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Health and ecological sustainability in the Arab world: a matter of survival

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Abstract

Discussions leading to the Rio+20 UN conference have emphasised the importance of sustainable development and the protection of the environment for future generations. The Arab world faces large-scale threats to its sustainable development and, most of all, to the viability and existence of the ecological systems for its human settlements. The dynamics of population change, ecological degradation, and resource scarcity, and development policies and practices, all occurring in complex and highly unstable geopolitical and economic environments, are fostering the poor prospects. In this report, we discuss the most pertinent population–environment–development dynamics in the Arab world, and the two-way interactions between these dynamics and health, on the basis of current data. We draw attention to trends that are relevant to health professionals and researchers, but emphasise that the dynamics generating these trends have implications that go well beyond health. We argue that the current discourse on health, population, and development in the Arab world has largely failed to convey a sense of urgency, when the survival of whole communities is at stake. The dismal ecological and development records of Arab countries over the past two decades call for new directions. We suggest that regional ecological integration around exchange of water, energy, food, and labour, though politically difficult to achieve, offers the best hope to improve the adaptive capacity of individual Arab nations. The transformative political changes taking place in the Arab world offer promise, indeed an imperative, for such renewal. We call on policy makers, researchers, practitioners, and international agencies to emphasise the urgency and take action.

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Contributors

AE-Z, SJ, IN, and HZ conceptualised the report and, with BT and MK, contributed to the writing of the main text. AE-Z was the main contributor and led the writing, editing, and discussions around the paper. MK, HZ, TT, YAM, JD-J, and NY wrote the panels as experts in their respective fields. All authors contributed to discussions and comments around successive drafts.

Conflicts of interest

We declare that we have no conflicts of interest.

Introduction

Although Arab countries agreed to the 1992 Rio Declaration on Environment and Development, the past two decades have seen accelerating degrees of environmental degradation and depletion in the Arab world.¹ In fact, use of natural resources is currently about twice that of the biocapacity. In 2008, countries in the Arab world had a footprint that was 150% greater than their biocapacity, much like the UK and parts of Europe (figure 1A), with the gap clearly continuing to widen (figure 1B). In public health, despite reported progress of selected indicators, the burden of disease is high, and environmental factors such as access to energy, nutrition, clean water, and clean air are important determinants of infectious and non-infectious disease prevalence.³ The need for a new framework to achieve human development objectives without undermining the ecological basis of life⁴—emphasised in the discussions leading to and following the Rio+20 UN conference, and articulated in the adopted document⁵—is especially relevant for the Arab world. Projection of threats beyond the framework of sustainable development, into explicit discussion of the prospects of social, economic, or physical survival of human populations has been made.² However, this research has had little resonance in the health literature.⁶ The disconnect between policies about population, environment, development, and health is one of the biggest problems facing the Arab world. (We use the terms Arab world and the region interchangeably when referring to the group of Arab countries as defined in Mokdad and colleagues³ study; however, we use the term Arab countries when national aspects are especially relevant to the context of the sentence.)

This report follows two overarching lines of enquiry. We argue that the Arab world is facing threats great enough to call into question its survival, then make the case for using survival as an analytical concept in studying dynamics driving the threats. In doing so, we emphasise the inseparability of the biological and social dimensions of survival and the political nature of these dynamics. First, we assess the nature and extent of the threats by focusing on population, environment, and development; second, we discuss their connections with health; third, we critically analyse the discourse on health, development, and environmental sustainability in the Arab world and the way it might help or hinder proper understanding of their interactions; fourth, we define the most pertinent research and practice implications of our analyses.

Threats to human settlements

The Arab world is undergoing a palpable decline in environmental resources.¹ Threats exist in three crucial domains: urban expansion (panel 1, figure 2), water (panel 2, figure 3), and land and food (panel 3, figure 4), which are interlinked through common underlying dynamics. The trends suggest that some Arab cities and countries, or substantial parts of them, are close to depletion of resources needed for viability of human living. For example, the recent prolonged drought in Syria has caused major population movement and upheavals.²⁴ Damascus, Sana'a, and Amman all have severe water rationing regimes in place.²⁵ The infrastructure, environmental deterioration, and water deficits in the Gaza Strip, occupied Palestinian territory, will make it uninhabitable by 2020.²⁶ Coastal settlements and economic productivity in Qatar and Egypt are extremely susceptible to sea-level rise—with

vast stretches of the Nile delta set to be lost.²⁷ Abu Dhabi, Dubai, and Muscat are considering or building giant water reservoirs as contingency for scarcity or war.²⁸ Saudi Arabia is investing in food-producing land in Africa as it begins to roll back decades of investments in local agriculture, which has been unsustainable.²⁹

What are the dynamics underlying these threats? What causal relations do these dynamics hold to health? How are they best understood and what changes in discursive practices are needed for such an understanding? How are they best tackled? In the next sections, we attempt to answer some of these questions.

Population–environment–development dynamics

Analytical approach

Complex interactions between population trends (P; figure 5), changes in ecological systems and the environmental services they provide (E), and development histories and pathways (D), drive threats to ecological sustainability in the Arab world (panels 4 and 5).

Here we use similar lines of enquiry to those used in political ecology, cultural ecology, and environmental politics, all of which emphasise the role of power and its distribution as fundamental in understanding the relation between societies and their natural and built environments—especially in the way power relations produce differential access to environmental services and differential exposure to environmental hazards.⁴² Unique features of the Arab world generate specific predispositions to these dynamics. For example, poor availability of freshwater and large endowments in fossil fuel have partly determined development trends and patterns of population concentrations and movements. Social hierarchies and prevalent cultural and religious world views, such as the desirability of children, tribal and clan loyalties, and beliefs about gender and old age, favour some development and population policies over others. However, important differences exist between various parts of the Arab world, reflecting the rich diversity of ecosystems, cultures, and development and political histories of the region.

We structure our discussion around four major threads linking the PED triad: population trends of urbanisation and migration; rising water scarcity and food insecurity; climate change; and war, conflict, and global transformations. In searching the vast amount of published work covering these topics, we have relied on the extensive knowledge we have gained through our respective areas of expertise, credible reports by international organisations as a source of synthesised data, and direct access to development and health databases.

Urbanisation and urban poverty

About 57% of the population in the Arab world live in cities, and this figure is projected to reach 70% in 2030, because of migration and natural increase (panels 1 and 4).³⁴ Much of urbanisation has been driven by economic rents, such as resource exports and ownership rights, with little productive base (panel 5). The inflationary expansion of the public sector, through various forms of employment guarantees, compensation policies, and urban bias in the location of, and support for, public enterprises, has been another factor in urban

growth.^{43,44} In some countries, environmental and war-related migrations have also played a large part.⁴⁴ For example, in Syria, even before the current conflict, the prolonged drought—which started in 2006, hitting the northeast of the country hardest, wiping out a substantial proportion of the agricultural sector and adding to a legacy of poor environmental policies—has led hundreds of thousands of people to move to cities, aggravating problems of employment, housing, and infrastructure^{24,45,46} and accelerating a long-term urbanisation trend.

The growth of the formal sector in many cities is insufficient to absorb the population, with informal housing and insecure, low-paid work becoming the only option for many people.⁴⁷ Informal settlements seem to be especially widespread in the poorer, fast-urbanising Arab countries (panel 1; figure 2). In cities such as Sanaa and Cairo, concentrations of urban poverty are usually found on precarious terrain where populations have poor sanitation and lack of access to safe water, and where droughts, floods, and heatwaves occur—conditions associated with several health problems, especially waterborne diseases.⁴⁸ Slums are often sites of small-scale industrial production, using informal adult and child labour with attendant occupational health hazards.^{49,50} And yet, cities offer the possibility of economies of scale in the provision of sanitation, education, and health care, and better connectivity to global market opportunities. Such prospects remain underachieved in the region even though cities have better living conditions than rural areas overall.

Several factors make the challenge of turning cities into productive bases of economic and social development more formidable, including climate change, the quasipermanent state of conflict faced by many countries, weak or corrupt public services, persistent inequities in access to resources within cities, the changing population age structure (panel 4), and changing patterns of regional labour mobility. In Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates), high unemployment, especially in young, educated adults, has led governments to attempt to reduce reliance on foreign labour, especially workers from other Arab countries.⁵¹ In lower-income, labour-exporting Arab countries, families typically pursue several sources of income, with some members migrating abroad or to urban centres for work and some seeking education, whereas those in rural areas sometimes remain to tend farms.⁵² However, with larger numbers entering the job market, high youth unemployment, smaller families becoming the norm, and remittances from expatriates in GCC countries and elsewhere declining, these survival strategies might be less viable in the future. Few housing and employment opportunities in cities, combined with social and cultural change under modernising pressures has made it difficult for urban dwellers to maintain extended kin ties, with male migrants to cities often leaving families behind and religious conservatism increasingly playing a role in regulating kin and gender roles and relationships. Will new forms of survival strategies emerge, with family ties constantly renegotiated under changing economic conditions and urban settings? What kind of economic and social policies are needed to allow this to happen?

These questions draw attention to the links between patterns of economic development and population and social change under environmental stress. These links operate at various

timescales, with both sudden shocks and slow, long-term changes in one of the poles of PED dynamics affecting the other two (table 1).

Water scarcity and food security

Water scarcity plays a multifaceted part in the Arab world. It is an abiding characteristic of this arid part of the planet, an immediate difficulty in supply to be managed by society, and an important determinant of several infectious diseases,⁵⁴ such as diarrhoea, cholera, dysentery, and typhoid, and some non-infectious diseases. For example, a high prevalence of methaemoglobinaemia in infants in the Gaza Strip is believed to be caused by high levels of nitrate in drinking water.^{55,56} Water supply per person is a quarter of its 1960 value, and the total demand is 16% higher than available renewable freshwater resources.²⁵ An increase in demand as a result of population growth and a rise in affluence, combined with a decline in supply due to climate change (especially changes in rainfall and seawater intrusion into groundwater reserves) and groundwater overuse, will push this figure to 51% by 2050 and place most Arab countries under the absolute water-poverty level, defined as 500 m³ per person¹⁸ (panel 2). Dependence on desalination has accelerated (79% of all water supplies in the GCC countries), causing some detrimental environmental effects—mainly high levels of energy consumption leading to large greenhouse-gas emissions and brine and chlorite effluents causing damage to human health, groundwater, and sand dune and wetlands ecosystems.^{6,57}

What is more relevant to our analyses is that water scarcity is a substantial constraint on, and an outcome of, development pathways, demographic change, and population policies.⁵⁸ From a strategic water-demand perspective, a strong disconnect between population trends and water resource allocation seems to exist, leading to conflicting pressures on policy and development directions. 57% of Arabs live in cities, whereas 88% of available freshwater is used for agriculture, highly inefficiently, contributing only 5.4% of gross domestic product (GDP).^{1,59} Historically, the agricultural sector has been adopted as a development pathway in some Arab countries (eg, Egypt, Saudi Arabia, Sudan) to achieve food security and rural regeneration and reduce urbanisation—none of which has been successful. However, despite the investment, crop productivity, especially of cereals, is among the lowest in the world, and the mounting share of imported cereals in Arab diet generates dangerous dependency on international price fluctuations (panel 3).⁶⁰ The more recent trend of some GCC countries of investing in agricultural land in some parts of Africa can be problematic because it puts a premium on much-needed food in Africa. It raises questions about competition for food and water rights between investor and local populations, creates conditions that can lead to famine in the host countries, and leaves food supply of investors open to geopolitical uncertainty.^{61,62}

The question then is how best to ensure adequate water and food supply in the short and long terms, despite declining reserves, climate change threats, receding arable land, growing population needs, and mounting pollution. Most publications about water in the Arab world call for major environmental management measures such as regional cooperation that protects watersheds, improvement of efficiencies in distribution, introduction of pricing strategies for different usages, and implementation of incentives for conservation, especially

in Arab cities in the Persian Gulf such as Dubai, Kuwait City, Doha, and Manama where per-person demand is among the highest in the world.⁶³ The potential for infrastructure improvements is indeed large because surface water usually originates from outside the region, with urban centres often located at the far, downstream end and leakage reaching up to 50%.⁶⁴

A few publications advocate the integration of policy making in the food and water sectors, around the concept of virtual water, which recognises the water value inherent in crops and meat, whether imported, exported, or locally produced for local consumption.^{25,65} This approach could help to push the Arab agricultural sector towards specialisation in water-efficient crops and concentration on agriculture in less water-stressed parts of the Arab world. With this approach, food security is achieved through diverse food sources rather than national self-sufficiency, with some staple crops imported through global or regional markets.^{25,34,65,66} Others have argued that market logic inevitably leads to unsustainable agricultural practices and called for non-market-based state intervention to support both sustainable food production and conservation of agrarian landscape.⁶⁷ Either way, water scarcity has to be an overriding consideration in agricultural policy. Worldwide, researchers have recently called for fundamental shifts in nutritional consumption patterns—such as a reduction in the proportion of animal protein in diets from the current 20% to 5% in 2050, because of the higher water efficiency of crop protein relative to animal protein—to bring about water and food security amid population increase.⁶⁸

Climate change

Anthropogenic climate change is further undermining the ecological and socioeconomic basis of life in the region.⁶⁹ Changes in the hydrological cycle will lead to a decline in freshwater supply and agricultural production, the anticipated rise in sea level will inundate and erode vast stretches of coastal settlements, and extended periods of drought are already causing losses to agricultural and pastoral land and rural livelihoods. These effects—assigned different levels of confidence by the International Panel on Climate Change and seen as illustrative rather than predictive⁷⁰—are set to have major implications for water and food security, and for health and the spread of disease. The increase in the frequency and amplitude of extreme weather events such as droughts, floods, and heatwaves is making obsolete traditions and long-standing arrangements that have evolved from experience in dealing with weather events, such as drainage infrastructures, emergency services, and water-sharing systems. The recent extended droughts in Algeria and Syria cannot be firmly attributed to greenhouse-driven climate change; however, they are examples of catastrophic climatic events that have overwhelmed the ability of existing social and institutional structures to deal with them, leading to suffering, injury, and death. One study in Yemen projects a substantial decline in income for non-farming rural households as a result of flooding, loss of yields, and global rise in food prices (figure 6).⁷¹ Results of another study showed that limits to the physiological tolerance of heat stress might lead to loss of productivity in low-income and middle-income countries where outdoor manual labour, especially in the agricultural sector, is prevalent.⁷² Under a scenario of small reductions in worldwide greenhouse-gas emissions over the next few decades, a more than 15% chance of a rise in mean global temperatures greater than 4°C by 2100 is predicted.^{73,74} This rise could

occur earlier under no-reduction policies, bringing about even more devastating effects. By increasing the prospects of poverty for part of the population, climate change threatens to reverse important human and economic development gains achieved over the past few decades.⁷⁵

Climate-change effect projections should be interpreted against the background of other demographic and environmental transformations affecting the region, and global change in trade and international relations and the decline of welfare states. The process by which rural populations move to cities, live under precarious subsistence conditions, and exercise more pressure on urban ecosystems is mirrored and amplified by two climate pressures: on the one hand, drought and declining rainfall, which undermine rural livelihoods and, on the other hand, sea level rise, floods, and heatwaves, which threaten the more susceptible urban dwellers—usually newcomers from the countryside or refugees, such as the Palestinians in Lebanon or Darfurians in Cairo—who tend to live on land that is more exposed to environmental stress. Therefore, climate change mostly exacerbates existing and already urgent weaknesses intimately related to poverty and disadvantage. Furthermore, adaptation to the effects of climate change (eg, on desertification, sea-level rise, and water management) will probably not succeed without regional cooperation between Arab nations, which is unlikely under current political conditions.⁷⁶

War, conflict, and global transformations

Fundamental changes in the economic and political organisation of the world and the modes of interaction between its populations over the past few decades (eg, the collapse of the eastern European Soviet bloc, increased US military presence in the Arab region, shift of the world's manufacturing centre of gravity towards Asia, rise of the information economy, retreat of the welfare state, consecutive financial shocks of the 1990s and 2000s) have created at least two conspicuous fault lines in the Arab world.

First, GCC states, supported by a steady flow of hard currency from petrochemical exports, have maintained strong welfare provision and political stability, combined with repressive and socially conservative state agencies. Internationally, they have played an increasingly important economic and political role in the US-led world order. The rest of the Arab world is teetering between its repressive and welfare provision instincts, and its foundering finances and the now vocal aspirations of its people. As welfare has been unravelling under neoliberal policies since the 1980s, non-state actors have moved to fill in the gaps left by the state in the supply of social services. The history and vagaries of access to universal health care in Egypt, Tunisia, Libya, Lebanon, and the occupied Palestinian territory are emblematic in this regard.⁷⁷

Second, the Arab world has undergone war and lower-level violent conflict, within and between states, triggering immediate processes of population movements, institutional paralysis, and environmental decline.⁷⁸ For example, well documented cases of heavy metal soil contamination in the Gaza Strip,⁵⁶ forest logging in Darfur,⁷⁹ petrochemical contamination of sea and soil in Lebanon,⁸⁰ systematic marshland destruction in southern Iraq,⁸¹ and burning of oil wells in Kuwait⁸² with consequent air, soil, and groundwater pollution, are all direct effects of military conflict. Even more damagingly, increased

militarisation—in the form of spending on weapons—and securitisation—as a form of dominance of security concerns over other social issues—have become distinguishing features of all.⁸³ These factors, combined with the scarring of populations through death, injury, trauma, disability, the relocation of populations, devastation of basic infrastructures of life, and impairment of economic growth, have led to a catastrophic slowing down or even reversal of development traction, with profound effects on health. In some cases, a complete breakdown of healthcare provision has occurred, leading to new therapeutic geographies of war.⁸⁴ Evidence of a war-associated rise in birth defects in Iraq is an example of the more insidious effects of war.^{85,86} Another striking example is the excess infant mortality as a result of conflict, estimated to be 1%, and equivalent to all battle deaths, using mean durations of conflict.⁸³

Health, wellbeing, and survival

The shortcomings of PED policies in the Arab world have affected, individually and in combination, the health profile and burden of disease. A striking example is that the region has high rates of both child stunting and adult obesity (figure 7). Geographical distribution, with richer Arab countries accounting for much of obesity and poorer ones accounting for undernourishment, only partly explains this finding because, in some cases, rates are increasing in the same countries, even the same communities.⁹¹ Rather, food insecurity, with its many PED causes, can lead to both child undernourishment and adult obesity through lack of nutritional diversity.⁶⁶ Similar consumption patterns in cities to those in the west lock populations into lifestyles characterised by high intakes of fats and carbohydrates and little physical activity, with a bigger effect on women (figure 7) because of their constrained mobility and restricted access to public space in the more conservative societies.^{92–95}

Extrapolating from nutritional problems, the aforementioned drivers are again, in various combinations and to different extents, important factors in other health disorders and risks (table 2). Equally typical of many of these problems is gender inequality.

The links between health, demographic change, environmental sustainability, and patterns of economic development have been widely documented in published work.¹¹⁹ The public's health is negatively affected by environmental and development failures (eg, informal housing and employment lead to higher prevalence of water-borne diseases, poor reproductive health, and occupational injuries; table 2).¹²⁰ Poor health outcomes in turn lead to slower human and social development, with effects on PED dynamics (eg, the burden of noninfectious diseases incurs a high cost as a percentage of GDP). This cycle is especially conspicuous in the legacies of war (Iraq, Sudan, occupied Palestinian territory, Lebanon, Syria, Libya), occupation (Iraq and occupied Palestinian territory), and economic sanctions (Iraq and Gaza Strip), which bring devastating health and environmental burdens, and a breakdown of institutional structures, all of which affect the potential for social and economic development.

How can PED dynamics be recognised by, and incorporated in, health practice? Ethnographic health research has shown repeatedly that patients' accounts of their illnesses lend support to what Hamdy¹²¹ calls political aetiologies of disease—eg, pesticides

contributing to male infertility in Egypt;¹²² war as a cause of male infertility in Lebanon;¹⁰⁹ corruption, failure of the welfare state, and environmental pollution exacerbating kidney disease in Egypt;¹²¹ and Somali refugees blaming unemployment and unmet day-to-day needs for mental illness, rather than trauma.¹²³ Lock and colleagues^{123,124} offer local biologies as a concept to emphasise several non-biomedical variables affecting health and, more importantly, developing better accounts of how place-specific social, institutional, and historical factors can modify the biological basis of disease. For such accounts to emerge, patient narratives,¹²⁵ political dynamics, and historical context would need to become a stronger part of health research in the Arab world. This approach could, in turn, help health practitioners better understand the PED context of a particular health problem and identify the levels at which it can be tackled more effectively, especially when recurring dynamics are common to a host of health problems, such as primary health-care failures, social inequities, environmental pollution, vested interests, and state violence. The question, however, is whether current discursive practices, in relation to population, environment, development, and health, are conducive to the emergence of more holistic diagnoses.

Discourse on sustainable development

Population, environment, and development

The dominant discourse on population and environment emphasises population increase and overconsumption of resources as a problem, and development as a process of income growth. Consistent with this discourse, population policies have tended to focus on reduction of fertility and improvement of maternal health in relation to childbirth, rather than address reproductive health issues holistically. Various forms of environmental managerialism—the notion that environmental problems can be solved through better environmental management and policy—are taken to be the most effective response to environmental degradation. Positive health and environmental outcomes are still assumed to derive automatically from economic development, following the development histories of Europe and North America, despite increasing doubts about this theory.^{126,127} Some scholars have pointed out that the causes of environmental problems cannot always be addressed by environmental ministries and agencies¹²⁸ and others have called for more integrative institutional arrangements that recognise the multidimensional nature of environmental problems.^{129,130} However, the environment in this discourse is essentially a depleting asset to be managed so as to protect it from growing populations. The more important implications of strategic development policies, and energy and resource extraction choices on the one hand, and local, non-governmental actions, choices, and responses on the other hand, are often overlooked. Politically, the discourse is produced and reinforced by asymmetric aid–donor relationships that mostly fund and sustain it, since it echoes the beliefs and opinions of international environmental and management industries. This discourse sits well with social and political authoritarianism in the region, restricting debate on strategic development issues, which are left in the hands of a small elite.

Two statistics show the kind of empirical reality that these discourses do not capture. Consistently, between 2001 and 2011, the Arab world ranked first for military expenditure as a percentage of GDP (5.5%, more than double the world's mean of 2.5%; figure 8A) and

second to last on total health expenditure as a percentage of GDP (4·2%, only just ahead of South Asia's 4·1%, and at less than half the world's 10%; figure 8A). The Arab world is the only region to spend more on armament than on health. Except for Tunisia, even countries whose health expenditure exceeds military expenditure (figure 8B) have ratios of health to military spending that are substantially lower than that for the world. Recent trends are more disturbing: trebling of US conventional weapon export agreements, from \$21·4 billion in 2010 to \$66·3 billion in 2011, is largely accounted for by an increase in Arab military spending, with purchases by the top five Arab importers—Saudi Arabia, United Arab Emirates, Egypt, Oman, and Algeria—amounting to \$42·3 billion.¹³² Ironically, this figure is close to one and a half times the entire 2011 US foreign assistance budget of \$30·7 billion.¹³³

Aside from the direct effect of armaments on health and wellbeing when used, these data raise several questions that are cause for concern. Would even a small shift in public spending from military to health, education, and environmental protection have a far greater effect on sustainable development than the kind of actions generally advocated in the reports about sustainable development—ie, would a substantial injection of capital generate a whole new set of possibilities in these three sectors? To what extent do actual security threats justify the vast defence budgets and where should the line be drawn between different security and social priorities? What role does and should the military establishment in different Arab countries play in civilian life? Who should make those decisions, and who does make them? Are the International Monetary Fund and the World Bank in a position to advise Arab governments against excessive military expenditure if that advice goes against a major donor's interests? These questions remain outside the boundaries of the debate set by the prevalent discourse on health and the environment. In fact, the political economy of military expenditure in the region remains woefully under-researched, not least because of the secrecy surrounding military contracts and military budgets. Nor is this a shortcoming on the part of the buyers only: results of a recent study of 129 major military suppliers—mostly US and European and accounting for most weapon sales worldwide—showed that two-thirds do not have adequate levels of transparency and almost half lack even the most basic systems for preventing corruption.¹³⁴

The foundations of the current regional geopolitical order were laid at the end of World War 1, and were further affected by the upheavals of World War 2 and the nationalist military coups of the 1950s and 1960s. Additionally, the creation of the state of Israel has triggered heavy militarisation in the region, which was then taken up by Arab regimes. This order clearly benefits the military industries of the west allied to Arab autocratic governments. It inflicts, at the very least, hefty opportunity costs on the people of the region, with untold environmental, developmental, and health implications.

Analytical concepts for sustainability

If the discourse on sustainability and health needs to be broadened to incorporate the PED dynamics and their politics, how is this best accomplished? In this respect, critical examination of three methods and concepts often used in the literature would be useful.

The Drivers, Pressures, State, Impact, Responses (DPSIR) framework, used in modelling environment– society interactions, distinguishes between a hierarchy of factors according to their importance as drivers, pressures, or effects.^{16,135} DPSIR has been criticised for reducing complex relations, lacking scale and spatial and temporal dimensions, and devaluing local responses to environmental problems by emphasising reaction to effects rather than action on drivers.^{136–138} This dissonance becomes especially relevant after the popular movements in the region that are calling into question the relationship between state and citizen, precisely around issues of security and access to resources. To mimic DPSIR parlance, the Arab uprisings that began in 2010–11 are instances in which local action has the power to affect drivers and pressures, something the framework does not allow for.

The concept of security now appears regularly in the health and environmental literature. On the one hand, physical safety and human security are recognised as important determinants of health outcomes.^{139–141} On the other hand, the concept of security is deepened beyond state security and applied to other sectors to deal with environmental and health problems (hence the emergence of such concepts as environmental and health security);¹⁴² this relatively new usage of the concept is what we are concerned with here. The Arab Human Development Report³⁴ has argued that this extension helps shift the focus from state to citizen security, which might be true. However, the concept can work in the opposite way. For example, the literature on environmental security, internationally and in the Arab world, is framing environmental problems as national security issues,^{143,144} because water and land are usually seen as part of the territorial integrity of the state. Furthermore, approaches to health and environment are tarnished by the authoritarian connotation of the term security—not least because the official titles of the repressive agencies of Arab police states almost always carry the word security (or *amn*, in Arabic) in their names. This does not necessarily make the term security unusable, but certainly calls for caution in using it.

Finally, the concepts of vulnerability and resilience, used extensively in environmental research, evoke a richer texture of states and responses than does security: something tends to be either secure or insecure, but can have different degrees of vulnerability. The concepts arose from research traditions in natural disaster and famine, the former emphasising the physical component of risk and the latter focusing on its socioeconomic dimension and the differential access to resources.^{145–147} Although useful analytically, precisely because of this synthesis, the concepts are fraught with difficulties, challenging metrics, and an insufficiently consistent approach.^{148,149}

Survival: towards new concepts

We argue that the concept of survival can be useful to identify and emphasise PED dynamics—along with their political background and health manifestations—that threaten ecological systems underlying Arab human settlements, hence questioning the existence of the social, economic, and cultural relations that make up the social texture of communities. By survival we mean the physical survival of a substantial proportion of a community's members and the survival of its social texture and entitlements. Threats to survival, in this sense, generate extreme types of insecurity. Survival, as an analytical concept, is therefore more selective and more focused than the concept of security, and by calling for more

urgency, it is more useful than security, at least in this sense. The concept can also help to correct the excessive emphasis on environmental managerialism and shift the debate towards strategic development choices.

The concept of survival has some risks too. The most obvious one is alarmism: the possibility that overly pessimistic prognoses are yielded by analyses using the concept, especially in view of the intrinsic uncertainty of projections of environmental trends, and such historical precedents as the notoriously inaccurate Malthusian predictions. More fundamentally, if survival is meant to draw attention to the urgent and existential nature of the problems that the region faces, two questions arise. First, whose survival is at stake? Clearly, the differential exposure to threats that communities and different individuals within a community have, and the different capacities they have to tackle them, should be recognised. Hence, in using the concept, the plight of the most susceptible individuals should be emphasised—ie, victims of war and those who are socially, economically, and politically marginalised or excluded because of class, sex, ethnic origin, military occupation, state violence, or non-citizenship.

A second question is: what kind of survival are we looking for? At first reading, the term seems to favour sheer biological survival, or what Agamben¹⁵⁰ calls bare life, over other qualities that make up the richer texture of life and wellbeing. However, we suggest a different interpretation of survival—offered by Fassin¹⁵¹ and partly inspired by narratives of South African patients with HIV/AIDS—that does not separate the biological body from its social manifestation and sees survival in terms of physiological life, affective life, and social life at once.¹⁵¹ As an analytical tool, survival is linked to other concepts that are intrinsically social or political in nature such as vulnerability, resilience, security, and precarity, the latter used by Butler¹⁵² to denote “that politically induced condition in which certain populations suffer from failing social and economic networks of support and become differentially exposed to injury, violence, and death”.¹⁵² In using survival in concert with other analytical methods, the most productive aspect of each can be drawn upon.

However, the concept of survival impels us to ask questions about the parameters and indicators that can best identify existential threats to communities, and the tipping points beyond which damaging processes become irreversible. It can shift the emphasis, where needed, towards early warning systems^{153,154} and, more broadly, can bring a temporal dimension to the analyses in a way that other more static concepts do not.

Regional cooperation for survival

The Arab world has a remarkable wealth of climatic zones, ecological systems, cultural and architectural heritage, religions, people, urban and rural traditions, and institutional and political histories. This diversity might yet turn out to be the most important asset the region has in tackling the formidable challenges we have discussed. Whether it does, depends on a choice that the region has to make collectively. This is a choice between, on the one hand, regional cooperation and ecological integration for the sake of survival and, on the other hand, war, sectarian divisions, mistrust, and little hope in the future.

The region stands to gain from cooperation.^{155,156} In principle, ecological integration enables more rational watershed management and more secure food and agricultural policies,² and a mutually beneficial exchange of labour and energy. It is, at the very least, a way of building much needed flexibility in national policy choices. And it is precisely around water, food, labour, and energy that the imperative for ecological integration is most urgent and has the best chance of succeeding. War, however, accelerates a downward trend in the ability of ecosystems to support current and future populations. For example, for every 3 years of violent conflict, poverty reduction is slowed by 2 · 7% according to one estimate.¹³⁰ The Arab world is in a quasipermanent state of conflict and the ecological disasters are already taking a toll on its most vulnerable populations. This situation requires the recognition that survival is at stake and investment in disaster preparedness—a task that is generally beyond the capacity of single nations—bringing up yet another imperative for cooperation around issues of survival.

Regional cooperation is of course not a universal solution. Some environmental resources such as water and food are tied up in networks beyond the Arab world, and closer cooperation between Arab countries does not preclude other regional and global forms of exchange. There are many obstacles to regional cooperation—political instability, mistrust, divergence in national histories, interests and trajectories, weak institutions, prospects of violent conflict, existing geopolitical alliances, and powerful global interests—and each case would have to be taken on its own merit. Regional cooperation is not a novel concept: regional groups in Europe, America, and Asia have emerged around common economic and ecological interests. The GCC is arguably one successful form of institutionalised regional exchange in the Arab world, even if it only includes high-income countries.

A call for an ecologically based integration of the Arab world in the 21st century is based on a widely shared sense of destiny for the people of the region despite mounting regional differences; it does not require political unity or abolition of national borders. It is an invitation to capitalise on endowments at a regional level and to recognise that the ability to survive and prosper in a fast-changing world hinges on making the diversity work for the Arab world rather than against it. It is also based on a recognition that respect for diversity will help push Arab countries towards the reorganisation of state–society relationships on the basis of democratic norms—ie, towards a reformulation and institutionalisation of this association in terms of citizenship. Nowadays, political decisions about, for example, the trade-offs between water and food security, military spending, and the human rights of populations under threat should no longer be made by a small, self-interested elite. Whether this bright version of the future happens or not depends of course on what populations of the Arab world do or do not do. But it also largely depends on whether global governance institutions that are truly democratic can be built, and whether powerful countries in the west are willing to build relationships with the Arab world that are not focused on narrow interests—energy and weapon sales. Initiatives such as the proposal to develop shared renewable energy production and transmission between north Africa and Europe offer a glimpse of what a healthier version of this relationship might look like.¹⁵⁷

Way forward

What can and should health professionals do? We suggest three possible sets of actions for health professionals—as public health practitioners, clinical providers, researchers, and activists (ordered to show increasing levels of outreach beyond the health sector).

First, the *Lancet* Series about health in the Arab world has pointed to specific actions towards good governance and accountability,⁷⁸ prevention of avoidable ill health,⁹⁴ strengthening of health systems, provision of universal health coverage,⁷⁷ and addressing of the health effects of war.⁸⁴ However, this agenda has not yet been considered seriously in public health discussions in the region and has not been integrated into public health work or education. We believe that health practitioners should engage with and push for change with this agenda. Additionally, some of these issues—effects of war, health systems, and health coverage—provide excellent platforms for regional collaboration in health research, education, and evidence-based policy. Building effective regional networks for the exchange of ideas and promotion of health agendas at regional levels would undoubtedly strengthen health advocacy and give advocates more legitimacy and negotiating power.

Second, health professionals can broaden the scope of their thinking about health to include population, environmental, and development issues that affect health. They can join in with professionals in those specialties to research, generate evidence, formulate measures, and engage with policy makers and the general public to change policy and practices around issues of common concern. For example, they can initiate or contribute to national and regional efforts to implement water and food policies that are sustainable, reduce militarisation and military budgets, increase spending on health and education, and fight sex_ and class inequities in access to environmental resources—all of which have major health implications that cannot be tackled by any sector alone, including the health sector. Multidisciplinary health research that is informed by an understanding of PED effects on health, including political, anthropological, and social science perspectives, is crucial in this regard. This kind of research, especially if it analyses and disseminates successful interventions and policy changes in several sectors, can build a powerful scientific foundation for multidisciplinary advocacy. Engagement with PED issues will also allow health professionals to feature the public health agenda more prominently in sustainability debates and forums, something that is lacking, except when the health effects of ecological deterioration are marshalled to make a case for environmental action. For example, the health case for low-carbon policies in the transport, housing, and energy sectors is compelling and yet often overlooked.¹⁵⁸

Third, but not least, health practitioners can open up issues for public debate and mobilise support for action on ecological integration and sustainability as matters of vital importance for people's daily subsistence, health, and survival. In international forums, they can affect international agendas and treaties around social and environmental problems—climate change, women's rights, children's rights, migrant labour, and poverty—over which Arab officialdom has often taken notoriously conservative stances. At local and national levels, they can use their professional capacity and professional platforms to contribute to new social contracts that aim to radically change the current relationship between citizens and

government in the Arab world for the better. They can engage a broader public in building new institutions that are democratic, responsive to the needs of all their constituents and, most crucially, ones that view the rich endowments of the Arab world—ecological, social, and cultural—not as exclusive assets for a privileged few or a means to service world powers, but as pathways to human development, social justice, and wellbeing.

Conclusion

What future does the Arab world want? We must recognise and respect the fact that different populations of the Arab world might want different futures; however, the fundamentals of new state-citizen relationships, responsive and accountable institutions, and cooperation for the sake of survival are arguably common to all of these visions. This is possibly the most important message that the Arab world can contribute to the global debate on sustainable development goals. It is not a particularly new message, but it is as urgent as ever. This is the future the Arab world deserves, the one it ought to want, and the one that populations of the Arab world everywhere, one way or another, are already asking for.

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References

1. UN Environment Programme. Environmental outlook for the Arab region (EOAR). Nairobi, Kenya: United Nations Environment Programme; 2010.
2. Saab, N., editor. Arab environment 5. Survival options: ecological footprint of Arab countries. Beirut, Lebanon: Arab Forum for Environment and Development; 2012.
3. Mokdad, Jaber, S.; Abdel Aziz, MI., et al. The state of health in the Arab world, 1990–2010: an analysis of the burden of diseases, injuries, and risk factors. *Lancet*. 2014. published online Jan 20 [http://dx.doi.org/10.1016/S0140-6736\(13\)62189-3](http://dx.doi.org/10.1016/S0140-6736(13)62189-3)
4. Waage J, Banerji R, Campbell O, et al. The Millennium Development Goals: a cross-sectoral analysis and principles for goal setting after 2015. *Lancet*. 2010; 376:991–1023. [PubMed: 20833426]
5. Rio+20 world leaders. [accessed Oct 5, 2012] The future we want: outcome document adopted at the Rio+20 conference. <http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf>
6. Jurdi, M.; Fayad, R.; El-Zein, A. Environmental degradation: the challenge of sustaining life. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. *Public health in the Arab world*. Cambridge, UK: Cambridge University Press; 2012. p. 47-59.
7. UN Department of Economic and Social Affairs. [accessed March 15, 2013] World urbanization prospects, the 2011 revision. <http://esa.un.org/unpd/wup/CD-ROM/Urban-Rural-Population.htm>
8. UN Human Settlements Programme (UN-Habitat). *The state of Arab cities 2012: challenges of urban transition*. 2nd edn. Nairobi, Kenya: United Nations Human Settlements Programme; 2012.
9. World Bank, UN Food and Agriculture Organization, International Fund for Agricultural Development. *Improving food security in Arab countries*. Washington, DC: The World Bank; 2009.
10. Australian Agency for International Development, UN Human Settlements Programme (UN-Habitat), UN Office for the Coordination of Humanitarian Affairs. *Tomorrow's crisis today: the humanitarian impact of urbanization*. Nairobi, Kenya: UN Office for the Coordination of

Humanitarian Affairs/UN Integrated Regional Information Networks and UN Human Settlements Programme; 2007.

11. Habib RR, Basma SH, Yertezian JS. Harboring illnesses: on the association between disease and living conditions in a Palestinian refugee camp in Lebanon. *Int J Environ Health Res.* 2006; 16:99–111. [PubMed: 16546804]
12. Habib RR, Yassin N, Ghanawi J, Haddad P, Mahfoud Z. Double jeopardy: assessing the association between internal displacement, housing quality and chronic illness in a low-income neighborhood. *Z Gesundh Wiss.* 2011; 19:171–182. [PubMed: 21475722]
13. Fawaz, M.; Peillen, I. Understanding slums: case studies for the global report on human settlements 2003—the case of Beirut, Lebanon. Nairobi, Kenya/Cambridge, London: United Nations Human Settlements Programme/Development Planning Unit, University College London; 2003.
14. UN Department of Economic and Social Affairs. World urbanisation prospects: the 2011 revision. New York, NY: United Nations, Department of Economic and Social Affairs; 2012.
15. UN Department of Economic and Social Affairs. World population prospects: the 2010 revision. New York, NY: United Nations, Department of Economic and Social Affairs; 2011.
16. UN Food and Agriculture Organization. [accessed Feb 21, 2013] AQUASTAT. www.fao.org/nr/aquastat/
17. UN Department of Economic and Social Affairs. World population in 2300. Proceedings of the United Nations Expert Meeting on World Population in 2300. New York, NY: United Nations; 2004.
18. Assaf, H.; Erian, W.; Gafrej, R.; Hermann, S.; McDonnell, R.; Taimeh, A. Climate change contributes to water scarcity. In: Verner, D., editor. Adaptation to a changing climate in the Arab countries: a case for adaptation governance in building climate resilience. MENA Development Report 64635. Washington, DC: International Bank for Reconstruction and Development and The World Bank; 2012. p. 109-151.
19. Kassas, M. Aridity, drought and desertification. In: Tolba, MK.; Saab, NW., editors. Arab environment. Future challenges. Beirut, Lebanon: Arab Forum for Environment and Development; 2008. p. 95-110.
20. Sadik, A.; Nimah, M.; Alaoui, SB. Agriculture. In: Abaza, H.; Saab, N.; Zeitoun, B., editors. Arab environment 4. Green economy: sustainable transition in a changing Arab world. Beirut, Lebanon: Arab Forum for Environment and Development; 2011. p. 1-52.
21. UN Food Agriculture Organization. [accessed Feb 26, 2013] FAOSTAT. <http://faostat.fao.org/>
22. Bucknall, J. Making the most of scarcity: accountability for better water management results in the Middle East and north Africa. Washington, DC: The World Bank; 2007.
23. International Food Policy Research Institute. Middle East and north Africa strategy. Washington, DC: International Food Policy Research Institute; 2010.
24. Erian, E.; Katlan, B.; Babah, O. Global assessment report on disaster risk reduction. Geneva: United Nations International Strategy for Disaster Reduction; 2010. Drought vulnerability in the Arab region. Special case study: Syria.
25. Droubi, A.; Zibari, WK.; Ashqar, H.; Water. UN Environment Program. Environmental outlook for the Arab region (EOAR). Nairobi, Kenya: United Nations Environment Program; 2010. p. 29-66. (in Arabic)
26. UN. Gaza in 2020. A liveable place? A report by the United Nations Country Team in the occupied Palestinian territory. Geneva: United Nations; 2012.
27. El-Raey, M. Coastal areas. In: Tolba, M.; Saab, N., editors. Arab environment. Climate change: impact of climate change on Arab countries. Beirut, Lebanon: Arab Forum for Environment and Development; 2009. 2009. p. 47-62.
28. Dawoud, MA. [accessed Dec 11, 2013] Strategic water reserve: new approach for old concept in GCC countries. <http://portal.worldwaterforum5.org/wwf5/en-us/worldregions/MENA%20Arab%20region/Consultation%20Library/Strategic%20Groundwater%20Reserve.pdf>
29. Green, AR. [accessed Dec 11, 2013] Africa: Saudi agriculture minister enticed by African land. This is Africa. 2012 Jun 8. <http://www.thisisafricaonline.com/Policy/Saudi-agriculture-minister-enticed-by-African-land?ct=true>

30. Tabutin, D.; Schoumaker, B. The demographic transitions: characteristics and public health implications. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. Public health in the Arab world. Cambridge, UK: Cambridge University Press; 2012. p. 35
31. UN Fund for Population Activities. By choice, not by chance: family planning, human rights and development. New York, NY: United Nations Fund for Population Activities; 2012. State of world population 2012.
32. UN Department of Economic and Social Affairs. [accessed Dec 14, 2012] Trends in international migrant stock: the 2008 revision. esa.un.org/migration/
33. UN Economic and Social Commission for Western Africa. Arab society: a compendium of social statistics and indicators, 2010–2011. Beirut, Lebanon: United Nations Economic and Social Commission for Western Africa; 2012.
34. UNDP Regional Bureau for Arab States. Arab human development report 2009: challenges to human security in the Arab countries. New York, NY: United Nations Development Program, Regional Bureau for Arab States; 2009.
35. UNDP Regional Bureau for Arab States. Arab human development report. 2002: creating opportunities for future generations. New York, NY: United Nations Development Program, Regional Bureau of Arab States; 2002.
36. UNDP Regional Bureau for Arab States. Arab human development report. 2003: building a knowledge society. New York, NY: United Nations Development Program, Regional Bureau of Arab States; 2003.
37. UNDP Regional Bureau for Arab States. Arab human development report. 2004: towards freedom in the Arab world. New York, NY: United Nations Development Program, Regional Bureau of Arab States; 2004.
38. UNDP Regional Bureau for Arab States. Arab human development report. 2005: towards the rise of women in the Arab world. New York, NY: United Nations Development Program, Regional Bureau of Arab States; 2005.
39. International Monetary Fund. [accessed Dec 11, 2013] Economic transformation in MENA: delivering on the promise of shared prosperity. <http://www.imf.org/external/np/g8/pdf/052711.pdf>
40. Gelvin, JL. The Arab uprisings: what everyone needs to know. New York, NY: Oxford University Press; 2012.
41. Sadowski Y. Scuds or butter: political economy of arms control in the Arab world. Middle East Rep. 1992; 177:2–13.
42. Greenberg JB, Park TK. Political ecology. J Polit Ecol. 1994; 1:1–12.
43. Waterbury, J. Exposed to innumerable delusions: public enterprise and state power in Egypt, India, Mexico and Turkey. Cambridge, UK: Cambridge University Press; 1993. Bald comparisons; p. 70-71.
44. Richards, A.; Waterbury, J. Chapter 6. In: Richards, A.; Waterbury, J., editors. A political economy of the Middle-East. 2nd edn. Boulder, CO: Westview Press; 1998. p. 145-172.
45. Integrated Regional Information Networks. [accessed Dec 11, 2013] Syria: drought pushing millions into poverty, Sept 9, 2010. <http://www.irinnews.org/report/90442/syria-drought-pushing-millions-into-poverty>
46. Femmia, F.; Werrell, C. for the Centre for Climate and Security. [accessed Dec 11, 2013] Syria: climate change, drought and social unrest, Feb 29,2012. <http://climateandsecurity.org/2012/02/29/syria-climate-change-drought-and-social-unrest/>
47. Khadr, Z.; Rashad, H.; Watts, S.; Salem, ME. Health inequities: social determinants and policy implications. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. Public health in the Arab world. Cambridge, UK: Cambridge University Press; 2012. p. 61-74.
48. Hajjeh, RA.; Talaat, M.; Jumaan, AO. Infectious diseases: the unfinished agenda and future needs. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. Public health in the Arab world. Cambridge, UK: Cambridge University Press; 2012. p. 136-148.
49. Nuwayhid IA, Usta J, Makarem M, Khudr A, El-Zein A. Health of children working in small urban industrial shops. Occup Environ Med. 2005; 62:86–94. [PubMed: 15657189]

50. Habib, RR.; Fathallah, FA.; Nuwayhid, I. Workers' health: a social framework beyond workplace hazards. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. Public health in the Arab world. Cambridge, UK: Cambridge University Press; 2012. p. 286-299.
51. Kapiszewski, A. United Nations Expert Group meeting on international migration and development in the Arab region: Arab versus Asian migrant workers in the GCC countries. Beirut, Lebanon: United Nations Population Division; 2006.
52. Richards, A.; Waterbury, J. Chapter 15. In: Richards, A.; Waterbury, J., editors. A political economy of the Middle-East. 2nd edn. Boulder, CO: Westview Press; 1998. p. 366-389.
53. Research Directorate, Immigration and Refugee Board, Canada. [accessed June 28, 2013] Saudi Arabia: information on the expulsion of foreign workers from Saudi Arabia in recent years. <http://www.refworld.org/docid/3ae6ab6e2.html>
54. WHO. Water quality and health strategy, 2013–2020. Geneva, Switzerland: World Health Organization; 2013.
55. Abu Naser AA, Ghbn N, Khoudary R. Relation of nitrate contamination of groundwater with methaemoglobin levels among infants and Gaza. East Medtierr Health J. 2007; 13:994–1004.
56. UN Environment Programme. Environmental assessment of the Gaza Strip following the escalation of hostilities in December 2008-January 2009. Nairobi, Kenya: United Nations Environment Programme; 2009.
57. Alharbi OA, Phillips MR, Williams AT, Gheith AM, Bantan RA, Rasul NM. Desalination impacts on the coastal environment: Ash Shuqayq, Saudi Arabia. Sci Total Environ. 2012; 421–22:163–172.
58. Larsen, B. Economic Research Forum, working paper 583. Cairo, Egypt: Economic Research Forum; 2011. Cost assessment of environmental degradation in the Middle East and north Africa region: selected issues.
59. Koohafkan, P.; Stewart, BA. Water and cereals in drylands. London UK: Food and Agriculture Organisation of the United Nations and Earthscan; 2008.
60. McDonnell, R.; Ismail, S.; Abu Salman, R., et al. Agriculture, rural livelihoods, and food security are stressed in a changing climate. In: Verner, D., editor. Adaptation to a changing climate in the Arab countries: a case for adaptation governance in building climate resilience. MENA Development Report 64635. Washington, DC: International Bank for Reconstruction and Development and The World Bank; 2012. p. 163-202.
61. UN Secretary-General's High-Level Panel on Global Sustainability. Resilient people, resilient planet: a future worth choosing. New York, NY: United Nations; 2012.
62. Jägerskog, A.; Cascão, A. Land deals: a 'green revolution' in global food and energy markets?. In: Jägerskog, A.; JØnch Clausen, T., editors. Feeding a thirsty world: challenges and opportunities for a water and food secure future, SIWI report 31. Stockholm: Stockholm International Water Institute; 2012. p. 45-50.
63. Chatila, JG. Municipal and industrial water management. In: El-Ashry, M.; Saab, N.; Zeitoon, B., editors. Arab environment. Water: sustainable management of a scarce resource. Beirut, Lebanon: Arab Forum for Environment and Development; 2010. p. 71-90.
64. Potter RB, Darmame K, Barham N, Nortcliff S. "Ever-growing Amman", Jordan: urban expansion, social polarisation and contemporary urban planning issues. Habitat Int. 2009; 33:81–92.
65. Barghouti, S. Water sector overview. In: El-Ashry, M.; Saab, N.; Zeitoon, B., editors. Arab environment. Water: sustainable management of a scarce resource. Beirut, Lebanon: Arab Forum for Environment and Development; 2010. p. 1-24.
66. Musaiger, M.; Ghattas, H.; Hassan, AS.; Obeid, O. Nutrition and food security: the Arab world in transition. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. Public health in the Arab world. Cambridge, UK: Cambridge University Press; 2012. p. 123-135.
67. Zurayk, R. MediTERRA 2012: the Mediterranean diet for sustainable regional development. Paris, France: International Centre for Advanced Mediterranean Agronomic Studies; 2012. Can sustainable consumption protect the Mediterranean landscape?; p. 155-170.
68. Falkenmark, M. Food security: overcoming water scarcity realities. In: Jägerskog, A.; JØnch Clausen, T., editors. Feeding a thirsty world: challenges and opportunities for a water and food

- secure future, SIWI report 31. Vol. 2012. Stockholm: Stockholm International Water Institute; p. 13-18.
69. Verner, D.; Ashwill, M.; Breisinger, C.; Noble, I.; Seltur, B. Climate change is happening now, and people are affected in Arab countries. In: Verner, D., editor. *Adaptation to a changing climate in the Arab countries: a case for adaptation governance in building climate resilience*. MENA Development Report 64635. Washington, DC: International Bank for Reconstruction and Development and The World Bank; 2012. p. 9-37.
 70. International Panel on Climate Change. *Managing the risks of extreme events and disasters to advance climate change adaptation*. New York, NY: Cambridge University Press; 2012.
 71. Wiebelt, M.; Breisinger, C.; Ecker, O.; Al-Riffai, P.; Robertson, R.; Thiele, T. IFPRI discussion paper 01139. Washington, DC: International Food Policy Research Institute; 2011. *Climate change and floods in Yemen: impacts on food security and options for adaptation*.
 72. Kjellstrom T, Holmer I, Lemke B. Workplace heat stress, health and productivity—increasing challenge for low and middle-income countries during climate change. *Glob Health Action* 2009; published online Nov 11.
 73. Intergovernmental Panel on Climate Change. *Climate change 2013: the physical science basis. Summary for policymakers*. Geneva, Switzerland: Intergovernmental Panel on Climate Change; 2013.
 74. The World Bank. *Turn down the heat: why a 4°C warmer world must be avoided—a report for the World Bank by the Potsdam Institute of Climate Impact Research and Climate Analytics*. Washington, DC: International Bank for Reconstruction and Development/The World Bank; 2012.
 75. The World Bank. *World development report (WDR) 2010: development and climate change*. Washington DC: The World Bank; 2010.
 76. Waterbury, J. *Arab human development report, research paper series: the political economy of climate change in the Arab region*. New York, NY: United Nations Development Program Regional Bureau for Arab States; 2013.
 77. Saleh, SS.; Alameddine, MS.; Natafagi, NM., et al. The path towards universal health coverage in the Arab uprising countries Tunisia, Egypt, Libya, and Yemen. *Lancet*. 2014. published online Jan 20. [http://dx.doi.org/10.1016/S0140-6736\(13\)62339-9](http://dx.doi.org/10.1016/S0140-6736(13)62339-9)
 78. Batniji, R.; Khatib, L.; Cammett, M., et al. Governance and health in the Arab world. *Lancet*. 2014. published online Jan 20. [http://dx.doi.org/10.1016/S0140-6736\(13\)62185-6](http://dx.doi.org/10.1016/S0140-6736(13)62185-6)
 79. UN Environment Programme. *Sudan post-conflict environmental assessment*. Nairobi, Kenya: United Nations Environment Programme; 2007.
 80. UN Environment Programme. *Lebanon post-conflict environmental assessment*. Nairobi, Kenya: United Nations Environment Programme; 2007.
 81. UN Environment Programme. *Iraqi marshlands observation system*. Nairobi, Kenya: United Nations Environment Programme; 2006.
 82. Omar, SAS.; Briskey, E.; Misak, E. Asem AASO. *The Gulf War impact on the terrestrial environment of Kuwait: an overview*. In: Austin, J.; Bruch, C., editors. *the environmental consequences of war—legal, economic and scientific perspectives*. Cambridge, UK: Cambridge University Press; 2000. p. 316-337.
 83. Gates, S.; Hegre, H.; Nygard, NM.; Strand, H. [accessed Dec 11, 2013] *Consequences of armed conflict in the Middle East and north Africa region*. 2010 Nov. http://folk.uio.no/haavarnn/MENA_Cons_Conflict.pdf
 84. Dewachi, O.; Skelton, M.; Nguyen, V-K., et al. *Changing therapeutic geographies of the Iraqi and Syrian wars*. *Lancet*. 2014. published online Jan 20. [http://dx.doi.org/10.1016/S0140-6736\(13\)62299-0](http://dx.doi.org/10.1016/S0140-6736(13)62299-0)
 85. Alaani S, Savabieasfahani M, Tafash M, Manduca P. Four polygamous families with congenital birth defects from Fallujah, Iraq. *Int J Environ Res Public Health*. 2011; 8:89–96. [PubMed: 21318016]
 86. Al-Sabbak M, Sadik Ali S, Savabi O, Savabi G, Dastgiri S, Savabieasfahani M. Metal contamination and the epidemic of congenital birth defects in Iraqi cities. *Bull Environ Contam Toxicol*. 2012; 89:937–944. [PubMed: 22983726]

87. UNICEF. [accessed Sept 30, 2013] ChildInfo: monitoring the status of children and women—child nutrition statistics. http://www.childinfo.org/malnutrition_nutritional_status.php
88. UNICEF. Tracking Progress on Child and Maternal Nutrition: A survival and development priority. New York, NY: United Nations Children’s Fund; 2009.
89. UNICEF. The State of the world’s children 2012: children in an urban world. New York, NY: United Nations Children’s Fund; 2012.
90. WHO. Global status report on noncommunicable diseases 2010. Description of the global burden of NCDs, their risk factors and determinants. Geneva, Switzerland: World Health Organization; 2011.
91. Ghattas, H. Food security, nutrition and health in the Arab world: the case of marginalised populations in Lebanon; Food Secure Arab World Conference; 2012 Feb 6–7. Session number 3b
92. Musaiger AO. Overweight and obesity in eastern Mediterranean region: prevalence and possible causes. *J Obes.* 2011; 2011:407237. [PubMed: 21941635]
93. Badran M, Laher I. Obesity in Arabic-speaking countries. *J Obes.* 2011; 2011:686430. [PubMed: 22175002]
94. Abdul Rahim, HF.; Sibai, A.; Khader, Y., et al. Non-communicable diseases in the Arab world. *Lancet.* 2014. published online Jan 20. [http://dx.doi.org/10.1016/S0140-6736\(13\)62383-1](http://dx.doi.org/10.1016/S0140-6736(13)62383-1)
95. Golzarand M, Mirmiran P, Jessri M, Toolabi K, Mojarrad M, Azizi F. Dietary trends in the Middle East and north Africa: an ecological study (1961 to 2007). *Public Health Nutr.* 2012; 15:1835–1844. [PubMed: 22317906]
96. UN Environment Programme. Global environment outlook (GEO-4): environment for development. Nairobi, Kenya: UN Environment Programme; 2007.
97. Batterman S, Eisenberg J, Hardin R, et al. Sustainable control of water-related infectious diseases: a review and proposal for interdisciplinary health-based systems research. *Environ Health Perspect.* 2009; 117:1023–1032. [PubMed: 19654908]
98. Pimentel D, Tort M, D’Anna L, et al. Ecology of Increasing disease: population growth and environmental degradation. *BioScience.* 1998; 48:817–826.
99. Casey JF, Kahn JR, Rivas A. Willingness to pay for improved water service in Manaus, Amazonas, Brazil. *Ecol Econ.* 2006; 58:365–372.
100. Schuster CJ, Ellis AG, Robertson WJ, et al. Infectious disease outbreaks related to drinking water in Canada. *Can J Public Health.* 2005; 86:254–258. [PubMed: 16625790]
101. Epstein P. Climate change and infectious disease: stormy weather ahead? *Epidemiology.* 2002; 13:373–375. [PubMed: 12094088]
102. Haines A, McMichael AJ, Epstein P. Environment and health: 2. Global climate change and health. *CMAJ.* 2000; 163:729–734. [PubMed: 11022589]
103. Myers SS, Patz J. Emerging threats to human health from global environmental change. *Annu Rev Environ Resour.* 2009; 34:223–252.
104. Ulijaszek S. Transdisciplinarity in the study of undernutrition-infection interactions. *Coll Antropol.* 1997; 21:3–15. [PubMed: 9225495]
105. Tekce, B.; Oldham, L.; Shorter, FC. A place to live: families and child health in a Cairo neighborhood. Cairo, Egypt: American University of Cairo Press; 1994.
106. Dagdeviren H, Robertso SA. Access to water in the slums of sub-Saharan Africa. *Dev Policy Rev.* 2011; 29:485–505.
107. Budds J, McGranahan G. Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America. *Environ Urban.* 2003; 15:87–113.
108. Panel on Urban Population Dynamics, National Academy of Sciences. Fertility and reproductive health. In: Montgomery, M.; Stren, R.; Cohen, B.; Reeds, H., editors. *Cities transformed: demographic change and its implications in the developing world.* Washington, DC: The National Academies Press; 2003. p. 231-246.
109. Kobeissi L, Inhorn MC, Hannoun AB, Hammoud N, Awwad J, Abu-Musa AA. Civil war and male infertility in Lebanon. *Fertil Steril.* 2008; 90:340–343. [PubMed: 17919611]
110. Assaad R, Arntz M. Constrained geographical mobility and gendered labor market outcomes under structural adjustment: evidence from Egypt. *World Dev.* 2005; 33:431–454.

111. Berer M. Who has responsibility for health in a privatised health system? *Reprod Health Matters*. 2010; 18:1–9.
112. Carballo M, Nerukar A. Migration, refugees, and health risks. *Emerg Infect Dis*. 2001; 7(suppl 3): 556–560. [PubMed: 11485671]
113. Arat ZF. Analyzing child labor as a human right issue: its causes, aggravating policies, and alternative proposals. *Hum Rights Q*. 2002; 24:177–204.
114. Gomes JO, Norman LN. The health of the workers in a rapidly developing country: effect of occupational exposure to noise and heat. *Occup Med (Lond)*. 2002; 52:121–128. [PubMed: 12063357]
115. Crebelli R, Tomei F, Zijno A, et al. Exposure to benzene in urban workers: environmental and biological monitoring of traffic police in Rome. *Occup Environ Med*. 2001; 58:165–171. [PubMed: 11171929]
116. Husyin R, Burgut AB, Sidahmed H, Albuz R, Sanya R, Khan WA. Risk factors contributing to road traffic crashes in a fast-developing country: the neglected health problem. *Ulus Travma Acil Cerrahi Derg*. 2010; 16:497–502. [PubMed: 21153940]
117. Al-Houqani M, Eid H, Abu-Zidan F. Sleep-related collisions in United Arab Emirates. *Accid Anal Prev*. 2013; 50:1052–1055. [PubMed: 22921908]
118. Pucher J, Korattyswaropam N, Mittal N, Ittyerah N. Urban transport crisis in India. *Transport Policy*. 2005; 12:185–198.
119. McMichael AJ. Globalization, climate change, and human health. *N Engl J Med*. 2013; 368:1335–1343. [PubMed: 23550671]
120. Haines A, Alleyne G, Kickbusch I, Dora C. From the Earth Summit to Rio+20: integration of health and sustainable development. *Lancet*. 2012; 379:2189–2197. [PubMed: 22682465]
121. Hamdy SF. When the state and your kidneys fail: political etiologies in an Egyptian dialysis ward. *Am Ethnol*. 2008; 35:553–569.
122. Inhorn MC. Middle Eastern masculinities in the age of new reproductive technologies: male infertility and stigma in Egypt and Lebanon. *Med Anthropol Q*. 2004; 18:162–182. [PubMed: 15272802]
123. Lock, M.; Nguyen, V-K.; Zaro, C. Global and local perspectives on population health. In: Heymann, J.; Hertzman, C.; Barer, ML.; Evans, RG., editors. *Healthier societies: from analysis to action*. New York, NY: Oxford University Press; 2006. p. 58-82.
124. Lock M, Kaufert P. Menopause, local biologies, and cultures of ageing. *Am J Hum Biol*. 2001; 13:494–504. [PubMed: 11400220]
125. Helman, CG. *Culture, health and illness*. 5th edn. London, UK: Hodder Arnold; 2007.
126. Stern, DI. Environmental Kuznets curves. In: Cleveland, CJ., editor. *Encyclopaedia of energy*. Amsterdam: Elsevier; 2004. p. 517-525.
127. M'henni, H.; Arouri, MEH.; Ben Youssef, A.; Rault, C. Economic Research Forum, working paper 587. Giza, Egypt: Economic Research Forum; 2011. Income level and environmental quality in the MENA countries: discussing the environmental Kuznets curve hypothesis.
128. Soussi, N.; Khouli, AO.; Abou Sowayrih, L.; Vukowics, W.; Al Masri, R.; Randall, T. UN Environment Program. *Environmental outlook for the Arab region (EOAR)*. Nairobi, Kenya: United Nations Environment Program; 2009. Challenges and opportunities; p. 269-312. (in Arabic)
129. UN Economic and Social Commission for Western Asia. *Governance for sustainable development in the Arab region: institutions and instruments for moving beyond and environmental management culture*. New York, NY: United Nations; 2003.
130. The World Bank. *World development report (WDR) 2011: conflict, security, and development*. Washington, DC: The World Bank; 2011.
131. The World Bank. *World Bank Open Data*. <http://data.worldbank.org/>.
132. Grimmett, RF.; Kerr, PK. Congressional Research Service report for congress, 7–5700. Washington, DC: Congressional Research Service; 2012. Conventional arms transfers to developing nations 2004–2011.

133. Organisation for Economic Cooperation and Development. [accessed Aug 28, 2012] Development: aid to developing countries falls because of recession. <http://www.oecd.org/newsroom/developmentaidtodevelopingcountriesfallsbecauseofglobalrecession.htm>
134. Pyman, M.; Clarke, T.; Mustafa, S.; Somerset, G. Defence companies anti-corruption index 2012. London, UK: Transparency International UK; 2012.
135. Kristensen, P. The DPSIR framework: workshop on assessment of the vulnerability of water resources to environmental change in Africa using river basin approach. Nairobi, Kenya: United Nations Environment Program; 2004.
136. Maxim L, Spangenberg H, O'Connor M. An analysis of risk for biodiversity under the DPSIR framework. *Ecol Econ.* 2009; 69:12–23.
137. Kohsaka R. Developing biodiversity indicators for cities: applying the DPSIR model to Nagoya and integrating social and ecological aspects. *Ecol Res.* 2010; 25:925–936.
138. Carr ER, Wingard PM, Yorty SC, Thompson MC, Jensen NK, Roberson J. Applying DPSIR to sustainable development. *Int J Sustain Dev World Ecol.* 2007; 14:543–555.
139. Giacaman R, Khatib R, Shabaneh L, et al. Health status and health services in the occupied Palestinian territory. *Lancet.* 2009; 373:837–849.
140. Dewachi, O.; Jabbour, S.; Yassin, N.; Nuwayhid, I.; Giacaman, R. Toward a regional perspective on health and human security. In: Jabbour, S.; Giacaman, R.; Khawaja, M.; Nuwayhid, I., editors. *Public health in the Arab world.* Cambridge, UK: Cambridge University Press; 2012. p. 467-476.
141. Batniji B, Rabaia Y, Nguyen-Gillham V, et al. Health as human security in the occupied Palestinian territory. *Lancet.* 2009; 373:1133–1143. [PubMed: 19268352]
142. Brauch, HG. Environment and security in the Middle East: conceptualising environmental, water, food, health and gender security. In: Lipchin, C.; Pallant, E.; Saranga, D.; Amster, A., editors. *Integrated water resources management and security in the Middle East.* Dordrecht, Netherlands: Springer; 2007. p. 121-161.
143. Brown, O.; Crawford, A. Rising temperatures, rising tensions: climate change and the risk of violent conflict in the Middle East. Manitoba, Canada: International Institute for Sustainable Development; 2009.
144. Cheterian V. Environment and security issues in the southern Mediterranean region. MEDSEC Partnership. 2011
145. Adger N. Vulnerability. *Glob Environ Change.* 2005; 16:268–281.
146. Fussler HM. Vulnerability: a generally applicable conceptual framework for climate change research. *Glob Environ Change.* 2007; 17:155–167.
147. Luers AL. The surface of vulnerability: an analytical framework for examining environmental change. *Glob Environ Change.* 2005; 15:214–223.
148. Hinkel J. Indicators of vulnerability and adaptive capacity: towards a clarification of the science-policy interface. *Glob Environ Change.* 2011; 21:198–208.
149. Tonmoy, F.; El-Zein, A. Assessment of vulnerability to climate change using indicators: methodological challenges. In: Dincer, I.; Colpan, CO.; Kadioglu, F., editors. *Causes, impacts, and solutions to global warming.* New York, NY: Springer; 2012. p. 143-156.
150. Agamben, G. *Homo Sacer: sovereign power and bare life* (translation by Heller-Roazen D). Palo Alto, CA: Stanford University Press; 1998.
151. Fassin D. Ethics of survival: a democratic approach to the politics of life. *Humanity.* 2010; 1:81–95.
152. Butler, J. *Frames of war. When is life grievable?* London, UK: Verso; 2010.
153. Funk C. We thought trouble was coming. *Nature.* 2011; 476:7. [PubMed: 21814237]
154. Eriksson, M. Early warning systems for water in agriculture. In: Jägerskog, A.; Jönch Clausen, T., editors. *Feeding a thirsty world: challenges and opportunities for a water and food secure future, SIWI report 31.* Stockholm: Stockholm International Water Institute; 2012. p. 39-44.
155. UN Environment Program. *Global environment outlook 2012.* Nairobi, Kenya: United Nations Environment Program; 2012.

156. Bensassi, S.; Marquez-Ramos, L.; Martinez-Zarzoso, I.; Zitouna, H. Economic Research Forum, working paper 635. Giza, Egypt: Economic Research Forum; 2011. The geography of trade and the environment.
157. Zickfeld, F.; Wieland, A. 2050 desert power. Executive summary: the case for desert power. Munich, Germany: 2012. Dii, 2012. <http://www.desertec.org/> [accessed Sept 18, 2013]
158. Watts, G. [accessed Dec 11, 2013] The health benefits of tackling climate change: an Executive Summary for The Lancet Series. <http://download.thelancet.com/flatcontentassets/series/health-and-climate-change.pdf>

Panel 1: Urban expansion

The most far-reaching population change over the past 50 years has been, arguably, the rate and extent of urbanisation, combined with high levels of internal and external displacements of populations driven by war and economic and environmental stress. Urban populations in the Arab world have increased by 2300% since 1950, whereas the overall population increase over the same period has been about 300%.⁷

57% of the population in the Arab world is estimated to live in cities. This proportion is projected to increase to 70% in 2030. These figures, however, hide substantial regional variations. The Mashreq, comprising Egypt, Iraq, Jordan, Lebanon, occupied Palestinian territory, and Syria, is mostly urban, with the urban proportion of the population ranging from 43% in Egypt to 87% in Lebanon. The Maghreb, comprising Algeria, Libya, Morocco, Tunisia, and Mauritania, is generally urban except for Mauritania. With the exception of Djibouti, the least developed Arab countries—Comoros, Sudan, Somalia, and Yemen—are the least urbanised, with 30–40% urban. The Gulf Cooperation Council (GCC) countries—Saudi Arabia, Qatar, United Arab Emirates, Kuwait, Bahrain, and Oman—make up a special case of mostly city states where 80% or more of the population live in urban areas. The least urbanised countries are undergoing the highest urban growth rates and have the largest proportions of dwellers in informal settlements.^{7,8}

Increasingly, many cities are becoming hosts for people with low income. In Amman, an estimated 12% of the urban population has a low income, but 71% of all those living on a low income in Jordan live in urban areas. In Djibouti City, 69% of urban dwellers live below the poverty line.⁹ In some cases, people with low income living in urban areas are moving into historic centres of cities, as has been seen in Aleppo and Cairo. They live in informally and precariously built environments (the *ashwayyat*), an occurrence that has proliferated in almost all cities except for those in the GCC. In Cairo, 62% of families live in informal settlements. The city's Manshiet Nasser slum alone houses around 1 million inhabitants living in poverty under precarious environmental conditions.¹⁰ In countries that have undergone conflict and collective violence—such as Sudan, Somalia, Comoros, Yemen, Lebanon, and Iraq—refugee camps and informal suburbs often become spatially interconnected and account for a large proportion of the urban population (about 50% in Lebanon and Iraq, 67% in Yemen, 69% in Comoros, up to 74% in Somalia, and 85% in Sudan).⁸ Although urban populations in the Arab world have better and almost universal access to water and sanitation than do their rural counterparts, the quality of service is highly variable and poor health outcomes, associated with poor living conditions, persist, especially in informal settlements.^{11–13}

Panel 2: Water

Present and future data on freshwater availability and water demand are pessimistic. The per-person share of water has dropped by more than two-thirds, from a mean of 3035 m³ between 1958 and 1962 to 973 m³ in 2003–07, and to the current level of 743 m³ (2011 data)—which is far below the water poverty level of 1000 m³/person per year. The per-person share of freshwater is only 10% of that for the world, and 14% and 20% of what it is in other parts of Africa and Asia, respectively. 16 Arab countries have a per-person share of water below the poverty level, of which 11 are already below the absolute water poverty level of 500 m³/person per year.^{16,17}

Only six countries do not have water poverty: Mauritania (3219 m³/person per year), Iraq (2751 m³/person per year), Comoros (1592 m³/person per year), Somalia (1538 m³/person per year), Sudan (1445 m³/person per year), and Lebanon (1057 m³/person per year). Four of these countries, however, depend on surface water that originates in major rivers descending from highlands outside the Arab world: Mauritania receives 97% of its freshwater from the river Niger; Egypt and Sudan rely on the Nile for 97% and 77% of their supplies, respectively; Iraq depends on the rivers Euphrates and Tigris for 72% of its supplies; and Somalia receives 59% of its freshwater supplies from the rivers Juba and Shebelle that descend from the Ethiopian highlands. Thus the only two Arab countries that can provide enough water supplies for their populations without being dependent on other countries are Comoros and Lebanon.

151137 million m³ of renewable freshwater is currently available to the Arab world, of which 82% is surface water, mainly transboundary, and the remaining 18% is groundwater originating in the region. In 2040–50, the total renewable water supply is projected to decline by 13% to about 131000 million m³, whereas the demand, which is about 181000 million m³, will rise by 65% to 300000 million m³. These data imply that, by about 2050, the prevailing water shortage in the Arab world will become much larger as the existing deficit between demand and supply continues to widen. On the basis of climate change projections, the situation might be even more critical and all Arab countries are likely to face serious water deficits by 2040–50 when the total renewable water shortage will be about 200000 million m³ per year.¹⁸

This deficit is expected to affect all sectors of development. The agriculture sector alone will need about 182 000 million m³ in 2040–50 (50 million m³ in excess of the available renewable resources by then) despite the expected decline in the share of the total consumption from 80% to 60%. The demand in the municipal and industrial sectors will increase by two or three times as consumption rates rise to 24% and 16% of the total demand, respectively.

Panel 3: Land and food

The Arab world has high levels of aridity and desertification that restrict the land that is available for cultivation. Growing demand for food is increasingly met by reliance on imports, leading to major price fluctuations.

The region is part of a belt that extends across Africa, north of the equator, to western Asia, dominated by hyper-arid conditions. About 52.5% of the total area of the region is desert, which is not suitable for agricultural development with the current climate and water scarcity.¹⁹ Another 44% consists of rangeland areas and only 3.4% of the total area is productive farmlands that are available for cultivation, of which 0.7% (8825 km²) is irrigated and 2.7% (36151 km²) rain fed.

Thus, most countries have extremely little land available for farming. Only Tunisia, Syria, Morocco, and Lebanon have farmlands that are between 5% and 25% of total land area. In the remaining countries, agricultural lands are predominantly rangelands that are prone to desertification and contribute poorly to agricultural economies.¹⁹ This type of environment partly explains the low productivity of agricultural land, particularly cereals, with the Arab world using twice that of the world's land area needed to produce the same amount of cereals.²⁰

Although production of cereals increased by 60% between 2000 (35.7 million tonnes) and 2009 (57.2 million tonnes), almost 95% of this increase was from six countries (Algeria, Egypt, Morocco, Sudan, Syria, and Tunisia). This increase is not reflected in the production of wheat. In 2009, Algeria was still importing 67% of its wheat, Egypt 26%, Sudan 57%, and Tunisia 22%.²¹

With net imports of 58.2 million tonnes (2007 data), Arab countries are the largest importers of cereal in the world.²¹ The gap between demand and supply continues to increase and by 2030, the amount of imported cereal required by the region is expected to rise to 73 million tonnes.

Panel 4: Population trends

The Arab world, although hardly homogeneous, has been undergoing remarkable demographic changes. Its population grew by about 370% during the past 60 years and is increasing at a rate of 2.1% yearly, well above that for the world of 1.16%.¹⁵ At this rate, the population of about 359 million is expected to double in about 35 years.

UN estimates show large disparities in population growth rates across countries. Most have fairly low to mean growth rates, with Lebanon, Morocco, and Tunisia growing at the lowest rate—about 1% per year. Some countries have high population growth rates, with Kuwait, Iraq, Jordan, and Yemen near 3% or more per year, and some Gulf Cooperation Council (GCC) countries (Bahrain, Qatar, United Arab Emirates) well above 3% per year.¹⁵ Changes in war-related displacements and regional and international migration account for recent fluctuations in these rates.

The Arab population has the following characteristics: a fairly high but rapidly declining fertility rate, declining and mostly low mortality rate, a young age structure, and substantial increases in the working-age population as a result of labour migration.³⁰ The region underwent one of the fastest declines in fertility and mortality over the last two decades or so, although the poorer countries have shown slower declines. Total fertility varies greatly from below replacement level (about 1.9) in Lebanon and Tunisia to over 5.0 in Comoros, Somalia, and Yemen. Life expectancy at birth has increased by about 20 years since the 1960s, and some GCC countries (United Arab Emirates, Qatar) recorded 78 years or more on average.¹⁵ Such improvements are not uniform, and poorer countries (eg, Comoros, Somalia, Sudan, Yemen) still have fairly high mortality rates. The maternal mortality ratio in 2010 ranged from 7 (Qatar) to 32 (Oman) deaths per 100000 livebirths in GCC countries; from 25 (Lebanon) to 100 (Morocco) in middle-income countries; and from 200 (Yemen, Djibouti) in low-income countries, reaching 510 in Mauritania, 730 in Sudan, and 1000 in Somalia. These figures show wide variations in maternal mortality across countries in the region, and a seemingly strong association between mortality levels and national income. With the exception of some GCC countries, maternal mortality ratio is an alarming indicator of women's health in the Arab world.³¹

Likewise, substantial heterogeneity in the age–sex profile of countries is reported, owing to varying stages of demographic transition and labour migration. The population is fairly young with a median age of about 22 years, compared with a world median of 29 years. The proportion of children younger than 15 years varies widely—between less than 15% in Qatar to more than 40% in countries such as Iraq, occupied Palestinian territory, and Yemen. Until recently, the proportion of young people aged 15–24 years has been increasing, and it now stands at nearly 20%. Populations are starting to age, with Lebanon and Tunisia having about 15% of people aged 65 years and older in 2010.¹⁵ All GCC countries have large migrant populations, with three having more foreigners than nationals.¹⁵ The United Arab Emirates stands out as having the largest share of foreigners at 7.3 million compared with less than 1 million nationals.³² Most of the foreigners in these countries are men of working age (15–64 years), distorting the age–sex composition—eg, more than 80% of the population of Qatar is of working age.³²

The region has the largest number of refugees in the world, and very high levels of displaced populations. The Palestinians are the largest and oldest group in the region: three countries (Jordan, occupied Palestinian territory, and Syria) have over 1.5 million refugees each, followed by Lebanon with more than 0.5 million.³³

Panel 5: Development trends

Characterisation of development trends is challenging in view of the vast differences in both natural resource endowments and income per person. A series of UNDP reports on Arab human development has attempted to draw broad conclusions, arguing that Arab countries are richer than they are developed.^{34–38}

Recent economic trends have not been positive. From 1980 to 2010, mean yearly growth of gross domestic product (GDP) was 3% and, on a per-person basis, 0.5%; the corresponding values in the rest of the developing countries in the world were 4.5% and 3%, respectively.³⁹ The region is also highly dependent on imports and international migration. It has relied on European markets for its exports, and there fore has been affected by the onset of the economic crisis there.³⁹

Development patterns have been distorted by a so-called resource curse whereby commodity sectors become inefficient and resources shift out of agriculture and industry to services; because of dependence on one or two strategic commodities, economies become affected by commodity price fluctuations.

Since the 19th century, the region has been highly penetrated by outside interests. Even the key resources exploited from the region—its position as a hub of international transport, and oil—have had highly political effects. The fact that no other world region contains states as dependent on economic rent as they are in the Arab world⁴⁰ has entrenched an authoritarian bargain and a substantial lag between Arab countries and other regions in terms of participatory governance.³⁵ As a result, growth dividends have become increasingly concentrated in the hands of the political and economic elite, with preferential access to crucial assets and resources.³⁷

The result of such trends has been a political geography characterised by huge inequalities in wealth and resource endowments for large and densely populated regions, with the wealth from oil and gas confined to ministates consisting of small populations. Similar problems prevail in terms of water endowment, which is generally poor in the region with its high likelihood of drought. Population concentrations are largely downstream from the region's main water sources, increasing the risk of acute environmental and food insecurity. Although 43% of the population is rural, agriculture—the primary economic activity—accounts for no more than 5.4% of GDP.³⁷ Since the 19th century, a shift towards export agriculture at the expense of greater food security and food sovereignty has occurred.

Several countries, including Egypt under President Gamal Abdel Nasser, adopted policies of import-substitution industrialisation that entrenched a large and overdeveloped state sector in which state employment and subsidies provided guarantees of welfare and basic livelihoods. This approach resulted in expanded educational opportunities and health services, but created high levels of graduate and youth unemployment. Nasserism also legitimised high levels of expenditure on the military. The region as a whole boasts the highest levels of military expenditure per-person in developing countries.⁴¹

The result of these trends has been a system with high food insecurity, large public sectors, and high dependence on imports. These factors made the region particularly susceptible to the 2008 food and commodity price hike, thus precipitating a wave of street protests initially led by public sector workers that contributed to the escalation of the 2011 Arab uprising.

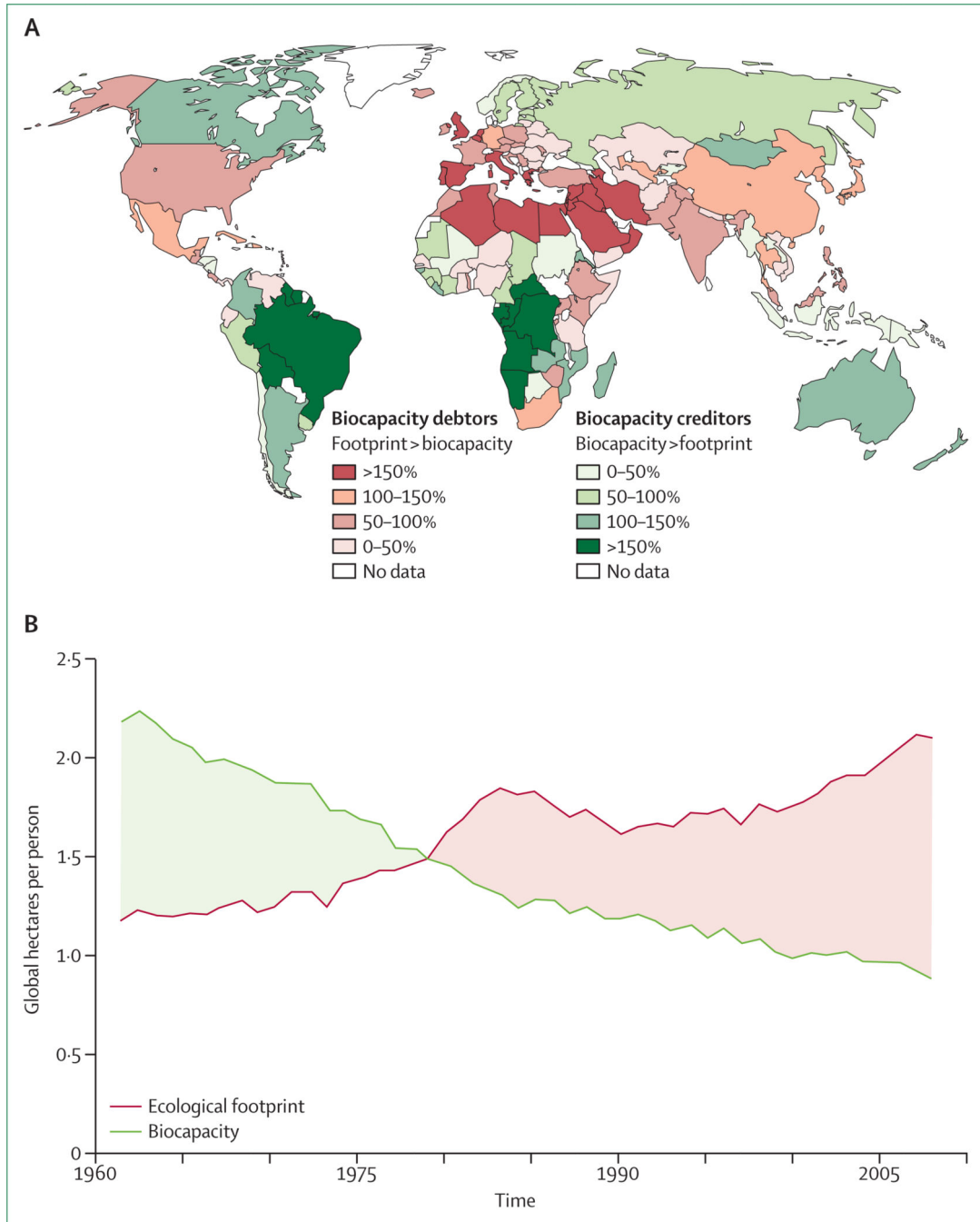


Figure 1. Worldwide spatial distribution of biocapacity in 2008 and trends in ecological footprint and biocapacity in the Arab world, 1961–2008

Ecological footprint and biocapacity represent, respectively, demand for and supply of resources, converted into units of global hectares. (A) Worldwide spatial distribution of biocapacity debtors and creditors in 2008. (B) Mean ecological footprint and biocapacity per person in the Arab world, 1961–2008; green shaded area shows excess in biocapacity relative to footprint until 1979, and red shaded area shows deficit in biocapacity relative to footprint since 1979. Reproduced from the 2012 report of the Arab Forum on Environment

and Development,² jointly prepared with Global Footprint Network, by permission of N Saab.

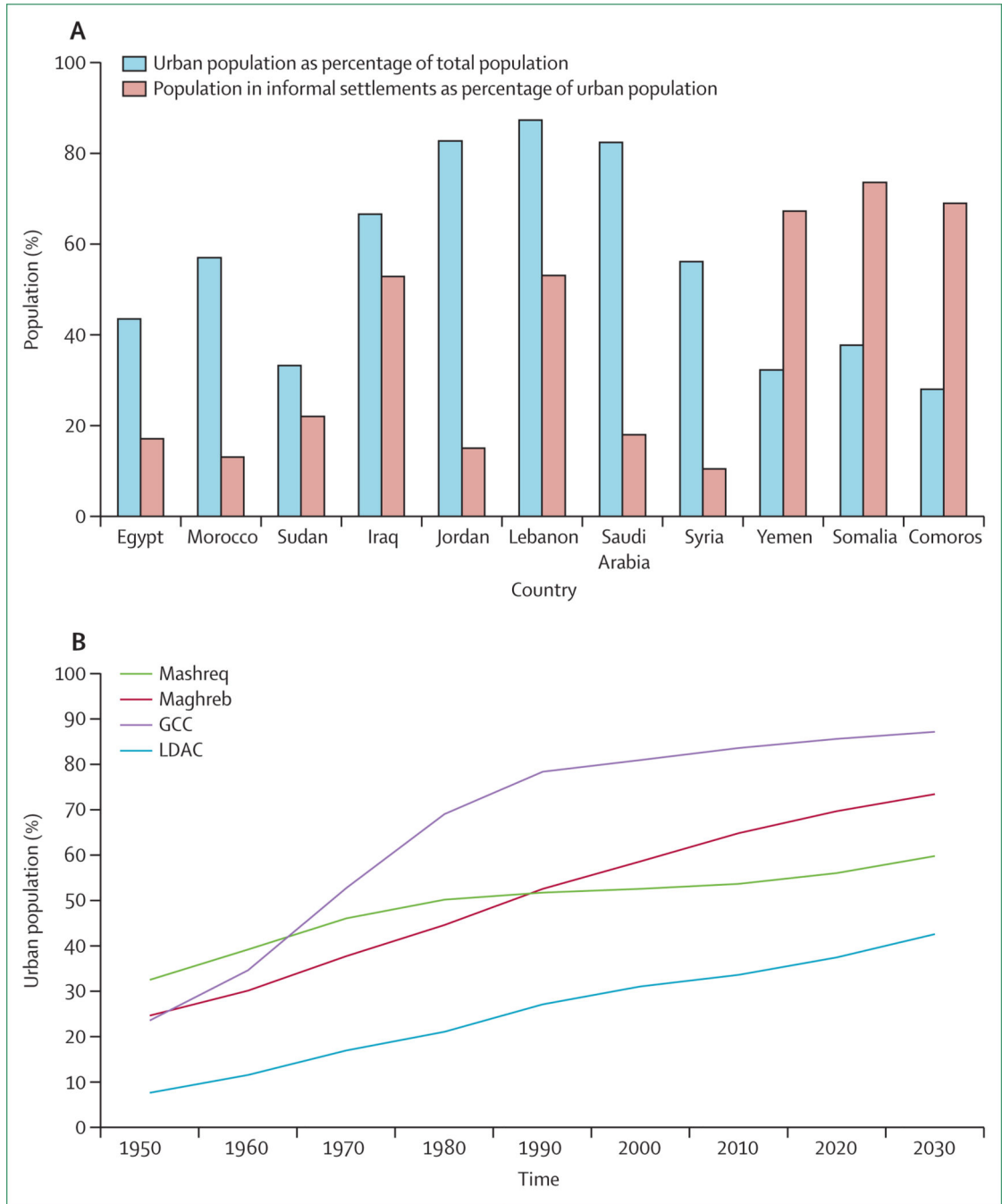


Figure 2. Current state and future trends of urbanisation in the Arab world

(A) Urban population and informal settlements in Arab countries for which data were available; data for urban populations are for 2010 and are from the UN Department of Economic and Social Affairs’ report on world urbanisation prospects¹⁴ and data for informal settlements are for 2005, from the UN Human Settlements Programme’s report on the state of Arab cities.⁸ (B) Urban population as a percentage of the total population by subregion, 1950–2030; data are from the UN Department of Economic and Social Affairs.^{7,15} GCC=Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia,

United Arab Emirates). LDAC=least developed Arab countries (Comoros, Djibouti, Somalia, Sudan, Yemen). Maghreb=Algeria, Libya, Morocco, Tunisia, Mauritania. Mashreq=Egypt, Iraq, Jordan, Lebanon, occupied Palestinian territory, Syria.

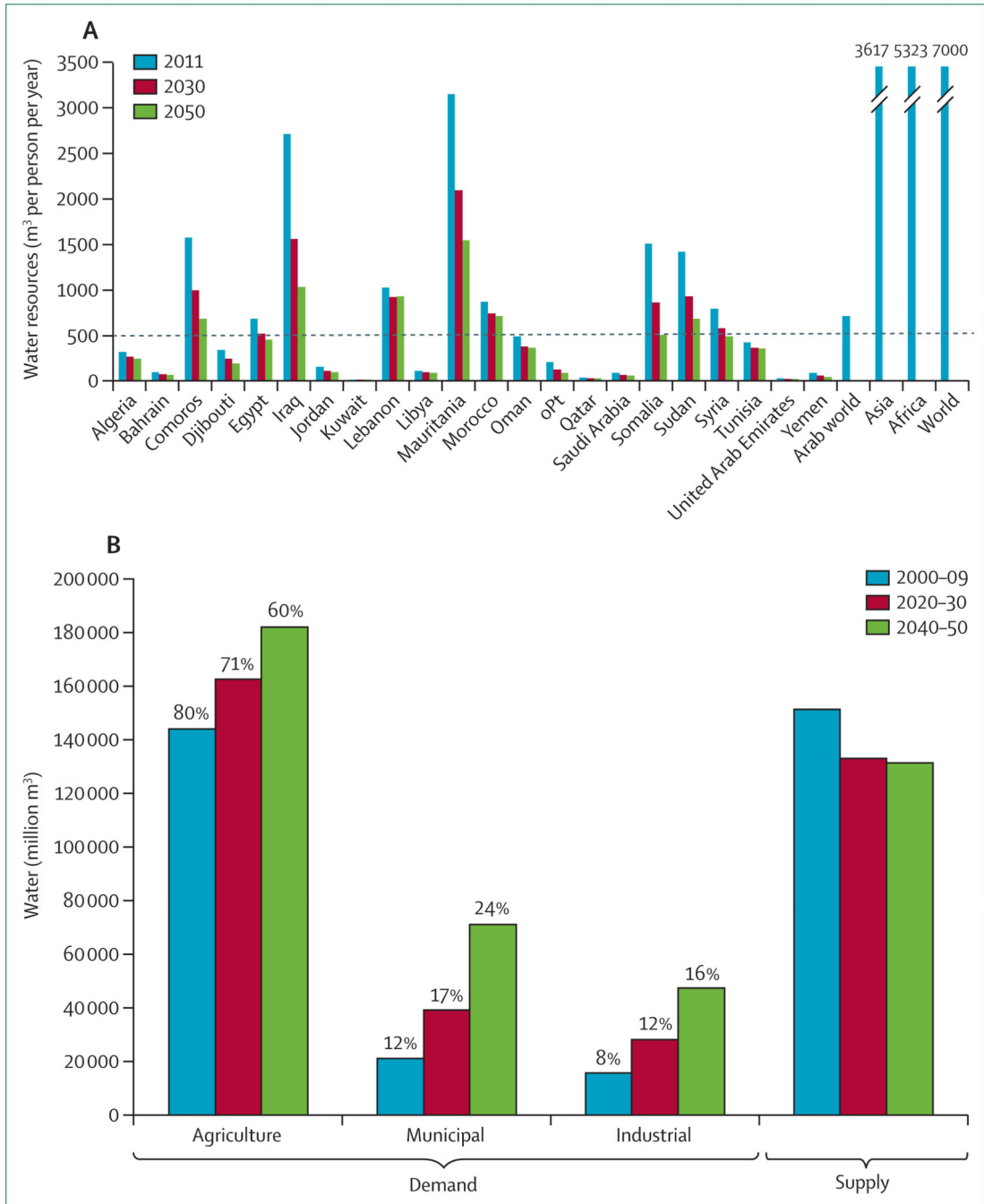


Figure 3. Change in water resources, 2011–50, and water scarcity and water demand by sector in the Arab world

(A) Current and projected total renewable water resources per person in 2011, 2030, and 2050 per Arab country, and total renewable water resources per person in 2011 in the Arab world, Asia, Africa, and worldwide. The horizontal dashed line shows the absolute water poverty limit (500 m³ per person per year). Data for 2011 are from AQUASTAT¹⁶ and data for 2030 and 2050 are from the authors' own calculations using AQUASTAT¹⁶ and data from the UN Department of Economic and Social Affairs.¹⁷ (B) Current and projected water supply, and demand by sector, for 2000–09, 2020–30, and 2040–50 in the Arab world;

percentages show the water demand per sector as a proportion of total demand. Data are from Assaf and colleagues.¹⁸ oPt=occupied Palestinian territory.

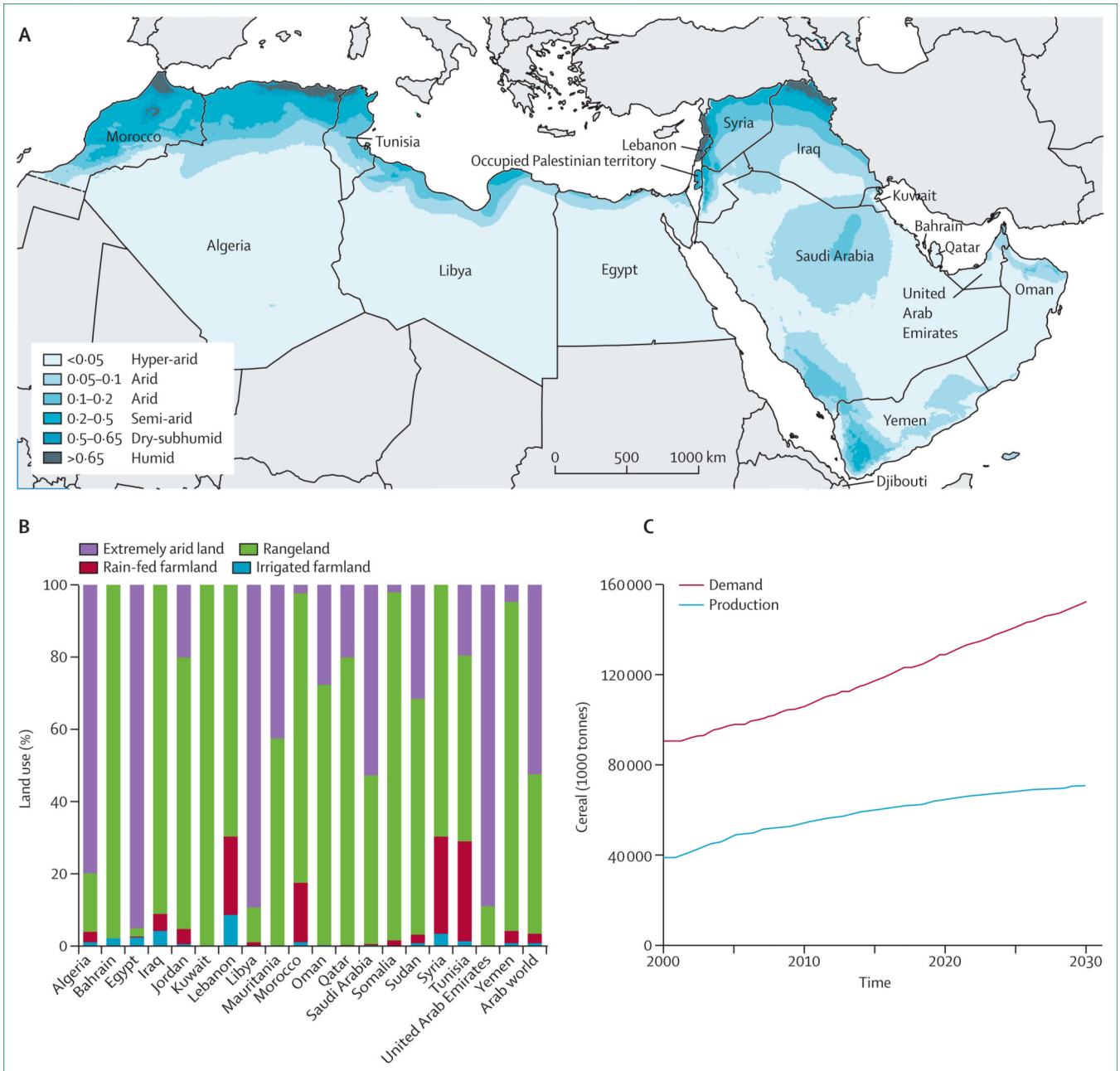


Figure 4. Aridity and food security in the Arab world

(A) Aridity, calculated by precipitation divided by reference evapotranspiration, in selected countries of the Arab world, 2007 Adapted from Bucknall,²² with permission of the World Bank. (B) Land use in Arab countries for which data were available and for the Arab world overall, 2008; data are from Kassas.¹⁹ (C) Demand for, and availability of, cereals (including feed) in the Arab world, 2000–30; reproduced from the International Food Policy Research Institute’s Middle East and north Africa strategy report,²³ by permission of the International Food Policy Research Institute.

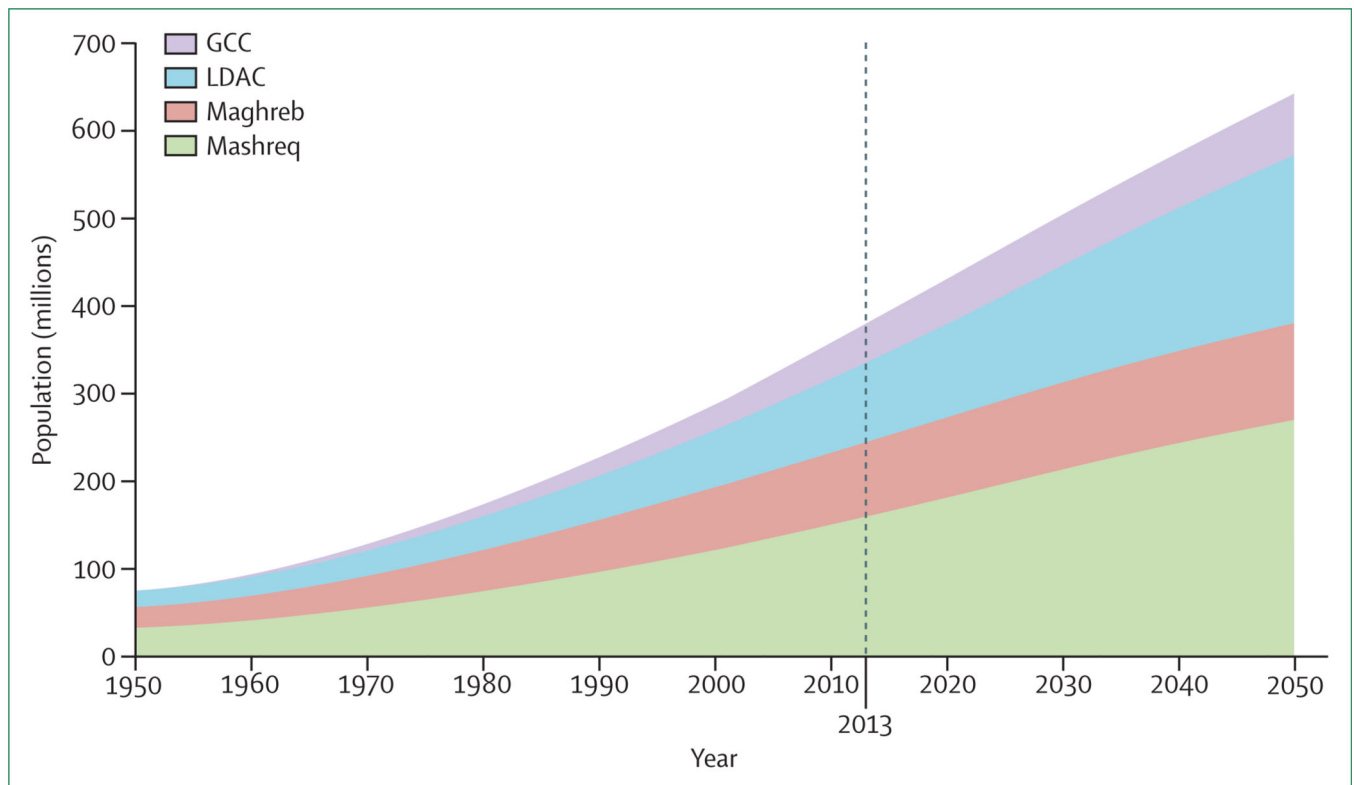


Figure 5. Change in population sizes in the subregions of the Arab world, 1950–2050

Data are from the UN Department of Economic and Social Affairs' report on world population prospects, 2010.¹⁵ GCC=Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates) LDAC=least developed Arab countries (Comoros, Djibouti, Somalia, Sudan, Yemen). Maghreb=Algeria, Libya, Morocco, Tunisia, Mauritania. Mashreq=Egypt, Iraq, Jordan, Lebanon, occupied Palestinian territory, Syria.

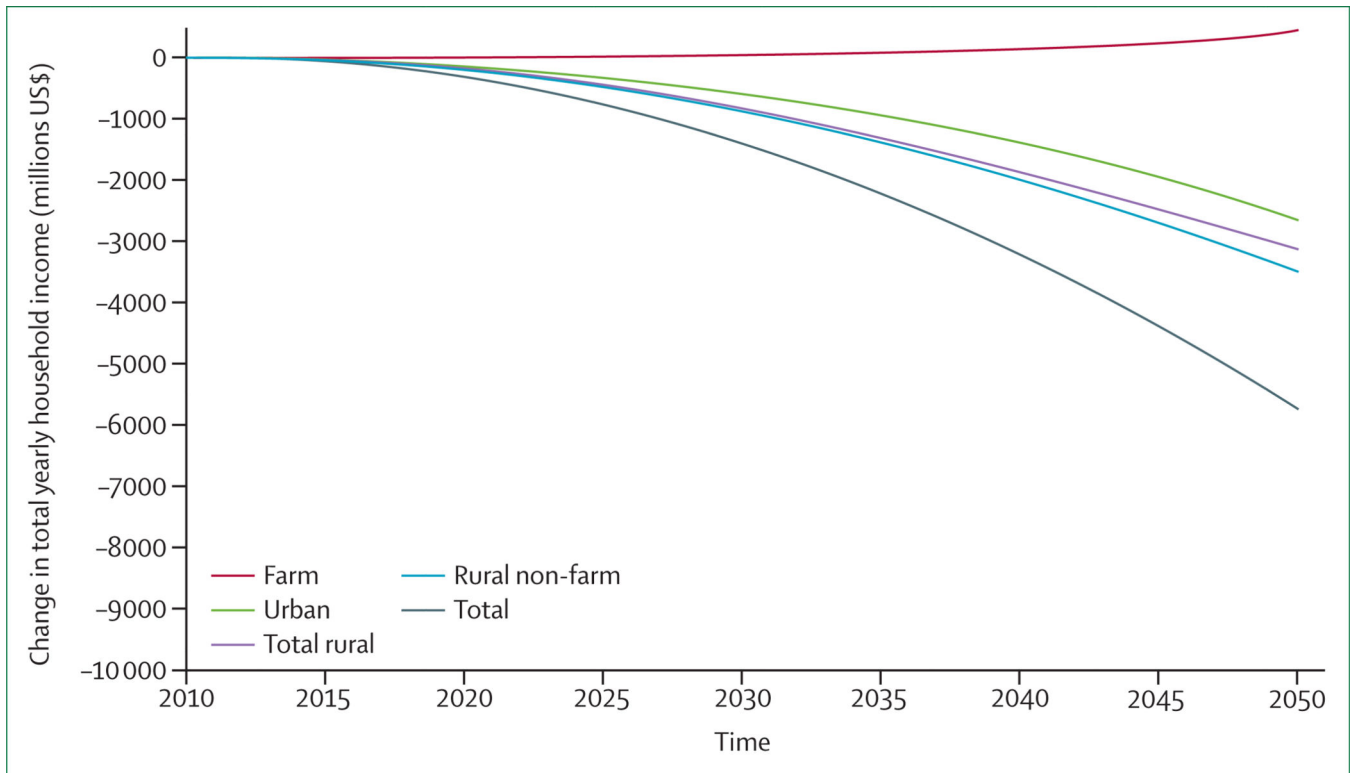


Figure 6. Projected change in total yearly household income in Yemen, 2010–50

Change as a result of local and global effects of climate change (eg, flooding, loss of yields, and global rise in food prices), according to one model. Reproduced from Wiebelt and colleagues,⁷¹ by permission of the International Food Policy Research Institute.

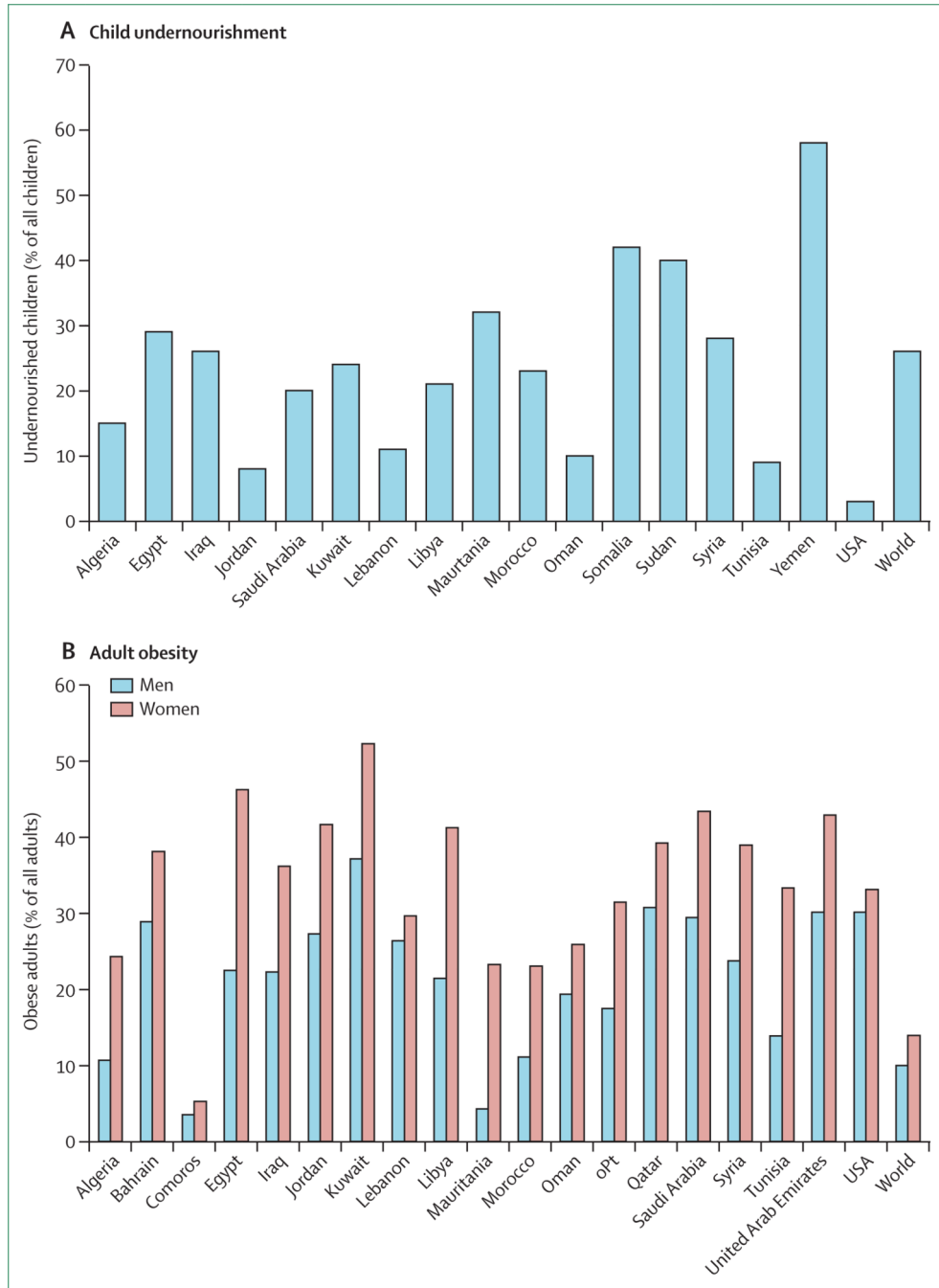


Figure 7. Prevalence of moderate and severe child undernourishment and adult obesity in the Arab world

(A) Latest national estimates of moderate and severe child undernourishment according to height-to-age ratio in children younger than 5 years in Arab countries for which data were available, and in the USA and worldwide; data are from UNICEF.^{87–89} (B) Latest national estimates of age-standardised adult obesity for men and women in Arab countries for which data were available, and in the USA and worldwide; data are from the WHO global status report on non-communicable diseases 2010.⁹⁰ oPt=occupied Palestinian territory.

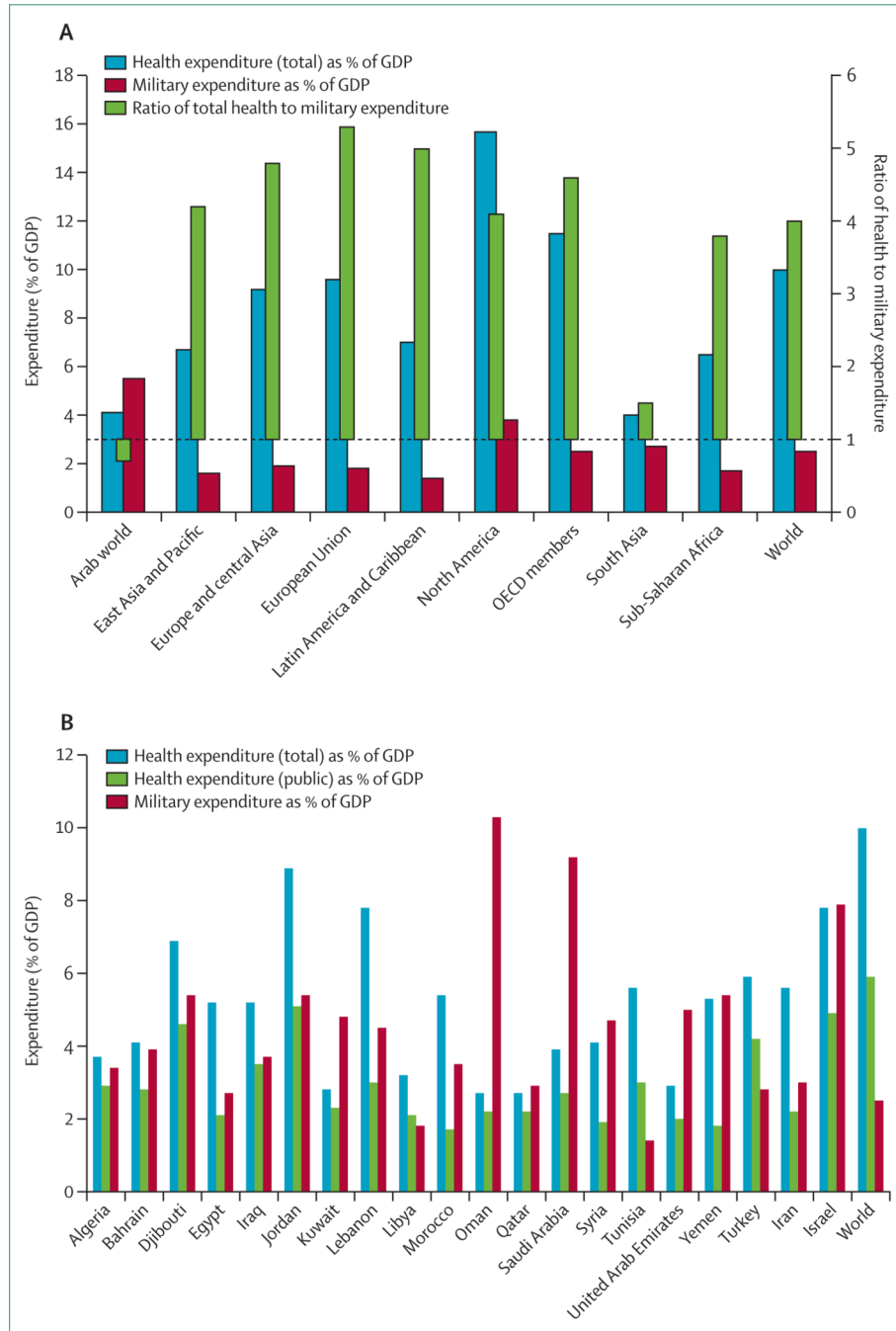


Figure 8. Health and military expenditure as percentage of GDP in world regions and Arab countries
 (A) 11-year mean (2001–11) of total health and military expenditure as a proportion of GDP (left-hand axis) and ratio of total health to military expenditure (right-hand axis), by world region and overall. (B) 11-year average mean (2001–11) of total health, public health, and military expenditure as a proportion of GDP for Arab countries for which data were available, and for Turkey, Iran, Israel (three non-Arab military powers in the Middle East), and the world for comparison. Data are from the World Bank WorldData database.¹³¹

GDP=gross domestic product. OECD=Organisation for Economic Cooperation and Development.

Table 1

Examples of population-environment-development dynamics around urbanisation, war, and migration at two different time scales

	Sudden and fast (ie, weeks and months)	Slow and long-term (ie, years and decades)
Population	War-driven exodus leading to loss of employment and loss of development gains, and an increase in environmental pressure in places of refuge, usually cities (eg, Iraqi refugees fleeing within Iraq and to other Arab countries)	Changes to the size and age structure of Arab families, especially in cities, leading to different economic survival strategies and patterns of environmental stress
Environment	Environmental event leading to economic ruin, loss of development gains, and displacement of people, usually towards cities (eg, Syria's 2006–12 drought and its effect on the agricultural sector, food prices, and rural-urban migration)	Long-term depletion and increased salinity of groundwater reserves leading to a decline in the agricultural sector and faster urbanisation; projected sea-level rise in Qatar, United Arab Emirates, and Egypt and its effects on coastal populations and livelihoods
Development	War-triggered loss of employment leading to displacement and environmental pressure in places of destination (eg, Saudi Arabia expelling Yemeni workers in 1990) ⁵³	Withdrawal of agricultural subsidies and development of alternative employment leading to faster urbanisation and more environmental pressure in cities

Table 2

Population-environment-development dynamics in selected health problems

	Population	Environment	Development
Waterborne diseases	Rural–urban migration and overcrowded urban centres with poor infrastructure cause overexploitation of water resources, a decline in freshwater availability, intense competition between different uses, and water contamination that in turn leads to increases in the incidence of diarrhoea and other waterborne diseases. ^{96–99} War-displaced populations live in unhygienic conditions, at high risk of exposure to waterborne diseases ¹⁰⁰	Water shortages increase the use of wastewater in irrigation of vegetables, and heavy rain floods the wastewater system and contaminates water supplies in urban areas with poor infrastructure, ¹⁰⁰ hence increasing exposure to waterborne pathogens. Climate change creates or exacerbates water supply problems ^{101,102} and water rationing, which increases exposure to waterborne pathogens in rural and urban areas and reduces food production, leading to more undernutrition, lower immunocompetence, lower resistance to infection and, as a result, more frequent and severe episodes of waterborne diseases ^{96,103,104}	Unplanned urban growth and lack of investment in water networks creates scarce and unreliable water supply services in cities, particularly in informal neighbourhoods, that leads to household measures to conserve water through storage, re-use, and hierarchies of use where hygiene is compromised, which increases exposure to waterborne pathogens. ^{96,97,105} Ineffectively executed and regulated privatisation policies for piped water provision might lead to lack of coverage in low-income areas, diminishing service quality and increasing prices over time, which jeopardise access to adequate and affordable water by the socioeconomically vulnerable urban populations, increasing their exposure to waterborne diseases ^{106,107}
Undernourishment	Population growth leads to more competition for food and water, more urban encroachment on agricultural land, reduction in available land per person, all contributing to less available and less diverse food, with resultant undernourishment for people with low income ⁶⁸	Depleting groundwater reserves and climate change lead to less rainfall, more frequent droughts, and sea-level rise, all of which reduce crops and available food to populations and cause substantial damage to rural livelihoods; the latter leads to faster rural–urban flux, less agricultural land, and more undernourishment in people with low income ^{69,96,103}	Government subsidies for irrigation agriculture lead to long-term depletion of groundwater resources, sea-water intrusion, and high susceptibility of yields, with a resultant decline in availability and diversity of food for growing populations. Urbanisation leads to changes in dietary habits towards more water-intensive animal protein, high dependence on imported food, and susceptibility to price fluctuations, all resulting in more undernourishment for people with low income ^{66,94}
Reproductive health problems	Migration, especially from low-income rural areas to the outskirts of cities and slum areas, is leading to increased urban poverty and low-income urban environments (crowding, pollution, restricted water supply, and bad sanitation). People in developing countries living in urban areas with a low-income have been shown to have less access to reproductive health services and to have more reproductive morbidities than those with higher incomes living in urban areas ¹⁰⁸	Pollutants in the environment as a result of war lead to increasing male infertility, which increases out-of-pocket expenditures and interferes with reproductive choice, resulting in worse reproductive health outcomes ¹⁰⁹	Shrinking of the public sector and privatisation lead to less employment opportunities for women in the public sector and more employment opportunities in the private and informal sectors, in which salaries and benefits are less secure. This precariousness of women's employment, especially women from a low-income background, together with women's decreasing access to services in a privatised health system, lead to less access to reproductive health services and increased likelihood of reproductive health problems ^{110,111}
Occupational health problems	People who have a low income, are unemployed, or are migrant workers often accept work in	Workers in many formal and informal sectors in the Arab world have higher-than-average exposure to	Economic restructuring, resource-based development, and free trade agreements create new job opportunities for some

	Population	Environment	Development
	hazardous occupations with minimal safety standards. ¹¹² Child labour increases in overcrowded urban neighbourhoods with poor public schooling systems. ¹¹³ Women in rural areas are overburdened with agricultural work in addition to housework and family rearing	climate-related hazards such as heatwaves, ¹¹⁴ sea-level rise, and spread of malaria. Outdoor workers (eg, traffic policemen, street sweepers) are at high risk of exposure to increased air pollution from traffic ¹¹⁵ and electric generators	(eg, construction workers in some countries bordering the Persian Gulf, women in the service sector) and unemployment for others (eg, labourers in agricultural sectors with low investment); changing employment modalities such as outsourcing, flexible working arrangements, migrant workers with little regulatory protection, low salaries, and job volatility often undermine social protection and lead to the dilution of health and safety regulations ⁵⁰
Traffic injuries	Crowded cities with poor public transportation generate traffic congestion, overcrowded buses and trains, and restricted space for pedestrians and bikers, increasing the risk of traffic incidents and injuries. Immigrant children ¹¹² and children from low-income backgrounds working in the streets are at high risk of traffic injuries	Adverse weather conditions (rain, dust storms) increase the rate of vehicle crashes ¹¹⁶ (eg, flash floods in the Arab peninsula have been associated with traffic fatalities)	Traffic injuries are a leading cause of death in Saudi Arabia and other high-income Gulf countries where extensive highways and high-speed cars increase traffic injury. ¹¹⁷ Poor public transportation leads to a greater use of private vehicles and motorcycles, increasing the risk of traffic injuries. ¹¹⁸ The mix of residential and commercial districts mostly in proximity to highways increases the risk of traffic injuries (eg, Egypt, Lebanon)