

S U S T A I N A B L E
LANDSCAPE DESIGN
I N A R I D C L I M A T E S



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Facsimile: (41.22) 909 72 92

Editor:

William O'Reilly, The Aga Khan Trust for Culture

Concept and Design:

Robin Oldacre, The Aga Khan Trust for Culture

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PROLOGUE:

Confronting Sustainability

Terence Young

INTRODUCTION:

A Geographical Perspective on Landscape Design in Arid Environments

James L. Wescoat, Jr.

Sun, Wind, and Water in the Arid Landscape

John T. Lyle

Aspects of a University Project and a New Town in Iran

Kamran T. Diba

The Preservation of Nature in the Alborz Ranges

G. Reza Pasban-Hazrat

Culture, Environment, and Sustainability: Theoretical Notes and
Reflection on a Community Park Project in Cairo

Abdelhalim I. Abdelhalim

Trees and the Desert: Village Protection in Northern Sudan

Paul Laird

Gardens in the Desert: A Landscape Architect in Saudi Arabia

Richard Bödeker

CONCLUSION:

Summary of Discussion and Future Concerns

James L. Wescoat, Jr.

CONFRONTING SUSTAINABILITY

Terence Young

According to Donlyn Lyndon, “sustainability” has become a “catch word of the times”.¹ Echoing Lyndon, Mike Pease writes that it seems that the word is appearing “everywhere”.² Certainly the landscape literature would lead one to this conclusion. Recent issues of such publications as *Landscape Design*, *Places*, and *The Urban Ecologist* have, for example, carried reports about the first meeting of the United Nations’ Sustainable Cities programme which included presentations from Senegal, Poland, China, Mozambique, Tanzania, and Chile; about “Green Korea”; a group working toward a sustainable Korean Peninsula; about the new Sustainable Development Centre in the United Kingdom; the President’s Council on Sustainable Development in the U.S.; and the World Congress of Architects’ “Declaration of Interdependence” calling for the profession’s dedication to achieving sustainable designs.

Despite this currency, however, the notion of sustainability is not without its history. A quick perusal of the literature finds glowing references to such lights as Louis Bromfield, Patrick Geddes, Ebenezer Howard, J.I. Rodale, and Rudolph Steiner. Intriguingly, these individuals all worked in mid-latitude, humid climates. Could it be that the pioneers in arid environments are absent from these hallowed halls because much of their work was not in English?

In addition to any biographical ancestry, it is clear that today’s sustainability has its roots firmly planted in the utilitarian resource management that began at the end of the last century. Progressive-era conservationists would recognise today’s sustainability as a child of the “sustained yield” concept for such renewable resources as game, fisheries, and forests. These early technocrats argued for levels of extraction that could be maintained without lessening future levels

of supply. Today's proponents of sustainable development borrow from their intellectual, policy, and design predecessors but then affix an insistence that no design will be sustainable if it does not recognise the complex interrelationship of the physical and the cultural.

What then is sustainability? As is often the case when a concept is widely embraced, there seem to be a great number of definitions. Robert Thayer, for example, defines it as "a characteristic of a process or state that can be maintained indefinitely".³ A group of student visitors to Habitat II in Istanbul link sustainability to a site and indicate that it occurs "where a designed area is wholly suitable to its location, cultural background, inhabitants, and users".⁴ Pressing onward, Lyndon declares that a sustainable design is not only appropriate today but one that "can support continued use and evolution".⁵ The most widely accepted definition seems to be the one coined in 1987 by the World Commission on Environment and Development. Drawing on the adage that we don't inherit land from our ancestors but borrow it from our children, the commission declared that sustainable development "meets the needs of the present without compromising the needs of future generations to meet their own needs".⁶ John Tillman Lyle declares this perspective a "revolutionary notion" because it means "living on the interest yielded by our natural systems rather than the capital"⁷ Revolutionary or not, the definition depicts sustainability as egalitarian because it states an allegiance to the future and implies a parity among the world's peoples.

Why should we or anyone else care? Because, announce the advocates of sustainability, we have responsibilities to others and we are living at the end of an age. These are the "declining and decadent years of the industrial era".⁸ The world's populations are growing, resources are depleting, and both natural and vernacular environments are degrading. Affluence, warns Peter Calthorpe, creates "a sense of entitlement" and security where none is warranted. Sustainability is a "profound necessity" for most people, he cautions, and it will soon be

come one for the middle classes as they experience a decline in wealth.⁹ Sustainability is not, however, merely an abstract virtue nor simply a brake on decline. It will deliver important benefits. The frugality of a sustainable future, promises Calthorpe, will bring “a more profound sense of community and potentially a finer life”.¹⁰

In refutation of these claims, critics ask how, by definition and in practice, does one attend to the continual redefinition and revaluation of resources. Today’s resource can become tomorrow’s liability even as yesterday’s waste becomes today’s valued commodity. This criticism recalls a similar problem encountered during the Progressive Era’s pursuit of sustained yields and hints at the difficulty of finding a demonstrable solution. Other critics argue that the use and full replenishment of resources without polluting the environment is “an impossible goal” in a developing, urbanising, consumer-driven, capitalist world.¹¹ Sustainable development, some charge, is an oxymoron since the first term is based on changelessness and the second on change. Finally, the most cynical denounce sustainability as merely the latest formula used by élites to maintain growth that benefits them while avoiding or finessing intractables.

Regardless of where one comes down on the issue of sustainability, it has provided a necessary focal point for discussion and debate in the chaotic arena of global change. No matter whether one is a theorist, designer or critic, sustainability forces one and all to attend to a number of fundamental questions. Among them are: what is nature and the proper human relationship to it? What is a society? Is it necessarily linked to the landscape it currently occupies or is that connection merely contingent? How does one develop a sustainable landscape design that takes into account the local, traditional, social organisation? Are the costs and benefits of sustainability to be distributed within a society? At what temporal and spatial scale is a given landscape design deemed sustainable? How does a sustainable design take into account dynamic technologies, ecologies, and social orders?

Finally, how does a designer inform his practice with theory and how do theorists gain the insights of practice? Sustainability will never be achieved without first providing answers for these difficult issues.

NOTES

1. Lyndon, Donlyn. "A Shift in Expectations." Places. 1995, 9(3): 2.
2. Pease, Mike. "Sustainable Communities: What's Going On Here?" Places. 1995, 9(3): 50
3. Thayer Robert L., Jr. Gray World, Green Heart: Technology, Nature, and the Sustainable Landscape. New York: John Wiley and Sons, 1994: 232.
4. A Glimpse of the Future from Istanbul. Landscape Design 253 (1996): 52
5. Lyndon Donlan, A Shift in Expectations, 2
6. World Commission on Environment and Development. Our Common Future. New York: Oxford University Press, 1987: 42
7. Lyle, John Tillman. Regenerative Design for Sustainable Development. New York: John Wiley and Sons, 1994: 3
8. *Ibid.*, ix
9. Okamoto, Paul; Wheeler, Stephen. "Transit-Oriented Development." The Urban Ecologist. 1993 (Fall(North)/Spring(South)): 1
10. *Ibid.*, 4
11. A Glimpse from the Future in Istanbul, 52



A GEOGRAPHICAL PERSPECTIVE ON SUSTAINABLE LANDSCAPE DESIGN IN ARID ENVIRONMENTS

James L. Wescoat, Jr.

It is useful to situate the case studies of arid landscape design in this volume within a geographic context that can facilitate analysis, comparison, and evaluation. This chapter offers a brief introduction to arid environments and to processes of desertification that can undermine sustainable development.

The term “arid” has a range of connotations that vary by culture and historical period. For some, it implies barren wastelands while for others it evokes landscapes of biological, cultural, and aesthetic richness (Wescoat 1990). From a scientific standpoint, aridity refers to a scarcity of moisture, in which precipitation is exceeded by potential evapotranspiration (i.e., the amount of water that would be consumed by plants and evaporation when unlimited water is available). Aridity and drought indexes have been developed to analyse water scarcity. These varied climatic patterns of water deficit interact with physiographic conditions to produce a variety of arid and semiarid environments (figure 1). Five major causes and contexts of aridity may be distinguished:

1. Subtropical Latitudes. Subtropical zones, around latitudes 30 degrees north and south, are more likely to be arid than other belts because they are dominated by high pressure systems of descending air that inhibit convective precipitation. These climatic processes account for the broad arid and semi-arid belts of the southwestern U.S., northern Africa, northwestern India and Pakistan, Australia, southern Africa, and the Sahara desert.

2. Rain Shadow Effects. When moist air masses encounter mountains, they ascend and cool, which leads to condensation and precipi-

ARID CONDITIONS IN SHIMSHAL, A SMALL VILLAGE IN NORTHERN PAKISTAN, SURROUNDED BY DESERT AND BARREN MOUNTAINS. WHEAT PRODUCTION IS IRRIGATED BY SMALL CHANNELS, DIVERTING WATER FROM THE RIVER.

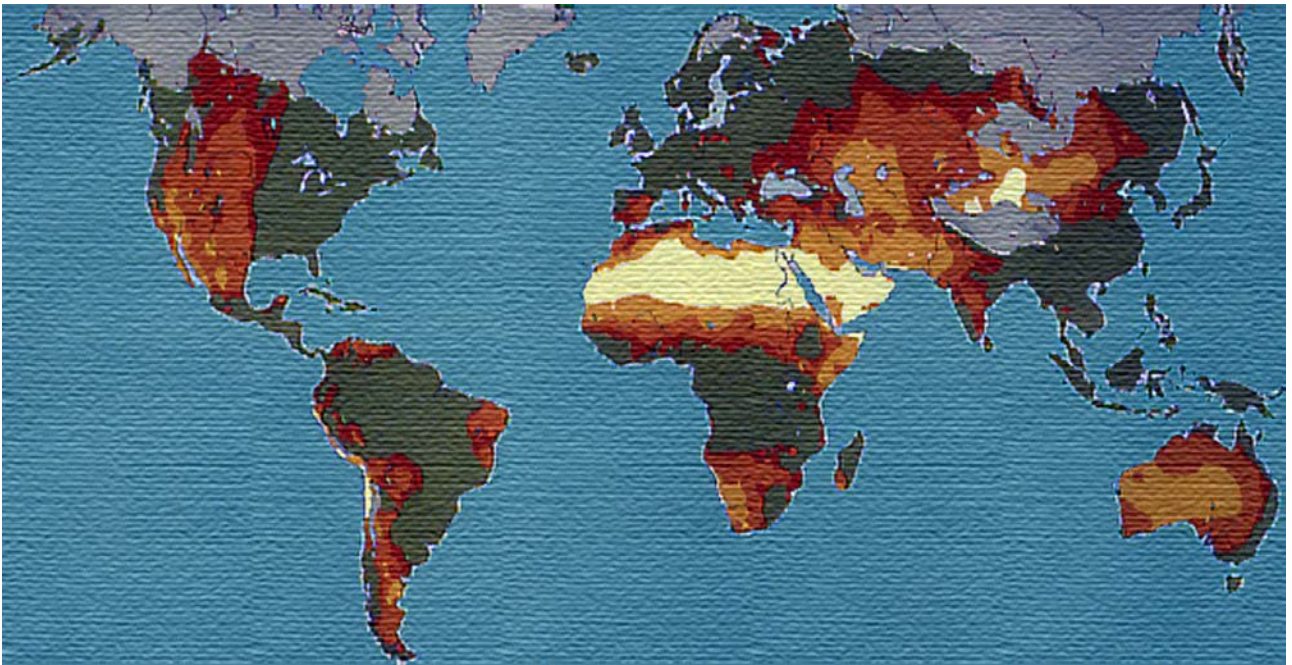


FIGURE 1
 WORLD ARIDITY MAP
 (FROM UNEP/FAO, WORLD ATLAS OF
DESERTIFICATION, LONDON, EDWARD
 ARNOLD, 1992)

tation on the windward side of the mountains. Downwind, dry descending air masses create a “rain shadow”. This effect produces the sharp climatic boundaries found along mountain ranges and escarpments of the northwestern U.S., southern India, and some Pacific Islands like Hawaii whose windward areas have humid subtropical climates while their leeward slopes are semiarid.

3. **Continent Interiors.** As air masses move across the large continents of the world, they lose moisture through precipitation, and then pick up little additional moisture by evaporation. Thus, they become increasingly dry, which helps explain the gradual transitions from sub-humid to sem-arid and arid conditions in the interior regions of the American Great Plains, Central Asia, and western China.

4. **Cool Current Coasts.** Cool ocean currents extend the arid conditions of subtropical regions into the middle or lower latitudes by reducing convection and precipitation. Such conditions occur on the western coasts of California, northern Mexico, South America, and southern Africa.

5. **High Altitudes and Polar Latitudes.** Although generally perceived as moist snow-covered landscapes, some polar and alpine regions have little precipitation and little water in a liquid state.

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These five phenomena give rise to seasonal and annual moisture deficits. Their complex interactions in and with the landscape yield an enormous variety of environmental and ecological conditions. Some deserts, such as the Sonora in the southwestern U.S., have highly diverse flora and fauna while others, like the nearby Mojave, have a more limited range of native species. Human uses of arid regions also vary enormously. Land uses range from pastoralism, rainfed and irrigated agriculture to mining, manufacturing, urban settlement, and recreation. Deserts are places of movement ranging from transportation to religious pilgrimage. They are also places of wilderness conservation and military testing. As technologies and patterns of desert occupancy change, so do trends in environmental design. Settlement on the humid margins of a desert shape the use, condition, and perceptions of the desert (e.g., Heathcote, 1983; and Sharma, 1972).

Perceptions are important in leading groups to settle in or avoid an arid region. The erroneous belief that “rain follows the plow... or the tubewell” has led many farmers to try to cultivate semi-arid lands (Glantz, 1995). They often hope that irrigation and shelterbelts will increase regional rainfall as well as local microclimates. Other groups, both in the U.S. and Middle East, have viewed deserts as promised lands, paradise gardens, or reclamation frontiers that will “bloom as a rose” when properly irrigated and tended by an upright society - perceptions and beliefs that are sometimes fulfilled and at other times dashed.

This diversity defies simple classifications of arid landscape problems and solutions. On the one hand, every desert area presents a different situation that changes as economic, political, technological, and cultural conditions unfold. On the other hand, experience gained in one arid environment can sometimes be successfully adapted for applications elsewhere.

What are the lessons and limits of landscape design in arid environments of the world? This was a key question for the roundtable dis-



LEFT: WATERLOGGING AND SALINITY NEAR THE SALTON SEA, SOUTHERN CALIFORNIA, USA.

MIDDLE: CHRONIC DRAINAGE PROBLEMS IN THE RAVI RIVER FLOODPLAIN, LAHORE, PAKISTAN.

RIGHT: ABANDONED SHIPS NEAR THE TOWN OF MUYNNAK, UZBEKISTAN, ALONG THE FORMER SHORELINE OF THE ARAL SEA.

cussion. Case studies were selected from Iran, Saudi Arabia, Egypt, Sudan, Morocco, and the United States. Although varied in geographic scope, these cases do not encompass all of the arid regions of the world (e.g., China, Central Asia, northwest India and Pakistan, southern Africa, and South America, not to mention some important areas of experimentation in the Middle East, Maghreb, and Sahara).

At the same time, the case studies do encompass an enormous variety of conditions: climatically, they range from the hyper-arid deserts of Saudi Arabia to sub-humid foothills of Iran; physiographically, from the sand dunes of northern Sudan to Mediterranean coasts of California; economically, from local orchards and herding communities of the Sudan to high-tech export marketing in Morocco; and socially, from urban children of Cairo and farmers in the Sahel to pre- and post-revolutionary urban life in Iran. These topics invite comparison and contrasts: universities in Iran and the U.S.; parks in Egypt and Iran; plant nurseries in the Sudan, Saudi Arabia, and the U.S.; and office complexes in Morocco and Saudi Arabia to name a few.

These case studies also reflect the problems of unsustainable development, or “desertification”, where environments become “desert-like”. Processes of desertification include deforestation, overgrazing, waterlogging, salinisation, accelerated erosion, and biodiversity reduction which lead to the degradation of vegetation, soils, ecosys-



tems, economies, and cultures. Although often associated with arid regions, they can occur in any environment, reminding us that the successes and failures of arid zone landscape design may also have broader relevance for humid regions of the world.

The theme of desertification also reminds us that the concerns of this symposium have salience for international efforts to negotiate a Convention to Combat Desertification (CCD), which entered into force in December 1996. The Convention is a priority of AGENDA 21, the action plan of the 1992 U.N. Conference on Environment and Development (UNCED). The draft convention provides for multilateral and regional arrangements to mitigate desertification with a special emphasis on vulnerable regions of Africa. It creates a “global mechanism” to stimulate funding for these efforts. The United Nations Environment Programme (UNEP), Food and Agriculture Organisation (FAO), and other international organisations sponsor desertification research and policy analysis (UNEP, 1995; UNEP/FAO, 1992; SCOPE, 1995; Stiles, 1995; Wasser and Hutchinson, 1995; and FAO, 1993). An international network of non-governmental organisations concerned with desertification and drought, RIOD, actively monitors and participates in debate over these policies and programs (<http://riod.utando.com>).

Environmental designers have had relatively limited influence on these negotiations and programmes, and it seems vital that stronger link-



LEFT: ANUP TALO POOL AT FATEHPUR SIKIRI, INDIA, THE ELEGANT MUGHAL CAPITAL (1571-1585) ABANDONED IN PART DUE TO ITS POOR WATER SUPPLY PROBLEMS.
MIDDLE: EXTRAVAGANT WATER DISPLAYS IN LAS VEGAS, NEVADA, USA.
RIGHT: ABANDONED FORT, SAINI, EGYPT.

ages be forged between landscape design and international environmental policy.

The current round of desertification negotiations builds upon previous generations of arid zone research in which landscape designers have had a role and which should therefore be briefly reviewed. Indeed, societies have experimented with medicinal, architectural, food, and forage aspects of desert landscaping for thousands of years. In antiquity, these experiments found expression in the literatures of natural history, agronomy, and medicine (Butzer, 1993). In the Islamic realm, they were advanced by al-Kindi (c. 795-870 CE), al-Dinawari (d. 895), ibn Wahshiya (fl. c. 903-30), and others in Persia and Nabatea, not to forget the agronomic treatise of Ibn al-Awwam of Seville (Butzer, 1994; Watson, 1983). The mediaeval period also yielded agronomic treatises and landscape architectural experiments in Yemen, Ottoman Turkey, Persia, and Mughal India (Petruccioli, 1997; Subtelny, 1997; Varisco, 1994; and Wescoat and Wolschke-Buhlmann, 1996).

In the 19th century, major centres of experimentation arose in the U.S., European colonies, and Australia. In 1902, the American Forestry Association went so far as to rename its journal American Forests as Forestry and Irrigation to pursue the exciting conservation programmes emerging in the arid West. Geographers, soil scientists, and ecologists in Europe, America, and Russia made breakthroughs in large-scale environmental and evolutionary modelling. Colonial re-



gimes initiated research on heat stress in humans, plants, and animals; on desert flora, agriculture, and horticulture, famine relief; and energy flux in buildings and building materials (e.g., Heffernan, 1996).

Also around the turn of the century, ideas emerged about the links between regional policy and landscape design. John Wesley Powell published a Report on the Lands of the Arid Region in 1878, which included innovative proposals for land and water management. H.W.S. Cleveland wrote Landscape Architecture as Applied to the Wants of the West, and although it referred to the midwestern U.S., it clearly asserted that different regions had different landscape design requirements (cf. Lewis, 1993).

These advances did not, however, prepare arid zone occupants for the disastrous drought, soil erosion, and economic depression of the 1930s. Those disasters gave rise to the U.S. Soil Conservation Service, to shelterbelt programmes, and to the expansion of irrigation. U.S. soil scientists such as Max Lowdermilk drew upon earlier experience in other parts of the world, such as Palestine and China. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia developed an interdisciplinary framework for arid zone research.

Comparative international arid zone research advanced more rapidly in the 1950s in large measure through programmes of United Nations

agencies, such as the arid zone research programme of UNESCO. UNESCO supported publications, scientific conferences, and research centres. Soviet research centres in Ashkhabad and Repetek were reported in an influential journal, Problems of Desert Development, which was paralleled by initiatives of the Chinese Academy of Sciences and arid zone research centres such as Jodhpur, India, that conducted research on sand dune stabilisation, soil erosion, and salinity.

Despite these growing international and national efforts, disasters continued in the 1960s and 1970s, most devastatingly in the semi-arid Sahelian region of Africa. While disaster relief programmes tried to cope with the consequences of desertification, other programmes of agricultural intensification and settlement aggravated them. Some modernisation programmes (e.g., roads and railroads) helped alleviate food crises while others increased drought vulnerability. The worst disasters, then as now, occurred in areas of political and civil conflict (Glantz, 1995). African food crises led to an expanded U.N. desertification control programme in the 1970's (EROS, 1995; UNEP, World Atlas of Desertification; and OSS-UNITAR spatial database).

Modest but increasing emphasis was placed on landscape design in arid environments, most notably at the University of Arizona's Office of Arid Land Studies and International Arid Lands Consortium (e.g., Miller, 1978). Efforts to combat desertification were paralleled by three other movements that shaped landscape design in arid regions: 1) the economic growth of OPEC countries which stimulated demand for landscape design and heritage conservation in the Middle East; 2) increasing historical research on arid landscapes; and 3) international and local environmental movements.

Increased oil revenues in the 1970s stimulated large-scale landscape construction in Kuwait, the United Arab Emirates, and Saudi Arabia. Landscape architecture also grew as a profession in these years in Iran, Iraq, Turkey, and India. Landscape designers in these countries

faced fundamental questions that persist today: rising demand for plants; plant propagation and protection; irrigation water supplies and technologies; and unclear social, cultural, and aesthetic aims (Miller, 1978; Cochrane and Brown, 1978; Goodin and Northington, 1979; Kelly and Schnadelbach, 1976). Golany's (1983) works on design in arid environments were influential in addressing these issues.

The fields of landscape and garden history also grew during this period in the American, European, and Islamicate realms (e.g., Environmental Design: Journal of the Islamic Environmental Design Centre, 1986; Hussain, Rehman and Wescoat, 1996; Petruccioli, 1994, 1997; Ruggles, 1991; Wescoat, 1996; Wescoat and Wolschke-Bulmahn, 1996). The Aga Khan Award for Architecture and programmes rec-

A RESTORED FARMHOUSE, IN WADI HANIFA, NEAR RIYADH, SAUDI ARABIA RESPONDS TO THE DEMAND FOR LANDSCAPE DESIGN AND HERITAGE CONSERVATION IN THE MIDDLE EAST.



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DIE HARD. ”

ognised historical and contemporary excellence in landscape design (Serageldin, 1989; Steele, 1994). These efforts were also complemented by a longer record of research on the history of agriculture, horticulture, and agronomy (Watson 1983; Butzer, 1994; and al-Hassan and Hill, 1986).

Environmental activists and scientists have been more effective in challenging modern development trends and impacts (Hester, 1990). They have struggled to reduce irrigation, increase use of native and drought-adapted plant species, and shift to wastewater and “grey water” for tertiary water treatment and landscape irrigation. Their criticisms have been translated into creative design solutions by groups such as the Center for Regenerative Studies at California Polytechnic University at Pomona, the Arid Lands Studies programmes at the University of Arizona, and Xeriscape organisations (Lyle, 1994; Phillips, 1995; Denver Water, 1997; and Sunset Books, 1988).

These trends continued in the 1980s and 1990s as horticultural and land development industries and government agencies sought to catch up with changing public demands for low input, low-water, and naturalistic styles of landscape design. During the 1990s Arizona has sponsored an annual desert horticulture conference that combines ecological, technological, and design issues (Desert Horticulture, 1996). Arizona’s Arid Lands Newsletter focused on “Desert Architecture” in its issue of Fall/Winter 1994. Other current newsletters and journals include the RIOD Circular on Desertification, the UNEP Desertification Control Bulletin, and the International Arid Lands Consortium Newsletter (<http://ag.arizona.edu/OALS/IALC>).

While landscape design preferences and practices seem to be changing as new emigrants to arid regions find beauty in xeric flora, old patterns of arid land and water development die hard, and the connections among landscape design, landscape history, and environmental policy in arid environments remain weak. Theses, monographs,

and dissertations on arid zone landscape design have not received the attention they deserve (e.g., Joma, 1991). Landscape design projects that explore the contours of sustainability in arid regions also warrant closer attention, and it is to such projects that we now turn.

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" IF WE CAN UNDERSTAND NATURE'S EVOLVED RESPONSES AND ADAPTATIONS TO CONDITIONS OF ARIDITY AND IF WE CAN OBSERVE AND COMPREHEND THE LANDSCAPE FORMS THAT DERIVE FROM THOSE ADAPTATIONS, THEN WE MIGHT USE THESE AS BASIC ARCHETYPES FOR ARID AND SEMI-ARID REGIONS. "

ARCHETYPES IN THE ARID LANDSCAPE

John Tillman Lyle

In the United States, we have too often tried to ignore the difficult fact of aridity. This applies as much to people living in dry regions as it does to others - perhaps even more.

The inescapable fact is that about 40% of the American landscape is arid or semi-arid. This includes most of the region west of the Rocky Mountains. The sizeable exceptions are the high mountain areas and a narrow coastal strip in the northwest corner of the country. This vast dry region is extremely varied in character. It has an expansive, austere beauty of its own, but it also has a forbidding inhospitable quality that speaks to the human spirit but does not invite long-term residency. Crops grow here only if they are given water beyond that provided by rainfall.

Most early settlers failed to come to terms with these conditions. The Mormons, who followed the Indians as early pioneers of irrigation in the West, were among the exceptions, but few followed their example. As a result, they left a trail of abandoned cabins and farms and scarred land. Scars last a long time in dry places and many of those left by the pioneers are still there.

Following the first of the great water diversion projects just after the turn of the century, water became available for both agriculture and urban growth in places where it had not been before, and the West began turning from browns and greys to bright green. Settlers tried to create lush water-rich landscapes like those of their former homelands in the eastern states and Europe. Cities became green with exotic plants brought from humid zones and supported by irrigation. Such artificial landscapes require enormous quantities of water usually brought hundreds of miles through pipes and channels. They also

AN OASIS IN THE SAHARA DESERT IN CHAD. SOME ARCHETYPICAL FORMS OF THE DRY LANDSCAPE INCLUDE THE WASH, OR WADI, THE DRYLAND RIVER, AND THE OASIS.

XERISCAPE

A LANDSCAPING TECHNIQUE,
BASED ON SEVEN SIMPLE PRINCIPLES,
WHICH SAVE WATER, PROTECT THE
ENVIRONMENT, AND COST LESS
TO MAINTAIN.



1. SOIL ANALYSIS



2. PLANNING & DESIGN



3. EFFICIENT IRRIGATION



4. PROPER PLANT SELECTION

require large inputs of chemical fertilisers and pesticides. Whereas natural landscapes are our major basic producers of energy and materials, these chemically and mechanically supported landscapes are net consumers of energy and materials. Furthermore, they offer little support for native wildlife populations and they emit quantities of water into the air, bringing about local climate change. Clearly, such landscapes are unsustainable. In fact, by consuming energy and materials year after year and returning only wastes in forms that are difficult to reuse, they represent the very essence of unsustainability.

In recent years, recognition of these problems has grown. The Xeriscape movement was developed by landscape professionals and water managers in Denver, Colorado, during a drought in the 1980s to solve a common problem-water wasted in the landscape. It has promoted use of drought-tolerant plants, and interest in native plants has become widespread. In a number of projects, landscape architects have planted communities of natives with beautiful and sustainable results. However, the use of local natives has its limitations. They provide a limited selection and cannot provide for all the functions and amenities that humans require in arid lands - for example, shade. Many dryland natives are hard to propagate, grow slowly, and often they are expensive to install.

My design work in the arid and semi-arid landscape has been based on an approach that is both more analytical and subjective. If we can understand nature's evolved responses and adaptations to conditions of aridity and if we can observe and comprehend the landscape forms that derive from those adaptations, then we might use these as basic archetypes for arid and semi-arid regions. Such a vocabulary might achieve both sustainability and a visual and ecological fit with its naturally evolved context. These archetypal forms might also serve as bases for design expressions to connect the human psyche with the larger arid landscape. To explore this approach further, I want to look at a few archetypal forms of the dry landscape and the processes they represent.

One universal dryland form is the wash, or *wadi*, as it is called in the Middle East. Washes collect water and convey it to a river or sink. There is a special type of wash that forms at the foot of the rugged San Gabriel Mountains in semi-arid southern California where steep-walled canyons meet the valley floor. Water flowing from the mountains collects in the wash and is held there for a time. A major portion of it soaks into the soil then moves downward to replenish the groundwater in this critical zone where mountains and coastal plain meet.



5. PRACTICAL GRASS AREA

In my own garden, which is also at the base of the San Gabriel Mountains, the small abstracted wash plays a similar role; that is, it collects water and allows it time to infiltrate the underlying soil and rock. While the garden wash collects only water draining from the roof of the house and from the surrounding paved or planted areas, the basic function is the same, and the basic materials - rock, gravel, and a few scattered plants - are the same. In the form, I have tried to recall the natural wash, not to imitate it in literal terms but to suggest its essential qualities, to establish a kind of symbolic correspondence.



6. MULCHING

Next, let's consider the adaptations of plants in dry landscapes. Most of them share certain characteristics of form specifically related to lack of water, to high levels of solar radiation, and strong winds. The plants grow low and spread wide, and their leaves are small, often spiky. Thus, they present a low profile to the wind and smaller surfaces for emitting water through evapotranspiration. Furthermore, they tend to point upward, more or less towards the sun and thus minimise surfaces exposed to desiccating solar rays. They also tend to be greyish green rather than the bright emerald green typical of plants in wetter regions. And, in the semi-arid landscape of southern California, as well as in the surrounding desert, many of the native plants produce brilliant displays of flowers following the winter rains - but only for a short time. As the summer sun gets hotter, the flowers fade and the plants return to their muted colours and low profiles.



7. PROPER MAINTENANCE



SHIBAM, YEMEN, WITH ITS MUD-BRICK SKYSCRAPERS, IS RAISED ON A MOUND IN THE MIDDLE OF WADI HADRAMUT.

In my garden, each member of the community of plants features most or all of these characteristic adaptations. A few are native to the area, but not all or even most. Many of them come from similar climate zones in other parts of the world. All of them seem at home in this setting. They use no chemical fertilisers or pesticides and little water. And they attract a great many birds and beneficial insects.

Let us turn our attention to a project in the rocky, rugged, mountainous region of southeastern Arizona where the Sonoran and Chihuahuan deserts meet. Here, the plants are sparse and far apart, except in a few small areas where water concentrates due to indentations in the land. The Indians who once inhabited this area developed a number of simple ways to augment and amplify these places of concentration and in some locations to create concentrations for their own purposes. Their means was the careful placement of small rocks. A typical example was the check dams they built within narrow drainageways to hold back small volumes of water.

This principle of occasional concentration is applied in the design of the landscape of the Quinn residence located in the Sonoran desert.



It is still under development; progress is slow in the desert. The house is a small structure adapted to the climatic extremes of its setting. Its walls are constructed of straw bales, a waste material with extremely high insulation value. It is passively solar heated and naturally cooled with roof forms that reach upward for light and heat and to guide warm air out of the building. South of the structure, a system of shallow swales traps runoff water moving downward and northward. Some of this water soaks into the ground while a portion follows the slight slope of the swale into a small drainageway on the eastern edge of the site. Some trees native to the area, primarily oaks, will be planted in the drainageway where water concentrates. Some of the water is diverted to a small vegetable garden while the rest continues moving downhill. Lower down, a series of check dams, similar to those built by the local Indians, traps small volumes of water, primarily to create a gathering place for wildlife. Nearer the house on its south side is a series of small, semi-circular water traps made of stone with cottonwood trees located to use the water. Adjacent to the house will be three circular basins designed to catch and hold water running off the roof. These will function like the vernal pools common to many parts of the West. A rich and dense mix of flowering native

DAR AL-ISLAM MOSQUE, IN THE HIGH SONORAN DESERT PLATEAU NEAR THE ANCIENT PUEBLO INDIAN VILLAGE OF ABIQUI, NEW MEXICO, COMBINED TRADITIONAL ADOBE CONSTRUCTION WITH ELEMENTS FOUND IN SIMILAR ENVIRONMENTS IN THE ISLAMIC WORLD.

“ HISTORICALLY, DRYLAND RIVERS
LIKE THE TIGRIS AND EUPHRATES,
THE INDUS, THE NILE, AND THE
COLORADO HAVE BEEN IMPORTANT
TO THE DEVELOPMENT OF
CIVILISATION.”

desert plants visible from inside the house and from the outside terraces is taking shape in these depressions. So far, no planting has been necessary. In the desert, where conditions are right, especially those related to water, the plants will find them. Thus, for at least a few weeks in the spring the view out to the desert will be framed in vibrant colour. These basins also provide infiltration to ground water.

Other than these small areas of concentration, the landscape of the Quinn residence will remain in its natural state, minimally altered. The natural plant cover is simple and scattered with a varied sculptural character.

My next archetype is larger in scale and plays a larger role in the overall pattern of desert ecology. This is the dryland river, a ribbon of life in a landscape otherwise sparsely populated by plants and animals. These rivers usually collect little water from the lands through which they flow. They serve primarily to move water from mountain watersheds with higher levels of rainfall to the sea. Historically, dryland rivers like the Tigris and Euphrates, the Indus, the Nile, and the Colorado have been important to the development of civilisation. Some of the world's first cities flourished on their banks over 5,000 years ago.

In the American West, we have treated rivers with a disdain they do not deserve, especially the smaller ones and most especially where they flow through cities. Typically, we encase them in concrete to prevent flooding, thus killing the ribbon of life.

The Santa Clara River is the last free-flowing unchanneled river in Southern California. But with its course winding through the rapidly suburbanising area north of the city of Los Angeles, its future is seriously threatened. What I want to discuss next is a plan for the Santa Clara where it flows through the newly incorporated (and mostly newly developed) city of Santa Clarita. Most of the people of Santa Clarita want to see the river remain in its natural state, and



they commissioned the California Polytechnic University 606 Studio to shape a plan to accomplish this.

Like most desert rivers, the Santa Clara is relatively shallow and its water levels vary greatly through the course of a year as well as from year to year. Often it spills over its banks in the spring and dries up entirely in the late summer. Since this erratic behaviour is the main reason for channelisation, it is essential that any plan to avoid channelisation recognises the process and the pattern it produces, which can be characterised in terms of floodway (frequently flooded) and floodplain (infrequently flooded). The floodplains form a sequence of spaces through the city, which can easily be developed into a linear park system. The floodways are hazardous places for developed parks but are suitable for some recreational use through most of the year and also provide rich wildlife habitat and corridors. By acquiring floodway and floodplain as parkland, the city can avoid concrete channels and provide a beautifully cohesive park system serving every neighbourhood in Santa Clarita. The cost is only a little more and for its money, the city gets both parks and a living river instead of an ugly, inert band of concrete.

DRYLAND RIVERS LIKE THE NILE, HERE AT ASWAN, MOVING WATER FROM MOUNTAIN WATERSHEDS TO THE SEA, COLLECT LITTLE WATER FROM THE LANDS THROUGH WHICH THEY FLOW, HAVE BEEN IMPORTANT IN THE DEVELOPMENT OF CIVILISATIONS.



OASES WERE USUALLY CREATED BY WELLS OR NATURAL SPRINGS, AS HERE IN LIBYA, BUT IN MODERN TIMES, OASES ARE MORE OFTEN CITIES WHERE WATER HAS BEEN BROUGHT BY ARTIFICIAL MEANS.

The dynamic, adaptive forms of the river also help to shape the forms of the parks. When the water is flowing, the river is an ever-changing, ever-moving pattern of braiding, interlacing movement that produces sandbars with characteristic narrow, pointed forms. This pattern is the basis of the design for the first parks in the system, over-lapping floodway and floodplain to give expression to the dynamics of the river. The trees planted in the park will be the species that once inhabited each zone: cottonwoods in the floodway and coast; live oaks in the floodplain.

The last dryland archetype that I want to discuss is the one that has made human habitation possible through history even in the driest deserts, and frequently the subject of fable, legend, and dream. This

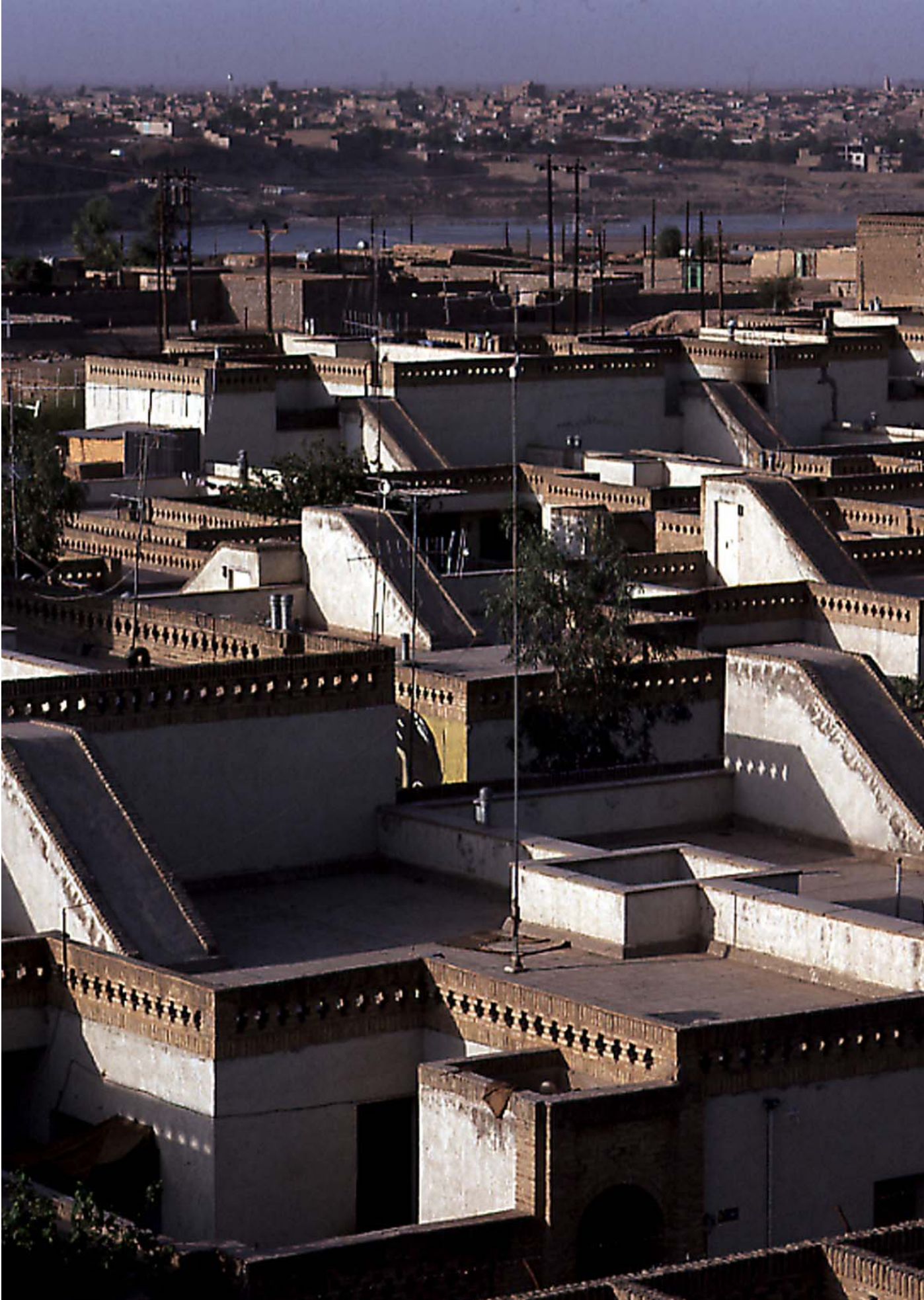
" ALL OF THESE LANDSCAPES ARE EXPERIMENTS.WE DO NOT KNOW YET IF THIS APPROACH, OR ANY OTHER, CAN RESULT IN TRUE SUSTAINABILITY IN ARID LANDS.THE RECORD OF THE PAST IS NOT ENCOURAGING. "

is the oasis, a well-watered island, usually created by wells or natural springs. In modern times, oases are more often cities where water has been brought, for better or worse, by artificial means. Once it is there, urban dwellers usually ignore the natural aridity of the environment and use water in prodigious quantities. This pattern of use produces volumes of once-used wastewater, which is commonly viewed as a disposal problem. The Centre for Regenerative Studies at California Polytechnic University at Pomona works with regenerative processes for using and re-assimilating water and other materials for both liveability and sustainability. In dry regions, even where a great deal of water is available, it is important to use it sparingly and to good purpose and to cycle it continuously in ways that follow the patterns of natural systems. Too much water in the wrong place can pose greater ecological problems than too little.

At the Centre, partially treated wastewater from the nearby Pomona Sewage Treatment Plant is given advanced treatment by aquatic plants in open ponds. Following this treatment the water is used very sparingly for aquaculture and irrigation before it is filtered through the soil into groundwater storage. The irrigation system uses the drip or trickle principle for minimum water consumption and the plants watered are mostly food crops mixed with a few species that follow the pattern of dryland adapted species mentioned earlier. It is a human oasis with carefully managed water flows, and the landscape reflects that character.

It is important to say at this point that in the long term, all of these landscapes are experiments. We do not know yet if this approach, or any other, can result in true sustainability in arid lands. The record of the past is not encouraging. All of the great dryland civilisations have eventually declined to small numbers of people living at subsistence levels. The long-sustained desert societies are mostly nomadic and poor. Perhaps our knowledge and technical skills will allow us to adapt more successfully with grace and beauty, and perhaps not.





" IN MOST INSTANCES, NATURE IS
ALREADY LANDSCAPED AND WE HAVE
LITTLE BUSINESS TO INTERVENE
UNLESS ABSOLUTELY NECESSARY. "

ASPECTS OF A UNIVERSITY PROJECT AND A NEW TOWN IN IRAN

Kamran T. Diba

In developing countries, there is less local awareness of ecology than in the West, and a lack of individual and institutional support for relevant ideas and projects. Often, neither the desire nor sufficient investment to conserve or improve open or green spaces is present. In spite of such circumstances, I carried out a series of landscaped projects in pre-revolutionary Iran, at the time when interest in landscaping was absent and the profession of landscape architecture did not exist.

During the course of my practice, I have noted and confronted several basic problems of a cultural nature:

1. The concept of maintenance and conservation did not exist in traditional societies. These societies often take their physical and natural environment for granted and ignore it to their own detriment.
2. There is an overall absence of respect and care toward public property. As a consequence, a blind eye is often turned to vandalism and the abuse of both the natural and the urban environment.

I believe that, in most instances, nature is already landscaped and we have little business to intervene unless absolutely necessary. Intervention is only justified if we have water and human resources to maintain and we need to shelter green and animal life. I prefer to concentrate available resources to a limited, confined area within a larger arid landscape.

This attitude derives from the concept of the Persian garden. The principal design criterion is to enclose a wall in a limited acreage by means

SHUSHTAR NEW TOWN, KHUZESTAN,
IRAN. PROVIDING SHADE TO THIS
WORKING - CLASS COMMUNITY
WAS ONE OF THE PRIMARY DESIGN
SOLUTIONS WHICH WON THIS
PROJECT THE AGA KHAN AWARD
FOR ARCHITECTURE IN 1986.

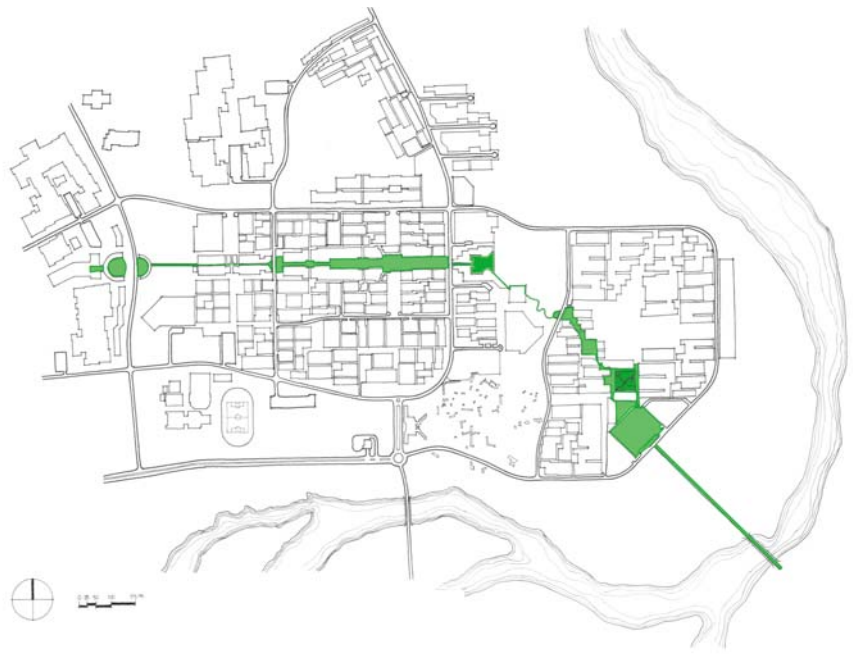


JONDI-SHAPOUR UNIVERSITY,
ASHWAZ, IRAN .
LEFT: AN EXAMPLE OF ARCHITECTURE
AS A COMPONENT OF LANDSCAPE
DESIGN. THE EXISTING WATER
CHANNEL DICTATED THE SITE PLAN.
RIGHT: THE PEDESTRIAN WALK
INTERLOCKS OPEN SPACES TO THE
MOSQUE COURTYARD.

of constructing a wall within which there is sufficient water, often supplied by means of a *qanat*, a non-mechanical method of bringing water from mountains and foothills to arid areas. Human resources can be focused on the creation of a concentrated universe of plant and animal life while ignoring the many hectares of land outside the walled garden. If any architecture is deemed necessary, it happens within this green universe. In other words, architecture is subservient to landscaping and comes into play as a design component in making the garden. This attitude is methodologically opposed to the current practice of landscaping, which is an afterthought, or, let us say, is used as *maquillage*, as the “make-up” of an architectural work.

There needs to be a closer link, indeed a marriage, between architecture and landscaping. In my career as an architect, I have never separated the two disciplines and often tried to play one against the other in order to arrive at a synthesis. By means of architecture, one can define and emphasise open and green environments in a vivid, comprehensible, and impressive way, as seen in traditional Persian gardens.

I believe under adverse climatic and cultural environments one should concentrate and reduce physical and human resources to a manageable level and avoid spreading the landscaping effort too thinly. In the



first of the two following projects, which are both located in Iran, we will investigate architecture as a “component” and, in the second, as a “container” of landscape design.

1. Jondi-Shapour University, Ahwaz, Iran

Through the linkage of three structures, we articulate a linear pedestrian walk which interlocks two diverse open spaces and green areas by a mosque courtyard, providing sunlight, shade, and change of environment. This modest example illustrates how a small structure, in this case a mosque and its courtyard, defines the end of one open space and the beginning of a new one. The other aspect of this project demonstrates how an existing water canal that cuts through a site could inspire and dictate site planning. And, lastly, the primacy of land features over architecture can be recognised.

2. Shushtar New Town, Khuzestan, Iran

The overriding design concern in this working-class town is how to create shade, and how, in extreme sunlight, people could move about in these high-density pedestrian islands with ease. Green areas and gardens were concentrated along a linear access, making them equally available to all residents. Street planting was avoided, a function belonging to the municipality, but at the same time greenery and tree shade was made available to street passages by designing private, individual gardens that provide such vegetation to the street. There are also many north/south narrow streets, which provide constant shade and channel cool winds in summertime.

ABOVE: JONDI-SHAPOUR UNIVERSITY FORMAL GARDENS CONTAINED IN A LINEAR MANNER WITHIN THE HEART OF THE COMMUNITY.

BELOW: SHUSHTAR NEW TOWN, KHUZESTAN, IRAN.





" IRANIAN GARDENS ARE HISTORICALLY RENOWNED. THE IDEA OF A GARDEN AS PARADISE IS CENTRAL TO THE CONCEPTION OF THE PERSIAN GARDEN, AS WELL AS TO GARDENS AND PARKS AROUND THE WORLD. "

SUSTAINABLE DEVELOPMENT IN TEHRAN

Gholam Reza Pasban-Hazrat

Iran is comprised of mountainous regions, deserts, and foothills. High mountains surround it on three sides and in the centre of the country there is a vast desert. Many major cities are situated along the margins of this mountainous crescent encompassing a large circular area of desert, the *dashte Kavir*; Tehran is one such city.

Through thousands of years of history, Iran has had to deal with environmental problems resulting from its natural environment, including water shortage, drought, and mountain floods. The significance and value of water is reflected in all the religions that have prevailed in Iran. Water is considered sacred.

Iranians have been very inventive in tapping water resources and have made optimum use of underground waters. An Iranian engineering innovation, the *tar* system, was a means of conducting water, without using any mechanical equipment, via tunnels dug deep underground through which water was conducted by using the force of gravity. *Qanats* brought water from the mountains and foothills tens of kilometres away into waterless regions. The survival of many villages and cities in Iran, including Tehran, depended on these *qanats*. Some have been in use for hundreds of years. One such example is the Dowlat Abad *qanat* in Yazd, which is 64 kilometres long. Historically, Iranians created exclusive orchards and gardens at the source of each *qanat* and spring so that not one drop of water would be wasted.

Iranian gardens are historically renowned. The term *pardons*, or paradise, has an Iranian origin and the idea of a garden as paradise is central to the conception of the Persian garden, as well as to gardens and parks around the world. The present paper will concern itself with Tehran and its problems of green space.

BAGH SANGI JAMSHIDIEH, TEHRAN, IN IRAN, AN EXAMPLE OF A NATURAL MOUNTAINOUS GARDEN, WHICH INCORPORATES CONCERNS FOR SUSTAINABLE DEVELOPMENT.



TEHRAN'S RAPID EXPANSION IS A
SERIOUS DANGER TO THE ECOLOGICAL
BALANCE AND NATURAL HERITAGE
WHICH SURROUND THE CITY.

Tehran is an exceptional case as far as natural conditions are concerned. Situated on the foothills of the Alborz Range, it is bounded by mountains, except to the south where an expansive area of wasteland lies. The volcanic mountain peak of Damavand (5,671 metres high) can be seen from the city, when the pollution index is low, as can the Towchal mountains (4,100 metres) and the Kolakchal (3,200-3,400 metres). A unique characteristic of Tehran are the numerous valleys through which water flows from *qanats* and springs originating in the Alborz. The valleys and mountain ranges located in the northern sector of the city, in the region of Shemiran, have always been part of the natural riches of Tehran. Once a separate town, the *yeylaq*, or summertime resort of the city, the area has now become its northern extension with a very large percentage of the population living there year round.

Today, the population of Tehran, excluding peripheral towns, is estimated to be seven million. If the present trend of development continues, it will become either the fifth or sixth most populous city in the world. Tehran's rapid expansion during the last two to three decades is a serious danger to the ecological balance of the mountains,

" SOIL AND WATER, THE TWO VITAL
ELEMENTS OF ECOLOGICAL BALANCE,
BECAME SUBJECT TO DAILY ABUSE
AND WASTE. "

valleys, and gardens of northern Tehran and Shemiran. Soil and water, the two vital elements of ecological balance, became subject to daily abuse and waste. Fortunately, these deteriorating conditions were highlighted by both naturalists and the general population. To prevent the destruction of this natural heritage, various ideas and solutions were proposed by both scientists and laymen. Tehran's municipality has taken some measures to find solutions for some of these problems.

My colleagues in Baft-e-Shahr Consulting Architects, Urban Planners, & Landscape Architects, have proposed two concepts for the sustainable development of Tehran. These notions originate from an earlier project implemented 20 years ago at the mouth of the Jamshidieh valley in the foothills of the Alborz. The premise was to protect the valley from urban sprawl.

The first concept is the protection of the zone at the foothills of the Alborz range. Four valleys are situated north of Tehran in the foothills of the Kolakchal Heights: the Dar-abad, Jamshidieh, Tang Hesark, and Golabdarreh valleys. Plans have been prepared to preserve the heights and valleys against Tehran's urban expansion. Part of this plan is currently being implemented.

The key to this concept is the zoning of an area with an approximate width of six kilometres and depth of two kilometres that is sandwiched between the urban fringe of the urban built area and the mountains.

The four zones in this area comprise:

1. The physical limit of the city. The last boundary where the city can expand is formed by natural or built elements such as a foot route with trees. This limit ranges between 1,800 and 1,850 metres in altitude.
2. The natural urban park area. Between the physical fringe of the city and the natural edge of the mountains, natural urban parks are cre-



FOOTHILLS NEAR THE CITY OF TEHRAN
ARE PART OF THE CITY'S RECENT
ZONING PLAN TO PROTECT AND
SUSTAIN THE NATURAL ENVIRONMENT.

ated (such as Jamshidieh park), or appropriate indigenous plantations of mountainous regions are planted. These parks are equipped with installations and facilities to provide services for people. They are places where citizens can spend their leisure time and the young can begin to learn mountain-climbing. These parks are located between, 1,850 and 1,950 metres.

3.The transition zone between the man-made and the natural. This comprises the trails and access routes through the mountains up to a height of 2,000 metres, used principally for recreational walking and mountain climbing. For green cover, plants and thickets resistant to the mountain climate are cultivated. The young and middle-aged will be the users of this area, which includes Ferdowsi Boustan and heights north of Jamshidieh park. These areas are located at altitudes between 1,900 and 2,100 metres.

4.Virgin territory. This includes the routes through arduous and high

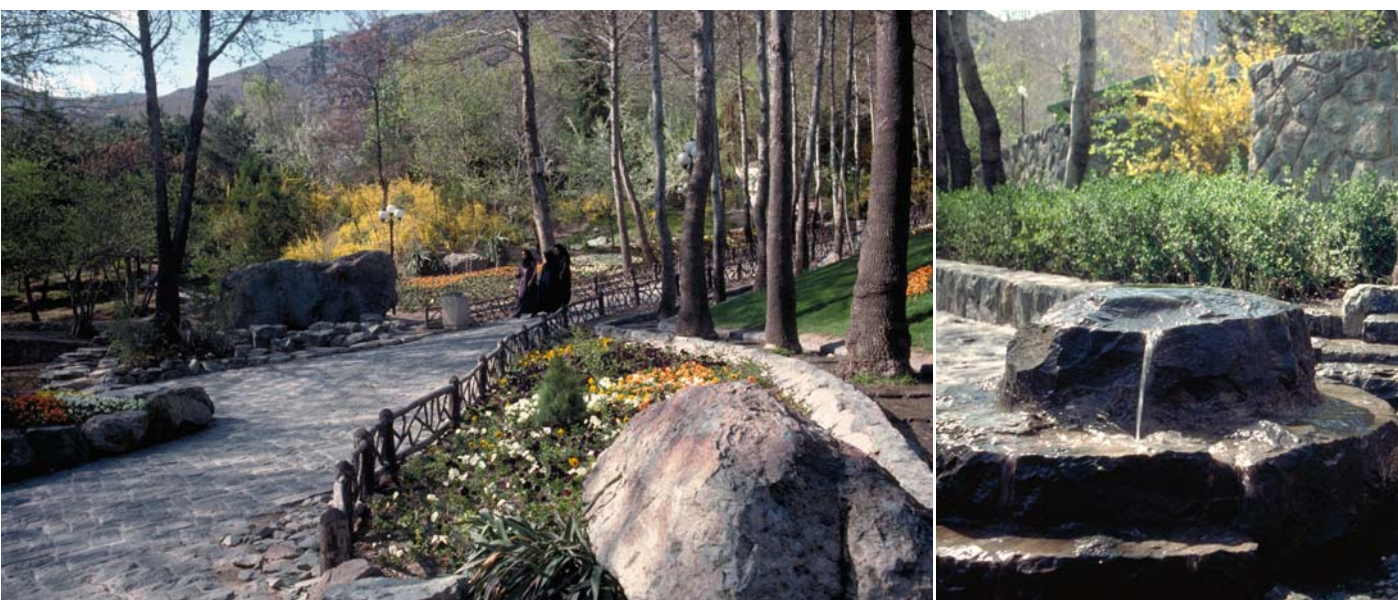
" FOCAL POINTS HAVE PRESENTLY BEEN IDENTIFIED TO PREVENT AND CONTROL THE CITY'S DESTRUCTIVE ENCROACHMENT ON NATURE. "

mountain passes. No buildings or installations will be built in this area and the routes are designed for young hikers, professional mountaineers, and mountain sports. It is located at altitudes of 2,000 metres and higher.

These zones characterise the limits of the ecological potential of each mountain and valley as well as their future function. The focal points have presently been identified to prevent and control the city's destructive encroachment on nature. Using sustainable and non mechanical devices, water will be channelled from valleys as the optimal irrigation method to develop green space. The soil will be stabilised and resistant; vegetation native to the mountainous region will be identified and cultivated.

The second concept implies the extension of the valleys into urban areas by restoring paths continuing into the city in order to form new green spaces. This concept has also been approved, and the plan for the first route will gradually be implemented along the Chamran Expressway (and Darakeh Valley). This route, 12.5 kilometres long and approximately 250 metres wide, will extend from the Alborz valleys into the heart of the city. The intention is to restore what had been destroyed in the past and to re-establish the city's connection with nature by providing paths, waterways, and gardens in the area. Since several neighbourhoods exist alongside this green route, the green bed will also function as a non-vehicular connecting path between them.

By implementing these concepts, the destructive trend of the city will hopefully be curbed and the northern belt of Tehran will be transformed into a protected green zone for use as a place of leisure and mountain sports. The plans for Darakeh and Jamshidieh valleys have already been prepared as well those for the northeast route of Tehran. At present our firm is studying and planning the fourth route along another valley known as Farahzad valley, which extends 10 kilometres.

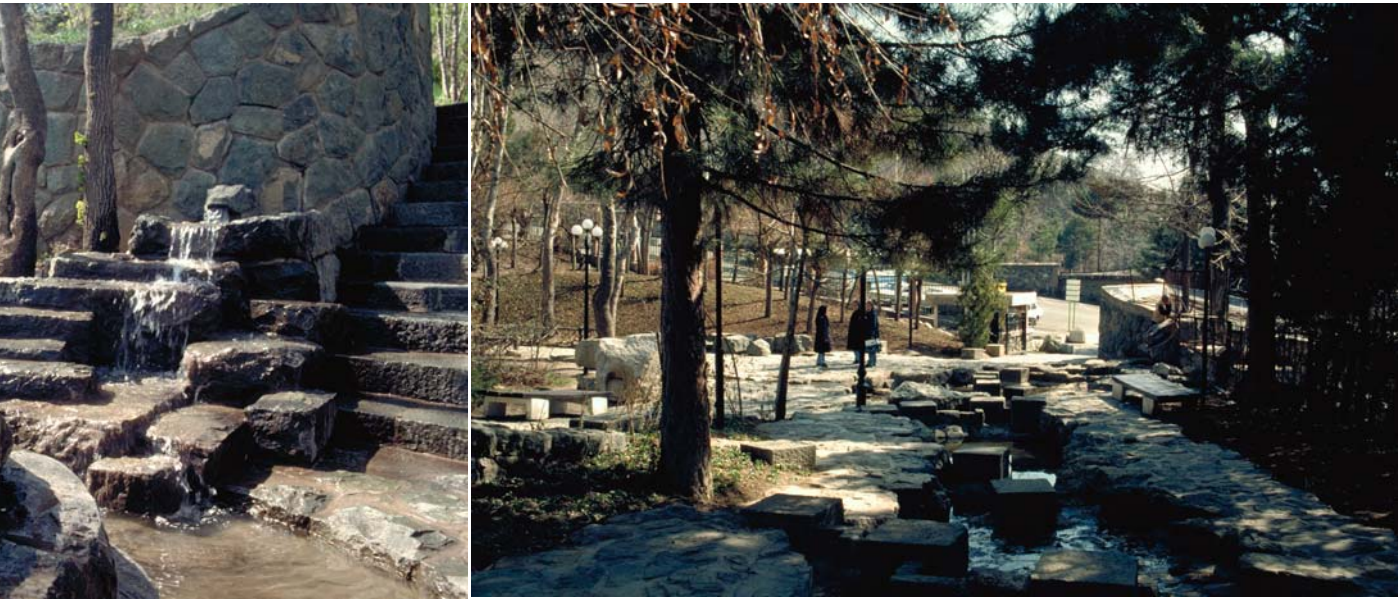


LEFT TO RIGHT: VIEWS OF THE BAGH SANGI JASHIDIEH PARK, LOCATED AT THE NORTHERN EDGE OF TEHRAN. FORMERLY A FRUIT ORCHARD, TRANSFORMED INTO A PUBLIC GARDEN.

Bagh Sangi Jamshidieh

An example of the natural mountainous garden mentioned above, and a project planned twenty years ago, the Jamshidieh stone garden incorporates concerns for sustainable development and constitutes a working paradigm for the two concepts outlined above. Iran's parks were a particular focus of the last ruling family - the Pahlavi's. Bagh Sangi Jamshidieh is the last of these efforts and was opened to the public just one month before the revolution. The seven hectares of land that the park covers were formerly a private fruit orchard with a residence at the corner. In 1976, its wealthy owner, Mr. Jamshid Davaloo Qajar, made a gift of the orchard (except the residence) to the Special Bureau of Her Imperial Majesty Empress Farah, with the request that it be used as the site of a home for the elderly. However, as the Special Bureau had recently completed such a facility in the same area, the Empress decided to turn it into a public garden. The idea behind the project was to create a public park upon the ruins of the old orchard and to attain the atmosphere of traditional Persian gardens for the enjoyment of nature and mountain lovers.

The park is located at the northern edge of Tehran in the Manzarieh area, at an altitude of 1,750 metres above sea level. Its northern edge is Jamshidieh hill and to the south in Hesarak valley, a fine neighbourhood of villas in large gardens. A 200-hectare park adjoins it to the east, which is a camp for boy scouts known as Manzarieh park. Early



in 1977, design and implementation of the Bagh Sangi Park were undertaken. Since there were rocks, tree roots, and natural features in the area, full-scale sketches were drawn on-site, similar to traditional Iranian methods. Step-by-step drawings were made only upon completion of each section of the garden. The overall work plan was only drawn in 1978, after completion of the whole project in April of that year.

As suggested by its name, which translates as “stone garden”, the park was designed around the theme of stone. It is built on steeply sloping land with an inclination of about 30 degrees from one end to the other. Triangular in shape, the garden narrows towards the south and its northwestern section is treated as a terrace and held by a substantial retaining wall. Various water channels have been constructed on the site and are connected to a man-made pool at the uppermost level, which in turn receives water from natural brooks coming from mountain sources.

The park covers an area of 70,000 square metres, and is now being expanded by 300,000 square metres towards the north. Within the park, there are five small buildings with a total area of about 2,000 square metres. There is a restaurant, located at the higher level on the northeast corner, an administration building near the entrance from the west, a children’s library on the southwest corner and a



LANDSCAPING OF THE PARK
WAS DESIGNED AROUND THE THEME
OF STONE.

gatehouse at the main entrance at the southeast corner. Toilets are located below ground level in three of the buildings (restaurant, administration, and children's library).

The restaurant is designed as a pentagonal building with a daring steel structure inspired by indigenous house design in northern Iran. Beside these built elements, the park was fitted with ten, stone or metal sculptures and consists of various thematic areas for different kinds of use, such as a playground for children, bird cages, an area for private recreation, a public arena, and an amphitheatre for public performances.

For landscaping, scattered loose rocks were used to create natural waterfalls, terraced enhancements, streambeds, and paving. Existing trees were preserved and new ones added. The existing pathways were revitalised to create three major axes running from north to south. The eastern axis lined with old plane trees (*Platanus orientalis*) is the largest and most prominent, descending smoothly and bordered on both sides by running brooks.

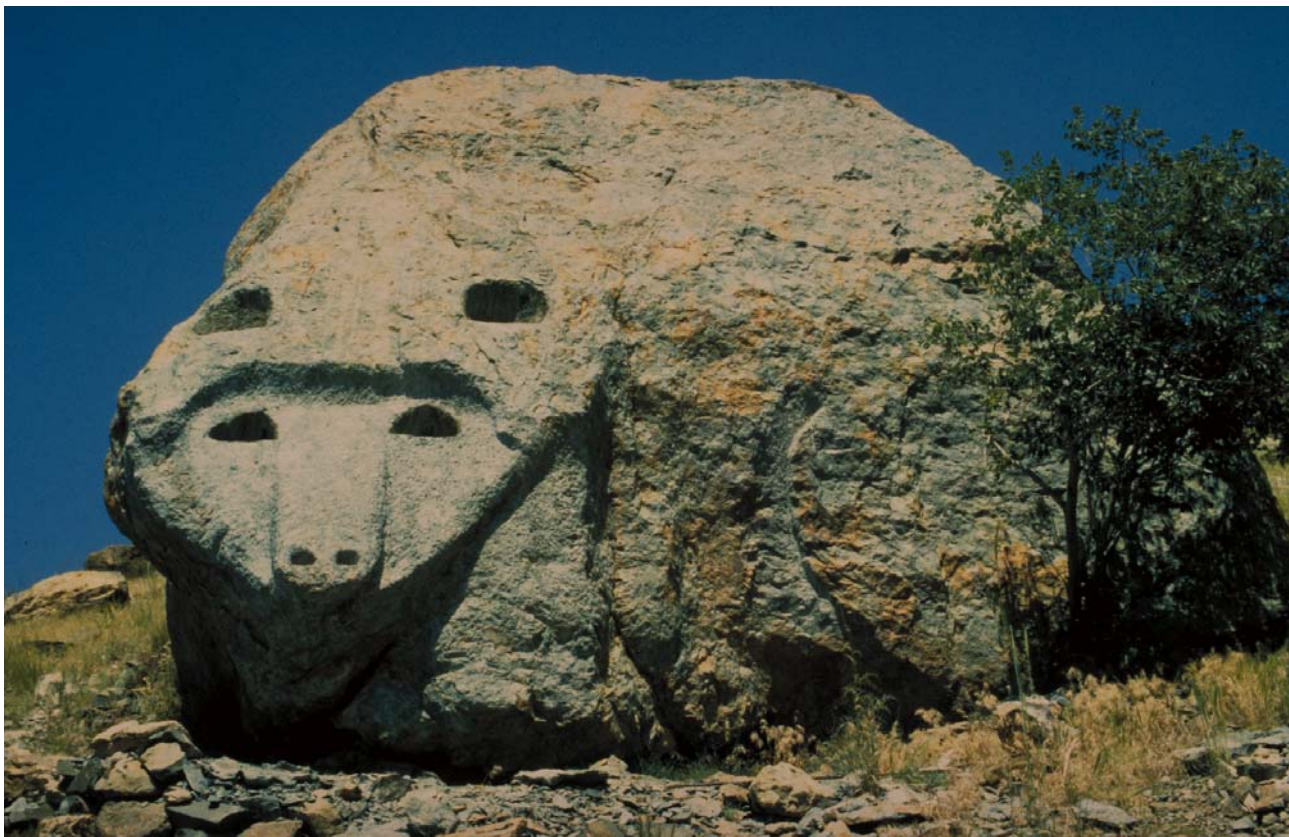
The central axis was also revitalised from an old path. The stone steps were pierced by a central water channel which creates a playful sound as water passes through and falls, before disappearing into a pond at the south end of the park. To supply water to the park, the old rectangular water reservoir at the highest level of the old orchard was enlarged to create a small lake with an artificial waterfall.

The western axis, diverging from the central one and terminating at the western entrance, is shorter and leads to a mountain-hiking path. Among the trees that were saved from the old orchard, the most impressive are the huge ash trees (*Fraximus excelsior*). The evergreens (*Cypressus arizonica* and *Cedrus deodora*) as well as the weeping willows and flowering varieties, such as cherry and plum trees, were planted anew, along with *forsythias*, *prunus mahaleb*, crape myrtles, and other shrubs and ground covers for summer flowering.

" IT IS TO BE HOPED THAT THE IMPLEMENTATION OF THESE PROGRAMMES WILL CURB THE DESTRUCTIVE TRENDS AT WORK, AND TEHRAN'S NORTHERN BELT WILL BE TRANSFORMED INTO A PROTECTED GREEN ZONE FOR USE AS A PLACE OF LEISURE AND MOUNTAIN SPORTS, AS GREEN AREAS ARE EXTENDED INTO THE CITY. "

The buildings that have been erected in the park are of secondary importance in comparison to the landscaping. Except for the restaurant, all other buildings are inconspicuous and located in remote corners and generally concealed by dense foliage. The setting is particularly convenient, for the toilet facilities and other built elements that are clearly hidden from the eye.

It is to be hoped that the implementation of these programmes will curb the destructive trends at work, and that Tehran's northern belt will be transformed into a protected green zone for use as a place of leisure and mountain sports, as green areas are extended into the city.





" GARDENING IN PARTICULAR AND
LANDSCAPING IN GENERAL CAN BE
A MODEL AND A FOCUS FOR THE
REINSTITUTION OF THIS AGE-OLD
PROCESS OF REGENERATION. "

CULTURE, ENVIRONMENT, AND SUSTAINABILITY: THEORETICAL NOTES AND REFLECTION ON A COMMUNITY PARK PROJECT IN CAIRO

Abdelhalim Ibrahim Abdelhalim

This paper consists of two complementary and loosely related parts. The first section, which I will entitle Culture, Environment, and Sustainability consists of three observations and a hypothesis about the interrelation between culture and the environment, and its dynamics of change, development, and sustainability. This hypothesis will serve as a theoretical and philosophical framework for the second part, in essence, an account of a ten-year-old experiment in linking the culture of a local community in Egypt to a major environmental and landscaping project. The community is Sayeda Zeinab, a vibrant but poor community of some 1,000,000 people in the old district of the city of Cairo, Egypt. The project is the planning, construction, and maintenance of the Cultural Park for Children in Sayeda Zeinab, a facility of two and a half acres which includes, among other things, a children's museum, an open-air theatre, a library, playgrounds, and several gardens.¹

THE CULTURAL PARK FOR CHILDREN
IN SAYEDA ZEINAB, CAIRO, WAS AN
ATTEMPT TO LINK THE LOCAL
COMMUNITY TO A MAJOR
LANDSCAPING PROJECT.

The theoretical framework and the account of the project will hopefully work together to illustrate an approach to a community-based planning and development process which rests on understanding and reconstructing age-old processes of development indigenous to most, if not all traditional or pre-industrial communities, while remaining completely rooted in the socio-economic and technical realities of today.²

The aim of this paper is to draw scholarly and professional attention to the importance of understanding local cultures as mechanisms for sustaining human solidarity and creativity in the context of the design and development processes. This is a tool, which when fully



RESTORATION OF OLD SANA'A, YEMEN IS AN EXAMPLE OF CURRENT TRENDS TYING THE ENVIRONMENT WITH THE CULTURE OF THE LOCAL COMMUNITY AND HERITAGE.

understood can, be mobilised to enable, empower, concretely and creatively engage local communities in the conception, production, and regeneration of their environment. The focus on landscaping is not an accidental or ephemeral aspect of present hypothesis, but is an essential part of the theoretical framework. As the account of the park will show, gardening in particular and landscaping in general can be a model and a focus for the reinstatement of this age-old process of regeneration.

I: Culture, Environment, and Sustainability

All living communities have their own culture with a set of norms and mechanisms shared by members of the community to establish and regenerate their identity and creative energy, and to re-establish their sense of solidarity. In traditional or pre-industrial, pre-modern societies, these cultural mechanisms were closely related to the creation and maintenance of the environment and its sustainability. In industrial and post-industrial societies, this relation seems to disintegrate. In such a context, a mode of environmental production prevails, where the conception, production, and maintenance of the environment is separated from the culture of the community. In the

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post-industrial context, the miserable failure of this material and excessively rational mode, which bases its triumph on the separation of culture from production, is apparent.

The position presented in this paper is that one can go beyond the industrial mode and become increasingly aware of models which work to mobilise, enable, and empower human resources and link them to the conduct of the affairs of life. This is becoming more apparent with the creation and maintenance of the environment, where the emphasis is placed on regeneration and not strict accumulation. It is in this context that I am arguing that certain cultural mechanisms can be used to help integrate the production of the environment with the culture of the local community. My argument and hypothesis rests on a three-fold observation:

- Culture has been and will continue to be the prime mechanism for the sustenance of a healthy environment and maintenance of vital community life. It is culture which has helped scores of communities, throughout the ages and until recently, to establish their identities, express their needs, and manage their resources in the most creative way possible. This vital function of culture has been integral to the creation and maintenance of the physical environment around the world.

- While rituals in general might appear to be the cultural mechanism to link community to the creation and sustenance of life, a particular class of rituals and ceremonies has arisen around certain buildings and productive operations in which the technical act of building or production is integrated with the symbolic and social dimension of the culture. It is this class of ritual which appears to link and address acts of building and landscaping to the social and cultural life of the community. This can be seen in archetypal form in the classical example of the Trobriand gardens in the South Pacific, as beautifully described by Malinowski, where the ritual acts of gardening amount to a blueprint for the planning and maintenance of all the compo-



TOWNS SUCH AS HAJJARA,
YEMEN, WERE BUILT, MAINTAINED
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nents of the gardens and the environment of the community. These rituals act as mirrors of the productive acts, establishing the mindset of the community for future actions. The case of Yemen is extremely illustrative as well. Marvellous towns were built in the highlands, maintained, and transformed over centuries into terraced gardens. Land, water, and the natural elements become the prime domain of this ritual operation, which may be called the regenerative process of building.

· For scores of communities, building ceremonies and rituals serve as mechanisms through which the order of the community is identified and expressed in the production of the environment. From roof construction among the Berbers in the Atlas Mountains in Morocco, community gardening in Niger, barn raising in rural America, land subdivision in Mexico, and house decoration in Nubia, the creative energy of the people is released and community resources and skills regenerated. It is these ceremonies and rituals that kept the vital relation of the community with the environment intact and sustained. On the other hand, institutional mechanisms such as building liens and regulations, environmental measures and other regulatory mechanisms, while helping to maintain the environment or to keep it within

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certain bounds of regularity and fitness, cannot guarantee the engagement of the community in the sustenance, health, and goodness of the environment.

It is within the bounds of these three observations that my basic hypothesis is formulated as follows:

- Up until recently, over two thirds of the world's population lived in communities where the production of the environment was, until recently, regulated by such production and building rituals.
- Today, with few exceptions, the life and environment of these communities are regulated by an imposed, top-down process of planning and production which draws its principles from sources alien to the community and its cultures. The result is apathy, underdevelopment, and immense waste and destruction of the environment and its resources.
- Any environmental plan in context of these developing communities should be taken as an opportunity to re-establish the relation between the culture and the production of its environment. The responsibility of the architect in any public project in this context is to re-establish that relation; hence, the fundamental task of architecture is to try to understand local life, and search for the mechanisms that bridge the gap between technology and society, the material and spiritual, and become once more vital to communities in the process of the rejuvenation of their identities. Architecture should not be used as a tool to disenfranchise and control communities into neat tidy plots, but should render building as an activity for the rejuvenation and empowerment of communities. The role of the architect and his responsibility should be to understand and interpret culture, and change society through his architecture.

A garden, park, or a small landscape project can be a valuable instrument to trigger and set into motion a community-wide process which

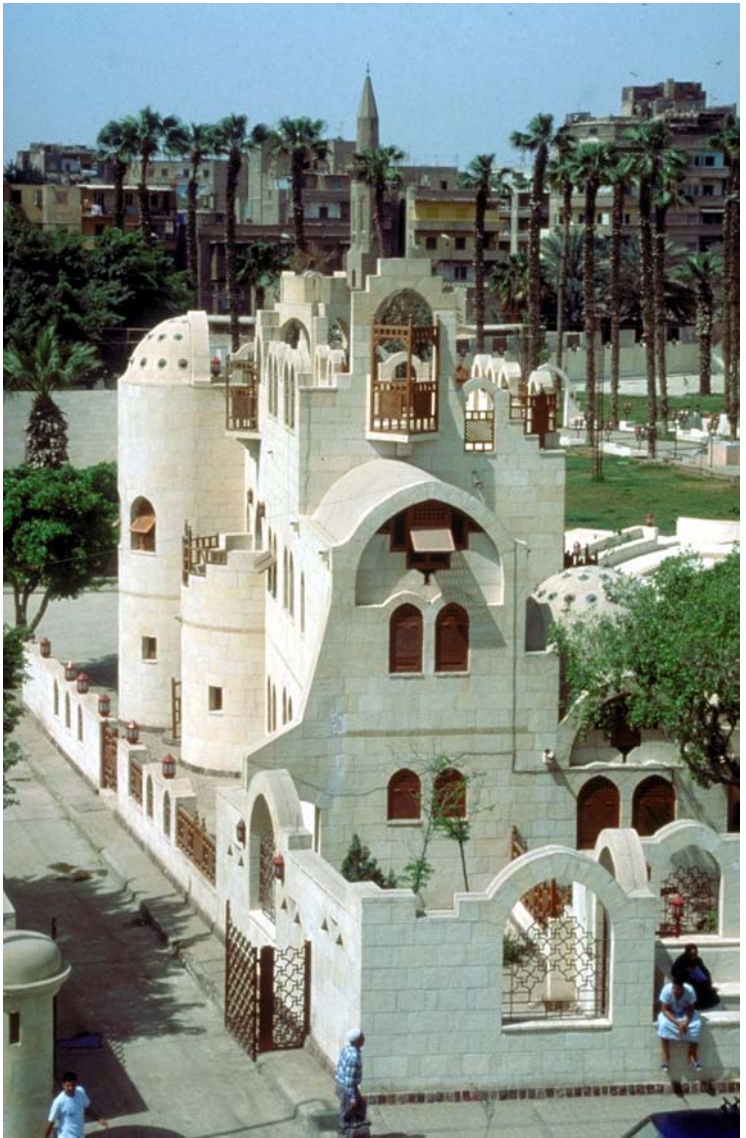
“ ONLY DURING THE SAYEDA ZEINAB
MOULID CELEBRATION WAS THE
GARDEN RECLAIMED BY THE
COMMUNITY, BRINGING PEOPLE AND
ACTIVITIES MOMENTARILY BACK INTO
THE TWO AND A HALF ACRE PLOT. IT
IS THIS COLOURFUL METAMORPHOSIS
OF THE AREA BY THE PEOPLE WHICH
POWERFULLY ILLUSTRATED THE
POTENTIAL FOR THE GARDEN'S
ADAPTIVE REUSE. ”

can uncover, re-establish, and perhaps reseal the gulf or the rupture caused by modernity and industrialisation, and reaffirm the culture of the that community and the production and sustenance of its environment. It is in this context that I describe in the following part an account of the creation of the Cultural Park for Children.

II: The Cultural Park for Children

The Children's Cultural Park is located in the heart of the Sayeda Zeinab district of Cairo. Although it is one of the oldest, most densely populated, and poorly maintained quarters in Cairo, it is also one of the most vibrant and lively. Named after Prophet Mohammed's granddaughter, the Sayeda Zeinab community draws strength and pride from its reservoir of history. No more than a few hundred yards from the park are the Ibn Tulun and Sayeda Zeinab mosques built during the Tulunid era. Both are among the many great buildings in the area that embody, in form, some of the power, vitality, and meaning of the community. This vitality has for centuries been annually replenished with the *moulid*, a remembrance festival for Sayeda Zeinab. During the weeklong festivities, the identity of the community is reaffirmed and regenerated through scores of ritual as well as productive acts.

The site of the park itself was built upon the remnants of an older, dilapidated garden called Al-Hod Al-Marsoud which dates back to the Mamluk period. A virtual wasteland in the midst of a concrete jungle, the garden was monopolised by street gangs and generated a sense of danger in the area, alienating the community and contributing to the general state of decay of the physical environment. Local children would occasionally gather to play but even their activity was restricted to the borders of the park, rendering it more part of street life than to park life. Only during the Sayeda Zeinab *moulid* celebration was the garden reclaimed by the community, bringing people and activities momentarily back into the two-and-a-half-acre plot. It is this



colourful metamorphosis of the area by the people which powerfully illustrated the potential for the garden's adaptive reuse that could extend beyond the *moulid*.

Such are the ingredients that provided inspiration for the transformation of the park. The organisation and form of the park was drawn from the interpretation of the spiral form of the minarets of the Ibn Tulun mosque. Clearly visible from the site, the minaret's spiral symbolised the idea of growth and was taken as the main theme for the children's park, giving form to what is common to both children and parks - growth and life. Reinforcing this theme is the evocative imagery of a tree provided by the Ibn Tulun minaret. Looking down from the minaret into the magnificent serenity of the mosque's courtyard, with its majestic arches and compassionate shade, one is re-

THE CULTURAL PARK FOR CHILDREN IN CAIRO, LOCATED IN ONE OF THE OLDEST AND MOST DENSELY POPULATED QUARTERS OF THE CITY.



LEFT: THE FORMAL LAYOUT OF THE PARK ORGANISED THE MAIN COMPONENTS AROUND THE PALM-TREE PROMENADE.

RIGHT: COMMUNITY INVOLVEMENT INSPIRED CONFIDENCE THAT DWELLINGS ADJACENT TO THE PARK WOULD NOT BE DEMOLISHED, AND PEOPLE SET ABOUT REPAIRING THEIR APARTMENTS.

minded of a *rawdah*, or garden, as the image of paradise. Resting in the middle of the courtyard is the fountain for ablutions, whose water reaffirms the symbolic and functional image of the garden. Here the metaphor between a mosque and garden becomes inescapable.

Looking out in the other direction from the minaret, however, the illusion quickly loses its effect. The garden is strangled on all sides by buildings. The terrific imbalance in the structure of the community is striking. In designing the park, the question became how to reforge this balance and translate the organising principle of growth concretely: in short, how to develop an architectural scheme that is ordered in accordance with community symbols and patterns. The response was to make the design process itself accretionary. The plan contained two layers of design thought.

The first layer is the formal layout inspired by the spiral pattern whereby the components of the project are organised around the palm-tree promenade. The existing trees of the earlier Al-Hod Al-Marsoud garden were maintained and reinforced, becoming the main axis for the conceived geometry of the park. Every tree became a pole, a point in the matrix; the whole is turned in a field of energy activated by the power of the transformed symbol of the Ibn Tulun

minaret. The starting point of this geometric order is, fittingly enough, also the place for water, the source of life and growth. The end point is a lone tree at the other extremity of the palm-tree axis. The site is then organised in stepped platforms following the geometry created by the spiral. The platforms move upwards toward the middle of the site to form an arena-like park, and then they turn in the opposite direction forming a downhill arrangement towards the end of the site where the museum is located. The theatre is situated at the turning point of the two movements. Those three elements, the water point, children's museum, and the theatre are the main poles around which sets of activities, and hence meanings, are created within the realm of the park.

The second layer is a circumstantial layout resulting from the ceremonial process. The building process was organised in a series of events, each of which combined technical work with cultural aspects of that particular operation. The park was built in stages, and the precise shape of each stage was defined as the work progressed. This granted us the manoeuvrability to wed conventional architectural design tools with the active participation of the community.

Initially, when we were first awarded the scheme following the design competition held by the Egyptian Ministry of Culture, the local residents were, if not uninformed, confused and suspicious about the whole project. Although the project made waves with the media, the people in the community who should have been its real supporters were removed from it. The issue became how to enlist their involvement, how best to transform them from passive observers to active participants in the design and construction of the park.

The opportunity presented itself when the Minister of Culture decided to hold the cornerstone-laying ceremony during the National Festival for Children, a celebration held yearly in Egypt during the month of November. Normally such ceremonies are dull affairs attended by bureaucrats politely standing by, along with the architects

THE SITE IS ORGANISED IN STEPPED PLATFORMS, FOLLOWING THE GEOMETRY CREATED BY THE SPIRAL.



“THE RESULT WAS THE CREATION OF
A SETTING THAT ENABLED THE
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PROPOSED AND TO GET INVOLVED.”

and some local representatives. Rarely are the general members of the surrounding community invited. For this reason, we proposed to the Minister of Culture that a community festival be held where the project’s facilities could be mapped out on a large-scale, canvas model representing the geometry and configuration of the scheme. Local artists, musicians, and dancers could also be invited and propose works suggesting the scheme which could then be performed by school children from the local community.

The result was the creation of a setting that enabled the community to see what was being proposed and to get involved. Rather than peering at meaningless plans, charts and miniature models, guest officials and the surrounding community found themselves facing a real-life situation. The building ceremony was thus not simply an empty ritual but a dynamic process where the static order of the original blueprint became flexible. Actual communication was established with local residents and creative decisions regarding how best to integrate the project into the community ensued, giving legitimacy to the process. Ideas and images emerged for the park that would not have transpired in the sterile environment of an architect’s drawing office.

As a consequence of the building ceremony, a number of services catering to the community, such as a corner cafe, a small mosque, an ablution fountain, stores, and workshops were added to the plans for the northwestern side of the park. The park wall, rather than preventing access, as is common in Cairo, became permeated by a series of openings to allow access to cultural facilities beyond. Again, in order to create a practical link between the service strip and abutting neighbours, the side street was pedestrianised. In addition, the Cairo Governorate was successfully lobbied to overrule an old expropriation law that prevented the renovation of the houses overlooking this street. Once residents were assured that their homes were not going to be demolished, they set about repairing their apartments, thereby upgrading the entire area.



Not only did the design festival actively engage residents, but the construction process also brought together skilled craftsmen with architects as partners in the building process. At a time when the dominant mode of production places primacy on control and efficiency of management and costs, the use of craftsmen in the era of mechanisation sadly becomes obsolete. For this reason the use of stone represented not only a building material appropriate to the surrounding environment, but also a meeting point for carpenters, formworkers, steelworkers and surveyors, i.e., typical members of a contracting crew with traditional craftsmen.

A full-scale model was constructed for each element, with the craftsmen present to advise on the materials and techniques involved. These models were then used as patterns for carving stone and building vaults and arches. This made it possible to combine the skill of the stonemason and his instinctive knowledge of geometry and measurement with the technician's ability to work from written instructions and drawings. The combination also made it possible to innovate. Craftsmen were able to regain lost skills and build upon their knowledge base, thereby reducing the gap between their skill and knowl-

A SHADED COURTYARD AREA
WITHIN THE PARK, COMBINES BOTH
ARCHITECTURE AND LANDSCAPE
DESIGN, ENGAGING RESIDENTS
AND VISITORS.



THE NATIONAL FESTIVAL FOR CHILDREN, HELD IN CAIRO EVERY NOVEMBER, WAS A UNIQUE OPPORTUNITY TO ENGAGE COMMUNITY INTEREST IN THE CHILDREN'S CULTURAL PARK PROJECT.

edge, while technicians were able to add advanced skills to their ordinary tasks of steel reinforcement and water proofing.

The Children's Cultural Park in Sayeda Zeinab represented an experiment to do away with the artificial separation between the steps of conception and design and those of execution. In order to allow the community's identity to emerge in the park, a break had to occur in the control normally exercised by conventional architectural practices. Mechanisms were created that allowed the process of building to occur incrementally or gradually, allowing for change and adjustments that can mesh the aspirations of a community with the potential provided by their surrounding environment.

It has been four years since the park was finally completed and it remains to be seen if the experiment is durable and replicable. The ultimate test of any community development project is the degree to which its targeted beneficiaries claim the project as their own.

In our case, the surrounding community became vibrant with activities. Residents upgraded their homes, street weddings and festivals became once again a feature of the community. For two years they

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celebrated the impact of the park in improving their environment. But something went wrong. The euphoria did not last. Official neglect by local authorities and the lack of institutional mechanisms at the community level to make up for this neglect led to the gradual deterioration of the street. With no regular maintenance, elements like street lighting and regular garbage collection disappeared.

As a result, the area once again appeared deserted and invited acts of vandalism from outside the area against the park. Drugs and prostitution, after being driven away for two years, reclaimed the territory. The proposed studios, shops, and community cafe along the side street, which were initially met with the much enthusiasm, failed to materialise due to government bureaucracy and now their establishment is looked on with scepticism and doubt.

In response to formal mismanagement and the general sense of apathy in the community, some members chartered a community-based organisation called the Abu Dahab Street Association to address these problems. Since its establishment earlier this year, the association has helped improve security in the area by lighting the streets once again and ensuring that they remain so. Garbage is now regularly collected. Income-generating projects were initiated along the street. Although it still remains to be seen the extent to which they can mobilise the community in general to lobby officials for a wider role in the park and the operationalisation of the park’s studios, shops and community cafe, initial results are promising. All these are positive indications of a community trying to have a bigger say in the nature of their surrounding urban environment and make the impact of the park in upgrading the area sustainable.

FOOTNOTES

1. Abdel Halim, Halim. 1983. “El-Houd El-Massoud.” *Mimar* 8, April-June 1983: 30-33
2. Abdelhalim, A. I. 1988. “A Ceremonial Approach to Community Building.” In *Theories and Principles of Design in the Architecture of Islamic Societies*, 139-148. Sevckenko Margaret (ed.). Cambridge, Massachusetts: Aga Khan Program for Islamic Architecture



" SAND FROM THE DESERT
ENCROACHES ON VILLAGES AND
FIELDS, DAMAGES CROPS AND WELLS,
BURIES HOUSES, AND LOWERS THE
QUALITY OF LIFE., "

PEOPLE, TREES, AND DESERT: VILLAGE PROTECTION IN NORTHERN SUDAN

Paul Laird

Introduction

This paper presents experience from shelterbelt and sand dune stabilisation projects developed by SOS Sahel, a British non-governmental organisation, in the Nile Valley of Northern Sudan since 1985. The paper draws especially on the work of the project at Ed Debba in Northern Province, where the threat of sand encroachment is most acute. The emphasis here is on actions taken by villagers to combat sand encroachment rather than the assistance provided by SOS Sahel.

The projects work with the men, women, and children of farming communities to help them plant trees around their villages and farms. Tree planting has become essential, as natural forests, which played a vital protective role, have vanished in recent decades. Sand from the desert encroaches on villages and fields, damages crops and wells, buries houses, and lowers the quality of life. Dunes, which were previously stabilised by natural vegetation, are reactivated. Sand encroachment is one factor, among several, which threatens the sustainability of a productive agricultural landscape and way of life developed over hundreds of years.

External agencies have a role in raising awareness and introducing technology, but the task of fighting sand encroachment essentially belongs to the villagers. It is important that they own the trees and shelterbelts, and feel confident of their capacity to replicate such work in future. Their own projects correspond to their perceived priorities. So their time horizons, land tenure systems, technology, labour, and materials shape shelterbelt and dune stabilisation designs.

IN NORTHERN SUDAN, SAND
ENCROACHMENT THREATENS A
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DEVELOPED OVER HUNDREDS
OF YEARS.

“ FOR HUNDREDS OF YEARS THE
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HAS PROVIDED GOOD CONDITIONS
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IN MARKED CONTRAST TO THE
HARSH ENVIRONMENT OF THE
SURROUNDING DESERT. ”

We have cautiously come to consider that “blueprint” designs for large scale, long-term (even “permanent”) treatment of moving sand, based on scientific and engineering concepts, devoid of local social, economic and tenurial considerations, are not helpful. The apparently piecemeal efforts of the farming communities are in fact a more realistic response to sand encroachment. The scale of the problem and the severity of constraints on control methods suggest that a concept of flexible management of the desert/farmland interface is more helpful than an attempt at a permanent solution. The plantations modify the landscape, especially at the interface between desert and farmland, and contribute to the sustainability and quality of life of the villages.

For hundreds of years the Nile Valley of Northern Sudan has provided good conditions for human life and agriculture, in marked contrast to the harsh environment of the surrounding desert. Farming communities have made considerable investments in their homes, farms, and wells, and the villages have strong traditions. The mud-built village houses (at their best) use simple local materials to create cool and tranquil living conditions. The date-palm groves and the shady *Acacia* trees at the edge of the dunes provide favourite sites for social gatherings.

The northern Nile Valley as a whole presents the essential features of an oasis: heat and aridity, but also shade and abundant water. The Ed Debba area in Northern Province has a hyper-arid climate with annual potential evapotranspiration over 2,500 mm and shade temperatures which rise above 40°C (104°F) from April to October and can reach 50°C (122°F). Relative humidity can be as low as 10% (Bristow 1996). Annual rainfall has declined over recent decades from negligible levels to almost zero (UNEP 1992).

Regular Nile floods used to deposit fertile silt on the river terraces, islands, and flood basins. The Nubian sandstone aquifer, re-



charged by the Nile, provides accessible groundwater for several kilometres on either side of the river (Bristow 1996).

Farmers used traditional means of irrigation or residual moisture from the floods to cultivate their crops. In recent years lower rainfall in the Nile's catchment areas and control of the river by dams have limited seasonal flooding and most present-day agriculture relies on diesel-pump technology. Private farmers install small pumpsets on river banks or in shallow wells, and much larger schemes are operated by businessmen, co-operatives, or the government. Crops include broad beans, sorghum, wheat, alfalfa, onions, dates, and citrus.

FARMERS USE TRADITIONAL MEANS OF IRRIGATION TO CULTIVATE THEIR CROPS AFTER NILE FLOODS DEPOSIT FERTILE SILT ON THE RIVER TERRACES.

“ WE PREFER THE TERM SAND
ENCROACHMENT, AS IT SIMPLY
MEANS THE PHYSICAL MOVEMENT
OF SAND INTO VILLAGES AND
FARMS IN THE FORM OF DUNES
OR SHEET DEPOSITION. ”

Threats to Sustainability

Many of the farming communities in the Nile Valley of Northern Sudan face the threat of gradual burial by sand. It is important to recognise that this is only one among several threats to the sustainability of the communities. Closely related is the problem of erosion; the Nile is constantly destroying old agricultural land and creating new sites by processes of erosion and deposition.

There has been a long-term trend of migration away from the area. This part of Sudan suffers from poor accessibility and communications. Employment opportunities are very limited. Many younger people attempt to find work elsewhere in the Arabic speaking world, and their remittances are important to the local economy. Many lost their jobs in Kuwait and Iraq at the time of the Gulf War. Increasing reliance on diesel-pump technology itself raises problems of sustainability, since imported fuel and spare parts are desperately difficult to obtain. The international isolation of Sudan, the closure of almost all externally funded development projects, its economic woes, and hyperinflation are perhaps the greatest threats to the northern Nile communities. Sustainability depends upon the continued attractiveness of the way of life and continued confidence for investment in farming.

Sand Encroachment

There is little that the communities can do about these external threats, but the problem of sand encroachment is one that they have played a part in causing, and will have to deal with themselves. The much abused word “desertification” sometimes appears in this context but we prefer the term “sand encroachment”, as it simply means the physical movement of sand into villages and farms in the form of dunes or sheet deposition. These processes have been occurring for many decades, but they have accelerated over the last forty years. Lower rainfall in the Nile’s catchment areas and control of the river by dams have reduced



the reliability of seasonal flooding and thus limited natural regeneration in the *Acacia* and *Tamarix* forests which formed a natural barrier to the sand along the fringes of the flood plain. Rainfall is now almost never sufficient to allow natural regeneration of even the hardiest perennial vegetation outside the flood plain.

The flood-plain forests were largely cleared, in part because of agricultural expansion made possible by diesel pumps. There has been persistent over-cutting for timber and fuel wood, associated with the failure of state forest control, a rising population, sedentarisation of nomads and refugees along the valley, and increased urban demand. Hardy shrubs such as *Capparis* and *Salvadora*, which used to colonise

MOBILE DUNES CREEP FORWARD
AND BURY VILLAGES, FARMS, WELLS,
AND CANALS.

“ IN THE OPEN DESERT WHERE THE SURFACE IS HARD AND SMOOTH, BARCHAN, OR CRESCENT DUNES, FORM. THE SPEED OF BARCHAN MOVEMENT IS IN GENERAL INVERSELY PROPORTIONAL TO DUNE SIZE, AND IN THIS AREA MOST BARCHANS ARE SMALL AND MOVE AT UP TO 30 METRES PER YEAR. ”

the low dunes near farmland, have also suffered from continuous browsing by an increasing population of goats and camels. Many of these changes are vividly depicted in the oral histories collected by Cross and Barker (1992).

Prior to the imposition of state control of forests, communities held traditional rights over nearby woodland, under their *umdah*, or sheikh. Community attitudes changed with state control. People were willing to risk being caught felling trees as penalties were often not imposed. The forest service became demoralised and the forests were treated as an open-access resource. The Forest Act of 1989 recognised the need to involve user groups in forest management, and there is provision for the creation of community-owned forests and plantations. But this change has come too late to save the northern riverine forests, which have already been cleared. The result is that previously stabilised dunes at the edge of the flood plan were reactivated.

Wind velocity has to reach a threshold level to entrain sand particles. Once reached, sand movement will continue until wind velocity drops to a much lower level. Often this occurs where obstacles in the path of the wind create turbulence and a protected zone of quiet air (small on the windward side and more extensive to the lee). All sand movement control methods manipulate these principles in order to prevent sand entrainment, or to cause sand deposition, or in some cases to dissipate existing accumulations.

In the open desert where the surface is hard and smooth, *barchan*, or crescent dunes, form. The speed of *barchan* movement is in general inversely proportional to dune size, and in this area most *barchans* are small and move at up to 30 metres per year (Ibrahim 1984). *Barman* dunes merge to form *barchanoid* transverse dunes. Sand also accumulates around obstacles such as rocky hills, trees, or buildings.

Around the agricultural land and villages, more complex dune forma-

tions develop. Sand gathers around trees and houses. Incoming *barchans* and sheet sand merge with earlier accumulations. The size and form of the resulting complex dunes relate to the quantity of incoming sand and the angle of the main dune front to the prevailing wind. Fortunately, these large complex formations close to agricultural land are less mobile than the individual dunes of the open desert (Ibrahim 1994).

The sites most exposed to the prevailing northerly winds - and thus to sand encroachment - are those on the “right” or north bank of the Nile where it flows in its great east-to-west loops. Here, dune movement towards the river can exceed 15 metres per year, and in some places the sand has covered the river terraces, broken through the

IN THE SAHEL, THE CONTINUOUS BROWSING OF GOATS AND CAMELS HAS DAMAGED HARDY SHRUBS WHICH BOUND LOW SAND DUNES.



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date palm groves, and now pours into the river. Neighbouring sheltered sites may pass almost unaffected.

The river is constantly creating new land by deposition as well as destroying old sites by erosion. There is always great scope for expansion of irrigation and cultivation in the desert, but the harsher conditions make this less economically attractive. The significance of sand encroachment is best measured, therefore, by estimating economic damage to villages and farms where investments and commitments have already been made, rather than notional figures of land lost per year.

The Community Forestry Project at Ed Debba

SOS Sahel has been working with villages around Shendi since 1985, and a women's forestry project is based at Ed Damer. SOS Sahel's Northern Province Community Forestry Project has been working with farming villages in the Ed Debba area since 1988. Its primary aim is to help these communities protect their land and homes from sand encroachment. Tree nurseries have been set up; hundreds of women, men, and children have raised seedlings on their farms or at home and farmers have planted kilometres of shelterbelts. The villagers themselves carry out most of the hard work of digging wells and irrigation channels, making sand-fixation fences and planting and protecting trees.

The project aims to raise awareness of the causes and effects of sand encroachment, develop technology, provide training, inform people of the opportunities for effective action, and motivate them to participate. Training and technology development are both based on a learning process with farmers. Top-down technical training by external "experts" would be inappropriate. The farmers have their own expertise based on long experience of living with sand and their own trial-and-error experiments. Sustainability implies local self reliance, so it is important to use locally available technology rather than undermining self reliance by the introduction of inappropriate methods.



The project helps people find the means to tackle the problem of sand encroachment rather than doing the job for them. People who plant and irrigate their own trees and stabilise their own dunes value and protect what they have achieved. Project staff are local people, familiar with the problems of the area, well trained, and with appropriate skills. They understand farmers' problems and perceptions but have gathered a more thorough grasp of the sand encroachment issue. Thus they can provide a support service to any community wishing to take action. The project won a United Nations Environment Programme "Saving the Drylands" award in 1996.

Sustainability and Participation in Sand Dune Stabilisation

The technical background of the agricultural engineers and foresters responsible for sand-dune stabilisation programmes does not encourage consideration of their social implications. Foresters in Africa have until very recently been trained purely in the technical aspects of forest and plantation management in what are assumed to be state-owned forest reserves. Agricultural engineers in Africa are accustomed to treat ero-

IN SUDAN, LONG-TERM REFORESTATION PROGRAMMES HAVE BEEN INSTITUTED IN ZONES WHERE THE RAINFALL IS ADEQUATE. ACACIA TREES IN IDD EL FURSAN PROVINCE.

sion control in topographically defined catchment areas. Forest management and erosion control plans are designed by trained professionals on the basis of technical considerations. But project managers, frequently with technical backgrounds, have begun to learn from the social science disciplines that the underlying causes of these problems are very often more social or economic than technical, and that sustainable solutions may not be simply a matter of the best engineering design.

Projects must respond to local needs and priorities and ensure that all social groups, including women, are heard and involved at all stages. Projects only succeed when local communities feel that they own and control them. The development of local skills, capacities, and management institutions is usually more important than the immediate



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physical outputs. And it is essential to respect and build upon local knowledge, experience, and perceptions rather than dismissing them in favour of imported “expert” solutions.

The terms “participation” and “sustainability” have become almost worn out by over-use in this rural development context, and they are in fact intimately linked. At times “sustainability” has meant little more than that a development achievement should endure for some time after the closure of the project which gave birth to it. We find it more useful to think in terms of two separate but related concepts: durability and sustainability. Durability refers to the technical lasting power of an improvement. What is the lifespan of a well or pump? For how long will a shelterbelt hold back sand? And so on. Sustainability refers to its social, institutional, and economic viability. Will the village have the organisation, skills, funds, and commitment to manage the well, pump, or shelterbelt? Is the tenure status of the shelterbelt secure or liable to give rise to conflict? And so forth. Sustainability in this sense implies the close involvement of the community in the identification, design, implementation, and management of projects.

Sand Dune Stabilisation Design

In the Ed Debba area farmers had already experimented with a range of techniques for control of sand encroachment with varying degrees of success. Sand dune stabilisation experts who visited the area tended to dismiss farmers’ efforts as ill-conceived or even futile. It was suggested that to continue with these methods could lead to delays in calling in the necessary expertise and resources to implement a proper programme of works. There was scepticism over the capacity and willingness of rural people to take effective measures.

The farmers and SOS project workers together began to define their sand stabilisation practice through a process of dialogue, adaptation,



IRRIGATION METHODS CAN RANGE FROM THIS PUMP/FILTRATION STATION AT THE DESERT PLANT NURSERY OF AL- AZHAR PARK IN CAIRO TO WATERING PLANTS BY HAND FROM ROPE-AND-BUCKET WELLS.

and practical trial and error. Yet it was for a long time worrying to note how far the techniques developed by farmers and the project differed from the standard practices in the literature. Communities, groups, and households preferred to implement specific priority projects to protect valued sites. These projects could not ignore the basic physical principles of sand dune stabilisation if they were to succeed, and thus did not diverge greatly from the more pragmatic examples given in the literature. But the apparently piecemeal progress of the work and its relatively short-term aims continued to attract expert criticism.

In the hyper-arid climate of Ed Debba, all planting depends on irrigation. The cost of irrigation in terms of capital and operational costs of pumps, wells and canals, transport of water, labour, and time, is the key constraint to re-vegetation. Villages or households consider tree-planting in broadly economic terms: how much water will the trees require, for how long; how much will it cost in time, labour, and inputs; what will be the returns? The feasibility of irrigation and the quantity of water available at a given site define the number of trees which can be planted in a given time. Farmers therefore choose

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sites to plant limited numbers of trees where they will have the greatest effect in the shortest time. Blanket re-vegetation is never possible.

Irrigation methods need to be manageable by farmers. Most farming relies on water pumped directly from the Nile. However, further from the river - such as at the shelterbelt or dune sites - farmers use shallow *matara* wells. The diesel pump is placed in a shallow well from the base of which a rising main is inserted into the aquifer. Pumps in *matara* wells can supply a simple canal and furrow system for shelterbelt irrigation on fairly level ground. The advantage of this method is that it is well known and understood by local communities. In some cases, farmers simply extend furrow systems already used for crops.

The disadvantages include water loss by seepage on sandy soils, and clogging of furrows by blown sand. Open furrow systems are difficult to use on sites with high exposure to rapid sand movement. Often it is better to deliver water directly to individual trees. Pipe systems operated from pumps or storage tanks deliver water effectively to the trees. Four-wheel drive lorry tankers can deliver water even to trees planted on dunes. The risk is that the offer of such assistance undermines local self reliance. Determined farmers can achieve impressive results watering trees by hand from simple rope-and-bucket wells, or transporting water by donkey cart.

Farmers need species with a root system which can reach the groundwater table-typically between eight and fifteen metres deep-as fast as possible, because this is the point where they can cease irrigation (Ibrahim 1994). Shallow-rooting grass or shrub species which perform well under conditions of low rainfall are useless where there is no rainfall.

Foresters are often blamed for imposing fast-growing exotic tree monocrops on rural people in place of better adapted indigenous species. Not so in this case! Most foresters and external experts recommend diversification and use of indigenous species. Some have re-

WATER MUST OFTEN BE DELIVERED INDIVIDUALLY TO EACH TREE.



SOS SAHEL HAVE MADE MANY EFFORTS TO PROPAGATE AND USE A VARIETY OF SPECIES.

commended shelterbelts composed of mixed species of differing height and form, to achieve ideal porosity and shelter characteristics. The SOS Sahel projects have devoted substantial effort to propagation and use of fine native shrubs and trees including *Leptadenia pyrotechnica*, *Salavadora persica*, *Tamarix nilotica*, *T. aphylla*, *Capparis decidua*, *Acacia nilotica*, *A. tortilis*, *A. Seyal*, *A. Ehrenbergiana*, and *Balanites aegyptiaca*.

It is the farmers who insist on the hard-headed economic choice. None of the native trees comes close to matching the performance of the exotic Mesquite (*Prosopis chilensis* or *juliflora*). Mesquite has been widely planted in Sudan since it was introduced from South America around 1940; it is a nitrogen-fixing leguminous tree. The timber is strong and heavy though rarely straight and it makes excellent firewood and char-



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coal. The pods provide nutritious livestock fodder but the tree itself is resistant to browsing and largely pest- and disease-free.

Despite its apparent lack of xeromorphic adaptations, its performance in the harsh conditions of northern Sudan is remarkable. Tap-root growth is exceptionally fast; the tree responds well to irrigation and can reach groundwater within six months (Ibrahim 1994). It has a high tolerance for soil or water salinity. Experiments suggest that Mesquite can tolerate longer periods without irrigation during establishment than alternative indigenous species (due to their slower tap-root growth). Mesquite can be planted on pure dune sand up to a depth of about four metres. In deeper sand, the trees appear to lack soil nutrients and become unrealistically slow to establish (Ibrahim 1994).

In 1995, the Government of Sudan banned Mesquite planting, and for a time the future of the Northern Province shelterbelts was in doubt. In parts of Sudan such as the Tokar Delta (where it should never have been introduced), Mesquite had become a noxious weed (Bristow 1996). It is always dangerous where it thrives. The seeds are spread by animals which eat the pods. Mesquite easily spreads onto farm land; if farmers fail to uproot it when young, it becomes difficult to eradicate. These risks are simply a consequence of choosing the most effective tree for the sand stabilisation task. A less aggressive species would not do the job. The government has now made a special dispensation for sites in the Northern Province.

Where farmers face an immediate threat of sand encroachment on farm land, their priority is to plant a shelterbelt directly in front of the oncoming dune. The farmer must accurately assess the rate of dune movement; the young trees will not survive if overwhelmed by sand in their first year, nor will the shelterbelt permanently protect the field. But the ability of Mesquite to continue growing while largely buried in sand ensures protection for ten years or more, depending on the rate of sand accumulation. The shelterbelt continues to grow within the slip-



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face zone of a transverse dune, which itself continues to accumulate sand. The wall of sand and foliage at the edge of the field shelters a large downwind area and provides excellent growing conditions for crops. Such a shelterbelt provides a breathing space for the farmer to consider options. The next move may be to plant a belt on the dune itself or an “external” belt to the windward side of the dune (if it is not too large). This will probably be a more difficult site for irrigation and tree establishment, with wind and sand exposure and a deeper water table. If it is successful, however, the external belt will cut off sand accumulation on the dune and provide a considerable degree of long-term protection. Every shelterbelt, however, will in due course create or modify its own dune, which may eventually become mobile. There is no permanent fix.

Thus, instead of complete re-vegetation farmers aim to establish linear belts of trees, usually as nearly as possible perpendicular to the prevailing wind, at strategic and feasible sites to the windward of the

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farms or houses which are to be protected. Where large mobile dunes would rapidly overwhelm the trees, farmers plant belts at an oblique angle to the wind, to encourage dune movement along the belt. Instead of working from the source of sand towards the mobile dune front, they usually work from the mobile front towards the source.

Time is a critical factor. By the time a large scale long-term programme is fully implemented the farmers (or householders) in the front line - those in fact who were most highly motivated to join in the work - may have seen their property engulfed.

The theoretical principle of working from the sand source towards the mobile dune front simply will not work in practice. Shelterbelts on the windward side of the dunes take longer to establish because of the harsher conditions. As they become established they will create a fore-dune. This will cut off sand supply to the main dune, and gradually reduce its size. The wind is relieved of its previous sand burden by the fore-dune, and as it passes over the main dune surface will entrain more sand particles. The rate of movement at the mobile dune front and the amount of downwind sheet sand deposition will increase.

A thick shelterbelt of Mesquite planted on good soil at the foot of the mobile dune front can reduce encroachment within its first year. As sand begins to pour into the shelterbelt, the Mesquite grows above dune level so that within two or three years the dune front has developed a "canopy" of Mesquite foliage, while the trees continue to tap the groundwater beneath the dune.

Farmers understand the role of mechanical fixation on sites where sand movement must be slowed to allow for shelterbelt establishment. Yet, an analysis of expert recommendations for the villages of Mora and Rekabiya in Northern Province showed that the sand fixation work itself required more labour than the villages could provide, without even considering the labour requirements of tree rais-

" A SHELTERBELT PLANTED ON AN EXPOSED SITE WILL NEED AT LEAST ONE LINE OF SAND FENCING TO WINDWARD TO PROTECT THE SEEDLINGS FROM SAND-BLASTING. "

ing, planting, and irrigation. So, they aim to minimise the need for fixation by choosing more favourable, less exposed sites for tree planting. Again, there is a case for planting at the foot of oncoming dunes in the zone of shelter. Farmers also make use of the remarkable properties of Mesquite. A shelterbelt planted on an exposed site will need at least one line of sand fencing to windward to protect the seedlings from sand-blasting. The fence will create a small fore-dune which will provide some degree of shelter. This fore-dune will begin to bury the first rows of trees. Irrigation by furrow may become impossible.

If the trees can keep pace with the sand accumulation, further mechanical fixation will no longer be needed. The trees are now the self-raising, self-renewing barrier. Once again, the outcome depends upon the race between competing factors: a combination of farmer commitment, shelter effects, irrigation, root growth, and groundwater table; up against abrasion and burial by wind-borne sand.

On sites with extreme exposure to sand blasting, farmers have invented various techniques for individual tree protection. Date palms are traditionally planted in small mud-lined "wells" sunk below ground level. Individual protectors for Mesquite trees may be made of mud, date leaves, or even an old up-turned bucket with the bottom punched out. The advantage is that sand passes between trees and does not accumulate until the belt is well established.

In Northern Sudan, farmers frequently own land on, near, or among mobile sand dunes. The nature of ownership varies, with complex arrangements for share-cropping or combined management of uneconomically small plots. Sometimes there is no title deed and the farmer may really be squatting. But in all cases, a farmer who has invested efforts in cultivating and irrigating the land will be highly motivated to protect it. The tenure status of land for community shelterbelts has to be clarified before planting starts.

“ IN MANY CASES “COMMUNITY”
ORGANISATION IS REQUIRED IN
ORDER TO PLANT LARGER-SCALE
SHELTERBELTS TO PROTECT ENTIRE
VILLAGES. ”

In the above discussion we have perhaps implied that all shelterbelt planting is carried out by individual farmers or households. In many cases “community” organisation is required in order to plant larger-scale shelterbelts to protect entire villages. The SOS Sahel projects have devoted much effort to awareness-raising and institutional development as prerequisites for such communal projects. Many successful village shelterbelts have been established around Shendi.

The design of these larger-scale schemes is of course “participatory”; it is always the result of intensive discussion and planning within the village, but a “unified” design and plan of action must emerge. In other cases where farmers prefer to work independently but share identical objectives, a unified design can emerge from many individual efforts. At the villages of Affad, near Ed Debba, shelterbelts planted by many individual farmers at the foot of the oncoming line of dunes on the northern edge of the agricultural land have combined to form a single, eight-kilometre belt.

Social and economic considerations affect the degree of unity of purpose in villages. When a mobile dune front is encroaching on agricultural land at five metres per year, the farmers in the front line may lose their entire plot within ten or twenty years, while neighbours who farm land just half a kilometre away know it is safe for the next century. People’s perceptions of time and sustainability come into play. We may hope that the village will show unity of purpose in protecting its members and thinking of the long term. But, there is clearly an economic case for those who are furthest from the dunes to free-ride and leave the task to those in the front line.

There may be deeper reasons for lack of unity. In many of the northern farming areas, there is a broad distinction between older villages within the agricultural schemes belonging to groups with a long history of settled farming, and villages on the fringes of the schemes, belonging to ex-nomadic groups who have settled more or less re-

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cently. There are underlying tensions between these broad groups, including disagreements over land ownership. At Affad, most land close to the dunes is farmed by ex-nomadic villagers. They are motivated to plant shelterbelts not only by the immediacy of the threat of sand encroachment, but also by the expectation that tree planting will reinforce their informal claims to land tenure. Thus the burden of sand stabilisation has tended to fall on the generally much poorer ex-nomadic villages for whom the debate over “sustainability” is by no means academic.

The concept of “sustainability” and permanence in this context is indeed a difficult one. Many of the criticisms made of farmers’ shelterbelt designs in the early days of the Ed Debba project revolved around questions of time-scale. Farmers seemed more interested in immediate results and short-term solutions than in permanent stabilisation. But the desert is vast and contains an endless supply of sand. Many of the villages are small. Some are still dilapidated from the effects of the 1988 and 1994 floods. Acute sand accumulation around villages and farm land is in fact rather rare and only occurs in sites exposed to the prevailing wind. But where it does happen, as for example at the village of Argi in Northern Province, it must not be imagined that a permanent solution, or complete stabilisation will ever be possible. The whole situation is dynamic, since there is evidence that the course of the Nile itself has moved. New agricultural lands are also created by the river and by dissipation of dunes overlying good soils. In the end, the long-term sustainability of the villages, their agriculture, and admirable way of life are more threatened by Sudan’s desperate economic problems than by anything sand can do to them.

Flexible management of the interface between the desert and the farms and villages is more appropriate than an attempt to achieve a permanent technical solution. The durability of any shelterbelt is important. But sustainability is more a question of villagers’ understanding, experience, skills, technology, resources, determination, organi-



sation, and confidence in the future. If they are to continue farming in these areas they must certainly expect that shelterbelt planting and maintenance will become a permanent part of their lives.

These considerations of scale and time-scale remind us why we considered “participation” essential to the “sustainability” of the work. In turn, the participatory approach is not only essential for “sustainability” but also has implications for technical aspects of design. The adoption of a participatory approach leads to a partial abandonment of the concept of an overall sand dune stabilisation “design”, in the sense of a master plan for a given area to be completed over a given time-scale. Such a plan will never work if it ignores the economic and social realities of material and labour constraints, tenure, social divisions and organisation, local priorities, needs, and perceptions.

The SOS Sahel projects build upon local skills, experience and technology, the communities’ own perceptions of tenure issues and priorities, and the determination of the most motivated individuals, groups, and villages. Instead of progressive work from the sand source towards the mobile front, comprehensive mechanical fixation and revegetation, farmers in the Ed Debba area adopt practices which are

COMMUNITIES IN THE NILE VALLEY CAN REGAIN CONFIDENCE IN THE VIABILITY OF THEIR HERDS AND CROPS THROUGH THE PROTECTION OF SHELTERBELTS.

“ THE FARMING COMMUNITIES OF THE
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NOT AS A FUTILE GESTURE, BUT AS
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THEIR WAY OF LIFE. ”

feasible under constraints of labour, materials, and irrigation. Typically these involve working from the mobile front towards the source of sand, minimising the amount of mechanical fixation and planting strategically placed belts of deep rooting trees.

The Benefits of Tree Planting

The farming communities of the Nile Valley regard tree-planting not as a futile gesture, but as essential to the sustainability of their way of life. They are enthusiastic about the benefits. Agricultural land is saved from burial by dune or sheet sand. Farmers feel more confident about investing in farming and long-term crops such as date palms. Canals, wells, and pumps are also protected from sand deposition; canal maintenance work is reduced and the operating life of pumps is improved.

Just as important as the protection of land and infrastructure is the improvement in crop conditions. A shelterbelt at the windward side of a crop field (often combined with a wall of sand) can reduce wind speeds for up to 20 times its own height downwind. In some cases, windbreaks within the agricultural land extend the sheltered zone. Relative humidity in sheltered zones is much higher than in more exposed sites. Evapotranspiration rates and irrigation requirements are reduced, and crop performance greatly improves. Abrasion by wind-borne sand - a major cause of crop failure - is almost eliminated downwind of the shelterbelt.

The shelterbelts provide ideal sites for livestock. Cattle, camels, goats, and sheep are tethered within their shade throughout the heat of the day, feeding on the Mesquite pods. Shelterbelts around villages on open desert sites cut off incoming sand which would otherwise accumulate around houses, schools, and mosques. People regain confidence in villages where it is no longer necessary to re-build every few years as a result of sand accumulation. The Mesquite trees are an increasingly important source of fuel wood, charcoal, and building

“ OUR EXPERIENCE SUGGESTS THAT “SUSTAINABILITY” RELATES NOT ONLY TO DURABLE PROTECTION OF HOMES AND FIELDS BY EFFECTIVE SHELTERBELTS, BUT ALSO TO VILLAGERS’ CAPACITY TO DESIGN AND IMPLEMENT THEIR OWN PROJECTS.”

poles. With careful management trees can be felled; the coppice regrowth is rapid. Taller shelterbelts are improved by pollarding.

The adoption of Mesquite and the development of shelterbelt and sand dune stabilisation methods are responses to the loss of services originally provided by the natural riverine forests: shelter from wind and wind-blown sand; protection from dune encroachment; shade for people and livestock; and forage, fuel, and timber. Mesquite will surely never compensate for the great old *Acacia tortilla* and *Faidherbia albida* trees, but people do gather in their shade as they did before under the forest trees. Shade trees around the village are almost as important as the houses themselves, as places to gather, relax, or discuss plans for the future of the village.

Conclusion

Our experience suggests that “sustainability” relates not only to durable protection of homes and fields by effective shelterbelts, but also to villagers’ capacity to design and implement their own projects in what will no doubt be a continuing struggle with a harsh environment. The concepts of “participation” and “sustainability” are intimately linked, and have implications for technical design. These communities will have to continue to live with sand encroachment. Permanent stabilisation of the threatening dunes is not a realistic alternative. The aim is to avoid the necessity of migration.

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" SUSTAINABLE LANDSCAPE DESIGN
IN DRY CLIMATES MUST CONSIDER
NATURAL RESOURCES. THIS APPLIES
TO BOTH A BALANCED WATER
MANAGEMENT AND THE APPLICATION
OF DESIGN CRITERIA. "

GARDENS IN THE DESERT: A LANDSCAPE ARCHITECT IN SAUDI ARABIA

Richard Bodeker

Saudi Arabia is the size of Central Europe. By comparison, its area would reach from Copenhagen to Palermo, from Paris to Budapest. In the middle of this huge desert area lies Riyadh, at the crossing point of the most important trade routes. Thanks to the abundance of water in the dry valley, the *Wadi Hanifah*, an oasis could develop here.

Desert and oasis - these two terms belong together. The one cannot be imagined without the other. The Semitic word *Arab* describes the barren desert. An Arab is therefore a person who does not live in a city, but roams the desert. The desert is a habitat for humans only where there are oases within sufficient distances. It is of strategic importance for survival in the desert to protect and extend the water sources. Sustainable landscape design in dry climates must consider natural resources. This applies to both a balanced water management and the application of design criteria, and especially to the selection of the right plants which should be adapted to the natural plant community as far as possible. The landscaping for the Diplomatic Quarter in Riyadh and other projects in and around Saudi Arabia's capital have established themselves as good examples of these practices.

TUWAIQ PALACE IN RIYADH, SAUDI ARABIA RECEIVED THE AGA KHAN AWARD FOR ARCHITECTURE IN 1998. IT WAS PRAISED FOR COMBINING BOTH ARCHITECTURAL QUALITIES AND INNOVATIVE LANDSCAPING.

Trees, water, and the colour green in Islam

All three great monotheistic religions originated in the Middle East and the scriptures of each of them reflect the landscape of this region. But none of these scriptures contains as many references to trees, gardens, and splashing water as does the Koran. Green was the colour of Mohammed the Prophet's warriors as more than a thousand years ago they conquered half of the world and finally built gardens representing their idea of paradise from Andalusia to India.



A RICHLY LANDSCAPED
ENVIRONMENT SURROUNDS
THE DIPLOMATIC QUARTER IN
SAUDI ARABIA.

Oil wealth suddenly catapulted Saudi Arabia, known to the Romans as *Arabia deserta*, from centuries of being a Bedouin state with an archaic social structure, into the modern world. In a country where nature is considerably more sensitive than it is in Central Europe, rapid development brings with it the disadvantage of a progressive expansion of the desert. The palm tree and the colour green are a symbol of the state, and it is not surprising that trees and gardens are attributed a very different value to that which they have in Germany.

My first visit to Saudi Arabia was in 1974 and resulted in the conviction, which remains unchanged, that this country needs trees and gardens more than anything else. A series of simple principles have served to make our client increasingly sympathetic to the ideas of landscape and environment, including the idea that trees should be planted before houses were built in the Diplomatic Quarter and the fact that recycling water could mean each person provided sufficient for six trees. In the Diplomatic Quarter and the Ministry of Foreign Affairs Staff Housing, these principles have been consistently applied to the extent that now, every weekend, some 5,000 car-loads of people from the city of Riyadh come to the gardens of the Diplomatic Quarter and spend their leisure time in the extensive landscape in order to seek closer contact with nature. This is something which we never foresaw during the planning stage, but is a gratifying testimony to the success of our work.

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ONE OF THE MOST IMPORTANT. ”

The Islamic Garden

A digression , taken from the article, “City and leisure parks”

(Richard Bodeker and Mohamed Scharabi, Garten und Landschaft, 8/1976)

Few Central Europeans and even few Arabs are aware that the roots of Western culture, not least in garden art and landscape design are essentially of Arabic origin. In the Orient the arts had time to put down deep roots. They were built on the inheritance from many cultured peoples: the Persians, Nabateans, Greeks, Romans, and Byzantines. All the customs of settled life took such root in the Orient that ineradicable traces are left behind. Among all these arts, garden design is, next to architecture, without a doubt one of the most important. Fountains and small bodies of water are conspicuous in many Islamic park areas. Water symbolises purity in Islamic teaching, and this virtue has great importance. In addition the water stands as a connecting element between architecture and vegetation. The constant flow of the water not only provides movement, but a cool atmosphere, which is desirable in the entire Near East region. Vine leaves often shaded entire courts and small gardens. Trees were set out in pots or planted at intervals. Flower beds, ponds, and canals were narrowly bordered. Next to the paths were pleasant flowers and plants and shrubbery. To create order in the multicoloured and multiform park, palms and other trees were regularly planted. They also formed a shaded area, which made possible a pleasant visit in the hot seasons. Visual prospects such as those in the garden park of the Alhambra were not a rarity. Balconies and terraces were built on natural or artificial hills viewing towers. From the descriptions of Islamic parks, we know the love of the Arabs for the unusual. To the traditional gardens belonged indigenous and foreign animals. These made a sort of zoo. In the ponds coloured fish were bred. Greenhouses, labyrinths, and sundials were built in the gardens. The greenhouses sometimes served as reception rooms in winter. Not only Arabic, but also European travellers described and admired the Islamic garden art. Chardin among others pictured the Tchegar-Bagh and Tschihil-Sutin in Isfahan. They were characterised by the complete subordination of architecture to the landscape formation. The parks were inseparable elements of the city ground plan and city life in general.

WATER GARDENS ENJOYED BY THE
PUBLIC ON THE SITE OF THE
DIPLOMATIC QUARTER, SAUDI ARABIA



THE DESIGN OF THE DIPLOMATIC
QUARTER RESPONDS TO BOTH
THE FREEDOM OF THE DESERT
LANDSCAPE AND THE FORMALITY
OF THE ISLAMIC GARDEN.

Riyadh Diplomatic Quarter

In 1977, members of the diplomatic missions in Jeddah were promised that when they moved to Riyadh six years later, they would enjoy a considerably higher quality of life than was normally the case for the capital city. Given the fact that the 900-hectare site for the proposed new Diplomatic Quarter resembled a moonscape, this promise was met with some scepticism.

Two or three Bedouin camps, with their herds of sheep, goats, and camels had ensured that, apart from a few meagre grasses, the site



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was completely bare of vegetation. So one of the first measures undertaken in the new Diplomatic Quarter was to fence out animals. After the first rains it was like a miracle to see the mass of annual and perennial plants which sprang up.

The Diplomatic Quarter, which will ultimately house some 35,000 residents, is a self-contained district of Riyadh, at the centre of which embassies are grouped on a linear axis, surrounded by five residential neighbourhoods. Each of these neighbourhoods has a local park of between two and four-and-a-half hectares, and is linked to the other districts and central facilities by a system of green spaces. Around the edge of the Quarter are a total of 18 gardens in a transition zone to an area of improved desert, which forms an enclosing belt.

A number of principles of Saudi culture provided an important starting point for the development of the design philosophy.

These can be summarised as follows:

- Small scale size, to ameliorate the desert climate;
- Shade; unity with the desert (therefore location of the gardens on the edge of the development);
- Separation between protected open spaces and the open desert using walls;
- No Western furniture (sitting is on carpets on the ground);
- Consideration of social behaviour;
- Provision of contrast to the interminable sun;
- Use after sunset;
- No metal play equipment (overheating);
- Use of vegetation with low water requirements;
- Response both to the formality of Islamic garden design and to the freedom of the desert landscape; and
- The use of naturally occurring rock as a design feature.



LEFT: FORMAL SHADED WALKWAYS LEAD THROUGH THE PARK OF THE DIPLOMATIC QUARTER.

MIDDLE: PLANTING OF NATIVE SPECIES ALONG THE ROADSIDE AROUND THE SITE IMPROVES THE DESERT LANDSCAPING.

RIGHT: FORMAL GARDEN AREAS SURROUND TUWAIQ PALACE.

The main types of green and open space developed were:

- *Roadside planting* of date palms on main streets and smaller trees on residential roads;
- *Residential courts* in the form of cul-de-sacs for parking but also with play areas, pergolas, and tree planting;
- *Green links* and *formal parks* and *gardens* based on three themes: the Islamic garden, the oasis, and the play area for all age groups;
- *Non-formal parks* and *gardens*, based on free forms and also containing play areas;
- The *improved desert*, with its use of native species, forming a buffer around the Diplomatic Quarter of between 80 and 100 metres wide from the motorways as well as from the *Wadi Hanifah* and contrasting with the designed parks and gardens.

The landscaping of the Diplomatic Quarter relates to the built-up part to its surroundings and is of two kinds: intensive and extensive.

The intensive landscape is irrigated and heavily planted. In it, a green network of paths and walkways relates public gardens, ranging from parks to small play areas, to each other. The intensive gardens provide a range of social and recreational opportunities, which are used in different ways by the various communities of the Diplomatic Quarter on Fridays and holidays.



The larger, extensive part is on the periphery of the built area and serves as a transition zone between it and the desert. There is little or no irrigation here; earth berms, artificial *wadis*, and basins collect run-off from roads and from drainage of the intensely irrigated parts, and direct water to green fingers and tiny gardens which soften the rugged landscape. Rainfall can be intense, up to 30 millimetres a day, an average yearly precipitation of only 115 millimetres.

The whole area is enclosed since, as a result of government grants and the mechanical digging of wells, overgrazing had killed all plants within a radius of 100 kilometres around Riyadh. Some 350 seed species were collected from the desolated area and have been raised in the project's nurseries to provide an authentic local flora. 250 animal and bird species have also been saved. A radically new, yet totally genuine environment was created for a self-sustaining ecological system in the extensive landscape areas.

The guiding principles which should be followed when planning in Saudi Arabia can be summarised:

1. In central Saudi Arabia, a real and not a man-made desert, sustainable with natural trees and vegetation, can only exist in *wadis* (dry riverbeds), which have good, deep soil and a very large rainwater catchment area.

“ WE DID NOT ALLOW ANY TRUCKS
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FOR LATER USE: ROCK PLACEMENT,
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2. To make desert cities habitable, trees, gardens, and parks are essential. In fast-growing cities like Riyadh, in the middle of the desert-where urban infrastructure can be overwhelming, the green factor is even more important.

3. The implementation of this greening needs the active participation of the landscape architect from the very beginning of each urban planning process; and sometimes he should be the leading figure.

4. The success and sustainability of Riyadh’s Diplomatic Quarter landscaping was, furthermore, only possible under the following conditions:

A client with a deep understanding of the need to apply landscape design to the 900-hectare site that was a barren moonscape, without any vegetation or soil. This client, H.E. Dr. Mohammed al Shaikh (now a Minister of State), made the implementation of parks, trees, and gardens possible before the urban development started.

The lack of water-the limiting factor of all vegetation in the desert-made the treatment of wastewater for irrigation purposes a necessity. One human being produces enough wastewater to irrigate six trees.

The Diplomatic Quarter nursery, one of the first projects to be implemented, produced indigenous trees. Seeds were collected in the *wadis* of central Saudi Arabia.

A construction site of 900 hectares produced an enormous amount of excavation material. We did not allow any trucks to leave the site! Excavated rock was sorted into three categories for later use: rock placement, erosion control, and rock art. Other excavation material was dumped to create the ten-kilometre-long earth berm, which acts as a noise and pollution barrier between the Diplomatic Quarter and the Hejaz (Makkah) Freeway.



A careful cut-and-fill design and management created the ten-kilometre-long, 80 to 100 metre wide escarpment edge of the *Wadi Hanifah*. Beautiful Riyadh limestone was used to create features in the so-called, extensive landscape areas along approximately 40 kilometres of car-free pedestrian and bicycle trails.

LANDSCAPING AROUND THE TUWAIQ PALACE ECHOES THE ROCKY DESERT SURROUNDINGS, WITH INDIGENOUS PLANT AND ROCK WALLS.

The formal heritage of the so-called intensive landscape areas reflects the rich cultural heritage of Arab history.

Stormwater run-off from all sealed and asphalted areas in the Diplomatic Quarter is guided and channelled to planted swales and retention areas in the extensive landscape to provide irrigation for the vegetation there, just as happens in nature.

In conclusion, these principles have been formulated on the strength of over 20 years experience in Riyadh's Diplomatic Quarter and the success of the project serves as testament to their relevance.



SUMMARY OF ROUNDTABLE DISCUSSION AND FUTURE CONCERNS

James L. Wescoat, Jr.

The Dumbarton Oaks roundtable series seeks to facilitate searching discussions of topics of contemporary intellectual and practical concern. Discussion of the arid landscape design case studies was wide-ranging and lively. This chapter briefly summarises the main themes under four broad headings:

1. Landscape technologies and knowledge
2. Community, privacy, and political institutions
3. Cultural dimensions of sustainable landscape design
4. Varieties of “naturalism” in arid regions

At the end of the programme, participants were asked to identify a key theme or concern that they would choose to focus upon in future discussions. Those future concerns are also summarised below.

COMMON DISCUSSION THEMES

Landscape Technologies and Knowledge

Technological aspects of sustainable landscape design figured prominently throughout the discussion. Participants shared ideas about pond systems for wastewater treatment, constructed wetlands, water conservation, plant propagation, and planting technologies. Provocative proposals for artificial turf and plastic trees from 20 years ago were briefly revisited. Some lines of environmental research (e.g., on sand dune stabilisation) were deemed overly technical and insufficiently concerned with social and cultural aspects of design. Some discussants advanced ideas about the roles of modern and high-tech building

THE AGA KHAN TRUST FOR CULTURE IS IN THE PROCESS OF TRANSFORMING A FORMER DUMP OF ALMOST 30 HECTARES INTO A UNIQUE PARK IN CAIRO, PROVIDING MUCH-NEEDED RELIEF FOR THE CONGESTED METROPOLIS.

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technologies, which led to questions about the continuing influence of modernism and internationalism in environmental design. Others raised questions about the roles of traditional and local knowledge in landscape design, which led to broader questions about the relations between technologies and different systems of knowledge.

Concern about the types of knowledge needed for sustainable landscape design dovetailed closely with discussions of the role of education in sustainable landscape design - both in academic settings like the Center for Regenerative Studies and in public settings. Some lamented the lack of public education about design while others stressed the need for greater education of designers by public groups (e.g., children and communities).

Perhaps the most common view of the group envisioned multiple combinations of landscape technologies and types of knowledge, depending upon the problems and situations involved.

Community, Privacy, and Political Institutions

The debate about public education was paralleled by discussions of community, privacy, and political institutions. The case studies in Iran raised questions about the nature of “community”, “the public”, and “private” life. Although most agreed that different patterns of community sustained different types of landscape design, the nature of those patterns and sustaining relations was not resolved. The children’s park project in Cairo offered a dynamic approach to community involvement and influence in design, and it also raised questions about the role of ritual in community building activities.

Discussion of sand stabilisation projects in Sudan, by contrast, stressed the importance of individual as well as collective responsibility and of individual land tenure security - themes that seem to have increasing salience in international development planning and policy. A re-



lated chord was struck in comments made about the importance of committed clients, patrons, and donors in Saudi Arabia and Egypt.

Institutions were regarded more as constraints on design, whether in California or Iran, than as part of the creative domain of design. Examples were given of bureaucratic behaviour and regulations that retarded shifts toward more sustainable landscape practices. The two case studies in Iran prompted comments about the impact of radical changes in political institutions on landscape design - the park in Tehran is noteworthy in that it thrived both before and after the revolution, which led to discussions of the cultural bases of arid zone landscape design.

Cultural Dimensions of Landscape Sustainability

The two major cultural themes concerned “difference” and “universals”, again both in the context of Iran. Some argued that the sustainable use of “public”, “community”, and “private” spaces (which proved to be unsatisfactory terms) were fundamentally different in Iran than in the West, while others raised questions and qualifications. The suc-

DEVELOPMENT OF AL-AZHAR PARK, MANAGED BY AGA KHAN CULTURAL SERVICES – EGYPT, IS ACCOMPANIED BY IN-DEPTH STUDIES OF THE URBAN FABRIC AROUND THE SITE.

“THE MOST COMMON VIEWS OF
NATURE FOR THIS GROUP WERE
EXPLICITLY LINKED WITH IDEAS
ABOUT SOCIETY AND CULTURE.”

cess of the Tehran park project before and after the revolution, however, led to a proposition by Dr. Mina Marefat that it may have achieved something of universal significance by speaking to basic human yearnings.

The idea of a common humanity recalled one of Ismaïl Serageldin’s principal themes, and it was repeated in the Saudi Arabian case study where a “human love of desert and trees” was said to account for the success of the Diplomatic Quarter landscape design outside Riyadh. When the discussion turned to Riyadh itself, however, participants questioned its coherence and sustainability.

Varieties of “Naturalism” in Arid Landscape Design

At the very start of the roundtable, a question was raised about the meaning of “nature” in arid environments. Although not taken up systematically, this question reappeared under each of the broad headings discussed above. Some participants stressed the role of natural technologies (i.e., those which employ or emulate natural materials and processes) while others were satisfied with a naturalistic appearance or allusions to nature in modern design and construction technologies. None of the participants in the group argued for strictly “native” plantings.

Indeed, it seems significant that the most common views of nature for this group were explicitly linked with ideas about society and culture. The basic human yearnings in Tehran noted above are viewed as natural desires; the principles of regenerative design and desert landscape forms are jointly social and natural; sand dune stabilisation in the Sudan integrates ecological and social adjustments of and to the environment; and the Diplomatic Quarter in Saudi Arabia brings together a love of deserts and oases.

Future Concerns

These four broad themes were barely defined before the roundtable concluded. They suggest many different directions for discussion, research, and design practice. To discern some of these future concerns, participants were asked to identify a major topic or question they would like to pursue further. Some of the common concerns are listed below:

1. The agricultural basis of landscape design.
2. The role of water in sustainable landscape design.
3. Comparison of landscape design in different climates.
4. Measurement of “sustainability”.
5. Comparison of Muslim new towns and Israeli kibbutzi.
6. Diffusion of sustainable design innovations.
7. Extension of local lessons to the regional scale.
8. Examination of the flows of arid zone experience between East and West.
9. Public education and sustainable landscape design.
10. Sustainable landscape design and curriculum development.
11. Longer term studies of the roots and sources of sustainable landscape design in theory and practice.
12. Attention to the role of humans in heavily modified landscapes.
13. Emphasis on the “range of choice” available to arid zone occupants.
14. Comparisons of sustaining and non-sustaining human behaviours (as in the Iranian case studies).
15. Adaptation and transformation of colonial patterns in post-colonial environments of the arid realm.
16. Consideration of economic class in sustainable arid zone landscape design.
17. Greater attention to theories of culture and order.

It is perhaps a reflection of these case studies, drawn from widely different cultural geographic contexts, and of the challenging issues they raised, that most of the roundtable participants would choose to pursue the fundamentally human dimensions of sustainable landscape design in arid environments.

Coda

The well known preface to the *Gulistan* (Rose Garden) of Sadi states:

“You are not ignorant that the flower of the garden soon fadeth, and that the enjoyment of the rose bush is of but a short continuance; and the sages have declared that the heart ought not to be set upon anything that is transitory...

I am able to form a book of roses which will delight the beholders, and gratify those who are present; whose leaves the tyrannical arm of the autumnal blasts can never affect, nor injure the blossoms of the spring.”¹

In the *Gulistan*, the listener throws away the flowers he has collected to listen to poems, “that will flourish forever”. In this roundtable discussion and related efforts, however, we return to the vulnerability, transitoriness, and beauty of the actual “rose gardens” that grace this world (*dunya*) and for which we bear a responsibility.

NOTES

1. Sadi, M.S. 1980 reprint. *Gulistan*. Trans. Francis Gladwin. Islamabad: Lok Virsa Publishing House, xv-xvi

Abdel Halim I. Abdel Halim

Professor of Architectural Design and Theory, Cairo University
Architect, Egypt, Community Design Collaborative

Richard Bödeker

Principal, Bödeker, Wagenfeld & Partner, Germany

Kamran T. Diba

Architect, Gaucin, Malaga, Spain

Paul Laird

SOS Sahel International, United Kingdom

John T. Lyle

Professor, California State Polytechnic University, Center
for Regenerative Studies at Cal Poly Pnomoma

G. Reza Pasban-Hazrat

General Manager, Baft-e-Shahr, Consulting Architects and Urban
Planners, Tehran

James L. Wescoat, Jr.

Associate Professor of Geography, Department of Geography,
University of Colorado at Boulder

Terence Young

Assistant Professor of Geography, Clemson University

LIST OF PARTICIPANTS

Ahmed El Neggar
Philippe Foret
David Haney
D. Johnstone
Maritta Koc-WeserElizabeth Kryder-Reid
Paul Laird
Mr. and Mrs. John Lyle
Mina Marefat
Roya Marefat
John McNeil
Henry Millon
Judy Millon
Louise Mozingo
Erik Neil
Therese O'Malley
Don Olson
Benedetta Origa
Attilio Petruccioli
Richard Quaintance
Scott Redford
Saud Al Shamiri
Anne Whiston Spirn
Cheryl Wagner
James L. Wescoat, Jr.
Terence Young
Moharnmad Fawzi Zniber

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	Page
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James L. Wescoat, Jr.	14, 15 ,16
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Office of H.R.H. Prince Sultan bin Salman Al-Saud	19
Tim Bradley	28, 42
Cradoc Bagshaw	29
Jarvitz Mostafa	31
Barry Iverson	33, 48, 55, 56, 57, 59, 60
Kamran Adle	35,36,37, 44,45,46,47
Farrokh Derakhshani	40
Monica Fritz	50
Christopher Little	52
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Dogan Kuban	83
Sutton Publishing	71
AKCS-E	75, 76
Mohamed Akram	86, 93
Reha Günay	88, 89, 90, 92, 95
Gary Otte	96, 99

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The purpose of the Trust for Culture is the improvement of built environments in societies where Muslims have a significant presence. To underwrite the vitality and integrity of built environments in the Islamic world, the Trust has developed programmes that support:

- the pursuit of excellence in contemporary architecture and related fields;
- the conservation and creative re-use of historic buildings and public spaces undertaken in the context of integrated social, economic, and cultural development of local communities;
- the strengthening of education for architectural practice, planning, and conservation;
- the international exchange of ideas to enhance understanding of the intimate connection between culture and built environments in the history and culture of Islamic civilisations and in contemporary Muslim societies; and
- the broader understanding of the richness, diversity, and pluralism of cultures in the Islamic world.

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