50; Henry Stanley BENNETT, *Life on the English Manor: a Study of Peasant Conditions 1150-1400*, Cambridge, Cambridge University Press, 1937, p. 158-168; David R. HAINSWORTH, "Stewards, Lords and People: the Estate Steward and his World in Later Stuart England", in *The Oakes Diaries I. Business, Politics and the Family in Bury St. Edmunds*, Suffolk, Boydell, 1992, p. XIX-278; Tim KOOIJMANS & Joost JONKER, "Chained to the Manor? Payment Patterns and Landlord-Tenant Relations in the Salland Region of the Netherlands around 1750", in *Tijdschrift voor Sociale en Economische Geschiedenis*, vol. 12, 2015, 4, p. 100-108; S. WEBSTER, "Estate Improvement and the Professionalisation of Land Agents on the Egremont Estates in Sussex and Yorkshire", *op. cit.*, p. 50.

(60) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715); Comptes des domaines Arenberg (Bierbeek-Heverlee), la2294 (1607), la3417 (1608), la2204/1 (1609), la3009 (1640), la2215 (1641), la5025 (1642), la2812 (1643), la 8170 (1644), la2298 (1645), la2220 (1646), la2300 (1647), la2801 (1648), la 2291 (1649).

(61) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181

incentivised to chop more wood than needed for optimal forest exploitation, while forestry investments – such as replanting trees – decreased⁽⁶²⁾. Moreover, stewards were not necessarily forestry specialists as they had to perform several tasks next to managing the forests. The general administrator had only two means to counter inferior management practices: checking the bookkeeping accounts⁽⁶³⁾ of the steward and occasional on-site visits⁽⁶⁴⁾.

These management practices did not suffice to control or monitor the stewards. Even fraudulent practices could remain unnoticed. Stewards could for example decide to sell trees without keeping a record of the transaction in the books of account. Initially, the Arenberg administration clearly had a typical decentralized structure. The general administrator was the only actor who could – to an extent – monitor and control the stewards. Despite this relative autonomy, there were some rules that stewards were bound to. For example, by a set of rules, Anne of Croÿ ordered her steward in Heverlee to frequently visit the forests together with the foresters, keep abreast of the situation in these forests, and assess the coppice. At the same time, the stewards were also guided how to sell stand trees⁽⁶⁵⁾. Likewise, there were some rules for the forest around Arenberg and Kommern: mainly dealing with solutions to counter deforestation⁽⁶⁶⁾. These rules may have been better implemented

(1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715); Comptes des domaines Arenberg (Bierbeek-Heverlee), la2294 (1607), la3417 (1608), la2204/1 (1609), la3009 (1640), la2215 (1641), la5025 (1642), la2812 (1643), la 8170 (1644), la2298 (1645), la2220 (1646), la2300 (1647), la2801 (1648), la 2291 (1649).

(62) F. SCHEELINGS, “Het bosbestand van de heerlijkheden in de nieuwe tijd: constant (of) verkleinend?”, *op. cit.*, p. 240-244.

(63) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715); Comptes des domaines Arenberg (Bierbeek-Heverlee), la2294 (1607), la3417 (1608), la2204/1 (1609), la3009 (1640), la2215 (1641), la5025 (1642), la2812 (1643), la 8170 (1644), la2298 (1645), la2220 (1646), la2300 (1647), la2801 (1648), la 2291 (1649).

(64) AAE, Règlement pour l'amélioration et entretien 1730, 54/18 SEM 18.

(65) AAE, Instruction pour François Le Comte de Heverlee 54/18.

(66) AAE, 'Ordonnance et règlement pour les bois et forêts du Duché d'Arenberg et seigneurie de Commeren 10 octobre 1656', 66/29/II/3.

in the estate of Heverlee (where the dukes and his administration lived and hunted very often), than in the distant Arenberg and Kommern estates, but it always depended largely on the motivation of the local steward.

Changing the structure and processes of an organisation – especially from a decentralized to a centralized one, is not achieved overnight. Drastic organisational shifts tend to take place only when organisations are in serious trouble, forcing them to divert from their previous path⁽⁶⁷⁾. The dukes had been spared from extreme internal crises until the beginning of the 18th century, when Leopold Philippe of Arenberg (1690-1754) became the duke. Under his dukeship, the management of the forests changed drastically.

Philippe Charles François of Arenberg, the father of Leopold Philippe of Arenberg, had been killed in the Battle of Slankamen (1691) while fighting the Ottomans, when Leopold Philippe was only one year old. Subsequently, his mother, Maria-Henriette del Caretto de Savona y Grana, became the guardian of both Leopold Philippe and his inheritance. From a young age, Leopold Philippe had a turbulent relation with his mother. The situation became even worse when she refused to give him information about his rural estates when he was allowed to govern these in 1708. A struggle between mother and son broke out and the young duke dismissed multiple stewards and other local agents, mainly because he feared that they were loyal to his mother⁽⁶⁸⁾. At the same time, the Arenberg family had run up large debts that had to be serviced⁽⁶⁹⁾. A combination of a high need for cash and internal conflicts within his administration forced the duke to act urgently. In 1712, only four years after he came of age, he embarked on a deep and wide-ranging reform of his administration. He decided to overhaul and centralize significant parts by creating a ducal council⁽⁷⁰⁾. The first important decision regarding the ducal council's existence goes back to 1723, when regulations for the council and other administrators were written down in internal documents⁽⁷¹⁾.

The general administrator remained the most important administrator and headed the ducal council⁽⁷²⁾. Though subject to regular change, the council initially consisted of the general administrator, three council members, a general treasurer, a secretary of the council, an archivist and, from 1735, a director of the domains. Each council member was responsible for his or her own field, for which the council members would conduct ad hoc tasks⁽⁷³⁾. The agent responsible for managing the people who worked on the rural estates was the director of the domains. He had to monitor the stewards and audit their accounts, together with the general administrator and the general treasurer. He could together with the general administrator, exert pressure on

(67) M.T. HANNAN & J. FREEMAN, "Structural Inertia and Organisational Change", *op. cit.*, p. 161-163.

(68) J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 134-136.

(69) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 3, *op. cit.*, p. 330-345.

(70) J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 135.

(71) AAE, 'Règlement pour l'administration des affaires de la S^{me} Maison d'Arenberg (Enghien 31 mai 1723)', 66/29/I/1.

(72) *Ibid.*

(73) *Ibid.*

the stewards, thus acting as a scourge for maleficent stewards who neglected or damaged estates or forests⁽⁷⁴⁾.

Initially, Leopold Phillippe centralized the administration mainly to solve the issues he had with his mother and to gain control over the stewards. However, the fact that the council remained in place later on and that the central administration was even expanded (e.g., the addition of the director of the domains) indicates that the centralization was more than just a means to have control over the estates and their stewards, and was also perceived as beneficial and useful for the dukes' finances. For example, the large loan of 45.000 Reichstaler obtained by Leopold Philippe in 1721 from the Bankhaus Meinertzhagen – one of the most important moneylenders of the family – in order to fight his mother, was gradually paid off over the years⁽⁷⁵⁾. This was achieved not so much by increasing austerity, as the duke was known to be a spendthrift⁽⁷⁶⁾, but by increasing the revenues of the estates of which the forests were an important part⁽⁷⁷⁾.

As Leopold Philippe distrusted his administration, and remained mainly absent from his estate due to military obligations⁽⁷⁸⁾, he encouraged the ducal council to develop written rules and instructions for the stewards. This resulted in an important regulatory directive (1730) that would drastically change the role of the stewards in the most important estates. These rules would mainly focus on forestry practices and forest management, dealing with the presence of cattle in the woodland and defining how forest borders should be organised to avoid discussions with neighbours – for example by digging ditches at the border and planting trees far enough from the forest border. Moreover, this directive stipulated that the (head)forester and the director of the domains became responsible for the identification of the trees that should be cut and deciding where construction works (e.g. ditches and roads) were to take place in the forest⁽⁷⁹⁾. From 1730 onwards, with the help of these rules, the power over the forestry had clearly shifted from the hands of the stewards to those of the central administration.

(74) *Ibid.*

(75) AAE, 'Biens d'Allemagne en général. Revenus et charges 1779 (Duché d'Arenberg)', Gaillard 1763-1783 65/4/II/2 D.1460.

(76) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 3, *op. cit.*, p. 340-345.

(77) *Ibid.* NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715).

(78) J-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*, p. 133-136.

(79) AAE, Règlement pour l'amélioration et entretien, 54/18 SEM 18.

During the 18th century, the structure of the administration evolved variously: sometimes with mere optimisations, including minor changes in the composition of the ducal council⁽⁸⁰⁾. While these had little impact on the way the central administration functioned, another evolution in the German estates did. The German property had always been considered as a separate division in the Arenberg patrimony. It was situated far from the Southern Netherlands and the German forests were still under the control of the stewards and a small local administration rather than under the supervision of the central administration in the Southern Netherlands. This was not a problem during the 17th century, since the German property was relatively small compared to the estates in the Southern Netherlands at the time. The German property was centred around their *Stammland* Arenberg, Kerpen and Kommern. In the 18th century, the property expanded through the inheritance of the domains of Schleiden and Recklinghausen. The central administration was increasingly concerned about the distance separating it from these domains, which caused difficulties in communication⁽⁸¹⁾ and turned the German estates into a blind spot⁽⁸²⁾. The central administration noted in the last quarter of the 18th century that forestry in these lands was not as efficiently performing as in the Southern Netherlands and France. As the local foresters and stewards did not know, for example, how large their forests or stands were. The Arenberg administration was not at all pleased with this situation and urged for the appointment of a local head forester who had thorough knowledge of forestry. The local head forester could increase production, which would enable the central administration to capitalize on the charcoal needed for the local forges⁽⁸³⁾.

With the political and economic turmoil that followed the French Revolution (1789-1799) and the Napoleonic wars (1803-1815), the Arenberg family, and the duke Engelbert of Arenberg in particular, were put under severe pressure. It would be impossible to discuss all the details here⁽⁸⁴⁾, but to provide an example, Engelbert was forced in 1803 to abdicate his German titles in favour of his son in order to keep his territory in the Southern Netherlands, as it would otherwise be confiscated. His son would become (in name only) duke of the German branch. Moreover, a full-fledged estate management developed with inspection facilities in Schleiden, Recklinghausen and Meppen during the period 1800-1820⁽⁸⁵⁾. With this move, the old system since 1656, where a relative independent *Oberforster* was responsible for the forests in the German

(80) Peter NEU, *Die Arenberger und das Arenberger Land*, Band 5 : *Das 19. Jahrhundert. Adelsleben-Besitz-Verwaltung*, Koblenz, Landesarchivverwaltung Rheinland-Pfalz, Koblenz, 2001 (Veröffentlichungen der Landesarchivverwaltung Rheinland-Pfalz, 92), p. 479-494; J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*

(81) AAE, 'Biens d'Allemagne en général. Revenus et charges 1779 (Duché d'Arenberg)', Gaillard 1763-1783 65/4/II/2 D.1460; 'Lettre concernant les difficultés à chaque édition des comptes de recettes de Arenberg, 27/05/1778', AR.FR.Seigneux II-35, 21.

(82) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 3, *op. cit.*, p. 63-65.

(83) AAE, 'Administration du bois de Schleiden, 1778', AR.FR.Seigneux 50, XV; 'Mémoire sur les états du duc d'Arenberg en Allemagne 1778', AR.FR.Seigneux 38, IV.

(84) I recommend those who wish to read more about the turmoil of events to read P. NEU, *Die Arenberger und das Arenberger Land*, vol. 5, *op. cit.*, p. 380-436.

(85) *Ibid.*, p. 383-418.

lands, was integrated within a more centralised structure⁽⁸⁶⁾. During the same period, a general director of the German estates and a general receiver were placed in Cologne. They were in direct contact with the administration in the (Southern) Netherlands⁽⁸⁷⁾.

With the development of an administrative satellite, Brussels finally had a clear view on what happened in their German estates. The blind duke and his son had opened the eyes of their central administration. While the Brussels administration could have had complete control over the German satellite in Cologne, they were in fact only interested in defining its overarching strategy. To that purpose, the German administration had to keep the central administration up to date about financial flows⁽⁸⁸⁾.

Remuneration practices

A form of remuneration which encouraged/motivated the steward to serve the interests of the duke was necessary to align the interests of the principal with the local agents⁽⁸⁹⁾. The stewards (and the bailiffs) had always been very well paid for their services to the duke⁽⁹⁰⁾. Until the first quarter of the 18th century, most of the stewards would receive a variable wage which amounted to roughly 5% to 10% of the overall estate's revenue. This resulted in rather high, but very inconstant wages: the steward of Heverlee-Bierbeek earned approximately 351 livres (Brabant) in 1609 and 1150 livres in 1640. The steward in Edingen earned 1855 livres (Tournois) in 1650, 1388 in 1700, and 1991 in 1705⁽⁹¹⁾. This kind of remuneration encouraged the steward to

(86) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 3, *op. cit.*, p. 36-65.

(87) P. NEU, *Die Arenberger und das Arenberger Land*, vol. 5, *op. cit.*, p. 383-418.

(88) AAE, 'Recette et dépense de monsieur Coomans', D.1845; 'Korrespondenz des Generalempfängers Coomans mit Hövelmann, Generalsteuerempfänger zu Recklinghausen. 1809-1810', D.1843; 'États de Caisse de Mr. Coomans (1808, 1809 and 1810)', D.1844.

(89) Kathleen M. EISENHARDT, "Agency Theory: An Assessment and Review", in *Academy of Management Review*, vol. 14, 1989, 1, p. 57-74; Linda K. STROH e.a., "Agency Theory and Variable Pay Compensation Strategies", in *Academy of Management Journal*, vol. 39, 1996, 3, p. 751-767.

(90) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769), D72 la7530 (1808); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136 (1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715); AAE, 'Règlement pour la régie et l'exploitation des bois de la maison d'Arenberg', 66/29/II/11.

(91) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718

trick the system, for example by generating a lot of revenue at the end of his contract through chopping too many trees, or halting necessary investments. In Heverlee, for example, the local steward cut too much wood in order to increase his wage in 1677. He also purchased wood from the forest, had it manufactured and sold it for his own profit⁽⁹²⁾.

From 1717 on, the steward in Heverlee received a fixed income of 1200 livres (Brabant)⁽⁹³⁾, with a similar shift taking place in Edingen⁽⁹⁴⁾. However, in other estates, like Wallers, it seems that the wages remained variable⁽⁹⁵⁾. The introduction of a fixed wage induced the steward not to overexploit the forest⁽⁹⁶⁾. It is noteworthy that the stewards who governed forests/estates located close to the administrative centre (around Brussels) were given fixed wage whereas those governing distant estates kept on receiving variable wages.

This difference can be explained by looking at the context of supervision costs (Table 3). A close supervision implies a lesser need for variable wages but involves substantial transaction costs⁽⁹⁷⁾. These transaction costs increase the further away from the administrative centre. Put in place since the 18th century, the above-mentioned forestry regulations and centralization required regular checks on the stewards' activities, regardless of his remuneration. The area around Brussels was more regularly visited by the duke and his administration. They resided several months a year in these estates and as a result, the general administrator and forest and domain inspectors were able to scrutinize the activities of these stewards more closely⁽⁹⁸⁾. Supervision of estates located farther way from the centre involved higher transaction costs due to less frequent visits by the central administration and the increased distance. The consequent lower level of supervision in these peripheral estates created a higher need to motivate their stewards and urged the duke to resort to variable remunerations in their cases.

(1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715); Comptes des domaines Arenberg (Bierbeek-Heverlee), la2294 (1607), la3417 (1608), la2204/1 (1609), la3009 (1640), la2215 (1641), la5025 (1642), la2812 (1643), la 8170 (1644), la2298 (1645), la2220 (1646), la2300 (1647), la2801 (1648), la 2291 (1649).

(92) F. SCHEELINGS, "Het bosbestand van de heerlijkheden in de nieuwe tijd: constant (of) verkleinend?", *op. cit.*, p. 243.

(93) NAB, Comptes des domaines Arenberg (Aarschot-Rotselaer and Bierbeek-Heverlee), La 9347/2 (1717).

(94) NAB, Comptes des domaines (Enghien), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751).

(95) NAB, Comptes des domaines Wallers, la2539 (1754).

(96) NAB, Comptes des domaines Arenberg (Aarschot-Rotselaer and Bierbeek-Heverlee), La 9347/2 (1717), La 9347/3 (1718), La 9347/4 (1719); AAE, 'Projet de Règlement pour la régie et l'exploitation des bois 1784', 66/29/I/10; 'Règlement pour la régie et l'exploitation des bois de la maison d'Arenberg', 66/29/II/11.

(97) Enrico MORETTI & Jeffrey M. PERLOFF, "Efficiency Wages, Deferred Payments, and Direct Incentives in Agriculture", in *American Journal of Agricultural Economics*, vol. 84, 2002, 4, p. 1144-1150.

(98) J.-P. TYTGAT, "Van rentmeesters en intendanten. Het beheer van de Arenberggoederen", *op. cit.*

	Minimum exploitation	Good exploitation	Overexploitation	Supervision cost
Fixed wage	No Motivation	No Motivation	No Motivation	Low
Fixed wage with checks	Motivation	Motivation	No Motivation	High
Variable wage	Motivation	Motivation	Motivation	Low
Variable wage with checks	Motivation	Motivation	No Motivation	Medium-low
Fixed wage with variable component and checks	Motivation	Motivation	No Motivation	Medium-high

Table 3. Stewards wage type, motivation and supervision costs

The costs related to additional checks and on-site supervision are important to understand the differences in wage structures. In line with the efficient wage theory⁽⁹⁹⁾, it can be said that the centrally located stewards – those living close to Brussels – may not have been so motivated to work hard due to their fixed wage, but their actions were supervised and monitored closely, so they would still be inclined to work efficiently. Therefore, the stewards near Brussels did not need the incentives of a variable wage, according to the central administration at the time. The variable wage for the peripheral stewards was suited for motivating them in the face of fewer regular visits, while the remaining visits and rules still avoided overexploitation.

During the last quarter of the 18th century, the remuneration of the stewards was redesigned once again. The central administration had noticed that the fixed remuneration did not provide enough incentives for the stewards close to Brussels (i.e., in Edingen, Heverlee-Bierbeek, Aarschot, Naast-Braine and Halle-Beersel) to develop and maintain the property, or at least those parts for which fixed wages were used. These stewards did neither fully neglect their estates nor commit fraud. However, the central administration noticed that the revenues of the centrally located estates did not increase as fast as the revenues of the estates where stewards received a variable wage⁽¹⁰⁰⁾. It was argued that the latter were more concerned about defending their property rights, timely payments or travel expenses. Moreover, the stewards in peripheral areas were keener to seek opportunities to increase revenue. It was, therefore, claimed that a variable, or partly variable wage had to be considered⁽¹⁰¹⁾.

In the end, the central administration decided to change remuneration practices in such a way that the major part of stewards' income remained fixed, but stewards could receive a bonus when a certain revenue threshold was exceeded. The threshold was rather high and not so easy to achieve; as a

(99) E. MORETTI & J. M. PERLOFF, "Efficiency Wages, Deferred Payments, and Direct Incentives in Agriculture", *op. cit.*, p. 1144-1150; James B. REBITZER, "Is there a Trade-off between Supervision and Wages? An Empirical Test of Efficiency Wage Theory", in *Journal of Economic Behavior & Organization*, vol. 28, 1995, 1, p. 107-129.

(100) AAE, 'Discussion receveurs', 66/29/II/10.

(101) *Ibid.*

result, stewards often failed to reach or exceeded it only by a small margin⁽¹⁰²⁾. To ensure sustainable gains, stewards were charged with specific amounts of money from the overall revenue, if they were considered by the central administration to have been responsible for ‘bad’ management, i.e., not being able to collect the bids on the sold trees⁽¹⁰³⁾. The peripherally located stewards kept on receiving a variable wage⁽¹⁰⁴⁾.

In line with modern economic theory, the Arenberg organisation preferred to provide a variable component rather than just a fixed wage as they wished to capitalize on the high-expected profits related to the increasing wood prices⁽¹⁰⁵⁾. The Arenberg administration had come to realise that the stewards were otherwise not motivated enough. They were able to monitor the steward to do exactly what he was told to do, as they did not complain about the state of the forests, but they noticed that the steward did not ‘run the extra mile’. In order to achieve this, a constant monitoring would have been needed, which would have come at a high cost; in fact this option was not even discussed by the Arenberg administration⁽¹⁰⁶⁾. Therefore this hybrid remuneration fitted best with the regular, but not constant, presence of the central administration in these centrally located estates. A system with an entirely variable wage and some field checks would not be in the benefit of the owner: the fixed wage was implemented as a means of ensuring that more money went to the owner. For example, in 1807 the steward in Edingen collected approx. 86745 livres Hainaut with good estate management. He received a fixed wage of 2000. For every livre he collected over 80000 he received a – rather low – bonus equal to one-thirtieth of each additional livre earned. He thus received a bonus of approx. 224 livres thanks to the 6745 additional livres he made after reaching the 80000 threshold. This made a total wage of 2224 livres Hainaut whereas, had the one-thirtieth rule been applied to the whole amount (86745), he would have received 2891,5 livres Hainaut⁽¹⁰⁷⁾. As the checks and controls remained in place for both systems, overexploitation was not a real danger anymore (table 4 and graph 2).

	Estates (central)	Estates (periphery)
17th century	Variable	Variable
18th century	Fixed with checks	Variable with checks
Late 18th and 19th century	Fixed wage with variable (component) and checks	Variable with checks

Table 4. Evolution of the wages of stewards in the service of the dukes of Arenberg (17th-19th centuries)

(102) NAB, Comptes des domaines Arenberg (Enghien), D72, la461/02 (1807) la7530 (1808), la6536 (1810).

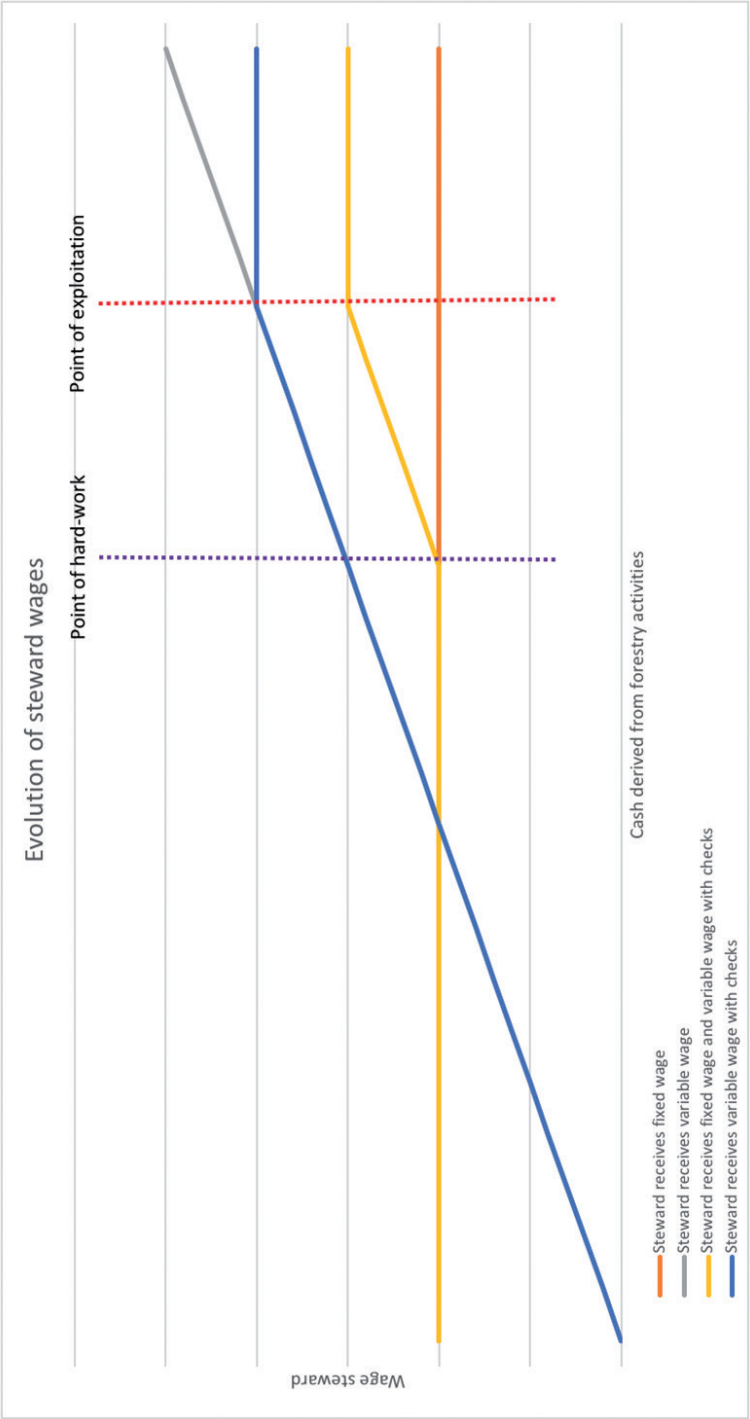
(103) *Ibid.*

(104) NAB, Comptes des domaines Wallers, sa1313 (1807-1808), Mg5732 (1809-1810), Mg5789 (1850-1852), Mg5790 (1853-1854).

(105) Herakles POLEMARCHAKIS & Laurence WEISS, “Fixed Wages, Layoffs, Unemployment Compensation, and Welfare”, in *The American Economic Review*, vol. 68, 1978, 5, p. 914.

(106) AAE, ‘Discussion receveurs’, 66/29/II/10.

(107) NAB, Comptes des domaines Arenberg (Enghien), D72, la461/02 (1807).



Graph 2. Evolution of steward wages

Property rights

The dukes did not only manage internal issues in their quest to increase production. External threats could also harm the productivity of the forests. People who challenged their ownership, but also shared property rights were a major threat for the productivity of the forests. For example, individuals and local communities could enter the forest and damage trees legally or illegally to pursue different economic benefits. In many cases, the damage was related to usufruct rights of local populations on the forest. Based on these rights, local populations were allowed to enter the forest to chop wood, collect branches, herbs and fruits or graze their animals⁽¹⁰⁸⁾. Evidently, such activities did not benefit forest-productivity. Chopping wood and collecting branches diminished the output directly, while collecting herbs, fruits and grazing animals damaged the trees (especially the young ones). Animals (especially sheep and goats) were known to consume young coppice and trees⁽¹⁰⁹⁾. Those who collected herbs and forest fruits could accidentally cut or damage trees or steal wood. In communities where collecting dead wood was allowed, sometimes the villagers damaged trees purposely and collected the dead wood once the tree had died⁽¹¹⁰⁾. Moreover, the owners of neighbouring forests could challenge the ownership of trees or the border of the forest⁽¹¹¹⁾. Lastly, the revenues of these forests had to be shared amongst different owners. The split-up of these revenues could be a point of heated debate due to unequal investments by different owners⁽¹¹²⁾.

The first proof of real interest in defending the property rights can be seen when Anne of Croÿ married into the Arenberg family. Anne was member of the noble family of Croÿ, owning several large estates like Aarschot-Heverlee, Chimay and Beaumont. She and her brother Charles III of Croÿ were the last in line of the de Croÿ family. When her brother died childless, Anne was able to inherit most of the family's property. This was not an obvious outcome, as Charles III of Croÿ always wanted to leave most of his property to his nephews rather than to his sister. In this way the de Croÿ heritage was incorporated in the Arenberg patrimony⁽¹¹³⁾.

The de Croÿ family was known to actively manage their forests and defend their property rights fiercely. Along with other achievements, they created a *woudgerecht* in the 15th century for the Meerdaalwoud near Heverlee. The *woudgerecht* – literally translated as forest court – was a special court dealing with forestry crimes, presided by the local steward. In the 16th century a series of rules and codes of behaviour were published in what was called *het*

(108) G. TACK, P. VAN DEN BEMT & M. HERMY, *Bossen van Vlaanderen*, *op. cit.*, p. 217-221; Hilde VERBOVEN, "De economische betekenis van domeinbossen", in C. BILLEN & A. VANRIE, eds., *Les sources de l'histoire forestière de la Belgique. Bronnen voor de bosgeschiedenis in België*, *op. cit.*, p. 252-254.

(109) H. VERBOVEN, "De economische betekenis van domeinbossen", *op. cit.*, p. 252-253.

(110) Hans BAETÉ, Paul VAN DEN BREMPT & Marc GAIJ, "Heerlijk Vrijwoud", in *Miradal. Erfgoed in Heverleebos en Meerdaalwoud*, *op. cit.*, p. 100-103.

(111) AAE, Règlement pour l'amélioration et entretien 1730, 54/18 SEM 18.

(112) G. LERNOUT, "Een bos met een verleden", *op. cit.*, p. 20.

(113) Pierre DEFRAINE, "1612-1640. Le Duché de Aerschot passe de la Maison de Croÿ à la Maison d'Arenberg", in *Le Folklore Brabançon*, vol. 173, 1967, p. 70-85.

eeuwig edict. Among other issues, this document dealt with the punishment of infringements of the usufruct rights. In this regard, not only sickles, which were used to cut young branches were banned in the forest, but more importantly, intentionally killing of trees and the smuggling of young branches in between heaps of dead wood were declared as major problems⁽¹¹⁴⁾. Charles III of Croÿ ordered the cartographer Petrus de Bersaques, to extensively map his own property⁽¹¹⁵⁾. Moreover, Charles III was actively involved in defining his property by ordering different (expensive) censiers and terriers books to defend his rights and property against others⁽¹¹⁶⁾. The expensive creation of new terriers and censiers was the result of the Eighty Years' War, during which several landowners lost their archives with all the documents that proved their property rights⁽¹¹⁷⁾. By ordering new ones, these landowners tried to (re) claim and defend the rights and land they owned⁽¹¹⁸⁾.

When inheriting the de Croÿ estates, Anne was inspired to continue her family's management practices in her inherited estates. Just like in the de Croÿ family, mapping⁽¹¹⁹⁾ and describing the property⁽¹²⁰⁾ would continue for both the existing and newly acquired estates of Anne of Croÿ and her husband Charles of Arenberg. With such an interest in cartography, it is unsurprising that in one of their most famous portraits, Anne and Charles were depicted with Frans Pourbus II dressed up as a cartographer⁽¹²¹⁾.

Anne also ordered some stewards to send her a detailed description of every piece of property she brought into her marriage with Charles of Arenberg. Amongst others, these included the domains near Heverlee-Aarschot (number 4 on the Figure 1), Chimay and Beaumont (both close to number 5 on the

(114) H. BAETÉ, P. VAN DEN BREMPT & M. GAIJ, "Heerlijk Vrijwoud", *op. cit.*, p. 102-104.

(115) Luc JANSSENS, "Cartographie picturale ou cartographie enrichie d'éléments picturaux", in Véronique VAN DE KERCKHOF, Helena BUSSERS & Véronique BÜCKEN, eds., *Le peintre et l'arpenteur. Images de Bruxelles et de l'ancien duché de Brabant*, Tournai, Renaissance du Livre, 2000, p. 33-34.

(116) NAB, Série Domaines de Bierbeek-Heverlee, dz14017 (1600), la3281 (1602), la2370(1621); Série Domaines d'Aarschot-Rotselaar, la1125 (1587-1592), la5675 (1601), la3067 (1607), la4083 (1626).

(117) Jos MOLEMANS, *Profiel van de Kempische toponymie*, s.l., Vereniging voor Limburgse Dialect-en Naamkunde, 1977, p. 2.

(118) Henricus Louis Maria VERA, ... *dat men het goed van den ongeboornen niet mag verkoopen. Gemene gronden in de Meierij van Den Bosch tussen hertog en hertog 1000-2000*, Oisterwijk, BoxPress, 2011, p. 23-26.

(119) NAB, 'Villers-Sur-Semois "La sarte sur la rivière de Smoy" par L. et J. de Bersaques', Cartes et plans Arenberg, 1449; Wancourt Plan figuratif des propriétés touchant au cogue et au courant du moulin à Wancourt par Camp', Cartes et plans Arenberg, 1775; Fragment d'une carte figurative panoramique de la seigneurie de Mirwart, actuellement conservé aux Archives de l'État', Cartes et plans, 3068; 'Neufchateau Carte intitulée: "La terre et Prevostee de Neufchateau avecqz ses despendence"', Cartes et plans Arenberg, 3091.

(120) NAB, Arenbergfonds, "Censier Bierbeek-Heverlee", Série Domaines de Bierbeek-Heverlee, la2370 (1621); "Censier Aarschot-Rotselaar", Série Domaines d'Aarschot-Rotselaar, la4083 (1626); "Description de parc de Mirwart", Série Domaines de Mirwart, la4180 dossier 2 Censier Aarschot-Rotselaar, 1626; Censier Bierbeek-Heverlee, 1621; Description parc of Mirwart, 1615

(121) Charles of Arenberg with family by Frans Pourbus II — Painting (painted ca 1593). Painting is currently held at the Katholieke Universiteit Leuven (Arenberg castle).

map), she had inherited in 1612. In her inquiry sent to her stewards just after the inheritance, she requested each of the stewards to answer 21 queries to get a clear picture of the state of her properties. She first asked to describe the rights she held in these domains, and asked for a description of the forests at point 7⁽¹²²⁾. In Mirwart for example, the steward, Bernard Funck, described the situation of the domain (and its forests) in a series of letters and kept Anne up to date about what happened in her domain. In this correspondence the steward recounts how he had taken action in 1607 already in order to defend the forestry interests of her brother: some trenches were dug to keep the forest within its limits, avoiding conflict with the neighbours⁽¹²³⁾.

In the same vein, a set of rules was sent out in 1615 by the general administrator of Charles of Arenberg to the stewards of the domain of Heverlee, explaining how the forests should be organised spatially, prohibiting the entrance of cows to pasture in some parts of the forests and the use of sickles by the local population to cut herbs in the forests⁽¹²⁴⁾. In 1625, a document describing the duties of the local bailiff/steward Francois Le Comte was sent out by Anne: the steward had to visit every forest on a weekly basis with his foresters. They together had to check if cattle was not destroying vulnerable parts of the forest and keep abreast of the general condition of the forest⁽¹²⁵⁾. Again, these rules clearly built further on earlier rules decreed by Charles III of Croÿ in 1610⁽¹²⁶⁾, proving the impact of the de Croÿ family in the Arenberg administration⁽¹²⁷⁾. An impact that was also noticed in the estate of Mirwart⁽¹²⁸⁾. These findings show that, while the usufruct rights were still present, the dukes and their administration interpreted them as strictly as possible during the 17th century. However, this strictness did not imply that every entrance of a commoner in the forests was seen as disadvantageous or harmful for the family's interests. In fact, in the German estates of Kommern and Arenberg, the dukes owned a right by which they could force families to plant 6 oaks in the forests or pay off their duty to do so⁽¹²⁹⁾.

(122) State archives in Saint-Hubert (hereafter SASH), Château de Mirwart, nr. 232 (1612-1613), Inquiry property, 1612-1613.

(123) AAE, "Rapport", Correspondance (Bernard Funck), nr. 918; SASH, Château de Mirwart, nr. 232 (1612-1613); Instructions for domain of Mirwart, 1620; Report of steward Bernard Funck on Mirwart, 1620.

(124) University Archives Katholieke Universiteit Leuven, Règlement de Charles d'Arenberg et Anne de Croÿ (1615), Archief van het kasteel van Arenberg te Heverlee, 697, Forestry rules Heverlee, 1615; H. BAETÉ, P. VAN DEN BREMPT & M. GAIJ, "Heerlijk Vrijwoud", *op. cit.*, p. 122.

(125) AAE, Instruction pour François Le Comte (1625), Heverlee 54/18.

(126) University Archives Katholieke Universiteit Leuven, Règlement de Charles III de Croÿ (1610), Archief van het kasteel van Arenberg te Heverlee, 1273.

(127) H. BAETÉ, P. VAN DEN BREMPT & M. GAIJ, "Heerlijk Vrijwoud", *op. cit.*, p. 122.

(128) Jean-Marie DUVOSQUEL, "Une initiative inspirée par les besognés de Charles de Croÿ: la description de la terre de Mirwart demandée en 1602 et en 1620 par la princesse Anne de Croy, comtesse d'Arenberg", in *Annales de l'Institut archéologique du Luxembourg. Arlon*, vol. 126, 1995 (= 1847-1997. Le 150^e anniversaire de l'Institut archéologique du Luxembourg), p. 155-180.

(129) AAE, 'Ordonnance et règlement pour les bois et forêts du Duché d'Arenberg et seigneurie de Commeren 10 octobre 1656', 66/29/II/3.

The 18th century witnessed a paradigm shift in the way property rights were perceived. Jurists increasingly refuted the idea of shared ownership and valued more the ideal of exclusive and individual ownership over property⁽¹³⁰⁾. During the 18th century, the Arenberg head forester and inspector of the domains consistently pushed the local population out of the forests. In this spirit, an important rule was decreed in 1730, which prohibited leasing pasture rights within the woods. Indeed, while pasturing cattle and pigs in the woods was necessary to control the growth of herbs, it could also cause damage to younger trees. Local farmers were not really concerned with the damage done by their cattle and would very often pasture their animals in areas with younger or pregnable trees. This led the administration to allow less and less animals of local farmers in the forests until their cows and pigs finally disappeared in 1730. From then on, foresters would herd the cattle (theirs or cattle owned by the duke) into the forests and let them graze those parts of the woods where no trees could be harmed and where the trees even benefited from the removal of herbs⁽¹³¹⁾. At the same time, usufruct rights were increasingly hollowed out in Western Europe⁽¹³²⁾. In the Meerdaelwoud near Heverlee, usufruct rights of gathering dead wood at the edges of the forest were limited to very poor Brabantians⁽¹³³⁾.

The dukes and their administration also increasingly used their legal power to fend off any person wishing to enter their forests. In the estate of Edingen (as in several others) more foresters and gamekeepers were hired at the end of the 18th century⁽¹³⁴⁾. Together with the local police force (sergeants), these people patrolled the forests and made sure that infringements and criminal activity in the forests were punished. At the end of the 18th century (table 5), the people in the estate of Edingen were increasingly fined for breaking of small branches or collecting herbs in the forests of the dukes. While these types of fines became more prevalent, they would never match the fines on poaching in monetary terms. They were meant to be irritating rather than to ruin the offenders financially as poaching fines could do.

(130) Stefan VON BELOW & Stefan BREIT, *Wald von der Gottesgabe zum Privateigentum: gerichtliche Konflikte zwischen Landesherren und Untertanen um den Wald in der frühen Neuzeit*, vol. 43, Stuttgart, Lucius & Lucius, 1998, p. 29-30.

(131) AAE, Règlement pour l'amélioration et entretien 1730, 54/18 SEM 18.

(132) Guido TACK, "Historische ecologie van het boslandschap in het oude graafschap Vlaanderen en de aansluitende delen van Brabant en Henegouwen", in C. BILLEN & A. VANRIE, eds., *Les sources de l'histoire forestière de la Belgique*, op. cit., p. 194-195.

(133) H. BAETÉ, P. VAN DEN BREMPT & M. GAIL, "Heerlijk Vrijwoud", op. cit., p. 103.

(134) NAB, Archives de la seigneurie d'Enghien, Comptes des droits casuels, C2 la5743 (1652), la5742 (1653), C3 la5740 (1655), La4680 (1656), La5741 (1656), La4679 (1657), La4417 (1658), La305 (1659), C4 la4403 (1661), la4394 (1662), la5739 (1663), C10 la4625 (1700), C11 la851 (1701), la2611 (1702), la15 (1703), C12 la1188 (1704), la16 (1705), la875 (1706), C13 la3424 (1707), la39 (1708), la295 (1709), la296 (1710), C14 la317 (1711), la2193 (1712), C15 la281 (1714), La2590 (1719), C23 la177 (1750), la1269 (1751), C24 la254 (1752), la457 (1753), C25 la340 (1755), C26 la1199 (1757), C27 la115 (1758), la2516 (1760), C28 la255 (1761), la2489 (1762), la1028 (1763), C29 la977 (1764), la27 (1765), la2470 (1766), C30 la4647 (1767), la5494 (1768), C31 la368 (1769), C32 la4685 (1770).

	1650-1669					
Type	Forestry	Poaching	Pasture	Collecting	Other	Total
Amount	50	23	35	0	3	111
Fines (livres tournois)	340,0875	947,0375	151,7	0	12	1450,825
Amount %	45%	21%	32%	0%	3%	100%
Fines %	23%	65%	10%	0%	1%	100%
	1700-1719					
Type	Forestry	Poaching	Pasture	Collecting	Other	Total
Amount	12	8	2	3	1	26
Fines (livres tournois)	234,9875	208,175	24	66	6	539,1625
Amount %	46%	31%	8%	12%	4%	100%
Fines %	44%	39%	4%	12%	1%	100%
	1750-1769					
Type	Forestry	Poaching	Pasture	Collecting	Other	Total
Amount	17	74	3	30	2	126
Fines (livres tournois)	47,05	2596	13,1	66,975	3,525	2726,65
Amount %	13%	59%	2%	24%	2%	100%
Fines %	2%	95%	0%	2%	0%	100%

Table 5. Crimes in the Arenberg forests by category (bailiwick of Edingen)⁽¹³⁵⁾

However, the exclusive property rights did not remain a privilege of the rich for long. As a reaction to the decreasing access to the forests, villagers also enforced their own property rights. A large number of wild animals lived in the forests of the dukes; the latter would even reserve several patches of forest and land as reproduction and living areas for wild animals (for hunting purposes)⁽¹³⁶⁾. The abundance of game did lead to damage on the surrounding

(135) NAB, Archives de la seigneurie d'Enghien, Comptes des droits casuels, C2 la5743 (1652), la5742 (1653), C3 la5740 (1655), La4680 (1656), La5741 (1656), La4679 (1657), La4417 (1658), La305 (1659), C4 la4403 (1661), la4394 (1662), la5739 (1663), C10 la4625 (1700), C11 la851 (1701), la2611 (1702), la15 (1703), C12 la1188 (1704), la16 (1705), la875 (1706), C13 la3424 (1707), la39 (1708), la295 (1709), la296 (1710), C14 la317 (1711), la2193 (1712), C15 la281 (1714), La2590 (1719), C23 la177 (1750), la1269 (1751), C24 la254 (1752), la457 (1753), C25 la340 (1755), C26 la1199 (1757), C27 la115 (1758), la2516 (1760), C28 la255 (1761), la2489 (1762), la1028 (1763), C29 la977 (1764), la27 (1765), la2470 (1766), C30 la4647 (1767), la5494 (1768), C31 la368 (1769).

(136) Charles ANCKAERT & August ROEYKENS, "De fameuse konijnenkwesitie te Vollezele in de achttiende eeuw", in *Het Oude Land van Edingen en Omliggende*, vol. 2, 1977, 5, p. 113-122; C. ANCKAERT & A. ROEYKENS, "De fameuse konijnenkwesitie te Vollezele in de achttiende eeuw (Deel 2)", in *Het Oude Land van Edingen en Omliggende*, vol. 3, 1977, 5, p. 195-203; C. ANCKAERT & A. ROEYKENS, "De fameuse konijnenkwesitie te Vollezele in de achttiende eeuw (Deel 3)", in *Het Oude Land van Edingen en Omliggende*,

fields. At the end of the 18th century, this situation outraged the farmers in the village of Vollezele (part of the Edingen estate). They suffered considerable damages caused by a rabbit breeding farm nearby. Their actions, organised and coordinated by the village elite, started with a plea of demands in 1762 and ended in 1771 with a lawsuit against the duke of Arenberg, who owned at the time three rabbit farms in the village. While it was the duke's legal right to own such farms, the excessive damage caused by these rabbits to the surrounding fields exceeded an acceptable level. The duke (represented by his steward and administrators) defended his cause by claiming that these rabbits were needed for the three months he spent each year in his castle in Edingen, that he had the right to own a rabbit farm and that the damage to the fields was in fact not substantial. Contrary to the duke's claims, the villagers were awarded a compensation for their losses in 1773 by the court after an investigation by specialists⁽¹³⁷⁾. Similar actions took place in 1759 in the villages of Lettelingen, Bierk, Heikruis, Herne and Herfelingen (also in the Edingen estate), where the villagers asked for compensation for the damage caused by wild boars living in the duke's forests⁽¹³⁸⁾. In this case, the duke was able to negotiate an agreement with the local population leading to the shooting of more boars to reduce the damage in future⁽¹³⁹⁾. In Heverlee, the dukes' armed men confiscated a dog that was used by a local farmer to frighten wild animals (boars) that were damaging his field. The farmer refused to hand over the dog and a fight occurred between the armed men and a village patrol. In the end, the dukes reintroduced some usufruct rights: villagers of Heverlee were allowed to cut grass to compensate for the damages suffered⁽¹⁴⁰⁾. Defending and being more strict in exercising the property rights was thus a double-edged knife. On the one hand, the duke was increasingly able to keep the local population out of his forests. On the other hand, the local population reacted by defending their property rights over the lands adjacent to the forest, asking for compensations for damages made by forest animals.

At the end of the 18th century, the dukes also started to find a solution for the problems arising from the co-management of forests by splitting them up. In Halle, the *Hallerbos* was divided between the chapter of Saint-Waltrudis and the duke of Arenberg between 1777 and 1779. This put an end to the discussions between the duke's steward and the chapter about their revenue shares⁽¹⁴¹⁾. The *Dreiherrenwald* near Rocherath, Krinkelt und Mürringen was split up in the years 1788-1789⁽¹⁴²⁾. In Neufchateau, the dukes would only

vol. 4, 1977, 5, p. 255-262; C. ANCKAERT & A. ROEYKENS, "De fameuse konijnenkwesie te Vollezele in de Achttiende eeuw (Deel 4)", in *Het Oude Land van Edingen en Omliggende*, vol. 4, 1978, 6, p. 273-277.

(137) *Ibid.*

(138) G. TACK, "Historische ecologie van het boslandschap in het oude graafschap Vlaanderen en de aansluitende delen van Brabant en Henegouwen", *op. cit.*, p. 199-200.

(139) August ROEYKENS, "Everzwijnen uit het Strihouxbos verwoesten velden te Bierk, Herfelingen, Heikruis, Herne en Lettelingen", in *Het Oude Land van Edingen en Omliggende*, vol. 3, 1977, 5, p. 213-217.

(140) F. SCHEELINGS, "Het bosbestand van de heerlijkheden in de nieuwe tijd: constant (of) verkleinend?", *op. cit.*, p. 233-234.

(141) G. LERNOUT, "Een bos met een verleden", *op. cit.*, p. 20-21.

(142) NAB, 'Schleiden, carte d'ajoute à la carte de la forêt des trois seigneurs (Dreiherren Wald) par B. Gaine', Archives du Palais d'Arenberg à Bruxelles, 2558; 'Schleiden, Dernier et final plan de partage du Bois des Trois Seigneurs situé dans le comté de Schleyden par

be able to do this in 1845-46, after a long lawsuit, because the locals opposed this process⁽¹⁴³⁾. By dividing the shared forests, the duke's stewards could finally manage the forests as they pleased.

Scientification

Gathering knowledge about forestry at the beginning of the early modern period was a process of trial and error. Most of the practices were largely based on local tacit knowledge⁽¹⁴⁴⁾. Therefore the state of the forest depended highly on the experience of the local steward and the quality of his foresters' team. Sometimes, local directives were implemented, providing rules and guidelines on the spatial organisation and exploitation of forests⁽¹⁴⁵⁾. In this way, some knowledge and practices could be passed on to the next generation of stewards and foresters. In this regard, Anne of Croÿ and Charles of Arenberg ordered some stewards to send a detailed description of every piece of property at the beginning of the 17th century. They also inquired for possibilities to further improve the domain and its forests⁽¹⁴⁶⁾.

When the central administration of the Arenberg family became more powerful in the course of the first half of the 18th century, the central administration did not only seek to exercise power over the stewards and the forests they had to take care of. It also wished to accumulate knowledge which would enable it to further organise forestry activities – by appointing a head forester, for instance⁽¹⁴⁷⁾. Hiring forestry specialists was necessary to optimize forestry practices, as the stewards were definitely not experts in this field. Stewards were required to have, amongst other capacities, knowledge of bookkeeping, negotiation skills to arrange leases and wages and organisational and supervising skills to successfully coordinate the construction works⁽¹⁴⁸⁾.

Gallibert', Archives du Palais d'Arenberg à Bruxelles, 1384.

(143) Victor WAUTHOZ, "Contribution à l'histoire de la forêt de Neufchâteau", in *Terre de Neufchâteau*, vol. 1, 1998, p. 12-26.

(144) P.-A. TALLIER e.a., "State Forestry in Belgium since the End of the Eighteenth Century", *op. cit.*, p. 94-102.

(145) AAE, Instruction pour François Le Comte (1625), Heverlee 54/18; University Archives Katholieke Universiteit Leuven, Règlement de Charles d'Arenberg et Anne de Croÿ (1615), Archief van het kasteel van Arenberg te Heverlee, 697.

(146) SASH, Inquiry property (1612-1613), Château de Mirwart, nr. 232.

(147) AAE, Règlement pour l'amélioration et entretien 1730, 54/18 SEM 18.

(148) NAB, Comptes des domaines Arenberg (Enghien), D9 la 57 (1650), D10 la 4683 (1654), la126 (1655), la1263 (1656), la178 (1657), D11 la2719 (1658), la2724 (1659), la2718 (1660), la2186 (1661), D12 la954 (1662), la955 (1663), la8173 (1664), la850 (1665), D13 la2572 (1666), la2571 (1667), la3413 (1668), la46 (1669), D20 la951 (1700), D21 la863 (1701), la509 (1702), la508 (1703), D22 la474 (1704), la729 (1705), D23 la1200 (1706), la2594 (1707), D24 la810 (1708), la3421 (1709), D25 la1175 (1710), la511 (1711), D26 la85 (1712), la847 (1713), D27 la741 (1714), la2541 (1715), D42 la 220 (1750), D43 la 332 (1751), D44 la 1181 (1752), D45 la 8049 (1753), D46 la 1076 (1754), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Arenberg (Rebecq), la359 (1660), la425 (1661), la7073 (1662), la7072 (1663), la7075 (1664), la7074 (1665), la2284 (1666), la2870 (1667), la1540 (1668), la1427 (1669), la3148 (1700), la3147 (1701), la3125 (1702), la3143 (1704), la3142 (1705), la997 (1706), la320 (1707), la3136

Even if stewards were a little more familiar with forest management than the average steward, they could only access and accumulate knowledge about their own forest. Most of them had never taken care of forests in other areas, and thus lacked a comparative perspective. In that sense, it was efficient to concentrate and centralize the whole process⁽¹⁴⁹⁾ of forest management and make central foresters and the director of the domains responsible for the management of the woodlands. Knowledge accumulation on the central level led to the making of new directives on how forestry had to be organised, based on the insights of several domains⁽¹⁵⁰⁾.

From the second half of 18th century, the dukes would not only gather information in their own organisation, but would also be part of a vanguard of estate owners involved in the scientification of forestry. Charles Maria Raymond (duke from 1754 on) can be seen as the first duke showing a real interest in science. Charles Marie Raymond was very interested in forestry and silvology. He did not only invested a lot in to his forests⁽¹⁵¹⁾, he also imported exotic trees like the Liriodendron or Aleppo oaks⁽¹⁵²⁾. He was also involved in the early experimentation and economic exploitation of new trees (Larch). Moreover, he visited London with the famous forestry specialist, Baron de Poederlé⁽¹⁵³⁾, and stood in contact with important forest biologists like Needham and Magellan⁽¹⁵⁴⁾.

Charles Maria Raymon's, Louis-Engelbert, would equally be involved in the scientific scene. Due to a hunting accident, Louis-Engelbert became blind very early in his life disabling him from pursuing a military career like his ancestors. However, the blind duke had a keen interest in science, technique, economics and art.⁽¹⁵⁵⁾ He was a member of the *Société royale*

(1708), la1527 (1709), la93 (1710), la501 (1711), la424 (1712), la423 (1713), la190 (1714), la79 (1715); Comptes des domaines Arenberg (Bierbeek-Heverlee), la2294 (1607), la3417 (1608), la2204/1 (1609), la3009 (1640), la2215 (1641), la5025 (1642), la2812 (1643), la 8170 (1644), la2298 (1645), la2220 (1646), la2300 (1647), la2801 (1648), la 2291 (1649); Comptes des domaines Wallers, la2539 (1754), la2540 (1755); 'Rechnung Kommeren', (Allemagne) la2622 (1785); 'Compte de Schleiden', (Allemagne) la3187 (1750); 'Compte de Schleiden depuis la levée du séquestre jusqu'à la fin de l'an', (Allemagne) la2887 (1805), 'Rechnung Kinzweiler', (Allemagne) la6944 (1756).

(149) Ram MUDAMBI, "Location, Control and Innovation in Knowledge-Intensive Industries", in *Journal of Economic Geography*, vol. 8, 2008, 5, p. 710-725.

(150) AAE, 'Règlement pour la régie et l'exploitation des bois de la maison d'Arenberg', 66/29/II/11; 'Projet de Règlement pour la régie et l'exploitation des bois 1784', 66/29/I/10.

(151) AAE, 'Projet de Règlement pour la régie et l'exploitation des bois 1784', 66/29/I/10; NAB, Comptes des domaines Arenberg (Enghien), D47 la 4188 (1755), D48 la 5495 (1756), D49 la 2534 (1757), D50A la 1028 (1758), D50B la173 (1759), D51A la49 (1760), D51B la147 (1761), D52 la816 (1762), D53 la374 (1763), D54 la337 (1764), la139 (1765), D55 la1176 (1766), D56 la2494 (1767), D57 la364 (1768), D58 la2529 (1769); Comptes des domaines Wallers, la2539 (1754), la2540 (1755); 'Rechnung Kommeren', (Allemagne) la2622 (1785); 'Compte de Schleiden', (Allemagne) la3187 (1750); 'Rechnung Kinzweiler', (Allemagne) la6944 (1756).

(152) Eugène DE POEDERLE, *Manuel de l'arboriste et du forestier belgiques*, vol. 2, Boubers, 1772, p. 120, 336.

(153) *Ibid.*, p. 189.

(154) AAE, Correspondance Jean Tourbeville Needham 1772-1778, 41/7/I/8; Correspondance Charles Marie Raymond and Jean Hyacinthe Magellan (1775-1779), 40/26.

(155) André CRESENS, "Het laboratorium", in Mark DEREZ e.a., eds., *De blinde hertog: Louis Engelbert van Arenberg en zijn tijd, 1750-1820*, Brussel, Gemeentekrediet, 1996, p.

d'Agriculture et de Botanique de Gand⁽¹⁵⁶⁾ and remained in contact with other important herbologists of his time. The duke was also related to the imperial and royal academy of sciences in Brussels. Like his father, he was in direct contact with the biologist John Needham, the director of the imperial and royal academy. Moreover, Jean Hyacinthe de Magellan offered him some seeds from North American trees⁽¹⁵⁷⁾. He also invited Jan Ingenhousz, who discovered photosynthesis, to the imperial and royal academy⁽¹⁵⁸⁾. That same institute awarded De Beunies – who came up with the idea of a three-class granulometry for soils – and the perspective that the clay fraction determines the fertility of soils – a prize for his work⁽¹⁵⁹⁾. The duke of Arenberg (and his administration) therefore had access to insights in the most recent developments in the field of biology and chemistry. Moreover, the duke of Arenberg was involved in economic discussions about how land should be organised to increase revenue – e.g., the discussion about leasing out large or small plots of land/farms⁽¹⁶⁰⁾.

Considering forests as the most important part of his patrimony⁽¹⁶¹⁾, the blind duke imported several exotic species into his garden in Edingen⁽¹⁶²⁾. Originally from central Europe, Larch trees would be introduced into the duke's property in the Southern Netherlands⁽¹⁶³⁾. Larches provide very durable and strong wood, and are highly suitable for construction, shipbuilding, mining activities and building fences. Moreover, they grow well in the Western European climate, especially when planted in sandy and loamy soils⁽¹⁶⁴⁾. Given the duke's knowledge of scientific progress, the new forestry rules issued in 1784 had a marked scientific component. They called for an investigation of the forest soils and showed a clear interest in mapping the forests⁽¹⁶⁵⁾.

With the regards to the scientification and rationalization of forestry, more detailed and systematic documents dating from the last quarter of the 18th century can be found. A set of rules (1785-1786) commanded an annual

183-192; Jan ROEGIERs & Helena WILLE, "Natuur en techniek", *ibid.*, p. 372-377.

(156) Joseph VAN DAMME-SELLIER, *Histoire de la Société royale d'Agriculture et de Botanique de Gand...*, Ghent, Impr. Is van Doosselaere, 1861, p. 36.

(157) Isabel MALAQUIAS, "Aspects of John Hyacinth de Magellan's Scientific Network Between Britain, Flanders and France", in José Ramón BERTOMEU-SÁNCHEZ, Duncan THORBURN BURNS & Brigitte VAN TIGGELEN, eds., *Neighbours and Territories: the Evolving Identity of Chemistry*, Leuven, ICHC, 2008 p. 609-612.

(158) Geerdt MAGIELs, *From Sunlight to Insight: Jan Ingenhousz, the Discovery of Photosynthesis & Science in the Light of Ecology*, Brussels, VUBPress, 2010, p. 103.

(159) P.C. BAVEYE, "Jean-Baptiste De Beunie (1717-1793)", *op. cit.*, p. 56-58.

(160) Claude BRUNEEL, *L'hostilité à l'égard des grandes fermes, un aspect du peuplement dans les Pays-Bas autrichiens: théorie et réalités brabançonnaises*, Louvain-la-Neuve, 1990 (Centre belge d'Histoire rurale, 93), p. 42-44.

(161) AAE, *Projet d'Instructions pour le Regisseur General de la S^{me} Maison d'Arenberg vers 1777*, 66/29/9.

(162) AAE, 'Letter of the blind duke to Dey (15/10/1817)', *Correspondance Dey*, 41/34.

(163) Eugène DE POEDERLE, *Manuel de l'arboriste et du forestier belgiques. Troisième édition, augmentée de plusieurs articles curieux et soigneusement corrigée par l'auteur*, Brussels, Plon, 1792, (2), p. 64-66.

(164) Andreas BERGSTEDT & Christian LYCK, "Larch Wood: A Literature Review", in *Forest & Landscape Working Papers*, n°. 23/2007, p. 10-43.

(165) AAE, 'Projet de Règlement pour la régie et l'exploitation des bois 1784', 66/29/I/10.

survey of the existing forests (age and species) and an improvement of sales procedures and hiring practices⁽¹⁶⁶⁾. Very detailed documents dealing with the sales and situation of the forests were produced (the earliest of which dates from around 1778)⁽¹⁶⁷⁾. Maps were made to have a clear view on the forests in the German lands, the Southern Netherlands and France⁽¹⁶⁸⁾. Annual assessments called *Plan de la coupe à exploiter*, which included a map of all the stands (smaller parcel within a forest) and indicated the portion of each stand that was chopped, were sent to the general administrator for each forest from the dawn of the 19th century on⁽¹⁶⁹⁾. Various topics such as the possibility to purchase adjacent forests or expand existing forest⁽¹⁷⁰⁾, damage control after a storm⁽¹⁷¹⁾, armament of foresters⁽¹⁷²⁾, reports on lumber sales⁽¹⁷³⁾ and the sequestration and occupation by France were constantly discussed between the stewards and the central administration⁽¹⁷⁴⁾.

(166) AAE, 'Règlement des appointements des receveurs', 66/29/II/10.

(167) AAE, 'Concernent les coupes de futaie, 1792-1822', SEC 753 (NI), 43, vol. 1; 'Ventes de taye, 1814', SEC 664; 'Ventes de haute futye faites, 1819', SEC 663; 'Extrait tableau du produit des bois, 1778', SEM 5, 51/I/II.

(168) NAB, 'Ronquières (1806), Carte topographique des biens appartenant à Monsieur le duc d'Arenberg par P. Marsille, arpenteur géomètre', Archives du Palais d'Arenberg à Bruxelles, 682; 'Braine-le-Comte (1805-1806) Plan géométrique des biens appartenant à monsieur le duc d'Arenberg situés sous la commune de Braine-le-Comte par P. Marsille', Archives du Palais d'Arenberg à Bruxelles, 957; 'Schleiden, Dernier et final plan de partage du Bois des Trois Seigneurs situé dans le comté de Schleyden par Gallibert', Archives du Palais d'Arenberg à Bruxelles, 1384; 'Arenberg (1778) Carte géométrique du bois de Hahn attenant à la montagne d'Arenberg avec les bois Breidscheidt, Strodt, Hutten Seiften et autres...', Archives du Palais d'Arenberg à Bruxelles, 1088; 'Waller (1808), Plan figuratif de la forêt de Wallers appartenant à monsieur le sénateur d'Arenberg', Archives du Palais d'Arenberg à Bruxelles, 1010; 'Arenberg-Schleiden, übersichtskarte von den Herzoglich Arenbergschen Besitzungen in der Forstinspektion Arenberg-Schleiden', Archives du Palais d'Arenberg à Bruxelles, 2887; 'Schleiden, carte d'ajoute à la carte de la forêt des trois seigneurs (Dreiherren Wald) par B. Gaine', Archives du Palais d'Arenberg à Bruxelles, 2558; 'Dworp (1805) "Plan d'un bois dit de Den hack situé dans la commune de Tourneppe, appartenant à S.A.S. Mgr le duc d'Arenberg"', Archives du Palais d'Arenberg à Bruxelles, 684; 'Lalaing "Plan figuratif de la taille du Coude Bois de Lalaing appartenant à S.A.S. Mgr le duc d'Arenberg"', Archives du Palais d'Arenberg à Bruxelles, 1783; 'Neufchâteau Plan de la forêt de la Banniebois', Archives du Palais d'Arenberg à Bruxelles, 1231.02.

(169) NAB, 'Bierbeek, Plans de la coupe dite Schrickelberg et de la coupe de Renissart à exploiter au bois de Mollendael pour 1840-1879', Archives du Palais d'Arenberg à Bruxelles, 150; 'Deux-Acren Plan de la coupe à exploiter au bois d'Acrennes pour l'ordinaire 1833', Archives du Palais d'Arenberg à Bruxelles, 148; 'Deux-Acren Plan de la coupe à exploiter au bois d'Acrennes pour l'ordinaire 1853', Archives du Palais d'Arenberg à Bruxelles, 149; Plan des coupes au bois de Rebecq de 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1821, 1822, 1823 par P. Marsille, Archives du Palais d'Arenberg à Bruxelles, 3082; 'Roelux "Plan de la coupe à exploiter au bois de la Pitoire pour l'ordinaire 1828" Par Ritterhaus', Archives du Palais d'Arenberg à Bruxelles, 134; 'Russeignes Plan de la coupe dite Martigaele, partie des bois du duc d'Arenberg à Russeignes par Désiré Van Huffel', Archives du Palais d'Arenberg à Bruxelles, 123.

(170) AAE, Letter on purchase forest exlaves Meerdael, 25-8-1806, 64(40/28).

(171) AAE, Letter storm damage Edingen, 20-2-1807, 64(40/28).

(172) AAE, Letter armament of foresters Differdange, 29-2-1807, 64(40/28).

(173) AAE, Letter on lumber sales Leerbeek, 2-6-1807, 64(40/28).

(174) AAE, Letter on sale forest of Chartreux, 31-8-1807, 64(40/28).

Conclusion

The dukes of Arenberg and their organisation managed their forestry activities quite successfully over the 17th and 18th century into the 19th century. They were able to capitalize on the rising wood prices by producing and selling more wood. To do so, they circumvented some major problems: the lack of information and knowledge about their property and forests, control over their stewards and property rights. These problems were solved by deploying four complementary strategies. Firstly, the management was centralised and specialised, enabling the central administration of the Arenbergs to control and guide the local stewards. Moreover, the remuneration of the stewards was adapted to maximize forestry revenues. Control, guidance and optimized remuneration ensured the stewards would not overexploit or neglect the forests they were in charge of. In fact, most of the forests of the duke of Arenberg were very well maintained by the end of the 18th century.

The dukes also employed a strategy to reduce the damage done by the local population. They did everything they could to protect their forests against intruders and to strengthen their property rights over the forest. They succeeded in this and rapidly avoided the intrusion of commoners, who would (il)legally take wood out of the forest or damage wood production. Rules sent out to the stewards helped them to take appropriate action. Moreover, co-managed woods managed by different owners were increasingly split between them.

Lastly, the scientification of the forestry enabled the increase of wood production. Forestry at the beginning of the 17th century depended largely on local experience. Over time, the information with regard to forestry was increasingly gathered, due to more stringent control over the local stewards. Insights from various sciences (chemistry, biology, economy and geography) were more and more taken into account. Again, the centralized and strong administration helped to spread scientific knowledge through the administration and to force the steward to make use of it.

These findings are not only relevant for the Arenberg case. The dukes might be an extremely successful example of how well one could manage their forests, but other forest owners had to overcome the same challenges and could grasp similar opportunities to capitalize on the increasing wood prices⁽¹⁷⁵⁾. For example, the discussions about property rights over forests were not limited to the dukes' estates; they also took place in several other parts of North-Western Europe⁽¹⁷⁶⁾. Moreover, the development of scientific knowledge about forestry was related to a dialogue between several scientists and landowners all over Western-Europe⁽¹⁷⁷⁾. Multiple studies show that restructuring an administration or sending out new (forestry) management

(175) Brinley THOMAS, "Was there an Energy Crisis in Great Britain in the 17th Century?", in *Explorations in Economic History*, vol. 23, 1986, 2, p. 142-143; S. VON BELOW & S. BREIT, *Wald von der Gottesgabe zum Privateigentum*, *op. cit.*, p. 2330.

(176) S. VON BELOW & S. BREIT, *Wald von der Gottesgabe zum Privateigentum*, *op. cit.*, p. 2330.

(177) P.C. BAVEYE, "Jean-Baptiste De Beunie (1717-1793)", *op. cit.*; I. MALAQUIAS, "Aspects of John Hyacinth de Magellan's Scientific Network", *op. cit.*

rules to stewards was not exclusive to the Arenberg administration⁽¹⁷⁸⁾. In short, the Arenberg case presents an example of how successful forestry co-aligns with a successful management of the administration to deal with opportunities and threats.

ABSTRACT

Sander BERGHMANS, *The Management of the Forests of the Dukes of Arenberg from 1600 until 1820*

With the rise of wood prices in Western Europe during the 17th and 18th centuries, forest owners could increase their revenues. The duke of Arenberg, who owned large forests in the Southern Netherlands, France and the Rhine area, managed to grasp this opportunity. By managing internal and external challenges, the dukes of Arenberg improved the production of their forests considerably over time. This article identifies four managerial changes that contributed to this change. First, the administrative structure and processes in the ducal organisation were upgraded. Second, remuneration policies were adapted to better align the interests of stewards and dukes. Third, the property rights over the forests became more exclusive and lastly, scientific insights percolated through the ducal administration proved beneficial for the forest management practices.

Business – history – management – forestry – estates – property rights – remuneration – structure – processes – early modern period – nobility – Arenberg – organisation

(178) C. BEARDMORE, “Landowner, Tenant and Agent on the Marquis of Anglesey’s Dorset and Somerset Estate”, *op. cit.*; D.R. HAINSWORTH, *Stewards, Lords and People*, *op. cit.*; S. WEBSTER, “Estate Improvement and the Professionalisation of Land Agents on the Egremont Estates in Sussex and Yorkshire”, *op. cit.*, p. 61-62.

SAMENVATTING

Sander BERGHMANS, *Het beheer van de bossen van de hertogen van Arenberg van 1600 tot 1820*

Op het moment dat de houtprijzen in West-Europa begonnen te stijgen tijdens de 17^{de} en 18^{de} eeuw, zagen veel bouseigenaars nieuwe kansen om hun inkomsten te verhogen. De hertog van Arenberg, die eigenaar was van diverse grote bossen in de Zuidelijke Nederlanden, Frankrijk en het Rijnland, wist gebruik te maken van deze opportuniteit. Door het oplossen van interne en externe problemen en het grijpen van kansen van allerlei aard, slaagden de hertogen van Arenberg erin om hun productie tijdens deze periode fors op te krikken. In dit artikel worden er vier beheerveranderingen besproken die bijdroegen aan verbeterde bosbouwpraktijken. Ten eerste werden de administratieve structuren en processen verbeterd. Ten tweede werd het verloningsbeleid aangepast zodat de belangen van rentmeesters en de hertog dichter bij elkaar kwamen te liggen. Ten derde werden de eigendomsrechten over de bossen exclusiever en strikter en ten slotte drongen nieuwe wetenschappelijke inzichten met betrekking tot bosbouw door in het beheer.

Bedrijfsvoering – geschiedenis – management – bossen – domeinen – eigendomsrechten – remuneratie – structuur – processen – vroegmoderne periode – adel – Arenberg – organisatie

RÉSUMÉ

Sander BERGHMANS, *La gestion des forêts des ducs d'Arenberg de 1600 jusqu'à 1820*

L'augmentation du prix du bois aux XVII^e et XVIII^e siècles en Europe occidentale fournit aux propriétaires de forêts l'opportunité d'augmenter leurs revenus. Les ducs d'Arenberg, propriétaires de vaste forêts dans les Pays-Bas méridionaux, en France et dans la région rhénane, réussirent à saisir cette occasion. En relevant les défis internes et externes, et en profitant de diverses opportunités, ils parvinrent à augmenter considérablement la production de leurs forêts au fil du temps. Cet article identifie quatre changements de gestion qui contribuèrent à cette amélioration. Premièrement, l'amélioration de la structure et des procédures administratives de l'organisation ducale. Deuxièmement, l'adaptation des politiques de rémunération pour mieux aligner les intérêts des intendants sur ceux des ducs. Troisièmement, une évolution des droits de propriété sur les forêts, allant dans le sens d'une plus grande exclusivité. Enfin, l'intégration des connaissances scientifiques au sein de l'administration ducale, qui permit d'améliorer les pratiques de gestion forestière avec un succès croissant.

Entreprise – histoire – gestion – forêts – domaines – droits de propriété – rémunération – structure – procès – époque moderne – noblesse – Arenberg – organisation