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ITALIAN “ECONOMIC BOTANISTS”
AND STATE-SCIENCE COOPERATION
(LATE EIGHTEENTH-EARLY NINETEENTH CENTURY)

In the late eighteenth and early nineteenth centuries, many Italian naturalists became increasingly interested in the application of science to agriculture and manufacturing, expressing a growing awareness of the economic benefits of scientific progress in their countries. For example, botany increasingly combined more traditional studies with new research and experimentation aimed at defining the potential of plants in the food and textile sectors. The article analyzes the profiles of a number of Italian scientists, focusing on their progressive specialization in “economic botany” and considering their role in the circulation of socio-economic ideas as part of an evolution of the State-science synergy that involved all of Europe. It not only illustrates how natural sciences and socio-economic thought from France and Central Europe influenced Italian scientists, but also demonstrates how this community elaborated its own original contributions to European economic thought.

Economic thought, late eighteenth century, Napoleonic Era, natural sciences, Italy

Tra la fine del Settecento e l'inizio dell'Ottocento molti naturalisti italiani si interessarono all'applicazione del proprio sapere all'agricoltura e alla manifattura, nella crescente consapevolezza del fatto che il progresso scientifico potesse giovare al benessere economico e sociale. La botanica, in particolare, venne sempre più frequentemente applicata a definire le potenzialità delle piante nei settori alimentare e tessile. Alla luce del più ampio contesto dell'evoluzione del rapporto fra Stato e scienza in Europa, l'articolo analizza i profili di alcuni esperti italiani, focalizzandosi sulla loro progressiva specializzazione nella cosiddetta “botanica economica”. Lo studio non ricostruisce soltanto l'influenza francese e mitteleuropea sulla variegata comunità degli studiosi italiani, ma dimostra anche come quest'ultima abbia offerto un proprio originale contributo al dibattito intellettuale e scientifico continentale.

Pensiero economico, tardo Settecento, età napoleonica, scienze naturali, Italia

1. *Introduction*

The connection between science and technology, on the one hand, and economic progress on the other, gained increasing importance during the second half of the eighteenth century and the early nineteenth century. Governments made new venues for debate and spaces for experimentation available to naturalists and facilitated the circulation of knowledge and the exchange of seeds, dried plant specimens, mineral and animal specimens, books, and journals. In exchange, experts made their knowledge available to the State, contributing in a structured way to prosperity. In particular, they were employed by the authorities to boost the economy via improvements in agriculture, animal husbandry, and manufacturing. An interesting role was played by botanists, who, often collaborating with experts from other branches of scientific and technical knowledge, were involved in plans for the improvement of agriculture and related spheres of manufacturing depending wholly or partially on the kingdom *Plantae* (for example, the textile sector, with fibers, oils, and dyes often of vegetable origin)¹.

In the late eighteenth and early nineteenth centuries, a trend developed in botany – a discipline that had acquired a good level of autonomy at this point – towards increasing emphasis on agriculture and manufacturing. This “economic botany” constituted the framework of what would later mature into a new discipline: agricultural science. However, botany continued to be the master discipline for a long time, the backbone of agricultural science developing over the period in question, and a reservoir for the State of consultants in agricultural/manufacturing matters and teaching staff for newly established chairs of agriculture or rural economics. If dynamics of this type were present in most of Europe, the Italian States before and during the Napoleonic Era presented an interesting variety of

¹ A. EDE, L.B. CORMACK, *A History of Science in Society: from Philosophy to Utility*, Toronto 2017³; J.E. McCLELLAN III, H. DORN, *Science and Technology in World History: an Introduction*, Baltimore 2015³; E.C. SPARY, *Feeding France: New Sciences of Food, 1760-1815*, Cambridge 2014; E.C. SPARY, *Eating the Enlightenment: French Food and the Sciences, 1670-1760*, Chicago-London 2012; C. ROTONDI, *Rendere facili le verità utili. Dalla Società Patriottica all'Istituto Lombardo (1776-1859)*, in *Associazionismo economico e diffusione dell'economia politica nell'Italia dell'Ottocento*, I, ed. by M.M. Augello and M.E.L. Guidi, Milan 2000, pp. 39-61; J. GASCOIGNE, *Science in the Service of Empire: Joseph Banks, the British State and the Uses of Science in the Age of Revolution*, Cambridge 1998.

cases, not yet fully studied. The complex and variegated situation in Italy derived mainly from its being a crossroads of knowledge from all over Europe in both technical and scientific fields and from the influence on political and economic thought by such currents as physiocracy and cameralism. The technocratic policy during the Napoleonic imperium was equally important and particularly fruitful in agricultural experimentation and teaching, especially in those areas of northern and central Italy that were part of the Italian Republic (1802-1805) and the Kingdom of Italy (1805-1814)².

My article analyzes the dynamics through which economic botanists worked to improve agricultural productivity in their countries, but also their background and how they contributed to and were influenced by the European knowledge network of which they were part. The analysis is structured in a first part dedicated to the study of some technical profiles of botanists operating in northern Italy between the 1760s and the 1820s. The second part is dedicated to the influence that schools of political-economic thought from France and Central Europe – such as physiocracy, cameralism, and debates on landownership – exercised on experts and institutions operating in northern and central Italy. My piece thus considers both the material and the intellectual aspects behind a sort of transition category, namely the economic botanists. The period under consideration takes into account the points of continuity and rupture between the late Ancien Régime, the Napoleonic Era and the Restoration.

The sources are largely unpublished, collected in Italian and Spanish archives and libraries. This documentation adds to a solid body of historiographical literature that has studied some of the technical profiles here considered in a comparative key as well as the intellectual debate on national productivity.

² For introductory studies on such topics see: M.L. FAGNANI, *From “Pure Botany” to “Economic Botany” – Changing Ideas by Exchanging Plants: Spain and Italy in the Late Eighteenth and the Early Nineteenth Century*, «History of European Ideas», (2021), online; M.L. FAGNANI, *L’agraria “italiana” prima e dopo Napoleone: percorsi formativi di una scienza*, «Società e storia», 169 (2020), pp. 457-491. See also C. BARGELLI, *Agronomi, riformatori, utopisti. Soffi di rinnovamento sull’agricoltura parmense nell’età del Moreau de Saint-Méry*, «Storia economica», IV (2001), pp. 423-483; D. BRIANTA, *Il dibattito economico-agrario nelle Accademie e nelle società economiche lombarde del Sette e dell’Ottocento*, in *Associazionismo economico*, pp. 3-38.



Main botanical centers discussed in the article

2. Between science and economy: the emergence of economic botanists

Northern Italy in the late eighteenth and early nineteenth centuries had a particularly active network of naturalists interested in the development of agriculture and manufacturing. These experts represented economic botany as a transition between pure science and agricultural science, but also as a requirement for the improvement of technical knowledge, for example in textiles and dyes. Some of these erudites operated both in the late Ancien Régime and the Napoleonic Era, sometimes continuing as far as the Restoration, while others were active only in one of the periods considered. I have selected the most significant ones in terms of the contributions of botany to the national economy, highlighting for each of them the research, experimentation, and counseling activities that allow us to presume that they belonged to a broad community of experts in transition.

The first of the botanists examined is the clergyman Fulgenzio Vitman (1728-1806), who had received his naturalistic training from important scholars of his order – the Vallombrosans – such as Bruno Tozzi and Giovanni Francesco Maratti. He was professor of botany

at the University of Pavia from 1763 to 1774 and at the Gymnasium of Brera, in Milan, from 1774 to 1806. By virtue of the latter appointment, he was involved in the activities of the Patriotic Society (Società Patriotica) founded by Maria Theresa in 1776 and active from 1778 until the arrival of the French. The Society sought to strengthen Lombard agriculture, animal husbandry, and manufacturing, its activities including attempts to acclimatize non-native plant species and experiments to improve existing crops. A large percentage of its members were noblemen and landowners, while others were naturalists, technicians, and officials – experts, in any case – such as the agricultural inspector (*ispettore agrario*) and the delegate to manufacturing (*delegato alle manifatture*) of the Duchy of Milan³.

Among the experts, Vitman was a representative of botany and, although he always remained oriented more towards the teaching and study of “pure botany”, he participated in the meetings of the Society from its earliest years⁴. The Society ran experiments on native plants that could serve as substitutes for expensive plant products imported from abroad. For example, experiments were initiated in 1781 in the Brera garden on the native common dogwood (*Cornus sanguinea* L.) as an oil source, but with unsatisfactory results. The most authoritative of the two supervisors was Vitman. However, his contribution to the experiments of the Society also extended to other oil plants, dye plants, and the species more suitable for fallowing/pastures⁵.

An exemplary case of “botanical enlistment” in the public administration was Giambattista Guatteri’s (1739-1793) work in Parma. With the reform of higher education promoted by Prime Minister Guillaume du Tillot in 1768 under duke Ferdinand I, the new chair of botany was attributed to the young clergyman Guatteri. Having

³ A. VISCONTI, *Nuovi strumenti per lo studio e l'insegnamento della botanica nella Lombardia dell'assolutismo asburgico: gli orti di Pavia e di Milano*, «Storia in Lombardia», 33 (2013), II-III, pp. 28-44; A. VISCONTI, *La fondazione dell'Orto botanico di Brera e gli anni della direzione dell'abate vallombrosano Fulgenzio Vitman (1728-1806) tra assolutismo asburgico ed età napoleonica*, «Atti della Società italiana di scienze naturali – Museo civico di storia naturale di Milano», 152 (2012), I, pp. 27-48.

⁴ Vitman attended a meeting for his first time in 1779, precisely the first meeting of that year: BIBLIOTECA NAZIONALE BRAIDENSE, AF XI 33.

⁵ A. VISCONTI, *Il giardino botanico della Società Patriotica di Milano (1776-1796)*, «Museologia scientifica», 14 (1998), I, pp. 266-269, in particular p. 268; VISCONTI, *La fondazione dell'Orto botanico di Brera*, p. 30; M. MAZZUCOTELLI, *L'abate Fulgenzio Vitman (1728-1806) e l'insegnamento della 'Botanica officinale ed economica' in Lombardia tra Sette e Ottocento*, «Benedictina», 49 (2002), II, pp. 440-491.

studied humanities and law until then, he was sent to the University of Padua to train in botany and natural history under the guidance of Giovanni Marsili. Returning to Parma in 1769, he was involved in the foundation of the new botanical garden, which began to function as an educational, cataloging, and research center using a modern apparatus of greenhouses, aimed not only at the more traditional medical-pharmaceutical uses, but also at agriculture «and many other arts». A good amount of space was dedicated to food plants – from *Poaceae* to fruit trees – and dye plants – such as *Isatis tinctoria* L., *Indigofera tinctoria* L., and *Rubia tinctorum* L.⁶ Guatteri was also consulted several times by the authorities on issues of agricultural interest: mulberry growing for silk production, edible mushroom cultivation, and defense of the crops against insect parasites. He performed a review of Parma agriculture in 1789, noting profound backwardness and lack of both up-to-date agricultural knowledge and experimentation⁷.

Both Vitman and Guatteri operated in the Ancien Régime (the former survived until 1806, but his contribution to economics was mainly linked to the activities of the Patriotic Society). In roughly the same years, Angelo Gualandris (1750-1788) studied and experimented with agriculture, first in the Republic of Venice and later in the Duchy of Mantua.

As for the links with the Republic, Gualandris was from Padua and studied medicine at the local university. In addition to classes in botany, the curriculum also included the study of agriculture, one of the first chairs in Europe together with a specific garden, held by Professor Pietro Arduino⁸. Thanks to his bond with Pietro Arduino and his brother Giovanni, superintendent of agriculture of the Re-

⁶ M.A. FAVALI, F. FOSSATI, *Giambattista Guatteri, fondatore dell'attuale Orto Botanico di Parma*, Parma 1993, pp. 20-21 and 52-54; A. PIZZALEO, *Guatteri Giovanni Battista*, in *Dizionario Biografico degli Italiani*, LX, Rome 2003. See also the catalog *Nomenclatura Plantarum Hortii Regii Botanici Parmensis* updated to 1791, of which I have read a copy with handwritten annotations kept in ARCHIVO DEL REAL JARDÍN BOTÁNICO, MADRID (from now on ARJB), DIV. I, 5, 3, 8. For example, the three dye plants mentioned in this article are on pages 18 and 28.

⁷ G. FUMI, *Botanica e agricoltura. Dal Collegio Alberoni all'agronomia a Piacenza tra Sette e Ottocento*, in *Hortus siccus. Una storia del Settecento: la botanica al Collegio Alberoni*, ed. by A. Marocco, Piacenza 2018, pp. 29-37, in particular p. 29.

⁸ P. DEL NEGRO, *La politica di Venezia e le accademie di agricoltura*, in *La politica della scienza: Toscana e stati italiani nel tardo Settecento*, conference papers (Florence, January 27-29, 1994), ed. by G. Barsanti, V. Becagli and R. Pasta, Florence 1996, pp. 451-489; P.G. ZANETTI, *L'orto agrario di Padova e l'agricoltura nuova*, «Rivista di storia dell'agricoltura», 36 (1996), I, pp. 5-67, in particular pp. 11-17.

public, Gualandris was involved in the activities of the Academy of Agriculture of Padua, of which he became deputy secretary. From 1775 to 1777, sponsored by the Reformers of the University of Padua (*Riformatori allo Studio di Padova*) and the Deputies to the Mines (*Deputati alle miniere*), he traveled to Switzerland, Germany, France, and England. The main interest of the trip was geological and mineralogical, but Gualandris's report also showed considerable interest in the agricultural practices of the countries he visited⁹.

In 1783, Gualandris entered the service of the Habsburgs in Mantua as professor of botany and natural history at the Gymnasium, member of the agricultural branch of the Academy of Sciences and Letters, and agricultural inspector of the Duchy. In the five remaining years of his life, he began numerous projects for the improvement of agriculture and derivative manufacturing: he worked on an agricultural study for the Duchy, planned reforestation projects, tried to relaunch olive growing on the Mantuan hills, and maintained relations with landowners interested in silk production. Unfortunately, after his death, the interventions he had planned and the information he had collected in his survey of the territory were not fully exploited by the authorities and there was no real agricultural and economic revival of the Duchy of Mantua¹⁰. Anyway, Gualandris is a good example of an expert imported from abroad (from the Republic of Venice, in this case), a frequent practice in Austrian Lombardy under Maria Theresa and Joseph II in a broad range of fields, from administration to science. As regards Guatteri in Parma, on the other hand, Tillot and the Bourbon administration preferred to train a local scholar by sending him abroad (in his case to Padua, again in the Republic of Venice).

For his part, Pietro Arduino (1728-1805), professor of agricultural science at the University of Padua, was appointed in 1768 by the government to survey the countryside in the Italian part of the Republic and draw up a report. Arduino outlined a very critical rural situation, in terms of cultivation and breeding as well as living conditions of

⁹ A. GUALANDRIS, *Lettere odepistiche*, Venice 1780; F. BARALDI, *Gli studi geologici di Angelo Gualandris nelle opere pubblicate e nei documenti inediti conservati nell'Archivio storico dell'Accademia Nazionale Virgiliana di Mantova*, in *Angelo Gualandris (1750-1788): Uno scienziato illuminista nella società mantovana di fine Settecento*, ed. by N. Azzi, F. Baraldi and E. Camerlenghi, Mantua 2018, pp. 9-77.

¹⁰ E. CAMERLENGHI, *Le perlustrazioni fatte nel Mantovano e i progetti politici agrari*, in *Angelo Gualandris (1750-1788)*, pp. 159-174; M.L. FAGNANI, *From Botany to Agriculture: the Scientific Network between Great Britain, Spain and Italy in the Late Eighteenth Century*, «Agricultural History Review», 69 (2021), II, pp. 213-235.

the populace. He called for greater circulation of new agricultural knowledge and greater rewards for farmers and peasants. Against the background of a rapidly evolving historical context influenced by the action of the Venetian government and the interests and know-how of landowners, clergymen, and experts in various fields, his voice helped shape a set of innovative instruments aimed at improving the agricultural sector, such as new administrative figures, a network of agricultural academies and societies, journals and books describing Italian and foreign progress, new teaching facilities, and the like¹¹.

The University of Padua, in particular, played a pivotal role in the development of agricultural institutions in the Veneto region. In addition to the agricultural garden founded by Pietro Arduino in the 1760s, the ancient botanical garden created in 1545 also contributed to the virtuous collaboration between science and socioeconomic thought during the nineteenth century, as recently highlighted by Ariane Dröscher¹². Significantly enough, an institute for veterinary teaching and research was also established in Padua (Collegio Zoiotrico) in the early 1770s, which – despite a temporary closure during the Napoleonic rule – influenced veterinary studies at the local university for much of the nineteenth century¹³.

Particularly interesting is the network formed by Filippo Re (1763-1817), Giuseppe Bayle Barelle (1770-1811), and Giovanni Biroli (1772-1827). Their “spiritual guide” was friar botanist Domenico Nocca (1758-1841). Nocca graduated in theology at the University of Pavia in 1786, but he always devoted himself to the study of natural sciences and in particular botany, moving to Vienna in 1789 to perfect his knowledge of the kingdom *Plantae*¹⁴. Count Filippo Re graduated

¹¹ M. SIMONETTO, *L'inchiesta Arduino e i grandi problemi dell'agricoltura veneta nel Settecento*, «Venetica», 1 (1998), pp. 9-44; M. SIMONETTO, *I lumi nelle campagne. Accademie e agricoltura nella Repubblica di Venezia (1768-1797)*, Treviso 2001, pp. 70-89.

¹² A. DRÖSCHER, *Plants and Politics in Padua During the Age of Revolution, 1820-1848*, Cham 2021. Arduino himself studied at this botanical garden and served as its gardener and supervisor for some years before his appointment as professor of agricultural science. For Arduino's life and career see N. TORNADORE, *Pietro Arduino*, in *Professori e scienziati a Padova nel Settecento*, ed. by S. Casellato and L. Sitran Rea, Treviso 2002, pp. 3-8.

¹³ A. VEGGETTI, B. COZZI, *La Scuola di medicina veterinaria dell'Università di Padova*, Trieste 1996.

¹⁴ FAGNANI, *L'agraria “italiana” prima e dopo Napoleone*, p. 465; G. POLLACCI, *Domenico Nocca*, «Atti dell'Istituto Botanico dell'Università di Pavia», s. IV, 8 (1936), pp. iii-v; P.A. SACCARDO, *La botanica in Italia: Materiali per la storia di questa scienza*,

in mathematics from the seminary-college of Reggio in 1781, but he too dedicated the following years to studying and experimenting in botany and agriculture, in his case in his family lands¹⁵. Biroli graduated in medicine in 1795 at the University of Turin and worked for several years as a physician in the Lomellina area; however, he too always showed great interest in botany and agriculture, defending a thesis on the pharmaceutical uses of ginger, exploring the eastern Piedmont countryside, and studying rural society¹⁶. Bayle Barelle is a totally different case. After a few years of theology at the University of Pavia between 1788 and 1791, he abandoned his studies and devoted himself until early 1804 to various jobs: he may have helped his father in the family bookstore in Milan, he was archivist and employee of the Cisalpine Republic and of the Italian Republic. In those years he gained a good knowledge of botany and agriculture by consulting the scientific books on sale at the family business, spending time with Vitman at the Brera botanical garden, and perhaps attending extra-curricular lessons in botany at the University of Pavia¹⁷.

It is interesting to note that Re, Bayle Barelle, and Biroli all became professors of agricultural science, while Nocca – to whom they all referred to some extent – was never officially associated with the discipline. Re held the chair of agriculture at the *Liceo* of Reggio (1790-1798), the University of Bologna (1803-1814), and the University of Modena (1814-1817). Bayle Barelle and Biroli, in succession, held the chair of agricultural science in Pavia during the Napoleonic era (1804-1811 and 1811-1814, respectively); Biroli had already taught the subject associated with botany at the *Liceo* of Novara (1807-1811). Nocca, on the other hand, first taught botany at the Gymnasium of Mantua as Gualandris’s successor for most of the 1790s and later at the University of Pavia from 1797 to 1826¹⁸.

Venice 1895, p. 198; *Memorie e documenti per la storia dell’Università di Pavia e degli uomini più illustri che vi insegnarono*, I, Pavia 1878, p. 426.

¹⁵ G. BONINI, R. PAZZAGLI, *Re Filippo*, in *Dizionario Biografico degli Italiani*, LXXXVI, Rome 2016.

¹⁶ S. BARTOLI, *Giovanni Biroli. Medico e botanico nella Novara napoleonica*, Novara 2012; contribution in *Palazzi del sapere: Giovanni Biroli e la Novara napoleonica*, ed. by S. Bartoli, Novara 2009.

¹⁷ FAGNANI, *L’agraria “italiana” prima e dopo Napoleone*, pp. 463-466.

¹⁸ For their career as professors, see the bibliography mentioned in notes 11-14. For Nocca’s transfer from Mantua to Pavia see also: BIBLIOTECA UNIVERSITARIA DI PAVIA (from now on BUPv), *Autografi*, 4, busta Girolamo Murari dalla Corte, Count Murari dalla Corte (Academy prefect) to Nocca, Bigarello, November 4, 1797.

All four were directors of the scientific-educational gardens associated with their chairs, so only Nocca did not superintend one that was also “agricultural” by name, but botanical. However, he was always active, both for his own interests and by institutional request, in economic planning that benefited from the deep botanical knowledge he had gained in Vienna, Mantua, and Pavia from years of study and experimentation. For example, between the Ancien Régime and the Napoleonic Era he supervised experiments on the cultivation of citrus, mulberries, and cotton both in open fields and in greenhouses. He was interested in the reforestation of Lombardy and gathered a lot of information on the vegetable sources of sugar used in different parts of the world¹⁹. His economic interpretation of botany is evidenced in the title of a book he wrote: *Istituzioni di botanica pratica applicabili alla medicina, alla fisiologia, all'economica ed alle arti* (Principles of Practical Botany Applied to Medicine, Physiology, Economics, and the Arts)²⁰.

Re, Bayle Barelle, and Biroli were very active in the agricultural initiatives of the Napoleonic Era. Re edited the periodical *Annali dell'agricoltura* (Annals of Agriculture) from 1809 to 1814, which continued the legacy of *Giornale d'agricoltura* (Journal of Agriculture) edited by Bayle Barelle and Biroli in 1807-1808. These publishing activities favored the circulation of agronomic knowledge in the Kingdom of Italy, to which they added several monographs and didactic texts. In addition, while Re and Biroli were animators of the Agricultural Societies of Bologna and Novara, respectively, Bayle Barelle in his years in Pavia promoted important studies on hybridization and phytopathology of the genus *Triticum* and on the cultivation and extraction of oil from peanuts²¹.

All the three professors of agricultural science sought the advice of Nocca to strengthen the botanical framework of their discipline. Bayle Barelle asked Nocca for advice especially at the beginning of his teaching career, when his knowledge of botany was still quite limited

¹⁹ FAGNANI, *From “Pure Botany” to “Economic Botany”*, pp. 5-6.

²⁰ D. NOCCA, *Istituzioni di botanica pratica applicabili alla medicina, alla fisiologia, all'economica ed alle arti*, 3 vols., Pavia 1808-1809.

²¹ On Bayle Barelle's experiments see M.L. FAGNANI, *Studying “useful plants” from Maria Theresa to Napoleon: Continuity and invisibility in agricultural science, northern Italy, the late eighteenth to early nineteenth century*, «History of Science», 59 (2021), IV, pp. 373-406, in particular pp. 383-385 and 395-396; M.L. FAGNANI, *Agricultural Science in Napoleonic Universities: Didactics and Research in Pavia, Bologna and Padua*, «Nuncius», 34 (2019), III, pp. 575-601.

and the elder botanist's experience could certainly help him²². Nocca was an even more important mentor to Re. Their interaction dates back to 1792, when Nocca was still living in Mantua and Re was a "foreign correspondent" with the agricultural branch of the local Academy of Sciences and Letters. Re wrote papers for the Academy on the management of meadows, reviewed literature of value in agricultural science, and shared his opinions of Mantuan academicians with Nocca. The two scholars continued to correspond after Nocca assumed a teaching post at the University of Pavia and Re at the University of Bologna, with Re seeking Nocca's opinions on agricultural botany on several occasions. They also exchanged seeds, commented on publishing ventures and book acquisitions, and shared opinions on national legislation concerning the teaching of agricultural and natural sciences. For example, Re shared with Nocca his skepticism about Bayle Barelle's studies on cereal growing in the agricultural garden of Pavia²³.

Biroli, in turn, was in contact with Nocca before being awarded the chair of agricultural science at the University of Pavia at the end of 1811. In 1807 and 1808, Biroli led experiments at the Agricultural Society of the Department of the Agogna, taught botany and agriculture at the *Liceo* of Novara, and published articles and books on agriculture, rural economics, and "economic flora". In that period he asked Nocca for information on good books on cryptogams and for dry specimens of such plants through contacts Nocca had in Germany. Nocca procured books written by the German botanist Carl Ludwig Willdenow for Biroli and his colleagues in Turin²⁴.

Although Biroli was primarily focused on economic botany, i.e., agriculture and manufacturing, his relations with Nocca tended to remain within the realm of pure botany (in 1802 he requested seeds from him for his botanical garden), which indeed constituted the backbone of Biroli's technical and material expertise in agricultural science. But Biroli also obtained seeds from Nocca in 1808 for the

²² The very few letters by Bayle Barelle to Nocca (which reveal great familiarity, suggesting a long acquaintance) were written in 1804 and 1805, kept in BUPv, *Autografi*, 3, busta Giuseppe Bayle Barelle.

²³ FAGNANI, *From "Pure Botany" to "Economic Botany"*, pp. 9-10.

²⁴ BUPv, *Autografi*, 3, busta Giovanni Biroli, Novara, June 30, 1807, January 8 and 30, 1808.

Novara agricultural garden, so there was some overlap in their relations²⁵. In 1814, Biroli shifted to a more pure botanical approach.

The case of Pellegrino Bertani (1778-1822) is also interesting. His contribution to the natural sciences of that period was relatively minor, so he has never been the subject of in-depth analysis by historians. However, some elements of economic botany in his work are worth highlighting to illustrate how the discipline pervaded the entire technical-scientific community. A pharmacist since 1799 and member of the Academy of Mantua, Bertani was lecturer in botany and agriculture and substitute professor of chemistry and natural history at the local *Liceo*. At the end of 1821 he moved to Brescia and taught natural history and technology at the *Liceo* there for a year before his death. He was also a member of the Ateneo of Brescia, a study center very interested in agriculture and animal husbandry²⁶.

Once again, we have a botanist trained in a medical discipline who was able to establish synergies with other natural sciences and technical fields within the context of increasing attention to the rural world. The three volumes of his *Nuovo dizionario di botanica* (New Dictionary of Botany) were published in Mantua in 1817-1818. References to agricultural practices such as grafting, crop pathologies, and species cultivated in fields and vegetable gardens (such as wheat, legumes, fruit trees, and cucurbits) were a constant throughout the dictionary²⁷. In 1822 he shared criteria for distinguishing between edible and poisonous mushrooms with his colleagues at the Ateneo of Brescia. Although his criteria were criticized for containing a number of errors, what interests us here is the context for the work: an entire family in the town of Verola had recently died from mushroom poisoning, raising widespread alarm²⁸. Meanwhile, Bertani was one of the many naturalists in contact with Nocca, who had been engaged by the Habsburg authorities in 1817 in a project to map Lombard plant and mushroom species harmful to humans

²⁵ BUPv, *Autografi*, 3, busta Giovanni Biroli, Novara, February 4, 1802 and January 30, 1808. On the foundation of the Agricultural Society of the Department of the Agogna in late 1802 and the organization of its agricultural garden in 1806-1807 see BARTOLI, *Giovanni Biroli*, pp. 25-26.

²⁶ P.A. SACCARDO, *La botanica in Italia: Materiali per la storia di questa scienza*, «Memorie del Reale Istituto Veneto di Scienze, Lettere ed arti», 25 (1895), IV, pp. 28 and 221-222.

²⁷ P. BERTANI, *Nuovo dizionario di botanica*, 3 vols., Mantua 1817-1818.

²⁸ «Commentari dell'Ateneo di Brescia dell'anno 1822», Brescia 1824, pp. 56-60.

and livestock²⁹. The involvement of Bertani and his colleagues in the matter was therefore an expression of the concern of the scientific community for the living conditions of the populace.

Access to Nocca's knowledge of botany in general and of southern Lombard flora in particular played an important role for Bertani, as it had for more specialized agriculturists such as Re, Bayle Barelle, and Biroli. In particular, Bertani was very interested in *Flora Ticinensis*, written by Nocca and the Piedmontese botanist Giovanni Battista Balbis after in-depth explorations of the Pavia and Oltrepò countryside³⁰. The work focused on spontaneous species and not on crops, however the economic usefulness of this mapping was clear. For example, it described spontaneous species that could be used as dyes in the textile industry, such as dyer's greenweed (*Genista tinctoria* L.) and golden marguerite (*Cota tinctoria* [L.] J. Gay), the first widespread and the second concentrated in the Stradella area and in Val Versa. There were also edible wild plants, such as rapunzel (*Campanula rapuncululus* L.), whose root was indicated as good to eat in salads³¹.

Moving eastward, the Veneto and Friuli regions provide another excellent example of naturalistic knowledge at the service of the State. Giovanni Mazzucato (1787-1814) was born into the field, being related to Pietro and Luigi Arduino. The latter had succeeded the former in the chair of agricultural science (established in the 1760s) at the University of Padua. Mazzucato's kinship to them strongly conditioned his choice of career as an economic botanist. He began

²⁹ ARCHIVIO DI STATO DI PAVIA, *Università – Rettorato*, 184, chancellor Marabelli to the General Director of the Public Education, Pavia, January 27, 1817 (draft); answer by Nocca and Siro Borda (professor of materia medica); list «delle più comuni piante velenose» [of the most common poisonous plants] by Nocca and Borda.

³⁰ BUPV, *Autografi*, 3, busta Pellegrino Bertacci (misspelling of Bertani), Bertani to Nocca, Mantua, July 30, 1817. Cfr. BUPV, *Autografi*, 4, busta Imperial Regio Governo, Nocca to the Imperial and Royal Government, Pavia, June 29, 1817 (draft): Nocca asks for money from the Government to have the second volume of "Flora pavese" (actually *Flora Ticinensis*) printed, having already paid for the first volume and the expenses for exploring the countryside out of his own pocket.

³¹ The dyer's greenweed is described in D. NOCCA, G.B. BALBIS, *Flora Ticinensis*, II, Pavia 1823, p. 39, and the golden marguerite as *Anthemis tinctoria* in II, p. 137. For the rapunzel see I, Pavia 1816, pp. 99-100. On the flora of the Pavese and Oltrepò countryside, see also D. NOCCA, *Clavis rem herbariam addiscendi absque praeceptore*, Pavia 1823. On the collaboration between Nocca and Balbis see A. PIROLA, *L'orto e l'insegnamento della botanica a Pavia tra Sette e Ottocento*, «Annali di storia pavese», 20 (1991), pp. 167-174, in particular pp. 171-172.

by studying medicine and worked as lecturer of agriculture at Padua while still very young, specialized in the genus *Triticum*. In 1807, at the age of twenty, he published the booklet *Sopra alcune specie di frumenti* (On Some Species of Wheat), included by his uncle Luigi in that year's catalog of the agricultural garden³².

In 1808, Mazzucato was transferred to the *Liceo* of Udine, where he was professor of agriculture and botany, director of the garden, and later chancellor of the entire institute. His lessons were also attended by seminarians in agreement with the archbishop, who wanted the future parish priests to know the principles of botany and agriculture so they could work with the local rural population to improve agriculture. From 1811 to 1813 Mazzucato was also deputy secretary of the local Agrarian Academy (Accademia aquileiese agraria), which carried forward the legacy of the Society of Practical Agriculture (Società di agricoltura pratica) of Udine. The latter had been the inspiration for the network of agricultural academies that began to develop in the Republic of Venice in the late 1760s³³.

One of the topics Mazzucato addressed while in Udine was sugar substitutes. He studied the extraction of a sugary substance from the fruits of the date-plum (*Diospyros lotus* L.) and its relative the American persimmon (*Diospyros virginiana* L.). In 1810, Filippo Re published the results of Mazzucato's research in the *Annals of Agriculture*. Mazzucato not only described his physical and chemical sugar-extraction experiments, but also the organization of seedbeds and nurseries for the date-plum and the natural geographical distribution

³² *Catalogo primo delle piante che si coltivano nel r. orto di agricoltura di Padova nonché di quelle che vi crescono spontanee*, Padua 1807, p. 36, note a; G. MAZZUCATO, *Sopra alcune specie di frumenti: Memoria botanico-georgica*, Padua 1807. On Mazzucato's life see C. BIANCHINI, *Mazzucato Giovanni*, in *Dizionario biografico friulano*, ed. by G. Nazzi, Udine 2007⁴, pp. 512-513. There is little documentation on Mazzucato's university training, except that it was in Padua. P.A. SACCARDO wrote that Mazzucato «studied medicine and philosophy» and that the appointment as lecturer in agricultural science took place after his graduation (*Della storia e letteratura della flora veneta*, Milan 1869, p. 71). We can have a sort of confirmation reading the cover of a book on cereals written by Mazzucato some years later (*Triticorum definitiones atque synonyma*, Udine 1812), where the author is introduced as «Philos. et Med. Doct.» (Doctor in philosophy and medicine).

³³ On Mazzucato's work in Udine see A. TONUTTO, *L'Accademia di Udine dalla caduta della Repubblica di Venezia all'unione del Friuli al Regno d'Italia (1797-1866)*, Udine 1997, pp. 106-107 and 120-121; FAGNANI, *L'agraria "italiana" prima e dopo Napoleone*, pp. 473-474. On the network of agricultural academies in the Republic of Venice see M. SIMONETTO, *I lumi nelle campagne*.

of the two species. If for the more exotic *D. virginiana* he made use of the reports of botanists and agriculturists who had already studied it, for *D. lotus* he demonstrated his direct knowledge of the Veneto and Friuli territory gained through his collection of plant specimens and naturalistic explorations there³⁴.

Our case studies show the involvement of botanists in research and experiments to benefit the national economy in the late eighteenth century. The continuity between the Ancien Régime and the Napoleonic Era is clear, with the inheritance of facilities, personnel, and knowledge gathered over decades of shaping economic botany into a more mature agricultural science. This was then enhanced both by greater geopolitical cohesion and the technocratic system of government imposed by Paris (via Milan in the Italian Republic and the Kingdom of Italy). These dynamics were common to different geographical areas of Frenchified Europe but they are little studied in relation to Italy³⁵.

All the individuals considered had in common a more or less official botanical specialization applied to agriculture, food, and manufacturing and recognized by colleagues, scientific institutions, and the authorities. Economic botany, however, included the synergy of pure botanical knowledge with other natural sciences and with technical knowledge, another transversal aspect confirmed by the profiles analyzed.

3. *Physiocracy, cameralism, and landownership*

In the previous section I examined the empirical component of the transition from classical to economic botany that took place in Italy. This shift was also driven by an intellectual and programmatic impulse shaped by new concepts of economy, society, and public

³⁴ FAGNANI, *Studying “useful plants” from Maria Theresa to Napoleon*, pp. 389-390.

³⁵ A good example of these dynamics is the attempts at acclimatizing cotton in some areas of southern Napoleonic Europe. In this regard see J. HORAN, *Napoleonic Cotton Cultivation: A Case Study in Scientific Expertise and Agricultural Innovation in France and Italy, 1806-1814*, in *New Perspectives on the History of Life Sciences and Agriculture*, ed. by D. Phillips and S. Kingsland, Cham 2015, pp. 73-91; J. HORAN, *King Cotton on the Middle Sea: Acclimatization Projects and the French Links to the Early Modern Mediterranean*, «French History», 29 (2015), I, pp. 93-108. See also: L. BRASSART, *Improving useful species: a public policy of the Directoire regime and Napoleonic Empire in Europe (1795-1815)*, «Historia Agraria», 75 (2018), pp. 93-113, in particular pp. 105-106; R. DE LORENZO, *Società economiche e istruzione agraria nell'Ottocento meridionale*, Milan 1998, pp. 181-184.

affairs developing mainly in France and Central Europe and later adopted and reworked in Italy.

Physiocracy irresistibly attracted the attention of several Italian individuals and institutions active in agricultural improvement. However, the perception and reception of Quesnay and Mirabeau's thought was anything but passive, sometimes resulting in a re-elaboration according to the needs of the context, while other times it was discussed and partly rejected.

In Tuscany, two interesting examples come from Ferdinando Paoletti (1717-1801) and Giovanni Fabbroni (1752-1822). Paoletti was rector of the seminary of San Miniato until 1746, then parish priest of San Donnino in Villamagna, where he became interested in cultivating the lands of his benefice, gaining sound agricultural knowledge and interacting with the large Florentine landowners in the area. Admitted to the Accademia dei Georgofili in 1769, Paoletti – inspired by the writings of Ludovico Antonio Muratori – was an advocate of public happiness and the role of parish priests in rural society as communicators of good agricultural techniques, solid moral foundations, and rigor in work. However, such changes could not happen without the intervention of the government, which had to establish public agricultural chairs available to clergymen, reduce the tax burden on peasants, and eliminate begging by mendicant friars. In his writings he also explicitly indicated agriculture, animal husbandry, and commerce as sectors that had to be strengthened. The physiocratic influence, received by Paoletti directly from Mirabeau, with whom he was in contact, thus found a fertile, well-structured substratum. The most significant work in this sense was *I veri mezzi di render felici le società* (The True Means of Making Societies Happy), published in 1772, where Paoletti adapted the physiocratic principles to the needs of the Grand Duchy of Tuscany³⁶.

Fabbroni's professional profile was very different from that of Paoletti and characterized by a greater cosmopolitanism. As a young man, he was the apprentice for eight years of the physicist and naturalist Felice Fontana from Trentino, who was organizing the Museum of Physics and Natural History of Florence at the time. From 1775 to 1780, Fabbroni accompanied Fontana on a long journey through

³⁶ R. PASTA, *Paoletti Ferdinando*, in *Dizionario Biografico degli Italiani*, LXXXI, Rome 2014; M. MIRRI, *Fisiocrazia e riforme: il caso della Toscana e il ruolo di Ferdinando Paoletti*, in *Governare il mondo: L'economia come linguaggio della politica nell'Europa del Settecento*, ed. by M. Albertone, Milan 2009, pp. 323-442.

Europe in search of new materials. They traveled through Rovereto, Milan, Turin, and Geneva and stayed in Paris and London, where Fabbroni was able to establish contacts with the animated local intellectual and scientific communities. His first agricultural publication was the *Réflexions sur l'état actuel de l'agriculture* (Thoughts on the Current State of Agriculture) published in Paris in 1780. In the introduction to the treatise Fabbroni interpreted physiocracy in a scientific key, giving primacy to sciences as the solution to human problems and the means to make advantageous use of nature. Back in Florence, he was elected member of the Accademia dei Georgofili, studying and writing over the years about mulberry growing, artificial meadows, and the export of raw silk. He also theorized the absolute autonomous management of private funds and discussed grain circulation and rationing measures when the Grand Duchy of Tuscany had become Napoleonic Kingdom of Etruria (1801-1807), thus demonstrating that he was able to adapt his studies to the current political and economic landscape and the constantly changing institutional context³⁷.

In Austrian Lombardy, the Patriotic Society of Milan and the Academy of Sciences and Letters of Mantua were only partially stimulated by physiocratic thought. Lavinia Maddaluno points out that the former held an ambiguous position towards physiocracy and never explicitly supported it. For instance, instead of championing large-scale agriculture (a concept at the heart of the French school), it encouraged the formation of a social group of small-scale landowners³⁸.

At the Academy of Mantua there was a line of economic and socio-political thought advocating a sort of soft physiocracy. Its exponents – including Count Giambattista Gherardo d'Arco of Trentino (1739-1791) and Count Carlo Ottavio di Colloredo of Venice (1723-1786), the Academy's first prefect – argued for improvements in agriculture as a starting point for boosting the Mantuan economy. Demonstrating an all-round knowledge of the Mantuan territory and

³⁷ F. VENTURI, *Giovanni Fabbroni (nota introduttiva)*, in *Illuministi italiani*, III, *Riformatori lombardi, piemontesi e toscani*, ed. by F. Venturi, Milan-Naples 1958, pp. 1081-1093; R. PASTA, *Fabbroni Giovanni*, in *Dizionario Biografico degli Italiani*, XLIII, Rome 1993.

³⁸ L. MADDALUNO, *De facto Policies and Intellectual Agendas of an Eighteenth-Century Milanese Agricultural Academy: Physiocratic Resonances in the Società Patriotica*, in *The Economic Turn: Recasting Political Economy in Enlightenment Europe*, ed. by S. Reinert and S. Kaplan, London 2019, pp. 395-438.

its resources as well as of the most advanced economic doctrines of the time, their support for agriculture was part of an overall vision that included the strengthening of manufacturing and commerce³⁹. The economy and agriculture of the Duchy of Mantua benefited only partially from the Habsburg reforms. But we may assume that the thought of the Counts d'Arco and Colloredo animated the Academy's technical and scientific work, constructing an institutional and intellectual framework for experiments led by members such as Angelo Gualandris and Domenico Nocca.

As for the University of Pavia, the chair of agricultural science was established in 1804, when the political, economic, and cultural context of Napoleonic Lombardy was very different from that of the previous decades. This may explain why it is difficult to find a true physiocratic orientation in Bayle Barelle's thought. He was above all a loyal State official dedicated to teaching and conducting research in natural sciences and techniques applied to agriculture and manufacturing. He was not a daring intellectual like Cesare Beccaria and Pietro Verri, who had animated the Patriotic Society of Habsburg Milan.

Bayle Barelle may have read physiocratic books on sale at his father's shop in Milan when he was young. For example, the catalog of 1785 listed some cornerstones of the French school in the 1760s, such as Mirabeau's and Quesnay's *Philosophie rurale* and the volumes of *Physiocratie* itself, which was the collection of Quesnay's writings made by his "disciple", the economist Pierre Samuel du Pont de Nemours⁴⁰. But it is difficult to determine the influence of physiocratic readings on Bayle Barelle's growth as an economic botanist. His theoretical writings principally made general reference to the responsibility, and technical and administrative unpreparedness, of landowners in national plans for the enhancement of agriculture (and economic growth). He also discussed the practical organization of agricultural production, for example whether to invest in the enhancement of native crops or in the acclimatization of allochthonous species (Bayle Barelle clearly favored the former strategy). Therefore, it is more logical to identify Bayle Barelle's thought with the interest

³⁹ C. VIVANTI, *Le campagne del Mantovano nell'età delle riforme*, Milan 1959, pp. 240-248; P. CABRINI, *Colloredo Carlo Ottavio conte di*, in *Dizionario Biografico degli Italiani*, XXVII, Rome 1982; G.G. D'ARCO, *Elogio di Carlo Ottavio conte di Colloredo*, Mantua 1787.

⁴⁰ *Catalogue des livres françois, italiens, latins, et anglois qui se trouvent chez Jacques Barelle libraire à Milan*, n.p. 1785, p. 111.

in landownership expressed both by his Italian colleagues, such as Filippo Re, and by economists of higher caliber, such as Sismondi⁴¹.

In the second half of the eighteenth century, Austrian cameralism was another current in the political-economic framework of reference for intellectuals and experts interested in agriculture and the development of economic botany. We may identify three main lines of thought among Cameralists regarding agriculture: agricultural exploitation of all available lands; study and diffusion of more productive crops; reorganization of agricultural relations of production in order to increase labor productivity. The centralistic State would be the guarantor of economic development at all levels – Joseph von Sonnenfels took a firm stance in this regard – weakening the traditional regionalist and class structure based on the division of authority between the State and peripheral bodies. This obviously caused conflict between Vienna and a tradition-based, fragmented society averse to innovation and dominated by a landed nobility that was very fond of its privileges. A major cultural and political reorganization of the Habsburg territories was necessary. In agriculture, this mainly took form, starting in the mid-1760s, in the establishment of agricultural academies and societies to study local agricultural problems and find practical solutions. However, one of the intrinsic problems of this network was that it was made up of noble landowners, ecclesiastics, scholars, and public officials, who had little entrepreneurial inclination and scarce propensity for change and modernization. The government thus found little collaboration in its initiatives⁴².

The Agrarian Colony (*Colonia agraria*), created as part of the Academy of Mantua in 1770, and the Patriotic Society of Milan, founded in 1776, further characterized the situation in the Habsburg territories, but some members distinguished themselves both for their tendency to collaborate with the authorities and for an entrepreneurial inclination that many others lacked. A good example is the dowager Marchioness Maria Teresa Cristiani Castiglioni (1735-1803)

⁴¹ Fagnani, *From "Pure Botany" to "Economic Botany"*, p. 11; D. Brianta, *La cattedra di agraria a Pavia fra età francese e Restaurazione*, «Annali di storia pavese», 20 (1991), pp. 175-197, in particular pp. 183-184.

⁴² A. Bonoldi, *Associazionismo e razionalizzazione nell'agricoltura sudtirolese (secoli XVIII-XIX)*, «Annali dell'Istituto storico italo-germanico in Trento», XIX (1993), pp. 97-147; *The Rise of Economic Societies in the Eighteenth Century: Patriotic Reform in Europe and North America*, ed. by K. Stapelbroek and J. Marjanen, Basingstoke-New York 2012.

of Casatico, in the Mantua area, who stood out in the 1780s for research and inventions in textile manufacturing. Her experiments on the use of vinegar instead of oil in the processing of linen and wool were greatly appreciated by the Academy, and her design of tools for spinning gained her membership in the Colony in 1775. To underline the importance of personal networks, which often favored the circulation of knowledge and new ideas, it is to be noted that she was also a correspondent of Angelo Gualandris since 1768, before his arrival in Mantua. In addition, the two were probably put in contact by Pietro Arduino, professor of the young Gualandris in Padua and friend of the Marchioness. Not surprisingly, Arduino and Gualandris were among her main expert consultants for the management of the Casatico estate and for agricultural experiments – for example, in cereal growing and viticulture – aimed at enhancing the productivity of her property and remedying the debt she inherited at her husband's death in 1763⁴³.

The Marchioness had also met the Spanish botanist Casimiro Gómez Ortega when he was studying medicine in Bologna and resumed relations with him thanks to the presence of both the Jesuit Juan Andrés and Gualandris in Mantua, who acted as intermediaries. For example, it is certain that on two occasions between the end of 1784 and the beginning of 1785 Gómez Ortega provided her with seeds to be sown on her lands⁴⁴. She also showed a good propensity for collaboration with the Agrarian Colony when it proposed large-

⁴³ ACCADEMIA NAZIONALE VIRGILIANA, ARCHIVIO STORICO (from now on ANV, As), *Colonia poi Classe agraria*, 30, 2, probably secretary Pellegrino Salandri to Pietro Arduino, Mantua, August 1, 1770; 30, 7, meeting of January 30, 1775; 32, 1, Maria Teresa Castiglioni to secretary Matteo Borsa, Casatico, May 20, 1788. ANV, As, *Lettere di accademici illustri*, 8, Borsa to Castiglioni, Mantua, May 1787. On the scientific correspondence between Castiglioni and Gualandris see N. AZZI, «Datemi vostre nuove elettrizzanti»: *Lettere dal carteggio di Angelo Gualandris e Maria Teresa Cristiani Castiglioni (1768-1788)*, in *Angelo Gualandris (1750-1788)*, pp. 79-157; FAGNANI, *From Botany to Agriculture*, p. 224.

⁴⁴ ARJB, DIV. I, 20, 2, 27, Angelo Gualandris to Casimiro Gómez Ortega, Mantua, February 3, 1785. In the letter, Gualandris specifies that the Marchioness expresses her thanks for the seeds from Gómez Ortega; the Toledan botanist then notes in the margin of the letter that «le envié para él [Gualandris] y para la marquesa de Castiglione en 20 de febrero dos paquetes de semillas por medio del abate Andrés» (I sent two parcels of seeds through abbé Andres for him [Gualandris] and the Marchioness Castiglioni on February 20). For Gómez Ortega's life see F.J. PUERTO SARMIENTO, *Ciencia de cámara: Casimiro Gómez Ortega, 1741-1818, el científico cortesano*, Madrid 1992.

scale experiments. For example, in May 1788 she agreed to conduct some experiments in feeding silkworms with dried mulberry leaves, probably looking for a way to limit the damage caused by particularly bad weather or diseases. The Marchioness gathered information to prepare for the experiment: she personally visited silkworm farms on Lake Garda, where the dried-leaf method had already been tested, and asked some contacts to conduct preparatory studies on her behalf⁴⁵.

The Marchioness therefore offers a good example of creative entrepreneurship, economy-science synergy, and collaboration with institutions, undoubtedly facilitated by her long-term acquaintance with the agricultural inspector Gualandris, and by the Academy, partly composed of functionaries and nobles of Mantuan origin or acquired by the Duchy years earlier. Those institutions in turn were part of a framework common to all of Habsburg Lombardy, represented in the Milan area by the Patriotic Society. The good contacts between Milan and Mantua allowed them to align their respective agricultural experiments and initiatives. In the case of mulberry growing, for example, in 1790 the Provincial Political Intendency of Mantua and the Agrarian Colony distributed to farmers more than twenty copies of «avvertimenti pratici per l'educazione de' bachi da seta» (practical instructions for silkworm farming) by the Patriotic Society, probably a summary of studies and experiments conducted by the latter⁴⁶.

The Marchioness, however, was rather an exception. When another landowner, Count Giuseppe Nuvoloni of Viadana, was involved in the experiments on feeding silkworms with dried mulberry leaves, the approach to solving the problems was very different. The man showed a certain commitment, but proceeded haphazardly, without a strategy, and in any case giving precedence to his «affari domestici» (household affairs), which he claimed consumed a great deal of his time⁴⁷.

⁴⁵ ANV, As, *Colonia poi Classe agraria*, 32, 1, Castiglioni to Borsa, Casatico, May 20, 1788.

⁴⁶ ANV, As, *Colonia poi Classe agraria*, 33, 1, Intendant Belloni to the Agrarian Colony, Mantua, April 30 and May 12, 1790; «Atti della Società Patriotica di Milano diretta all'avanzamento dell'agricoltura, delle arti, e delle manifatture», II (1789), pp. cviii-cvix. «Opuscoli scelti sulle scienze e sulle arti», I (1778), pp. 196-202 and 425-427; 2, 1779, pp. 303-305, illustrates experiments conducted by the Society and its correspondents, inspired in part by French experiments, to kill the worm without damaging the cocoon.

⁴⁷ ANV, As, *Colonia poi Classe agraria*, 32, 1, letter by Giuseppe Nuvoloni, Viadana, June 10, 1788.

Although the academies and societies in the Habsburg domains did not manage to establish an efficient agricultural production structure, they nevertheless achieved some results. According to Andrea Bonoldi, they were undoubtedly centers of study, discussion, and dissemination of agricultural knowledge, intermediating between political authorities and the rural world. In some cases they played an important role in promoting training courses and agricultural education plans. They also introduced certain crops⁴⁸. The Patriotic Society gave support to the agricultural inspector Eraclio Landi in acclimatizing on Lake Como a variety of olive tree from Tuscany resistant to northern winds. If writer and traveler Mary Shelley could still admire luxuriant olive tree groves on Lake Como in 1840, alongside vineyards, mulberries for silk production, and natural woods, it reflects the success of Landi and the Society's experiments⁴⁹.

Finally, with regard to the difficult coexistence of centralized policies and regional autonomies in the field of agriculture, animal husbandry, and derived manufacturing, the regions under the Habsburgs were not the only ones affected. There were numerous complications and clashes over attempts at standardization in the Republic of Venice, where the network of academies, scientific institutions, and authorities responsible for strengthening the rural productions otherwise worked quite well since the 1760s⁵⁰. For example, in 1792 the aforementioned Society of Practical Agriculture of Udine objected when two erudites from Verona presented a new method to treat bee swarms to the Deputies of Agriculture in Venice, proposing to test it in every province of the Republic for at least fifteen years. The people of Udine declared it contrary to «quel libero commercio che forma in presente uno dei più serii oggetti della sapienza del sovrano» (that free trade which currently forms one of the most serious traits of the sovereign's wisdom). Acknowledging that beekeeping

⁴⁸ BONOLDI, *Associazionismo e razionalizzazione*, pp. 112-113.

⁴⁹ A. VISCONTI, *Il trasferimento delle piante nella Lombardia austriaca negli ultimi decenni della dominazione asburgica*, «Altre modernità», 10-11 (2013), pp. 39-51, in particular pp. 43-4; A. VISCONTI, *Paesaggi di Lombardia: Il caso dell'ulivo tra ambienti naturali e tecniche manifatturiere (1772-1796)*, in *Oltre il giardino: Le architetture vegetali e il paesaggio*, ed. by G. Guerci, L. Pelissetti and L. Scazzosi, Florence 2003, pp. 167-174. For Mary Shelley's reference see *Selected Letters of Mary Wollstonecraft Shelley*, ed. by B.T. Bennet, Baltimore-London 1995, pp. 296-300, Mary Shelley to Everina Wollstonecraft, Lake Como, July 20 [1840].

⁵⁰ On the development of agricultural academies in the Republic of Venice from the late 1760s to the end of the century see M. SIMONETTO, *I lumi nelle campagne*.

was widespread in Friuli and did indeed need improvement, they stated that indiscriminate imposition of a new method was not the most effective solution. The most direct solution was for Venice to legislate on the issue, encouraging farmers and landowners to invest in beekeeping. As for «the two Veronese zealots», they should have published their project in a pamphlet or communicated it to the agricultural academies, which would assess the matter on a case-by-case basis. A few weeks later, the Deputies of Agriculture reassured the Society of Udine, stating that they had «valido argine al [...] tentativo contrario al nazionale vantaggio» (valid safeguards against [...] attempts contrary to national advantage)⁵¹.

What the Society had asked of Venice was therefore protection and promotion policies for beekeeping and the production of honey and wax. At the same time, it wanted the distinct characteristics of each territory to be honored and entrusted to local academic bodies that would work, as a whole, to strengthen the overall economy of the Republic, while also limiting the risks of standardization, which would damage production in individual areas and weaken the economy generally.

Historian Luciana Morassi highlighted the lack of a revolutionary attitude in the Society of Udine, characterized instead by elitist tendencies. The background was «un ceto dirigente locale che importava casse di libri dalla Francia, ma continuava a fondare la propria esistenza economica sulla rendita» (a local ruling class who imported crates of books from France but continued to base its economic existence on rents). Venice was not inclined to structural reforms that affected the inalienability of land, the pulverization of property, and existing management agreements. The local administrative class did not press in this direction, proving to be as culpable as the rulers. Many members of the Society limited their proposals to the moral level, suggesting education of peasants or providing examples of good agriculture through the landowners⁵².

The defense of Friuli beekeeping against the two men from Verona seems to corroborate Morassi's thesis. However, we can look at the episode as motivated by the awareness of a varied territory and a

⁵¹ ARCHIVIO DI STATO DI UDINE, *Archivio Florio*, 60, Giuseppe Sabatini and Filippo Florio to the Deputies of Agriculture, Udine, January 11, 1792 (copy); the Deputies to the Society, January 27, 1792.

⁵² L. MORASSI, *La Società d'agricoltura pratica di Udine (1762-1797)*, in *Venezia e la Terraferma attraverso le relazioni dei Rettori*, conference papers (Trieste, October 23-24, 1980), ed. by A. Tagliaferri, Milan 1981, pp. 368-370.

proto-industry with diversified needs within the broad mosaic of the Republic. Ironically, the ruling class of Verona also long complained about interference from the Venetian central authorities⁵³.

4. Conclusion

The cases analyzed above show that economic botanists constituted a sort of transition community towards more mature nineteenth-century disciplines, primarily agricultural science and agronomy. We can understand that above all from the good number of experts who dedicated their knowledge of the kingdom *Plantae* – and possibly of other natural sciences too – to the enhancement of agriculture and related products. However, if that was the case with experts such as Arduino, Gualandris, Re and Biroli, other examples are more difficult to interpret, where botany tended to remain “pure” but nevertheless contributed in one way or another to economic aims. Examples of the latter include Vitman, Guatteri, and Bertani. Nocca, Bayle Barelle, and Mazzucato were even more atypical, evidencing the transitory and fluid nature of the category of botanists discussed in this article.

Many other case studies could be included in this field of research, extending the phenomenon of transition from pure botany to agricultural science and related fields into the Restoration and beyond. A good example is that of Giuseppe Moretti (1782-1853), who was Giovanni Biroli’s successor to the Pavia chair of agricultural science, or rather of «rural economics», as it was renamed on the return of the Habsburgs. He had already graduated in pharmacy when the Napoleonic agricultural program was initiated in 1803. In any case, from the first years of his career as professor and “scientist” (a title not yet in use in his day), he dedicated himself to the application of natural sciences – botany included – to practical uses: initially in pharmaceutical chemistry and even explosives, but soon also in agriculture. He taught as a professional agriculturist into the early 1830s and continued to study and do research into the 1840s. In parallel, however, he continued working in traditional botany, assuming the chair of botany at the University of Pavia in the mid-1830s⁵⁴.

⁵³ SIMONETTO, *I lumi nelle campagne*, pp. 263-271.

⁵⁴ FAGNANI, *L’agricoltura “italiana” prima e dopo Napoleone*, pp. 482-484. See also: ARCHIVIO DEL MUSEO PER LA STORIA DELL’UNIVERSITÀ, *serie 1 – Giuseppe Moretti*,

Moretti's case deviates from the chronological limits within which economic botanists typically thrived as a transitional category, extending into the mid-nineteenth century, when agronomy proper began to take on the features of a well-defined discipline in Italy within the framework of a national economy bonded to agriculture and animal husbandry⁵⁵. It would be interesting to analyze the entire Italian scientific community – some forty careers peaked every decade in the period 1780-1830, increasing to nearly eighty by 1880 – to identify who was effectively furthering processes of agricultural and manufacturing enhancement⁵⁶. A comparative study of the situations in northern Italy – considered in this article together with references to central Italy – and southern Italy would be also useful, accounting for very different institutional, political, and economic frameworks⁵⁷.

The technical and empirical aspects of botany applied to the economy rested on a theoretical framework characterized by cosmopolitanism and interest in the international political and economic debate. On the one hand, the broad network of botanists allowed

«Appendice alla tabella...»; G. VELADINI, *Cenni necrologici intorno ad alcuni membri effettivi dell'I.R. Istituto Lombardo di scienze, lettere ed arti*, Milan 1857, pp. 31-35.

⁵⁵ On nineteenth-century agronomical development see: M. VAQUERO PIÑEIRO, “Empirici” e “istruiti”. Fattori e periti agrari in Italia tra XIX e XX secolo, in *Gli agronomi in Lombardia. Dalle cattedre ambulanti ad oggi*, ed. by O. Failla and G. Fumi, Milan 2006, pp. 84-104; G. FORNI, *La formazione scientifico-culturale dell'agronomo da fine '700 al '900. Un'analisi critica*, in *Agricoltura come manifattura. Istruzione agraria, professionalizzazione e sviluppo agricolo nell'Ottocento*, I, ed. by G. Biagioli and R. Pazzagli, Florence 2004, pp. 157-169; M.L. BETRI, *Gli agronomi dell'Ottocento: dall'arte alla professione*, in *Storia delle professioni in Italia tra Ottocento e Novecento*, ed. by A. Varni, Bologna 2002, pp. 173-184.

⁵⁶ R.M. GASCOIGNE, *The Historical Demography of the Scientific Community, 1450-1900*, «Social Studies of Science», 22 (1992), III, pp. 545-573. The graph *Italy* (p. 558) shows the decades of birth. It should thus be understood, as Gascoigne points out, that the activity of the scientists took place some thirty years later. Furthermore, the same source used by Gascoigne (R.M. GASCOIGNE, *Historical Catalogue of Scientists and Scientific Books*, New York 1984) to draw up the graph in question is by his own admission less selective than others, also considering scientists of minor importance. This makes the figures of the Italian scientific community plausible, understood as a whole and not only represented by its most renowned exponents (pp. 547-549).

⁵⁷ L. DE MATTEO, *Una “economia alle strette” nel Mediterraneo: modelli di sviluppo, imprese e imprenditori a Napoli e nel Mezzogiorno nell'Ottocento*, Napoli 2013; E. FELICE, *Perché il Sud è rimasto indietro*, Bologna 2016; V. DANIELE, P. MALANIMA, *Il divario Nord-Sud Italia, 1861-2011*, Soveria Mannelli 2011; P. MALANIMA, *L'economia italiana: Dalla crescita medievale alla crescita contemporanea*, Bologna 2003, pp. 93-149.

the circulation of seeds, specimens, and texts, on the other hand the influence of physiocracy, the debate on landownership, and the cameralistic theories involved intellectuals, officials, enlightened landowners, and even some naturalists and agriculturists (such as Paoletti, Fabbroni, and Bayle Barelle). In this intellectual context, our case studies demonstrate a creative response from the Italian network, which adapted the suggestions of foreign philosophical, political, and economic thought to the geopolitical fragmentation and different needs of the Italian States.

The role played by naturalists in economic renewal was already manifest in the second half of the eighteenth century, with sizable benefits for the institutions providing support to the rural sphere. Even though the cooperation between science and State, as well as the interaction between natural sciences and socioeconomic thought clearly gained momentum during the Enlightenment, it must be said, however, that these key developments to a certain extent also drew upon a preexisting knowledge network and legacy, and later on would have exerted a profound influence on the development of human capital throughout the nineteenth century. We have seen this in Austrian and Napoleonic Lombardy, in the Republic of Venice, and to some extent in Tuscany.

Actually, a few interesting examples of response to international stimuli can be found also in other Italian States. For instance, we could mention Paolo Balsamo (1764-1813), agriculturist, economist, and professor at the Academy of Studies in Palermo. In 1809, examining the landholdings of Sicily and observing a situation that was anything but encouraging, he took as a model the resourcefulness of the English landowners with whom he had interacted in 1789-1790 during a long agronomic journey through Europe⁵⁸. Important as this and other interesting southern examples are, though, the fact remains that the innovative networks in northern and central Italy were broader and more robust, on the whole, than in the rest of Italy.

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⁵⁸ G. GIARRIZZO, *Paolo Balsamo economista*, «Rivista Storica Italiana», 78 (1966), pp. 5-60, in particular pp. 54-60.