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Irrigated Gardens of the Indus River Basin

Toward a Cultural Model for Water Resource Management

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The cultural connections among water, gardens, humanities, and policy span more than five thousand years in the Indus River basin, from the archaeobotany of Harappan floodplain settlements to the historical geography of Mughal gardens and waterworks, to critical histories of massive colonial canal irrigation and searching reflections on postcolonial waterscapes. In this chapter we ask how policy inspiration can be drawn from the composite culture of irrigated gardens in the Indus basin. This effort at the basin scale bears comparison with Victoria Strang's essay in this volume on the role of cultural values at the global scale in United Nations water policy. In between these basin and global scale perspectives lie expansive new studies of "Asia's" water resources (e.g., Amrith 2018; Chellany 2013; Ray and Maddipati 2020). While helpful for extending the boundaries of analysis to a macroregional scale, they tend to emphasize geopolitical histories of water development, particularly in the Indus, which is an important perspective that we acknowledge but seek to move beyond. The literature on cultural values of water in the Indus, by comparison, includes historical relationships among the arts, religion, caste, honor, gender, and tribal as well as territorial politics (e.g., Gilmartin 2015; Meadows and Meadows 1999; Mustafa 2013; Naqvi 2013). Scholars from all disciplines in the humanities have contributed to this emerging perspective, especially historians, albeit in small numbers and with limited reception. It seems fair to say that cultural research has contributed more to policy history and critique and less toward policy alternatives of the sort that Strang suggests and that this chapter seeks to imagine.

Among the myriad coexisting, often conflicting, cultural values of water at work in the Indus, we focus here on the generative metaphor of "irrigated gardens" (Schön 1979). We show how irrigated gardens have developed in inspiring ways from the Indus headwaters in the Hindu Kush and Karakorum mountains to the plains of the middle Indus basin, and ultimately out into the Indus delta and Arabian Sea. Our approach is not strictly limited by Indus River basin boundaries, for its relevance extends to adjoining landscapes that drain into the Amu Darya, Helmand, Yamuna, Ganga, and Luni rivers. We concentrate on the Indus basin as a case study, however, to envision a new approach to its management and care. Our emphasis on garden ideals thus has normative and historicist, as well as historical, aims. We argue for what could be, and what could be better, if the jointly humanistic and scientific ideals of irrigated gardens were adopted in water resources research and management.

A CULTURAL PERSPECTIVE ON THE IDEA OF THE INDUS AS AN IRRIGATED RIVER BASIN

The Indus River basin is one of the world's international water resources and irrigation laboratories (map 8.1). It has been the focus for massive programs of physical transformation, investment, and research on irrigation and drainage systems (Wescoat, Halvorson, and Mustafa 2000; Yu et al. 2013). Before evaluating that record, it is interesting to ask: how did the Indus come to be regarded as a basin? Any search for origins is elusive. At the deepest historical level, one may speculate that riparian settlements of the protohistoric Indus Valley civilization were part of a common socio-hydrologic region during the fourth to second millennia BCE. Harappa itself had richly irrigated plantings of cereals, millets, oil seeds, vegetables, and fruits (Weber 1999). However, Harappan cultural sites were not limited to the Indus valley. They extended into the Yamuna basin, the Thar Desert, and the Saurashtra coastal region, well beyond the Indus (Wright 2010).

The Indus River channel was known as Sind in antiquity. Alexander of Macedon famously crossed the Sind in 327 BC before his final battle against a regional ruler named Porus, who is known throughout Punjab to this day (McCrindle 1896). Ptolemy's second-century-BCE *Geography* referred to the river as Sind, from the Sanskrit place-name *Sindhu*, and the river was inscribed as such on countless maps from the thirteenth to the sixteenth century, when the postclassical Latin word Indus was adopted. Timurid histories of this period described the origin of the Jhelum tributary in Kashmir, its confluence with the Indus main stem, and ultimate discharge into the Arabian Sea (e.g. Yazdi 1976, 521–52). A Mughal map copied in the eighteenth century clearly delineates the Indus main stem and five major tributaries of the Punjab ("five waters") region, which began to convey the

MAP 8.1. INDUS River Basin map. UN FAO, Aquastat, 2011, Indus River Basin map, url: https://storage.googleapis.com/fao-aquastat.appspot.com/PDF/MAPS/indus-map_detailed.pdf). Reproduced with permission.

broader sense of a tributary river network (Phillimore 1952). Some painted maps and silk tapestries of this period also depicted large water bodies and associated plantings in the region (Gole 1989, 116–32).

Even though scientific delineation of *bassins* only developed with the work of French geographer Philippe Buache in the early eighteenth century, most nineteenth-century accounts continued to treat the Indus, and other rivers, as channels and not as basins (Buache 1757; Wescoat 2017). The term *Indus basin* was used in *A Catalogue of the Plants of the Punjab and Sindh* by the botanist James Edward Tierney Aitchison (1869) and in late-nineteenth-century geographical descriptions of the region by Clements Markham, Elisee Reclus, and others. One also finds geological references to the "upper Indus" as a basin in the same period (Drew 1874; Greenwood 1874).

British irrigation works were sometimes organized by basin, omitting the word *river*, for example, Ganges basin, Indus basin, and so on. However, the major irrigated provinces of the Indus basin—Punjab and Sindh—developed separately from and often in conflict with one another over basin water resources from the advent of British canal irrigation projects in the 1850s onwards (Gilmartin 2015).

The river basin concept was central to David E. Lilienthal's (1951) argument for treating the Indus as a shared context for water resource development in independent India and Pakistan. Eight years of negotiation culminated in the Indus Waters Treaty of 1960, along with the Indus Basin Development Fund created by the World Bank in 1961 to implement the infrastructure investment provisions of the treaty, and it was in the latter context that the term *Indus basin* came into widespread use. Interestingly, the Indus Waters Treaty refers twice to "household gardens and public recreational gardens," excluding these domestic and civic uses from regulation.

Thus, the concept of the Indus River basin may have had ancient origins, but it has had only recent usage for water resources management purposes since the mid-twentieth century. While the expression *Indus basin* implies a geographically shared natural resource, the Indus Waters Treaty of 1960 sacrificed that ideal for a division of the tributary river channels between India and Pakistan (see the extensive treatments in Adeel and Wirsing 2017; Amrith 2018; Gulhati 1973; Haines 2016; Hussain 2017; Michel 1967).

CULTURAL INTERPRETATIONS OF THE INDUS RIVER BASIN AS A WATER SYSTEM AND FOOD MACHINE

The Indus Waters Treaty of 1960 coincided with three major advances in river basin planning and development. Financially, to support the treaty that it helped broker, the World Bank created an Indus Basin Development Fund with support from a consortium of "friendly countries" that funded investments in dams, link canals, and other major infrastructure works (on a scale analogous to the Midi

canal in Mukerji's chapter in this volume). New models and analytic methods helped guide these investments. They built upon advances in computing power to generate synthetic hydrologic flow series, develop hydro-economic optimization models, and evaluate development alternatives (Maass et al. 1962). Applications of systems analysis in the water resources field are attributed in part to the Harvard Water Program. The system in this case involved a network of channels to deliver water to different agro-economic zones (Ahmad and Kutcher 1992; Duloy and O'Mara 1984).

The systems approach is itself a cultural model. Systems analysis emerged out of the field of cybernetics at a time of transdisciplinary mathematical and computational research that introduced systems thinking into water resources research (Wiener 1961). Simulation modeling identifies components, links them, and then alters those components in various ways to assess their effects. An optimization model, by comparison, searches for the best solution to any change in conditions. The World Bank's Indus Basin Model optimizes the net economic benefits of infrastructure investment and policy reform alternatives (Ahmad and Kutcher 1990; Yu et al. 2013). This idealized vision of optimal solutions to complex water problems captivated the collective engineering imagination during the second half of the twentieth century, and it was some time before its elusive qualities were realized and addressed with modified strategies of seeking solutions deemed good, or good enough, by society and policy makers.

The water engineering culture has been accompanied by an institutional culture evolving to address transboundary water issues (Michel 1967). It is interesting to note that the Harvard Water Project was led by political scientist Arthur Maass (1962). An institutional challenge at the international level is that India and Pakistan have federal systems of government, in which water is primarily a state subject with intense interstate water conflicts, which clashes with the strong centralized water organizations created after independence. For example, inspired in part by the Tennessee Valley Authority, Pakistan created a central Water and Power Development Authority (WAPDA) for a basin five times the size of the Tennessee River basin!

In a third development following independence, the Indus basin came to be conceived as a "food machine," which is once again an Anglo-American cultural construct (see Wescoat [2013] on its late-eighteenth-century origins). Professor Roger Revelle (1985) seems to have coined the food machine metaphor during his team's research on waterlogging and salinity of irrigated lands in Pakistan, commissioned by President John F. Kennedy during the regime of President Ayub Khan in the early 1960s. This was the era of the Green Revolution, when India and Pakistan were not yet food secure, and the food machine metaphor implied a visionary remedy for the problem, which critics later cast as socially and ecologically damaging (Johnson, Early, and Lowdermilk 1977; Kango 1997). Even so, the machine metaphor continues to be applied or evoked in large river basins of South Asia (e.g., Acciavati 2015).

THE SHIFT TO WATER RESOURCES MANAGEMENT: A CULTURAL INTERPRETATION

While the engineering systems approach and machine metaphor proved fruitful for physical infrastructure development, their outcomes on the ground posed jointly material and cultural issues. These included the environmental and social impacts of dams, waterlogging and salinity from canal seepage, groundwater depletion as millions of private tubewells supplemented surface water deliveries, and a rural-to-urban shift in water demand (Wescoat, Halvorson, and Mustafa 2000). Widespread social inequities in water deliveries, especially in the tail end of canals, contributed to lower crop yields than in other regions (Briscoe and Qamar 2005; Mustafa 2013).

"Management" became the cultural and policy innovation for addressing these problems. The shift from infrastructure to management encompassed multiple scales and sectors. At the local level, gaps between infrastructure investment and agricultural yields were attributed to poor water management by farmers at the field level. Management reformers sought to link improved canal deliveries by provincial irrigation departments to on-farm support for farmers administered by provincial departments of agriculture (World Bank 2017). The International Irrigation Management Institute (later the International Water Management Institute, see IWMI n.d.), created in 1984, brought together an expanding network of anthropologists, geographers, and sociologists who drew attention to cultural as well as operational issues (e.g., Merrey 1986).

At the highest level, the top-down approach described in Veronica Strang's chapter in this volume, the Global Water Partnership advanced a comprehensive approach called Integrated Water Resources Management (IWRM). The IWRM approach combined earlier models of integrated river basin development with increased emphasis on water resource economics, institutions, environment, and gender issues (Lenton and Muller 2009). It too faces criticism for eliding the political and cultural roots of mismanagement, economic distortion, hazards, and social injustice (Mehta, Derman, and Manzungu 2016; Mollinga, Athukorala, and Dixit 2006). For example, East Punjab the celebrated "breadbasket" of India in the 1960s now faces deepening socioeconomic problems that include groundwater depletion and farmer suicides (Singh, Bhangoo, and Sharma 2018), while Kashmir has suffered violent multidecadal conflict (Rao 2008).

There have been innovative efforts to address these weaknesses in the management paradigm. Elinor Ostrom (1990; 1993) developed a framework of Institutional Analysis and Design (IAD), which emphasized "rules in use," that is the actual social relationships, modes of communication, and informal rules that govern social action, rather than formal written policies that obscure as much as they explain. Water governance is a rapidly expanding focus of research. The emerging field of socio-hydrology strives to couple hydrologic and social processes through historical, comparative, and analytical methods (Wescoat 2013; Wescoat, Muhammad, and Siddiqi 2018). These approaches have made important contributions, but

they have met with limited success in turning around troubled irrigation systems. *It seems clear that something is missing and that a fresh cultural approach is needed.*

"IRRIGATED GARDENS" OF THE INDUS RIVER BASIN

We propose to think about river basins as complex historical and cultural processes in which the humanities play a vital role (Wescoat 2012; Muhammad 2016). The humanities have been largely implicit or limited in the approaches to water management discussed above, even though there is an abundance of relevant and available material, which includes histories of monsoon rainfall, irrigated landscapes, gardens, water architecture, and more (Rajamani, Pernau, and Schofield 2018). The humanities have explored water folklore, water aesthetics, water symbolism, water rituals, and still more (see Meadows and Meadows [1999] and Naqvi [2013] for Indus examples). We call this perspective "cultural" in a renewed sense of the Berkeley school of cultural geography, which has focused on environment-society relationships in agrarian landscapes (e.g., Leighly [1963] and Wallach [1996], and critiques by Agarwal and Sivaramakrishnan [2000] and Mitchell [1996], as discussed in Faletti's chapter in this volume).

Irrigation is by far the largest use of water in the Indus and other arid river basins (Wescoat 2000). To probe the humanistic dimensions of these irrigated landscapes, we undertake a geographical study of irrigated gardens that provide promising models of creative water management from the headwaters to the delta.

Gardens exist in many forms, some metaphorical and others literal. Even Roger Revelle (1985, 32), who characterized the Indus basin as a food machine, wrote, "I think that the main thing we did, in reality, as opposed to reputation or talk, was our insistence that this could be a Garden of Eden, that this was a tremendous agricultural resource and could be developed in a very profitable, very useful [way] for the people of Pakistan."

There are some pitfalls to be avoided with the irrigated garden concept. Take the famous Mughal gardens of Lahore, in which the ideals of paradise gardens in the Qur'an contrast starkly with the historical realities of those gardens (Wescoat 1991; 1995). Mughal gardens had the physical characteristics ascribed to paradise gardens but lacked the Qur'anic ideals of religious faith and good works. Late-twentieth-century research has drawn attention to such gardens as spaces of territorial domination and social control (Mitchell 2002). The Qur'an has several verses that warn about the destruction of worldly gardens that produced thistles rather than fruit, and were destroyed for the hubris they embodied (e.g., Qur'an 18:32–43; 44:25).

There are other places that were not called gardens but that have had some of the spiritual qualities of paradise that we seek in the Indus basin. We envision the basin as a mosaic of such gardens, including small horticultural plots and urban gardens, which have influenced one another upstream and down. Before surveying this mosaic, we briefly consider the history of ideas about gardens in the region.

The earliest evidence of gardens comes from ethnobotanical centers of Harappan civilization (third to second millennia BCE). As noted above, Harappa supported horticultural crops of fruits and vegetables that included melons, dates, and grapes as well as grains (Weber 1999; Weber and Belcher 2003). While the ideological character of Harappan cultivation is unclear, horticulture was foundational to this earliest civilization in the Indus basin (Wright 2010).

By comparison, Sanskrit literature of the first millennium CE associated gardens with groves, orchards, and parks (*udyana, apavana, sada-pushpa, vata*, etc.). Some major themes in those gardens involved pleasure, play, and romantic trysts in forest landscapes; with flowers, fruits, and kitchen gardens in domestic enclosures (Apte 1957–59; MacDonnell 1929). The celestial gardens of Indra, Krishna, and the *devas* were said to be located on the eastern side of the sacred Mount Meru near two large pools. References to gardens in Pali literature (e.g. *amba, arama, iddhi, uyyana*) likewise stress pleasure gardens associated with parks, groves, and natural streams (Pali Text Society 1921–25).

Modern Hindi and Urdu concepts of gardens have even broader connotations (Platts 1884). Some derive from Sanskrit (e.g., *upavan*, which refers to planted groves; and *udayan*, to royal gardens). Other words build upon the early Persian garden concept of the *bagh*, which carried over into the regional languages of Punjabi, Pushto, Sindhi, and Urdu. These modern languages stress practices of gardening, as in orchards, kitchen gardens, fields, and plantations. *Bagh* remains a common word for gardens in South Asia and is variously associated with the *chahar bagh* (fourfold garden) and *baghicha* (small gardens). The related Persian word *bustan* variously denotes orchards, flower gardens, and fragrance gardens. Other Urdu-Persianate garden terms include *pushpa* and *phulwari* (flower garden), *gul* and *gulistan* (rose garden), *jannat* and *firdaws* (paradise), *rauza* (tomb garden), *chamman* (meadow), *kiari* (planting beds), and more. Gardening castes and tribal groups of the north Indian region included *Arains, Baghbans, Malis*, and *Kachwaris* (Ibbetson and Maclagan 1911–19).

With these historical and linguistic notes in mind, we move to the search for irrigated garden precedents in the Indus, from its headwaters downstream to the delta. This downstream approach stands in contrast with upstream narratives that struggle against the current and terrain, in ways that have been associated with pilgrimage journeys and colonial conquest (Wescoat 2018). The sequence of subregions considered is:

1. Upper Indus River above Tarbela Dam;
2. Kabul River and its tributaries above the Indus main stem;
3. Upper Jhelum and Chenab basins of Kashmir and Jammu;
4. Punjab tributaries (Hills, East and West); and
5. Lower Indus basin from Panjnad to the delta.

When finished, we reappraise the implications of this composite mosaic of irrigated garden cultures in the Indus basin.

1. Irrigated Gardens of the Upper Indus River Basin

Irrigated gardens of the Upper Indus exemplify the garden ethos espoused in this study. The Upper Indus basin is bounded by the Himalaya, Hindu Kush, and Karakorum mountain ranges, sometimes called the water towers of Asia, that give rise to a dynamic regime of snow and ice hydrology (Bianca 2005; ICIMOD 2018; Khan et al. 2014; Kreutzmann 2006). Major subregions include Chitral, in the far northwest; Gilgit and Baltistan, which flank the upper Indus mainstem and its Shyok tributary; and Ladakh, which drains the northeastern headwaters of the Indus on the margins of China and Tibet.

Notwithstanding its high-altitude remoteness (Hussain 2015), the upper basin has a rich heritage of irrigated gardens that range from orchards to terraced fields and countless household kitchen gardens (*basi* in Burushaski and Shina languages). An extensive *Grammar of Shina Language and Vocabulary* features 146 entries for "Farming, gardening, trees, vegetables, fruits, and flowers" (Rajapurohit 2012, 102–7). Irrigation channels cut from small tributaries run by gravity for kilometers along the contours of steep hillslopes.

An important collection of essays drew attention to traditions of sharing water that are central to the garden ideals introduced earlier (Kreutzmann 2000). These villages celebrate irrigation festivals that build solidarity through the growing season and observe water use taboos to minimize pollution and scarcity. Innovative irrigation communities construct "artificial glaciers," in which early snowmelt on south-facing slopes is diverted to north-facing slopes, where it refreezes (Angchok and Singh 2006). When this frozen water remelts later in the season, it is used downslope or diverted back around to south-facing slopes for much needed late-season irrigation water. This ingenious irrigation method entails a high level of community collaboration on multiple scales.

The Aga Khan Rural Support Programme employs traditional and modern cultural approaches to improving irrigated farms in the upper Indus basin through a combination of sociocultural mobilization, technical support, women's education, ethno-religious pluralism, and financial planning (Wood, Malik, and Sagheer 2006, 454–90). The Aga Khan Trust for Culture has a parallel program of cultural heritage conservation projects in the Karakorum region that include links between water and gardens (Bianca 2005).

Irrigated orchards and kitchen gardens make significant contributions to agrarian landscapes of the northern areas (Kreutzmann 2006; Parveen et al. 2015). Local irrigation systems have a combination of formal organizations and informal rules for water allocation by turns, canal maintenance, dispute resolution, and emergency repair. Recently, fifty-seven local gardeners formed a Chitral Horticultural Society that featured ten of its members' gardens on its website, along with plant lists and Khowar garden poetry. In addition to these physical gardens, regional folktales speak of magical gardens watered by running streams that have trees of life and death, tended by elderly couples, inhabited by fairies (*pari*), and full of moral lessons (Swynnerton 1987).

These irrigated gardens of the upper Indus combine beauty, economy, ecology, morality, and spiritual life in integrated ways. They encounter numerous hazards and display remarkable cultural adaptation and resilience. They also face challenges posed by government proposals to build massive hydropower projects on the Indus main stem. Before proceeding to those downstream connections, we need to consider the adjacent headwaters of the river Indus.

2. Irrigated Gardens of the Kabul River Basin

The Kabul River was not included in the Indus Waters Treaty, but it has a fascinating historical geography of irrigated landscapes from antiquity to the present that is relevant for the Indus. Kabul was associated with a beautiful paradisiacal city mentioned in *The Rigveda* (Jamison and Brereton 2017). Ancient Gandharan sources mention charitable wells (Falk 2009) associated with monasteries and settlements north of the Kabul River and in the tributary Swat River valley.

Some of the early irrigated gardens and waterworks of Kabul were built by the founder of the Mughal dynasty, Zahiruddin Muhammad Babur, from 1504 to 1526 CE (Parodi 2021, forthcoming; Wescoat 1991). A famous image of Babur laying out the *Bagh-i Wafa* (Garden of Fidelity) downstream from Kabul near Jalalabad draws together formal, symbolic, and experiential garden qualities (Wescoat 1989, 2021). The *Baburnama* makes it clear that gardens were places of cultivation, poetry, camaraderie, and sensory enjoyment. While many of these sites have been lost, Babur's terraced funerary garden of fruit trees along a central water axis, known as the *Baghe Babur*, has been recently restored by the Aga Khan Trust for Culture in Kabul. Later Mughal governors built irrigated gardens in downstream reaches of the Kabul basin in Peshawar, Naushehra, Vallai, and Swat (Rehman 1996).

The garden heritage in this region faces serious challenges, however, including decades of conflict in Afghanistan that have spilled into the Swat valley and other areas of Pakistan. Anticipating a lessening of those conflicts, proposals have recently been put forward to build a cascade of dams and reservoirs along the upper Kabul River in Afghanistan. These projects promise upstream water, agriculture, and power benefits, accompanied by downstream water and environmental costs (World Bank 2010). Similar dam proposals and controversies roil downstream in Pakistan at sites like Kalabagh, which means "black garden," which may refer to mango orchards whose dark green foliage appears black from a distance. The current situation in the Kabul River basin demands a new approach that takes upstream and downstream landscapes seriously.

3. Irrigated Gardens of the Upper Jhelum and Chenab Rivers in Kashmir and Jammu

Few places on earth have as strong an association with gardens, water bodies, and paradise symbolism as the greater Kashmir region. Few places have as great a need for a transformative approach to water and environmental management. Flooding, conflict, and controversial water development proposals afflict the region

(Rao 2008). At the same time, historical conceptions of Kashmir as a paradisiacal landscape have deep roots that can inspire a fresh cultural approach to water management (e.g., Inden 2008; Petruccioli 1985). Kashmir and neighboring Azad Kashmir drain the upper Jhelum river basin, which has a mix of snow and ice melt, while the adjacent district of Jammu drains the Chenab River, which has a combination of monsoon rainfall and snowmelt. Each of these headwaters regions faces distinct challenges and opportunities.

Kashmir has the most renowned garden history in the Indus basin and in South Asia at large. Its origin myth involves the draining of a great lake that was named *Satisar* by a powerful religious saint (*rishi)*. Water and garden verses weave throughout the poet Kalhana's epic *Rajatarangini* (River of Kings), written in the thirteenth century, which narrates the vicissitudes of good and bad rulers (Pandit 1935; Kaul 2018; Stein 1900; Zutshi 2014). The text speaks of thousands of gardens and water bodies that had widely varying qualities of beauty and danger, growth and decline, poverty and prosperity (Stein 1900).

Four centuries later, Mughal rulers built pleasure gardens along the shores of Dal Lake, and countless poems and texts proclaimed Kashmir's affinity with the gardens of paradise. When the Mughals rulers invaded Kashmir toward the end of the sixteenth century, it reminded them of a Central Asian paradise lost, as well as a new paradise found. They appropriated Kashmir's mytho-poetic paradise heritage, which they fused with their own tradition of garden building and literature (Sharma 2017). They represented water gardens in paintings. The fourth Mughal ruler Jahangir (1999) went so far as to speak of Kashmir as a regional garden, as his father Akbar had for all of Hindustan (Koch 2008). Later rulers commissioned large silk and cotton maps of this Dal Lake and River Jhelum landscape.

Today, the Indian National Trust for Art and Cultural Heritage (INTACH) features gardens and waterworks in its heritage conservation projects. Kashmiri garden ideals find expression in vernacular as well as elite courtly texts. Vegetable gardeners on the margins of Dal Lake ingeniously expanded their planting beds and yields by creating floating gardens. Floating on light wooden frames, the lake gardens have layers of rich silt and organic matter in which vegetables root and grow (Casimir 2021). Water gardens extend from these floating vegetable plots to the formal water and *chinar* (Oriental plane) tree axes in Mughal gardens to fields irrigated by mountain springs (INTACH 2014). Conservation of Kashmir's water garden heritage draws together popular, poetic, and provincial aspirations (figure 8.1).

As noted above, the Indus Waters Treaty of 1960 excludes floating domestic gardens of the sort that abound in Kashmir. Indus water developers focus instead on large hydropower projects like India's Kishanganga Dam on the Jhelum River, which competes with Pakistan's nearby Neelum-Jhelum project. International arbitration drew attention to environmental impacts downstream that neither country seemed well prepared to address, but that would be central in a garden approach.

FIGURE 8.1. Mughal water gardens in Nishat Bagh, Kashmir. Photo courtesy James L. Wescoat Jr.

There is a need to comprehensively rethink the waters of Kashmir, including their linkages with irrigated garden heritage downstream in Punjab. That vision seems remote at present, as conflict and mismanagement have wracked the region for decades, leading some to regard Kashmir as a "paradise lost" (Rao 2008; Sharma 2017). However, the region has a unique heritage and prospects for renewal as an irrigated garden.

The Jammu region in the upper Chenab River basin lies just east of Kashmir. It has a very different origin myth in which King Jambu Lochan saw a lion and a goat drinking side by side from a stream, which led him to select that peaceful site for his capital in Jammu. His brother Bahu Lochan built a garden fortress and temple on the banks of the Tawi River known as *Bagh-e Bahu* (Garden of Bahu). The Tawi and Chenab basins have historically supported irrigated rice in summer and wheat in winter, along with vegetables and medicinal plants, but they too face pressures to develop large hydropower projects.

4. Irrigated Gardens of the Punjab ("Five Rivers")

Downstream, Punjab presents new patterns of irrigated gardening that have had global as well as regional significance. Punjab comprises broad alluvial plains, which are watered in part by runoff from the former Punjab hill states in the northeastern headwaters of the basin (Malhotra and Mir 2012). For most of its

FIGURE 8.2. Irrigated orchards and fields in Punjab. Photo courtesy James L. Wescoat Jr.

premodern history, the region had extensive pastoral lands and localized areas of flood farming, inundation canals, and shallow dug wells, which supported riparian settlements and dispersed hamlets on upland *bar*s, from antiquity to the early modern era (Gilmartin 2015; Mughal 1997).

These early irrigated landscapes underwent three major transformations during the Mughal, colonial, and postcolonial periods (figure 8.2). For example, Punjab has some of the earliest Mughal period gardens on the subcontinent. They include Kallar Kahar, where Babur occupied a rock outcrop carved into a throne (*takht*) that provided views of a lake and surrounding orchards. Mughal rulers also built riverfront gardens like Kamran's *baradari* along the Ravi riverfront, which emulated the riverfront gardens of other Mughal cities like Agra and Delhi. Over time, Mughal gardens became monumental in size, design, and waterworks; and the Punjab capital city at Lahore came to be known as the Mughal City of Gardens. Emperor Shah Jahan (r. 1627–57) ordered construction of a large canal to irrigate Shalamar Bagh and adjacent garden plots along the Ravi River terrace near Lahore. However, the French traveler Francois Bernier wrote a cautionary letter to Jean-Baptiste Colbert, the finance minister for Louis XIV (discussed in Mukerji's chapter in this volume), on the deterioration of water infrastructure in regimes that neglect the rights of cultivators (Wescoat 2000).

These Mughal gardens were places of dynastic pleasure and power that had the form and elements of paradise in Islam, but often lacked its ethos. For example, Kamran's baradari in early-sixteenth-century Lahore witnessed a series of internal betrayals among Mughal brothers, fathers, and sons (Wescoat 1995). Mughal

paintings of gardens and waterworks provided idealized representations of what gardens ought to be as, for example, when they depicted dignified gardeners tending the soil and plantings, or Sufi mystics conversing in idyllic garden settings.

Eastern Punjab had Mughal gardens like Pinjore, and charitable drinking water wells at caravanserais along the Grand Trunk Road from Bengal to Kabul. These facilities were followed by important Sikh gardens and sacred water bodies like the Amritsarovar tank surrounding the Golden Temple (Parihar 1989; CRCI 2009). When one considers Sikh faith and practice, as we have for Islamic gardens and water rights in western Punjab (Wescoat 1995), a rich perspective emerges. The *Guru Granth Sahib* has scores of references to gardens (*baga*) and waterworks. A search for the keyword "garden" yields verses that associate the idea of the garden with God's creation: "This world is a garden, and my Lord God is the Gardener" (Sri Granth n.d., Guru Amar Das 118, line 7). The relationship between gardens and irrigation is profoundly spiritual: "The Word is the tree; the garden of the heart is the farm; tend it, and irrigate it with the Lord's Love" (Sri Granth n.d., Guru Nanak Dev 254, line 17). Sikh texts include fascinating historical garden stories as well, like the refuge sought by Guru Gobind Singh in the village garden of Macchiwara in 1704 CE. Verses on water and waterworks frequently mention pools (*pula*), a logical image given the reliance on rainfall, floodplains, and wells in precolonial Punjab (Wahi 2014).

Proceeding upstream a bit, the headwaters of the former Punjab Hill States offer additional perspectives on montane waterworks, gardens, and landscapes in the region. These small kingdoms were established in the foothills of the Himalayas from Jammu in the northwest to Garhwal in the southeast. In between lay dozens of small principalities in the upper Ravi, Beas, and Sutlej river tributaries of the Indus. We gain special insights into their irrigated gardens from exquisite local schools of painting that flourished in the late eighteenth through mid-nineteenth centuries (Archer 1973; Losty 2017). Seven examples stand out for their water and landscape imagery.

Basohli state was situated on the right bank of the River Ravi right where Jammu, Punjab, and Chamba territories intersect. Its painters depicted religious scenes with circular enclosures of forest and flowering trees, often surrounding a pond with floating lotus leaves and flowers, opening up to a river in the foreground. Further upstream, Chamba state drains the Ravi river headwaters. Its paintings feature more elaborate forest scenes in waterfront locations. Some depict Rama, Sita, and Lakshman in their forest hermitage. Many celebrate Radha and Krishna's love in beautiful forest settings along rivers, as well as rajas and ranis emulating those passions in formal garden pavilions like those of the Mughals.

To the southeast, the Beas River flows through the former Mandi, Kangra, and Guler states. Mandi and Kangra paintings feature images of Radha longing for Krishna in forests and waterscapes. Downstream on the Beas, Guler artists produced paintings that have abundant images of lakes, rivers, and ponds. Many

feature women swimming, including the Punjabi folktale of Sohni floating dangerously across the river to meet her lover Mahiwal. One Guler painting depicts an irrigated garden scene with a Persian wheel and gardeners tending flower parterres in a large enclosure (Archer 1973, 111, 112). For the most part, Punjab hill paintings emphasized forest landscapes with free-flowing rivers and ornamental waterworks, which complement the intensively irrigated plains below.

In both areas—hills and plains—pre-nineteenth-century irrigation practices relied on streams, wells, and inundation canals. Water-lifting devices included buckets, Persian wheels, chains of pots, and inclined ramps drawn by animals (Crooke 1989). The early social histories of these irrigated gardens across the Punjab remain to be written. They are crucial for constructing a cultural approach to water management from the ground up that would draw upon all of the humanities, along with the historians who have contributed so much to date (e.g., Gilmartin 2015).

The culture of colonial canal irrigation, by comparison, involved extensive manipulation of social and environmental relationships, coupled with irrigation projects on a monumental scale. The first of these projects began with strategic cartographic surveys of the river and region by explorers such as Alexander Burnes (1834), who praised the lush irrigated gardens along the river in Multan. These river surveys contributed to the aggressive annexation of Punjab and Sindh, after which the British took a combination of military and civilian approaches to irrigated gardens by constructing Soldier Baghs, Company Baghs, botanical gardens, and canal plantations of great length and diversity. For example, the early Bari Doab Canal reports mentioned that, notwithstanding a decade of political disturbance, cultivation of the region was almost garden-like in character (Crofton, Dyas, and Napier 1850). Canal planner Richard Baird Smith (1849) wrote about the agricultural potential of the Punjab, noting its carefully irrigated and well-tended garden-like character. It is interesting to note that when California engineers sought models for developing the Central Valley, discussed in Faletti's chapter in this volume, they viewed colonial Punjab as a promising precedent (Wescoat 2000).

The vast canal irrigation system constructed in Punjab during the late nineteenth and twentieth centuries settled decommissioned soldiers and pastoral peoples on newly irrigated lands to increase political control and revenue (Gilmartin 2015). The British manipulated tribal customary law and power relations when laying out settlements and allocating land grants. Unlike gardens in the upper basin, these early canal irrigation projects sought to spread water as far and as thinly as possible to maximize social and territorial control.

To accomplish this aim, irrigators received relatively low water entitlements in rotations or "turns" known as *waribandi* (Wescoat 2013). Previous research has examined the (in)efficiency and (un)fairness of these water deliveries in relation to entitlements, frequently noting the low water deliveries to low status farmers

at the tail ends of distributaries. It is speculative but inspiring to consider the cultural bases for regarding a turn (*waar*) not so much as a right as a form of duty or even sacrifice to others, as in the Punjabi Sufi poem titled "Sammi waar." Sufi literature has many tales of sacrifice (ایثار) in which a small amount of water is shared among dying companions stranded in the desert or on a battlefield. The companions keep sacrificing (واری) their turn (وار) for others, and the cup of water is thus never entirely consumed. In an ideal world, water users of all types and at all levels might be imagined to واری their وار for others. Although the social science literature records many examples of the opposite behavior, to our knowledge few have searched for cultural evidence of such sacrifice.

Concurrent with the expansion of canal irrigation in the mid-nineteenth century was the establishment of the Agri-Horticultural Society of the Punjab. As its title indicates, it aimed to create a bridge between field and garden cultivation (Kerr 1976; Rehman 2014). Punjab was not the only branch, but it was an active one, originating just two years after annexation of the province by order of Governor-General Dalhousie, who lamented the lack of forest, fruit, and shrub cover in Punjab's agrarian landscape (Kerr 1976). Dalhousie gave directions to line the banks of the Bari Doab Canal with tree plantings and encouraged village communities to set aside lands for this purpose. While largely functional in purpose, the cultural motivations for corridors of road and canal bank tree plantings soon after annexation reflected an imperial vision of landscape transformation and bounty.

Following partition and independence in 1947, postconflict reconstruction included cooperative "garden colonies" in irrigated districts of East Punjab to promote fruit production, especially citrus. The duty of water (water allocation per acre) was increased for these valuable garden crops (Randhawa 1954). While the culture of irrigated gardens in Punjab has a rich and diverse history, its breadth, depth, and salience for the basin's past and future have yet to be fully embraced.

5. Irrigated Gardens of the Lower Indus Corridor and Delta

The lower Indus basin is an arid landscape with broad floodplains and extensive irrigation. It may seem the least garden-like region in character, but only if one fails to search and see (Haines 2013; Pithawala 1937). Some colonial writers wrote despondently about the region as "the unhappy valley," and indeed the lower Indus faces some of the greatest livelihood challenges of waterlogging, salinity, drainage, flooding, oppression, and deltaic deterioration.

But the lower Indus River channel and plains have also been envisioned at various places and times as irrigated gardens. For example, a leading scholar in Islamic studies, Annemarie Schimmel (1999), cites modern poets and Sufi saints on the beauty and bounty of the lower Indus, including its barrages: "What a plenitude of fruits and vegetables can now be grown in the country! From carrots, garlic, corn, watermelon and sugarcane to wholesome plants that help cows to produce more milk—there is 'relief after grief.' . . . Not only dozens of hitherto unknown

FIGURE 8.3. Orangi Pilot Project self-help wastewater sewerage and community development. Photo courtesy James Wescoat.

vegetables and fruits can now be harvested—there is also a variety of birds which begin to nest in the fresh greenery, among them crows and doves, Meena birds and ring doves and many others" (413).

Upstream near Sukkur barrage, Larkana district has long been known as the "garden of Sindh" and the "Eden of Sindh" for its bountiful rice cultivation (Holmes 1968). The *Globe Encyclopedia* described Larkana in 1878 as "situated in the most fertile part of the province, and from its gardens and tree-lined roads has been called the 'Eden of Scinde'" (Ross 1878, 56). During the colonial period, Sindh was famous for its fruit and vegetable cultivation, as well as for its rice, wheat, and cotton. Aitken (1907, 36–38) listed dozens of garden fruits and their performance in the province.

Just above the delta, the Mughal capital at Thatta was famous for its flower and fruit gardens (especially pomegranates) (Aitken 1907, 238). The successor capital at Karachi also had a reputation for fine gardens at the turn of the last century: "along the Lyari River and as far as Malir, there are gardens, owned by Khojas or Memons, which supply the market with all the standard fruits" (238; though see the critical contemporary perspective of Ginn 2018). Despite all of its stresses, the vast low-income Orangi neighborhood in Karachi has kitchen gardens, tree plantings, and a plant nursery as part of its wastewater infrastructure and community development program ("Orangi Pilot Project: NGO Profile" 1995) (figure 8.3).

Even the deteriorating Indus delta has had its gardens. Medieval geographers like al-Idrisi mentioned towns surrounded by gardens, one of them known as Jun on a branch of the lower Indus (Haig 1894). "Clay vessels, leather bags, and other receptacles were filled from the surface water bodies and were carried by man to the required places. The amount of water thus raised was sufficient for the small farms and gardens common to early farmers" (Rahman 1960, 78).

SYNTHESIS AND IMPLICATIONS FOR INDUS RIVER BASIN MANAGEMENT

We have followed the Indus from its vast headwaters in the Kabul, Jhelum, Chenab, and Beas-Sutlej watersheds through the plains and down to the delta. We are now in a position to draw these threads together in a perspective on irrigated gardens of the Indus, and imagine the entire Indus as a landscape of irrigated gardens. Indeed, five humanistic threads seem to tie these irrigated garden cultures together:

Deep historical continuity. The Indus basin has deep garden history and heritage, originating in the earliest centers of civilization at Harappa and continuing up to new internet forums in Pakistan that feature hundreds of garden webpages.

Basin-wide geographical extent. We have shown that inspired and inspiring irrigated gardens extend from the upper reaches of the Indus main stem and all of its tributaries, through the broad plains of Punjab and Sindh, into the estuaries of the Indus River delta. Many of these gardens are fed by small tributary streams, and some rely on wells, while still others draw upon major river channels and floodplains that connect the Indus as a basin.

Diverse types of irrigated gardens. The diversity of irrigated gardens ranges from rice fields to orchards and flower gardens. These extend from the smallest kitchen gardens to the entire irrigated basin. The denotation of the irrigated garden thus encompasses remote rural villages, megacities, and expanding suburbs.

Shared meanings and values. Notwithstanding this diversity, our interpretation reveals several widely held connotations of irrigated gardens. There are important variations, to be sure, but well-watered gardens are associated with the creation of the world, its sacredness, human stewardship, and rewards for those who have done good. The best gardens reflect the virtues and dignity of lives well lived.

Visions for a common future. Collective understanding, be it in the form of myths, stories, and legends or as shared values reflected in gardens, provides ideals for envisioning a common future for the basin. Although not explored in this essay, futuristic imagination that features societal interactions with new technologies (Muhammad 2016) and new environmental challenges (e.g., climate change) may be explored using the garden as a metaphor. The good irrigated gardens of this world are indeed signs of beneficence and of what is possible.

Collectively, these five aspects of irrigated gardens in the Indus offer culturally inspired and inspiring models of conscientious waterscapes that embrace and go beyond the accomplishments of twentieth-century water management. No

river basin model currently aspires to these humanistic ideals or offers real and imagined examples of their potential. Mainstream models of river basin management speak to other social objectives. Colonial approaches combined the aims of economic efficiency and sociopolitical control (Gilmartin 2015). Postcolonial accounts remain focused on the politics and geopolitics of water development (Amrith 2018). Modern multi-objective river basin planning has addressed tradeoffs among economic, ecological, and equity goals in ways that promoted economic growth and development. Overall, however, these modern approaches did not aim high enough in cultural terms. They sought to enhance material production to achieve social goals and mitigate the harms of water development projects. While those aims represent an advance over the current situation of inefficiency, inequity, and environmental deterioration, they are much less than what is possible with a cultural approach on a river basin scale.

Critical assessments have underscored the deficiencies of modern water management (Mustafa 2013). It is not just inefficiency: unfair competition, unbridled capital accumulation, and oppressive power relations are widespread. Conflict is one of the most prevalent themes in water resources research in the Indus and elsewhere (Adeel and Wirsing 2017; Amrith 2018; Haines 2016). The history of water resource management is replete with examples of social domination, oppression, and inequity (Naqvi 2013). The humanities have also shed light on these dark themes in garden history (Wescoat 1991; 1995).

In place of the illusory goal of optimizing economic development or romanticizing traditional landscapes, the cultural approach espoused here helps articulate the "purpose" of a river basin's existence, the "meaning" of its people's aspirations, the moral dangers of mismanagement, and the aesthetic prospects of the irrigated garden model. As demonstrated here, a cultural approach can identify places on the ground, throughout history, and throughout the basin, that manifest the beauty and meaning of irrigated gardens in theory and in practice. These irrigated gardens constitute a mosaic and network of inspired and inspiring water flows in the Indus River basin. Collectively, they point toward larger processes of irrigated garden development at the scale of canal commands, provinces, nation-states, the international river basin, and beyond. They remind one of the paradise gardens at the end of time, and how they guide those who strive to have faith and do good work in the Indus basin today.

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