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‘The same procedure as last year’: managing competition and conflict over water in classical antiquity

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Conflict over water, or at least the potential for conflict, seems to be more or less inevitable in most societies; it is no coincidence that the word ‘rivals’, and cognates in other European languages (Rivalen, rivali, rivals etc.), derives from the Latin *rivales*, those who share a bank or own land adjacent to the same watercourse – competition and rivalry are assumed in such a situation. This is most obviously due to water’s status as an essential, multi-facted resource, for human survival, for agricultural production and the watering of animals, for many forms of industrial activity, for transport and travel, and for social and cultural purposes; a resource whose supply is sometimes limited and often highly variable, both intra- and inter-annually. Further, water has a dual nature; in some environments, it can be a threat, a destructive, unpredictable and extremely powerful force, so that the rivalry between neighbours lies less in securing an adequate share of the supply of water, even at the expense of one’s rival, than in diverting excess water from one’s own land and thus avoiding the impact of flood, erosion and so forth – even at the expense of one’s rival. The fact that the United Kingdom this summer experienced what has been called ‘the wettest drought ever’, with destructive floods alongside restrictions on water use, sometimes even in the same districts, emphasises the paradoxical nature of water.

Obviously the degree and nature of water conflict varies widely between different periods and different societies, for a combination of reasons. The availability of water (or the extent to which excess water represents a problem) at a given time of year in any particular district or region depends on the combination of weather patterns (i.e. timing and amount of precipitation, level of evaporation), geology (water retentiveness of the soil, level of run-off rather than absorption) and topography (relief, course of streams and rivers, presence of marshland or lakes) – all of which are often to some extent interdependent. Of particular importance is the degree of variation in supply, both within the year and across a period of

years – the predictability of water supply and the likelihood of periodic crisis. Secondly, there is wide variation in the level and nature of demand, both in aggregate and at different times of year, depending on the size of the population, the nature of the productive regime (how much water is required for different forms of agriculture, pastoralism, industry) and the social and cultural uses of water (hygiene, ritual, leisure) – which may involve differentiation between water sources, and hence competition over them, in terms of quality as well as quantity. Thirdly, there is wide variation in the technology available for channeling, storing and managing the flow of water on different scales, in the knowledge of climatic patterns and hydraulics that can inform the management of water supply (up to a point; as the many destructive floods worldwide just in the last few years demonstrate, rainfall remains highly unpredictable at the best of times) and in the political and social institutions developed to manage conflict between neighbours, whether developed specifically for water conflicts or more general systems of social order.

In brief, different societies face different problems with regard to the supply and management of water, and respond to these in very different ways. Water thus becomes a crucial test case for understanding the developing relationship between societies and their environments: the different ways in which a society with particular patterns of water use can adapt to a given precipitation regime, whether by limiting population growth (crudely, a Malthusian view of the availability of essential resources establishing the maximum number of people that the region can support) or adopting/developing technological solutions or changing consumptive practices. As always, I find Braudel's metaphor of the 'limits of the possible' useful for thinking about these issues; the availability of water does not represent an absolute limit on human activity, but going beyond those limits may require substantial investment of energy and other resources, and may have unintended consequences. It is entirely possible, for example, to have luxurious golf courses and a flourishing market garden industry in the arid southern regions of Spain, but these developments are underpinned by elaborate and expensive technology (above all the infrastructure of international air freight) and driven by specific market conditions, and increasingly, maintaining them has adverse consequences for other regions (elaborate technology has certainly not banished all possibility of water conflict; quite the opposite). Of particular interest – compared, say, to the relationship between a particular society and the geology and topography of its region – is the degree of variation in the patterns of precipitation from year to year, and the possibility of substantial change in environmental conditions on a relatively short time-scale. Many studies of environmental history and the sociology of risk – and not least the limited response of

contemporary societies to the problems of climate change – suggest that human societies are relatively poor at responding to changes in structures, like the environment, that are assumed to be fixed. In the case of water, we are considering both the ways that societies develop in response to a context where variation can be considered normal (within a limited range, following a more or less predictable pattern) and the ways in which they respond, if at all, to more dramatic and less predictable changes. To use some other Braudelian terms, rainfall patterns can equally be understood in terms of *l'histoire événementielle* and *la longue durée*...

My focus in this paper is on the Mediterranean in classical antiquity, and on the period of the early Roman Principate in particular. Discussion of ancient environmental history invariably run into the question of whether 'the Mediterranean' is a meaningful or helpful term of analysis at anything other than the most general comparative level, and discussions of climate and precipitation are no exception (cf. attempts at identifying 'Mediterranean-type' climates in regions like California and Chile, defined largely by latitude and forms of vegetation). The claim of Horden and Purcell in *The Corrupting Sea* that the Mediterranean is characterised by 'unity in diversity' – in other words, it's the very degree of fragmentation and variation, in terms of topography and climate, that allows us to make meaningful generalisations about 'the Mediterranean' – simply emphasises the problem, and any plausible general statements must invariably be hedged around with qualifications – Egypt is always a special case, not least because of the Nile, and there are marked differences between the northern and southern shores. However, within these limits there is general about certain basic characteristics of the Mediterranean climate and its precipitation regime. Especially if contrasted to the Atlantic littoral, the tropics and continental Eurasia, the Mediterranean is characterised by fairly consistent temperatures in different seasons, and relatively predictable seasonal patterns of rainfall, resulting in similar vegetation across the whole region (whether or not one believes in the significance of the so-called 'Mediterranean triad' of crops – wheat, olives and vines – these are plants that flourish and have been extensively cultivated all round the Mediterranean littoral). Spring and autumn are both fairly short, though not absent altogether (unlike most of central and western Asia, for example). Winters are generally mild and damp, dominated by weather fronts coming in from the Atlantic; summers are generally dry and hot, dominated by weather fronts coming up from the Sahara.

The average level of annual precipitation is more than adequate for growing the standard range of food crops (including the Mediterranean triad), especially on the northern side of the sea; dry-farming techniques, designed to minimise the level of evaporation from

the ground and hence make the most of a limited amount of rainfall, have historically not been widely practised in peasant agriculture in most areas of countries like Spain and Italy, apart from inter-cropping (e.g. growing crops between the olive trees), which can be a means of maximising output from a limited amount of land as much as a means of limiting evaporation. However, the 'average' here is more than usually misleading. Rain in the Mediterranean tends to come in a number of heavy downpours rather than consistently through the winter months; further, the timing of this rainfall is crucial (a point emphasised by ancient agricultural handbooks), as farmers needed rain at the right moment in the autumn (for ploughing) and spring (for sowing), and never too much — floods could be as dangerous and destructive as droughts. While the average levels of precipitation, like the average temperatures across the year, look relatively favourable and pleasant, it would be equally accurate to characterise the Mediterranean climate as as 'harsh, violent and capricious' (Horden & Purcell again) and highly unpredictable, with frequent droughts, extremes of temperature, floods and storms. Above all, the fragmented topography of many regions led to wide local variation in rainfall from year to year and between different areas, with frequent 'rain shadows' so that one valley could experience a downpour while the valley next door remained in need of water (we might think of the scene in Marcel Pagnol's *Jean de Florette* where Jean Cadoret, desperate for water for his crops, can hear the thunder in the distance but his fields remain dry; the book emphasises the enormous advantage of having a perennial spring on one's land, especially if it lies in such a rain shadow).

The second crucial element in establishing the general context, as noted above, is the level of demand for water within classical culture – or rather, how it is likely to have compared with other pre-industrial cultures. Greek and Roman farming techniques, and the majority of crop varieties grown, were such that irrigation was not necessary if sufficient rain fell from autumn to spring – most crops were either harvested before the full heat of the summer, or were capable of doing without extra water. The obvious exceptions were those regions which did not generally receive suffient rain – the southern shores of the Mediterranean, above all – and the growing of fruit and vegetables, along with various forms of *pastio villatica* (raising small animals and birds for the table) and fish farming, where a continuing supply of water was essential. The general impression given by literary sources is that demand for these more 'luxurious' foodstuffs increased substantially under the Roman empire, at least in the vicinity of the major urban centres, above all Rome; the demand for specialised foodstuffs transformed the economy of the Roman *suburbium* in many ways, and demand for water was one of them – the work of Frontinus, at one time *curator aquarum*, on

the subject of aqueducts notes the problems with farmers out in the countryside illegally drawing water from the channels that were intended to supply the city. Studies of the archaeology of water supply in the Italian countryside show that most farms had cisterns, fed by rainwater or some other source, but that these generally contained no more water than would allow irrigation of crops for a couple of days. Insofar as fruit, vegetables etc. were grown on a commercial scale, rather than just as an adjunct to the household, they required a regular source of water.

Various industrial activities, such as brick-making and metal-working, required water, but not on a large scale. Mining could involve substantial quantities of water, with the development of techniques for exposing seams using controlled flooding, but this was not essential for the extraction of metals; rather than being a widespread demand for a share of the water supply, it was confined to those locations which had both rich mineral deposits and the water sources available to be made use of. A much more controversial and potentially more significant demand was the use of water for power, in driving mills. The traditional view was that the Romans made little or no use of water mills, relying largely on donkey mills or on hand-powered machines, and this was both a puzzle to be explained (by, for example, the theory that the prevalence of slavery inhibited the development and adoption of labour-saving technology) and a clear sign of the relative underdevelopment of the Roman economy; at the most, it was suggested, a few water mills were developed in a limited number of places under the later empire, perhaps in response to labour shortages. More recent research has made it clear that water-wheel technology was much more widely used, and developed at a much earlier stage, than the traditional view suggested – the large and elaborate structures with multiple wheels, known from archaeological remains at Bargel in France and from literary sources from Rome, were the industrial-scale exceptions, the culmination of a longer development, rather than an isolated occurence in late antiquity. The problem is much of this case rests on combining visual evidence that water-wheels were not unusual with the argument that the lack of unmistakable material evidence (e.g. on the scale of a Barbegal) does not imply the absence of water-mills in the many locations that were otherwise suited to them. The obvious problem is that this cannot tell us how common they actually were in different regions, and how far this may have created problems. Disputes over changes to the flow of water caused by alterations made to improve the performance of water mills were ubiquitious in medieval Europe; we do not have the records of actual court cases from the Roman period that might indicate whether such disputes were common then as

well, only the theoretical writings of the jurists (of which more below), that do not mention problems connected with water wheels – but don't have much to say about irrigation either.

The other significant aspect of the Greek and Roman demand for water is less pragmatic: the extent to which these societies, especially the Roman, placed water at the heart of many of their cultural and social activities. Springs and rivers were regarded as sacred, inhabited by supernatural beings that needed to be propitiated, and perhaps as a direct result sacred building complexes frequently incorporated fountains, pools and springs – not only those that were actually constructed around natural springs, but buildings like the Roman *nymphaeum* where water was brought in through artificial channels in order to create a spring. Waterfalls, pools and springs (sometimes constructed so as to appear natural, sometimes rigorously geometric) featured heavily in the homes and gardens of the wealthy elite, creating the desired atmosphere of *otium* (leisure) *salubritas* (healthfulness) and *amoenitas* (pleasurableness). The importance of bathing in Roman culture, valued equally for health (even if, as Scobie has argued, its effectiveness in this regard may be doubted) and as a social activity, is well known. The result was expenditure on a grand scale to manage water in an urban context; sewer systems to drain away waste water (primarily water from the marshy areas such as the Roman forum, rather than for hygienic purposes – few Roman houses were connected to the sewers) and aqueducts to bring in water from the surrounding countryside to supply fountains, bathhouses, public buildings and private houses. In one sense, this can be seen as a form of conspicuous consumption; as has long been recognised, the volume of water supplied by aqueducts to Roman cities far exceeded the requirements of their inhabitants for drinking water (and so cannot be used as a proxy for the size of the urban population, to the regret of many historians); however, it was regarded not as a luxury but as an essential element of life, a mark of civilisation. Frontinus noted that this investment in aqueducts, and the efforts devoted to developing this technology, was peculiarly Roman – 'with such an array of indispensable structures carrying so many waters, compare, if you will, the idle Pyramids or the useless, though famous, works of the Greeks!' (I.16) – but the emphasis here is on the practical wisdom of the Romans that they have provided themselves effectively with something that everyone would want, rather than seeing their consumption of water on a vast scale as itself in any way unusual or in need of explanation. In brief, the more that the Romans' wealth increased, with the concomitant expansion of urbanisation (most visibly in the growth of mega-cities like Rome) the greater was their consumption of water, both per head and in aggregate – at the same time as this same increase of wealth was increasing demand for water in the areas outside the city as well, with the expansion of

market gardening and the spread of the 'leisure' villas of the elite. Rome was an exceptional case, but every Roman city with any pretensions to status sought to have an aqueduct among its collection of public buildings, whether constructed at the expense of a local notable or of the emperor. The village of Romanised Gauls in Goscinny & Uderzo's *Le combat des chefs* seems all too plausible a portrayal of this aspect of the process of 'Romanisation': "We're going to build an aqueduct." "An aqueduct? But chief, we don't need an aqueduct. The river flows right through our village and our fields." "Then we'll redirect the course of the river! Aqueducts are more Roman!"

The third contextual element is technology, in the broadest sense. The ancients, and above all the Romans, have a well-deserved reputation for their prowess in this respect, with the development of hydraulic cement (i.e cement that will set even under water), lead pipes and siphon technology, and the surveying techniques needed to plan the routes for aqueducts. All these gave them considerable control over the channelling and storing of water. However, it is worth emphasising that these are found almost exclusively in the context of urban supply and distribution; what we know of the techniques involved in irrigation and rural water use is much more limited, relying on sluice gates and simple ditches (a few references in legal sources to channels lined with clay tiles and/or roofed over) for the distribution of water from rivers and other sources, along with a range of basic water-lifting devices like the Archmedian screw and the water-wheel. In his discussion of water-lifting machines, Vitruvius notes that through the *tympanum* 'a large quantity of water is furnished for irrigation in gardens, or for supplying the needs of saltworks' (10.4.2); in the case of the pump of Ctesias, however, 'water can be supplied for a fountain from a reservoir at a lower level' (10.7.3). As with water-mills, the difficulty is knowing how widespread the use of such devices may have been, in the absence of material evidence, and in particular whether we can trust the overall impression that the most elaborate techniqes and technology were employed in supplying the 'water culture' of the cities – while bearing in mind that, if true, such a situation might still reflect the choice of the most appropriate technology for different purposes, rather than simply the dominance of consumptive rather than productive uses in the allocation of resources.

Finally, there are the distinctive systems and institutions for the management of water resources and above all for the resolution of conflicts. Leaving aside the long-standing systems of Egypt, we have epigraphic evidence for the existence of formalised schemes for distributing water from a shared source between different users from Italy, Spain and North Africa, along with some passing references to a scheme in the neighbourhood of Rome in

Cicero's letters and Frontinus' work on aqueducts. The inscriptions from Spain and Numidia provide sufficient contextual information to indicate that the schemes were set up by the Roman authorities following the breakdown of existing informal arrangements. It seems entirely possible, as Brent Shaw for example has argued, that the scheme at Lamasba in Numidia simply institutionalised long-standing native arrangements (above all, the allocation of water rights to particular pieces of land, and the distribution of the water by time rather than volume), rather than imposing an entirely new system along Roman lines. The Spanish case may be more complicated as it has to govern relations between two different communities, one up-stream and one down-stream, and includes many more clauses governing responsibility for different sorts of maintenance and repair work, that may not have existed in any form before the intervention of the authorities. Beyond the simple fact that in the one case there was a break-down of social cohesion within the community, and in the other a breakdown of relations between two different communities, we know little about the precise causes of the conflict over water resources; above all, the question of whether this was primarily the result of changes in the social or political context (for example, an influx of newcomers leading to disputes) or of a shortage of water, and if the latter whether this was because of increased demand (new uses, increased population) or decreasing supply, either a short-term fall in precipitation or longer-term climate change. What we can say is that different regions of the empire had well-established schemes for the allocation and distribution of water resources, but that these were not capable of managing every possible conflict without the intervention of external authorities.

The Italian evidence is relatively scant, simply showing that in at least one case the water was distributed in regular quantities on set days (which corresponds to references in the legal sources), and in one case the quantities supplied were determined by the length of time during which a given estate was entitled to draw water; Cicero paid a regular sum to the municipal authorities in the town of Tusculum for his right to draw water from the former source, known as the Aqua Crabra. It is possible that, as in Numidia and Spain, these schemes were established formally after previous, less formal arrangements had broken down; it is equally possible that the high level of demand for water in the immediate vicinity of Rome by this date, as discussed above, meant that the local authorities were able to charge users for their share of this public resource, both as a means of rationing supply and as a source of income. Perhaps in imitation of such schemes, the right to draw water from the aqueducts of Rome (and also the aqueduct of Venafrum in Campania, known from an inscription) was sold by the imperial authorities to rural users. This does seem to mark a

significant difference from the distribution schemes in Numidia and Spain, where there is no mention of any charge simply for having access to the water supply (as opposed to, at least in the Spanish case, financial obligations incurred as a result of having access to the water, namely to maintain and repair the watercourse). In Italy, access to water was (or at least could be) determined by wealth, rather than simply membership of the community and ownership of land adjacent to the water source; as a result of the influence of the city of Rome, arguably, the market principle held much greater sway here than elsewhere.

As well as these distribution schemes, in which access to a particular water source was more or less formally regulated, there are the extensive comments by Roman jurists on water rights and the management of conflict over them, preserved in Justinian's Digest of Roman Law in the sixth century; the legal principles employed in the resolution of conflicts between individuals rather than conflict within or between entire communities. Arguably, these precepts may relate to relatively small-scale disputes in terms of the water source in question as well as the number of people involved – so, private disputes over small springs and streams rather than larger 'public' rivers – though in fact the jurists include some discussion of laws relating to the latter as well, above all the requirement to keep the water flowing sufficient for navigation – in other words, the right to channel water from such a source could be curtailed if it conflicted with the needs of the wider community, an important legal principle. By implication, the role of Roman municipal authorities in managing the assets of the whole community, the best-known example being the management of public land, a highly contentious topic in certain periods, provided the underpinning for the water distribution schemes seen in Italy, but this is not discussed expressly by the jurists.

Justinian's Digest is a compilation of what were felt by its compilers to be the most salient arguments and opinions from several centuries of debates and discussions between different jurists carried out through their writings; their decisions on which opinions and interpretations should be given precedence – effectively, which opinions were to be accorded the status of law – were, insofar as this can be reconstructed, based partly on the inherent logic of the arguments and partly on an established tradition of individual authorities. It has to be stressed that, before this work of editing and compilation in the sixth century, there was no such thing as the 'body of Roman law' on this or any other subject, but only an unmanageable morass of competing interpretations of and arguments about a limited number of official pronouncements and principles (the standard format of a section of the Digest begins with a citation of what "the praetor says", followed by a vastly more extensive discussion of what this means in practice). Especially given that those administering the law

in the cities of the empire were effectively amateurs rather than trained lawyers, we may assume that the majority of magistrates were at best familiar with the principles set out by earlier praetors, and perhaps with a few of the jurists' commentaries. Even if the Digest itself is consistent in its treatment of a particular issue – which is not always the case – actual Roman practice in earlier periods need not have been. Our knowledge is further limited by the fact that we do not have any actual case records, to see how Roman justice may have worked in practice, only these abstract theoretical arguments; the closest we have to such concrete examples are the relatively detailed records made by Christians of the trials of martyrs, which seem to reinforce the impression that the adjudicating magistrates had an extremely free hand in deciding cases on their own authority, with reference only to a limited number of general principles and imperial pronouncements.

One thing that the juristic texts do offer us is a sense of the kinds of situations that could arise; a significant theme in their approach to legal argument is the construction of hypothetical scenarios as a means of exploring the implications and limitations of different legal interpretations. Obviously it is possible that these scenarios were constructed solely to provide a complex legal problem, rather than having any purchase on reality, but the rhetorical style is one of down-to-earth realism, and where we do have external evidence for particular themes – for example, the management of auctions of agricultural produce, or the operation of loans and other financial arrangements – it generally meshes quite easily with the legal material. We can, then, get an idea of what kinds of conflict were envisaged, such as the case of the man who sent his slaves to prevent his neighbour from chaneling water (which raises interesting issues of agency and responsibility) and the problems created when floodwater drained from one estate into another without any intent on either part. More importantly, however, the Digest may offer us a sense of Roman legal thinking with regard to water resources, the ways in which the issues were generally understood and the kinds of principles that governed judgements; and this may be revealing of broader Roman attitudes and conceptions, rather than being solely a legalistic perspective, insulated from reality.

Rather than taking this for granted, however, I want to focus for the remainder of this paper on one of those general principles, arguably the most important one invoked in the context of disputes over water (in cases both when water was a desirable resource and when it was a problem). My aim is to use this example as a means of opening up a series of questions about Roman conceptions of water and its exploitation, above all because the legal principle appears, at least at first glance, to be quite at odds with the reality of the Mediterranean environment and the particular nature of water.

> *Digest* 43.13.1: Ulpian, *edict, book 68*: the praetor says: "I forbid anything to be done in a public river or on its bank, or anything to be introduced into a public river or on its bank, which might cause the water to flow otherwise than it did last summer." 1. By this interdict the praetor has made provision against a river's drying up because of unauthorised tapping by watercourses, or bringing any injury to neighbours by changing its bed. 2. It applies to public rivers, navigable and unnavigable. 3. The praetor says: "which might cause the water to flow otherwise than it did last summer." So not everyone who introduced or did something is liable, but only one who by doing or introducing something causes the river to flow otherwise than it did last summer. The words "flow otherwise" do not refer to the volume of the water, but to the manner and direction of its current. So it is generally to be said that someone is liable under the interdict of what he has done changes the current by making the water deeper, or narrower and hence swifter, to the inconvenience of the neighbourhood.

There are a number of curious aspects to this passage, above all the contradiction between .1 and .3: is one of the primary purposes of this interdict to prevent excessive use of the water, as stated initially, or only to prevent substantial changes to its course/or and current? It is possible that Ulpian concentrates on the second aspect because the first was covered by the previous section, stipulating that nothing may be done to hamper navigation on a public river, including drawing off water (43.12.2: Pomponius: Nothing prevents water from being drawn off from a public river (unless the emperor or the senate forbid it), provided that it will not be water in public use. [a stipulation that effectively protects urban supplies at the expense of rural users]. But if the river is navigable or another river derives its navigability from it [a stipulation which appears to cover the vast majority of rivers, however small, in the vicinity of Rome, since they all flowed into the Tiber] it is not permissible to do this). In that case, it seems curious that the extraction of water was mentioned here at all. However, the most important question about this passage is the practicality of its key principle, a principle that is found in a number of other areas of water law: the principle that everything should be based on the way things were the previous summer. This principle is applied to the right to channel water across someone's land, whether from a public or a private river; to the right to water animals from a stream, including the right to lead them across another's land to do so; and to the right to draw water for any number of different purposes, both rural and urban:

> 43.20.1: Ulpian, *Edict, book 70*: The praetor says: "Insofar as you have this year drawn off water in question not by force or stealth or *precarium* from such a one, I forbid force to be used to prevent you from drawing it off in this manner.

The basic question is this: given what is known about the variability of rainfall patterns in the Mediterranean from year to year as well as in the course of the seasons, how could this principle possibly work as a basis for resolving conflicts and informing legal judgements? In this environment, the most likely source of conflict was not that one person extracted water illegally or exceded his allocation to the detriment of another, but that in years with a reduced supply of water, let alone in a drought situation, an individual exercising his full legal right to extract water might nevertheless be injuring his neighbour by preventing him from exercising his own rights to extract water. The supply of water is likely to be variable from year to year; how useful, then, is a principle that seeks to exclude such variability, basing judgements on conformity to the way things were in the previous summer (because, Ulpian claims, the flow of the water in the previous summer is less open to doubt than its flow this summer or in winter: 43.13.1.8) regardless of the particular circumstances of the present year?

A range of possible explanations for this problem can be suggested, some of which have previously been discussed by historians; none of them is without its problems.

1. Firstly, we may question how far the Romans were actually conscious of interannual variation in rainfall, or saw it as a normal feature of their environment rather than as a rare (if not catastrophic) event that might be interpreted as resulting from the anger of the gods – how far, we might ask, did the Greeks and Romans share the view of Horden and Purcell that their environment was characterised by variability, uncertainty and crisis? Certainly the impression given by the jurists in several passages is that their understanding of climate was fairly minimal; most obviously, the distinction they develop between winter and summer water implies at one point that there might be some water available only in summer – "if it is water that cannot be drawn off other than in summer... and if the place is such that by nature does not allow of water other than in summer" (43.20.1.3) – but this appears to be simply legal thoroughness in identifying every possible meaning of the term 'summer water', which is then defined primarily as "as what can indeed be drawn off daily, or only in summer, but is only drawn off in summer and not in winter, not because it cannot be drawn off in winter, but because this is not normally done". Daily water and summer water are defined by patterns of use rather than supply; water used daily throughout the year (for bathing and fountains,

industrial purposes, watering animals etc.) versus water used only in summer (most obviously for irrigating crops). The lack of a definition for 'winter water' presumably reflects the fact that there were no such additional season-specific tasks in winter; there is no reference to the possibility that summer water might be important precisely because it may be in shorter supply.

In the wider culture, it is clearly the case that at least some variation in rainfall and other climatic events was recognised; discussions of agriculture time and again emphasise the unpredictability of the weather and hence the uncertainty of the activity – "Zeus who holds the aegis has a mind unknowable for men and changeable", as Hesiod put it, although this is focused on the timing of rainfall in relation to the framing year as much as on its volume; even if you've missed the opportune time for ploughing, "if, from the third day, Zeus sends constant rain until the water rises to a point no higher than an ox's hoof but not much lower, then the farmer who ploughed late may rival him who did the job on time". A sixth-century CE parody of an astrological prediction gives a stronger impression of the role of risk and uncertainty in ancient agriculture, starting with rainfall:

> If your bit of land receives sufficient rain, and grows no crop of wild weeds; if frost does not break the furrows; if hail does not nip off the tops of the sprouting ears; if no deer grazes down the crops and if it meets with no other disaster from air or earth, I prophesy that your harvest will be excellent and you will cut the ears with success — only beware the locusts. Agathias Scholasticus

More scientific accounts of the weather, albeit operating according to an entirely different set of principles and assumptions from modern accounts, clearly emphasise variation and unpredictability, seeing continual movement and change:

> This region below the moon, and a long way below it, blends together an unlimited quantity from the upper element of air and an unlimited quantity of terrestial vapour, being a combination of both orders. From it come clouds, thunder-claps and also thunder-bolts, hail, frost, rain, storms and whirlwinds; from it come most of mortals' misfortunes, and the warfare between the elements of nature. The force of the stars presses down terrestrial objects that strive to move towards the sky, and also draws to itself things that lack spontaneous levitation. Rain falls, clouds rise, rivers dry up, hailstorms sweep down, rays scorch, and impinging from every side on the earth in the middle of the world, then are broken and recoil and carry with them the moisture they have drunk up. Steam falls from on high and again returns on high. Empty winds

> sweep down and then go back again with their plunder... So many living creatures draw their breath from the upper air; but the air strives in the opposite direction, and the earth pours back breath to the sky as if to a vacuum. (Pliny, *Natural History* 2.102-4)

This system is understood to be a combination of regularity (even if this cannot be properly perceived by mortals) and accident, resulting above all from the complex interactions of the influences of many different heavenly bodies:

> Storms and rain obviously have some regular causes, but some that are accidental, or at all events not hitherto explained. For who can doubt that summer and winter and the yearly vicissitudes observed in the seasons are caused by the motion of the heavenly bodies? Therefore as the nature of the sun is understood to control the year's seasons, so each of the other stars also has a force of its own that creates effects corresponding to its particular nature. Some are productive of moisture dissolved into liquid, others of moisture hardened into frost or coagulated into snow or frozen into hails, others of a blast of air, others of warmth or heat, others of dew, others of cold. (Pliny, 2.105)

The consequence, as Pliny notes both here and elsewhere, was variation in the flow of rivers and springs: the source of the river Po was noted for drying up at midday, while wells and springs often failed in September rather than in the summer, and some failed to return until the spring (*NH* 2.224-5, 31.42, 31.50-1). Of course, this is intra- rather than inter-annual variation, but Pliny does note that the taste of water varied according to the season and still more at times of drought, at least acknowledging the latter as a possibility. Finally, we may note that one possible reconstruction of a fragmentary section of the Spanish irrigation decree dealing with conflict between competing users locates this in the context 'an extraordinary watering cycle', most likely a period of shortage – again, without any indication as to whether such an event occurred in most years (e.g. in mid-summer when demand for water was at its peak and the supply might be diminished) or was a less regular but still expected occurrence.

On balance, given the clear awareness within ancient culture of variations in the level of rainfall and the availability of water, over the course of the seasons if not from year to year, the neglect of this as a relevant factor by the jurists seems curious; their world appears to be one in which year on year there is a sufficient supply for both daily use and for the additional demands in the summer months, without any expectation of a level of shortage that would prevent those with the right to extract water from exercising their right – unless this were to interfere with the navigability of public rivers. There is not even any reference to the

possibility that water might be in reduced supply at precisely those times of year when demand increased, and certainly none to the possibility that in certain years it might be entirely impossible for things to be done as they had been in the previous summer.

2. The second possibility is that there was indeed no serious problem, at least in certain areas of the Roman empire, and that the writings of the jurists reflected this local situation rather than that prevalent across much of the Mediterranean. This is the interpretation hinted at by Brent Shaw in his studies of irrigation in North Africa, pointing out the emphasis in Roman law on the control of flood waters and the need to ensure that flood water was drained away from fields as quickly and efficiently as possible – in contrast to the desperate need of African farmers to gain access to run-off waters – and noting the surprise expressed by Italian surveyors that African farmers built embankments to try to retain water rather than divert it from their property. Shaw argues that Roman law was concerned above all with flood control rather than irrigation, and that this was because it was developed in a region with numerous perennial springs and streams providing sufficient water for the inhabitants' needs in most if not all years. The implication is that Roman law's limitations with regard to irrigation conflicts simply reflected its original environment; meanwhile, communities in other regions of the empire, especially south of the Mediterranean, relied on storing run-off waters and carefully managing potential conflicts over access to the limited number of perennial or semi-perennial sources (such as at Lamasba); they had to rely on traditional, indigenous solutions because Roman assumptions and principles were simply inadequate. Although Shaw does not develop this point, one could argue that the extensive discussion of the rights to channel and draw water in the Roman jurists – which might seem to undermine his assertion that the legal texts are uninterested in irrigation and water supply issues – in fact focus almost entirely on the right to do things on another's land; in other words, this is the same kind of legal problem as a right of access across a field, with the fact that this right (technically known as a servitude on the land) is connected with water being irrelevant either to the legal issues or to the potential for disputes.

It is difficult to know how to evaluate this theory, given the impossibility of establishing either the level of demand for water in different regions of Italy or the level of supply. Thomas and Wilson have produced estimates for the amount of water required for different agricultural activities, and have surveyed the main water sources available for different areas in the vicinity of Rome (noting in passing that the ground water level today is significantly lower than it was in the Roman period, suggesting that there were probably

more springs and streams in the past). The main thrust of their argument is that cisterns were inadequate for all the population's needs, and that there was an extensive hydraulic infrastructure to support relatively intensive rural settlement (a result of the exceptional nature of the region around Rome, as argued above), reflecting substantial investment. What they do not argue is that this infrastructure was wholly adequate to meet all needs without any serious possibility of conflict between users, suggesting instead that the existence of a substantial body of Roman law on water rights, and the fact that Cicero consulted a legal expert in relation to the water supply of one of his estates (*pro Balbo* 45), points to the likelihood of disputes. We are left with the impressionistic picture offered by a few literary sources; on the one hand, the extensive evidence that there was high demand for water (above all the illegal tapping of aqueducts reported extensively by Frontinus) and the existence of distribution schemes, versus the curious absence of serious consideration of the problem of variable supply in the jurists, and the passing remark of Cicero that water was flowing well to his villa through its channel, despite the severe drought – perhaps the hydraulic infrastructure around Rome was genuinely adequate to prevent shortages and thus avoud conflict during dry spells, at least among the wealthier landowners who were likely to resort to the law.

3. A third possibility is that, rather than being shaped by a specific environment in the form of the immediate vicinity of Rome, the opinions of the jurists were not in fact influenced to any significant degree by the external environment at all, but rather by the internal dynamics of legal thought. There is clearly no direct evidence against which we can test this theory, but it is suggested by Joshua Getzler's exhaustive 2004 study of the history of water rights in English common law. Getzler's core point is that, despite a manifest need for adequate legal remedies for disputes in this area – with increasing demand for control of water, not so much for irrigation as for powering mills, especially in the early years of the industrial revolution – common law did not develop a coherent system of water rights until the 1850s, when it adopted a range of doctrine from American and Roman law.

This can be attributed in part to the problematic nature of the subject matter: flowing water cannot be possessed in a tangible fashion, only appropriated, and the complex interplay of diverse interests in any dispute over water rights was inherently unsuited to an adjudicative system. Common law sought to grasp the problem using its existing categories and principles, however inadequate for the problem; the law of possession was inappropriate, so legal writers concentrated initially on actions for either novel disseisin (implying that the plaintiff's title to his land was affected) or, more commonly, for nuisance (an action on the

plaintiff's land that affected his enjoyment but not his title). This involved a concentration on servitudes – the right to channel water across another's land, the right to enter the land to clear one's own channel and so forth – exactly as we have seen in Roman law; it is tempting, then, to conclude that Roman law was driven by a similar dynamic, unable and/or unwilling to consider flowing water as something that could be effectively possessed and hence compelled to concentrate on related actions (channelling water, driving animals to water) that *did* impact on the plaintiff's property. In legal terms (both Roman and English) there was no 'water right' in the sense of a right to enjoy a certain amount of water, only the right to do things (like constructing a channel or opening a sluice gate) that would, if the supply was sufficient, result in the temporary enjoyment (but never possession) of some quantity of water.

In other words, it was not so much that Roman law was incapable of resolving disputes over the rights of individuals to a certain share of a water source, so much as it did not recognise these rights in law as constituting any basis for action. Regardless of what one might call the reality of the problem, the established principles and categories of legal thought refused to consider it a problem if presented in that way; someone who felt disadvantaged by his neighbour's actions would need to formulate his case in terms that the law would recognise, for example claiming that there was no right to channel water or that an existing servitude had been abused. Only when the communal interest was threatened did the extraction of water itself become seen as a problem capable of legal resolution, an idea which in contrast did not become established in English common law, although Henry of Bracton in the thirteenth century, influenced by Roman law, had argued for the reasonable restraint of individuals' rights to extract water, analogous to the problem of over-stocking common land. A more typical view was that expressed centuries later by John Locke: water exists in abundance as a gift of nature, so it belongs to whoever takes it from a fountain in a pitcher. This was a doctrine even less well suited to drier parts of the world than the limited perspective of Roman law, but it was also extremely limited as a approach to resolving conflicts between mill owners along the same stretch of river; where reality was unhelpfully complicated, it was trumped by legal theory most of the time. We may suspect that variations in the level of rainfall from year to year were similarly uninteresting to the jurists when set against the power of the principle of consistency: same procedure as every year.

Insofar as Roman law offers any sort of solution to a conflict between two individuals over a water source with a reduced supply in a particular year, neither of whom can draw their

accustomed quantity of water without injuring the other, it is this: a double interdict will apply, so that neither party is permitted to take any action until the matter has been resolved. As we have seen, Roman law offers no guidance as to how the matter may be resolved; we are left to imagine that it might involve some form of compromise between the contending parties, most likely along similar lines (an agreement about when each is permitted to take water, perhaps, with further regulation of the size of conduit) to those water distribution schemes known from inscriptions around the Mediterranean. Arbitration and mediation are known to have been key elements of the practical operations of the Roman legal system, but elements which are rarely visible, in contrast to the apparent completeness of the juridical doctrines. Indeed, one obvious conclusion from this discussion is a still greater emphasis on the importance of informal, social solutions to conflicts over water, often (it appears) relying on traditional systems, even when an elaborate legal framework existed. It was not only in Numidia that the limitations and blindspots of Roman law were exposed; this was true in any region where water supply varied from year to year.

This raises some interesting questions about the currently popular interpretation of Roman law in terms of the ideas of New Institutional Economics, as a means of reducing transaction costs and thus promoting, or making possible, economic activities: without an elaborated system of property law, it is argued, individuals will be unwilling to risk any sort of investment in cultivating their land or building a business; without sales and contract law, market prices would have to include the costs of measurement and enforcement, pushing up prices and perhaps making the trade uneconomical. In these terms, Roman law on water rights seems decidely inadequate. Water was a vital production factor for various agricultural and industrial activities, as well as being in demand as a good in itself; however, not only was it not commoditised – so that farms and businesses were unable to guarantee the supply they needed through purchase – but there was no other mechanism to adjudicate formally between competing claims if the supply was limited. Unless the supply was indeed as abundant, in certain regions, as Shaw has implied, why would anyone take the risk of investing in a water-dependent activity such as market gardening or milling? The answer seems relatively straightforward. Firstly, to a much greater degree than today, activities were located close to the resources they required – we do not hear anything of attempts at growing lettuces in an arid region, and the availability of a suitable water supply is one of the key criteria promoted by the agricultural writers in choosing a farm. Secondly, traditional social institutions for sharing the use of a common resource and resolving conflicts between users were generally adequate, whether agreements between individuals or community-level systems; the law was

largely incidental to such arrangements, with the wealthy elite more likely to resort to it. The involvement of the Roman state in resolving water conflicts in Spain and Numidia might suggest the limitations of such informal institutions – but it might also be a product of the fact that there was now an external authority to whom one could appeal, whereas previously disputes would have been resolved locally. In a similar way, the growing role of money in giving access to water in the region around Rome – whether paying a rent to the local authorities, or buying the right to tap an aqueduct from the emperor – may reflect the especially high level of demand in that area, but also the way in which the growth of Roman power went hand in hand with the increasing pervasiveness of the market and the power of wealth. At any rate, the idea that the privatisation of a common resource, let alone one as vital as water, was a worrying development is not a uniquely modern phonomenon; the elder Pliny mourned the fact that the waters of two of the finest aqueducts in Rome were being diverted from the city through 'ambition and avarice' to the suburban villas of the wealthy. Even when the overall supply of water is sufficient, it is a locus of conflict between different systems of values.

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