

## **Cooperation and Private Enterprise in Water Management in Iraq: Continuity and Change between the Sasanian and Early Islamic Periods (Sixth to Tenth Centuries)**

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### **Abstract**

This article shows that the management of water resources in Late Sasanian and Early Islamic Iraq (6<sup>th</sup>- 10<sup>th</sup> centuries AD) implied the participation of local communities and the mutual cooperation of landholders. The organisation of water management in the Late Sasanian Period (6<sup>th</sup>-7<sup>th</sup> centuries) depended on a highly complex system of interaction between local communities, aristocratic rulers and the imperial bureaucracy. This interaction allowed the government to gather information from different regions of the empire and to understand the needs of the different stakeholders. As such the system provided a favorable institutional framework for the expansion of irrigated agriculture. The system changed when landholding conditions were transformed in the Early Islamic period, during the ninth century. These institutional transformations allowed the influence of a group of tax-farmers and merchant-bankers to increase. Irrigation policies were therefore bent to the interests of these new elites, which often lay in short-term gains rather than in long-term success. The article suggests that in the long run, these socio-economic and institutional changes contributed substantially to the breakdown of the agricultural system in Ancient Iraq.

### **Key words**

irrigation, water management, property rights, Sasanian Empire, Sawād, Iraq

### **Introduction**

In Late Antique and Early Medieval Iraq (6<sup>th</sup>- 10<sup>th</sup> centuries AD), agriculture was heavily dependent on the organisation of and investment in water management. The period in question, between the sixth and the tenth centuries, saw the transition from the Sasanian Empire (which covered a large part of the Middle East between 226 and 651 CE) to the

establishment of the Islamic Caliphates and the decline of the Abbasid dynasty. The rulers of the Sasanian and Abbasid empires had their power bases in Iraq. By ‘Iraq’, we mean the fertile alluvial plains of Mesopotamia situated along the Tigris and Euphrates rivers, which were known as the Sawād in the Early Islamic period.<sup>1</sup> Covering about 200,000 km<sup>2</sup>, the Sawād was thus somewhat smaller than the present-day state of Iraq. The financial stability of the state was dependent upon the efficient functioning of the water management system, since the land tax was the main source of support for the two empires that consecutively ruled this area, the Sasanian Empire and the Islamic Caliphates. The land tax provided much higher returns than any tax on trade.<sup>2</sup> The administration of the land tax and water management were therefore closely interconnected.<sup>3</sup>

An elaborate irrigation water management system sustained the high soil productivity of the Mesopotamian plains. In the ninth and tenth centuries an environmental collapse occurred, expressed by demographic contraction, decreased harvest outputs and declining building activities<sup>4</sup>. This article wants to retell this well-known story from an institutional perspective, with a particular focus on the role of landowners and their relations to other social groups. In part this has become possible thanks to recent publications of studies on the Sasanian period.

After decades of debate centred on ‘top-down’ versus ‘bottom-up’ versions of water-related policies,<sup>5</sup> recent studies have painted a more nuanced picture of Mesopotamian water management. On the one hand, recent work confirms that state intervention and investment

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<sup>1</sup> Hans H. Schaeder, ‘Sawād’, in *Encyclopaedia of Islam* (Brill: Leyden and New York, 1997<sup>2</sup>), p. 87.

<sup>2</sup> Michele Campopiano, ‘Fiscalité et structures économiques et sociales en Irak de la conquête arabe à la crise du califat abbasside (VIIe-Xe siècles)’, in Sophie Gilotte and Elise Voguet (eds), *Terroirs d’Al-Andalus et du Maghreb VIII<sup>e</sup>-XV<sup>e</sup> siècle. Peuplements, ressources et sainteté* (Paris: Edition Bouchène 2015), pp. 51-77.

<sup>3</sup> Bas van Bavel, ‘New Perspectives on Factor Markets and Ancient Middle Eastern Economies: A Survey’, *Journal of the Economic and Social History of the Orient* 57 (2014): 145-172, at 153-158; Michele Campopiano, Land Tax *Alā l-misāḥa* and *muqāsama*: Legal Theory and Balance of Social Forces in Early Medieval Iraq (Sixth to Eighth Centuries), *Journal of the Economic and Social History of the Orient*, 54 (2011): 239-269 ;

<sup>4</sup> Michele Campopiano, State, Land Tax and Agriculture in Iraq from the Arab Conquest to the Crisis of the Abbasid Caliphate (Seventh-Tenth Centuries), *Studia Islamica* 3 (2012): 35-80; Hugh Kennedy, ‘The Decline and Fall of the First Muslim Empire’, *Der Islam* 81( 2004): 3-29; Peter Christensen, *The Decline of Iranshahr. Irrigation and Environments in the History of the Middle East, 500 BC to AD 1500* (Copenhagen: Museum Tusulanum Press, 1993), pp. 86-89; David Waines, ‘The Third Century of Internal Crisis of the Abbasids’, *Journal of the Economic and Social History of the Orient* 20 (1977): 282-306; Robert McC. Adams, *Land behind Baghdad. A History of settlement on the Diyala plain* (Chicago and London: The University of Chicago Press, 1965).

<sup>5</sup> Robert McC. Adams, ‘Intensified Large-Scale Irrigation as an Aspect of Imperial Power’, in J. Marcus and C. Stanish, (eds) *Agricultural Strategies* (Los Angeles: Cotsen Institute of Archaeology, 2006), pp. 17-37; Robert McC. Adams, *Heartland of Cities. Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates* (Chicago and London: The University of Chicago Press, 1981); Karl August Wittfogel, *Oriental Despotism. A Comparative Study of Total Power* (New Haven, Yale University Press, 1976), p. 25;.

played a crucial role in the economic performance of the Sasanian Empire.<sup>6</sup> This has been shown for other parts of the empire as well, a good example being the city of Merv in Turkmenistan. Here, the discovery of cotton seed and the development of irrigation systems in the area have been shown to be connected to imperial investment in the development of this new crop. It was previously thought that the diffusion of cotton began in the Early Islamic period, as a result of investment by new Muslim elites.<sup>7</sup> The development of another cash crop, sugar cane, likewise seems to have been related to state initiatives. Traces of its cultivation survive in Khuzestan (in present-day Iran), an area where we can distinguish clear signs of Sasanian imperial investments.<sup>8</sup> To take another part of the Sasanian Empire as an example, Rezakhani's study of the Deh Lūrān plain (Iran) and the Dāmghān plain (Iran) emphasises the role played by local managers in administering a network of local canals, which connected regional areas to a large imperial infrastructure.<sup>9</sup> Scholars also point to the presence of state investment in water management in the Early Islamic period,<sup>10</sup> often stressing the continuity with the pre-Islamic, Sasanian past.<sup>11</sup>

On the other hand, recent studies show that government investment in water management in Late Antiquity depended on cooperation between the aristocracy and the crown.<sup>12</sup> Hartnell emphasises the collaboration of the court and the aristocracy of Fars in the development of irrigation in the province, with imperial officials supervising projects on a regional scale that would have enriched aristocratic landowners as well as the imperial

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<sup>6</sup> Richard Payne, 'The Archaeology of Sasanian Politics', *Journal of Ancient History* 2/2 (2014): 80–92; Donald Whitcomb, 'Landscape Signatures in Sasanian Archaeology', *Journal of Ancient History* 2/2 (2014): 209–215.

<sup>7</sup> St John Simpson, 'Merv, an Archaeological Case-Study from the Northeastern Frontier of the Sasanian Empire', *Journal of Ancient History* 2/2 (2014): 116–143. Compare with: Richard W. Bulliet, *Cotton, Climate and Camels in Early Islamic Iran. A Moment in World History* (New York: Columbia University Press, 2009), pp. 42–68.

<sup>8</sup> Khodadad Rezakhani, 'Continuity and Change in Late Antique Irān: An Economic View of the Sasanian', *International Journal of the Society of Iranian Archaeologists* 1/2 (2015): 95–108, at 101.

<sup>9</sup> Tony J. Wilkinson, Remy Boucharlat, Maurits W. Ertsen, Gavin Gillmore, Derek Kennet, Peter Magee, Khodadad Rezakhani, Tijs De Schacht, 'From Human Niche Construction to Imperial Power: Long-term Trends in Ancient Iranian Water Systems', *Water History* 4/2 (2014): 157–158, at 171.

<sup>10</sup> Hugh Kennedy, 'The Feeding of the Five Hundred Thousand: Cities and Agriculture in Early Islamic Mesopotamia', *Iraq* 73 (2011): 177–199.

<sup>11</sup> Campopiano, 'State, Land Tax and Agriculture'; Michele Campopiano, 'L'administration des impôts en Irak et Iran de la fin de l'époque Sassanide à la crise du califat Abbaside (vie-xe siècles)' in X. Ballestin- E. Pastor (eds), *Lo que vino de Oriente* (Oxford: BAR, 2013), pp. 17–27.

<sup>12</sup> As effectively summarised in Payne, 'The Archaeology of Sasanian Politics': 83–84.

treasury through taxation.<sup>13</sup> Alizadeh argues that irrigation projects were a standard feature of the *dastkard*, the large domains developed by the nobility or the crown.<sup>14</sup>

However, more agents than the state and aristocracy need to be taken into account. Wilkinson *et al.* claim there is a need to develop an overall conceptual framework for dealing with ancient water systems. They argue that for this reason, it may be necessary to shift the focus to a more ‘nuanced understanding of water management such as local management within an imperial framework’. They also emphasise that many ‘imperial’ projects were administered by small-scale social groups.<sup>15</sup> Besides confirming the role of imperial investment and coordination on the Mesopotamian plains, research points to the increasing role played by large landholders in water management and land administration as one of the innovative aspects of the Early Islamic period, either as a feature that stimulated economic growth and economic development,<sup>16</sup> or as a force that upset both the political and the ecological balance.<sup>17</sup>

Analysing a society’s institutional framework, including property rights regimes and bureaucratic organisation, can be seen as the key to formulating a hypothesis on the role played by human factors in environmental transformations. Rather than wealth, knowledge and technology, institutions constitute the framework that determines the diversity of human impact on the environment.<sup>18</sup> It is through the study of institutional frameworks that we can understand how societies were more or less vulnerable to environmental hazards, and more or less capable of implementing sustainable forms of land-use.

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<sup>13</sup> Tobin Hartnell, ‘Agriculture in Sasanian Persia: Ideology and Practice’, *Journal of Ancient History* 2/2 (2014): 182-208.

<sup>14</sup> Karim Alizadeh, ‘Borderland Projects of Sasanian Empire: Intersection of Domestic and Foreign Policies’, *Journal of Ancient History* 2/2 (2014): 93-115.

<sup>15</sup> Wilkinson, ‘From Human Niche’, 158.

<sup>16</sup> Although focusing on Iran rather than on Iraq, we can point at Bulliet, *Cotton*, pp. 63-68.

<sup>17</sup> Campopiano, ‘State, Land Tax’.

<sup>18</sup> Bas van Bavel and Erik Thoen, ‘Rural History and the Environment. A Survey of the Relationship between Property Rights, Social Structures and Sustainability of Land Use’, in: Bas van Bavel and Erik Thoen (eds) *Rural Societies and Environments at Risk: Ecology, Property Rights and Social Organisation in Fragile Areas (Middle Ages-Twentieth century)* (Turnhout: Brepols, 2013), pp. 15-42, at p. 16; see also: Bas van Bavel and Daniel R. Curtis, ‘Better Understanding Disasters by Better Using History: Systematically Using the Historical Record as One Way to Advance Research into Disasters’ *International Journal of Mass Emergencies and Disasters* 34 (2016) 1, 143-169 (Working paper, Utrecht University) and Gerrit J. Schenk, ‘Managing Natural Hazards. Environment, Society, and Politics in Tuscany and the Upper Rhine Valley in the Renaissance (ca. 1270-1570)’, in Andrea Janku, Gerrit J. Schenk, and Franz Mauelshagen (eds), *Historical Disasters in Context. Science, Religion and Politics* (New York-London: Routledge, 2012), pp. 31-53.

This article shows how the management of water resources implied the participation of local communities and the mutual cooperation of landholders. Recent anthropological and sociological research presents local rural communities as a focus for cooperation and the development of collective responsibilities in the management of common goods, including water management.<sup>19</sup> Having a small number of actors in rural communities facilitated communication among the members and encouraged both the development of expertise and the potential to coordinate strategies.<sup>20</sup> Frequent interaction in a localised physical setting fostered trusting relationships. Such a dynamic would have lowered monitoring costs and prevented free-riding problems.<sup>21</sup> Local communities could organise the workforce, manage the crucial tasks of water management and resolve conflicts among the beneficiaries.<sup>22</sup>

Apart from describing several historical agents, this article also discusses how changes in the power relations between different social groups affected water management systems. Which roles did ruling dynasties, economic and social elites (landowners, government officials, merchants) and rural communities play in establishing water related policies? In order to answer this question, one needs to understand not only the political and administrative changes that occurred in the period discussed in this paper, but also how this was affected by the complex bundles of property rights in Ancient Iraq and the changes therein. In a recent contribution, Van Bavel, Campopiano and Dijkman show that ‘the late eighth and ninth centuries ... saw the rise of large landholders from the Sawād who extended their domains and captured large parts of the surpluses’.<sup>23</sup> These groups acquired political influence and were able to change taxation systems and property rights regimes, and through

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<sup>19</sup> Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990), in particular pp. 58-83; Constance Dustin Becker and Elinor Ostrom, ‘Human Ecology and Resource Sustainability: the Importance of Institutional Diversity’, *Annual Review of Ecology and Systematics* 26 (1995): 113-133, at 114; John Kerr, ‘Watershed Management: Lessons from Common Property Theory’, *International Journal of the Commons* 1 (2007): 89-109.

<sup>20</sup> On the role of local knowledge of hydrology and hydraulic techniques: Elinor Ostrom, ‘Common Pool Resources and Institutions: Toward a Revised Theory’, in: B. Gardner and G. Rauser (eds), *Handbook of Agricultural Economics*, 4 vols (Amsterdam: Elsevier, 2001-2009), vol. 2, 1316-39, at 1319; Robert C. Hunt, ‘Size and Structure of Authority in Canal Irrigation Systems’, *Journal of Anthropological Research* 44 (1988): 335-55; Clifford Geertz, ‘Organization of the Balinese Subak’, in E.W. Coward (ed.), *Irrigation and Agricultural Development in Asia: Perspectives from the Social Sciences* (Ithaca, NY: Cornell University Press, 1980), pp. 70-90.

<sup>21</sup> Ostrom, *Governing the Commons*, 93-100, at 184.

<sup>22</sup> On these aspects of water management, see Robert C. Hunt, ‘Appropriate Social Organization? Water User Associations in Bureaucratic Canal Irrigation Systems’, *Human Organization* 48 (1989): 81-3; Becker and Ostrom, ‘Human Ecology’, 124.

<sup>23</sup> Bas van Bavel, Michele Campopiano and Jessica Dijkman, ‘Factor Markets in Early Islamic Iraq, c. 600-1100 AD’, *Journal of the Economic and Social History of the Orient*, 57 (2014): 262-289, at 282.

these changes were also able to modify water-related policies. We therefore need to consider the relationship between land ownership, land tax systems and the evolution of leasehold.

Studies on European water management (in particular in the Low Countries) have considered the interaction between state intervention, property rights regimes and the local level of water-resource administration.<sup>24</sup> Likewise, for the Mesopotamian plains, a more nuanced analysis is needed of the complex relations between land ownership, surplus extraction and water rights. This will lead to a better understanding how different economic and political interests were integrated in multi-layered systems of water management. In the following I first describe the environmental change and collapse, then I describe and explain the administrative reforms leading to higher integration levels of the administrative layers between the late fifth century and the early seventh century. Then I treat the Islamic period and first evaluate the laws, particular the strenghtening of individual property rights. In the last paragraph I describe how landownership and tax systems changed.

### **Water infrastructures and environmental change (6<sup>th</sup>-10<sup>th</sup> centuries)**

The delicate ecological balance that sustained the high soil productivity of the Mesopotamian plains could be seriously harmed. Summer heat could dry out the land, and the expansion of the tilled surface area was dependent upon extensive irrigation works.<sup>25</sup> Floods or changes in the course of the Tigris and the Euphrates could also seriously threaten the environment, turning the tillable surface into a swamp. Additionally, insufficient drainage could increase the level of salinisation, causing serious harm to agriculture. Some of these changes were wrought by human agency, like irresponsible land administration. In this paragraph some are described, in particular the ones leading to the environmental breakdown in the Islamic period.

Iraqi agriculture seems to have reached its peak during the Late Sasanian period (6<sup>th</sup>-early 7<sup>th</sup> centuries). Adams' research demonstrates how the cultivation of the Diyālā region,

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<sup>24</sup> See for example: Milja van Tielhof and Petra J.E.M. van Dam, *Waterstaat in stedenland. Het hoogheemraadschap van Rijnland voor 1857* (Utrecht: Matrijs, 2006); Tim Soens, *De spade in de dijk? Waterbeheer en rurale samenleving in de Vlaamse kustvlakte (1280-1580)* (Ghent: Ginkgo Academia Press, 2009).

<sup>25</sup> Curtis E. Larsen, 'The Mesopotamian Delta Region: A Reconsideration of Lees and Falcon', *Journal of the American Oriental Society* 95/1 (1975): 43-57; Eugen Wirth, *Agrargeographie des Irak* (Hamburg: De Gruyter, 1962), pp. 97-98; Peter Buringh, *Soils and Soil Conditions in Iraq* (Baghdad: Ministry of Agriculture, Agricultural Research and Projects, 1960), pp. 255-263;

east of what would later become Baghdad, reached a highpoint in Late Sasanian times.<sup>26</sup> Recent studies confirm the high level of canal construction activity in the area during this period.<sup>27</sup> There is also evidence of investment in hydraulic infrastructure in the Late Sasanian period in other parts of the Empire, such as the large irrigation canals revealed by satellite photographs and archaeological surveys along the edge of the Aras River terrace on the Mughan Steppe.<sup>28</sup> The most interesting case is that of the Qātūl al-Kisrawī, a giant feeder canal, c. 100 km long, that was drawn from the Tigris. It was intended to supply the lower Nahrawān<sup>29</sup> and to relieve the chronic water shortages in some parts of the region. Islamic geographers and scholars such as Yāqūt ar-Rūmī (1179-1229) and al-Qazwīnī (1203?-1283) attributed the building of the canal to Husraw.<sup>30</sup> As Alistair Northedge notes, the construction of the Qātūl ‘fundamentally changed the landscape by the digging of canal beds of enormous dimensions’.<sup>31</sup> The king established the three administrative districts of the Upper, Middle, and Lower Nahrawān, where the Qātūl al-Kisrawī played a central role in the canal system.<sup>32</sup> The two original inlets of the Qātūl al-Kisrawī, now commonly referred to as Nahr al-Raṣāṣī, which has an offtake from the Tigris at the northern end of the site of Samarra,<sup>33</sup> and Nahr al-Qā’im, which has an offtake from the Tigris below Tell al-Suwwān, were probably also Late Sasanian.<sup>34</sup>

There seems to have been a high degree of continuity in the infrastructure systems of the Late Sasanian and Early Islamic periods. In the case of the Diyālā region, this is emphasised by Adams, who argues that in the Early Islamic period this area still benefited from the canal infrastructure developed in the Late Sasanian period.<sup>35</sup> There are other examples of such continuity, such as the four great canals that connected the Tigris and the Euphrates (Nahr al-Malik, Nahr Sarsar, Nahr Kūtā, and Nahr ‘Īsā), three of which were definitely of pre-Islamic

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<sup>26</sup> Adams, *Land*, pp. 69-83.

<sup>27</sup> Alistair Northedge, *The Historical Topography of Samarra* (London, British School of Archaeology in Iraq, 2008), pp. 62-72.

<sup>28</sup> Karim Alizadeh and Jason A. Ur, ‘Formation and Destruction of Pastoral and Irrigation Landscapes on the Mughan Steppe, North-Western Iran’, *Antiquity* 81 (2007): 148-160, at 151-154.

<sup>29</sup> Adams, *Land*, pp. 76-80.

<sup>30</sup> Northedge, *The Historical Topography*, p. 65.

<sup>31</sup> Northedge, *The Historical Topography*, p. 61.

<sup>32</sup> Adams, *Land*, p. 76; Northedge, *The Historical Topography*, pp. 62-5.

<sup>33</sup> Alastair Northedge, Tony J. Wilkinson and Robin Falkner, ‘Survey and Excavations at Sāmarrā’ 1989’, *Iraq* 52 (1990): 121-147.

<sup>34</sup> Northedge, *The Historical Topography*, pp. 65, 68, 70.

<sup>35</sup> Adams, *Land*, p. 75.

origin.<sup>36</sup> It is uncertain whether the fourth, the Nahr ‘Īsā, was built by ‘Īsā ibn ‘Alī when Baghdad was founded (in the year 762) or whether his name was given to a pre-existing canal.<sup>37</sup> Northedge’s excavations in the area of Samarra reveal continuity of occupation between the Sasanian and Islamic periods in several sites.<sup>38</sup>

However, there is evidence of a breakdown in the agricultural system, in particular by the mid-ninth century and several types of evidence exist, which I will summarise in the following. According to Adams, the tilled surface area in the Diyālā region shrank from 8,000 km<sup>2</sup> at the end of the Sasanian era to just 6,000 km<sup>2</sup> by the middle of the ninth century.<sup>39</sup> Two cities, five smaller urban centres, three large towns and ninety villages or boroughs were abandoned soon after the end of the Samarran period.<sup>40</sup> According to Adams, other archaeological surveys conducted in the floodplain of the Central Euphrates show a decline in land use from the seventh century onwards, and the land was almost abandoned in the ninth and tenth centuries.<sup>41</sup> Of course, there are various methodological risks involved in using, as Adams does, the absence of diagnostic sherds to prove the absence of occupation at a site, one of which is the need to use pottery to establish a relative chronology of settlement.<sup>42</sup> However, the process of abandonment seems to have taken place over several centuries, therefore reducing the possibility of making an error in relation to chronology or settlement occupation. Furthermore, written sources progressively show less evidence of irrigation works taking place from the ninth century onwards.<sup>43</sup> It is also telling that whilst in 819, according to the jurist Qudāma Ibn Dja‘far, the revenue of Iraq was 177,200 *kurr* of wheat, 99,721 *kurr* of barley and 8,095,800 dirhams,<sup>44</sup> in the mid-ninth century, the geographer Ibn Khurdādbih reported that the revenue of as-Sawād

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<sup>36</sup> Peter Verkinderen, *The Waterways of Iraq and Iran in the Early Islamic Period: Changing Rivers and Landscapes of the Mesopotamian Plain* (London: Tauris, 2015), pp. 170-175.

<sup>37</sup> Verkinderen, *The Waterways*, pp. 174-175.

<sup>38</sup> Northedge, *The Historical Topography*, pp. 62-70.

<sup>39</sup> Adams, *Land*, p. 102.

<sup>40</sup> Adams, *Land*, pp. 98.

<sup>41</sup> Adams, *Heartland*, pp. 218-23; for land abandonment, see also Robert McC. Adams and H. Nissen, *The Uruk Countryside. The Natural Setting of Urban Societies* (University of Chicago Press: Chicago and London, 1972), pp. 63-65.

<sup>42</sup> Michael G. Morony, ‘Land Use and Settlement Patterns in Late Sasanian and Early Islamic Iraq’, G.R.D. King and Averil Cameron (eds), *The Byzantine and Early Islamic Near East, Land Use and Settlement Patterns*, vol. II (Princeton: The Darwin Press, 1994), pp. 222-226.

<sup>43</sup> Ira M. Lapidus, ‘Arab Settlement and Economic Development of Iraq and Iran in the Age of Umayyad and Early Abbasid Caliphs’, in A.L. Udovitch (ed.), *The Islamic Middle East 700-1900: Studies in Economic and Social History* (Princeton, Darwin Press, 1981), pp. 177-208, at p. 189.

<sup>44</sup> A *kurr* is a unit of mass equivalent to 2,925 kg. Michael J. De Goeje (ed.), *Liber viarum et regnorum auctore Abu'l-Kasim Obaidallah Ibn Abdallah Ibn Khordadbeh et Excerpta e Kitab al-Kharadj auctore Kodama Ibn Dja'far* (Leyden: Brill, 1889), pp. 239-40.



amounted to 70,650 *kurr* of wheat, 112,050 *kurr* of barley or rice and 11,848,840 dirhams.<sup>45</sup> One is immediately struck by the abrupt fall in wheat production and yet rice and barley were more robust grains and capable of growing in highly saline soils.

The decline of wheat production and the cultivation of more robust grains such as rice and barley point to an increasing salinization of the soil. We have clear evidence of extreme degradation of the soil due to salinisation in the area of Basra in Southern Iraq. Many of the large estates in Southern Iraq were planted with sugar cane. This is a crop that needs to be watered frequently, resulting in salinisation of the soil. This problem was so pronounced in the plains around Basra that *Zandj*, African slaves, were brought in to remove by hand the salty layers of the soil in order to keep the land of Southern Iraq cultivable.<sup>46</sup> At the end of the ninth century, their terrible working conditions prompted a rebellion that shook the foundations of the Abbasid Caliphate. In the tenth century, there also seems to have been a sharp fall in the urban population, as declining agricultural production was unable to sustain numbers at their current level.<sup>47</sup> It is also clear that land-tax revenue in Iraq declined drastically between the ninth and tenth centuries, possibly by a factor of ten. We find total figures of 125,000,000 or 123,740,000 dirhams (silver coins) for the period of Harūn ar-Rashīd, whereas for the financial year 918-919, the total was only 27,354,100 dirhams. The decline can be attributed to a general reduction in the tilled surface area and overall land productivity.<sup>48</sup>

### **Water management, land tax and land tenure in the Late Sasanian period (5<sup>th</sup>-7<sup>th</sup> centuries)**

In the introduction, we suggested that the administration of the land tax and of the water management were deeply interrelated in Late Antiquity. Here we will investigate how reforms affected the integration of the several layers of administration. The administration of the land tax underwent great changes in the Late Sasanian period due to the reforms introduced by King Kawād (488-496 and 498-531) and continued by King Husraw Anōšag-ruwān (531-579). Not

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<sup>45</sup> A. von Kremer, *Culturgeschichte des Orients unter den Chalifen* (Wien: Braumüller, 1875-1877), vol. I, p. 291; De Goeje, *Liber viarum et regnorum*, pp. 8-14.

<sup>46</sup> Alexandre Popovic, *La révolte des esclaves in Iraq au III<sup>e</sup>/IX<sup>e</sup> siècle* (Paris: Geuthner, 1976), pp. 13-25; Mohamed Ouerfelli, *Le sucre : Production, commercialisation et usages dans la Méditerranée médiévale* (Leyden: Brill, 2008), pp. 22-24.

<sup>47</sup> Maarten Bosker, Eltjo Buringh and Jan Luiten van Zanden, 'From Baghdad to London: Unravelling Urban Development in Europe, the Middle East and North Africa, 800-1800', *Review of Economics and Statistics* 95/4 (2013): 1418-1437.

<sup>48</sup> Campopiano, 'Fiscalité', pp. 51-77.

every part of the large and heterogeneous Sasanian Empire was affected in the same way by the reforms. Recent research, and in particular important work by Pourshariati, shows the complexity of the political relationships on which the Empire was based. Some clans and local rulers preserved a high level of political and fiscal autonomy.<sup>49</sup> The area of Iraq with the Persian system of capital cities, however, the main ‘bread basket’ of the Empire, was undoubtedly affected more directly by the political and administrative reforms. The crown tried to modify patterns of surplus distribution through a new system of tax assessment. A cadastre was started under Kawād and completed under Husraw Anōšag-ruwān. The cadastre provided the foundation for a reform of land-tax assessment that led to a more centralised system of surplus extraction, with the bureaucracy more closely involved in the work of tax collection at every level. The land tax was collected on the basis of a fixed amount of money or crops per unit of surface area. The tax rate varied according to the nature of the crops. For example, tax rates for fields cultivated with wheat were different those for fields cultivated as vineyards.<sup>50</sup> The role of state officers in tax collection became more important at every level.

We can reconstruct these transformations of the administration on the basis of documents in Middle Persian, sometimes written in the sixth or seventh century, or also on the basis of later Arabic works which were largely based on previous Sasanian texts. Arabic texts tend to reflect propagandistic views of the Sasanian monarchy expressed by the Middle-Persian works on which they directly or indirectly depend. However, their accounts are in broad terms coherent with the structure of the Sasanian administration that emerged from the *Hazār Dādestān* and the Pahlavi documents, and reflect therefore core real administration practices<sup>51</sup>.

The *Hazār Dādestān*, a collection of legal rulings by seventh-century Zoroastrian jurists, reveals a complex tax and administrative system. To some extent, the information provided by this legal text can be checked against the limited collections of Middle-Persian documents that have emerged in the course of recent decades. Of particular interest is the Berkeley Pahlavi

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<sup>49</sup> Parvaneh Pourshariati, *Decline and Fall of the Sasanian Empire: The Sasanian-Parthian Confederacy and the Arab Conquest of Iran* (London: Tauris, 2008), p. 99.

<sup>50</sup> Michele Campopiano, ‘Land Tax Alā l-misāha and muqāsama: Legal Theory and Balance of Social Forces in Early Medieval Iraq (Sixth to Eighth Centuries)’, *Journal of the Economic and Social History of the Orient*, 54/2, (2011): 239-269; Zev Rubin, ‘The Reforms of Khusro Anūshirwān’, in Averil Cameron, (ed.), *The Byzantine and Early Islamic Near East. III: States, Resources and Armies* (Princeton: Darwin Press, 1995), pp. 227-297; Andrea Gariboldi, *Il regno di Xusraw dall’anima immortale. Riforme economiche e rivolte sociali nell’Iran Sasanide del VI secolo* (Milano: Mimesis, 2007), pp. 178-179.

<sup>51</sup> For recent discussions of these sources, see: Michael R. Jackson Bonner, ‘Sasanian Propaganda in the Reign of Husraw Ānūšīrvān’, in Christelle Jullien (ed.), *Husraw Ier – Reconstructions d’un règne. Sources et documents* (Leuven: Peeters, 2015), pp. 257-284; Campopiano, ‘L’administration’, pp. 17-19; Campopiano, ‘Land Tax’, p. 246.

Archive, dating from the middle of the seventh century. The precisely dated documents range from 643/644 to 682/683.<sup>52</sup> The levying of taxes lay in the hands of the state bureaucracy and the hierarchies of the Zoroastrian church. The *mowbed*, or ‘chief priest,’ and the *rad*, or ‘spiritual master’, seem to have played significant roles in tax collection.<sup>53</sup> The ‘judge’ (*dādwar*) played an extremely important role in land administration, as he had expertise in what we would now call ‘property rights.’ He knew what (*če*), how much (*čand*), how (*čiyōn*), and in what form (*čewēnag*) landowners held the land.<sup>54</sup> These competencies were similar to those of a modern-day cadastral bureau. The judge had authority over the *tāsūg*, which seems to have been the smallest administrative division above the village (*deh* in Middle Persian).<sup>55</sup> Another official who clearly played a role in tax collection was the *ōstāndar*, who was also responsible for tax assessment (*sāk abar nihād*).<sup>56</sup> The *ōstāndar*’s role in financial administration is confirmed by documents in the Berkeley Pahlavi Archive, which show that the *ōstāndar* monitored the expenses and payments of other administrators who depended on him.<sup>57</sup>

Arabic sources and translations of Middle Persian texts confirm the existence of a bureaucratic structure devoted to more direct control of the system of surplus extraction by the central authority. One important account of the tax reform is to be found in the historical work *Ta’rīkh al-rusūl wa-l-mulūk*, written by aṭ-Ṭabarī (839-923). He states that the judges in each administrative district received a copy of the tax register in order to prevent extortion. They also had to inform the king about the condition of the land, so that taxes could be remitted in the case

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<sup>52</sup> Philippe Gignoux, ‘Les comptes de monsieur Friyag; quelques documents économiques en pehlevi’, in *Source pour l’histoire et la géographie du monde iranien (224-710)* (Paris : Groupe pour l’étude de la civilisation du Moyen-Orient, 2009), pp. 115-142 ; Philipp Gignoux, ‘Aspects de la vie administrative et sociale en Iran du 7ème siècle’, in Rita Gyselen (ed.), *Contributions à l’histoire et la géographie historique de l’empire Sassanide* (Leuven: Peeters, 2004), pp. 37-48.

<sup>53</sup> Farraxvmart ī Vahrāman, *The Book of a Thousand Judgments (a Sasanian Law-Book)*, edited by Anait G. Perikhanian (Costa Mesa: Mazda, 1997), pp. 294-297; Maria Macuch, *Das sasanidische Rechtsbuch Mātakdān i hazār Dāristān (Teil II)* (Wiesbaden: Kommissionsverlag Steiner: 1981), p. 51 (Middle Persian) and 189 (German translation); see also: Touraj Daryaee, *Sasanian Persia: The Rise and Fall of an Empire* (London: Tauris, 2009), pp. 128-129.

<sup>54</sup> Farraxvmart ī Vahrāman, *The Book*, 292-3; Macuch, *Das sasanidische Rechtsbuch*, 49-50 (Middle Persian) and 188 (German translation); see also: Daryaee, *Sasanian Persia*, p. 133.

<sup>55</sup> Daryaee, *Sasanian Persia*, pp. 125-6.

<sup>56</sup> Daryaee, *Sasanian Persia*, p. 126.

<sup>57</sup> Philippe Gignoux, ‘La collection de textes attribuables à Daden-vindad dans l’Archive pehlevie de Berkeley’, Rita Gyselen (ed.), *Sources for the History of Sasanian and Post-Sasanian Iran (Res Orientales 19)* (Leuven: Peeters, 2010), pp. 11-134. Rita Gyselen, *Nouveaux matériaux sigillographiques pour la géographie administrative de l’empire sassanide. Collection A. Saeedi* (Paris: Cahiers de Studia Iranica, 2002), pp. 117-120.

of crop failure.<sup>58</sup> Ibn al-Muqaffa' (d. 756/759), one of the most important translators of Middle Persian texts, stated that Husraw appointed officers to supervise crop failures and remit taxes in the case of shortages.<sup>59</sup>

The *Sīrat Anūshirwān* presents the most revealing account of Husraw's reforms. The *Sīrat Anūshirwān* is a first-person narrative of the main deeds of Husraw, probably based on ancient Middle Persian rulers' deeds,<sup>60</sup> preserved in the *Tajārib al-umam* written by Miskawayh (ca. 1030).<sup>61</sup> It contains some interesting elements that help us to understand how the process of tax collection worked. The fiscal prefect (*āmil* in Arabic or *āmārgar* in Middle Persian, as mentioned above) and the taxpayers (*ahl al-kharādj*) had the right to present complaints to the judge (*qādī*, probably the *dādwar* described above). The fiscal prefect, the judge, the *amīn ahl al-balad* and the region's scribe (*kātib al-kūra*, or *shahr-dibīr*, a royal tax collector sent to the province<sup>62</sup>) reported to the royal department.<sup>63</sup> The taxpayers of each district gathered in the chief town with their leader (*qā'id*, probably the local lord), the judge, and the *amīn ahl al-balad* ('the trustworthy amongst the people of the country') to discuss their problems with the king's representatives.<sup>64</sup> The judges also had to assemble the inhabitants of the district without revealing their actions to the lords or fiscal prefects.<sup>65</sup> Delegates from the district, even from the peasantry, were able to report to the government.<sup>66</sup> Although the description of the tax reform in the *Sīrat Anūshirwān* is ideological to a large extent, it does broadly agree with the account of structure of the Sasanian administration that emerges from the *Hazār Dādestān*, especially the duty of supervision that was accorded to the judges.

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<sup>58</sup> Michael J. De Goeje *et al.* (eds), *Annales quos scripsit Abū Djafar Mohammed Ibn Djarīr At-Tabarī*, 15 vols (Leyden: Brill, 1879-1901), vol. I, 960-963.

<sup>59</sup> Reported in the *Nihāyat al-'arab fī akhbār al-Fars wa-l-'arab*; the Arabic text in: Mario Grignaschi, 'La riforma tributaria di Ḥosrō I e il feudalesimo sassanide', *La Persia nel Medioevo. Atti del Convegno Internazionale sul Tema* (Roma, 31 marzo - 5 aprile 1970) (Roma: Accademia Nazionale dei Lincei, 1971), pp. 87-131, at 135. On Ibn al-Muqaffa', see Ersilia Francesca, *Il Principe e i Saggi. Potere e giustizia nel medioevo islamico* (Monza: Polimetrica, 2005), pp. 46-47; Charles Pellat, *Ibn al-Muqaffa' (mort vers 140/757) 'conseiller' du calife* (Paris: Publications du Département d'Islamologie de l'Université de Paris-Sorbonne, 1976).

<sup>60</sup> This narrative is related to the epic narratives of the *Xwadāy Nāmag* tradition: for a short but good overview and bibliography see: Carlo Cereti, *La letteratura Pahlavi* (Milano: Mimesis, 2001), pp. 191-192.

<sup>61</sup> On Miskawayh and his works, see: Mohammed Arkoun, *Contribution à l'étude de l'humanisme arabe au IVe/Xe siècle: Miskawayh (320/325 - 421)=(932/936 - 1030) philosophe et historien* (Paris: Vrin, 1970).

<sup>62</sup> Daryaei, *Sasanian Persia*, p. 54.

<sup>63</sup> Mario Grignaschi, 'Quelques spécimens de la littérature sassanide conservés dans les bibliothèques d'Istanbul,' *Journal asiatique* 254 (1966), 16-45, at 18; Arabic text (manuscript facsimile): *The Tajārib al-umam or History of Ibn Miskawayh*, preface and summary by L. Caetani, 2 vols. (Leyden: E.J. Brill, 1909), I, p. 190.

<sup>64</sup> Grignaschi, 'Quelques spécimens' pp. 20-21; *The Tajārib al-umam*, p. 194.

<sup>65</sup> Grignaschi, 'Quelques spécimens', p. 22; *The Tajārib al-umam*, p. 195.

<sup>66</sup> Grignaschi, 'Quelques spécimens', pp. 20-21; *The Tajārib al-umam*, p. 196.

The inclusion of some form of local participation is probably related to the strong property rights held by peasants. At that time, the main form of tenancy was permanent sharecropping for one-quarter to one-third of the crop. The sharecropper held permanent rights to the land and could sublet it if he wished, which made the sharecroppers important stakeholders in land management and more interested in long-term investments in land.<sup>67</sup>

By acquiring a larger and steadier share of surplus extraction through the land tax and administrative reforms, at least in Iraq, the Sasanian crown had both an interest in and the possibility of investing in water management. Bureaucrats were directly involved in water management. According to Ibn Qutayba ad-Dīnawārī, a ninth-century Iraqi scholar, the Persians used to say that the secretary who does not know about water mains, digging, closing canal locks and other water management issues is a useless secretary.<sup>68</sup> The ‘judge’ (*dādwar*), whose supervisory function and role in cadastre assessment has already been discussed, was also able to resolve private disputes concerning water management.<sup>69</sup>

The activities of local landholders were integrated and coordinated by this bureaucracy. The *Hazār Dādestān* shows how some canals were owned by private investors, either jointly or individually. Elman points out that this source refers to over-ground canals dug for irrigation, which were sourced from major rivers, such as the Tigris and the Euphrates, and from larger canals.<sup>70</sup> The *Hazār Dādestān* tries to establish rules concerning possible uses of these canals by the community at large. For example, it states that if a canal dug by an individual owner runs around a plot owned by other landholders, the former may not dig an outflow until he has made an agreement with the owner of the canals and paid him compensation.<sup>71</sup> However, most of the paragraphs concerning irrigation deal with canals co-owned by different landholders, who also enter into partnerships for the division of agricultural revenues. According to the *Hazār Dādestān*, a man who had individually borne the cost of indispensable maintenance for canals that were co-owned jointly with others could enlist the judge’s support for his claims for adequate compensation for his expenditure, if his

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<sup>67</sup> Khodadad Rezakhani and Michael G. Morony, ‘Markets for Land, Labour and Capital in Late Antique Iraq, AD 200-700’, *Journal of the Economic and Social History of the Orient* 57 (2014): 231-261; Van Bavel, Campopiano and Dijkman, ‘Factor Markets’, 269.

<sup>68</sup> Ibn Qutayba ad-Dīnawārī, *Uyūn al-aḥbar*, 2 vols, (El Cairo: Dār al-kutub al-miṣriyyah, 1925), vol. I, pp. 44-45.

<sup>69</sup> Farraxmart ī Vahrāman, *The Book*, p. 201 (85-86); Macuch, *Rechtskasuistik*, pp. 550-551, 553-554 and 557-558.

<sup>70</sup> Yaakov Elman, “‘Up to the Ears’ in Horses’ Necks (B.M. 108a): On Sasanian Agricultural Policy and Private ‘Eminent Domain’”, *Jewish Studies, an Internet Journal* 3 (2004): 95-149.

<sup>71</sup> Farraxmart ī Vahrāman, *The Book*, p. 201; Macuch, *Rechtskasuistik*, pp. 550-551, 553-554 and 557-558.

partners and co-owners refused to collaborate.<sup>72</sup> Until he was reimbursed, he was entitled to hold as a security the part of the estate belonging to the co-owners.<sup>73</sup>

To summarise, the administrative reforms of Husraw's period allowed the activities of local communities to be integrated into the central bureaucracy. The new system had to be based on cadastral surveys, since a fixed amount of money was levied per unit of surface area, with tax rates varying according to the crops being grown. This meant that having a huge amount of data on land conditions was essential for the central administration. Furthermore, sources point to the existence of several control systems in which the bureaucracy and locals interacted. This is revealed, for example, by the duties of the judge, which included meeting and discussing with locals, hearing their complaints and possibly allowing tax remissions in the case of a bad harvest. The flow of information thus produced helped the authorities to understand local conditions. The integration of different administrative levels and the availability of local knowledge were key factors in improving conditions for water management. The complex, multi-layered system of land and water management described above lay at the foundations of the expansion of irrigated agriculture on the Mesopotamian plain in the Late Sasanian period.

### **Continuity and change between the Late Sasanian and Early Islamic periods (7<sup>th</sup>-10<sup>th</sup> centuries)**

As noted in the first paragraph on environmental change, archaeological evidence points to a degree of infrastructural continuity between the Late Sasanian period and the Early Islamic period. In this section, we ask how far there was also continuity in the administration of water management, as well as the related issues of land ownership and tax administration. One element of continuity was to be found in the established aristocratic and royal domains, between the Sasanian *dastkard* and the estate around the Islamic *qaṣr*. The rise of desert castles in an area dominated by Umayyad dynasties in present-day Jordan, Palestine, Syria, and Iraq, some of them built under Hisham, such as Qaṣr al-Ḥayr al-Sharqī and Qaṣr Ḥayr al-

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<sup>72</sup> Farraxvmart ī Vahrāman, *The Book*, pp. 201-202; Macuch, *Rechtskasuistik*, pp. 550-551, 553-554 and 557-558.

<sup>73</sup> Farraxvmart ī Vahrāman, *The Book*, p. 203; Macuch, *Rechtskasuistik*, pp. 550-551, 553-554 and 557-558.

Għarbī, was to a certain extent connected to the expansion of irrigated agriculture.<sup>74</sup> Similar structures may have been based on examples of edifices from the pre-Islamic period. Although in the case of Syria it has not yet proven possible to identify an edifice from pre-Islamic times that might have served as a model, studies in Mesopotamia have revealed a different situation. Recent work at Qaṣr Bani Muqātil by Finster and Schmidt has led to the re-advancement of the idea, originally proposed by the two scholars in the 1970s, that these buildings were built in the Sasanian period. Qaṣr Banī Muqātil in particular seems to date back to the sixth century.<sup>75</sup> Although Marwanid investment in similar settlements is evident, it may have been based, to a large extent, on Sasanian models.<sup>76</sup> The central authorities continued to play a crucial role in water management after the Arab conquest. The caliphs, both Umayyad and Abbasid, were involved in huge reclamation initiatives that helped them to expand their financial base. The caliphs tried to extend the estates under their direct control by reclaiming Sasanian crown land and swamp land, especially in the area of al-Batā'ih, the large swamps in lower central Iraq.<sup>77</sup> We know of investments in land colonisation during the period of the Caliph Hishām, one example being the feeder canal built near Raqqa.<sup>78</sup> Important initiatives were also taken under the first Abbasids. Considerable irrigation works were undertaken by the first members of the 'Blessed Dynasty', initially in the areas of Basra and Wāsit, with attention then shifting to the areas of Baghdad, Samarra and the central reaches of the Tigris River.<sup>79</sup> Some of these works relied on existing Sasanian networks, such as the Qatul Abī al-Djund, built by Harūn ar-Rashīd (786-809) with the intention of irrigating the zone between the Nahrawān and the Tigris to the north of Baghdad, thereby integrating the Nahrawān canal system.<sup>80</sup>

Islamic jurists focused on the government's duties in relation to building and maintaining infrastructure. Abū Yusūf (d. 798), who was appointed *qāḍī* (judge) of Baghdad

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<sup>74</sup> J.L. Barach, 'Marwanid Umayyad Building Activities. Speculations on Patronage', *Muqarnas* 13 (1996): 27-44, 30-31; Denis Genequand, 'From "Desert Castle" to Medieval Town: Qaṣr al-Hayr al-Sharqī (Syria)', *Antiquity*, 79 (2005): 350-361; Hugh Kennedy, 'Great Estates and Elite Lifestyles in the Fertile Crescent from Byzantium and Sasanian Iran to Islam', in Albrecht Fuess and Jan-Peter Hartung (eds), *Court Cultures of the Muslim World* (London: Routledge, 2011), pp. 54-79.

<sup>75</sup> Barbara Finster-Jürgen Schmidt, 'The Origin of "Desert Castles" Qaṣr Bani Muqātil, near Karbala, Iraq', *Antiquity*, 79 (2005), 339-349, at 345-347.

<sup>76</sup> Whitcomb, 'Landscape Signatures Add full reference', p. 210 (and footnote 8) and p. 213.

<sup>77</sup> Lapidus, 'Arab Settlement', pp. 183-187.

<sup>78</sup> Barach, 'Marwanid', 30.

<sup>79</sup> Lapidus, 'Arab Settlement', p. 187-189; Kennedy, 'The Feeding'.

<sup>80</sup> Northedge, *The Historical Topography*, p. 65.

on the order of the Caliph Hārūn ar-Rashīd, put much emphasis on the revival of the ‘dead lands’ and the importance of irrigation for this purpose in his *Kitāb al-Kharāj*, *Book of Land Tax*.<sup>81</sup> He argued that ‘if the main canals and watercourses, from the Tigris and Euphrates, need clearing and cleaning the expenses should be borne by the Treasury and by those directly benefiting from such watercourses’.<sup>82</sup> He also stated that ‘the expense of the upkeep of the walls on the river banks, to prevent flooding, of the dams and the water locks on the Tigris and Euphrates and similar great rivers, must be borne by the Treasury alone, because it is in the public interest that they should be kept in order as any malfunction will cause damage to agriculture and decrease the income from taxation’.<sup>83</sup> Qudāma affirmed that major Muslim jurists, such as Abū Ḥanīfa (ca. 699-767) and Malik (708/716?-796), also asserted that the supervision of irrigation and the damming of the overflows of the great rivers had to be sustained by the government at the expense of the treasury.<sup>84</sup> A later source, the *Kitāb al-Hāwī*, a mathematical tract for the tax collectors in Iraq that was probably written in the second quarter of the eleventh century, refers to several calculations for the digging and administration of canals. Claude Cahen stresses that the care taken by tax-collectors in relation to the digging of canals had to do with the necessity of guaranteeing a stable income from the land tax.<sup>85</sup>

Islamic jurists also discussed issues relating to the joint management of water resources, which are also clearly present in the *Hazār Dādestān*.<sup>86</sup> Abū Yūsuf stresses that all Muslims are partners in the use of the large rivers, such as the Tigris and the Euphrates. If someone wants to run a canal from one of these to irrigate his land, he will only be allowed to do so if this does not damage the river.<sup>87</sup> Abū Yūsuf writes that those who jointly own a canal must make a proportional contribution to its digging and dredging. If some of the owners of a canal decide to strengthen its walls for fear that they might break, the other partners can be

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<sup>81</sup> The Book of Land Tax was published in Arabic in 1886 and in English 1969: Abū Yūsuf, *Kitāb al-kharāj* (Cairo: Būlāq, 1886); *Abū Yūsuf's Kitāb al-kharāj* (Leyden and London: Brill, 1969)

<sup>82</sup> For example, Abū Yūsuf, *Kitāb al-kharāj* pp. 62-63. *Abū Yūsuf's Kitāb al-kharāj*, p. 106;

<sup>83</sup> *Abū Yūsuf's Kitāb al-kharāj*, p. 106; Abū Yūsuf, *Kitāb al-kharāj* p. 63.

<sup>84</sup> *Qudāma ibn Ja'far's Kitāb al-kharāj* (Leyden and London: Brill, 1965), p. 62 (English translation), pp. 96-97 (Arabic); Muhammad ‘Abdul Jabbar, ‘Agricultural and Irrigation Labourers in Social and Economic Life of ‘Irāq during the Umayyad and ‘Abbāsīd Caliphates’, *Islamic Culture* 47 (1973): 15-31.

<sup>85</sup> Claude Cahen, ‘Le service d’irrigation en Irak au début du XIe siècle’, *Bulletin d'études orientales* 13 (1949-1951): 117-143.

<sup>86</sup> John Wilkinson, ‘Muslim Land and Water Law’, *Journal of Islamic Studies* 1 (1990): 54-72.

<sup>87</sup> *Abū Yūsuf's Kitāb al-kharāj*, p. 127; Abū Yūsuf, *Kitāb al-kharāj*, p. 55.



forced to share the expenses if it is thought that a lack of maintenance will cause damage.<sup>88</sup> Yaḥyā ibn Ādam (d. 818) describes a tradition whereby when people divide land, they are meant to regulate water rights among themselves, and they are considered partners with right of pre-emption.<sup>89</sup> Yaḥyā ibn Ādam also reports traditions against and in favour of the sale of surplus water for irrigation, allowing it to be used by neighbours.<sup>90</sup> This problem may have been related to the strengthening of individual property rights over land, which may have caused conflicts between the eighth and ninth centuries (when Yaḥyā ibn Ādam lived).<sup>91</sup> He also reports the tradition that if a man were cut off from a source of water by someone else's land, he could legitimately let an irrigation canal pass through his neighbour's property.<sup>92</sup> This situation contradicts a statement in Abū Yūsuf's book, in which the jurist claims that a man cannot dig a canal through someone's else land without his permission, although a landowner cannot prevent his neighbour's canal from running through his land if this how the canal lay when he acquired the property.<sup>93</sup> Again, this points to a strengthening of individual property rights over land and water.

It is clear from the above that central authority continued to play a crucial role in the expansion and maintenance of water infrastructure in the early Islamic period. Islamic law maintained forms of cooperation among different landholders in the use of water resources (as they existed in the Sasanian period), but it also showed a strengthening of individual property rights in relation to water.

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<sup>88</sup> *Abū Yūsuf's Kitāb al-kharāj*, p. 125; Abū Yūsuf, *Kitāb al-kharāj*, p. 54.

<sup>89</sup> Yaḥyā Ibn Ādam, *Kitāb al-kharāj*. Edition: Th. W. Juynboll (ed.), *Le livre de l'impôt foncier de Yaḥyā Ibn Ādam*, (Leyden, 1896), p. 71.

<sup>90</sup> Yaḥyā Ibn Ādam, *Kitāb al-kharāj*, p. 75.

<sup>91</sup> Van Bavel, Campopiano and Dijkman, 'Factor Markets', 266-268.

<sup>92</sup> Yaḥyā Ibn Ādam, *Kitāb al-kharāj*, p. 77.

<sup>93</sup> *Abū Yūsuf's Kitāb al-kharāj*, p. 129; Abū Yūsuf, *Kitāb al-kharāj*, p. 57.

## Change in land ownership and tax assessment in the Islamic period (7<sup>th</sup>-10<sup>th</sup> centuries)

In this section, we will show how an important new feature of the Islamic period, the strengthening of individual property rights over water, was linked to two new developments: the increasing amount of land held by political and economic elites, and the transformation of property rights over land. The latter was related to and influenced by changes in the tax assessment system. The overall result was that the state lost some of its control over water management as it came into the hands of new elites.

After the conquest, land-tax assessment in Iraq continued to follow the general outlines of Sasanian surplus collection, and the land tax remained the main source of state income.<sup>94</sup> The main land tax, described in juridical sources as the tax imposed on the land of conquered populations who had not accepted Islam before the conquest and had not signed a special agreement (*ṣulḥ*),<sup>95</sup> was usually called *kharādj*.<sup>96</sup> The word *kharādj* is undoubtedly of pre-Arabic origin (perhaps from the Akkadian *ilku*),<sup>97</sup> and it probably passed into Arabic usage through Sasanian administration. In the Hazār Dādestān, we find the word *harg*, which probably refers to the land tax. In the documents of the Pahlavi archive in Berkeley, we find a functionary called *frašn-hargarīg*, who probably had to identify the contributors subject to the land tax, since *frašn* means question and *hargarīg* is related to *harg*. Tax assessment on *kharādj* land mainly followed a system called *‘alā l-misāḥa*: a fixed amount of money and/or crops was collected from a fixed portion of land (usually one *djarīb*, that is, 1,592 m<sup>2</sup>),<sup>98</sup> thus continuing the Sasanian system in this respect.<sup>99</sup> Like the Late Sasanian kings, the Umayyads also carried out land surveys. For example, a land survey in Northern Mesopotamia was held in 691/2,<sup>100</sup> and a land survey of the

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<sup>94</sup> Guitty Azarpay, Kathleen Martin, Martin Schwartz and Dieter Weber, ‘New Information on the Date and Function of the Berkeley Middle Persian Archive’, *Bulletin of the Asia Institute*, 17 (2003), 17-29.

<sup>95</sup> Campopiano ‘L’administration’; Fred Donner, *The Early Islamic Conquests* (Princeton: Princeton University Press, 1981), pp. 239-240.

<sup>96</sup> Campopiano, ‘Land Tax’.

<sup>97</sup> Wilfred van Soldt, ‘The Akkadian Legal Texts from Ugarit’, in Sophie Démare-Lafont and André Lemaire (eds), *Trois millénaires de formulaires juridiques* (Geneva: Droz, 2010), pp. 85-124.

<sup>98</sup> Walther Hinz, *Islamische Masse und Gewichte* (Leyden: Brill, 1955), pp. 55 and pp. 65-66.

<sup>99</sup> Michael G. Morony, *Iraq after the Muslim Conquest* (Princeton: Gorgias Press, 1984), p. 100.

<sup>100</sup> Chase F. Robinson, *Empire and Elites after the Muslim Conquest. The Transformation of Northern Mesopotamia* (Cambridge: Cambridge University Press, 2000), pp. 44-50.

Sawād was conducted in 105 AH (723-724 AD) by the governor ‘Umar Ibn Hubayra, at the request of King Yazīd II.<sup>101</sup>

However, water management and, in particular, land reclamation, were also entrusted to private initiatives. To a large extent, water management passed into the hands of new landed elites. Reclamation was encouraged through land grants and tax cuts. Islamic law granted ownership of the soil to people who revived ‘dead land’, land out of tillage, usually because of a lack of irrigation. These *qatī’a* (the Arabic word for these land grants) could yield very high revenues. ‘Abd Allāh ibn Darrādī, for example, was able to reclaim swamp land that yielded five or even 15,000,000 dirhams (silver coins).<sup>102</sup> These land grants could be enormous, covering as much as 1,592 m<sup>2</sup>.<sup>103</sup>

There were disputes among the jurists concerning the necessity of having a land grant as a condition for taking possession of the land. At-Ṭaḥāwī (853-893) writes that according to Abū Ḥanīfa, land could only be reclaimed by agreement of the Imam, a principle with which he agreed.<sup>104</sup> The concession (*iqṭā’*) of the Imam became void if the person who wanted to reclaim the land had failed to cultivate it within three years.<sup>105</sup> To a large extent, this was a theoretical discussion; land grants and reclamation went together. In most cases, only the wealthy were able to undertake this work, and this led to an expansion of the big estates.<sup>106</sup> Arabic sources offer some concrete evidence of how members of the elite were awarded these grants. One interesting example is provided by Al-Balāḍurī, the famous historian of the Arab conquest, who describes the reclamation project of Maslama, the son of the Umayyad caliph ‘Abd al-Malik, in Southern Iraq during the reign of al-Walīd (705-715).<sup>107</sup> Maslama proposed to invest money in a reclamation project, the cost of which had been estimated at about 3,000,000 dirhams. Maslama

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<sup>101</sup> Wadād al-Qāḍī, ‘Population Census and Land Surveys under the Umayyads (41-132/661-750)’, *Der Islam* 83 (2006): 341-416, at 365.

<sup>102</sup> Campopiano, ‘State’, 20.

<sup>103</sup> Michael G. Morony, ‘Landholding in Seventh-Century Iraq: Late Sasanian and Early Islamic Patterns’, in Abraham L. Udovitch (ed.), *The Islamic Middle East, 700-1900. Studies in Economic and Social History*, (Princeton: The Darwin Press, 1981), pp. 135-75; Michael G. Morony, ‘Landholding and Social Change: Lower al-Iraq in the Early Islamic Period’, in Tarif Khalid (ed.), *Land Tenure and Social Transformation in the Middle East* (Beirut, American University of Beirut, 1984), pp. 209-222.

<sup>104</sup> At-Ṭaḥāwī, *Mukḥṭar* (Cairo, 1853), p. 134.

<sup>105</sup> At-Ṭaḥāwī, *Mukḥṭar*, p. 135.

<sup>106</sup> Hugh Kennedy, ‘Elite Incomes in the Early Islamic State’, in John Haldon and Lawrence I. Conrad, *The Byzantine and Early Islamic Near East*, VI. *Elites Old and New in the Byzantine and Early Islamic Near East* (Princeton: Darwin Press, 2004), pp. 13-28.

<sup>107</sup> Michael J. de Goeje, *Liber expugnationis regionum, auctore imaimo Ahmed ibn Jahja ibn Djabir al-Belaidisorii* (Leyden: Brill, 1866), p. 294.

requested that the land that remained under water be given to him as *qatī'a*. The reclamation project was so successful that farmers were brought in to work the land, and many other people entrusted their farms (*diyyā'*) to Maslama for 'protection'.<sup>108</sup>

Specific tax arrangements existed to promote land reclamation. Owners of privately reclaimed land usually only paid the tithe (but there were juridical debates concerning this point) or even only half of the tithe, due to the extensive artificial irrigation works or drainage that had been carried out.<sup>109</sup> Many of the land grants given by caliphs and governors consisted of dead land from the area around Basra, a tithe-paying area important for its sugar cane plantations.<sup>110</sup> The largest estates were frequently used for market-oriented monocultures, often, from the end of the seventh century, due to the introduction of *Zandj*, the African slaves mentioned above.<sup>111</sup>

We have stated that in the Sasanian period permanent share-cropping for one-quarter to one-third of the crop, dominated the property structure. After the Islamic conquest, while the landed elites were expanding their influence, it also seems that short-term leases were becoming the dominant form of land tenure, creating insecurity and therefore reducing tenants' incentives to invest in land. In early medieval Iraq, sharecroppers holding grain land (*muzāra'a*), held their land mostly for only one or two years.<sup>112</sup>

The need to maintain good relationships between the new dynasty and the landholding elites of Iraq probably led to the redefinition of the system of surplus extraction and distribution. The land-tax collection system was reformed, with the diffusion of a new system of tax assessment, the *muqāsama*, on *kharāj* land in Iraq. According to al-Balādhurī, at the end of the reign of al-Manṣūr (754-775), the Muslims of Iraq requested that the tax assessment system be changed. Under al-Mahdī, a new taxation system was enforced, based on a share of the crops. This system was known as *muqāsama*. Yahyā Ibn 'Adam wrote of the *muqāsama* in the Sawād: 'the people (*nās*) asked for this from the ruler in the last period of the Caliph al-Manṣūr's reign'.<sup>113</sup> Under this form of tax assessment, instead of a fixed amount of money or

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<sup>108</sup> Campopiano, 'State', 20-21.

<sup>109</sup> *Qudāma ibn Ja'far's Kitāb al-kharāj*, p. 37 (English translation), p. 123 .

<sup>110</sup> Ouerfelli, *Le sucre*, pp. 20-24; Husam es-Samarraie, *Agriculture in Iraq During the 3rd Century AH* (Beirut : Librairie du Liban, 1972), p. 94.

<sup>111</sup> Popovic, *La révolte*, pp. 62-3.

<sup>112</sup> Van Bavel, Campopiano, Dijkman, 'Factor Markets', 269-270.

<sup>113</sup> Al-Balādhurī, *Kitāb futūḥ al-buldān (Liber expugnationis regionum, auctore imāmo Ahmed Ibn Jahja Ibn Djabir al-Belādsori)*, ed. by Michael J. de Goeje (Leiden: Brill, 1866), p. 271.

crops, taxpayers were required to pay a share of the crop: one half of the crop for land irrigated by flooding, a third for land irrigated by waterwheel, and one quarter for land irrigated by animal-turned wheels, according to al-Māwardī.<sup>114</sup> According to Qudāma Ibn Dja‘far, the system was introduced thanks to the support of Abū ‘Ubayd Allāh,<sup>115</sup> the first author to write a book on *kharādj*, who was appointed under al-Mansūr to the retinue of his heir al-Mahdī, and vizier under al-Mahdī’s government (probably appointed in 775, died 786-787).<sup>116</sup> This reinforces the notion that there was an agreement between the Muslim Iraqis (*nās* in the Arabic text of Balādhurī) and a scholar who held a key position in the imperial administration (the vizier). Scholars who have investigated the economic views of Abū Yūsuf have explained his support for *muqāsama* on the grounds that this system would be more bearable for farmers.<sup>117</sup> This is an important point; local elites would doubtless have preferred to avoid having peasants flee the land due to an excessive tax burden. Ibn al-Muqaffa‘, for example, complains of the oppressive effects of *‘alā ‘l-misāḥa* and of the absence of clear regulations for farmers.<sup>118</sup> However, one should not forget the larger economic and social context in which surplus extraction took place. The dependent peasantry mainly worked the land of the Iraqi Muslim landed elite. The surplus that was extracted had to be shared between the landed elite, who were taking rent, and the state, which was taking taxes. Moreover, the Abbasids, who had been in power for about twenty years, had to maintain good relations with the Iraqi Muslims, who had given them valuable support in their rise to power. The *muqāsama* would have implied a less stable tax income for the state compared to the fixed amount of cash or crops collected under the *‘alā ‘l-misāḥa* system.<sup>119</sup>

However, the potential for weakening effects did not go unnoticed by Muslim scholars. For example, aṭ-Ṭabarī (839-923) gave a favourable account of the tax reform enforced by Husraw, since cadastral assessments, a land tax based on fixed rates and a centralisation of tax

<sup>114</sup> Al-Māwardī, *al-Aḥkām al-sulṭāniyya wa- l-wilāyyā al-dīniyya* (Beirut: Dār al-Kutub al-‘Ilmiyya, 1980), p. 221.

<sup>115</sup> Qudāma ibn Dja‘far, *Kitāb al-kharādj*, p. 118 .

<sup>116</sup> Campopiano, ‘Land Tax’, 258.

<sup>117</sup> Verrier speaks of ‘plus juste et plus équitable’ taxation; Ramon Verrier, *Introduction à la pensée économique de l’Islam du VIII<sup>e</sup> au XV<sup>e</sup> siècle* (Paris: L’Harmattan, 2009), p. 69; ‘with the adoption of a proportional rate, variations in the price of grain will not significantly affect the burden on farmers’; M. Nejatullah Siddiqi-S. M. Ghazanfar, ‘Early Medieval Islamic Economic Thought: Abu Yousuf’s (731-798 AD) Economics of Public Finance’, in S.M. Ghazanfar (ed.) *Medieval Islamic Economic Thought. Filling the Great Gap in European Economics*, (New York: Routledge Curzon, 2003), pp. 209-227, at p. 216.

<sup>118</sup> Francesca, *Il Principe*, p. 21.

<sup>119</sup> Qūdama Ibn Dja‘far affirms that the *‘alā ‘l-misāḥa* would have protected the State against price fluctuations: Qudāma Ibn Dja‘far, *Kitāb al-kharādj*, p. 40 (English translation), p. 119 .

revenue would have strengthened the state.<sup>120</sup> As taxation was not based on fixed cadastral assessments, but required a calculation of the state's share, the role of intermediaries who could ensure some form of stable income became more important. The difficulty of estimating tax revenue was one of the reasons why the Abbasid Empire resorted to using more tax-farmers, as the latter would pay a fixed sum to the state in exchange for tax-collection rights. The recourse to intermediaries finally culminated in the creation of the *iqṭā'* system, a devolution of tax collection rights in exchange for services to the state (such as military service) under the Buwayhid (945-1055). Tax-farming and *iqṭā'* either assured a more stable income for the state, or saved the government from paying salaries to officers and soldiers and hiring agents to collect taxes around the empire. The role played by tax-farmers (*ḍāmin*) was extremely important. In the year 280 AH, for example, the entire Sawād income depended on a contract with Aḥmad Ibn Muḥammad aṭ-Ṭā'i.<sup>121</sup>

Tax-farming was possible at different levels; at the level of central or local government, or even at that of smaller districts. Before a contract was signed, the sum to be handed over to the state, which consisted of the general amount of revenue and all extra charges, was fixed on the basis of previous income from that area. At the request of the tax-farmer, the treasury could also allocate some funds for important works in the farmed area, such as irrigation. However, the tax-farmers were expected to undertake tasks such as ground amelioration and hydraulic works, and their activities were controlled by inspectors.<sup>122</sup> As the contract ran for a limited period, the interest of the tax-farmer lay in the opportunity to minimise costs (including ground amelioration costs) in order to maximise profits. He therefore had a greater interest in 'squeezing' money from tax-payers than in investing in water management. The tax-farmer was forced to hand over a fixed sum to the state, even if the general revenue was smaller than the sum agreed in the contract.<sup>123</sup> In the case of a decline in revenue, the tax-farmer, who was unable to modify the sum to be handed over to the state, would try to increase the burden on the taxpayers. To offer the necessary financial guarantees to the state, tax-farmers had to be chosen from the upper echelons

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<sup>120</sup> Ulrika Mårtensson, 'Discourse and Historical Analysis Discourse and Historical Analysis: The Case of al-Tabarī's "History of the Messengers and the Kings"', *Journal of Islamic Studies* 16/3 (2005): 287-331.

<sup>121</sup> Makoto Shimizu, 'Les finances publiques de l'Etat Abbaside', *Der Islam* 42 (1965): 1-24; for the contract with Aḥmad Ibn Muḥammad aṭ-Ṭā'i: H.F. Amedroz (ed.) *The Historical Remains of Hilāl al-Sābi. First Part of his Kitāb al-Wuzara (Gotha Ms. 1756) and Fragment of his History (389-393) A. H. (B. M. Ms, add. 19360)*, (Leyden: Brill, 1904), pp. 10-11.

<sup>122</sup> Frede Løkkegaard, *Islamic Taxation in the Classic Period with Special Reference to Circumstances in Iraq* (Philadelphia: Porcupine Press, 1978), p. 96.

<sup>123</sup> Shimizu, 'Les finances', 12-14.

of Abbasid Society. According to al-Muqtadir's vizier Ibn al-Furāt, three social groups could act as tax-farmers; merchants (*tādjir*), trustworthy officers (*'āmil waḥī*) and wealthy landlords (*tān ḡhanī*).<sup>124</sup> The role played by merchants, and in particular grain merchants, is very relevant, because it suggests a clear link between tax-farming and the grain trade. Tax-farmers often abused their position in order to speculate on grain prices.<sup>125</sup>

To summarise, the establishment of water management policies in the Early Islamic period fell first into the hands of large landowners with strong political ties, and then into the hands of tax-farmers, who were often also powerful landholders, merchants and important officials. This pattern of limited intervention by the central authority and interaction between central rulers and local communities was typical of the Sasanian period.

## Conclusion

The article has shown how organisation of water management in Late Antique and Early Medieval Iraq should be studied in the broader institutional context in which it is placed (property rights, tax administration etc.). The organisation of water management in Late Sasanian Iraq depended on a highly complex system of interaction between local communities, aristocratic rulers and the imperial bureaucracy. This interaction allowed the government to gather information from different regions of the empire and to understand the needs of the different stakeholders. As such, the system provided a favourable institutional framework for the expansion of irrigated agriculture.

The system changed when landholding conditions were transformed in the Early Islamic period. We have argued that in this period, changes were made to the system of tax collecting and land tenure that favoured landed elites. These ninth-century transformations allowed the influence of a group of tax-farmers (large landholders, merchants and important officials) to increase. Irrigation policies were therefore bent to the interests of these new elites, which often lay in short-term gains rather than in long-term success. As suggested by Van Bavel, Campopiano, and Dijkman, the eighth and ninth centuries saw the rise of an elite of landholders, tax-farmers and merchant bankers, who came to control a large part of the land and its

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<sup>124</sup> Amedroz, *The Historical Remains*, p. 71.

<sup>125</sup> Aḥmad Ibn Muḥammad at-Ta'ī's speculations concurred with rising prices in Baghdad in 272 AH; at-Ṭabarī, *Ta'riḫ*, III series, 2110; Shimizu, 'Les finances', 16.

surpluses.<sup>126</sup> We can add that they also came to control the water management system, using it to serve their short-term interests. The fact that they managed to achieve the upper hand in water management often led to the exclusion of other stakeholders, such as local communities, in the process of forming water policies. My research strongly suggests that in the long run, these socio-economic and institutional changes contributed substantially to the breakdown of the agricultural system in Ancient Iraq.

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<sup>126</sup> Van Bavel, Campopiano, Dijkman, 'Factor Markets', 281-284.