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Turning wetlands into "Productive" spaces: modernization and sustainable rural development in Romania, 1900–1945

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Abstract
The Romanian authorities regarded the Danube's wetlands with suspicion, the health authorities especially turning critical eyes on wet or moist places as constant sources of infectious disease; but many others complained that their economic potential remained untapped. A policy of turning areas of wetland into farmland became therefore an important state-building measure that was aimed at improving both the country's food security and the health of its population. State actors commissioned specialists to design drainage and cultivation schemes and, after training abroad, young scientists flocked to the Danube to experiment with the scientific methods they had learned. This article examines how the Danube's floodplain then became a battleground for the conflicting agendas pursued by landowners and leaseholders on the one hand, and government officials and scientists on the other. The most contentious matter turned out to be the question of which particular wetlands should be drained for cultivation and which should be improved to increase fish yield, pitching an alliance of those favouring land extension schemes against those keener to protect fishing grounds. The disagreement split scientific communities and state institutions, but with his vision of a "sustainable" economic exploitation, in the 1930s the biologist Grigore Antipa managed to forge a consensus to harmonize arable and fish farming while setting clear environmental boundaries to human interventions in the floodplain. In practice however, the complex environmental reality and diverging economic interests between state institutions and property administrators meant that many of Antipa's principles proved difficult to follow.

Keywords land reclamation · rural · Danube · Romania · land reforms · Anthropocene

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Introduction

This article examines early- to mid-twentieth century land reclamation practice and other improvement projects along the Romanian Danube as a history of conflict surrounding state-sponsored modernization projects in rural areas. Since its foundation in 1878, the Romanian state had pursued internal coherence, centralization, and modernization as official policy, and one of the most significant of its modernization projects focussed on the Danube, where state authorities strove to change nature for the benefit of humans (Ardeleanu 2020; Gatejel 2022). Attempts to control the river were designed to improve its navigability for transport on the one hand, and on the other to drain the floodplains and integrate the newly created landscapes into the national economy. In Romania, as in many other Southeast European peasant societies, borderlands like the Danube floodplain became key sites for rural development programmes which combined state-building measures, social engineering and scientific management of resources (van de Grift 2018; Patel 2018; Lučić and Müller 2022). As the twentieth century turned, those programmes brought new actors such as scientific experts, entrepreneurs, and ministry officials to the mostly remote floodplain regions. State employees commissioned specialists to design drainage and cultivation schemes, prompting them to experiment with various scientific methods, many of which were mutually conflicting. Soon enough, one main contentious matter emerged, namely which wetlands should be drained for cultivation and which improved to increase fish yield. The result was two alliances, one supporting land reclamation schemes and one wishing to protect fishing grounds; and thereby a series of rifts was created between scientific communities, property owners and state institutions.

The Romanian case study belongs to a wider history of drainage and water management in Europe and beyond, which Ellen Wohl termed "the Great Drying" (Wohl 2019, p. 4). Land reclamation schemes changed rural life and brought agriculture into areas that had until then always been more or less under water, such as swamps, river floodplains or sea shores. As a result of the transformation of previously uncultivated land into production areas, entire ecosystems were changed and social relationships remade. Dating back to preindustrial times, it was enormously intensified during the nineteenth and twenties centuries, spurred on by the rise of the modern state and its new technologies (Ash 2017; Fata 2022). Early modern drainage schemes declared war on mud and morass, which perceived through the lens of Enlightenment became "barbaric elements," characteristic of "failed" states (Pospiszyl 2023). The nineteenth century further saw an increased number of so-called "expeditions" in which state officials and scientists systematically explored nearby and distant water landscapes and drew up plans for their transformation (Bruisch 2019). Driven by nascent ideas of a capitalist economy, first attempts at draining swamps started in the late eighteenth and nineteenth centuries, only to grow in scope when fascists and state-socialist bureaucracies became involved in their execution (Dorondel and Olenenko 2022; Hoxha 2023). Common to these schemes, was a bird's-eye view that attempted to re-shape and simplify these areas, which were perceived as confusing and unruly. This urge for clarity and legibility is seen as typical of (high) modernist states irrespective of their political organization, which coalesced under the strive to organize geographical spaces and their populations in such a way that rational administration and efficient resource extraction become possible (Scott 1998).

In that sense, amelioration schemes served various purposes: for government actors they reinforced political power and bolstered legitimacy, while for both private and state entrepreneurs they opened up new commercial avenues. As for scientists, they now saw chances to advance their careers and cement their political influence (Bruisch, van de Grift 2022, 37; Wendland, Siebert, Bohn 2019, 319–343). However, like most modernizing projects land reclamation created opportunity for some but meant losses for those who for centuries had learned to adapt to seasonally shifting amphibian environments, but despite concerted official efforts to re-shape landscapes into reliable spaces of commodification, many premodern coping mechanisms survived well into the twentieth century (Blackbourn 2007; van Bavel et al. 2020, 9–10).

It was ideas of progress, development, or modernity that provided states and their institutions with the ideological backing for large-scale engineering interventions into river spaces, creating works that would permanently change dynamic ecosystems into manageable watercourses that offered reliable services both to local communities and the national economy (Bruisch, van de Grift 2022, 40). Concerted interventions during the nineteenth and twentieth centuries not only produced "new" environments enabling efficient management of resources, but led also to many "unintended" consequences and no little damage (specifically in the case of the Danube see: Schmid et al. 2023). Current debates about the concept of the Anthropocene have further shown that freshwater environments have proved to be some of the most vulnerable spaces in the earth's ecosystem, and have been deeply affected by anthropogenic environmental change (Kelly 2018, XVIII). In that sense Romania was no different from other countries undergoing a modern transformation of river spaces and the first negative impacts had already become visible by the beginning of the twentieth century. This article examines how Romanian scientific experts and policy makers responded to those earlier anthropogenic impacts by trying to mitigate the environmental consequences of human actions without completely curtailing an extractive resource management system; the article therefore contributes to our understanding of global climate change, which began as a historical and localized process driven by specific socio-political concepts and policies.

Conflicts and controversies among experts

The first reclamation projects along the Romanian Danube were carried out at the beginning of the twentieth century when, following a devastating flood in 1897, the Romanian Ministry of Public Works drew up a dam-building programme to prevent anything similar. Until then, levees built along the river had either improved navigability or safeguarded cities from high waters, but after 1897 the government began to eye the rural areas between, with the idea of protecting them from floods of both the normal seasonal variety and the extraordinary one that had just occurred. In 1910 therefore, the Ministry of Agriculture created the Office for Rural Improvement Works (Serviciul de Îmbunătățiri Funciare) to develop (a pune în valoare) the land on the Danube's flood plain. A new law empowered the Office's engineers to design, plan, and execute all dam constructions and necessary works to drain, improve, and increase the agricultural yield of the Danube's wetlands. The damming projects targeted the so called "insanitary land" (terenuri insalubre) of the floodplain, which were actually submerged fields and various marshes, temporary or permanent. There were waterholes too, covered with vegetation (smârcuri) and small ponds of stagnant

water (japşe) which were legally classified as threats to public health (Monitorul Official, no. 212/1910, 8550). Besides addressing health concerns therefore, policy-makers believed that land reclamation projects could increase agricultural production as a way to guarantee the food security of a growing population and boost trade revenues mainly reliant on grain exports (Hitchins 1994, p. 180). Those measures reflected a general policy trend in Romanian agriculture that pursued ever more extensive use of land exclusively for farming as the most convenient method of increasing agricultural yields (Hitchins 1994, 169–170; Murgescu 2010, 133–135).

Land reclamation got off to a rather slow start because it was to a large degree a voluntary endeavour. Although the Office for Rural Improvement Works was headed by a well-known Romanian engineer named Angel Saligny, he was able to coordinate very few reclamation projects. While the Office had a mandate to build dams on state farms administered directly by the Ministry of Agriculture, there was little it could do to convince other owners to pursue similar projects on their estates. Private landowners or leaseholders had to undertake any drainage measures themselves and the Office could act only in an advisory capacity (Monitorul Oficial, no. 212/1910, 8550–8555). Its lack of influence during its first years meant that the Office found itself obliged to adopt a piecemeal approach: it could only counsel and design dam projects for individual properties where managers were willing to pursue reclamation schemes. By taking into consideration the particular needs and local aspects of each property separately, it tended to design such projects independently of each other, so that no general blueprint was ever developed for future projects. As a result, a handful of un-coordinated projects were initiated, scattered along the floodplain.

In 1911 however, biologist and by then head of the Romanian State Fisheries Grigore Antipa challenged the step-by-step approach and the concern solely with land reclamation. When the administrative council of the Office for Rural Improvement Works discussed the construction of dams on Borcea Island on an area of 813 square kilometres surrounded by two separate branches of the Danube, Antipa, as one of the council's regular members, protested against the project. Antipa feared that the dams would negatively impact the lakes in the area, and after the meeting he submitted three memorandums detailing his reservations and requesting postponement of the decision until the council had agreed general principles for the guidance of all amelioration works. In response, in 1912 the Minister of Agriculture, Ion M. Lahovary, appointed a commission to investigate the matter and to decide upon general principles for future interventions. Although a number of their fellow council members brought forward their own arguments, the work of the commission revolved mainly around Antipa's and Saligny's positions.

In his memorandums, Antipa enumerated the several negative impacts dams might have on the environment of the Danube, such as changes to its micro-climate, more severe floods, diminishing vegetation and drying out of existing ponds. He was concerned mainly about the wellbeing of fish, because dams would not only cut off the vital fresh water supply to large lakes and ponds but would also sever natural canals linking the Danube's main channel with the floodplain, which would prevent migratory fish from reaching their spawning grounds (Antipa 1913, p. 8). Since his appointment at the State Fisheries in 1892, Antipa had designed a vast programme that had institutionalized what he called "rational" fishing along the Romanian Danube and in particular in its delta. He took as the basis of his work that fish represented one of the country's underused natural resources that could help feed a growing population. In that sense therefore, his "rational" management offered a scientifi-

cally grounded alternative to extensive agricultural production (Ardeleanu 2025) intended to protect the fishing grounds on the one hand from negative impacts of various types of built infrastructure or overexploitation, and on the other hand to optimise nature's work so that fish stocks could thrive. An important component of Antipa's thinking was the need for strong state involvement as the only way to guarantee fair and balanced exploitation of resources (Dorondel and Mitroi 2017).

Alongside his own personal observations, Antipa based his arguments on a number of studies and reports that had assessed and compared drainage schemes implemented worldwide. From the outset, he noticed considerable differences both regarding the aims of such schemes and the methods they applied to them. He saw that The Low Countries and Italy strove to make more land available to accommodate a growing population by draining wetlands, whereas Germany and the United Kingdom, for example, used amelioration projects to remove excess humidity from the soil to improve agriculture. By natural contrast, dry places like Egypt welcomed the flooding of the Nile to fertilise their cultivated land. Antipa further remarked Bohemia's long tradition of maintaining large ponds alongside their larger rivers, ponds which served the double function of acting as natural reservoirs to prevent inundation and as accommodation for fish farming. The Tisza river in Hungary, on the other hand, had been encroached upon by massive dams on both sides, with the resulting new land being used exclusively for agriculture. However, studies showed that the productivity of that land decreased constantly, necessitating artificial fertilization. In the light of what he had learned, Antipa urged Romanian specialists and managers to decide which system would best suit both the country's economic needs and would best fit the natural conditions of the Danube's floodplain. (Antipa 1913, p. 23)

To establish the criteria, Antipa delved into a thorough biological and hydrological analysis of the Danube floodplain. He remarked that it was made up of four different types of landscape: (1) rising ground or natural levees which were well suited to agriculture, (2) lower-lying land dotted with small ponds and sheets of water which would be suitable for cultivation when dried, (3) wetlands that could be used for pasture from time to time, and finally, (4) permanent ponds and lakes that were very well suited to fish production. In other words, not only did the shape and width of the floodplain change year by year, but the ratio between dry and wet areas was variable over the course of a single year. The effects of erosion and currents, and amounts of precipitation altered the extent of lakes, marshes and tributaries—sometimes even their positions within the floodplain (Constantinescu and Tănăsescu 2020). By thus noting seasonal shifts, Antipa devised a so called "flood pulse concept" for the Romanian Danube which determined the principles for human intervention into what was clearly a dynamic environment (Constantinescu et al. 2015, p. 262). In other words, Antipa described the Danube as "an assemblage of life forms that depend on the river for subsistence and well-being," as a circulatory system that connects the main channel to the floodplains and its tributaries and as a place of amphibious cultures and interspecies connections, similar to James C. Scott's recent manifest in praise of floods and untamed rivers (Scott 2025, p. 4).

According to Antipa therefore, the main goal of any improvement works must be to ensure the highest possible productivity of all the different natural elements and landscapes on the floodplain. He further thought that since state institutions owned the vast majority of land there, its use should serve as an example for private owners. In practical terms he endorsed two guiding principles. First, dams should not in any way impinge upon large lakes and their

canals inside the floodplain; and second, engineers should recommend building lower, so called "overflow" (submersibile) dams that would allow occasional flooding to regenerate the land behind the dams. Such periodic flooding would mean in practice that a number of dry years of cultivation would be interspersed with years of controlled flooding, with the resulting inundation used for fish breeding (Antipa 1913, p. 9). Antipa thus advocated a system that would allow the land once every four or five years to "rest without profit" for a year during which revenue-loss would be made good through higher fishing yields. For the scheme to work, owners and administrators would need to be willing themselves to switch their efforts between fish farming and agriculture, and as Head of State Fisheries, Antipa was able to certify that economic gains from lakes and ponds, though rather modest when taken per year, were in the long run more reliable than agricultural revenues (Antipa 1913, p. 25). However, he knew that if grains were repeatedly cultivated on alluvial land, that land would become exhausted to the extent that only applications of mud and fresh water could serve to restore its fertility. A dynamic landscape should therefore be matched by dynamic and rotating land use, and all the more effectively if attempts could be made to drain lakes that contained water throughout the year, for otherwise such areas would soon turn into unproductive swamps (Antipa 1913, 31–32). Antipa further pleaded for measures to secure and optimize the quality of the lakes as fishing grounds, for to his mind it was not enough to protect the balance among different landscapes and natural elements to keep the dynamic fluvial regime intact. Nevertheless, while recognizing the importance of nature, as a modernizer Antipa endorsed policies and interventions that improved the natural qualities of the environment, such as, for instance, that lakes and ponds should not depend purely on annual rainfall and flood water, but on man-made constructions, such as "feeder" canals. He viewed such engineering as essential if the land were to receive enough fresh water to support large-scale fish production (Antipa 1913, p. 24). These guidelines resembled very much to the so called "multipurpose river development," ideas circulating between US and Soviet specialists since the interwar period which integrated different forms of economic exploitation with conservationist practices along large rivers (Coumel 2019).

However, engineer Saligny rejected Antipa's suggestions during the meetings. Saligny began by questioning whether it would even be possible to adopt general principles that would guide all construction works on the floodplain. Very much a practical man, Saligny considered that dam constructions should be conceived locally to take into account specific circumstances. Equally, he did not believe that reclaimed land would lose its fertility within a couple of years; to him the Hungarian projects along the Danube and Tisza rivers were positive examples, proving that building tall, strong levees to keep flood water out was a precondition for the cultivation of that land. However, if the fertility of the drained land were to decrease at some time in the future, it could be restored through irrigation and fertilization. And finally, Saligny could see no climatic nor hydrological changes that could reasonably be attributed to dams, although he did agree with Antipa on one point, for he acknowledged that his Office had never intended to encircle large lakes. That being said, Saligny did propose that any areas deemed suitable for drainage should be protected by massive, "non-overflow" (insubmersibile) dams, and positioned at least 200 m from the Danube's banks. In principle, Saligny was not against alternating crop cultivation with fish breeding on drained land, but he was sceptical that owners who had paid large sums to build dams would agree to such use. But unlike Antipa who believed that the state had a duty to impose property owners certain limits in the name of the common good, Saligny was much

more attuned to land owners' needs and interests. After all, thought he, rotating grain crops with fishing would make sense only if such a model were to be economically profitable in fact. Relatedly, Saligny questioned Antipa's estimated revenues from fishing, considering them too optimistic. To Saligny's mind, in years when the land was under water the owners would simply lose their profits, and he further cautioned that even carefully controlled inundation could have adverse effects, because any level of flooding would wash away and therefore destroy some part of any earthen dams used, which would of course in turn lead to additional repair costs. Overall, Saligny was equally doubtful that even keeping most ponds intact would prevent seasonal floods, and in particular floods caused by ice-melt. He could attest to such an effect only in the delta. In sum, Saligny was no supporter of absolute solutions, but clearly expressed himself in favour of extensive levee construction on designated areas with the aim of ensuring reliable crop cultivation. That, he thought, would be the best way to increase the productivity of the Danube floodplain (Ministerul Agriculturii si Domeniilor 1929, 38–40).

This divergence of opinion between biologist and engineer should come as no surprise, for each relied on very different knowledge and expertise to reach their conclusions. Furthermore, although the judgements of both were grounded in local observation, they were employed to serve different ends. Engineer Saligny's main task was to build dams that divided space into distinct units, whereas biologist Antipa was applying his knowledge to uncover visible and hidden connections inside the floodplain that would be adversely affected by damming. Moreover, their positions as Heads of the State Fisheries and of the Office for Rural Improvement Works respectively gave them different and sometimes mutually incompatible responsibilities. Saligny was aiming for steady increases in reclaimed areas for crop cultivation, an endeavour that often ran afoul of Antipa's goal of improving fishing grounds. As a consequence, both men—and their institutions—wrangled with each other for resources, employees and political influence (Dorondel and Şerban 2022, 115). In essence, when the two experts clashed over the dimensions of dams and their usefulness, they endorsed different concepts of the floodplain and its economic value (Dorondel and Şerban 2019, 354). Both men followed modernising visions that proposed active interventions in the environment, but each set different constraints to their pursuits. Saligny placed owners' economic benefits at the core of his argument, while Antipa was interested first and foremost in the "natural" potential of the area. Consequently, the former favoured a localized approach to land reclamation that would suit the particular conditions and means of each property, while the latter took a bird's eye view. Antipa preference was for the establishment of general principles for the entire floodplain; ultimately he was asking for stronger state intervention along the Danube that he believed would put both the general interests of the country's economy first and would be the best way to protect the natural environment from needless human damage.

In late 1912, the commission's deliberations concluded with a compromise decision that partly favoured Saligny's outlook. First, damming projects were to be restricted to the area between the city of Giurgiu and Borcea island, and were to exclude large lakes and the entire Danube Delta. Second, reclaimed agricultural areas were to be protected using non-overflow dams, along with other arrangements which would maintain that land as suitable for cultivation. No alternative use, such as fish breeding, was envisaged as necessary for those particular areas. Third, large lakes would not be encircled by dams but would be "kept under the natural regime of the river," in order to safeguard fish breeding. Fourth and finally,

controlled flooding to improve the land quality would not be required (Ministerul Agriculturii si Domeniilor 1929, 45–46). After analysing those policy proposals and their scientific underpinnings, the next section will assess how decisions to champion land reclamation were implemented on the ground and how those directly involved in the various schemes experienced them differently from the experts in high office.

Practical trials and tribulations

When the Danube floodplain was integrated into the Romanian state from the Ottoman Empire during the nineteenth century, the state took possession of most property, for which there were two different forms of ownership. First, were state farms which were directly administered by the Ministry of Agriculture and Estates; second, large properties became the responsibility of various other public institutions, such as the Civil Hospitals Administration (ANIC, Eforia Spitalelor Civile) or the Academy of Science, as a means to cover some of their expenses. Private ownership either by smallholders or larger estates accounted for less than 20% of the entire floodplain (Hitchins 1994, p. 339; Sandru 2007).

One of the first attempts to drain land and encircle it with dams took place on the Chirnogi estate, which lay near the town of Oltenița, owned by the Civil Hospitals Administration. The reclamation plan was designed by State Engineer George Caracostea and approved by Saligny himself, who promoted strong dams that could withstand the highest floods yet measured in the area. The proposed structures would line three sides of the property, the first dam to stand parallel to the Danube, to be complemented by two more dams at each end which would extend to the river. Saligny was willing to compromise on the matter of the length of the dams and so adapt them to local circumstances, although following his aim to reclaim as much wetland as possible, the dams' designs took into account the ownership structure of the area. Saligny had therefore proposed shorter dams that would not obstruct the main creek that brought fresh water to a nearby lake, his decision informed by the fact that the lake was under different ownership and there would be complaints or even legal action if the water quality should deteriorate as a result of the proposed construction works. Perhaps significantly, concerns about disrupting the aquatic ecosystem per se seem not to have played any significant role in Saligny's decision, for since his focus was on land reclamation and on increasing the agricultural revenues of the owners, he looked beyond the property's limits only when some such legal liability loomed which might then prompt him to consider the wellbeing of fishing and fish-breeding grounds in the area. Nevertheless, all of this attests to Saligny's acute awareness of the interconnectedness of different landscapes that crossed property lines on the floodplain. Still, his approach adhered to a policy of localized intervention aimed at protecting and insulating the reclaimed land from the surrounding areas (ANIC, Eforia Spitalelor Civile (ESC), 14/1897).

Despite the state's involvement in them in the persons of its engineers and through its legal arrangements, land reclamation schemes started out as purely for-profit endeavours. The state offered technical assistance and advice, but private and public owners were required to support the costs and supervise the projects themselves. Since Chirnogi belonged to a state institution entirely lacking in expertise in land drainage, the solution was a convenient long-term lease contract to allow the execution of the project and for benefit to accrue from the improved conditions. Thus in 1904, the Danish engineer Hans Dithmer signed a fifteen-year lease binding him to build the proposed dams on the property.

In exchange, he was exempted from paying land taxes. Dithmer, who called himself both an agronomist and an engineer, was at that time one of very few individuals familiar with land reclamation in Romania. After a failed stint in the Danube Delta, he proceeded to direct his attention further upstream to the Danube's plains where arable farming was possible at least sometimes in dry years. Dithmer set himself the new target of draining inundated wetland for grain cultivation as the only way to turn a profit on his investment. Planning to sow the reclaimed land with wheat and barley, two of Romania's main export staples at that time, he reluctantly agreed to suspend cultivation of those crops after four harvests and replace them with corn or rapeseed (ANIC, ESC, 34/1911). Dithmer largely followed Caracostea's plan and erected dams—they were more than 17 km long and reached half a metre above the highest measured flood. Their erection would create roughly 2,000 hectares of reclaimed land (ANIC, ESC, 14/1917).

Dithmer's three earthen dams were finished by 1906, but they failed to consistently keep flood water from the farmland. In spring 1907, ice-melt water breached one of the dams and flooded the entire property, compromising that year's harvest. We know all this because in 1912 a local inspector summoned Dithmer and ordered him to stop planting wheat and barley and to change crops, as had been written into his lease contract. Arguing against the order, Dithmer emphasized that because in 1907 he had been unable to cultivate grains, he still had one more year left before he needed to rotate crops. In addition, he could not confirm that planting grains every year was depleting the soil; on the contrary in fact he believed the reverse to be true, namely that grain cultivation had the beneficial effect of "weakening" alluvial deposits and thus, making them suitable for stable agricultural production. Whether Dithmer's observation was accurate or nothing more than a self-serving untruth is difficult to determine; in any case all we know for certain from the written sources is that Dithmer failed to convince the inspector and ultimately paid his fines (ANIC, ESC, 73/1912). What also transpires from the recorded correspondence is that massive dams were less reliable than engineers had thought, and gave no guarantee of stable grain production. Claims that cereals either depleted or improved soil quality were inextricably linked to individual interests—short or long-term—on the floodplain: but it also emphasized that the particular soil became very fertile if subjected to flood deposits.

We encounter Dithmer again in 1917, when the Hospitals Administration wanted him off their property, a year before his lease was due to end. The owners argued that Dithmer had neglected the property, a number of harvests had failed and the dams were in a state of disrepair. In a letter to the county tribunal, Dithmer argued against his expulsion, blaming his dire situation on the war. He pointed out that first, during the Bulgarian and later the German occupation, the protective dams had been converted into trenches with the consequence that the reclaimed land had been repeatedly inundated. He further complained that the occupying armies had confiscated most of what there had been of his crops, leaving him with no means to fulfil his lease. To make up for the losses, Dithmer even demanded that his lease be extended by two or three years, but again his plea failed and he was forced to vacate the property (ANIC, ESC, 14/1917).

Dithmer's undertakings on the Danube's floodplain had in fact produced mixed results. On the one hand he had succeeded in extending the area of arable land by damming his estate, but on the other hand the dams had been inadequate to keep the water at bay reliably. Dithmer's efforts at controlling the flow of the Danube had at least shown that building river infrastructure differed from other engineering ventures. Overall, constructions intended to

contain a fluid element must be designed to be as seamless and comprehensive as possible. However, quite often the man-made structures installed on riverbanks proved too simple to accommodate the intricate ways water flowed (Radkau 2008, 90–93*)*. Moreover, the engineers and technicians tasked with building and supervising such structures came to understand that to work properly, river infrastructure would always require unceasing maintenance and periodic reinforcement. Dithmar's dams, for instance, had required extension to protect the nearby village (ANIC, ESC, 14/1917). In other words, even when a new piece of infrastructure was initially successful, it tended to be a temporary achievement. Erosion and floods were the most obvious causes of damage, but humans too might sometimee purposely destroy structures that had been built and consolidated over a number of years, rendering all previous efforts futile. In Chirnogi for example, World War I meant both a figurative and literal break from previous reclamation practices, for the conflict left dams and property in general disarray.

Dithmer was a private entrepreneur who had come to the young state of Romania to experiment with technology in the hope of material gain, for which he focussed on cash crops, particularly wheat and barley. Another example, this time from a state farm, adds detail to the picture of how the first land reclamation projects unfolded on the ground. In 1911, Gheorghe Ionescu-Şişeşti, a young agronomist newly graduated from the University of Jena in Germany, was employed by the Office for Rural Improvement Works to oversee cultivation on the state-owned Spanţov farm. Ionescu-Şişeşti's remit included the reclaimed land which lay a few kilometres downstream from Chirnogi, and he noted in his diary that he "couldn't be happier" to have secured his position allowing him to pursue practical work without abandoning pure science. Upon his arrival, Ionescu-Şişeşti quickly set to work surveying the estate, remarking that agricultural cultivation, pasture usage, fish and animal breeding all nicely complemented each other. What impressed him most was the extremely high agricultural productivity of the dried alluvial land, which yielded an unprecedented 1,000 kg of wheat per half hectare (pogon) and 1,500-2,000 kg of barley per half hectare (Ionescu-Şişeşti 2013, p. 247).

At the beginning of his tenure at Spantov, the young agronomist had been convinced that his professional influence would increase as his employer gained more resources and prestige. However, for the time being he found himself obliged to admit that his office was poorly organized and some of its reclamation works were of low quality. For instance, drainage channels and a pumping station regularly underperformed, leaving part of the land under water throughout the year. To Ionescu-Şişeşti it became clear that this particular land reclamation scheme was marred by many flaws, among others by a combination of lack of appropriate resources, insufficient qualified personnel and poor logistics. Added to that was the dispute—already mentioned here—between Saligny and Antipa which went on throughout 1912, about whether to alternate fish breeding with agriculture or to pursue only high yielding cereal cultivation. Their stalemate stalled vital work on the farm. (Ionescu-Şişeşti 2013, p. 249). Because things did not improve in 1913, Ionescu-Şişeşti left abruptly to work on another state farm near Bucharest which offered him better conditions of employment. Still, he learned a number of important things during his short stint by the Danube, valuable experience which would inform his future scientific outlook, and it was in Spanţov that Ionescu-Şişeşti first learned about the dynamics of floodplain landscapes and the unmatched fertility of flood deposits. His observations there taught him that successful land reclamation and cultivation projects should take into account how water both

above and below ground moved between ponds, waterholes and creeks (Buhociu 2015, 46). Starting out as Saligny's subordinate, over the years he came to fully embrace Antipa's flood pulse concept, as his acceptance speech at the Romanian Academy of Science in 1937 proves: "The soil in the floodplain is capable of nourishing certain flora and fauna when the waters run high and different ones when they retreat. Nature has ordered a wonderful rotation of life and production there" (Ionescu-Şişeşti 1937, p. 14). This meant to Ionescu-Şişeşti that the best way to cultivate such a dynamic landscape was to apply a dual method of harmonizing agriculture and fish production (Ionescu-Şişeşti 1937, p. 19).

Assessing the few land reclamation schemes implemented in Romania before World War I therefore, we see that they provided obvious opportunities to various actors who went to the floodplain for various purposes. First there was the chance for entrepreneurs and adventurers like Dithmer to make money and for young university graduates like Ionescu-Şişeşti to advance their careers. And for eminent experts such as Antipa and Saligny, those first attempts at improving the yields of wetlands enabled them to offer scientific and practical guidance within a newly established field of activity that could increase their individual prestige and expand their political influence. However, despite the high hopes attached to these endeavours, those directly involved came to realize how difficult it was to pursue stable agricultural production on drained land. Everyone spotted the great potential of alluvial land and noticed the hydrological intricacies of the floodplain, but they often underestimated the concerted effort it would take to keep excess water out of the fields. In addition, external factors such as military conflict, slim resources and poor equipment adversely affected their various projects.

The two particular projects mentioned here were of experimental character designed to match the specifics of each property, be it in terms of finances, technical features or required knowledge. While both properties focussed on grain cultivation, there were significant differences between the two. Dithmer's enterprise was an emblematic capitalist effort involving high risk and potential high gain. The moment he signed the lease, Dithmer assumed all costs and responsibilities for the eventual success of the reclamation project, and the Romanian state did not even consider granting him support funds even in the case of force majeure represented by the War. For a while indeed, his agricultural enterprise fared better than the similar project implemented on the state farm in Spanţov. There one can find a number of shortcomings typical of state-sponsored development schemes, such as profligacy with money and resources, neglect, and delays. While employees in Spanţov had to contend with all those flaws, Dithmer was able to build his dams swiftly and soon began cultivating the reclaimed land. However, even the sturdy dams he built could not in the end be relied upon to keep flood water out of the property. Each year, his land was inundated, and he lost his annual income. It was fair to assume that in those years incomes from fish production increased in the floodplain, but for Dithmer it meant no harvest, and he could not make good his losses with revenues from fish production because there were no ponds on his estate. Unlike the biologist Antipa, Dithmer was not interested in the floodplain as a whole, but only in the agricultural profits his leased property could generate. A short-sighted view, perhaps, but one that reflected the pragmatism of private investors, who were willing to invest only if they believed they would reap reliable gains, such as were often associated with grain production. By contrast, decision-makers in Spanțov faced less pressure to ensure immediate gains from land reclamation, although that had the detrimental effect that the Spantov project underperformed for years (Ministerul Agriculturii si Domeniilor 1929,

4–5). The many setbacks these single reclamation arrangements suffered ultimately showed that they remained daring attempts that in the end offered no blueprint for how larger-scale schemes might be pursued.

Changes after the war

World War I caused an important political rupture for Southeast Europe: it was a time marked by the dissolution of empires and new state-building processes, but in the case of Romania, where political independence had actually predated the conflict, the primary changes were not institutional but socio-economic. One particular priority after the war was finding a solution to the so called "agrarian question," which required allocation of sufficient arable land to destitute peasants. Besides being the main promise Romanian officials made to the rural population during conscription, land reform policy was directed at the overall goal of alleviating rural poverty. The popularity of that promise in a country where the majority of the population were peasants, prompted parliament in 1921 to adopt sweeping land reform, according to which all destitute peasant families would be allocated up to five hectares of arable land (Müller 2020). It is worth mentioning that land distribution practices often adopted an exclusionary "nationalist" rationale that discriminated against ethnic minorities. As such the Romanian state, systematically excluded citizens of Bulgarian or Hungarian descent from receiving or maintaining property rights. This was a wide-spread phenomenon among many of the newly constituted nation states after the dissolution of empires in East Central and Southeastern Europe (Müller 2017; Vlachos 2022).

Given these conflicts over land distribution, one might assume that land allotment went smoothly in ethnically homogenous regions like the Danubian floodplains below Bucharest. Another reason why land re-distribution plans, however popular among the rural poor, proved a very fraught process in practice was that it prioritized social justice over economic gains. For instance, high productivity rates could hardly be achieved on small allotments owned by peasants who were too poor to make the necessary investments. Thus, despite the official rhetoric claiming justice was being done by the rural poor, in the end the reforms stopped short of breaking up large farms that were profitable. In fact the law included a number of stipulations to ensure that large-property owners could keep sizable portions of their land—up to 100 hectares on each estate they owned (Șandru 1975, 107–109).

Regarding the Danube floodplain, article 14 of the land reform law for the so-called Old Romanian Kingdom (namely all provinces that already belonged to the Romanian state prior to 1918) contained a provision that exempted wetlands from expropriation if the owners agreed to drain that land and transform it into arable land within ten years. As with the reclamation law of 1910, wet and muddy areas prone to flooding were again labelled unproductive and were required to be converted into arable land that would return revenue to the national budget (Monitorul Oficial, no. 82/1921). The best way to achieve that transformation was to afford the former owners of such land another chance to pursue comprehensive reclamation works. Although many owners had been reluctant to do that before the war, when faced with the threat of expropriation they now acquiesced. Effectively, the Romanian state authorities were betting on continuity, at least as far as floodplain amelioration was concerned, and they therefore largely preserved the pre-war legal framework outlining that. The new land reform law would now be used as an incentive to nudge owners

into undertaking the significant investments in infrastructure necessary for land reclamation (sandru 2007).

Again, things did not go as smoothly as planned. There were many delays in the expropriation process which was punctuated by much litigation, by bureaucratic delays, and by a shortage of qualified personnel to supervise the parcellation process. Rural Romania therefore descended during the 1920s into a state of turmoil which was not conducive to heavy investment. Further, in 1928, the Peasant Party for the first time won a national election with a programme closely focussed on rural development. The new government was much more interested than previous ones in finalizing the land reforms and to implement new programmes that would boost agricultural revenues (Hitchins 1994, 360–370; Harre 2009, p. 147). However, an inventory at the Ministry of Agriculture revealed that previous land reclamation schemes had become a shambles and could not serve as a model. To that date only 7,211 hectares of land had been reclaimed, and whether successfully or not was very difficult to estimate. The report mentioned delays, expensive dam constructions and decreasing yields both from drained land and the nearby lakes and ponds. In addition, most of the dammed properties were affected by undesirable side effects such as water infiltration and soil erosion (Ministerul Agriculturii şi Domeniilor 1929, p. 5). To deal with the situation, Ion Mihalache, the new Minister of Agriculture appointed a scientific commission to provide practical solutions, gathering the best experts in hydraulic engineering, agriculture, fishing, and forestry, as well as legal, economic, and financial experts. To a certain extent Mihalache's initiative was a reiteration of the 1912 commission, although with a broader scope aimed at providing a comprehensive programme for the exploitation of the entire Danube floodplain and its integration into the national economy.

Grigore Antipa who had been central to the deliberations of the first commission, came to dominate the second one, too. In a statement to that commission he declared that the fundamental error of the Office for Rural Improvement Works over the last decades had been its reduction of an economic problem to a purely technical one focussed exclusively on what shapes and dimensions of dams would make them suitable for land reclamation. Antipa insisted that amelioration works should never be reduced to building dams to drain fields. He gave the example of Lake Poldu on the Spanţov estate as a negative outcome; that lake had dried out because the dams had cut off its supply of fresh water, so that its bed had turned into a muddy pit as unsuited to agriculture as to fisheries. That example showed that for half of the floodplain, amelioration should mean improving the water quality of lakes by systematically guiding seasonal floods to replenish large ponds or to fertilize agricultural plots and pastures. Thus, the overall scope of improvement works should be to enable (să fie pusă in stare) wetlands and lakes on the Danube floodplain to deliver both to the national economy and to their owners the maximum productivity and profitability which the natural conditions and current scientific knowledge allowed (Ministerul Agriculturii şi Domeniilor 1929, p. 133).

Antipa clung to the principle that nature itself was best placed to determine the best system to improve the floodplain, by which he meant that humans should be mindful of their obligation not to disturb the state of equilibrium nature had created. Specifically, construction of dams and water circulation systems should balance each other out to protect nature and thereby increase the economic output of the floodplains. There are two important aspects to that statement. On the one hand, Antipa like many other Romanian experts dealing with the Danube endorsed a modernizing vision intended to improve nature. Through-

out his professional career he had been consistently pleading not to leave the floodplains untouched but to make careful changes to certain aspects that should make the area easier to exploit. On the other hand, one may agree with Dorondel and Şerban's reading that Antipa's view embraced concepts of biodiversity and nature conservation that set clear limits to human intervention, because Antipa knew that when taken too far, such intervention could cause irreparable damages to both human communities and the natural ecosystem (Dorondel and Şerban 2022, 115). In practical terms, Antipa had simply re-stated his suggestions of 1912, but this time had insisted that his principles should now all be included in a new law to establish a general framework for improvement works on the floodplain (Ministerul Agriculturii şi Domeniilor 1929, p. 559).

The new law effected significant policy and institutional changes. The State Fisheries and the Office for Rural Improvement Works which for decades had competed with each other over political capital, resources and influence over the floodplains, were now merged into a new institution overseen by Antipa. The hope was that the new Administration of Fisheries and Amelioration on the Danube Floodplain would better coordinate the various types of improvement works, and unlike in 1912 when Saligny (who died in 1925) had successfully resisted an overall plan for the entire region, the new law referenced the entire floodplain, which was now defined as the area covered with water after the flood of 1897, which was then still the widest extent of flooding. The floodplain would be divided into small regions called "natural units of production" which would each receive its own improvement project irrespective of whether that area was state-owned or private property. The "natural units" would differ significantly in size, which would be determined by their particular biological and hydrological conditions. All owners of the new units, whether owners of small plots, owners of large private estates, or the state, would become members of an association that would supervise all amelioration works. As such, Antipa could now operate on a much larger scale than previous programmes had allowed, to regulate the impact of human intervention over the entire floodplain. (Monitorul Official, no. 150/1929, 5175).

The detailed amelioration plan adopted in November 1929 divided the entire floodplain into roughly sixty "natural units" which were to undergo specific amelioration programmes (Monitorul Official, no. 249/1929, 8433). The area targeted for land reclamation was roughly 140,000 hectares, with the remaining 420,000 destined for pasture and fish (Ministerul Agriculturii şi Domeniilor 1929, p. 25). The first and most obvious effect of the law was that because the new natural units did not coincide with existing property boundaries, a number of new owners' associations had to be set up. Another change from previous experience was that there was better public endorsement, in the form of low interest loans and technical support. At first, most associations pursued improvement works that combined fishing and various forms of agriculture, ranging from cereals and vegetables, to fruit and grassland. Because the dams commissioned by the associations were smaller and were permeable to extraordinary floods, they would enable alternation of crop cultivation in dry years with fish breeding in wet years. In sum, Antipa had finally succeeded in getting written into law many of the scientific principles he hoped would protect the natural balance of the floodplain while ensuring that scientific fish farming and land reclamation could thrive there.

In practice however, Antipa's nature-friendly approach fared no better than the previous one focussed on maximization of profit. Analysts primarily blamed external influences for that outcome, such as the economic hardship caused by the Great Depression or, more simply, widespread flaws in implementation. Although owners could apply for generous state

loans, they were faced with rising expenses, and due to inflation costs increased many times more than had been estimated. Above all, it soon emerged that owners' associations had underestimated the costs and effort required for maintenance work, such as the installation of additional pumps and drainage channels. Moreover, a shortage of labourers made it difficult to work quickly, so that the associations fell ever deeper into debt, with many indeed facing bankruptcy. In 1934 the Romanian government responded with a decree that took over 70 per cent of the associations' debts (ANIC, Ministerul Finantelor (MF), 73/1934) an intervention to revive the improvement schemes that in fact signalled a sharp turn to distance itself in its reclamation policy from the principle of owner responsibility. However, even direct state involvement failed to bring with it the much-hoped-for breakthrough, for it was a case of "too little, too late". In the end, the cascading debt situation proved insoluble, and there was no incentive to begin new initiatives.

The complex evolution of damming activity as it unfolded on the ground in the late 1920s and into the 1930s shows that converting scientific observations into concrete action is never a straightforward process. The following is a particularly good example of how reclamation projects changed when their supervisors took into account the local dynamics of the floodplain. In 1927, Nicolae Greceanu, an engineer turned entrepreneur, leased a property on the Danube below Bucharest and began building dams which eventually encircled approximately 6,400 hectares of cultivable land. According to Greceanu himself he was saving his land from inundation to place it under cultivation. He was also pleased to point out that once the water was gone, so were the mosquitos. When commissioning the dams, Greceanu had made sure that they should be as small and thin as possible to reduce costs; he was not a bit concerned about flood water finding its way onto the property because he had planned to install pumps. But like his predecessors, he soon found he had underestimated the havoc even a mild flood could cause. In spring 1929, before workers could even finish the dams, a melt-water flood breached them, leaving behind as the only glimmer of a silver lining that Greceanu was at least able to observe how the water retreated day by day and hour by hour. What he saw prompted him to redesign a number of the drainage canals to allow water to move naturally between the floodplain and the main channel to enable more effective evacuation. Greceanu's approach was therefore similar to that of Antipa, in that by opting to trace the natural connections inside the floodplain he was able to improve the quality of man-made constructions (Greceanu 1933, 54–57).

However, the two disagreed on much else. Greceanu's involvement in the floodplain revolved around high-yielding crop cultivation and he cared little for fish breeding. In one of his publications propagating the success of his reclamation scheme, he even cautioned state authorities not to take the protection of fishing grounds too far. His goal was straightforward: to convert wetland prone to infectious disease into farmland. Like Dithmer before the war, Greceanu believed in capitalism in which state involvement should be reduced to the minimum. He was particularly proud that he had been able to finish building his dams more quickly than had the state their similar ones on their own property. Greceanu measured his success exclusively by the revenues generated from agriculture; his own calculations of yields per hectare compared to the costs of dam construction convinced him that the reclamation scheme was profitable (Ministerul Agriculturii şi Domeniilor 1929, 85–94). However, Greceanu's positive assessment cannot obscure the fact that by the mid-1930s he had become involved in a number of legal cases with members of the owners' association

over financial matters (ANIC, Ministerul Agriculturii şi Domeniilor (MAD), Exproprieri Ilfov, 443/1927).

It is clear that Greceanu's focus on land cultivation was a far cry from a system of integrated floodplain use which would benefit all types of landscape. And therein lay the main reason why Antipa's mindful interactions with nature were so difficult to put into practice, for owners' interests were simply incompatible with a policy of resource management pursued in the name of the common good. As had become clear even before the War, land reclamation schemes tended to isolate themselves from the surrounding landscape and "defend" themselves against adverse effects. More so, dammed properties caused damage elsewhere. In addition, when improvement projects began to be placed closer to each other they exposed the intricate connections within the floodplain both above and below ground—something we can clearly see reflected in the plethora of legal cases between neighbours demanding compensation for various damage. Pond owners for example often complained that dammed properties had cut off their supply of fresh water. One particularly pertinent case revealed that large amounts of water had gathered behind dams after a violent spring flood. In order to drain off the water, the property's administrators breached one of the dams and simply allowed the water to escape. As a consequence, plots and pastures downstream of the dammed property were flooded. Added to which, there was no indication that the administrators had intended to let the land "rest" for the year, as Antipa had suggested (ANIC, CENTROCOOP, 1/1939).

In the long run, more and more owners' associations managing "natural units" grew disillusioned with the rotating exploitation of crop and then fish farming. The associations therefore tended to disintegrate to form smaller entities revolving around just one type of exploitation, which made it easier to reach agreement and split financial burdens equally, especially since land reclamation schemes were significantly more expansive than works designed to improve the quality of lakes (Monitorul Official, no. 132/1931, 7412). Only large estates that had both large ponds and significant reclaimed land continued to employ mixed-use methods, but even those estates ceased to cooperate on improvement schemes with neighbouring properties, despite some involved parties admitting that it would have been more efficient and lucrative to do so (ANIC, ESC, 88/1936). In sum, what looked good on paper, made most scientific sense, and took the greater good into account, was not always easy to implement.

Conclusion

During the entire interwar period only 46,000 of the targeted 140,000 hectares of land along the Danube were reclaimed. In the long run therefore, agricultural yields on the newly cultivated plots fell short of expectations and were unable to amortize the construction costs (Bularda and Visinescu 2014). Means and organizational capacities too lagged behind expectations on many occasions, while the lack of scientific consensus on how to pursue such projects further hindered their completion. Bearing that in mind, then, what was later referred to as the "conquest of nature" turned out to be a slow-paced undertaking that did not even get off the ground for decades. However, those early setbacks should not obscure the fact that the initial intention had always been to both dominate nature and re-organize local economic practice. After 1929, the scale of intervention changed when the entire Dan-

ube floodplain became the object of a comprehensive technological transformation, a new approach that strengthened the state's role, extending their local involvement from technical assistance to financial backing and in some cases even direct management. That change anticipated the redesign of rural development programmes under state socialism, when amelioration work was carried out exclusively under the guidance of the state, whose employees finally managed to build solid dams along the entire Romanian Danube, with little consideration for possible environmental boundaries. (Dorondel and Posner 2022, 176–180). To be clear, although the drainage paradigm had little practical impact in the first half of the twentieth century, its significance lies first, in this shift from a very localized perspective to a bird's eye view of the floodplains and second, in the complex environmental knowledge that experts and practitioners produced with regard to a shape-shifting Danube.

The story this article tells is a much more complicated one than the straightforward subjugation of nature for economic benefit, although that was an important feature. Land reclamation and other amelioration schemes pursued in Romania during the first half of the twentieth century shed light on an intricate process of state-building that extended to the organization of the human and natural environments. An open decision-making process invited scientists, policy-makers, and practitioners to share their opinions on best practice in conducting the proposed works. With the help of two mixed expert commissions a gradual policy consensus emerged towards accepting that any successful intervention in the floodplain must take into account a dynamic, constantly shifting landscape. Based on Grigore Antipa's insight, in the 1930s the Romanian government implemented a legal framework they considered best attuned to nature preservation, and that aimed to increase the economic profitability of the floodplain without disturbing the natural balance. However, that attention for natural processes and their protection did not lead to better schemes, at least not for land reclamation, mainly because the immediate economic interests of property owners and leaseholders did not align with the overall purpose of mindful exploitation of the entire floodplain. In the end, no other form of exploitation could compete with the profits from high- yield grain production; and besides, firmly-constructed dams were poorly suited to containing water, while machinery such as pumps and drainage canals often proved inadequate in a shifting landscape. Flexible use of the wetlands sounded good on paper, but in practice a plot under water meant a year without revenues, plus additional costs for dam repairs. Unsurprisingly, that was something owners resisted.

One question that arises at the end of this examination is to what degree Antipa's and his followers' views were exceptional. To fully answer this question more in-depth studies in various other contexts are needed. However, the existing literature provides some hints that Antipa's concept of complex and dynamic interactions inside the floodplain might not have been that singular. Like numerous other graduates at the university of Jena in Germany, Antipa was very much influenced by the writings of his professor Ernst Haeckel who had coined the concept of "ecology" by studying organisms in their habitat and focussing on their relations among each other (Koszor-Codrea 2021, 312–314). The only truly exceptional feature of his career was his decade long tenure as the Head of the National Fisheries, irrespective of regime and policy changes, thus being able to implement many of his scientific ideas. Only after World War II did his political influence wane and while some of his concepts were picked up by younger specialists, they had less and less influence on the way drainage projects were put into practice (Dorondel and Şerban 2019, 357). Only after

the fall of communism did scientists rediscover his ideas and his long forgotten political influence (Giosan et al. 2013).

The reception of Antipa's work in Romania from outstanding personality to being forgotten and his posthumous rediscovery was another motivation for this article. In light of the current state of rivers due to the large-scale damaging consequences of human interventions, Antipa's influence offers a cautionary tale. While most scientist agree that river management is an ideal metric for the Anthropocene, some like James C. Scott contend that few voices cautioned against hydrological consequences of imprisoning rivers (Scott 2025, p. 161). Current remedies belong to the so called "soft-path engineering," in the form of low-head dams or run-of-the river dams, all measures that would make again room for rivers to swell (Scott 2025, 188−89). This sounds similar to the measures Antipa already proposed in 1912. It is almost a truism that historical environmental studies uncover forgotten knowledge that would have put land reclamation projects on a different, possibly more sustainable path. The lesson learned here is that in spite of advanced biological and hydrological knowledge and real political leverage, there were several other practical limitations, besides personal vanities, such as competing knowledge, institutions and property rights that stood in the way of implementing "softer" technical interventions at that time. Still, it is important to emphasize that many of the "fixes" that are currently debated have very long traditions, that range back at least to the beginning of the twentieth century.

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