

ARTICLE

Where Europe ends, where Africa begins: Transimperial dryland science in the Italian south (1900s–40s)

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Abstract

This article investigates the global history of dryland modernisation through the case study of southern Italy. From the early twentieth century to the fascist years, several intellectuals, scientists, and politicians reinterpreted the apparent and long-standing backwardness of this region as fundamentally due to its hydrology and climate: southern Italy was rediscovered as a dry land, formally part of Italy and civilised Europe and yet environmentally closer to extra-European spaces of empire. The article shows how Italian agrarian scientists mobilised this ‘environmental Otherness’ of the Italian south as the key to developing a ‘dryland’ science alternative to that of ‘humid’ northern Italy and continental Europe. Instead, this ‘dryland’ approach to modernisation grounded southern Italy within a vast transimperial network defined by the co-production and circulation of knowledge and technologies allowing the adaptation of modern and intensive food production to semi-arid regions. As such, the article argues that Italian agrarian scientists redefined the spatial order of the Italian south in a transimperial sense, embracing its environmental Otherness as a vantage point for its rehabilitation within Italy’s nation-building.

Keywords: agriculture; environment; Italy; Mezzogiorno; fascism; knowledge; drought; climate; wheat

‘A paradise inhabited by devils’. Devils—primitive and savage people—degrading the bountiful fertility of their land: a paradise, but a fading one. This saying has at once deep roots in the local history of the Italian south, and, with various inflections, in the global history of empires and the civilising mission. Throughout the early modern era, it symbolised widespread perceptions of southern Italy’s decline vis-à-vis the mythicised richness of its ancient past. Together with sixteenth- and seventeenth-century Jesuit missionaries’ conception of southern Italy as the *Indias de por acá* (Indies down here) and to common juxtapositions with Africa since the eighteenth century, it was part of a discursive tradition affirming the peculiar alterity of this region, its ‘liminal position’ between Europe and its Others.¹ This trope of waning paradises inhabited by devils, indigenous institutions, and practices depleting otherwise fertile lands progressively took on a global dimension. Especially since the mid-nineteenth century, it had morphed into declensionist narratives instrumental to the justification of European imperialism and colonial rule.² Following national unification in 1861, northern Italians’ attitudes toward their newfound southern countrymen refracted this imperialist vision through a domestic lens, integrating the

¹Nelson Moe, *The View from Vesuvius: Italian Culture and the Southern Question* (University of California Press, 2002). See also Jennifer D. Selwyn, *A Paradise Inhabited by Devils: The Jesuits’ Civilizing Mission in Early Modern Naples* (Routledge, 2004).

²Diana K. Davis, *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa* (Ohio University Press, 2007).

binary of devils and paradises into the civilisational hierarchies of progress developing globally at the time. Echoing French colonial discourses on the opposite shores of the Mediterranean, southern Italian peasants were placed below ‘the Bedouins’, their ‘barbarism’ evoking the idea of Africa rather than that of a modern Italy.³

In a fashion typical of the nineteenth century as the ‘Age of Questions’, Italy’s post-unification state-builders conceptualised the apparent divergence between a civilised north and a backward south as the ‘Southern Question’ (*questione meridionale*).⁴ The imaginary of southern Italy as a fertile land held back by its inhabitants’ lack of civilisation did not always remain unchallenged, but persisted in the national public discourse. Only towards the turn of the twentieth century did this representation start to be questioned head-on. Key to this critique were the very people supposed to ‘unlock’ southern Italy’s horn of plenty: agrarian scientists, who had entered the debate on the Southern Question following the southward spread of the state technical apparatus. In a 1909 article which caused a national sensation, prominent scientist Giuseppe Cuboni twisted from within southern Italy’s long-held association with Africa in order to dispel the myth of its blessed natural abundance:

Too often we legislate, converse, and act as if Italy’s political unity also meant an uniformity of climate and soils. And yet there are few regions in the world as different as the north and south of Italy! With its cold winter and warm-rainy summer, the climate of northern Italy is not too dissimilar to that of central Europe. Southern Italy, instead, with its mild winter and its dry summer [belongs] to the Mediterranean region, which forms a unit with Northern Africa and the coasts of Asia Minor until Palestine. Between this side and the other of the Apennines there is one of the strongest climatic contrasts in the world. On the one side is Europe that ends, on the other is Africa that begins.⁵

The Italian south was reframed once again as a liminal space between Europe and Africa. This time, however, the fundamental Otherness of southern Italy did not lie in the deficiencies of its people, but in those of its environment and climate. The Italian south was revealed as a dry land: formally part of Italy, Europe, the metropole, and yet environmentally closer to extra-European spaces of empire.

By investigating the rationale and dynamics of the construction of the Italian south as semi-arid ‘environmental Other’, this article makes the case for re-interpreting the national and local history of the Southern Question as a key episode in the global history of dryland modernisation. The article shows how, from the early twentieth century to the fascist years, dryness became the foundation upon which several Italian agrarian scientists built a peculiar approach to solving the Southern Question. The essence of this approach was that the solution to the backwardness of southern Italy lay in the development of a ‘dryland’ science, a climate-adjusted agronomic modernity alternative to that of ‘humid’ northern Italy and continental Europe. The article fundamentally argues that Italian agrarian scientists built such a ‘dryland’ approach on a distinct set of global connections, grounded within a transimperial network defined at once by a common climate and a shared socioeconomic aim: the ecological adaptation of modern and intensive food—especially grain—production to semi-arid regions.

Since the late nineteenth century, this network had been key to the penetration of modern states, settler societies, and colonial regimes into global drylands. Through the co-production and

³Moe, *The View from Vesuvius*, 165.

⁴Holly Case, *The Age of Questions: Or, A First Attempt at an Aggregate History of the Eastern, Social, Woman, American, Jewish, Polish, Bullion, Tuberculosis, and Many Other Questions over the Nineteenth Century, and beyond* (Princeton University Press, 2018).

⁵Giuseppe Cuboni, ‘I problemi dell’agricoltura meridionale’, *Rassegna Contemporanea* 2, no. 4 (1909): 29. This and all the following translations from Italian to English in this article are the author’s.

circulation of ‘dry farming’ techniques and drought-resistant crops, it promoted the expansion of ‘grain belts’ and European colonisation in places as diverse as the North American Great Plains and the *pampas* of South America, Australia and South Africa, and French North Africa and Italy’s own colonies. The article argues that Italian dryland science was transimperial because it placed its participation in the production and exchange of such technoscientific knowledge, practices, and organisms as the principal means for the agrarian modernisation of southern Italy. By connecting the Southern Question with the technoscientific workings of imperial drylands, Italian agrarian scientists redefined the spatial order of the Italian south in a transimperial sense. In other words, Italian dryland science *produced* the Italian south as a transimperial space, embracing its Otherness, its liminal position between Europe and Africa as a vantage point for its rehabilitation within Italy’s nation-building.

The article draws on a growing body of historiography combining global environmental history and the global history of science and technology. Bringing ecology to the fore as a key framework for analysing space as a historical construct, global environmental history offers an ideal lens for reconstructing the porous and shifting boundaries of political, economic, and cultural hierarchies between world regions. The ecology of space establishes new pathways to question not only the nature of nation-states but also that of entities at a continental and global scale, allowing us, for example, to rethink ‘what Europe is and where it properly ends’.⁶ As a case in point, aridity and particularly semi-aridity—both as cultural constructs and unstable climatic realities—have historically lent themselves to ambiguity as to whether they constituted ‘normal’ or ‘abnormal’ European environments. Unlike tropicality, semi-aridity could be experienced on both the domestic and colonial shores of the Mediterranean. Through common anxieties of ‘desiccation’, it could be imagined as expanding from faraway imperial deserts to the doorstep of metropolitan heartlands.⁷ As such, this article’s analysis of the reconfiguration of the Italian south as a semi-arid environmental Other, a liminal space between Europe and Africa, contributes to ongoing historiographical efforts to challenge the analytical boundaries between metropolitan and colonial spaces, European centres and extra-European peripheries.⁸

The global history of science and technology offers complementary approaches to question the nature—literally and figuratively—of European spaces and spaces of European imperialism. Recent works highlight the importance of ‘moving crops’ and associated global flows of expertise in the history of modern states and empires.⁹ Several of these studies show how such exchanges often remodulated political, social, economic, and cultural boundaries within and across various imperial projects in dryland regions.¹⁰ Especially in light of its multiple dimensions as

⁶Alison Frank Johnson, ‘Europe without Borders: Environmental and Global History in a World after Continents’, *Contemporary European History* 31, no. 1 (2022): 135–6.

⁷Philip Lehmann, *Desert Edens: Colonial Climate Engineering in the Age of Anxiety* (Princeton University Press, 2022).

⁸See Matthias Middell and Katja Naumann, ‘Global History and the Spatial Turn: From the Impact of Area Studies to the Study of Critical Junctures of Globalization’, *Journal of Global History* 5, no. 1 (2010): 149–70; Antje Dietze and Katja Naumann, ‘Revisiting Transnational Actors from a Spatial Perspective’, *European Review of History* 25, no. 3–4 (2018): 415–30; Ángel Alcáde, ‘Spatializing Transnational History: European Spaces and Territories’, *European Review of History* 25, no. 3–4 (2018): 553–67; Daniel Hedinger and Nadin Heé, ‘Transimperial History: Connectivity, Cooperation and Competition’, *Journal of Modern European History* 16, no. 4 (2018): 429–52; Christian G. De Vito, ‘History without Scale: The Micro-Spatial Perspective’, *Past & Present* 242, Supplement 14 (2019): 348–72.

⁹Francesca Bray, Barbara Hahn, John Bosco Lourdasamy, and Tiago Saraiva, eds., *Moving Crops and the Scales of History* (Yale University Press, 2023); Salvador Álvarez and Alejandro Tortolero, eds., *Continentes, intercambios e hibridaciones: Transferencias técnicas y culturales en la historia rural entre Europa y América (Siglos XVI al XX)* (Editorial Unimagdalena, 2023).

¹⁰Sarah T. Phillips, ‘Lessons from the Dust Bowl: Dryland Agriculture and Soil Erosion in the United States and South Africa, 1900–1950’, *Environmental History* 4, no. 2 (1999): 245–66; Omar Tesdell, ‘Territoriality and the Technics of Drylands Science in Palestine and North America’, *International Journal of Middle East Studies* 47, no. 3 (2015): 570–3; Andrew C. Isenberg, Katherine G. Morrissey, and Louis S. Warren, eds., ‘Special Issue: “Deserts in Environmental History”’, *Global Environment* 12, no. 1 (2019): 237–52; David Moon, *The American Steppes: The Unexpected Roots of Great Plains Agriculture*,

modernising nation, colonial power, and ‘hidden’ empire, post-unification Italy remains still underexplored from this perspective.¹¹ In particular, the Italian south rarely figures in these studies, if not in reference to its *quasi-colonial dependency* on the Italian north’s knowledge production and technology transfer. In order to foreground modern Italy as a significant—and in many ways peculiar—arena in the global history of science and technology, this article advances a parallel argument about the historical spatialisation and political geography of this region. By affirming southern Italy’s environmental Otherness, dryland scientists intended precisely to breach the technoscientific dependence tying agricultural growth in the region to northern Italian models. Becoming a transimperial space for southern Italy meant shifting from exclusive dependence on the nation to mutual interdependence in a much more global set of relationships, grounded in a spatial order defined not by political borders, but by the shared ecological and economic framework of dryland modernisation.

As the article shows, the transimperial connectedness of the Italian south became particularly pronounced under Mussolini’s regime, precisely when the development of this region was bound to the nationalistic diktat of food autarky. Agrarian scientists did not hesitate to introduce foreign ideas and technologies to the Italian south, if they could contribute to mitigating environmental obstacles against production. Dryland science was functional to autarky, but far from autarkic in itself. Its incorporation into the autarky programme underscores a fundamental pragmatism and malleability in the fascist politics of modernisation. Dryland science’s locally sensitive approach diverged from the high-modernist vision of science as a means for ‘conquering nature’ shared by fascist and colonial regimes alike.¹² Despite this ideological incongruence, the article shows how dryland science gained prominence within fascist policy, because it represented a cost-effective and politically palatable alternative to much-propagandised, yet long-drawn and expensive plans for hydraulic reclamation. The toolkit of fascist modernisation was totalitarian by design, multi-polar by necessity. Another case in point is that of ‘technoscientific organisms’ such as ‘improved’ plant varieties, which, as Tiago Saraiva shows, ‘embodied’ fascist modernisation.¹³ These varieties did not adapt well to southern Italy’s drylands. In response, dryland scientists reclaimed southern farmers’ traditional knowledge and local crop biodiversity as valuable tools for dryland adaptation. These may not have embodied fascist ideology, but they were assimilated into fascist policy as long as they served to advance autarky. Moreover, Italian dryland scientists co-opted and refashioned local practices and resources as their own technoscientific heritage, facilitating their transimperial circulation as key instruments in the pursuit of food self-sufficiency in foreign drylands. In a peculiar reversal of fate, what was once viewed as the symbol of the primitiveness of indigenous ‘devils’ became an integral part of the transimperial emergence of dryland science.

1870s–1930s (Cambridge University Press, 2020); John B. Seitz, ‘Imagining Alfalfastan: Plant Exploration, Technopolitics, Colonialism, and the Environment in the American West and Russian Central Asia, 1897–1930’, *Agricultural History* 95, no. 3 (2021): 444–71; Natalie Koch, *Arid Empire: The Entangled Fates of Arizona and Arabia* (Verso, 2022).

¹¹Most of the relevant scholarship focuses on the fascist period. See Tiago Saraiva, *Fascist Pigs: Technoscientific Organisms and the History of Fascism* (The MIT Press, 2016); Roberta Biasillo, ‘Socio-Ecological Colonial Transfers: Trajectories of the Fascist Agricultural Enterprise in Libya (1922–43)’, *Modern Italy* 26, no. 2 (2021): 181–98; Michele Sollai, ‘How to Feed an Empire? Agrarian Science, Indigenous Farming, and Wheat Autarky in Italian-Occupied Ethiopia, 1937–1941’, *Agricultural History* 96, no. 3 (2022): 379–416. Works on earlier periods include Martino Lorenzo 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* 48, no. 4 (2022): 402–20; Lucy Riall, ‘Hidden Spaces of Empire: Italian Colonists in Nineteenth-Century Peru’, *Past & Present* 254, no. 1 (2022): 193–233.

¹²See Marco Armiero, Roberta Biasillo, and Wilko Graf von Hardenberg, *Mussolini’s Nature: An Environmental History of Italian Fascism* (The MIT Press, 2022).

¹³Saraiva, *Fascist Pigs*.

The southern climatic question

The contrast between abundant natural wealth and a backward agricultural system was a persistent theme in representations of southern Italy—also known as the *Mezzogiorno*—long before its integration into the Italian nation-state.¹⁴ While modern intensive farming started to take hold in England and continental Europe, the two pillars of agriculture in the Kingdom of the Two Sicilies remained extensive wheat farming and transhumant pastoralism, often referred together as the system of the *latifundium*. From eighteenth-century southern Enlightenment thinkers to mid-nineteenth and post-unification reformers, transforming this system according to an emerging canon of agricultural modernity was often viewed as the key to harnessing the full potential of southern Italy's climate and soils.¹⁵

Over the first half of the nineteenth century, 'high farming' revolving around new crop rotations was the brightest example to follow. Especially since the Mediterranean expansion of the Black Sea grain trade in the 1810s had exposed the structural weaknesses of cereal production in southern Italy, many invoked the introduction of forage crops to break down the monoculture of *latifundia*, restore fertility, and allow the transition to fixed livestock farming.¹⁶ The 'invasion' of North American grain since the 1870s only heightened widespread perceptions of the economic inefficiency of southern agriculture, leading post-unification agriculturists to advocate for the dissemination of chemical fertilisers and mechanisation, the newest precepts of modern capitalist farming.¹⁷

The calls to reform southern Italy according to the paradigms of agrarian modernisation developing in Europe in the nineteenth century remained mostly on paper. Besides the volatile and delimited growth of horticulture, market crises not only failed to undermine, but even entrenched the predominance of extensive wheat farming typical of the *latifundium*. The post-unification emergence of the Southern Question revolved around the very perpetuation of this system, often attributed to the faults of institutions and men which for historical, political, and socioeconomic reasons persisted in the 'vampire-like', extractive deterioration of southern soils' natural fertility.¹⁸

Within this nineteenth-century-long debate, however, there were also those who questioned the long-held assumption of the region's blessed climate and environment. In comparison with rain-abundant northern Europe and highly irrigated Lombardy, southern Italy was progressively found to be water-scarce, a scarcity significant enough to affect its ability to conform to continental models of agricultural progress. Since the early nineteenth century, a minority of reformers had emphasised insufficient rainfall, along with widespread hydrogeological degradation, as important factors contributing to the backwardness of the Italian south.¹⁹ The deep connection between socioeconomic structures and environmental conditions, advanced by eminent economist Carlo Cattaneo, strongly influenced this perspective. Some post-unification

¹⁴Walter Palmieri, 'L'"offerta di Stato" nell' agricoltura meridionale del primo Ottocento: Trasformazioni e vincoli', *Meridiana*, no. 25 (1996): 133; Federico D'Onofrio, *Observing Agriculture in Early Twentieth-Century Italy: Agricultural Economists and Statistics* (Routledge, 2016), 26.

¹⁵Marta Petrusiewicz, 'Before the Southern Question: "Native" Ideas on Backwardness and Remedies in the Kingdom of Two Sicilies, 1815–1849', in *Italy's 'Southern Question': Orientalism in One Country*, ed. Jane Schneider (Berg, 1998), 27–49.

¹⁶Piero Bevilacqua, 'Clima, mercato e paesaggio agrario nel Mezzogiorno', in *Storia dell'Agricoltura Italiana in età contemporanea. Volume 1: Spazi e Paesaggi*, ed. Piero Bevilacqua (Marsilio, 1989), 643–76.

¹⁷Aldo Cormio, 'Note sulla crisi agraria e sulla svolta del 1887 nel Mezzogiorno', in *Problemi di storia delle campagne meridionali nell'età moderna e contemporanea*, ed. Angelo Massafra (Dedalo, 1981), 539–67.

¹⁸Marta Petrusiewicz, *Latifundium: Moral Economy and Material Life in a European Periphery* (University of Michigan Press, 1996), 1–21. On the attribute 'vampire-like' (*vampiresco*), see Saverio Jovino, 'Politismo granario meridionale', *L'Italia Agricola* 76, no. 11 (1939): 852.

¹⁹David Gentilcore, 'Decadent Infrastructure? Representations of Water in the Kingdom of Naples in the Early Nineteenth Century', in *Environment and Infrastructure*, ed. Giacomo Bonan and Katia Occhi (De Gruyter, 2023), 199–230.

authors recognised that water scarcity in the *Mezzogiorno* was a barrier preventing the transfer of agrarian models from water-abundant England, France, and northern Italy.²⁰

Towards the turn of the century, ‘southernist’ intellectual Giustino Fortunato caused a dramatic escalation of these environmental concerns.²¹ According to his contemporary Benedetto Croce, Fortunato ushered in ‘the crisis . . . of the illusion of the immense fertility and wealth of southern Italy’.²² Fortunato claimed that a strong climatic and environmental contrast set the *Mezzogiorno* apart from civilised Europe. The Italian south was dry, the rest of Italy was not. It was this climatic divide which paved the way for the historical divergence then known as the Southern Question.²³ Giuseppe Cuboni’s above-mentioned passage, which depicted the *Mezzogiorno* as a climatic frontier between Europe and Africa, clearly echoed this view. In fact, it coincided almost verbatim with a speech that Fortunato delivered shortly before the publication of Cuboni’s article.²⁴

Fortunato’s argument, expanded and validated by Cuboni, indicated that by the early twentieth century, the environment of the *Mezzogiorno* was becoming an important framework for understanding the Southern Question. The words of Cuboni were brandished in Parliament to invoke stronger government measures to counter ‘the great scourge’ of drought in the region.²⁵ As the Italian south’s climate and soils became more apparent as impediments to European-style modernisation, the traditional practices and techniques underpinning extensive wheat farming and transhumant pastoralism started being recognised as imperfect but rational—and sometimes even ingenious—adaptations to the constant struggle against the ‘imperium of the atmosphere’ (*imperio dell’atmosfera*).²⁶ In fact, contrary to environmental determinist theories *à la Montesquieu* establishing a direct link between climate and the character of men, this new understanding of the Southern Question emphasised climate not as a determinant of southern people’s predisposition for progress, but as a structural constraint on their ability to pursue it. Opposing commonplace prejudices on the laziness and ignorance of southern farmers vis-à-vis the industriousness of northern ones, for example, Cuboni strongly argued that any deficiency attributable to the former was not due to the innate inferiority and primitiveness of the ‘southern race’, but rather on the more adverse circumstances of the southern environment.²⁷ For him, southern farmers had been admirably tackling these circumstances to the best of their skills with the few means at their disposal. In Cuboni’s own words, the supposedly more civilised ‘Danish farmer would absolutely not be able to work [as] profitably if transplanted to the arid areas of the *Mezzogiorno*’.²⁸ When prominent agronomist Eugenio Azimonti’s train from Bologna to Bari crossed the barren plains of Apulia stricken by drought, he recounted hearing his fellow northern passengers commenting on the local ‘pre-Adamite agriculture, the fertile land failed to be

²⁰See, for example, G.A. Pasquale, ‘Dell’agricoltura industriale nelle provincie meridionali d’Italia’, *Atti del Reale Istituto d’Incoraggiamento alle Scienze naturali economiche e tecnologiche di Napoli* 7 (1870): 204–6.

²¹The term ‘southernist’ (*meridionalista*) refers to the intellectuals and politicians who, since the mid-late nineteenth century, were dedicated to debating the origins and dynamics of—as well as solutions to—the Southern Question. See Luigi Musella, *Meridionalismo: percorsi e realtà di un’idea, 1885–1944* (Guida, 2005).

²²Benedetto Croce, *Storia del Regno di Napoli*, ed. Giuseppe Galasso (Adelphi, 1992 [1st edn, 1924]), 549.

²³Giustino Fortunato, *La questione meridionale e la riforma tributaria* (1904), in Giustino Fortunato, *Il Mezzogiorno e lo stato italiano: Discorsi politici (1880–1910)*, vol. 2 (Laterza, 1911), 314–15.

²⁴Giustino Fortunato, *Agli elettori del Collegio di Melfi* (1909), in *Il Mezzogiorno e lo Stato Italiano*, 401.

²⁵Filippo Longo, ‘Intervento: Bilancio del Ministero di Agricoltura, Industria, e Commercio’, *Atti Parlamentari della Camera dei Deputati del Regno d’Italia* (hereafter, APCD), *Legislatura XXIII, 1st sessione* (13 May 1910), 6841; Domenico Zaccagnino, ‘Intervento: Bilancio del Ministero di Agricoltura, Industria, e Commercio’, APCD, *Legislatura XXIII, 1st sessione* (17 May 1910), 6965.

²⁶Antonio Lo Re, *Capitanata Triste* (Tip. della Scienza e del Diletto, 1902 [1st edn, 1896]), 14.

²⁷On the origins and evolution of the idea of ‘Two Italies’ divided by a superior northern race and a southern ‘cursed race’, see Angelo Matteo Caglioti, ‘Race, Statistics and Italian Eugenics: Alfredo Niceforo’s Trajectory from Lombroso to Fascism (1876–1960)’, *European History Quarterly* 47, no. 3 (2017): 461–89.

²⁸Cuboni, ‘I problemi dell’agricoltura’, 33.

exploited, the southern indolence'. As Azimonti resisted the temptation to intervene, he thought to himself: 'we shall see, we shall see, dear Sirs, today, what the *enlightened* and wealthy farmer can do against the adversities of [this] climate'.²⁹ In this corner of Europe where the African desert loomed, the old adage *annus fructificat, non tellus*—'the season bears fruit, not the land'—still seemed to capture an enduring reality.

By the early twentieth century, it had also become established that the dry reality of the Italian south had not only endured but even worsened due to the indiscriminate exploitation of southern forests in past centuries but also in more recent decades. The direct connection between deforestation and decreasing rainfall had been a recurring theme in popular climate change theories throughout Europe and the colonial world. However, at the time the prevailing perspective among Italian political and scientific circles was rather that massive deforestation throughout the nineteenth century had heightened the disruption of the hydrogeology of the southern Apennines, increasing the intensity of drought and floods in agricultural areas.³⁰ Contrary to colonial narratives of environmental decline and desiccation prevalent at the time, moreover, it was not the local farmers and pastoralists but rather the 'greed' of post-unification governments that was deemed primarily responsible for deforestation in the *Mezzogiorno*. In the aftermath of unification, rising wheat prices triggered an uncontrolled speculative rush to extend wheat farming at the expense of forest areas. The 1877 forest law, rooted in markedly liberal economic principles, was often identified as the main driver of accelerated deforestation in the foothills of the southern Apennines between the 1880s and the 1890s.³¹

Towards an alternative agronomic modernity

The idea that semi-aridity constituted a fundamental reason for the backwardness of the Italian south was met with scepticism in some quarters.³² Still, the 'climatic' understanding of the Southern Question became central to debates and policies in the following years. The institutional consolidation of agrarian science in the Italian south, particularly at the Royal School of Agriculture of Portici, played a key role in validating this perspective. The Portici School became the epicentre of a distinct type of dryland expertise, grounded in—but not confined to—the local context of the *Mezzogiorno*. From the 1910s, the Portici School increasingly focused on investigating the environmental Otherness of southern Italy as a dry land. Given this expertise, it also became an ideal centre for studying the drylands of Italy's colonies and beyond. The conquest of Libya in 1911 provided new opportunities for Portici graduates to apply the experience acquired in the *Mezzogiorno* to this new colonial dryland, and vice versa.³³ Jewish students, some of whom would later work as technical experts in the Zionist agrarian colonisation of Palestine, chose Portici as their training ground.³⁴ Agrarian chemist Celso Ulpiani conducted experiments both in

²⁹Eugenio Azimonti, 'Pregiudizi e realtà', in Eugenio Azimonti, *Il Mezzogiorno agrario quale è* (Laterza, 1919), 87–8 (Emphasis).

³⁰See, for example, Francesco Saverio Nitti, *Relazione della Sotto Giunta Parlamentare, Tomo III. Volume V: Basilicata e Calabria* (Inchiesta Parlamentare sulle condizioni dei contadini nelle province meridionali e della Sicilia) (Giovanni Bertero, 1910).

³¹Nitti, *Relazione*, 36; Cuboni, 'I problemi dell'agricoltura', 38; Felice de Dominicis, 'Il disboscamento nel Mezzogiorno d'Italia', *Rivista Internazionale di Scienze Sociali e Discipline Ausiliarie* 59, no. 236 (1912): 445; Angelo Fraccacreta, *Le forme del progresso economico in Capitanata* (Luigi Piero Editore, 1912), 2. See also Cormio, 'Note sulla crisi agraria', 545; John R. McNeill, *The Mountains of the Mediterranean World: An Environmental History* (Cambridge University Press, 1992), 244, 301; Frank M. Snowden, *The Conquest of Malaria: Italy, 1900–1962* (Yale University Press, 2006), 30.

³²See Carlo Maranelli, *Considerazioni geografiche sulla questione meridionale*, ed. C. Barbagallo, G. Luzzatto, and F. Milone (Laterza, 1946 [1st edn, 1907]).

³³Manlio Rossi-Doria, 'La Facoltà di Agraria di Portici nello sviluppo dell'agricoltura meridionale', *Quaderni Storici* 12, no. 36 (1977): 844–5.

³⁴Manlio Rossi-Doria, *La gioia tranquilla del ricordo: memorie, 1905–1934* (Il Mulino, 1991). One of these students, Nissim Masciah, wrote a remarkable literature review of dryland science at the global level as part of his assistant duties in Portici. See

the *Mezzogiorno* and Libya on the relationship between soils, water, and fertilisers. He then drew on this work to examine the fertility of drylands as a global problem.³⁵ A similar approach characterised the career trajectory of Emanuele De Cillis, who, after graduating from Portici, became colonial Libya's leading agrarian scientist in the 1910s. This experience made De Cillis into a full-blown dryland scientist, a role which he continued to apply seamlessly to southern Italy's agriculture upon his return to Portici as professor in 1920. Despite the contrast between the colonial context of Libya and the metropolitan one of the *Mezzogiorno*, De Cillis's research served as a formative ground for the development of a transversal vision of the nature and purpose of dryland science. This vision was further ingrained into that of the School itself, once he was promoted to its director in 1930.

Between the 1900s and 1920s, the growth of agricultural meteorology, agronomy, and soil chemistry at the national level deepened the scientific understanding of the southern environment.³⁶ The availability of more extensive agroclimatic data made the 'climatic' divergence between north and south an almost inescapable theme in the national debate on the Southern Question. Agrarian scientists could now explain at a granular level why climate and the environment produced an 'enormous disparity ... between *us* and the remainder of Italy', as Fortunato put it.³⁷ More than average annual rainfall, the clearest indicator of semi-aridity in much of the Italian south was irregular rainfall distribution from year to year and from season to season. Hot and dry sirocco (*scirocco*) and *favonio* winds often exacerbated seasonal droughts, much like North Africa's infamous *ghibli* winds. Isolated but violent storms could be equally damaging. They often created the ideal conditions for the diffusion of rust, a plant disease common in southern grain fields. Due to deforestation in the Apennines, heavy rains frequently turned into floods, exacerbating the spread of malaria in plain areas. Besides, most of the *Mezzogiorno* was composed of scarcely permeable clay soils, which during droughts cracked and quickly dispersed their already meagre water reserves. The highly irregular rainfall regime turned the southern landscape into 'arid steppes' from May to November.³⁸ Keeping the land fallow during these months appeared as a necessary evil, precluding 'modern' crop rotations and the combination of cereal with livestock farming. Not enough cattle in the farm meant insufficient manure to fertilise the soil, highly depleted from consecutive wheat harvests. This cyclical hardship played a fundamental role in the persistence of the *latifundium* and transhumant pastoralism, despite their low economic returns.

A growing consensus among agrarian scientists held therefore that climate had trapped southern Italy's agriculture in a vicious circle. This was a form of environmental determinism, but not one that devolved into fatalism. For their clear-eyed rejection of dreams of boundless agricultural prosperity, agrarian scientists like De Cillis were labelled 'eminent pessimists'.³⁹ However, this so-called pessimism was better viewed as the pragmatism necessary to identify the right technoscientific framework to steer the Southern 'climatic' Question towards a lasting resolution. While previous attempts to implant 'modern' agricultural technologies had done little to overcome the many climatic adversities of the Italian south, this did not mean that local farmers had to be condemned to a fate outside of modernity and civilisation. According to prominent agronomist Eugenio Azimonti, after all 'there is a great difference between not being able to

Nissim Masciah, 'I più recenti studi intorno ai problemi dell'aridocoltura con particolare riguardo alle lavorazioni del terreno', in *I primi quattro anni di sperimentazione nel campo di aridocoltura di Cerignola*, ed. Emanuele De Cillis (Ernesto della Torre, 1931), 15–77.

³⁵Celso Ulpiani, 'La lotta contro il deserto', *L'Agricoltura Coloniale* 8, no. 12 (1914): 769–800.

³⁶On meteorology, see Angelo Matteo Caglioti, 'Science and Fascism, or Fascist Science? Meteorology in Fascist Italy', in *Rethinking the History of Italian Fascism*, ed. Giulia Albanese (Routledge, 2022), 155–79.

³⁷Giustino Fortunato, 'Prefazione', in Eugenio Azimonti, *Il Mezzogiorno agrario quale è* (Laterza, 1919), vii.

³⁸Cuboni, 'I problemi dell'agricoltura', 35.

³⁹Orazio Pedrazzi, 'Intervento: Bilancio Ministero delle Colonie', APCD, *Legislatura XXVII, 1st sessione* (29 November 1924): 972.

triumph over an adverse climate and being subjected to it in a Muslim way [*musulmanamente*, i.e. fatalistically].⁴⁰ In contrast to stereotypical representations of North African *fellahin*, who would merely submit to their scorching suns and cloudless skies as an act of God, Italian agrarian scientists believed they could still endow southern farmers with something more tangible than prayers for rain in order to set them on the path to progress. The key was rethinking science as a means to adapt to—rather than merely triumph over—an unfavourable climate and hydrology: if the dryland environments of the Italian south did not fit with ‘modern’ agricultural models, then these models could be rethought to better fit these dryland environments. Therefore, a solution to the Southern ‘climatic’ Question could lie in the elaboration of scientific principles and technologies specifically adapted to the dryland ecosystems of southern Italy.

None embraced this concept more fully than Emanuele De Cillis. Writing from Libya in 1917, De Cillis took his advocacy for the necessity of a dryland-adapted agrarian science as far as to relativise, or rather radically historicise, the universality of what was commonly understood as ‘modern’ agriculture at the time. According to De Cillis, the principles and practices that, since the mid-eighteenth century, had coalesced into the corpus of ‘modern’ agrarian science originated from—and were therefore naturally tailored to—countries with humid and temperate climates. During the nineteenth century, these precepts and their related technologies—from intensive crop rotations to deep-ploughing machinery and chemical fertilisers—progressively disguised their historical roots and acquired universal legitimacy. As agricultural modernity was increasingly measured by this universal paradigm, farming systems in Great Britain, France, Germany, and northern Italy earned the status of ‘rationality’, while all other non-conforming systems—such as traditional agriculture in dryland regions—were labelled as ‘empirical’ and unscientific. For De Cillis, the repeated failures of this scientific ‘rationality’ in the semi-arid *Mezzogiorno* only revealed that its supposed universality was merely an illusion, concealing a well-defined spatial and ecological framework. This kind of ‘modern’ agrarian science, a product of wet climates, was unfit to be applied to dry climates. Rather, what was needed was an alternative agronomic modernity, a dryland science that would originate from—and be well adapted to—dryland regions such as the *Mezzogiorno*.⁴¹

Dryland science, transimperial science

While the establishment of the environmental Otherness of the *Mezzogiorno* as a dry land posed a barrier to conventional technoscientific transfers from ‘humid’ northern Italy and continental Europe, it opened a whole new path for comparing and connecting this region with drylands well beyond national and continental borders. De Cillis and several other agrarian scientists’ case for an alternative agronomic modernity for the Italian south was, in fact, influenced by the contemporary global development of a new approach to agrarian science. By the mid-nineteenth century, the maximisation of soil fertility had become the guiding principle of ‘modern’ agrarian science. The international popularisation of mineral conceptions of soil fertility, predominantly geared on chemical fertilisers, deeply intertwined with the development of capitalist systems of industrial farming around the world.⁴² However, the late nineteenth-century acceleration of modern

⁴⁰Eugenio Azimonti, ‘Aspetti e problemi particolari della granicoltura meridionale’, *L’Italia Agricola* 62, no. 9 (1925): 483. On the colonial origins of the stereotype of Muslims as characterised by fatalism and laziness ‘impeding all social progress towards modernity’, see Paul A. Silverstein, ‘The Context of Antisemitism and Islamophobia in France’, *Patterns of Prejudice* 42, no. 1 (2008): 6–10. On the nineteenth-century use of ‘Muslim fatalism’ as a pejorative analogy to scientific determinism, see M. Alper Yalçinkaya, ‘Kindred Fatalisms: Debating Science, Islam, and Free Will in the Darwinian Era’, *Annals of Science* 79, no. 3 (2022): 364–85.

⁴¹Emanuele De Cillis, ‘Introduzione’, in John A. Widsøe, ‘Dry Farming’, *Sistema di agricoltura per le regioni dalle piogge scarse*, trans. Guido Rossato (Tipografia Nazionale Bertero, 1917), 14.

⁴²Greta Marchesi, ‘Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century’, *Environmental Humanities* 12, no. 1 (2020): 205–26.

capitalism and colonisation into drier, once marginal lands—where water, rather than soil nutrients, was most essential to agriculture—posed a serious challenge to this paradigm. In many of these dryland regions, both independently and in dialogue with each other, a solution to this challenge was found in the development of a ‘dryland’ science: a series of scientific principles and technologies aimed at maximising the absorption and conservation of moisture in the soil.

Italian agrarian scientists knew well that the North Americans had come a long way in the development of a ‘dry’ approach to modern farming in the Great Plains, once known as ‘the Great American Desert’. The westward expansion of the US frontier fostered the diffusion of state and private scientific endeavours providing settlers with a technoscientific roadmap to navigate the business of farming in a hitherto unknown, alien environment. ‘Dry farming’ became the most publicised example of such ‘dry’ visions of agrarian science, first symbolised by the ‘system’ of tillage techniques and new machinery elaborated by South Dakotan farmer and businessman Hardy Webster Campbell between the 1890s and the 1900s.⁴³ However, it was the several dryland experts from the US Department of Agriculture (USDA) who laid out the scientific bases of dryland science in the Great Plains. The ‘ecological approach’ of the USDA Office of Dryland Agriculture, founded in 1905 and directed by Ellery C. Chilcott, focussed on crop rotations and cultivation techniques tailored to semi-arid environments.⁴⁴ From the Bureau of Plant Industry, Mark A. Carleton and William M. Jardine conducted several studies on the introduction of drought-resistant food and forage crops. As Chief of the Bureau of Soils, Milton Whitney advocated for a physical rather than chemical understanding of soils, emphasising the importance of tillage in relation to moisture and temperature in the attainment of fertility.⁴⁵

The development of agronomy, crop research, and soil science in the Great Plains was influenced by parallel scientific advancements in dryland regions, especially in the Russian Empire.⁴⁶ At the same time, the dryland technologies developed by the USDA and state experiment stations had a profound impact well beyond the Great Plains. At the turn of the century, however, the contribution of the United States to the growth of dryland science worldwide became identified primarily with the ‘movement’ of ‘dry farming’. According to John A. Widtsoe, one of the primary propagandists of dry farming, this new approach represented a different, but no less scientific, ‘system of agriculture for countries under a low rainfall’.⁴⁷ More than a coherent system, in fact, dry farming was popularised as an agrarian gospel promising all semi-arid regions of the world a new centrality in global capitalism. The International Dry Farming Congresses held between the 1890s and the 1910s, and the discussions of dry farming at the International Institute of Agriculture, testified to how dry farming had effectively become a global brand capable of attracting a broad range of political and economic interests.⁴⁸

Dry farming as a popular concept, and dryland science as a set of methods and technologies, became integral components of the expansion of the economic frontiers of several nation-states, empires, and colonial regimes into drier environments.⁴⁹ Dryland science became a transimperial

⁴³Mary W.M. Hargreaves, *Dry Farming in the Northern Great Plains, 1900–1925* (Harvard University Press, 1957), 85–94.

⁴⁴Jeremy Vetter, ‘Regionalizing Knowledge: The Ecological Approach of the USDA Office of Dryland Agriculture on the Great Plains’, in *New Perspectives on the History of Life Sciences and Agriculture*, ed. Denise Phillips and Sharon Kingsland (Springer, 2015), 277–96.

⁴⁵E.J. Russell, ‘Prof. Milton Whitney’, *Nature* 121, no. 27 (1928): 27.

⁴⁶Moon, *The American Steppes*.

⁴⁷John A. Widtsoe, *Dry-Farming: A System of Agriculture for Countries under a Low Rainfall* (The MacMillan Company, 1911). According to Widtsoe, dry farming was primarily meant for semi-arid regions, i.e. territories where average annual precipitation ranged between 500 mm, above which were temperate and tropical wet regions, and 250 mm, below which the cultivation of common crops would only be possible through irrigation.

⁴⁸E. de Miklós de Miklósvár, ‘Rapport pour l’Assemblée Générale de 1913 sur le No. 10 du Programme concernant le Dry-Farming’, *Comité Permanent: Procès-Verbaux* (Rome: Institut International d’Agriculture), 269–72.

⁴⁹Alan L. Olmstead and Paul W. Rhode, ‘Biological Globalization: The Other Grain Invasion’, in *The New Comparative Economic History: Essays in Honor of Jeffrey G. Williamson*, ed. Timothy J. Hatton, Kevin H. O’Rourke, and Alan M. Taylor (The MIT Press, 2007), 115–40.

science *par excellence*, as it offered a set of technoscientific tools to unlock the productive potential of spaces that had long remained marginal to capitalist agriculture, turning them into grain-producing hubs for national, imperial, and global markets. Dry farming and dryland science were key to white settlement and agricultural exploitation in British dominions. Canada was involved from the start in the elaboration and promotion of dry farming, and Canadian technological innovations—especially drought-tolerant crop varieties—supported the emergence of ‘wheat belts’ across the North American prairies.⁵⁰ Australia had its own dry farming conferences, and Australian dryland scientists played a fundamental role in the expansion of rainfed wheat farming in the country’s vast semi-arid regions.⁵¹ Likewise, the gospel of dry farming spread in South Africa as a means to promote agrarian colonisation in semi-arid Transvaal and Natal.⁵² In India, since the mid-1920s the Imperial Council of Agricultural Research had funded a vast programme of dryland research in the semi-arid states of Madras, Bombay, Mysore, and Hyderabad.⁵³ In the Mediterranean region, too, dryland science found several fields of application. In Spain and Portugal, dryland agronomists elaborated innovative moisture-saving techniques of cultivation.⁵⁴ French entrepreneurial colonists as well as plant breeders contributed to the growth of dryland colonisation in Tunisia, Morocco, and Algeria.⁵⁵

In all these very different contexts, the example set by the United States in the Great Plains encouraged scientists to think in new ways about their contributions to modern farming and agrarian colonisation in semi-arid ecosystems. Still, the global growth of dryland science as a distinct, spatially grounded understanding of agrarian modernity was not due solely to the reverberation of American models. British plant breeders working for the Argentinian government, for example, imported Indian and Australian drought-resistant wheats for trial in the *pampa seca*.⁵⁶ From his estate in Alentejo, Portuguese agronomist José Pequito Rebelo devised a farming system integrating several cultivation techniques from French North Africa and the Russian Empire.⁵⁷ Overall, the emergence of dryland science was the result of a transimperial effort, fuelled by reciprocal exchanges of knowledge and technologies informed by the common goal of modernising grain production in semi-arid regions.

Dry farming meets the nation

Italy was no less partaking in the global development of this ‘dry’ vision of agrarian modernity. According to an anonymous commentator, dry farming concerned both ‘our *ancient Mezzogiorno* and our *new, African one*’.⁵⁸ Also thanks to Ulpiani, De Cillis, and other Portici School members’ double exposure to colonial and metropolitan agronomy, Italian scientific interest in dry farming

⁵⁰Nicholas Tošaj, ‘Weaving the Imperial Breadbasket: Nationalism, Empire and the Triumph of Canadian Wheat, 1890–1940’, *Journal of the Canadian Historical Association* 28, no. 1 (2018): 249–75.

⁵¹See Report of the First Interstate Dry Farming Conference held in Adelaide, 6–8 March 1911 (Department of Agriculture of South Australia, 1911).

⁵²Phillips, ‘Lessons from the Dust Bowl’; William Beinart, *The Rise of Conservation in South Africa: Settlers, Livestock, and the Environment, 1770–1950* (Oxford University Press, 2003), 235–65.

⁵³N.V. Kanitkar, *Dry Farming in India* (Indian Council of Agricultural Research, 1968 [1st edn, 1944]).

⁵⁴Marcelino de Arana y Franco, *Nuevos métodos de cultivo en secano: el cultivo continuo* (Imprenta de Ramona Velasco, 1925); José Pequito Rebelo, *Novos métodos de cultura: o método integral* (Livraria Ferin, 1919).

⁵⁵F. Couston, ‘Notre but’, *Revue du Dry-Farming Nord-Africain* 1, no. 1 (1912): 1–5; Emile Miège, ‘L’experimentation agricole au Maroc’, *La Terre Marocaine*, no. 2 (1931): 5–8. Félicien Boeuf, ‘Amélioration de la culture du Blé en Tunisie’, *Revue de Botanique Appliquée & d’Agriculture Coloniale* 6, no. 63 (1926): 657–66; Léon Ducellier, *Les blés du Sahara* (Imprimerie Algérienne, 1920).

⁵⁶Federico Martocci, ‘Cultivar al agricultor en la Pampa seca: Generación y difusión de conocimientos agrícolas en las primeras décadas del siglo XX’, *Mundo Agrario* 15, no. 29 (2014).

⁵⁷Saraiva, *Fascist Pigs*, 43–7.

⁵⁸A.S., ‘Dry-Farming’, *L’Italia Agricola* 49, no. 7 (1912): 149–50.

was linked from the start both to the 'fight against the desert' in colonial Libya, and to the Southern 'climatic' Question.⁵⁹ Considering that semi-aridity and drought also concerned Italy's colonies in the Horn of Africa as well as several regions of Italian migration in the recent past, many viewed the diffusion of dry farming and dryland science as truly a 'question of life or death' for the future of Italian development and colonisation both at home and abroad.⁶⁰

The proliferation of articles and pamphlets on dry farming during the 1910s reflected the lively interest sparked by this global agricultural trend. Similarly to other countries, in Italy there was no shortage of commentators eager to replicate US dry farming 'systems', often based on impressionistic analogies between the drylands of the *Mezzogiorno* and those of the Great Plains.⁶¹ The majority of those who intervened in this debate were, however, rather sceptical towards the universalistic claims of dry farming's most fervid apostles. Ulpiani warned that the *Mezzogiorno* 'should not prostrate itself before the new idol from across the ocean'.⁶² According to De Cillis, dry farming should not be treated as a 'gospel' or 'revealed truth'.⁶³ Rather than emulating pre-defined foreign 'systems' of dry farming, Italian agrarian scientists should draw inspiration from the broader development of dryland science as a new approach to the agroclimatic challenges of semi-arid regions. Just as the French were doing in Algeria and Tunisia, for example, the global popularisation of North American dry farming should prompt scientists and farmers to develop their own dry farming systems, tailored to the conditions of their respective regions. By the early 1920s, a growing number of Italian agrarian scientists agreed that the key to solving the Southern 'climatic' Question was not the homologation to foreign models, but a vast programme of experimental research forming the basis of a distinctive, locally adapted dryland science.

Italian scientists' ambivalent attitude towards dry farming was reflected in the national political arena. MP Paolo Bignami reported enthusiastically about the global phenomenon of dry farming in the Chamber of Deputies. In 1910, he requested that the government organise an ad hoc technical mission to the United States.⁶⁴ In 1914, Bignami himself visited Tunisia to observe French advancements in dryland colonisation in view of applying them to Italian Libya.⁶⁵ The Ministry of Agriculture took its first active steps towards dry farming shortly afterwards. In 1912 and 1917, Italian delegations were sent to International Dry Farming Congresses in Canada and the United States.⁶⁶ In 1916, the Ministry of the Colonies commissioned the International Institute of Agriculture and the Italian Colonial Agricultural Institute to translate and edit Widtsøe's dry farming bestseller.⁶⁷ At the same time, other MPs encouraged the government to subject dry farming to rigorous testing, given southern Italy's many climatic differences with the Great Plains.⁶⁸ In 1923, Agriculture Minister de Capitani d'Arzago responded to a parliamentary inquiry about the application of dry farming in Italy, mentioning some preliminary trials of foreign dry farming techniques conducted in the previous years. Although the results were discouraging, they

⁵⁹Celso Ulpiani, 'La lotta contro il deserto', *L'Agricoltura Coloniale* 8, no. 12 (1914): 769–800.

⁶⁰Saverio Jovino, 'Agricoltura asciutta in paesi semiaridi', *Nuova Antologia* 61, no. 1313 (1926): 362–72.

⁶¹Venanzio Manvilli, *Dry-Farming (Coltivazione delle terre aride)* (Battiato, 1923 [1st edn, 1909]); Arturo Bruttini, *Sul metodo Campbell per trattenere l'umidità nei terreni aridi* (Tip. dell'Unione Editrice, 1911).

⁶²Celso Ulpiani to Nicola Balenzano, 30 June 1919, box 498, Archivio Centrale dello Stato, Ministero dell'Agricoltura e delle Foreste, Direzione Generale della Produzione Agricola, Archivio Generale: I Versamento (hereafter, ACS, MAF, DGPA, AG, IV).

⁶³Emanuele De Cillis, 'Introduzione' to Widtsøe, *Dry Farming*, 6.

⁶⁴Paolo Bignami, 'Intervento: Bilancio del Ministero di Agricoltura, Industria, e Commercio', APCD, *Legislatura XXIII, 1st sessione* (13 May 1910): 13953–5.

⁶⁵Paolo Bignami, 'Intervento: Spese dipendenti dall'occupazione della Libia', APCD, *Legislatura XXIV, 1st sessione* (17 February 1914): 1338–43.

⁶⁶Giuseppe de Capitani d'Arzago, 'Intervento: Diffusione del dry farming nel Mezzogiorno d'Italia', APCD, *Legislatura XXVI, 1st sessione* (10 July 1923): 1406.

⁶⁷Widtsøe, *Dry Farming*.

⁶⁸Giovanni Antonio Colonna Romano di Cesaro, 'Intervento: Bilancio di Agricoltura, Industria, e Commercio', APCD, *Legislatura XXIII, 1st sessione* (12 May 1912): 18787.

did not shake the Ministry's confidence in the value of dryland science for southern Italy. Still, they reinforced the need to readjust foreign dry farming models to local conditions.⁶⁹

The progressive rise at the national stage of dryland adaptation as a valid technical framework intertwined with the contemporary consolidation of another popular approach to the Southern 'climatic' Question, centred on the radical hydraulic revolution of the southern landscape. Already since the 1830s, Bourbon engineers' plans of land reclamation had reflected a growing trust in the power of hydraulic science and technology to conquer 'the mute desert of the [southern] plains'.⁷⁰ Since the post-unification years, the 'artificial motherland'⁷¹ of Lombardy, constructed through vast networks of irrigation canals, had become a key developmental model for the *Mezzogiorno*. Beyond Italy, the late nineteenth century saw the global spread of imperialist endeavours to re-engineer water-scarce ecologies into water-abundant ones through dam-building, aquifer-pumping, and large-scale irrigation. Imaginaries and projects of 'desert Edens' and 'hydraulic frontiers' in distant and nearby imperial drylands provided a powerful example for addressing water scarcity in the Italian south.⁷² Between the prewar decade and the early postwar years, the high-modernist hydraulic transformation of the *Mezzogiorno* became the strategy of choice of a growing number of Italian scientists and politicians. Hydraulic engineer Angelo Omodeo and politician Francesco Saverio Nitti became the leading spokespersons for a wide range of technical experts and government leaders that believed that the primary solution to the Southern 'climatic' Question was to entrust the state with 'reshaping the environment' through the establishment of artificial lakes and large-scale irrigation.⁷³ The unification process had 'made Italy' politically; in the aftermath of the First World War, many believed that the new imperative should be to 'remake Italy' environmentally.⁷⁴

Many of the agrarian scientists who had revealed the water scarcity of southern Italy acknowledged the potential benefits of the region's 'hydraulic redemption'.⁷⁵ As past endeavours had proved, however, large-scale reclamation and irrigation projects in the complex topography of the *Mezzogiorno* were costly, lengthy, and fraught with technical challenges.⁷⁶ In this light, the introduction of dry farming onto the national stage offered a valuable alternative for those concerned that hydraulic engineering alone would not suffice to modernise the *Mezzogiorno*. If southern drylands could not be fully brought under hydraulic mastery, dryland science could still allow to confront them on their own terms. The parliamentary discussions of dry farming clearly exemplified this point. When in 1910 MP Bignami drew the government's attention to dry farming, he did so with the explicit intention of offering an alternative to what he saw as the 'hydraulic illusion' prevailing in Italy at the time.⁷⁷ Likewise, in 1912 MP Colonna Romano di Cesarò brought up dry farming in light of the fact that 'we have always sought to find remedies to aridity through hydraulic solutions—artificial lakes, reservoirs, canals—measures that are costly and often impractical for the very areas that need them most'.⁷⁸

⁶⁹De Capitani d'Arzago, 'Intervento'.

⁷⁰Carlo Afan de Rivera, *Considerazioni sui mezzi da restituire il valore proprio a' doni che ha la natura largamente concesso al Regno delle Due Sicilie*, vol. 1 (Stamperia e Cartiera del Fibreno, 1832), 188.

⁷¹According to the famous definition of Carlo Cattaneo. See Giorgio Bigatti, 'I volti plurimi di una "patria artificiale"', *Mélanges de l'École française de Rome* 118, no. 1 (2006): 181–8.

⁷²Lehmann, *Desert Edens*; Corey Ross, *Liquid Empire: Water and Power in the Colonial World* (Princeton University Press, 2024). See Giuseppe Zoppi and Giacomo Torricelli, 'Laghi artificiali dell'Algeria, della Francia e del Belgio', *Annali di Agricoltura* (1886): 7–140.

⁷³Nitti, *Relazione*, 212. Giuseppe Barone, *Mezzogiorno e modernizzazione: elettricità, irrigazione e bonifica nell'Italia contemporanea* (Einaudi, 1986), 21–36.

⁷⁴Filippo Turati, *Rifare l'Italia! Discorso pronunciato alla Camera dei Deputati il 26 Giugno 1920* (Lega Nazionale delle Cooperative, 1920), 70.

⁷⁵Turati, *Rifare l'Italia!*, 65.

⁷⁶Barone, *Mezzogiorno e modernizzazione*, 255–66.

⁷⁷Bignami, 'Intervento: Bilancio', 13953.

⁷⁸Colonna Romano di Cesarò, 'Intervento', 18787.

It would be incorrect, however, to consider dryland science and hydraulic engineering in purely oppositional terms. Based on the example of the US Great Plains, for example, Celso Ulpiani championed the possibility of making dry farming and large-scale irrigation co-exist within the framework of the capitalist modernisation of the southern countryside.⁷⁹ After all, the advocates of dryland science and those of hydraulic engineering were both part of a vast milieu sharing a technocratic approach to the development of the Italian south. In the following twenty years of fascist rule, the regime's official discourse prominently featured the high-modernist hydraulic model. Still, 'dry' visions of modernisation managed to co-exist with—and sometimes even surpass—this model in the regime's policy choices regarding the development of the *Mezzogiorno*.

The fascist politics of dryland science

The scientists and intellectuals who constructed the environmental 'Otherness' of the *Mezzogiorno* as a dry land did not exclude political and socioeconomic considerations from their understanding of the Southern Question. Still, they subordinated them to the region's climatic and environmental disadvantages. For them, these disadvantages constituted a technical problem to be resolved primarily through technical means.⁸⁰ The fascist regime drove this understanding to its extreme, denying the Southern Question as a political and socioeconomic issue and imposing a fully technocratic approach on the development of the Italian south. The problem of water scarcity continued to be one of the primary targets of this approach. Mussolini claimed that the 'problem of problems' of Sicily—and by extension, of the whole south—'is enclosed in a short, simple, *italianissima* word: water'.⁸¹ Fascist MPs went as far as to politicise the unpredictable semi-arid climate of the *Mezzogiorno* as 'anti-fascist' for periodically disrupting the regime's production goals.⁸²

In this light, it is not surprising that the fascist regime appropriated the call of many post-First World War technocrats for a 'war plan for the conquest of water in the South'.⁸³ Fascist ideology aimed to wage war on the dryness of the *Mezzogiorno*, and planned to do so through grand projects of environmental transformation. Throughout the twenty years of fascist rule, 'integral land reclamation' (*bonifica integrale*) was the overarching framework to achieve this goal. In its original configuration, its key element was 'hydraulic reclamation' centred on the construction of reservoirs, swamp drainage, and large-scale irrigation. Hydraulic reclamation would allow for 'agrarian reclamation', the modernisation of southern farming via the diffusion of fertilisers, modern machinery, and water-intensive horticultural crops. In turn, agrarian reclamation would be essential for 'human reclamation', the internal colonisation and settlement of a new type of independent smallholder to break up the system of the *latifundium*.

Despite the fascist emphasis on hydraulic engineering, dryland scientists still gained substantial political weight in the framework of integral land reclamation. Beyond the veneer of totalitarian coherence, the fascist politics of modernisation were profoundly dynamic, malleable, and uncertain. Development strategies and expectations were constantly recalibrated in the face of neglected or unforeseen economic, environmental, and political obstacles. The pragmatism of dryland scientists allowed them to navigate these circumstances, adapting to mainstream modernisation plots while capitalising on their setbacks.

⁷⁹Celso Ulpiani, 'I privilegi del suolo e del clima d'Italia', *Annali della Regia Scuola Superiore di Agricoltura in Portici* 15 (1918–1919): 1–46.

⁸⁰Vincenzo Rivera, *Il problema agronomico nel Mezzogiorno d'Italia* (Bardi, 1924), 4.

⁸¹Benito Mussolini, 'Il discorso di Palermo', 20 August 1937, in *Opera Omnia di Benito Mussolini*, vol. 27, ed. Edoardo Susmel and Duilio Susmel (La Fenice, 1959), 240.

⁸²Gabriele Canelli, 'Intervento: Bilancio del Ministero di Agricoltura e Foreste', APCD, *Legislatura XXVIII, 1st sessione* (12 February 1931): 3750.

⁸³Rivera, *Il problema agronomico*, 138.

In continuity with past endeavours, the regime's plans of hydraulic reclamation contended with the technical and financial difficulties of modern irrigation in southern Italy. Even when experiments showed the feasibility of irrigating new areas, the expected productivity gains rarely offset the required investments. While extending irrigation would have allowed for the expansion of water-intensive, high-value commercial crops at the expense of wheat, the benefits of this transition became progressively less certain, not least due to mounting competition resulting from the increasing globalisation of Mediterranean-style horticulture.⁸⁴ In this context, dryland scientists' approach to modernisation through dryland adaptation emerged as a practical, cost-effective solution for adjusting integral land reclamation to the economic realities of the *Mezzogiorno*.

The 'dry' solution to modernisation became a valid policy avenue also due to the political tensions caused by the original plan of hydraulic reclamation. The 1923 law launching the programme of integral land reclamation required the expropriation of land from any landowner who failed to commit to hydraulic improvements. The ensuing mobilisation of the 'agrarian bloc' of southern *latifondisti* against this clause pushed integral land reclamation in a more conservative direction, decentring large-scale irrigation as its essential precondition.⁸⁵ In this conjuncture, the technoscientific framework of dryland adaptation became a viable point of convergence between the regime's modernising drive and the political interests of large southern landowners. Dryland scientists exhibited in fact more than a few overlaps with the power structure of the *latifundium*, though they did not reject the opportunity for land reforms nor the value of hydraulic reclamation. Some of the key personalities behind the introduction of dryland science backed the subdivision of large estates into smaller units, and led important irrigation experiments functional to this end.⁸⁶ At the same time, others—or sometimes the same persons—explained the persistence of the productive system of the *latifundium* as a rational adaptation to an adverse climate, implicitly acknowledging that next to smaller, intensive farming units, large estates too could potentially work as agents of dryland modernisation.⁸⁷ After all, along with fascist governmental institutions, big landowners too served as key enablers of dryland science on the ground. Southern agronomists often depended on the land grants of sympathetic *latifondisti* to experiment with dry farming methods and crops. They were sometimes entrusted with the administration of the entirety of their estates, which was crucial for testing their findings on a large-scale. In some cases, key proponents of dryland science were themselves *latifondisti*.⁸⁸

Roberto Curato, for example, was the owner of a large estate in Apulia's Tavoliere plain, the south's largest and driest wheat farming region. In the postwar years, Curato advocated for the establishment of an institute of dryland research in the Tavoliere based on the model of state experiment stations of the US Great Plains.⁸⁹ He then argued for integral land reclamation to maintain and modernise the structure of the *latifundium* via the large-scale adoption of dry farming. This plan gained political traction in 1933, when Curato was appointed head of the consortium responsible for land reclamation in the Tavoliere.⁹⁰ Despite the opposition of those who believed that aggressive plans of environmental remaking through *idro-coltura* ('hydro-farming', i.e. irrigation) were still not only the best, but also the most fascist way to overcome the climatic disadvantages of southern Italy, the influence of 'dry' approaches to land reclamation grew in the following years.⁹¹ De Cillis and other

⁸⁴José M. Critz, Alan L. Olmstead, and Paul W. Rhode, "Horn of Plenty": The Globalization of Mediterranean Horticulture and the Economic Development of Southern Europe, 1880–1930', *The Journal of Economic History* 59, no. 2 (1999): 316–52.

⁸⁵Barone, *Mezzogiorno e modernizzazione*, 75–8.

⁸⁶Leandra d'Antone, *Scienze e governo del territorio: medici, ingegneri, agronomi e urbanisti nel Tavoliere di Puglia (1865–1965)* (FrancoAngeli, 1990), 103–6.

⁸⁷Emanuele De Cillis, 'Le basi tecniche della cerealicoltura nell'Italia Meridionale', *Terra Lucana* 10, no. 6 (1930): 185.

⁸⁸Emanuele De Cillis, *Il campo sperimentale di aridocoltura a Cerignola* (Provveditorato Generale dello Stato, 1927), 46; Gioacchino Viggiani, *Agricoltura meridionale vissuta* (Mario Nucci, 1941).

⁸⁹Roberto Curato, *Per un Istituto sperimentale agrario in Capitanata* (Frattarolo, 1919).

⁹⁰D'Antone, *Scienze e governo*, 97–106.

⁹¹Raffaele Tramonte, *Colonizzazione in Puglia: Idro-coltura o arido-coltura?* (Laterza & Polo, 1934).

dryland experts were entrusted with drafting the reclamation plans of various areas of the Tavoliere. Even when Curato's death in 1935 halted his *latifundium*-centred programme of dryland modernisation, dryland science continued to find important echoes in the fascist policies of 'colonisation of the latifundium' of the late 1930s.

The fascist masterplan of food autarky known as the 'Battle of Wheat' was another key policy terrain that dryland scientists leveraged to strengthen their political clout. Both globally and locally in southern Italy, wheat constituted the quintessential dry-farming crop. As Italian dryland experts were often wheat experts, positioning themselves as essential to wheat production in the *Mezzogiorno* allowed them to channel increased government resources on this crop towards the institutional consolidation of dryland science. Thanks to his leading role in the main decision-making body of the Battle of Wheat, De Cillis secured funding for the establishment of a 'Dry Farming Experiment Station' (*Campo sperimentale di aridocoltura*) in Cerignola, Apulia. Under his direction, the Cerignola Station conducted the most comprehensive programme of dryland experimentation in the Italian south.⁹² The scientific team included Enrico Pantanelli, who since 1920 had taken the reins of the Agrarian Experiment Station in Bari, Apulia. Masterminded by Ulpiani right before his death in 1919, the Bari Station undertook an equally vast research programme specialised on drought-resistant grain crops.⁹³ With a similar agenda, a Wheat Farming Experiment Station for Sicily—named after Mussolini and headed by De Cillis's son Ugo—started operating in the Catania plain in 1931. The Bari and Catania Stations' research on dryland-adapted cereals added to the work of Italy's star plant breeder Nazareno Strampelli in the Wheat Experiment Stations in Foggia (Apulia) and Cagliari (Sardinia).⁹⁴

Transimperial *aridocoltura*

Thanks to its ability to capitalise on the fascist political landscape of integral land reclamation and wheat autarky, Italian dryland science managed to develop an independent and distinctive identity both nationally and internationally during the interwar years. This was evident in the Italianisation of the English term 'dry farming' into *aridocoltura*. This semantic change symbolised the co-optation of both ancient and present elements of Italy's agrarian tradition within the distinctive heritage of Italian dryland science. While still openly acknowledging the influence of foreign knowledge and technologies, Italian dryland scientists frequently described their approach also as a modern, updated version of Ancient Roman agrarian wisdom.⁹⁵ What is more, they reappraised several elements of traditional southern farming as contemporary manifestations of Roman ecological acumen. Traditional practices such as bare fallow or implements such as the ard plough appeared then as 'imperfect' yet valuable reflections of modern dry farming. Far from discarding local knowledge and techniques as remnants of a primitive agriculture, Italian *aridocoltura* integrated them as key experimental material in their quest for locally adapted dry farming systems.⁹⁶ The ennobling of traditional agriculture extended to indigenous farming in the colonies. Agronomist Vittorio Peglion acknowledged that Eritrean and Libyan farmers 'would have little to learn from' Widtsoe's 'gospel' of US dry farming.⁹⁷ Considering how Ethiopian traditional agriculture 'perfectly dovetailed' with local climatic

⁹²De Cillis, ed., *I primi quattro anni*.

⁹³*Relazione sul primo triennio di vita della stazione* (Stazione Agraria Sperimentale Bari, 1922).

⁹⁴*Origini, sviluppi, lavori, e risultati* (Istituto Nazionale di Genetica per la Cerealicoltura in Roma, 1932).

⁹⁵It was no coincidence that Celso Ulpiani, among Italy's main dryland scientists, was also a renowned commentator on Virgili's *Georgics*. See Celso Ulpiani, 'Le Georgiche', *Annali della Regia Scuola Superiore di Agricoltura in Portici* 14 (1917): 1–162.

⁹⁶Emanuele De Cillis, 'Può il maggese nudo abolirsi completamente nelle regioni caldo-aride dell'Europa meridionale?', *Annali di Tecnica Agraria* 1–2, no. 5 (1929): 527–32.

⁹⁷Vittorio Peglion, 'Il contributo di prodotti agricoli delle Colonie alla Madre Patria', in *L'Italia agricola e il suo avvenire: Studi promossi dalla federazione Italiana Consorzi Agrari* (R. Accademia dei Lincei, 1919), 213.

conditions, De Cillis claimed that the 'Italian colonist [of the fascist empire] will have to consider the indigenous farmer as his foremost teacher'.⁹⁸

Rather than obscuring its foreign lineages, the progressive maturation of *aridocoltura* at the national level made it an even more recognisable and active player in transimperial exchanges of dryland knowledge and technologies. The Battle of Wheat constituted an ideal scenario for Italian dryland scientists to profitably mobilise this network, especially when it came to developing drought-resistant wheats capable of mitigating the yield damages of scarce and unpredictable rainfall. Nazareno Strampelli's 'elite' soft wheat varieties—the technological keystone of the fascist autarkic plan—almost systematically failed to adapt to the agroclimates of the *Mezzogiorno*.⁹⁹ In response, southern breeders—including Strampelli himself—first turned to the improvement of drought-tolerant local wheats as key sources of dryland adaptation. Due to the local success of some of these 'improved' varieties, in the 1930s they were distributed in colonial Libya and occupied Ethiopia, and sent for trial in Australia, North Africa, Greece, and Palestine.¹⁰⁰

Alongside the valorisation of local genetic resources, exchanges of 'exotic' varieties were in fact crucial to the transimperial growth of dryland science. Australian breeders, for instance, relied on wheat varieties from India and vice versa.¹⁰¹ Wheat varieties from the Russian Empire's southern steppes were a fundamental resource for experiment stations across the Great Plains.¹⁰² As in this latter case, such transimperial scientific transfers overlapped with a longer history of plant mobility driven by migration and trade which also included the *Mezzogiorno*. The early nineteenth-century 'invasion' of Black Sea wheat in southern Italy, for example, not only affected local markets but local fields too, as imported varieties started being cultivated in Sicily and elsewhere due to their drought-tolerance and milling qualities.¹⁰³ Conversely, Italian migrants and Genoese traders brought the southern variety *Barletta* to Argentina, where due to its great adaptability to the agroclimates of the *pampas*, it became the country's most utilised wheat well into the interwar years.¹⁰⁴

The Battle of Wheat allowed Italian plant breeders to institutionalise and intensify these exchanges, turning southern drylands into key spaces of transimperial wheat experimentation. The wide diversity of North African durum wheat provided the primary pool for finding genetic properties favouring adaptation to the southern Italian climate. From a pure-line selection of a Libyan landrace named *Tripolino* previously introduced to Sicily, Strampelli obtained the cultivar *Aziziah 17-45*, which was positively received by several experimenters and southern farming communities from the 1920s.¹⁰⁵ The most resounding success of Strampelli's tinkering with North African durum wheat was, however, the cultivar *Senatore Cappelli*, obtained from a selection of the Algerian-Tunisian landrace *Bidi*, likewise previously introduced to Sicily.¹⁰⁶ *Senatore Cappelli*

⁹⁸Emanuele De Cillis, 'I problemi della cerealicoltura nell'A.O.I.', in *Agricoltura e Impero* (Sindacato Nazionale Fascista Tecnici Agricoli, 1937), 181.

⁹⁹Michele Sollai, 'The Fascist Green Revolution', *Plants, People, Planet* 6, no. 5 (2024): 1094–103.

¹⁰⁰Ugo De Cillis, *I frumenti siciliani* (Zuccarello & Izzi, 1942); Giuseppe Conti, 'Il problema granario appulo-lucano: Risultati di un ventennio di selezione', *Annali della Sperimentazione Agraria. Nuova Serie* 2 (1948): 317–54; *Relazione su l'attività della Stazione dal 1938 al 1943* (Stazione Agraria Sperimentale Bari, 1946), 28.

¹⁰¹Albert Howard and Gabrielle L.C. Howard, *Wheat in India: Its Production, Varieties, and Improvement* (Thacker, Spink & Co., 1910), 93–113; F.B. Guthrie, 'William J. Farrer, and the Results of His Work', *Science Bulletin*, no. 22 (Department of Agriculture New South Wales, 1922).

¹⁰²Moon, *The American Steppes*, 129–77;

¹⁰³Antonino Vivona, 'La distribuzione geografica dei frumenti coltivati in Sicilia e la loro reciproca posizione nella lotta per la conquista delle superfici', *L'Italia Agricola* 71, no. 2 (1934): 159.

¹⁰⁴Julio Djenderedjian, 'Del arado criollo al granero del mundo: La transformación tecnológica de la agricultura pampeana Argentina, 1840–1900', *Historia Mexicana* 70, no. 1 (2020): 125–6.

¹⁰⁵Saverio Jovino to Nazareno Strampelli, 28 July 1934, box 67, Archivio di Stato di Rieti, Stazione Sperimentale di granicoltura Nazareno Strampelli, Rieti. See also Archimede di Lauro, *Frumenti libici sperimentati nel Salento* (Reali, 1924).

¹⁰⁶*Bidi* is mentioned in Felicien Boeuf, *Le blé en Tunisie. Volume 1. La Plante. Le Milieu physico-chimique* (Société anonyme de l'Imprimerie rapide de Tunis, 1932), 27. Strampelli misattributed the lineage of *Senatore Cappelli* to another Tunisian landrace named *Jenah Rhetifah*.

rapidly took over more than 50% of wheat fields in the *Mezzogiorno* and is still widely cultivated nowadays.¹⁰⁷ From the late 1930s and well into the postwar years, its popularity as a climate-resilient and high-quality cultivar led to its spread across the Mediterranean region, both directly in farmers' fields and indirectly as genetic material for breeding.¹⁰⁸ The Agrarian Experiment Station in Bari consolidated this connection between wheat research in the southern Italian and North African shores of the Mediterranean. The Station's main cereal breeder Giuseppe Conti produced further selections of the Libyan wheat *Aziziah* and of other varieties provided by colonial agronomists in Tripolitania and Cyrenaica. Moreover, Pantanelli and Conti developed close ties with French counterparts, which led to several trials—and in some cases to the distribution to farmers—of selected Algerian, Moroccan, and Tunisian durum wheats.¹⁰⁹

Besides neighbouring colonial North Africa, the transimperial connections of the Bari Station stretched into the far-off drylands of India and Australia. Conti was among the many dryland scientists who drew on the groundbreaking breeding work of Albert and Gabrielle Howard at India's Imperial Agricultural Research Institute in Pusa, Bihar. Of particular interest was the early-ripening, rust- and drought-resistant cultivar *Pusa 4*, widely cultivated across India and popular in several foreign wheat-breeding programmes.¹¹⁰ After some positive trials in the early 1930s, the Bari Station started its diffusion in coastal Apulia.¹¹¹ As for Australian wheat, Conti relied on the collaboration of breeders in New South Wales and Western Australia. Among the several Australian varieties tried in Bari, a special focus was put on the internationally renowned *Clarendon* and *Florence*. During the 1930s, *Florence*—under the name of *Australiano*—acquired good popularity among various farming communities in Apulia and Basilicata, also thanks to the parallel promotion of this variety by local millers.¹¹²

A wider kind of autarky

Despite their contribution to crop improvement, southern Italian agronomists and plant breeders frequently reiterated that better and more adapted wheat varieties were only one of the many techno-fixes necessary to overcome the Southern 'climatic' Question. Even the policy framework of the Battle of Wheat was progressively adjusted in light of the fact that the emphasis on wheat and on improved wheat seeds would not suffice to fully integrate the *Mezzogiorno* into the national food autarky agenda.¹¹³ The Italian south needed a whole new approach to farming—its own, locally adapted approach. In the fascist years, Italian dryland scientists worked on two key elements deemed fundamental to this end: soil management and tillage and crop rotations.

Against the blanket propaganda of fertiliser manufacturers, Italian dryland research attested that chemical fertilisers were a complement rather than a substitute to manure and tillage in the improvement of southern Italy's dry and poorly structured soils.¹¹⁴ Soil scientists abroad made it clear that 'we live in a moist world, and of all the chemical compounds, water is the most wonderful and universally useful. A severe drought emphasizes the value of a soil with good

¹⁰⁷Raffaele Ciferri, G. Marchetti, 'Seconda inchiesta sulle razze di frumento coltivate in Italia nel 1940–41', box H.3.3, Archivio Storico dell'Accademia dei Georgofili. Sezione Contemporanea, Florence.

¹⁰⁸Fernando Martínez-Moreno et al., 'Durum Wheat in the Mediterranean Rim: Historical Evolution and Genetic Resources', *Genetic Resources and Crop Evolution* 67, no. 6 (2020): 1426–7.

¹⁰⁹Relazione su l'attività della Stazione nel biennio 1922–1923 (Stazione Agraria Sperimentale Bari, 1924), 50–5.

¹¹⁰Preeti, 'An Imperial 'Shrine' to Agrarian Research and Education: Decoding the Imperial Agricultural Research Institute, Pusa, in Bihar, 1905–36', in *Planting Seeds of Knowledge: Agriculture and Education in Rural Societies in the Twentieth Century*, ed. Heinrich Hartmann and Julia Tischler (Berghahn, 2023), 33–50.

¹¹¹Relazione su l'attività della Stazione nel 1934 e 1935 (Stazione Agraria Sperimentale Bari, 1936), 19.

¹¹²M. Labella, 'Varietà di grano da preferire nel nostro ambiente agrario', *Agricoltura Materana* 3, no. 11–12 (1930): 753.

¹¹³Edoardo Bassi, *La Battaglia del Grano e dell'Agricoltura* (Primi Piani, 1938), 39–40.

¹¹⁴De Cillis, 'Le basi tecniche', 198–200; Alfonso Draghetti, 'L'humus ed i concimi minerali nell'evoluzione della fertilità agronomica del terreno', *L'Italia Agricola* 77, no. 12 (1940): 819–30.

moisture-holding capacity.¹¹⁵ Southern Italian soils notably lacked this capacity. Rather than tackling this issue with mainstream deep-turning modern machinery, local dryland scientists identified the improvement of shallow tillage—as it was traditionally practiced by small-scale farmers in southern Italy and the colonies—as the key to soil management in the *Mezzogiorno*.¹¹⁶

The increasing prominence of these ideas within fascist policy became evident during a 1933 conference at the Portici School, in which southern Italy's agrarian experts convened to discuss regional approaches to integral land reclamation. As the School's director, De Cillis officially endorsed the 'Del Pelo Pardi system', which would then become the most popular and original application of Italian *aridocoltura*.¹¹⁷ Like other Italian dryland scientists, Giulio Del Pelo Pardi—the inventor of this system—was a connoisseur of Ancient Roman agricultural knowledge and a revisionist of southern farming's traditional farming practices.¹¹⁸ Drawing on this tradition as well as on contemporary dry farming models, Del Pelo Pardi envisaged a series of avant-garde yet simple soil drainage and cultivation techniques in association with light implements of his own design. The fundamental goal of these technical innovations was to enable the soil to exploit every single drop of rainwater in the best possible way, with a minimum level of resources.¹¹⁹

From the 1930s, the very promising experimental results of the 'DPP' system convinced not just De Cillis, but nearly the entire Italian scientific community to advocate for its diffusion in the Italian south.¹²⁰ Accolades in the national agrarian press helped the DPP system gain a progressively broader implementation in policy as a cost-effective strategy of hydraulic and agrarian reclamation. The system became the subject of government-financed courses and the preferred solution for the reclamation of Apulia's Tavoliere.¹²¹ In the early 1940s, it featured prominently in the fascist programme of 'colonisation' of Sicily's *latifundia*, and continued to be applied as a valid pathway to land reclamation well into the postwar years.¹²² The popularity of the DPP system was such that it caught the interest of dryland scientists from colonial North Africa, Spain, India, and the United States. In the 1930s, a Greek agronomist's research visit to Italy, followed by an official fascist technical assistance mission to Greece, led to the experimental application of the DPP system in the drylands of Attica and the Peloponnese.¹²³

One of the key advantages of these soil management and tillage techniques was that they could allow diversifying crop rotations without the aid of irrigation. Italian dryland scientists had long recognised the improvement of crop rotations as a critical issue for the development of the *Mezzogiorno*. Particularly in the context of the Battle of Wheat, cultivating wheat in rotation with forage crops was deemed essential for enhancing fertility and thus contributing to the productivity gains expected by the regime. While wheat monoculture was rapidly consuming and would eventually deplete southern soils, the greater diffusion of forage crops was thought to ensure the long-term sustainability of the Battle of Wheat.¹²⁴ In addition to the key role of nitrogen-fixing

¹¹⁵Gove Hambidge, 'Soils and Men—A Summary', in *USDA Yearbook of Agriculture: Soils and Men* (United States Department of Agriculture, 1938), 40.

¹¹⁶Emanuele De Cillis, *Dopo nove anni di sperimentazione cerealicola in clima caldo-arido (Cerignola)* (Della Torre, 1935).

¹¹⁷*Atti del Secondo Raduno dei Tecnici Agricoli del Mezzogiorno e delle Grandi Isole d'Italia* (Ernesto della Torre, 1933): 229–30.

¹¹⁸The system rallied around it a club of aficionados named 'Cato Agricultural Group'. See Francesco Guerrazzi, 'Les labours et la culture du froment dans l'ancienne agriculture des Romains renouvelée par M. Giulio Del Pelo Pardi', in *La Question du Blé au Point de Vue International: Actes de la 1ère Conférence Internationale du Blé* (Institut International d'Agriculture, 1928).

¹¹⁹Giulio Del Pelo Pardi, *Cenni Illustrativi sul 'Sistema Culturale Del Pelo Pardi'* (Tipografia Antoniana, 1933).

¹²⁰Edoardo Bassi, 'Il metodo Del Pelo Pardi: Un convegno imponente', *Giornale di Agricoltura della Domenica* no. 13 (1933): 118.

¹²¹Livio Gaetani to Ministero dell'Agricoltura e Foreste, 6 December 1939, box 79, ACS, MAF, DGPA, AG, IV. See also D'Antone, *Scienze e Governo*, 115.

¹²²'Il sistema del Pelo Pardi', *Bonifica e Colonizzazione* 6, no. 1 (1942): 36–45; 'La chiusura del Corso di Agraria "Pelo-Pardi" a Foggia', *Rigenerazione Italiana: Voce Patriottica del Mezzogiorno*, no. 27 (1948): 2.

¹²³F. Tonti, 'Nouvelle technique de labourage en Italie', *Fruits & Primeurs de l'Afrique du Nord* 4, no. 47 (1934): 405–6; 'Affermazioni italiane all'estero', *Giornale di Agricoltura della Domenica*, no. 43 (1934): 424; Cirillo Maliani, 'I primi risultati dei campi Del Pelo Pardi istituiti in Grecia', *Giornale di Agricoltura della Domenica*, no. 2 (1936): 11.

¹²⁴Bassi, *La Battaglia del Grano e dell'Agricoltura*, 9.

plants such as alfalfa, the larger availability of animal feed would promote livestock farming and consequently facilitate the enrichment of wheat fields with more manure, still considered the true 'king of fertilisers' in the Italian south.¹²⁵

Based on the successful example of South Africa and the US Great Plains, Italian dryland scientists also focused on the introduction of drought-resistant plants suitable for forage production. While sporadic efforts in this direction had been made in the pre-unification years,¹²⁶ it was only from the early twentieth century—particularly during the fascist period—that dryland forage experimentation began to gain traction in southern Italy. The Bari Station was dedicated to the collection and breeding for dryland adaptation of southern Italy's wild flora and common forage crops. Thanks to the innovative selection work of local alfalfa varieties, in the 1930s the Station was invited to participate in a wide transimperial project for alfalfa varietal improvement co-ordinated by renowned British grassland scientist George Stapledon.¹²⁷ Moreover, drawing on parallel experiments in Australia and the United States, the Station's director Pantanelli devised a method to profitably grow alfalfa—normally a very water-intensive crop—without irrigation. The promising results of this method of alfalfa *aridocoltura* at the local level caught the attention of several foreign scientists, establishing the Station as a prestigious international hub for dryland forage research.¹²⁸

Southern Italy's involvement in these transimperial collaborations also encompassed the introduction of forage plants native to or bred in foreign drylands. The Bari Station continued, with varying success, the trials of Australian saltbush, South African Rhodes Grass, and other 'exotic' plants initiated in southern Italy since the early twentieth century.¹²⁹ However, it was the indigenous staples of Italy's Horn of Africa colonies—teff, pearl millet, finger millet, and above all, sorghum—that became the main subjects of experimentation as drought-tolerant forage crops. Thanks to USDA botanical expeditions, sorghum had become the US Great Plains' main dryland forage crop. By the interwar years, the transimperial diffusion of 'improved' sorghum varieties began to include both traditional producers like India and emerging ones such as Australia.¹³⁰ Italian colonial rule in Eritrea and Somalia incited agricultural research in the same direction, leading to the first metropolitan trials of indigenous sorghum. The transimperial growth of sorghum research progressively allowed Italian dryland scientists to expand the pool of sorghum varieties available for experimentation. Thanks to their contacts with grassland scientists in Texas, Kansas, Algeria, or New South Wales, the Portici School and the Bari Station collected, tested, selected, and distributed a wide range of forage, grain, and sweet sorghums.¹³¹ The use of sorghum as a drought-resistant forage crop in the *Mezzogiorno* increased in the years leading to the Second World War. Despite excellent experimental results, however, Italian dryland scientists did not manage to rally government support for its large-scale diffusion within local crop rotations. This plant gained political prominence as 'autarkic plant par excellence'¹³² in other regions and for

¹²⁵Francesco Passino, *Per l'incremento della produzione granaria in Sardegna* (Comitato Nazionale per l'Incremento delle Concimazioni, 1938), 13.

¹²⁶Palmieri, 'L'offerta di Stato', 160.

¹²⁷*Relazione su l'attività della Stazione nel 1933* (Stazione Agraria Sperimentale Bari, 1934), 34; Enrico Pantanelli, *La vita di un medicaio in clima caldo-arido* (Luigi Macri Editore, 1940), 5. On Stapledon, see Tom Brooking and Eric Pawson, eds., *Seeds of Empire: The Environmental Transformation of New Zealand* (Tauris, 2011).

¹²⁸Enrico Pantanelli, *Il medicaio asciutto in Puglia* (A. Dragone, 1928); *Relazione su l'attività della Stazione nel 1934 e 1935*, 24.

¹²⁹Giacomo Albo, 'Foraggi estivi per climi aridi', *L'Agricoltura coloniale* 6, no. 1-2 (1912): 24–8. For a transimperial perspective on saltbush, see Jodi Frawley and Heather Goodall, 'Transforming Saltbush: Science, Mobility, and Metaphor in the Remaking of Intercolonial Worlds', *Conservation and Society* 11, no. 2 (2013): 176–86.

¹³⁰H.N. Vinall, R.E. Getty, and A.B. Cron, 'Sorghum Experiments on the Great Plains', *USDA Department Bulletin*, no. 1260 (1924); A.T. Jeffries, 'Sudan Grass as a fodder', *Journal of the Department of Agriculture, South Australia* 28, no. 4 (1924): 332; F.G. Sly, 'The Trial of Exotic Drought-Resisting Plants in India', *The Agricultural Journal of India* 2, no. 1 (1907): 168.

¹³¹Luigi Leggieri, *Tre anni di sperimentazione sul sorgo sottile (pianta foraggera dei climi aridi)* (Società tipografica modenese, 1927); Enrico Pantanelli, 'Il Sorgo: una coltura autarchica', *La Conquista della terra* 15, no. 4 (1938): 23–8.

¹³²Ernesto Parisi, 'La coltivazione del sorgo zuccherino', *Giornale di Agricoltura della Domenica*, no. 15 (1939): 133.

other reasons. Since the threat of an international oil embargo following the invasion of Ethiopia forced Mussolini to intensify the search for alternative sources of fuel, sorghum became Italy's top option for the production of ethanol. In the late 1930s, its cultivation spread largely in irrigated areas of central and northern Italy, due to the higher amounts of nutrients and water required to profitably grow sorghum as an alcohol-producing plant.¹³³

Conclusion

The fall of the fascist regime brought all these plans and exchanges to an abrupt end. From the ruins of the Second World War, the Southern Question dramatically resurfaced as an urgent political, social, and economic question—but underneath, it never ceased also to be a question of environmental 'Otherness'. For the Economic Commission of the Ministry for the Constituent Assembly, 'the poor soils, the arid climate, the impetuous winds' of much of the *Mezzogiorno* posed a unique set of challenges for the region's postwar reconstruction plans.¹³⁴ Still in the 1950s, Manlio Rossi-Doria, a Portici School graduate and one of the key actors of Republican Italy's postwar agrarian policy, explicitly reaffirmed Fortunato and Cuboni's vision of two Italies divided by climate and natural wealth.¹³⁵ Based on his pragmatic understanding of the 'relative inferiority of the agrarian *Mezzogiorno*', Rossi-Doria made a further spatial distinction which revealed the primacy of water as a determinant of (under)development. Rossi-Doria described as the 'meat' of southern Italy the one-fifth of its territory that could rely on irrigation for the development of intensive horticulture or had agroclimatic conditions already suited for this type of agriculture.

The remaining four-fifths were the 'bone' of the *Mezzogiorno*, the mountain areas and the drylands where wheat monoculture—and farming in general—persisted in the face of an adverse climate.¹³⁶

Italy's postwar plans of agrarian reform and development tackled these problems through a high-modernist blend of new international models and old strategies of integral land reclamation, centred on the modernisation of the southern environment through large-scale projects of hydraulic engineering. Fascist-era dryland scientists such as De Cillis and Pantanelli continued to be revered by some as patrons of southern agronomy,¹³⁷ and a few of the dryland technologies that they had promoted—the wheat variety *Senatore Cappelli*, or the DPP system—survived in the postwar landscape. However, the overall framework of dryland science as an alternative agronomic modernity faded into the past along with the sudden obsolescence of the autarky framework. Interwar Italian dryland science did not find a place in a postwar context dominated by aggressive plans to radically alter both the environment and the socioeconomic structure of the *Mezzogiorno*. The pragmatic overlaps of some dryland scientists with that very structure while navigating the fascist politics of modernisation might well have been an additional reason for the overall marginalisation of this approach within the postwar development agenda. Gramsci famously described Giustino Fortunato—the foremost proponent of the Southern 'climatic' Question—as one of Italy's 'most industrious reactionaries', because his intellectual work ultimately shielded the southern 'agrarian bloc' from the prospect of structural reforms—whether environmental, social, or economic.¹³⁸ As highlighted in this article, a similar reasoning could be applied to the scientific heirs of Fortunato. Dryland scientists wanted to adapt modernisation to

¹³³Ettore Mancini, 'Le possibilità della sorghicoltura dai risultati della campagna 1942', *L'Italia Agricola* 80, no. 6 (1943): 287–94.

¹³⁴Ministero per la Costituente, *Rapporto della Commissione Economica. 1. Agricoltura: Relazione* (Istituto Poligrafico dello Stato, 1946), 40.

¹³⁵Manlio Rossi-Doria, *Dieci anni di politica agraria nel Mezzogiorno* (Laterza, 1958), xviii–xix; 3.

¹³⁶Rossi-Doria, *Dieci anni*, xxi–xxii.

¹³⁷Raffaele Barbieri, 'I sistemi colturali nel Mezzogiorno in relazione alle caratteristiche dell'ambiente', in *Problemi dell'Agricoltura Meridionale* (Istituto Editoriale del Mezzogiorno, 1953), 606.

¹³⁸Antonio Gramsci, *La Questione Meridionale* (Editori Riuniti, 1991), 37.

the local environment. While doing so, however, they often ended up adapting this vision of modernisation to the local status quo.

Despite the politically conservative implications of certain segments of fascist-era *aridocoltura*, the emergence of Italian dryland science over the first half of the twentieth century still constituted a unique and in many ways innovative approach to the Southern Question. The construction of this question as a question of environmental Otherness forced the debate on the *Mezzogiorno* out of its exceptionalism. Aridity and climate instability were found to be a barrier against the capitalist intensification of agriculture in this corner of Europe as well as in Italy's colonial drylands in Africa and in various semi-arid frontiers around the globe. The adaptive solutions that Italian dryland scientists offered to this problem intertwined with parallel endeavours to turn dryland adaptation into a strategy of development and imperial expansion. The dryness of the Italian south set it apart from conventional European modernisation paths. At the same time, dryness became the key environmental framework that enabled southern agrarian scientists to weave this European region into the transimperial fabric of dryland modernisation.

Italian dryland scientists re-conceptualised the Italian south as a transimperial space, a land whose development fed into the technoscientific dynamics of agricultural colonisation and imperial expansion across extra-European drylands. As the article has shown, however, transimperial integration did not mean homologation. Italian dryland scientists introduced foreign dry farming ideas, techniques, and crops, rejecting some and adjusting others to the peculiar agroclimatic conditions of the Italian south. Integration meant that the Italian south progressively became an independent contributor of transimperial dryland science. The valorisation and co-optation of local practices and resources spurred the formation of a distinctive Italian body of dryland science in the interwar years. As various elements of this body started circulating in foreign dryland regions, the Italian south became in itself an important driver of transimperial exchanges.

In recent decades, the Italian south has become once more a laboratory of dryland adaptation. Due to climate change, food production in the Mediterranean region has been and will continue to be impacted by more frequent and severe droughts. As water-intensive agricultural systems become increasingly unsustainable, dryland science has re-emerged as a crucial tool for climate change adaptation policies. National and international agencies are once again mobilising traditional agroecological practices and the rich biodiversity of the *Mezzogiorno* as valuable assets for enhancing climate resilience.¹³⁹ Originated as a framework of transimperial expansion, the technoscientific governance of dryness has now become a planetary concern. Then and now, the Italian south remains a pivotal space in this unfolding history.

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¹³⁹See e.g. 'Il grano del futuro, il clima folle e il valore della micro-biodiversità: Le strategie agro-sostenibili per affrontare l'impatto del deficit idrico sulle coltivazioni', *La Gazzetta del Mezzogiorno*, 1 December 2024, 14.