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Chronicle of a disaster foretold: The politics of restoring Lake Urmia (Iran)

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ABSTRACT

Like many of the world's large-scale terminal lakes, the Urmia saltwater lake in northwestern Iran is undergoing a process of desiccation. The anticipated economic, social, environmental and health consequences of this are daunting. We set out to examine the policies that have been designed in response to the lake crisis in the past twenty years. We focus on the set of measures proposed by the Urmia Lake Restoration Program (ULRP) and explain why their impact on water savings are overstated while the potentially most effective measures are abandoned. We then discuss the various social, institutional and political factors that have led to this state of affairs. Identifying and understanding the array of political and other factors that combine not only to impede appropriate remedial measures but also to fuel the overexploitation of water are essential to our comprehension of how to avert unsustainable water futures.

1. Introduction

The Aral Sea catastrophe is arguably the most well-known poster child of the tragic consequences of overexploiting river systems while ignoring the environmental dimension of water. Its causes are well understood and its implications in terms of environmental degradation, loss of biodiversity, destruction of livelihoods, and human health well documented (Glantz et al., 1993; Peterson, 2019). Yet, many terminal lakes of endorheic basins worldwide have experienced, or are currently experiencing, a similar fate (Wurtsbaugh et al., 2017; Hassani et al., 2020), amid a general feeling of hopelessness and the display of catalogues of insufficient or flawed conventional measures. These include prominent lakes such as the Dead Sea in Jordan/Israel, Utah Lake or the Salton Sea in the US, Lake Poopo in Bolivia, or Poyang Lake in China. Endorheic basins are no different from any other river basins in the world that have followed a process of *closure,* wherein anthropogenic use has outstripped the available resource, leading to aquifer depletion and environmental desiccation (Molle, 2008; Molle and Wester, 2009). But what differentiates them is that the extension of their terminal lakes provides a visual and graphic benchmark of the impact of human activities on the water cycle, notwithstanding the possible influence of hydrological variability.

Considerable work has been devoted to documenting the shrinking of lakes and its dire consequences (Wurtsbaugh et al., 2017). Although, largely limited to distinguishing between natural/climatic and anthropogenic/human use factors, research on the underlying causes has identified an 'Aral Sea syndrome' (AghaKouchak et al., 2015) that includes 'technological optimism' (Wine & Laronne, 2020), upstream competition, water resource overdevelopment and the expansion of irrigated agriculture expansion, 'the primary driver of desiccation of global lakes' according to Wine and Laronne (2020). If, on the one hand, nobody denies that the devastating economic, health and environmental impacts of these phenomena should be averted at all costs and, on the other, their causes are well understood, then the unabated degradation of terminal lakes remains a policy riddle of paramount importance. We contend that the societal and political factors behind these returning 'Tragedies of the Commons' (ibid.:10) remain largely unaddressed and deserve more attention.

One of the most significant ongoing tragedies is the shrinking of Lake Urmia in northwestern Iran, which has lost 96 % of its volume in only 20 years, primarily as a result of water withdrawals in its basin (AghaKouchak et al., 2015; Hassani et al., 2020). After years of denial of the water crisis at the highest political level, in 2013 the newly elected president Hassan Rouhani proclaimed his resolve to fix the country's longstanding water management problems, including the crisis of Lake Urmia, the world's second-largest hyper-saline lake. His concern quickly

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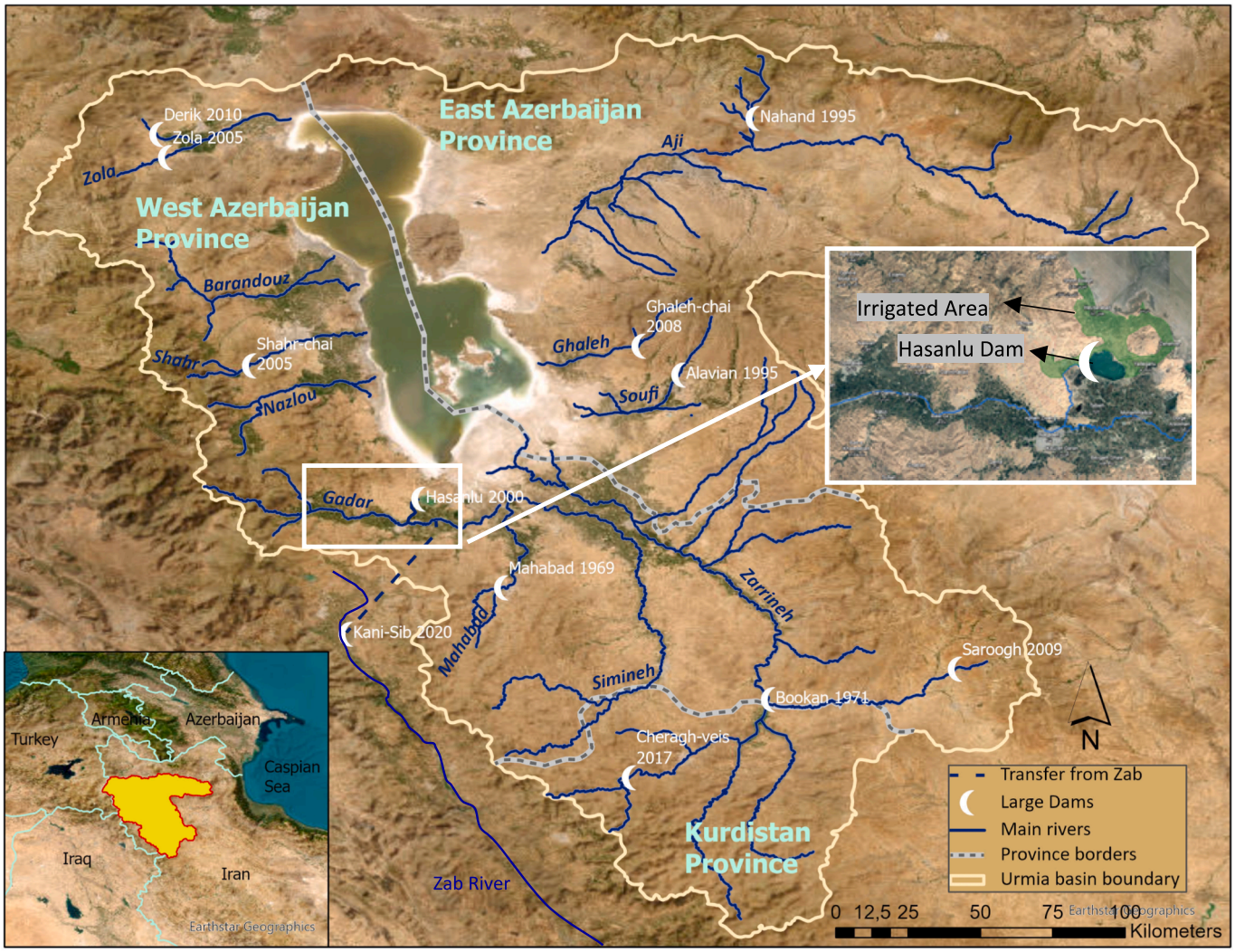

Fig. 1. Lake Urmia and its main contributing rivers located in three provinces, and the inter-basin water transfer project from the Zab basin.

translated into the Urmia Lake Restoration Program (ULRP) (Salimi et al., 2019). Framing the fate of Urmia Lake as an issue of national importance, Rouhani himself stated that its demise could affect 50 million Iranians, with severe health problems from salt winds and forced migration. Seven years later, capitalising on a good rainy season and some recovery of the water level, the president and ULRP representatives celebrated their achievements in the lake's restoration. Yet, in 2023, its water level had fallen back to the lowest historical record.

Massive scientific research has been conducted to understand the crisis. A recent review of scientific publications dealing with the status and future of Lake Urmia identified over 500 articles published in the past 15 years (Parsinejad et al., 2022). The overwhelming majority of these, however, are concerned with particular bio-physical aspects of the lake, its basin or water use. In this paper we chronicle the policy process, examining the various initiatives taken by the central government between 2008 and 2021 to address the impending catastrophe, as well as the constraints faced by decision-makers. Our central concern is to foreground the political aspects, both structural and processual, of the ULRP's implementation in answering the questions of why and how substantial scientific, financial and high-level political support has been ineffective in averting the looming crisis. Not only is Urmia Lake the world's second largest hypersaline lake; its proximity to the Aral Sea makes it a fascinating case through which to unveil the deep drivers behind the replication of the 'syndrome'.

The Urmia Lake story intersects with a number of research fields from which we draw inspiration and to which we contribute. First, it is a textbook example of river basin closure, where unchecked withdrawals gradually reduce outflow (to the lake) and generate tighter interdependence and competition between users and between users and environments. We use Molle (2008) analysis of the societal and political factors leading to basin 'overbuilding' and closure. Iran is a country that resonates with the literature on the 'hydraulic mission' (Worster, 1985; Swyngedouw, 2015; Molle et al., 2009) that foregrounds the role of state water bureaucracies in the preference given to capital-intensive infrastructural solutions. We also show the importance of cultural/cognitive frames that sustain 'the rationality project' (Stone, 2012) pursued by experts and bureaucrats to rescue policy from 'irrationalities and indignities of politics'. Together with roles and values anchored in the history of water resource development, these frames have been institutionalised over time, limiting change and generating path dependency (Mahoney, 2006; Sager & Gofen, 2022).

The implementation of Lake Urmia's restoration plan also speaks to the literature derived from implementation studies. In line with Barrett (2004), we conceptualise implementation as 'negotiated order' and emphasise the power-interest structures and the intra- and inter-organisational relationships and competition that take place between participating actors and agencies. Change is influenced by the political, financial, managerial and technical resources that can be mustered, as well as by policy elites and managers in strategic locations who have a degree of power in shaping processes and outcomes (Thomas & Grindle,

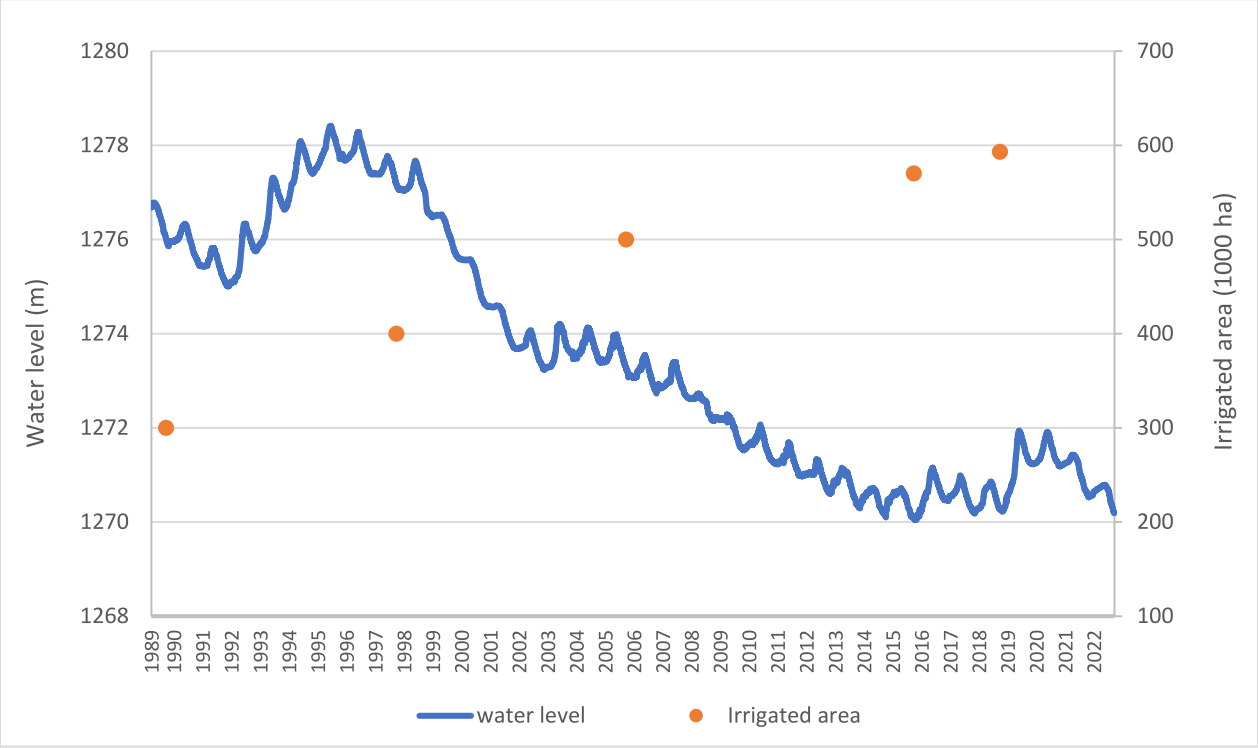

Fig. 2. Irrigated area in the lake urmia basin and water level (above mean sea level) in lake urmia.

1990). Our case study also links to the concept of 'institutional layering' (Mahoney & Thelen, 2009, p.17), a configuration whereby '[proponents of change] work within the existing system by adding new rules on top of or alongside old ones.' While defenders of the status quo may be able to preserve the original rules, they are unable to prevent the introduction of amendments and modifications. Layering also exacerbates competition between the water, agricultural and environmental sectors (Özerol & Bressers, 2015; Molle & Sanchis-Ibor, 2019).

With this background, our analysis draws upon three sources of information. First, part of the insight provided in this paper was gained from the Iranian co-authors' position on the Cultural and Social Committee of the ULRP in 2016–17. This gave the opportunity for informal discussions with ULRP officials as well as observing many official and unofficial interactions between national and regional authorities. In a consultative study for the ULRP on reducing water use in Hasanlu they visited the province several times, establishing closer communications with various local actors (including farmers, water user associations and local authorities). Supplementary surveys conducted during summer and autumn 2019 provided a second source of information. A total of 30 open-ended interviews were conducted with farmers and their representatives in Miandoab and Hasanlu, 5 with provincial authorities in EAZ (Eastern Azerbaijan) and WAZ (Western Azerbaijan), and 8 with (retired) officials from the ULRP and Conservation of Iran Wetlands Project (CIWP). To substantiate and triangulate our insights, we gathered research articles, project reports (i.e., Conservation of Iran's Wetlands Project and Urmia Lake Restoration Program), the statutes of various authorities, official letters, media articles and reports, as well as interviews with and speeches given by various authorities.

The analysis starts with an account of the policy process between 2008 and 2022 and then turns to examining in more detail the relevance of the 26 measures proposed by the ULRP. Having shown that the majority of the measures intended to enhance flow into the lake were of limited, if any, potential, we turn to the pivotal question of why the arguably genuine and high-level political will to salvage the lake was unable to avert the looming crisis, despite being underpinned by massive scientific efforts to understand the drivers of and solutions to the crisis and backed with substantial funds. In other words, and to paraphrase Pressman and Wildavsky (1973), we investigate how great expectations in Tehran were dashed in Urmia. The answers are, we claim, quite generic in nature and therefore of major relevance to the understanding of human societies' (in)capacity to manage water resources in a sustainable way.

2. Urmia Lake Basin: The unfolding of a crisis

2.1. Background on water resource development

Beyond the aridity of its climate, the various historical elements that have fostered major, and ultimately excessive, water resource development in Iran have been extensively analysed (Yazdanpanah et al., 2013; Bakhtiari et al., 2020; Saatsaz, 2020). Iran's hydraulic mission developed in the 1960s with the support of American expertise and the Shah's White Revolution (McLachlan, 1986). During the 1970s unprecedented oil revenues, in combination with other contextual factors, in particular rapid population growth, turned Iran into a country dependent on food imports (Ehsani, 2006). The ensuing Islamic Revolution led to dramatic change in the path of agricultural development (Mojtahed & Esfahani, 1989). By rejecting food imports as a hallmark of dependence on foreign powers and blaming the Shah's regime for impoverishing farmers and forcing them to migrate to cities, Ayatollah Khomeini praised farming as 'the sacred job of the prophets' allowing the independence of the country. During Rafsanjani's presidency (1989–1997) numerous dams and irrigation projects were completed, including in the endorheic Lake Urmia Basin, in the northwest of the country, that receives roughly half of its flow from two permanent rivers located to the south, i.e. Zarrineh and Simineh (Fig. 1).

Ever-growing consumptive water use, mostly in agriculture (the irrigated area has increased from 300,000 ha in 1979 to 570,000 ha in 2022 [Payamema, 2022]), and the construction of numerous dams combined with climatic change has severely affected the water flow into the lake. The lake experienced a steady decline in water level after 1995 and by 2013 it had lost about 60 % of its area and more than 90 % of its

volume (Schulz et al., 2020). The increase in the irrigated area and the drop in the water level in the lake are shown in Fig. 2. While there is abundant literature devoted to disentangling the anthropogenic and climatic causes of this (e.g. AghaKouchak et al., 2015; Ashraf et al., 2019; Khazaei et al., 2019), no one denies the significance of the laissez-faire attitude regarding agricultural development and water management.

Despite the political centrality of these policies, in 2000 the Department of Environment (DoE), after several declarations and official letters to the parliament or the Ministry of Energy (MoE), warned that 'the expansion of agriculture, the construction of dams and the digging of illegal wells' were playing a major role in the decrease of the lake level (Isna, 2005). In 2003 Issa Kalantari[1], President Khatami's advisor for water and agricultural affairs, also warned about the dark future posed by dam construction and agricultural expansion in the basin. The 2005–2009 five-year national plan reflected the DoE's call for the protection of the lake, advancing that ecosystem management should be planned and implemented in sensitive wetlands, including Lake Urmia.

2.2. The CIWP and early efforts at averting the crisis

The goal of this national plan to protect key lakes in the country was operationalised through the 2005 'Conservation of Iranian Wetlands Project' (CIWP) funded by the Global Environment Facility (GEF) and implemented by the DoE and the UNDP. It involved the establishment of a dedicated organisation and a plan to restore three wetlands, including Urmia. From the outset the CIWP made outstanding achievements in developing a multilevel structure to plan and monitor the restoration of Lake Urmia (Ciwp, 2012b; Krijnen & Rahmani, 2013): the National Committee for the Sustainable Management of Lake Urmia (NCSMLU) at the national level (a sub-group of the cabinet whose decisions would be automatically considered as cabinet directives), paralleled by the Regional Council for the Management of Lake Urmia Basin[2] at the basin level, supported by technical working groups. The CIWP also drew up an Integrated Management Plan for Lake Urmia, which included 24 priority projects, targets for restoring inflows and a minimum water level in the lake, the sharing between the three provinces of the required inflow, a drought risk management plan and the banning of further allocation of water for development purposes.

However, the implementation phase after 2010 showed that these achievements at the national level had been too aspirational. The 24 priority projects approved with a budget of 1.3 billion US Dollars in practice boiled down to a research project on drought risk management (Ciwp, 2012a), the dredging of inflowing rivers and a few pressurised irrigation projects (Snn, 2012). As reported by one official interviewed, the chair of the NCSMLU dubbed the investment of millions of dollars to release more fresh water into a 'hypersaline' lake 'nonsense'. Although the cabinet prohibited further development of water resources (Zad et al., 2013), this decision remained a dead letter. The CIWP eventually turned into a consultant research project with expert-driven recommendations to the authorities. A subsequent two-year phase launched in 2013, financially supported by the Japan International Cooperation Agency (JICA), focused solely on agricultural techniques to increase farmers' productivity. Although the project was compromised by political turnover and foot-dragging by many stakeholders, it would pave the way for renewed advocacy for the lake.

2.3. Urmia lake restoration program

In early 2011, two years before President Ahmadinejad left office, Lake Urmia became a national political concern. Faced with a popular pro-lake movement that involved local gatherings and demonstrations around the lake and in large cities, by April the authorities decided to repress the uprising. In August an emergency bill was submitted by 66 members of parliament (MPs) compelling the MoE to transfer a minimum of 1 billon m^3 (Bm^3) of water to the lake from the Aras River (north of the basin) and the Silveh River (southwest of the basin) by the end of the year to urgently save the lake (MRC, 2011). The bill was rejected by a majority in a general session of the parliament in August 2011 (MRC, 2012) but an open letter written by 22 MPs from the northwestern region reiterated their support for the bill and warned the government of the consequences of the desiccation of the lake (DW, 2011).

The shrinking of the lake and the discontent triggered by the postponing of the water transfer project were seized by politicians as a window of opportunity in the wake of the 2013 presidential election campaign. Rouhani visited Urmia city and, to a large audience, declared 'We will restore Lake Urmia and will not allow it to dry'. He added that a working group at the Centre for Strategic Research had shown that if the lake were to dry up, 14 million lives would be threatened by salt winds; and that water should therefore be transferred from the Caspian Sea.[3]

On winning the election Hassan Rouhani kept his promise, and the Urmia Lake Restoration National Committee (ULRNC) was established with the Minister for Energy as its chair. Ambiguously, the pre-existing NCSMLU was completely ignored and there was no sign of the working group or of the studies the president had alluded to earlier. Remarkably, for the first time in the entire history of the country, the Minister for Energy, who is responsible for water affairs, hinted at the fact that the country may 'have gone too far with dam construction in the past' (FARS, 2014).

Having held a few public and private meetings, in 2013 the ULRNC came up with a new policy package not dissimilar to the CIWP's previous 24-item proposal. Four months later Vice President Eshaq Jahangiri became the head of the committee, in place of the Minister for Energy, in a bid to boost its authority and legitimacy, yet without the executive power once granted to the NCSMLU.[4] The cabinet nominated Issa Kalantari as the secretary of the ULRNC. In addition to his warning about the possible forced migration of around 50 million Iranians from the central plateau he was also among the few who had voiced explicit opposition to the promotion of food self-sufficiency – a sacred and pivotal policy of the Islamic Republic of Iran – as well as critiques of the DoE (Aftabnews, 2015). Kalantari first established the Urmia Lake Restoration Program (ULRP) as the agency for the design, coordination and monitoring of the restoration plan. To boost its legitimacy, he established the Planning and Resource Mobilisation Unit (PRMU), the main office of the ULRP, inside the Sharif University of Technology in Tehran. Within six months the ULRP had prepared a policy package of 26 items, emphasising that hundreds of national and international scientists had endorsed or contributed to the plan.

The most controversial measures in the ULRP's plan were the reduction of water use in agriculture and preventing the expansion of water use in the basin. Halting new development projects in the agricultural sector, considering the national and wider regional contexts, broke a taboo. The cabinet's initial support for this shift was extraordinary. Kalantari and Rouhani staunchly opposed current dam projects, and while the construction of the Cheragh-veis Dam could not be stopped, cancelling projects that were already underway was a remarkable achievement of the programme. In contrast, the operationalisation of temporary/permanent land retirement, the cornerstone of agricultural water use reduction, was completely unsuccessful. Shortly

[1] Issa Kalantari was previously the Minister of Jihad-Agriculture for over a decade, and from 2013 became the director of the restoration programme in Rouhani's cabinet.

[2] Including the governors and high-level authorities of the three provinces.

[3] http://rouhani.ir/event.php?event_id=77. (Accessed July 18, 2021).

[4] Cabinet Directive no. 44040/17182 (18/4/2010)

after the voicing of strong concerns over the social impacts of this measure by certain MPs, the ULRP agreed to shelve it with no justification. Likewise, the intended water use reduction plan was largely ineffective (see next section).

More abundant rainfall combined with interventions to enhance water delivery to the lake gave the ULRP the opportunity to claim success in reducing water use and that restoration was progressing as planned (Dolat, 2019). The head of the PRMU rejoiced in October 2019 that the ULRP had been successful in reducing agricultural allocation by 29 % in the hydrological year 2018. The hallmark of this overall success was the 60 % reduction in water use in the irrigation network of Hasanlu Dam. This dam is located in the Solduz Valley on the southern side of Lake Urmia (Fig. 1). The Solduz Valley is home to a small lake surrounded by rain-fed land, which prompted local authorities to request a transfer from the Gadar River to irrigate 5700 ha of land. With the construction of the dam land value had increased about tenfold, and the price offered by the government for the retirement of land was half that sought by farmer representatives. Despite the ban on irrigation expansion, the Hasanlu network increased its coverage from 3945 ha to 5300 ha (Tajrishi, 2022). The ULRP reported this illegal act by local authorities to the Ministry of Agriculture, as the expansion was implemented by its provincial branches, but to no avail.

Consequently, the ULRP focused on the idea of a 40 % reduction in dam water allocation. In the ensuing years water allocated for irrigation decreased forcefully, with no compensation paid to farmers. Favoured crops such as sugar beet and alfalfa had to be replaced by wheat and barley. In our visit to the area in September 2019 the irrigation associations complained they had no alternative source of water and felt that their sacrifice had only a marginal impact on the refilling of Lake Urmia. A post on the ULRP's website featured Hasanlu as a success story of water use reduction (by 65 %) through voluntary changes in cropping patterns, while the cultivated area had increased (ULRP, 2019a). Whether this achievement was due to the favourable precipitations in 2018 or changes in cropping patterns, it fed into a success-story narrative drummed up by President Rouhani who stated that 'if Lake Urmia had not been restored, 14 million people would now be wandering in the west of the country, with their industry, agriculture and lives destroyed'.

2.4. Post-ULRP political challenges

Despite the celebration of the Lake Urmia programme as a game-changer (Khabaronline, 2021), the ULRP was worried about the future too. Its putative achievements could simply be dismissed by the next cabinet, as had happened with the CIWP. Item #20 in the policy package endorsed by the cabinet in 2014 referred to the establishment by the DoE of a Centre for monitoring and future studies. The plan was to establish a new institution that would have legal authority granted by the vice president, with direct connections to most governmental and even security and military authorities. Although they succeeded in constructing a building for the centre near Urmia city, its inauguration only took place in the last week of Rouhani's term.

While the substantial hike in the water level that occurred in 2019 was sufficient for a political celebration, for President Ebrahim Raisi, who began his term in August 2021 as a sharp critic of Rouhani, there was no reason to keep playing the game. Moreover, the level had declined again (Fig. 2) and in the year 2021 was close to where it had been when President Rouhani had promised to restore the lake within 10 years. The parliament – with an absolute majority of conservative members – ordered an investigation into the ULRP in July 2022. Accusing Rouhani of making 'a deal with the West' and heading a corrupt 'government of 4 %', the new cabinet tried to undermine the programme's legacy by investigating its financial management and questioning the scientific basis of its strategy and the project's impact on farmers' livelihoods.

In the initial months of Raisi's presidency there was no mention whatsoever of the new centre. But the new government also had to deal with the stubbornly dropping water level: it claimed that efforts were 'speeded up' and financial resources allocated, blamed it on the lower precipitation that occurred in winter and spring 2022 (ISNA, 2022) and engaged in wishful thinking, 'hop[ing] that the problem of the lake gets resolved in the near future' (IRNA, 2022a). The new government declared the ULRP's authorities incompetent, accused them of delaying the completion of the transfer from the Zab River (see Fig. 1) and finally deposed Kalantari as the secretary of the ULRNC, replacing him with the governor of the WAZ province.

3. A catalogue of ill-fated measures: the politics of lake restoration

While the available resource depends on rainfall in the basin (and possible interbasin transfers), the flow reaching the lake depends on how much water is depleted through the evapotranspiration (ET) of water bodies, natural vegetation or rainfed/irrigated crops, notwithstanding possible changes in surface (dams) or groundwater (aquifer) storage. While it is agreed that the lake has been affected by both reduced rainfall and increased uses (Alborzi et al., 2018), we concentrate here on the latter, the 'manageable' factor, and review the main measures proposed in the ULRP's 26-item programme (Appendix A). What we stress here is not so much the technicalities of the programme but the political cost to politicians or decision-makers that accompanies each measure. These costs operate a selection that eventually confines action to those measures which do not impinge on the interests of particular powerful constituencies, such as farmers in EAZ/WAZ or the hydraulic bureaucracies).

Before examining actual water use we must briefly address supply-augmentation options (measures #4 and #7). The treatment and transfer of the effluents of big cities are supposed to bring approximately 300 Mm^3 to the lake, but a basin-wide view asks where the untreated water is going at present. If it is already going to the lake, the balance will remain unchanged; if it is used in nearby agriculture, a reallocation would have to occur (and would be contested). There is no mention of this in the ULRP's documents, which suggests that no 'new' water is likely to be channelled to the lake. The transfer from the Zab Basin, aside from the serious transboundary issues it raises (Corona, 2020), will certainly add water to the basin. But in the absence of the capacity/willingness to limit abstraction at a provincial level, the extra water is likely to be partly absorbed by expanding irrigation areas on the way to the lake, a trend that was indeed witnessed right after the opening of the transfer in 2023.[5]

As for reducing ET in the basin, the most effective measure (#8a) proposed by the ULRP was the *temporary/permanent fallowing of land*. As indicated earlier, this radical option was challenged by local MPs and abandoned by the ULRP with no apparent fight. Evidence from Hasanlu also suggests that the government was not prepared to shoulder the cost of compensation.

Prominent measures to avoid further *expansion* of irrigated agriculture and ET included the interruption of the construction of dams (except two) (#3) and the banning of additional abstraction (#1). The halting of several dam construction projects was undoubtedly an achievement by the ULRP, which manifested the political will to stop the unrelenting process of water resource development. However, as illustrated by Hasanlu, the irrigated area in the entire basin was reported by the head of the PRMU to have increased by 47,492 ha (about 10 %) in the period 2015–2019 (Tajrishi, 2022). Comparisons of TM and Sentinel satellite images from 2014 and 2020 also show small expansions at the margin of irrigated areas. There is no evidence of additional abstraction having been banned.

The issue of illegal abstraction by wells was prominent in measures

[5] See for example 'Stealing water from the lake', https://irannewspaper.ir/8155/15/11575. (Accessed September 14, 2023)

#6 and #18. According to Bashirian et al. (2020) the number of wells in Lake Urmia Basin had increased from 55,199 in 1984 to 106,200 in 2017, while there were 48,000 unauthorised wells (Hosseini, 2022). The MoE was responsible for closing these wells by 2017, but only 8 % of this task was completed, according to Salimi et al. (2019). These numbers point to unchecked growth in the number of wells and a lenient approach by politicians and relevant authorities towards unauthorised wells. What has been achieved in terms of regulating unauthorised surface water abstraction (#2) is also unclear. The MoE, with the responsibility for this task, has so far concentrated on replacing traditional diversion/abstraction points with new water gauges to better control water abstraction from waterways. While monitoring a smaller number of abstraction points can be logistically efficient for short periods, such as strategic dam releases, it is unsuitable for controlling the access to water over the entire irrigation season.

Measure #8 aimed at reducing agricultural water allocation from dams by 40 % (a yearly reduction of 8 % for five years). The operation data for Bookan Dam, the main 'supplier' of water to the lake, shows that the water stored in the dam at the beginning of the irrigation season, and therefore subsequent releases, was not significantly lowered. During a visit in September 2019 along the Zarrineh River, downstream of the Bookan Dam, we investigated how the ULRP's measure to curtail supply was being responded to by local people, believing farmers were making up the shortfall of water from alternative sources (such as drains, rivers, wells…) (Torabi Haghighi et al., 2018). We randomly interviewed farmers who relied on the Zarrineh River and found that their day-to-day preoccupations revolved around issues such as marketing, input prices, disease control and poor fertilizer quality. Even in the downstream villages close to the lake, farmers had not noticed significant change compared to previous years with regard to water availability. Most had not even heard of the ULRP.

Reducing 'non-productive' ET is also a way forward. Measure #15 was intended to ease the movement of water through the lake's riverine swampy areas, where it is depleted by evaporation, to the main water body. This objective is also behind the technique of releasing water from dams in 'pulses' ('flushing releases'), so that a higher proportion can reach the lake (Torabi Haghighi et al., 2018). Although these measures are likely to have had a positive, albeit modest, effect in quantitative terms, the aim of minimizing ET is somewhat inconsistent with ensuring environmental flows to riverine systems and peripheral wetlands (measure #9).

Failing to control additional or illegal abstraction means that the bulk of the use-reduction burden falls on the ET of irrigated crops. The success of the policy is measured according to the promise that more can be produced with less water (as followed in measure #8b,c). Pouladi et al. (2021) showed that, unfortunately, the crops with a higher return, preferred by farmers, are also those with higher water requirements (e.g. sugar beet and alfalfa). The modernisation of irrigation is a countrywide policy of the Ministry of Jihad-Agriculture (MoJA). (In 2016 it planned to convert 4 million ha of irrigated land to pressurised irrigation within 10 years, believing that the irrigated area could be doubled with improved efficiency). Yet, some experts warned that the water-saving expectations were 'fundamentally unrealistic' and that the failure to distinguish between efficiencies at the plot and basin scales was 'a serious strategic error' (Azari, 2017). Indeed, Ahmadzadeh et al. (2016) found that 'changing the current irrigation to a pressurized system can increase water productivity up to 15 % (…). However, pressurized irrigation results in no significant change in total inflow to the lake. Notably, these systems can intensify drawdown of the basin's water table up to 20 %' because of reduced groundwater recharge. Indeed, more often than not, these systems spur irrigation expansion (Grafton et al., 2018).

From the start the ULRP chose to measure water use as the volume of water diverted to or extracted by agriculture. It based its plan on the MoE's figure of 7 Bm^3 of annual resource, of which agriculture consumes 5 Bm^3 (surface and groundwater). Taking the MoJA's figure for the agricultural area (approximately 500,000 ha) it was concluded that the sector was using an average of 10,000 m^3/ha, pointing to substantial 'overuse' and a large scope for 'water savings'. However, hydrological modelling and remote sensing techniques helped cast a radically different picture. Farokhnia (2016) showed that in the decade from 1999 the annually exploitable water had been approximately 4.5 Bm^3 of which 2.1 Bm^3 had been depleted by agriculture, while Shadkam (2017) calculated these values at 5.6 and 2.9 Bm^3 respectively. A more recent water accounting study by the FAO/ULRP revealed that annual ET in agriculture was about 2.1 Bm^3 and that at best 0.32 Bm^3 could be 'saved' (Karimi et al., 2019)[6]. These studies provide an idea of the degree to which the ULRP has overestimated actual water consumption by making the all-too-common mistake of confusing withdrawals with consumption to extrapolate potential 'water savings' (Grafton et al., 2018; Perry et al., 2017; Ahmadzadeh et al., 2016).

If the cultivated area cannot be reduced, it is still possible that ET can be reduced through changes in cropping patterns and techniques. The field trip to Hasanlu suggested that reduced allocation did result in shifts towards less water-intensive crops. However, this was an exception due to the unique water control conditions in that area. In contrast, the field trip to Miandoab revealed that farmers could grow whatever they wished. Measure #26 prohibiting the export of unprocessed sugar beet from the Western Azerbaijan province in order to curb its cultivation was also claimed to be successful based on the reported decrease in the sugar beet cultivation area from 2013 onwards. However, this area rose again from 2017 onwards and a large sugar factory was even constructed in Urmia Basin during the ULRP's tenure (Tajrishi, 2022).

Against all scientific evidence the ULRP assumed that agriculture could incrementally reduce its water use by 40 % through efficiency-improvement projects, with stable and even increased production. Unfortunately, this optimistic target collided with hard-nosed realities: extra water can hardly accrue to the lake, save marginal efforts at reducing unproductive ET or eliciting changes in cropping patterns, if ET is not substantially reduced. We see that the measures with a political cost (imposing or discouraging certain crops, reducing abstraction, clamping down on illegal wells, and even a hard-to-implement compensation scheme for land fallowing) were sidelined or watered down. The next section further elaborates on the very constrained political environment within which the implementation of the plan must be understood.

4. Making decisions in a constrained environment

While some of the political costs of the measures reviewed above readily reflect their economic impact on water users, there are other historical, social and political factors that contributed to the gradual undermining and even counteracting of the established policy objectives. The most salient facets are discussed here.

4.1. *Building and adjusting discourses*

High political stakes make discursive power and the 'blame game' crucial. The ULRP required powerful justifications for such a large investment into the restoration of the lake. Its proponents resorted to 'securitisation' (Mirumachi, 2015), using a powerful and persuasive evocation of the looming complete destruction of the region, and the social, health and environmental impacts, and predicting the subsequent migration of 14 million citizens. As Kalantari recently reflected (Ensafnews, 2022): '*The government cannot allow the lake to dry, even if this means destroying agriculture, because 13 billion tons of salt are lying on its bed. If this salt bed is uncovered, millions of people, including the residents of*

[6] Evaporation is found to be 33% of ET, a value which in other basins can be as low as 18%. To reach such a low percentage in Urmia basin 2.1*(33–18) would have to be saved.

Tabriz city, will have to be evacuated.'

This approach instilled a sense of urgency and was powerful enough to garner financial and political support in harsh financial circumstances (Madani, 2020). However, the power of the discourse could also allow the rapid and unchallenged planning of infrastructural projects, as the problem was increasingly equated with and reduced to enhancing water flows into the lake, and provide ground for conflicting debates. For example, while the media and politicians are fond of doomsday predictions and scientists largely agree on the ecological and health impacts of the lake's desiccation (e.g. Hossein Mardi et al., 2018; Boroughani et al., 2019), there is no solid evidence of such a dramatic future. There is also still a strong argument against the priority given to Lake Urmia compared to other devastating environmental disasters in the country (e.g. Noori et al., 2021).

Discourses not only serve to muster selective support, they also apportion blame. Ahmadinejad both incriminated climate change and maintained that European countries were involved in changing the rainfall patterns through cloud seeding (Dalby & Moussavi, 2017). Likewise, his government was accused by Kalantari of having 'dried the lake out of ignorance, forcing and obliging us to revive it under any conditions and at any cost' (Ensafnews, 2022). Political gains can be achieved by blaming earlier administrations while also claiming to avert a catastrophe. Once the Ebrahim Raisi's government took office, Rouhani's handling of the Lake Urmia crisis was investigated on financial grounds as a means of discrediting him. For the administration in charge it is tempting to blame catastrophic events on climate change (Madani, 2014) or to leave it to God.

4.2. A persistent hydraulic mission

It is worth examining the reasons behind the unchecked investments in dams and interbasin transfers, that have remained lavish, despite growing criticism within the country (Balali et al., 2009; Madani et al., 2016). One first well-identified element is the strength of the 'hydraulic mission' in Iran (Bakhtiari et al., 2020), where the dominance of infrastructural solutions has been entrenched in an engineering culture and a hydraulic bureaucracy. As mentioned earlier, the Islamic Revolution took up the mission, in a bid to ensure food self-sufficiency and independence. During the presidency of Rafsanjani, known as the 'commander of construction' (Nabavi, 2022) or 'general of reclamation', numerous dams and irrigation projects were completed (Bakhtiari et al., 2020).

Nabavi (2022) showed 'how Iranian governance and engineering have co-produced one another'. Engineers are perceived as 'development soldiers' who realise political ambitions, while in return politicians 'make the engineers the gatekeeper of knowledge, and the engineering the gold-standard to define what is valid and what is not'. Engineering has established itself as a hegemonic discipline in terms of numbers of university graduates but also social prestige, and its dominance shaped the narratives around the nature of the crisis and its solutions (ibid.). This has created a sort of path dependency: 'seeing water like a state', the mission became hard to unsettle and its logic came to be reinforced by its very failure, as recurring water shortages generated by both climate change and unchecked use were endlessly providing the justification for more water resource development.

Beyond these historical and epistemic dimensions, part of the answer also lies in the political and financial interests associated with this industry (Molle et al., 2009). During the war with Iraq, the creation of Khatam al-Anbiya was ordered as a construction firm that fulfilled the twin objectives of carrying out major (re)construction projects and employing war veterans (Kowsar, 2021). Emulating Deng Xiaoping's engineering drive, Rafsanjani developed the Khatam al-Anbiya into what was to become a multibillion regional economic giant. Khatam al-Anbiya's dam-building arm, *Sepasad*, constructed 56 % of the country's storage capacity (Rudaw, 2018) and is part of the economic network of the military force. Such relationships between the state and associated contractors have given rise to what some observers (e.g. Kowsar, 2021; Keynoush, 2019) and even insiders at the Center for Strategic Studies (the consulting body of the President's office) have called a 'water mafia', that is, a commonplace 'iron triangle' between national and provincial politicians, the state bureaucracy and construction companies (Molle, 2008) – except that in this particular case companies are strongly integrated in the state's structure. Regional MPs lobby the government for investments in dams and irrigation to boost their chances at reelection (Madani, 2014; Ketabchy, 2021; Salimi et al., 2019). Echoing the criticism of these closed-shop interests, the Center for Strategic Studies even funded a controversial documentary called *Matricide* in 2015.

Unsurprisingly, then, 83 % of the whole restoration budget has accrued to the Ministry of Energy, showing the dominance of the hardware component in the project and prompting Issa Kalantari to opine that 'the Ministry of Energy and Water has confused the ULRP with a milk cow' (Payamema, 2022). Again, Khatam al-Anbiya was the main contractor of the most expensive project (transfer of water from Zab) to 'save Lake Urmia'. With the new administration under President Ebrahim Raisi the 'mission' seems to have resumed: the Nazlou and Barandoz dams, once abandoned are now being completed by the MoE. The transfer of water from the Aras River has also been hastily initiated by the MoE and Khatam al-Anbiya to allegedly save 'millions of endangered lives' (Irna, 2022b).

4.3. Regional politics and ethnicity

Reordering water allocation in the Lake Urmia Basin means apportioning new costs and benefits between WAZ, EAZ and Kurdistan. The administrative reforms conducted between 2009 and 2013 transferred water management responsibilities from the regional to the provincial level (Madani, 2014; Ženko, 2020), promoting non-integrated management and provincial free riding. While the MoE in Tehran produces plans for shared river basins, like Urmia, these often fail to be implemented on the ground as competition/conflict, rather than coordination and negotiation, dominates the relationships between the provinces concerned (Mirnezami & Bagheri, 2017; Salimi et al., 2019; Pouladi et al., 2021).

Some observers have related the presence of ethnic minorities (Turks and Kurds) around the lake with what they perceive as discrimination against Lake Urmia (Hassaniyan & Sohrabi, 2022; Jannatov, 2022; Souleimanov, 2011). Although the repression of ethnic minority activists under the presidency of the Mahmoud Ahmadinejad (2005–2013) stirred Azeri nationalism,[7] this argument is belied by the fact that all of Iran's terminal lakes are facing desiccation (Madani, 2014), as well as by what could be seen as special treatment for Lake Urmia, when President Rouhani promised Azerbaijanis he would save their lake and launched the largest environmental programme in the country's history. Observers point to a further ethnic dimension of water resource sharing (Jannatov, 2022; Souleimanov, 2011; Pouladi et al., 2021). Azeris are Shia and make up 30 % of Iran's population; its urban elites are prominent in commercial activities and well integrated into the national polity. In contrast, Kurds form a mostly rural population of Sunni tradition, often confined to low-salaried jobs, with less infrastructure and less access to well permits, who manifest political aspirations for autonomy (Hassaniyan & Sohrabi, 2022; Ženko, 2020). Since the Kurdish population is mostly located upstream, the Azeris have tended to benefit substantially more from state-funded water resource development projects. Kurdistan claims that while it provides 85 % of the Bookan Dam's water it receives only a tiny share of its waters (Hashemi,

[7] Demonstrations in mid-2011 included banners declaring 'Lake Urmia is drying up; the majlis has ordered its execution' (Michel, 2017). Some warned of a 'separatist movement' in the Lake Urmia watershed and that the Anatolian news agency was encouraging dissent among Azeri-speaking Iranians (Ensafnews, , 2022).

2012; Pouladi et al., 2021). In addition, the Zab transfer project directly affects the Kurds, meaning that a solution to an Azeri problem actually shifts the costs onto them.

Regional politics also involves balancing acts between WAZ and EAZ. To avoid competition between Urmia University and Tabriz University in hosting the Urmia Lake Restoration Headquarters, and to ensure a degree of neutrality, the centre was based in Tehran's Sharif University of Technology. Kalantari emphasised that 'East Azerbaijan was fully involved, but the biggest problem was our colleagues in West Azerbaijan; its governors always resisted in some way, because 91 % of the water for the restoration of Lake Urmia was supplied by West Azerbaijan, and about 51 % of the water for the lake was supplied from the Zarrineh River' (Ensafnews, 2022). Local/regional perceptions of 'water ownership' are a key factor in river basin overbuilding, as representatives of every region traversed by water claim the right to use it (Molle, 2008). WAZ showed little sign of compromise. As Kalantari once commented, 'the Urmia Lake Restoration Program included a ban on [further] irrigated agriculture in the lake basin, which they violated by covertly adding 20,000 ha of gardens' (Ensafnews, 2022). Despite the CIWP's early attempt to allocate expected flows to the lake by province, a 'tragedy of the commons' of some sorts is visible among the three provinces concerned (Zad et al., 2013).

Provincial MPs also exert pressure to deflect measures affecting their constituencies and promote development projects regardless of resource availability (Ketabchy, 2021). According to Kalantari, 'the very representatives who signed the investigation of Lake Urmia said: "Don't give water to the lake!" They want to get votes, and water is a vehicle for their acceptance in the region' (ibid.). Local MPs were instrumental in defeating the ULRP's land retirement measure that was withdrawn by Rouhani after closed debates between politicians.

4.4. *Institutional layering and bureaucratic competition*

The ULRP tried to rectify the poor coordination between the various stakeholders and their conflicting aims (Salimi et al., 2019) by taking on a number of strategic roles in mediating funding, allocating budget, and monitoring line agencies and the planned releases from dams to the lake. As such, the ULRP was layered on top of existing organisations and overlapped with many of their remits (Mahoney & Thelen, 2009, p.17). The layering of new bodies is all too common in Iran's water policy (e.g. the Office for Water Allocation, the Supreme Water Council, the National Program for Adaptation to Water Scarcity, etc.) and, like the ULRP, each of these initiatives was launched with high aspirations and promises of coordination that have been undermined to a large extent by the most powerful actors already in place.

Two main actors, the MoE and MoJA (including their representations at lower levels), dominate water affairs in Iran. Thus, despite seeing itself as an overarching coordinating body with cabinet backing, the ULRP had no choice than to play the game of the water bureaucracy. To implement its measures (e.g. dam releases, control of illegal abstraction, adjustment in cropping patterns, etc.) it needed the cooperation of the MoE and MoJA and their provincial/local officials, who did not necessarily agree with the plan. For example, blocking the illegal wells of farmers whose livelihoods depend on them 'raised social tensions' and 'brought disagreements between political and executive officials to pursue such plans' (Danesh-Yazdi & Ataie-Ashtiani, 2019). The land retirement policy also faced strong bureaucratic reluctance and opposition, in part due to the formidable challenge of distributing compensation fairly.

The ULRP had limited leverage points. While it could veto some projects, it could not stop them if they had funding that escaped the ULRP's control. It subcontracted local universities in the East and West Azerbaijan provinces to independently assess projects, but warnings were largely disregarded. It also attempted to impose its own aims, such as stopping some dam construction projects, exposing corruption within local authorities involved in water development projects, and the MoE's foot-dragging with regard to releasing water to the lake. The undermining of the ULRP could have political roots. In 2016 Kalantari disparaged 'the officials of the Ministry of Energy [who] prevent the release of water behind the dam into the lake' and 'a handful of incompetent managers […] probably connected to Ahmadinejad's government' (Iew, 2015). He believed that the MoE's lack of cooperation over the release of water to the lake was a case that the ULRP should have brought before the judiciary (Khabaronline, 2021).

The programme was also challenged by the lack of 'alignment' and sectoral contradictions that are pervasive in the fields of agriculture in general and irrigation in particular (Özerol & Bressers, 2015; Molle and Sanchis-Ibor, 2019). The MoJA shows limited concern for water overexploitation and irrigation expansion. It champions agricultural productivity and sees modern irrigation technologies and improved cropping patterns and techniques as viable solutions to the water crisis. The MoE, in turn, sees progress in terms of the number of dams and their total storage capacity, and the number of telemetering devices, water transfers and water user associations established. Both blame the limited success of their silver bullets on one another, the lack of political will or financial support, and the reluctance of other actors to play their ascribed roles. The discrepancies found in the databases of the MoE and MoJA, and their provincial representatives (Hashemi, 2012) also reflects

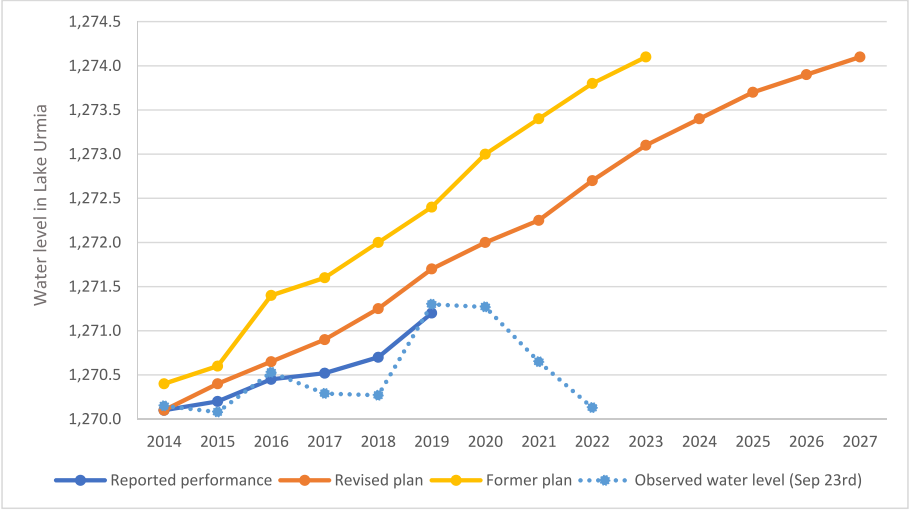

Fig. 3. Lake restoration initial target, the revised restoration plan and observed water level (above mean sea level) in Lake Urmia.

their conflicting strategic positioning and 'truth claims'.

Layering can also be seen in the way the early ULRNC was ignored and replaced by the NCSMLU, alongside the Urmia Lake Restoration Program (ULRP) as the agency, and by the attempted establishment of the Center for Coordination and Assessment of Lake Urmia Restoration, which was ignored by the next government. Regardless of their mandates and power, these overlaid institutions had a hard time struggling against the established power holders (MoE, MoJA, MPs, governors, etc.).

4.5. Science and policy interfaces

At its outset the ULRP promised to follow a 'scientific path' to restore the lake, as an expression of neutrality and independence. It boosted its legitimacy by claiming to be actively involving 700 scientists and a number of well-known international universities and organisations (such as the FAO). The URLP's rejection of the president's favourite project – transferring water from the Caspian Sea – manifested this spirit and its authority. Against this background it is necessary to explain how the wealth of scientific expertise at its disposal was partly commandeered into supporting a catalogue of measures based on shoddy or ambiguous science (as reviewed in the preceding section), centring notably on the proposal that a '40 % reduction in water use' would 'save water for the lake' without affecting farmers.

A first reason to be considered is the gradual shrinking of the ULRP's room for manoeuvre. With the deactivation of land retirement and no real control of illegal withdrawals – the two measures with clear potential to reduce water consumption – along with the problems involved in transferring water from the Zab, the ULRP had no option but to overemphasise the impact of the MoE's dam releases, extrapolating the success in reducing water use in the specific case of Hasanlu, confusing the reduction in dam allocation with a decrease in water consumption, considering the wastewater to be treated as an additional source of supply, and assuming that water transferred from other basins would automatically end up in the lake. It even uncritically presented the MoJA's 'performance' in expanding the area under drip irrigation, or reducing/controlling the number of diversion structures, as contributing to restoration objectives. The measures that were still achievable needed to be endowed with more water-saving potential than they really had, and the ULRP was loath to discuss the details.

So much was at stake in political terms that it became necessary to make reality look like the plan. By adding four years to the roadmap's 10-year horizon the ULRP was able to post a more optimistic chart on its official website (Fig. 3 shows the evolution for two planning horizons – in orange and yellow – and how the change drew the observed water level [blue] closer to the target) (ULRP, 2019b). It also shows a dramatic gap widening after 2019.

There are other reasons why so many of the nation's best scientists failed to engage fully with the programme's technical ambiguities. One is the cultural deference to senior/retired 'old guard' scientists, and those in positions of power and authority in general, which stymies direct criticism (Javidan & Dastmalchian, 2003). Another is the web of interests generated by the public subsidies in the MoJA's irrigation modernisation plans to the tune of US$2.6 Billion for 412 consulting companies, 1200 contractors and 312 manufacturers and importers. Since these all thrive on the programme there is a 'dominance of organisational interest over national interests' (Azari, 2017). Yet another factor, not specific to Iran, is the implicit subservience of consultants and scientists (many play both roles) to the policy goals and rationales set up by the administration that contracts them. The two main universities in WAZ and EAZ were also contracted and neither challenged the 40 % target despite the fact that even with optimistic hypotheses they could not identify measures to achieve it. Those with more fundamental critiques generally preferred to keep silent than antagonise their peers or potential backers. Even the financially independent FAO experts crudely concluded that there was 'ample opportunity to reduce water consumption in agriculture' (Karimi et al., 2019). International universities and institutes (Wageningen, Melbourne and the IIASA) provided expertise on specific, discrete issues without biting the hand that fed them (Water Partnership, 2017; ULRP, 2018).

In addition to these limitations is the fact that over the last decade Iran began using its public broadcasting to suggest a relation between environmentalism and espionage (IRIB-Channel2, 2017; see also Hassaniyan, 2020). Foreign spies were accused of conjuring a picture of utter water crisis to justify land retirement, moving away from agriculture and reducing the population as a means of weakening the country and discouraging it from 'improving agricultural irrigation'. Any criticism of water or agricultural policies, for example, could suggest that a scientist or activist was (un)intentionally playing for the enemy or an 'influence network' (Jahan-Ara, 2017). In 2017 a number of environmental activists were detained on grounds of espionage, and a year later the then deputy head of the DoE was forced to resign and flee the country (Global Witness, 2019). Such a climate of fear confined scientists to an advisory role detached from active criticism and engagement.

4.6. Structural change left unaddressed

Restoring a lake like Urmia demands much more than the stick-and-carrot policies to which the ULRP had assumed stakeholders would react homogenously. The implications of curtailing the irrigated area must be addressed head on: threatened water-related line agencies would have to adjust; political ideologies around agriculture and development would have to evolve; people would have to change economic activities and incomes. But, tellingly, Measure #22 on 'Preparing alternative livelihood plans by the related organisations' was only an add-on to the programme rather than a key structural change. It mainly included studies of value chains and ecotourism, handicrafts and food festivals/exhibitions, with their implementation entrusted to provincial governorate administrations.

Studies by Pouladi et al. (2020, 2021) showed that farmers' behaviours (e.g. planting thirsty crops) and the race to the bottom for water resources (e.g. drilling illegal wells) were governed primarily by economic survival objectives. Not only did market prices fail to direct farmers towards less thirsty crops, but they were also out of sync with massive investment in agricultural production. During the field visits in 2019 we observed the huge production of tomato that followed high market prices in 2018 but saturated the market and sent prices down one year later. Likewise, due to overproduction, vast quantities of unfit-for-market apples for bulk purchase could be seen at the roadside.

Pouladi et al. (2021) also showed that some farmers felt unconcerned, expecting the lake to be replenished naturally and/or considering it the government's responsibility to solve the problem (despite resentment from past experience). This both nurtures and responds to a perception of the lake restoration as a bureaucratic problem to be tackled by the government and funded through adequate budgeting, with the public having no other role than waiting and praying (Mirnezami, Bagheri, & Maleki, 2018). The political pressure to demonstrate visible outcomes prioritised rapid solutions, making the complex and unpredictable engagement with stakeholders unattractive. With limited buy-in, the reform failed to garner significant interest or challenge current practices as required for large-scale adaptation, leaving the mental models and behaviours of water users and managers unchanged (Yazdanpanah et al., 2015).

5. Discussion and conclusions

The significance and size of the Urmia Lake, the high political stakes for the government and the substantial quantum of political will, expertise and funding injected into the restoration project make it all the more necessary to understand what went wrong. While some contextual

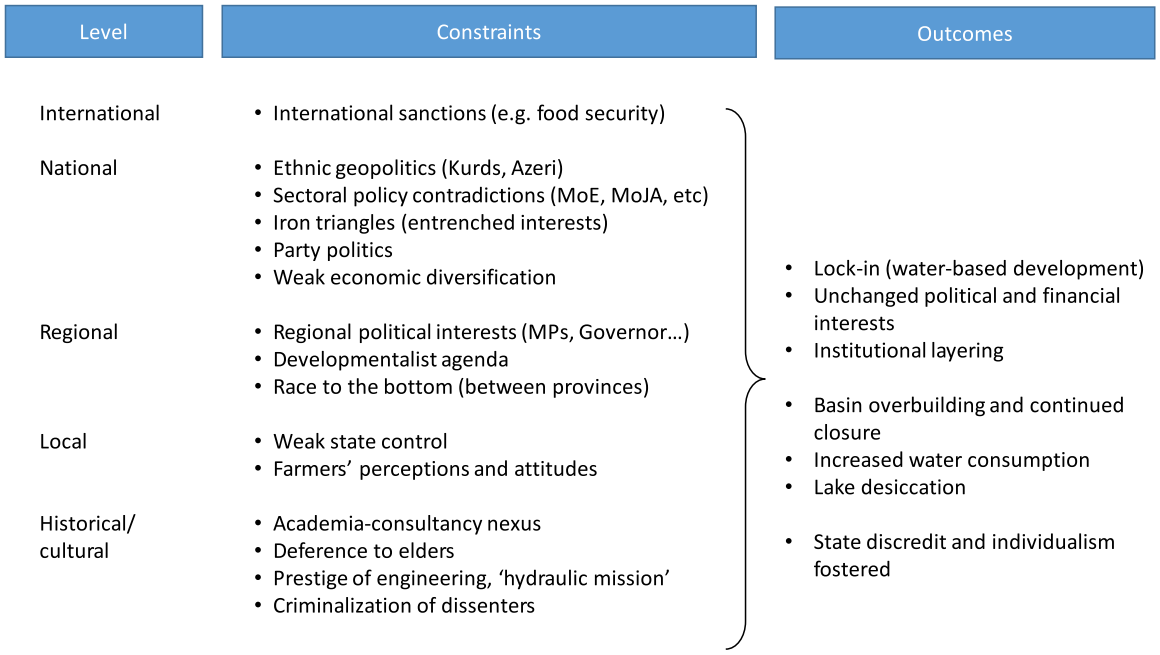

Fig. 4. Summary of main restoration constraints and outcomes.

factors (downward trend in precipitation, rising temperatures, international sanctions and economic difficulties [including high inflation and unemployment rates], or lack of funding[8]) reduced the government's room for manoeuvre, we believe that these factors were 'crisis catalysers' (Madani, 2014) rather than major drivers. Our analysis points to a host of political factors that appear systemic, echoing similar situations worldwide. Fig. 4 summarizes the main obstacles to solving the crisis as identified in the analysis, differentiating between levels (left column) and main outcomes.

A general lesson to be drawn is the overstating of state power in regulating water use on the ground. A large part of water use is individual and diffuse and escapes the government's capacity for monitoring and enforcement (Molle & Closas, 2020). Even that which is theoretically within governmental control, like dam releases, proved in fact to lie under other lines of authority and to be hard to ensure (Schmidt et al., 2021). Despite support at the highest level, the ULRP found itself undermined by the centrifugal, sectoral agendas of old players and interests at the national level (the water bureaucracy at the MoJA and MoE) and at the provincial level (MPs, governors, line agencies' local branches). This also extends away from executive authority to other recipients of power, such as private companies, notwithstanding the political opposition at work and the constraints of the ethnic and international contexts. The ULRP's leaders failed to fully integrate the political situatedness of the reform and the power of line agencies, ministries and local politicians to derail or reshape it to their interests, keeping to a technocratic formulation of the restoration programme and layering new institutions on top of existing ones.

One key aspect of such socio-environmental transformation is the time it takes for the magnitude of the problem to be fully comprehended. By the time overexploitation, groundwater depletion, and the environment's slow desiccation have become fully apparent it is already too late to react, as the developed capacity to transform water into evapotranspiration far exceeds the average available resource (see Alborzi et al., 2018). Restoring the system (here the lake) then inevitably includes *reducing overall ET*, which means acting to curtail the stream of benefits people draw from water. Politically, this is a tall order: consequently action remains largely confined to capital-intensive supply-side solutions, illusory techno-fix, and measures that were innocuous to people's livelihoods, but then also to the status of the lake … The proposal to retire irrigated land finally gave way to an increase in the irrigated area; a new sugar factory was constructed in Urmia Basin; and well drilling continued. Thus, short-term political and financial interests, as well as regional economic priorities, prevailed. No radical structural change was attempted –no exit strategies for farmers with longer-term investments in terms of education, labour or infrastructure.

Unsurprisingly, the predominance of political realities relegated science to a subservient role, with occasional ad hoc distortions, rather than one of guidance. Reduced dam allocation to agriculture was presented as equivalent to water use reduction in the sector, with a claim that production would not be affected by a 40 % drop in water share. Confusing gross water allocation with net consumption, just as failing to dispute the MoJA's claim that drip irrigation would save water or to discuss where Tabriz wastewater was going before being treated to 'replenish the lake', is an all-too-familiar way to circumvent the hard-nosed realities of the mass balance (Molle & Closas, 2020). These blind spots sustain the hope that a capital-intensive technical fix can still save the day without affecting specific constituencies. This conclusion cannot be overstated: while the pretence of technical rationality at all costs conveys the message that the government is doing something to avert the catastrophe, it in fact caters to the interests of the state – its hydrocracies and construction companies – and attempts to stabilise rural incomes in the face of sheer social challenges and international vulnerabilities. This political settlement is barely avoidable, with the cost being shifted onto the environment and the young/next generations (see Ženko & Menga, 2019). The fate of each of the 26 measures directly reflected their political costs.

Despite its subversive and aspirational beginnings, the legacy of the ULRP was a lake with the same depressing level at which it started, but also an unchanged hydro-bureaucracy, a development-oriented national agenda, new unjustified reallocations of water (inside and outside the basin) and, perhaps more importantly, unchallenged hydro-social relations between the people and the lake. The ULRP policy process clearly echoes the Aral Sea syndrome (Peterson, 2019) and illustrates how water is caught up in a political gridlock that pervades the MENA region (Molle and Sanchis-Ibor, 2019) and beyond: strong path dependencies,

[8] Spending was actually one third of what was planned (Salimi et al., 2019).

entrenched iron triangles, faith in technoscience, limited power of the state at the regional and local levels, contradictory sectoral policies and rural economies locked in water-based activities.

As the lake's level neared its all-time low in late 2022 the worst-case scenario is never fully certain. Will an exceptional El Niño year, added to transfers from the Zab Basin (operational from February 2023), provide respite and hope in the short term? Or will a prolonged drought spell doom and trigger a full-blown social and political crisis? Either way, the dynamics of river basin overbuilding and closure (Molle, 2008) leave little doubt as to where Lake Urmia is heading over the medium-term (Saemian et al., 2020).

CRediT authorship contribution statement

S. Jalal Mirnezami: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing. **François Molle:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Soroush Talebi Eskandari:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: First and third authors declare they have been hired as consultants by the ULRP project between 2016 and 2017.

Data availability

No data was used for the research described in the article.

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Appendix A

Table 1
ULRP policy package endorsed by the cabinet to restore the Lake Urmia (summarised).

1	Banning further abstraction from water resources in the LUB and banning further development in the agricultural sector
2	Banning illegal water abstraction from surface water
3	Stopping all construction and studies of dams (except for Shahid Madani and Cheragh-veis dams) and irrigation networks in the LUB. Water storage will be used to replenish Lake Urmia.
4	Financing the Zab water transfer to the LUB.
5	Comprehensive plan for education and raising awareness and participation of the local communities
6	Controlling illegal wells in the LUB and installing volumetric measurement devices
7	Transfer of wastewater in the basin to the lake
8	Control and decrease of the water used in agriculture: Decreasing 40 percent of groundwater and surface water rights through buy-backs by the Ministry of Energy Implementing a plan to increase water productivity in the remaining 60 % Providing financial and technological means for enhancing productivity by the government
9	Biodiversity protection projects for satellite wetlands and small islands
10	Preparing the cadaster of the LUB
11	Implementing the plans approved and monitoring and evaluation of their implementation by the PRMU
12	Designing and implementing the integrated Decision-support system for the LUB
13	Impact study of the planned "Shahid Kalantari" causeway on the ecosystem of the lake and providing solutions
14	Assessment and feasibility study for salt extraction from the lake bed
15	Channelling river flows to the lake body to avoid losses
16	Identification of the sources of dust and the way to fix them
17	Study and implementation of the ecological protection program for Lake Urmia National Park, concentrating on the southern part
18	Legal verification of unlicensed groundwater abstraction points, concentrating on the wells impacting surface flows
19	Identification of the important zones that contribute water flows into the lake, and improving their condition by watershed management and groundwater recharge projects to increase base flows
20	Establishment of the 'Future-studies centre' for Lake Urmia by the Department of Environment
21	Assessing the health, sanitation, social and environmental impacts of lake shrinkage and preparing and implementation of a prevention and risk control plan
22	Preparing alternative livelihood plans by the related organizations
23	Feasibility study of applying modern technologies to the lake restoration
24	Studying the project of transferring water from the Caspian Sea
25	Identification of appropriate halophyte crops and planning for their planting in the salt-zones around the lake
26	Banning the export of sugar-beet from the Western Azerbaijan province from mid-2016

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