MONGOLIA HUMAN DEVELOPMENT REPORT 2011

FROM VULNERABILITY TO SUSTAINABILITY: ENVIRONMENT AND HUMAN DEVELOPMENT

GOVERNMENT OF MONGOLIA

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

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ADB	Asian Development Bank
AFR	Adolescent Fertility Rate
AHDER	*Aimag* Human Development and Environment Report
AR	Assessment Report
ASM	Artisanal and Small-scale Mining
CBD	Convention on Biological Diversity
CBI	City Biodiversity Index
LLDC	Landlocked Developing Countries
CDM	Clean Development Mechanism
CES	Central Energy System
CHP	Combined Heat and Power
CITES	Convention on International Trade on Endangered Species
CM3	Hadley Climate Model
CNDS	Comprehensive National Development Strategy
CVI	Common wealth Vulnerability Index
EF	Ecological Footprint
EIA	Environmental Impact Assessment
EITI	Extractive Industries Transparency Initiative
EPI	Environmental Performance Index
EVI	Economic Vulnerability Index
FAO	Food and Agriculture Organisation
FNC	First National Communication
GCSD	Gender Centre for Sustainable Development
GDP	Gross Domestic Product
GEF	Global Environment Fund
GFN	Global Footprint Network
GHG	Green House Gas
GII	Gender Inequality Index
GNI	Gross National Income
GNP	Gross National Product
GTBR	Green Tax Budget Reform
HD	Human Development
HDI	Human Development Index
HDR	Human Development Report
HSES	Household Socio-Economic Survey
IAD	Institutional Analysis and Design
ILO	International Labour Organisation
IMR	Infant Mortality Rate
IPCC	Intergovernmental Panel on Climate Change
IRBM	Integrated River Basin Management
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Programme
LAB	Local Action on Biodiversity
MARCC	Mongolia: Assessment Report on Climate Change
MAPCC	Mongolia Action Programme on Climate Change
MDG	Millennium Development Goal
MDSWA	Mongolian Democratic Socialist Women's Association
MEV	Multi-dimensional Environmental Vulnerability
MMR	Maternal Mortality Rate
MNET	Ministry of Nature, Environment and Tourism

MNUST	Mongolian National University of Science & Technology
MOFAT	Ministry of Foreign Affairs and Trade
MNET	Ministry of Nature Enoironment and Tourism
MNT	Mongolian *Togrog*
NUM	National University of Mongolia
MOFALI	Ministry of Food, Agriculture, Light Industry
MPI	Multi-dimensional Poverty Indicator
MSWL	Ministry of Social Welfare and Labour
MVTA	Motor Vehicle Traffic Accident
NAMA	Nationally Appropriate Mitigation Action
NAPCC	National Adaptation Programme for Climate Change
NCAP	Netherlands Climate Assistance Programme
NCD	Non-Communicable Disease
NDIC	National Development and Innovation Committee
NDVI	Normalised Difference Vegetation Index
NEMA	National Emergency Management Agency
NGO	Non-Governmental Organisation
NHDC	National Human Development Commission
NHDR	National Human Development Report
NSO	National Statistical Office
NYCDEP	New York City Department of Environmental Protection
PAHO	Pan American Health Organisation
PEG	Poverty Electricity of Growth
PES	Payments for Ecosystem Services
PM	Particulate Matter
PNN	Post Neo-Natal
PPP	Purchasing Power Parity
PREF II	Poverty Research and Employment Facilitation for Policy Development
PV	Photovoltaic
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SCP	Sustainable Consumption and Production
SES	School of Economic Studies
SNC	Second National Communication
TOE	Tonnes of Oil Equivalent
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organisation
URS	URS Corporation Ltd
USA	United States of America
US$	United States Dollar
WHO	World Health Organisation
WWF	World Wild Fund

%	percent
^{0}C	degree Celsius
CO_2e	CO_2 equivalent
cukm	cubic kilometre
Gg	Giga gram
GWh	Giga Watt hour
kg	kilo gram
km	kilo metre
kW	kilo Watt
kWh/sqm	kilo Watt hour per square metre
m	metre
m/s	metre per second
mg	milligram
mm	millimetre
MW	Mega Watt
sq km	square kilometre
µg/м^3	micro gram per cubic metre

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Above all, the Advisory Board presided over the entire process to ensure that the Report becomes a dynamic advocacy tool, grounded in thorough, analytic research and evidence-based facts, which will help to develop lively debates around policies and actions needed to advance Human Development in Mongolia while being confronted with environmental challenges. The Board comprised Mrs.Ayush N., Head of Strategic Planning Department, MSWL (Chair), Mr.Batnasan N., Professor, SES, NUM (Deputy Chair of the Board), Mr.Sodnompil Ts., Head of the New Century and Health Department NGO, Mr.Bat-Erdene R., Invited Professor, Tokyo Institute of Technology, Japan, Mr.Banzragch Ts., Director, Sustainable Development and Strategic Planning Department, MNET, Mr.Batkhurel G., Director of Development Policy and Strategic Planning Department, NDIC, Mrs.Badamtsetseg B., Head of Macro-economic Statistics Department, NSO, Mr.Togtokhsuren D., Governor of Ovorkhangai *aimag*, Mr.Ganbold D., Deputy Mayor of Ulaanbaatar City, Mrs. Undarya T., General Coordinator, National Network of Mongolian Women's NGO, Mrs.Enkhtuya O., Director, The Nature Conservancy NGO, Mr.Dorjdari N., Manager, Economic Policy Issues, Open Society Forum, Mr.Gombosuren Ya., Professor, Mining Engineering School, MNUST, and Mr.Batbayar Sh, Former Minister for Social Welfare and Labour.

A series of consultations started with a brainstorming meeting on the theme of the Report on the 5th of December, 2008 with 74 leading representatives of various stakeholders who set the process in move. Many individuals were directly or indirectly involved in the preparation of background papers, supplementary studies, additional surveys and communication activities. Amongst those, our special thanks go to international and national writers lead by Dr. Anand P.B. and supported by Dr. Bolormaa Ts., Narmandakh D., and Iderbat L.

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We thank all involved individuals and parties in contributing to our efforts.

The report preparation team

Mongolia is a country with rich and abundant mineral deposits. But the real wealth of Mongolia is its people, and in recognition of this, the Parliament endorsed an MDG-based National Development Strategy in 2008 with an ambitious goal of bringing Mongolia's human development status to the same level as that of the developed countries by 2020. After declining during the transition many of the human indicators have now begun to improve and the country is on- track to achieving the above goal. As the Head of Government, I would like to confirm that human development is at the center of government policy and we are taking all efforts to achieve this goal.

Yet, Mongolia faces many challenges in achieving these goals. Major issues such as unemployment, poverty and inequality are coupled with environmental problems such as climate change, pasture degradation, natural disasters, droughts, dzuds, water and forest resource depletion, air and soil pollution. These issues evidently impact negatively on the livelihoods, health and wellbeing of the traditional nomadic herders and ordinary Mongolians.

Both sound policies and joint efforts are essential in solving these development challenges.

The current Human Development Report of Mongolia has been produced on the theme of "From Vulnerability to Sustainability: Environment and Human Development". The report is of significant importance since it presents readers the findings of innovative analysis of how environmental challenges affect human development and provides policy recommendations on priority issues.

Our generation engaged in resource-based economic development are the offspring of nomadic herders with multinnia-old tradition of living in harmony with nature. Therefore, it is everyone's duty to reinvigorate our ancestors' respect of environment and land and to contribute his/her utmost to the protection of our mother-nature.

Increasing consumption, economic growth and accelerating development of the mining sector are obviously intensifying the pressure on nature and environment. Economic growth is essential for the wellbeing of people. However, it is of utmost importance to be aware of how this growth would affect our future generations and at what cost the growth is built.

Today, protection of nature and environment has become a key issue at the center of the world's attention. We are facing the needs of exerting more efforts to keep our way of living in harmony with natural laws, develop green economy and introduce environmentally-friendly production technologies.

The conclusions and recommendations of this National Human Development Report are of great value for our country to strengthen and move forward with its progress and achievements in human development, especially, when we have stepped on the new path of resource-based dynamic development.

The Fifth National Human Development Report is the result of joint efforts of our prominent researchers and international advisors with the support of UNDP in Mongolia. The report presents a document which reminds us, Mongolians, to place human development at the center of development. We hope that the report will be an invaluable contribution in our endeavors in achieving the human development goals in the country.

May Mongolians Always Prosper!

Sukhbaatar Batbold
Prime Minister of Mongolia

UNDP works with countries across the world to prepare national human development reports, which are independent intellectual exercises that capture a wealth of empirical data to focus attention on current and emerging policy challenges as they relate to human development. All of them are based on the simple premise enunciated in the first global human development report that: "*People are the real wealth of a nation.*"

Mongolia produced its first human development report in 1997 and I am delighted to launch the fifth report: "From Vulnerability to Sustainability". Like the previous ones, this Report has also been prepared on a topic of considerable relevance to Mongolia. The Report shows that reducing the vulnerability of people, maintaining sustainability of natural resources, and promoting human development are not just closely connected but are integral parts of a strategy for sustainable human development.

The Report's intended audience includes policy makers at the national, regional and local levels, civil society and academia, international partners, multilateral financial institutions, and the general public. We hope that the Report will contribute to the ongoing national effort to address the challenges in moving from environmental vulnerability to sustainability while promoting human development.

The Report was prepared by a large group of national and international experts, and benefited from extensive stakeholder consultations and international technical assistance throughout its preparation. I wish to congratulate the team for their painstaking and hard work.

I look forward to this Report generating extended discussions about environment and human development in Mongolia, and the role of different stakeholders in addressing the challenges. As we celebrate the 50th year of Mongolia's accession to the United Nations, UNDP reaffirms its commitment to support the Government in its endeavour to improve the lives of the Mongolian people.

Sezin Sinanoglu
UN Resident Coordinator and
UNDP Resident Representative Mongolia

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BOXES

1. In Mongolia, a concern about the environment is almost as old as nomadic pastoralism. Additional concerns have emerged due to global and regional climate change, increasing frequency of natural disasters, a rapid increase in livestock population, and unprecedented mining-driven economic growth. These changes contribute to a sense of vulnerability - both nationally and for individual Mongolians.

2. Human development is about people - the real wealth of Mongolia. Reducing vulnerability, maintaining natural resources sustainability, and promoting human development are integral parts of a strategy for sustainable human development. ***The main message of this report is that promoting human development should be at the centre of strategies for achieving sustainability.*** While economic growth is essential for increasing material standards of living, growth is a means to achieve human development.

3. Human development is not merely about health and education. It is about enhancing substantive freedoms including 'freedom from want' and 'freedom from fear'. Environmental changes increase the nature of risks faced by many ordinary Mongolians. Environmental vulnerability can slow down further progress in human development and cancel out some of the recent gains.

4. Since its transition to democracy in 1990, real GDP per capita in Mongolia has more than doubled. According to the Global Human Development Report (HDR) 2010, Mongolia has a human development index (HDI) value of 0.622. It takes 100th place in a list of 169 countries. Mongolia is in a group of countries where HDI increased by over 1 percent per annum between 2000 and 2010. However, while there was consistent progress with regard to human development indicators, in particular income per capita and life expectancy and also on some environmental indicators, concerns about sustainability remain.

   National level sustainability indicators such as 'adjusted savings' indicate that energy and mineral depletion, forest degradation and air pollution damage are eroding a significant extent of the potential to invest and maintain the wealth of the nation.

5. ***The dzud (harsh winter drought) in 2010, which resulted in the loss of nearly a fifth of the nation's livestock, has highlighted the connections between environmental, economic and social aspects of vulnerability.*** Nearly nine thousand herders lost their entire livestock while several thousands of herder households lost a majority of their livestock.

   Mongolia is vulnerable to food insecurity. Notwithstanding impressive gains in national income and HDI, the number of persons under-nourished remained unchanged at 0.6 million during 1990-2007. Also, compared to many of its "HDI neighbours", Mongolia has a high number of persons affected by disasters.

6. Harsh climate is nothing new to Mongolians. However, climate change increases variability which can complicate decision-making by herders and others with traditional accumulated knowledge. Annual average temperatures have already increased by around 2.1^{0}C between 1940 and 2005. Climate change is likely to reduce permafrost and glacier covered areas, affect ecosystem boundaries, increase the variability of annual rainfall. Winter precipitations are likely to increase while summer precipitations decrease. Water resources are unevenly distributed with absolute water scarcity in at least 6 *aimags*. The situation regarding water insecurity is likely to worsen unless necessary steps are taken.

7. Climate change affects human development in many ways. With further deterioration of the steppe ecosystems due to a combination of both natural and human made factors, the ability to support livestock could be diminished. As a result, rural incomes could decrease. Herders may be required to move frequently and over longer distances; this could impact on the health and educational outcomes. Increased vulnerability could result in more people migrating to urban areas or taking up other risky jobs including small scale or micro-mining. Pastoralism that has been sustained for millennia could be threatened as younger generations leave for urban labour markets. Income inequality can increase further. All of these can impact on human security and life expectancy.

8. There is high level commitment by the government to address climate change issues. The special meeting of the cabinet convened by the Prime Minister in the Gobi in August 2010 issued a resolution calling on the global community to take urgent action. The Second National Communication to UNFCCC submitted by Mongolia in 2010 presents evidence on various impacts of climate change and adaptation and mitigation measures. The National Action Programme on Climate Change includes priority issues and activities for adaptation to and mitigation of climate change.

9. There are many challenges to realising the aims of mitigation strategy. The economy of Mongolia remains very carbon intensive though this intensity has been coming down significantly. ***Compared to many countries with similar HDI, Mongolia has high level of CO_2 emissions per capita.*** There is an urgent need to delink carbon and human development so that progress on human development does not have to cost the earth. Pursuing 'low carbon' or 'carbon-neutral' development path is crucial.

10. Though Mongolia is one of the most sparsely populated countries in the world, land degradation is an important challenge. Degradation of agricultural lands or grasslands is the main form of land degradation. Forest and steppe fires and mining account for a smaller share of all land degradation.

    Within Asia, Mongolia has the highest proportion of people living on degraded lands. Land degradation is occurring in all *aimags*. However, bulk of land degradation is occurring in five *aimags*, namely, Sukhbaatar, Dornogovi, Dundgovi, Ovorkhangai and Khovsgol. These five *aimags* together account for nearly 60 percent of all land degraded in Mongolia.

11. Forests contribute to the environment and the economy in many ways. About 5 percent of forest area is degraded each year. At this rate there is a significant risk that forests in some *aimags* (Orkhon, Dornod, Darkhan-Uul, Arkhangai and Bayan-Olgii) may completely disappear within a short time. Urgent steps are needed to address this. Annual revenues from logging use and hunting are very significant and have increased. Approximately, 600 thousand cubic metres of timber is consumed from forests. ***Forest area about the size of Ulaanbaatar is lost in forest fires every year***. With climate change and increased periods of dryness, there will be greater risk of forest fires in the future.

    Human development impacts of forest degradation include direct loss of hunting and forest produce which at present supplements household food production, indirect losses due to drying up of water resources or loss of firewood and consequently having to spend a greater proportion of household income or time on securing energy to keep warm. Other losses also include reduction in biodiversity which can further threaten the health of pastures and loss of species and accumulated knowledge.

12. The uneven distribution of water is exacerbated by climate change. Already, ***seven aimags face an absolute water scarcity with the amount of useable water resources per capita well below the international norm***. Data from water censuses of 2003 and 2007 suggests a rising trend in the proportion of water sources drying up especially in Dornod, Khentii, Orkhon, Sukhbaatar and Omnogovi.

13. Notwithstanding increasing water stress, the proportion of population nationally with access to improved sources of water increased from 58 percent in 1990 to 76 percent in 2008. However, a significant number of residents especially in large cities such as Ulaanbaatar remain dependent on tanker trucks. Some 41 percent of rural households depend on unimproved sources of water.

14. Lack of access to improved sources of water and sanitation has a direct impact on human development from increased health risks and increased risk of water borne diseases. Indirect impacts include reduction in freedoms, having to move over longer distances to obtain adequate water, with potential impacts on school attendance or completion of some children. Nearly one half of the population does not have access to improved sanitation though there is little data available to assess the proportion of people with access to improved water and sanitation at the *aimag* level.

Nationally some 39.2 percent of population is considered to be poor while in Ulaanbaatar this proportion is less than 29.8 percent. ***Poverty is concentrated in rural areas but urban poor households also face multiple vulnerabilities***. Lack of access to clean sources of energy and heating, lack of access to improved water and sanitation remain key challenges for many households. Air pollution in Ulaanbaatar fluctuates seasonally and exceeds the safe limits in winter months, thereby increasing health risk. ***Ulaanbaatar's CO_2 footprint has been estimated at about 13.5 tonnes per capita. This high level is largely because of the reliance on fossil fuels***.

15. In an attempt to track changes in environmental vulnerability, this report has developed a multi-dimensional environmental vulnerability (MEV) index using data from National Statistical Office (NSO) and the Ministry of Nature, Environment and Tourism (MNET). Vulnerabilities in 16 dimensions under three categories: social, economic and environmental, were considered. It shows that even while many issues remain equally important at national level, there is significant variation from one *aimag* to another. So, while forest fires are a key issue in Khentii, water scarcity is a major concern in Omnogovi. In some *aimags*, social or economic issues appear to contribute a lot more to overall multi-dimensional vulnerability while in others environmental quality indicators contribute to much of the vulnerability. On the whole, *aimags* with high human development index appear to be less vulnerable.

Key policy recommendations

16. Based on the analysis in this report, several detailed recommendations are possible. The following policy recommendations are presented under five priority themes.

A. Reduce environmental impacts

(A-1) Prepare a time-bound plan to significantly reduce CO_2 emissions in Ulaanbaatar. Consider strategies to reduce emissions from the energy sector, improve energy efficiency in all sectors including office buildings, transport, industry and commerce, and create incentives for energy-saving and CO_2-saving technologies. Set a deadline for Ulaanbaatar to become carbon neutral.

(A-2) Publish government's carbon and ecological footprints and aim to reduce these by 20 percent within five years. In consultation with international organisations and the United Nations (UN), develop a common strategy for achieving significant CO_2 reductions, CO_2 offsetting mechanisms and independent verification mechanisms.

(A-3) Reduce vulnerability of urban residents to urban air pollution in Ulaanbaatar, Orkhon, Darkhan and the *aimag* centres by improving energy use industries including CHP plants, heat only boilers and road transport – focusing on issues that are not covered but complement programmes by other international or national agencies.

B. Invest in conserving resources

(B-1) Design and develop Sainshand and other large scale urban development projects to become carbon neutral and go further to be net-contributors to bio-capacity. Apply these principles in relation to regeneration of Erdenet and Darkhan where this is relevant.

(B-2) Take necessary steps to secure access to improved water to all citizens. Develop systematic collection of data at the *aimag* level on persons with access to water and sanitation.

(B-3) Build on the success of 'national tree planting day' with institutional measures to promote tree planting activities as part of wider efforts to combat desertification, promote biodiversity and conserve water resources. Develop the necessary organisational capacity to deliver these outcomes.

(B-4) Develop a rapid response mechanism to control forest and steppe fires with the involvement of a number of relevant stakeholders at the *aimag* level in the first instance in the worst - affected *aimags*.

C. Empower citizens to participate in decision making at all levels

Participation of all stakeholders in decision making is crucial to sustainable human development. This corresponds to 'agency freedoms' i.e., freedom to participate in civic and community life, to be valued as a person, to have the ability to express opinions.

(C-1) Develop a better understanding of citizens' vulnerability. Organise a national workshop of stakeholders to discuss, design and develop a Multi-dimensional Environmental Vulnerability indicator based on international practice and national conditions. Based on this, selected indicators may be piloted by the NSO and MNET and the results presented via national and local workshops to mainstream the indicators.

(C-2) Consolidate the progress already made with regard to gender equality law and the ideals of equality mentioned in Comprehensive National Development Strategy. There is an urgency to constitute a '*multi-stakeholder-group on human security*' to analyse and reduce the instances of violence against women as a step to improve human security and in turn to lay foundations to social and environmental sustainability.

(C-3) Support the educational institutions and Non-Governmental Organisations (NGOs) already doing pioneering work in environmental education and create *aimag* and

soum level 'citizen environmental councils'. Encourage and facilitate such councils to prepare local human development and environment reports periodically.

D. Strengthen the capacity of national and local institutions

(D-1) Constitute a *National Human Development Commission* (NHDC) with members from government, academia and civil society to mainstream human development in national level policies. While the National Human Rights Council focuses on protecting human rights such as right to life, the NHDC should be empowered to set policy guidelines based on international best practice for the use of the Human Development Fund and monitor its utilisation. The NHDC should focus on reducing vulnerability – social, economic and environmental.

(D-2) To reduce vulnerability of rural households, develop and strengthen local common property institutions and common oversight mechanisms such as 'rules of use of the steppe' and the size of livestock.

Develop further the role of community based forest conservation and biodiversity protection institutions in *aimags* with considerable forest land area.

Also, promote research in (a) impact of climate change and other environmental factors on human well-being and (b) natural resources management such as developing grass and plant varieties with seeds that can be easily propagated by livestock.

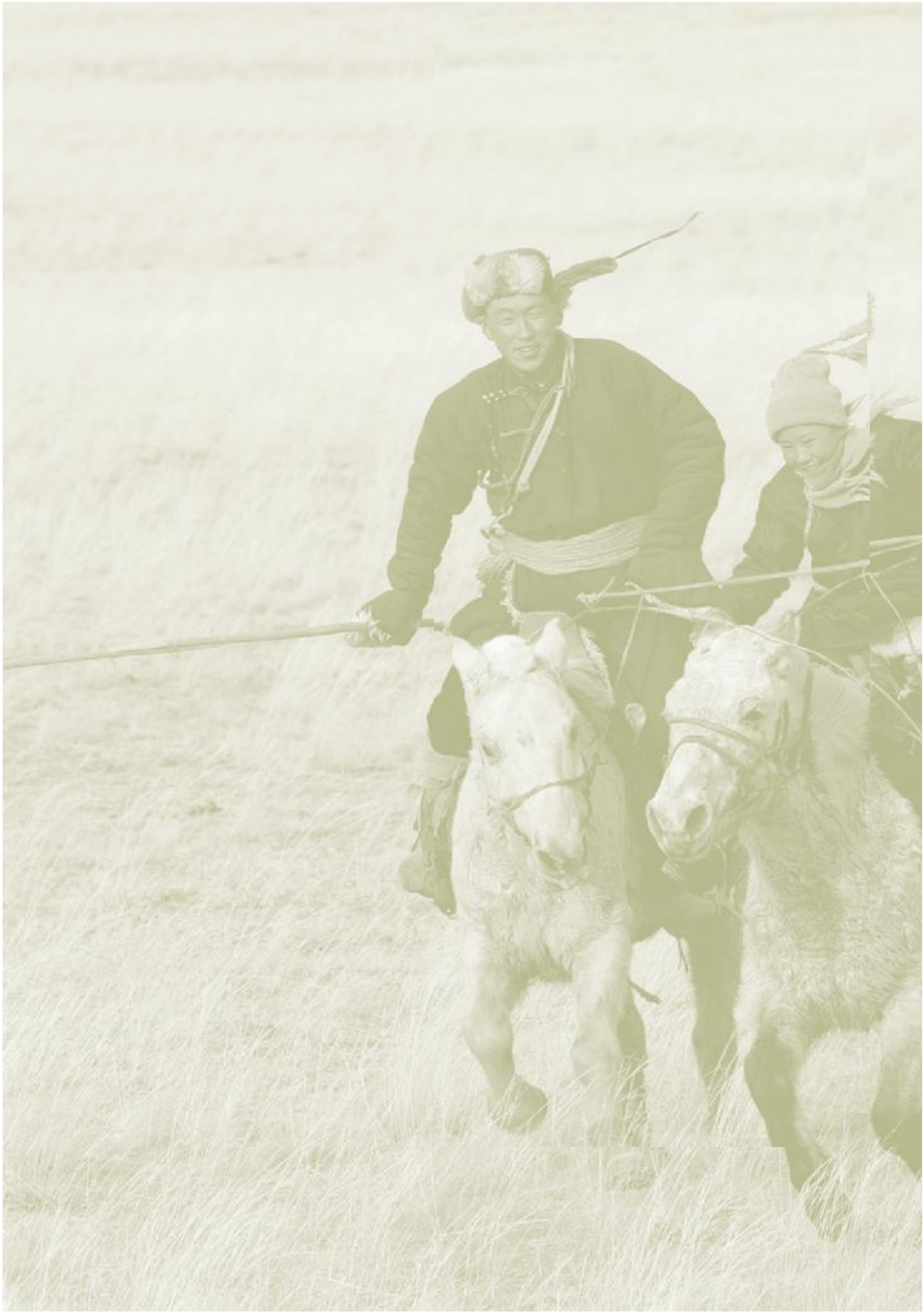
(D-3) Develop the organisational and leadership capacity of *bagh* and *soum* level institutions in the *aimags* and *khoroo* and district level institutions in the Capital city to track changes in environmental vulnerability and use the human development approach in policy making.

(D-4) Support the NSO to develop necessary statistical measures including poverty and environmental statistics, access to water, sanitation and energy and the key indicators of human development to enable the bag and *soum* level organisations to monitor progress.

E. Lead and mobilise international co-operation

(E-1) Consolidate Mongolia's position in international climate change negotiation by hosting a meeting on 'Climate change adaptation by the Land-locked developing countries' (LLDCs) between 2012 and 2015 and aim to host a global summit of the Environment Ministers of all the Conference of Parties of a post-2012 climate change treaty between 2015 and 2020.

(E-2) Use international co-operation to promote technology transfer and develop internal market and fiscal instruments.



CHAPTER 1

SUSTAINABILITY AND HUMAN DEVELOPMENT: OVERVIEW

1.1 Introduction

Environment is a central feature of the economy and culture of Mongolia. Many passages in the *Secret History* describe in great detail the environment and various flora and fauna. Mongolia also boasts a long experience of protected forest areas with Bogd Khan Uul protected area created in 1778 (Myagmarsuren and Enebish, 2008:31). However, with demographic and economic transition and increasing emphasis on mining, concerns about the environment and long term sustainability have become very important.

There are many reasons for this growing concern about the environment. There is clear evidence of significant warming consistent with climate change in Mongolia. The consequences of climate change in terms of potential health impacts, irreversible changes that could undermine rural ecological base, and decline and vulnerability of water resources are all causes of concern. Second, the total livestock in Mongolia nearly doubled in the twenty years since 1990 leading to a debate on the sustainability of pastures and economic and social costs of land and pasture degradation. Third, as mining becomes an important driver of the economy and exports, concerns are being raised about its potential and actual environmental impacts. Fourth, as the share of urban population steadily increased to over 63 percent, many urban infrastructure services in the larger urban areas are facing capacity constraints. In particular, deteriorating air quality due to increased air pollution mainly from energy use and its likely impact on health are also concerns. Mongolia has made steady and significant progress in human development. The challenge now is to continue the trajectory of progress in achieving human development without compromising on sustainability and environmental conservation goals.

This report argues that realising sustainable development and promoting human development are in effect part of the overall aim of promoting human flourishing and freedoms. The concept of human development puts people at the centre of development. An approach based on human freedoms is essential to embed the principles and values of sustainability, equity, efficiency, participation and inclusiveness into all development strategies and decisions.

1.2 Mongolia-the context

Location plays an important role in Mongolia's economy and its environment. As land-locked country, Mongolia is in a strategic location in central part of Asiatic continent between China and Siberia of Russian Federation. Much of the country is about 900 to 1,500 m above sea level, though there are several high mountains in the Altai mountain range. In terms of ecosystems, it is located at the meeting point of Central Asian desert steppe and Arctic Taiga ecosystems. Mongolia has a harsh continental climate. Coldest month is usually January when mean temperatures can dip down to minus 30^0C to 34 ^{0}C in the mountain areas of Altai and Khangai. In July, average temperatures in the Gobi are usually between 20^0C and 25^0C while the highest temperature recorded so far has been 44^0C. Annual mean precipitation is about 300-400 mm in the mountain areas in the North West and is between 150 and 200 mm in the steppe and less than 100 mm in the Gobi. As a result, fresh water availability varies significantly with location. With land area of about 1.5 million square kilometres Mongolia is among the 20 largest countries. However, with only 2.8 million inhabitants, Mongolia is among the most sparsely populated nations. Landlocked countries often face the 'tyranny of geography' whereby distance from sea-ports disadvantages them in international trade. The time and cost involved in moving goods by land and across borders can make them less competitive.

Since its transition to democracy in 1990, successive governments have tried to use economic policies to overcome locational disadvantages. During the first five years of transition, economic growth faltered and overall national income per capita decreased. However, after 1996, the economy recovered and since then there has been a trend of positive growth rate. In 2009, per capita income registered a decline due to fall in commodity prices in the light of the 2008 Global Financial Crisis. Preliminary estimates for 2010 suggest that there has been a modest recovery (Figure 1.1).

Figure 1.1: **Real gross national income per capita, Mongolia, 1985-2010**

Source: World Bank, 2010. World Development Report 2010.

Both internal and external factors contributed to this impressive growth performance. As will be seen later in this chapter, Mongolia's human development index (HDI) also steadily improved between 1990 and 2010, with significant increases in all three elements, namely, life expectancy, education and income. However, this trajectory of progress could be at risk from environmental changes.

In terms of governance, Mongolia's 1992 Constitution provides for a parliamentary republic. The President is directly elected by all citizens for a term of four years. The national people's legislature, the *State Great Khural* has 76 members also elected for a term of four years. The leader of the majority party or coalition forms a government as the Prime Minister and appoints a cabinet in consultation with the President and with the approval of the *State Great Khural*.

Administratively, Mongolia is divided into 21 *aimags* and the capital city. Most maps and statistics also show Mongolia into four regions, namely, Eastern, Central, Khangai, and Western regions. There is no political institution at the level of regions. The sub-national or local government institutions are at the level of *aimag* or capital city. The capital city is further constituted into 9 districts and these into 132 sub-districts or *khoroos*. The 21 *aimags* are constituted into 329 *soums* and these further into 1,550 *baghs*. The Constitution provides for self-governance at all levels. *Bagh* governors are proposed by the *bagh* assembly and appointed by the *soums*; *soum* governors are proposed by the *soum* assemblies and appointed by the *aimags*; the *aimag* governors are proposed by *aimag* assemblies and appointed by the Prime Minister. At each level, the governor's office has the responsibility to prepare plans and implement policies.

However, local governments have limited financial autonomy and a low tax base. Most of their revenue comes by way of transfers from national government. There are also issues regarding organisational capacity, human resources and skills and a high monitoring effort required to ensure effectiveness. There is limited scope for exploiting economies of scale due to vastness of area and limited population. Consequently, unit costs of administrative services could be higher as many functions need to be duplicated at different levels. There is the issue of gender inequality in representation in offices at all levels of local government. Nationally, only 17 percent of all local governors in 2010 were women (MDSWA, 2010). Notwithstanding these difficulties, on the whole there is a reasonable institutional structure of democratic local governance albeit one which needs to be strengthened.

1.3 Vulnerability, sustainability and human development

Reducing vulnerability, pursuing sustainability and promoting human development are all closely related – more so in a country where many economic activities are directly connected with nature.

Understanding vulnerability

The concept of vulnerability is related to fragility of a society and its ability to absorb risks and external and internal shocks. Historically, Mongolians have adapted to a harsh environment and developed nomadic pastoralism and associated cultural values. However, rapid changes in social, economic and environmental dimensions are raising new forms of vulnerabilities. With particular regard to climate change, vulnerability "...is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change" (IPCC, 2007). The more resilient societies are those that are better prepared for risks and shocks and are better able to absorb them when they do occur. In any society, certain shocks such as natural disasters or global food and fuel price movements affect all households; other indirect or second-order shocks are transmitted through the state, market and social institutions. If such institutions are well-developed, then such shocks would be fully absorbed by such institutions without affecting people's well-being. However, if such institutions do not exist or if they are not robust enough, the shocks will have the effect of reducing the incomes and well-being of all people but the most vulnerable are likely to suffer most.

The concept of human security is highly relevant to human development which focuses on two freedoms: 'freedom from want' and 'freedom from fear'. Human security is person centred idea of security and in its narrow version focuses mainly on freedom from fear. As the 1994 Global Human Development Report noted: "...for most people, a feeling of insecurity arises more from worries about daily life than from the dread of a cataclysmic world event. Will they and their families have enough to eat? Will they lose their jobs? Will their streets and neighbourhoods be safe from crime? Will they be tortured by a repressive state? Will they become a victim of violence because of their gender? Will their religion or ethnic origin target them for persecution?" However, as that Human Development Report and many others subsequently argued, 'freedom from fear' is closely related to 'freedom from want'. A broader view of human security requires securing and enhancing all freedoms not merely a section or class of freedoms. While human development focuses on enhancing substantive freedoms, human security concerns securing the freedoms that do exist.

In a previous study by Government of Mongolia and UNDP (2005), vulnerability was defined as "...the risk of being negatively affected by shocks that impact the growth and development path of a country, usually with negative consequences for human security". In that study, alternative approaches based on national level indicators were considered. One approach, based on the Commonwealth Vulnerability Index (CVI) put Mongolia at 20th place in a list of 112 countries from the most vulnerable to least vulnerable. An alternative approach using the Economic Vulnerability Index (EVI) developed by the United Nations Committee of Development Practice also puts Mongolia among the more vulnerable countries at a rank of 19 among 64 countries. Both these approaches emphasise the economic vulnerability of Mongolia. However, for human security, it is important also to assess how this national level picture translates to or impacts on different individuals or sections of society within

Mongolia. More importantly, in addition to economic security, it is also important to assess other factors of security[1] especially environmental security.

Both rural and urban economies of Mongolia are very closely related to natural resources. Nomadic pastoralism that has been practised for millennia in the Mongolian steppe is currently under threat due to various factors including climate change and variability in precipitation, human induced land degradation, overgrazing, and mining activities. Climate change and other environmental factors can increase the vulnerability of herder households and other rural households. This increased vulnerability can in turn force them to take actions which will further undermine the sustainability of other resources such as water resources, forests and range lands.

The urban economy is equally dependent on natural resources because of the central role played by mining in both output and exports. The dip in economic performance during 2009 is a reminder of the economic vulnerability of mineral driven growth. Rural to urban migration, lack of access to basic urban services including heating, water and sanitation, increased intensity of energy use, consequent air pollution are all manifestations of vulnerability of urban households.

In Mongolia, an important element of overall vulnerability of households is the environmental vulnerability. The Global HDR 2010 includes five aspects of environmental vulnerability, namely: population living on degraded land, population without access to water and sanitation, deaths due to indoor and outdoor air and water pollution, and population affected by natural disasters.

1 The 1994 Global Human Development Report identified seven aspects of human security namely: economic security, food security, health security, environmental security, personal security, community security, political security.

Defining sustainability

Reducing vulnerability and increasing resilience are closely related to promoting sustainability. Sustainable development is clearly recognised as the central plank of government policies. The Millennium Development Goals (MDG) based Comprehensive National Development Strategy (CNDS) outlines sustainable development as one of the principles of Mongolia's national development, with a focus on development of a 'sustainable knowledge based economy', 'creating a sustainable environment for development by promoting capacities and measures on adaptation to climate change, and protecting the country's ecosystems. Further, the vision for Mongolia's national development emphasises abundant natural resources, economic entities are called upon to protect the environment and introduce environmentally-friendly technologies.

Sustainability has narrow and broader interpretations. Narrow interpretation is focused mainly on 'natural resources' and in this view, sustainability is to keep capital (investment) intact by maintaining and protecting natural resources such as forests, wetlands, ecosystems, and endangered species such as those in the Mongolian Red Book.

A society's net wealth made up of human made capital (buildings, infrastructure), natural capital (energy resources, minerals, forests, steppe, water resources and the atmosphere) and knowledge capital. The *strong sustainability* approach requires that each form of capital is maintained intact. Environmentalists who argue for preservation of forests, special protected areas or certain species in essence take a strong sustainability perspective. The main difficulty is how to deal with exhaustible resources such as mines which cannot be replaced.

The *weak sustainability* approach allows for some compensation and substitution

between different forms of capital. One form of capital, for example the mineral wealth may be exhausted provided the overall wealth is maintained by investing 'equivalent' amount in other forms of capital.

This 'stewardship' view of environment is however, limited in its reach. Though the intention of this approach is positive, it can also lead to a 'technocratic' and top-down approach to sustainability where ordinary citizens and firms are part of the problem and experts (such as rangers, ecologists, scientists) are part of the solution.

Linking sustainability and human development

The World Commission on Environment and Development (1987) chaired by Gro Harlem Brundtland defined sustainable development as "development that meets the needs of the present generation without compromising the ability of future generations to meet their needs". This definition highlights at once that (a) a concern for sustainability cannot be detached from a concern for meeting the needs of present generation; (b) sustainability requires actions to ensure that ability of future generations to meet their needs is not compromised. However, the main criticisms relate to the word needs. As Amartya Sen (2009) commented: "Certainly, people have 'needs', but they also have values, and, in particular, they cherish their ability to reason, appraise, act and participate. Seeing people in terms only of their needs may give us a rather meagre view of humanity." There are also problems with the words: meeting, compromising, and future generations. Words such as meeting or compromising are highly subjective and contextual. The obligation to future generations does not clarify whether it is an obligation to immediate successor generation or one to follow way into the future or to each and every generation that follows from now on until eternity.

Robert Solow offered an alternative definition. For Solow, what is to be sustained is not a specific resource but 'the generalised capacity to achieve economic well-being' or 'standard of living'. For Solow (1992), "a sustainable path...is one that allows every future generation the option being as well off as their predecessors". Sen (2009) points out that while this definition is comprehensive and the emphasis on standard of living can include environmental conservation, we may value and have reason to value many things which may not matter at all to our standard of living.

To Anand and Sen (1994, 2000), sustainable development is essentially about sustainable human development in terms of enhancing substantive freedoms and capabilities of present generation without compromising the capability of future generations. Sustainable human development therefore includes social, cultural, and environmental dimensions in addition to economic considerations. The 27 Rio Principles (from the declaration at the UN conference on environment and development at Rio de Janeiro in 1992) also echo sustainable human development. The first principle states "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature." Further, principles 3 and 10 emphasise equity and participation dimensions while other principles identify important responsibilities of state and international actors.

From this brief review, it is clear that sustainable development is about human development i.e., expanding freedoms. A question may be posed how human development is related to preserving or conserving specific species or ecosystems or natural resources. An approach based on freedoms is not the same as a free for all (where every person can do whatever they like). There is no contradiction between enhancing substantive freedoms and conserving pristine wilderness areas such the Lake Khovsgol special protected

area or protecting endangered species such as the snow leopard. If advances in human development are achieved by degrading the environment or putting certain ecosystems or protected areas at risk, it is not *sustainable* human development.

The idea of freedoms inherent in sustainable human development includes the freedom to know and care about the environment and to take part in institutions governing the environment and the processes of decision making. Therefore, sustainable development is not limited to making of laws and regulations, essential as they are. Sustainability also requires the strengthening of participation and ownership of local communities and citizens in the making of decisions on conserving pristine and protected areas or endangered species. Deliberations and public reasoning should be at the centre of any such strategies[2].

1.4 Human development in Mongolia

According to the 2010 Global Human Development Report, Mongolia is among medium human development countries. It occupies 100th rank amongst 169 countries.

Articles 14 and 16 of the Constitution of Mongolia framed and adapted in 1992 guarantee several freedoms of Mongolia's citizens. Human development features in the very first paragraph of the Millennium Development Goals (MDG) based Comprehensive National Development Strategy (CNDS) endorsed by the State Great Hural in January 2008. In a small survey of 100 rural households we conducted in March 2010, however, 57 percent of respondents said that they have heard the expression human development but they do not have a full idea.

In this report, the expression human development means 'expanding substantive freedoms'. Human development is not merely about health and education. A human development approach means putting people at the centre of development strategies and creating opportunities for them to exercise freedoms. In the literature on freedoms, a distinction is sometimes made between 'well-being' freedoms which relate to physical, social, psychological and emotional well-being and 'agency' freedoms which relate to the ability to be actively involved in making decisions (Sen, 1992; 1999).

Human Development Index

Since its introduction in the 1990 Global Human Development Report, the human development index (HDI) has been used as an alternative way to compare development performance of countries. HDI captures only some aspects of human development. It does not capture issues related to gender dimensions, inequality, governance and participation dimensions. Though we use HDI as a convenient indicator of human development, we should remember that it reflects only a small part of human development (Box 1.1).

Box 1.1 HD and HDI

"Not surprisingly, the HDI, which proved very popular in public discussion, has a crudeness that is somewhat similar to that of Gross National Product (GNP), the crude HDI did what it was expected to do: work as a simple measure like GNP but, unlike GNP, without being oblivious of everything other than incomes and commodities. However, the huge breadth of the human development approach must not be confused, as it sometimes is, with the slender limits of the HDI."

-Amartya Sen in the introduction.
In the Human Development Report 2010
(UNDP, 2010a)

Until 2009, HDI was calculated as an arithmetic mean of three indices, namely, gross domestic product (GDP) per capita, life expectancy index and an education index (based on gross enrolment ratio and adult literacy). The Global HDR 2010 introduced a new method based on geometric mean

2 Participation of stakeholders has been crucial throughout the process of writing of this report. See *Appendix-1* for details of various ways in which different groups of stakeholders were consulted.

Table 1.1: **Determinants of HDI, component indexes and HDI, Mongolia, 1980-2010**

Year	Life expectancy	Expected years of schooling	Mean years of schooling	GNI per capita	Life expectancy index	Education index	GNI per capita index	HDI
1980	56.4	9.9	6.5	...	0.579	0.511	...	...
1985	58.9	10.5	7	2259	0.615	0.546	0.404	0.514
1990	60.8	9.8	7.6	2132	0.645	0.550	0.395	0.520
1995	62.5	7.7	7.7	1988	0.672	0.491	0.384	0.502
2000	64.2	9.5	8.1	2195	0.699	0.559	0.400	0.538
2005	65.5	12.6	8.2	2765	0.719	0.648	0.435	0.588
2010	67.3	13.5	8.3	3619	0.748	0.675	0.477	0.622

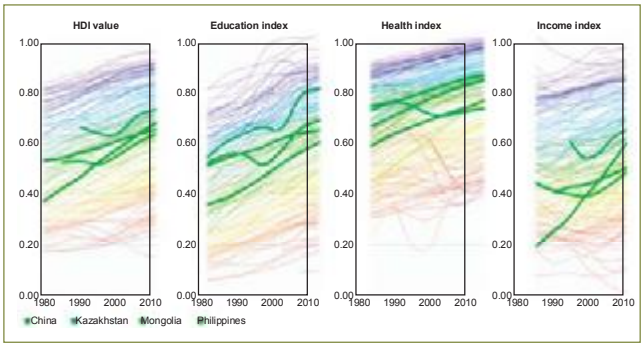
Source: UNDP, 2010a. Human Development Report 2010.

and using gross national income (GNI) per capita, life expectancy index, and a new education index[3]. The new education index takes into account the expected years of schooling a child entering school age today can attain. According to the new approach, Mongolia's HDI is estimated to be 0.622 in 2010. Table 1.1 shows the values of new education indicators, new indexes and the trends in the component indices and overall HDI for Mongolia since 1980.

As the Global HDR 2010 noted, Mongolia's HDI (0.622) is higher than the average for the medium human development countries (0.592) but is lower than the average for all countries in East Asia (0.65). Between 1990 and 2010, average annual growth rate in HDI value is 0.9 percent. Between 2000 and 2010 this value is 1.43 percent.

A comparison of Mongolia with China, Philippines and Kazakhstan suggests that making steady progress over long period of time is crucial. In 1980, China's HDI was the lowest amongst these four countries but by 2010 China's HDI has surpassed both Philippines and Mongolia. Though a significant extent of this improvement is visible in China's economic growth (and hence increase in income index in the last panel), more or less throughout the period, China had highest value for the health index. With regard to education index, we can see that education received some setback during transition years of early 1990s in both Kazakhstan and Mongolia and in both cases the recovery has also been quite swift (Figure 1.2).

Figure 1.2: **Human Development Indicators – Comparison with Human Development Index neighbours**



Source: UNDP, 2010a. Human Development Report 2010, Chapter 2.

This discussion suggests that while there has been significant progress with regard to HDI in Mongolia in the last twenty years, there is considerable further progress to be made. The CNDS endorses the need for a time-bound progress in HDI as a priority:

> *"A policy shall be pursued to fully achieve the Millennium Development Goals and reach human development index of 0.83 by 2015, continuously improve the 'Quality of life of Mongolians' through creating favourable conditions to live healthy, sound minded, long and peaceful lives, respect their history and culture, work creatively, uncover and develop their intellectual abilities, talents and skills, enjoy ample choices and opportunities."*

3 In the previous method of calculating HDI using arithmetic mean, advances on one component can compensate for shortcomings in another component. Thus, individual components become perfectly substitutable. In the new approach of geometric mean, the components are not perfectly substitutable.

Table 1.2: **Medium human development countries in descending order of annual growth rate of HDI during 2000-2010**

HDI 2010 Rank	Country	Human development index (HDI)				HDI annual growth rate		
		1980	1990	2000	2010	1980-2010	1990-2000	2000-2010
108	Indonesia	0.390	0.458	0.500	0.600	1.43	1.35	1.82
124	Cambodia	..	..	0.412	0.494	..	..	1.81
119	India	0.320	0.389	0.440	0.519	1.61	1.44	1.66
125	Pakistan	0.311	0.359	0.416	0.490	1.52	1.55	1.64
112	Tajikistan	..	0.592	0.493	0.580	..	-0.10	1.61
107	Maldives	..	..	0.513	0.602	..	..	1.60
89	China	0.368	0.460	0.567	0.663	1.96	1.83	1.57
122	Lao People's Democratic Republic	..	0.354	0.425	0.497	..	1.69	1.56
114	Morocco	0.351	0.421	0.491	0.567	1.59	1.49	1.44
100	Mongolia	..	0.520	0.539	0.622	..	0.90	1.43
113	Viet Nam	..	0.407	0.505	0.572	..	1.70	1.24
117	Equatorial Guinea	..	..	0.477	0.538	..	..	1.21
99	Moldova (Republic of)	..	0.616	0.552	0.623	..	0.06	1.21
98	Botswana	0.431	0.576	0.572	0.633	1.28	0.47	1.01

Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

An ambition to reach HDI of 0.83 (in the previous approach to measurement) means graduating from medium human development group to high human development group (i.e., HDI value above 0.677 in the new approach to measuring HDI). Moving from HDI of 0.622 to 0.677 requires an overall growth in HDI of about 0.9 percent per annum over a period of ten years (which appears feasible based on the trend that annual growth rate of Mongolia's HDI was 0.9 percent in 1990-2000 and 1.43 percent in 2000-2010).

During the period 2000-2010, other medium human development countries where HDI increased at a faster rate than Mongolia's include: Indonesia, Cambodia, India, Pakistan, Tajikistan, China, Lao People's Democratic Republic, and Morocco (Table 1.2). Many of the 'high performers' seem to share a common feature, namely, that high growth in HDI is sustained over a long period of time.

Thus, it is important to make progress with regard to all three dimensions (income, education, and health) and these improvements must be done in a sustainable manner (i.e., not at the cost of environmental and social objectives).

Reaching high HDI status: education and health

What does it mean for Mongolia to move to high human development group? The average for all medium human development countries (hereafter 'medium HDI' group) for adult literacy rate is 80.7 percent. This figure for the high human development countries ('high-HDI') is 92.3 percent. On adult literacy, secondary and tertiary enrolment rates, Mongolia is already comparable to, if not ahead of, high HDI countries (Table 1.3). However, it is clear that stronger progress is needed to improve the primary enrolment ratio.

Table 1.3: **What distinguishes low human development countries from high human development countries: Education indicators**

Categories	Adult literacy rate	Primary enrolment ratio (net)	Secondary enrolment ratio (net)	Tertiary enrolment ratio (gross)
Very high human development	...	95.6	91.7	70.8
High human development	92.3	94.4	74.9	43.2
Medium human development	80.7	88.5	57.0	17.6
Low human development	61.2	73.4	30.9	6
Mongolia	97.3	88.7	82.0	49.8

Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

Table 1.4: **What distinguishes low human development countries from high human development countries: Health indicators**

.Categories	Infant mortality rate (per 1,000 live births) 2008	Under 5 mortality rate (per 1,000 live births) 2008	Adult mortality –female (per 1,000 population) 2008	Adult mortality –male (per 1,000 population) 2008	Age standardised death rates from non-communicable diseases (NCD) (per 100,000 population) 2004
Very high human development	5	6	60	114	418
High human development	18	21	106	216	666
Medium human development	38	49	140	206	678
Low human development	83	134	339	376	851
Mongolia	34	41	145	291	923

Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

Similarly, there is still considerable progress to be made on the health indicators. Infant mortality rate for high HDI countries is 18 compared to Mongolia's infant mortality rate (IMR) of 34. Under-5 mortality rate for high HDI countries is nearly half of that of Mongolia's figure of 41 (Table 1.4).

HDI and poverty

Poverty is not merely about lack of income. It is also about lack of opportunity and the ability to influence life choices. Persistence of poverty is incompatible with a human development approach with its focus on freedoms.

In Mongolia, various surveys conducted by the National Statistical Office (NSO) provide information on poverty headcount at periodic intervals. According to these surveys, poverty headcount has not changed much during the last fifteen years. However, World Bank estimates based on US$ 1.25 a day (PPP) and US$ 2 a day (PPP) poverty lines suggest that initially poverty in the 1990s may have gone up but since then it has decreased significantly.

Measuring poverty is subjective as this depends on how the poverty line is defined and once it is defined whether and how it is periodically adjusted to take into account inflation and changing tastes and preferences. The figures in the Table 1.5 appear to present dramatically different pictures (Box 1.2). In an economy which is significantly dependent on food imports, an international poverty line using purchasing power parity adjustment may not be capturing the welfare effects of food price inflation and how it affects different sections of the society. While there is not much change in incidence of poverty at the national level, poverty seems to have increased in Ulaanbaatar from 27.3 to 29.8 percent between 2002 and 2010, whereas in the countryside, it has gone up from 42.7 to

Table 1.5: **Trends in poverty and HDI - different estimates, Mongolia,1995-2010**

Year	Population below US$ 1.25 a day poverty %	Population below US$ 2 a day %	Population below National poverty line %	Multi-dimensional poverty	HDI (new)
1995	18.8	14.4	35.6	...	0.502
1998	34.2	26.3	...	...	...
2000	...	...	...	...	...
2002	15.4	12.2	36.1	...	...
2005	...	17.2	...	...	0.588
2006	...	...	32.2	...	...
2008	...	...	35.2	...	...
2010	...	...	39.2	15.8	0.622
Source	World Bank	World Bank	NSO	HDR 2010	HDR 2010

Sources: NSO, 2009; UNDP, 2010a; World Bank, 2010.

54.2 percent[4] (Box 1.2).

Box 1.2: Debate: Has poverty in Mongolia decreased?

Notwithstanding the impressive economic performance, there are concerns whether the recent growth has resulted in poverty reduction and whether inequality has been increasing. The Household Socio-Economic Surveys (HSES) conducted by the National Statistical Office (NSO) estimate poverty based on basket of consumption bundle. NSO estimates indicate that between 2002 and 2008, proportion of households below national poverty line has decreased slightly from 36.1 percent to 35.3 percent. This reflects the view that as economy grows; the minimum acceptable consumption bundle also needs to be adjusted, in addition to making any adjustments to take into account inflation.

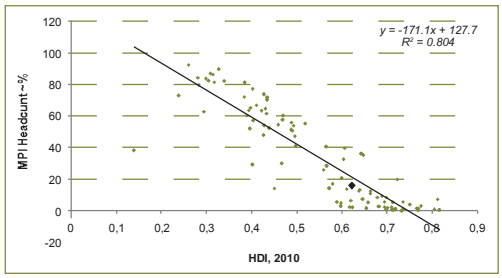
However, a World Bank (2008a) report estimates based on the same surveys but keeping the poverty line consistent and unchanged (and adjusting for inflation based on consumer price index) indicated that national poverty rate decreased from 36.1 percent to just below 15 percent. This is based on view that when comparing poverty at different points in time it is necessary to hold the consumption bundle constant except over a long period of time when tastes and preferences would have changed.

Due to the limitations of income based head count measures of poverty, in the Global HDR 2010, a multi-dimensional poverty indicator (MPI) has been introduced. The MPI methodology proposed by Alkire and Foster (2009) is based on household level data and it provides a detailed picture of the number of dimensions in which a household is poor and the intensity of such poverty.

A strong negative association between HDI and multidimensional poverty (headcount) is evident (Figure 1.3). Niger has HDI of 0.261 and more than 92 percent of the people are multi-dimensionally poor; Latvia has HDI of 0.769 and less than 0.3 percent of population is multi-dimensionally poor. In comparison, 15.8 percent of population in Mongolia is in multidimensional poverty.

4 This issue is revisited briefly in Section 4.3 in Chapter 4 in relation to urban bias.

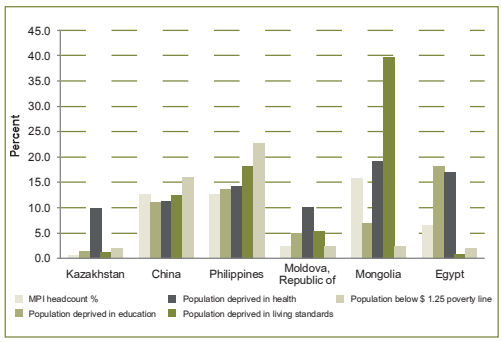
Figure 1.3: **Human Development Index and Multidimensional Poverty Index, selected 98 countries**



Source: Estimated based on data from UNDP, 2010a.
Note: Mongolia shown as black dot.

According to the data on MPI components, around 7 percent of Mongolia's population is deprived in educational dimension. Another 19 percent of all Mongolians are deprived in health dimension. Relative to Mongolia's HDI-neighbours, deprivation in Mongolia is more pronounced in health and living standards dimensions. This is evident from the MPI data for Mongolia and some of its HDI neighbours (Figure 1.4).

Figure 1.4: **Multidimensional Indicators of Poverty (2000-2008) by selected countries**



Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

Inequality and human development indicators

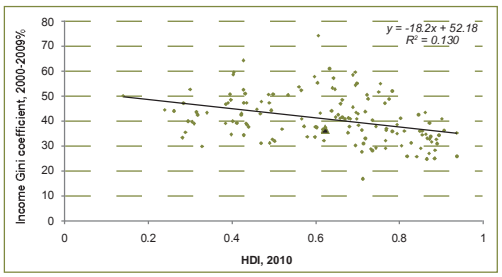
The emphasis on freedoms in a human development approach also requires that opportunities are available to all irrespective of their gender, location, disability or other aspects of identity.

Gini coefficient is a common indicator of income inequality. Latin American countries

such as Brazil, Columbia and Chile have high level of income inequality reflected in the high values of Gini coefficient in the range of 52 to 58 percent. Countries such as Norway, Sweden, Denmark and Finland have low level of income inequality and their Gini coefficient is around 25 percent. In comparison, Gini coefficient for Mongolia increased from 32 percent in 2002 to 36.6 percent in 2008.

In general, a movement towards high HDI suggests a lower level of income inequality (Figure 1.5).

Figure 1.5: **Human Development Index and Income Inequality, selected 145 countries**



Source: Estimated based on data from UNDP, 2010a.
Note: Mongolia shown as black dot.

Income inequality in Mongolia is lower than some of its 'HDI-neighbours'. For example, Namibia has HDI of 0.606 but Gini coefficient of 74 percent. In Namibia, the top 10 percent of households accounted for 50 percent of all expenditure while the bottom 10 percent of households had less than 1 percent (Namibia National Planning Commission, 2008). Egypt has HDI of 0.62 but Gini coefficient of 32 percent.

The inequality adjusted human development index presented in the Global Human Development Report 2010 assesses the impact of inequality on human development outcomes. Mongolia's HDI (using a new method introduced in the report) is 0.622 placing it at rank 100. The impact of inequality would reduce this HDI to 0.527 (a loss of 15 percent). Within the three dimensions of life expectancy, education, and income, the biggest impact of inequality in Mongolia appears to be on life expectancy (Table 1.6).

Mongolia's ambition to move to high 'human development' status requires that inequalities are reduced in all dimensions but more so in relation to life expectancy and living standards.

Vertical and horizontal inequalities

Measures such as the Gini coefficient highlight 'vertical' inequality such as economic inequality or income inequality.

According to Household Socio-Economic Survey (HSES) 2007-2008 the consumption share of bottom 20 percent of the population is 7.3 percent while the share of top 20 percent of population is 43.4 percent. HSES 2010 findings suggest that the situation has not changed much with the corresponding proportions being 7.8 and 41 percent respectively. The gap between the shares of bottom and top 20 percent of households were similar in both rural and urban populations.

Table 1.6: **Inequality and human development indicators, all countries**

Categories	HDI 2010	Inequality adjusted HDI	Overall loss %	Inequality adjusted life expectancy index	Loss %	Inequality adjusted education index	Loss %	Inequality adjusted income index	Loss %
Very high human development	0.878	0.789	5.0	0.907	5.0	0.810	5.7	0.668	19.5
High human development	0.717	0.575	13.8	0.718	13.8	0.561	17.6	0.472	28.1
Medium human development	0.592	0.449	22.4	0.611	22.4	0.369	29.3	0.401	21.9
Low human development	0.393	0.267	40.8	0.348	40.8	0.227	38.2	0.242	23.2
Mongolia	0.622	0.527	15.2	0.579	22.6	0.635	5.8	0.399	16.4

Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

Table 1.7: **Aspects of gender inequality and HDI, all countries**

Categories	HDI 2010	Gender inequality index	Maternal mortality rate	Adolescent fertility rate	Parliamentary seats%	Labour force participation rate female%	Labour force participation rate male %
Very high human development	0.878	0.319	8	19.1	20.5	65.3	80.2
High human development	0.717	0.571	82	47.7	13.3	52.7	79.5
Medium human development	0.592	0.591	242	41.8	16	54.7	84.1
Low human development	0.393	0.748	822	108.9	14.4	61.3	83.4
Mongolia	0.622	0.523	46	16.6	4.2	70.0	79.5

Source: UNDP, 2010a. Human Development Report 2010, Statistical Annex.

However, as the work of Frances Stewart (2002), Martha Nussbaum (2000 and 2006), Bina Agarwal (2007) and others shows, it is very important to consider 'horizontal' inequalities such as between men and women or between different groups or communities (for example, different ethnic groups) and spatial inequalities (i.e., between urban and rural populations or different regions). For instance, the average per capita monthly consumption for urban households was 139,440 MNT while the figure for rural households was 109,780 MNT as per the HSES 2010.

Another dimension of inequality is evident from spatial or regional variations. For example, more than 51 percent of households in Western and Khangai regions were poor as compared to around 29 percent of households in Central region and in Ulaanbaatar being poor.

Gender inequality is another important structural and horizontal inequality. The Global HDR 2010 includes a gender inequality index computed on the basis of gender based inequality in reproductive health, empowerment, and labour market. For reproductive health, maternal mortality rate (MMR), and adolescent fertility rate (AFR) are used as indicators. Share of parliamentary seats and secondary and tertiary education enrolment rates are used as indicators of empowerment; labour market participation rate is used as indicator of inequalities in labour market. The gender inequality index (GII) constructed using these values ranges from 0 to 1 with higher values indicating higher level of inequality. The Netherlands (the most gender equal country) has GII value of 0.174 while Yemen (the most gender unequal country) has GII of 0.853. The overall GII for Mongolia is 0.523 as compared to 0.591 for all medium HDI countries (Table 1.7).

There is some evidence from Reproductive Health Survey (NSO, 2009a) that the proportion of women-headed households has increased from 10 percent in 1998 to 15 percent in 2008. The Time Use Survey (NSO, 2009b) noted that: "...single parent households continue to be especially vulnerable. In some cases, women are left alone with children due to the death of their husband or divorce. Other women in herding households choose to live separately in order to be closer to schools and health care."

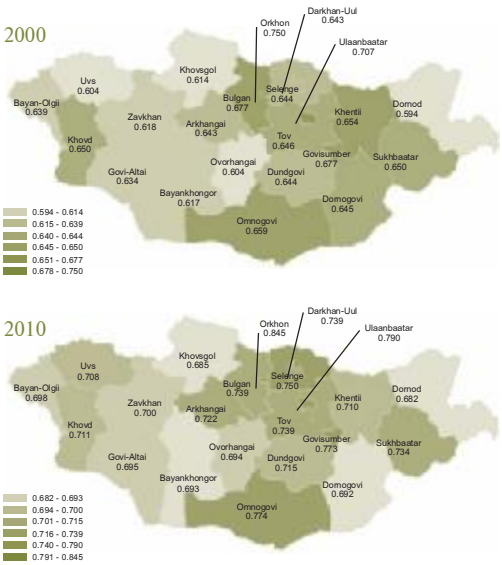
In some respects, Mongolia has a strong record on gender dimensions. Life expectancy at birth for women is almost 7 years greater than that for men; female adult literacy rate and female combined gross enrolment ratios are greater than corresponding male averages. Nearly two thirds of university and higher education graduates are women. All of these suggest that significant progress has been made. However, gender inequality in terms of opportunities seems prevalent. Though women outnumber men in tertiary and

professional education, only 4 percent of Parliament seats are held by women. Around 16 percent of all chair-persons of local level people's *khural* at *bagh*, *soum* and *aimag* levels, are women. Out of 13,000 civil servants in Mongolia, nearly 7,200 are women. However, women tend to occupy many lower level positions. Among the 500 highest level positions of leading officers and principal officers, 154 (or around 30 percent) are women. Based on a three year study conducted by the National Commission on Gender Equality and supported by the Asian Development Bank, recently, the law of gender equality has been passed in February 2011. The implementation of this law is likely to lead to improvements in some of the issues mentioned above. However, there is progress to be made in ensuring that decision making processes at all levels are inclusive and representative of the population they are serving.

Spatial variations in Human Development within Mongolia

As with any aggregate indicator, the national headline figure of HDI does not reflect regional or local variations. National and local HDI data is available based on 'old method' of arithmetic mean index. Low HDI *aimags* are: Dornod, Khovsgol, Dornogovi, Bayankhongor, Ovorkhangai, Govi-Altai and Bayan-Olgii. High HDI *aimags* include Orkhon, Ulaanbaatar, Omnogovi, Govisumber and Selenge (Figure 1.6).

Figure 1.6: **Human Development Index (old methodology) by *aimag*, Mongolia, 2000 and 2010**



Source: NSO, 2011. Mongolian Statistical Yearbook 2010.

The map above also suggests that a central corridor is emerging as high HDI corridor and *aimags* in both Eastern and Western periphery are lagging behind.

This highlights the need to develop policies to address spatial and regional variations in human development within Mongolia.

1.5 Sustainability indicators

So far we have mainly considered progress with regard to human development indicators. What about sustainability? There are various ways in which sustainability can be considered. Here, two indicators are considered: adjusted savings and ecological footprint.

Adjusted savings

An indicator of weak sustainability is the adjusted savings rate. This is savings rate adjusted for consumption of fixed capital as well as natural capital. Suppose the gross savings rate is 3 percent per annum but consumption of fixed capital is 10 percent, such a society is not saving enough. This results in net consumption of fixed capital of 7 percent. Such a situation will lead to gradual erosion of fixed capital. Continuing with this analogy, genuine savings rate provides an indicator whether savings rate is adequate to cover consumption of fixed capital and also depletion of natural resources. A society that saves (and thus invests) more than it takes from its environment is considered to be sustainable.

In the World Bank's calculations, adjusted savings rate is obtained by adjusting

gross savings rate for three components, namely: consumption of fixed capital, environmental impacts, and education expenditures. The first two items are negatives while the last item is considered as 'adding to knowledge capital'.

Adjusted savings = Gross savings - {consumption of fixed capital} - {energy depletion + mineral depletion + forest degradation + air pollution damage} + {education expenditure}.

Though gross savings rate for Mongolia in 2008 was 26.5 percent, adjusted savings was 3.2 percent. Consumption of fixed capital (9.67), energy (5.94) and mineral depletion (9.24) appear to have contributed to most of the difference between gross savings and adjusted savings (see Appendix 2). These calculations suggest that Mongolia needs to reduce consumption of fixed capital, reduce dependence on energy and mineral depletion and invest more on education.

Nations such as Bhutan have very high adjusted savings rates; other such as Slovakia have very high negative adjusted savings (-80 percent). Many resource dependent nations such as Trinidad and Tobago, Chile, Saudi Arabia, and Azerbaijan have higher HDI than Mongolia but lower adjusted savings rate than Mongolia. On the other hand, Botswana and China have HDI value fairly close to Mongolia's 0.622 but have very high level of adjusted savings.

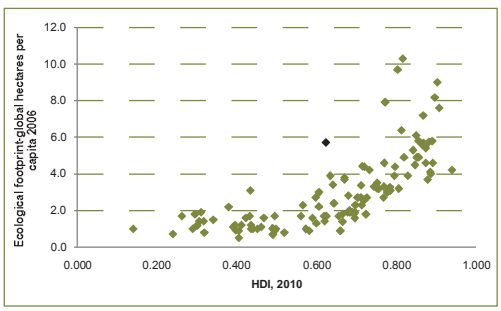
These calculations should be considered as indicative of the challenges rather than as being accurate measures. For instance, CO_2 damage depends on quantity of CO_2 emissions and the valuation of damage per tonne of CO_2. At present, CO_2 damage appears to have been valued very low[5]. For example, in the case of China, CO_2 damage reduces adjusted savings by merely 1.26 percent and in the case of USA, CO_2 damage reduces savings by 0.3 percent. Similarly, net forest depletion is accounted as zero (0) for many countries including Mongolia. These issues suggest that the assumptions made in this methodology need to be re-visited and both data and methods need to be improved. However, the overall point remains valid that in order to be sustainable, countries need to reduce negative environmental impacts and increase investment in human capabilities in terms of education.

A commitment to human development is much broader than the few indicators that have been included in adjusted savings approach. Thus would include commitments to protect the freedom to live a long and healthy life (hence, decreasing air pollution, PM10 damage), to invest in freedom to know (educational expenditures), and to protect the freedoms of future generations (sharing inter-generational resources fairly, conserving forests, reducing CO_2 damage).

Ecological footprint

Some proponents of 'strong sustainability' approach suggest that different aspects of environmental resources should not be considered as substitutes. One of the environmental indicators suggested is an 'ecological footprint' defined as the extent of land area in global hectares required to meet the consumption requirements and absorb the wastes. The Global Footprint Network (GFN) publishes data on footprint for a number of countries. The relationship between HDI and ecological footprint (Figure 1.7) suggests that ecological

Figure 1.7: **Human Development Index and Ecological footprint, selected 117 countries**



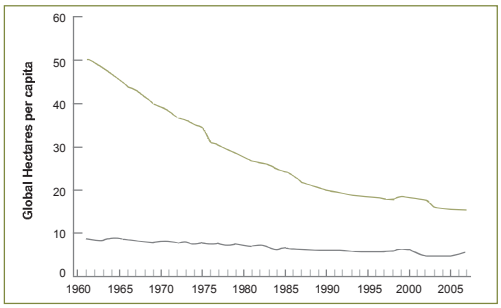
Source: Estimated based on data from UNDP, 2010a.
Note: Mongolia shown as black dot.

5 See Bolt et al (2002) for details on the methodology of calculating adjusted savings.

footprint is likely to increase significantly as countries move from medium to high human development index level. However, there is considerable variation. For example, both Norway and USA have HDI value above 0.9 but Norway's ecological footprint is around 4.2 global hectares per capita whereas ecological footprint for USA is 9.0 hectares per capita.

Mongolia's ecological footprint is estimated to be 5.5 global hectares per capita. Trend in terms of ecological footprint and bio-capacity are shown in Figure 1.8.

Figure 1.8: **Ecological footprint and Bio-capacity, Mongolia, 1960-2005**



Source: Global Footprint Network, 2010. Ecological footprint atlas of the World 2010.

Ecological footprint of Mongolia slightly decreased from 1961 until 2004 but there has been a slight upward increase since then. Mongolia's bio-capacity has also decreased steadily from around 50 global hectares per capita in 1961 to around 15.1 global hectares per capita in 2007. Mongolia remains an 'ecological creditor' i.e., its bio-capacity is still greater than its ecological footprint. In an analysis of several countries, Neumayer (2010) considers HDI of a country to be unsustainable if the ecological footprint (EF) of the country is above the global threshold bio-capacity. Many developed countries which have high HDI do come up as unsustainable in Neumayer's analysis. Mongolia is also included in the unsustainable group. However, as the gap between these two lines in Figure 1.8 narrows down, the net absorption capacity is decreasing.

Mongolia's ecological footprint is much higher compared to most of its 'HDI neighbours' among the medium human development countries (Table 1.8).

The headline figure of 5.5 global hectares per capita puts Mongolia on par with countries such as Kazakhstan (4.5), Malaysia (4.9), Saudi Arabia (5.1), Singapore (5.3), and Kuwait (6.3).

Nearly 70 percent of Mongolia's ecological footprint comes from 'grazing footprint' while carbon footprint accounts for 22 percent. For many countries mentioned above, much of their footprint is due to their carbon footprint. This highlights three important issues: (i) as Mongolia aims to move from medium to high human development level, policies are needed to

Table 1.8: **Ecological footprint of Mongolia in comparison to HDI neighbours**

Country	Ecological Footprint of Consumption	Cropland Footprint	Grazing Footprint	Forest Footprint	Fishing Ground Footprint	Carbon Footprint	Built-up Land
Kazakhstan	4.5	1.05	0.18	0.16	0.02	3.07	0.06
China	2.2	0.53	0.11	0.15	0.12	1.21	0.09
Philippines	1.30	0.47	0.03	0.09	0.33	0.32	0.06
Moldova	1.4	0.32	0.07	0.11	0.07	0.79	0.03
Mongolia	5.5	0.26	3.89	0.13	0.00	1.24	0.01
Egypt	1.7	0.63	0.06	0.14	0.05	0.62	0.17
Indonesia	1.2	0.42	0.02	0.14	0.22	0.33	0.07
Cambodia	1.0	0.48	0.06	0.25	0.07	0.14	0.04
Tajikistan	1.0	0.48	0.14	0.02	0.00	0.28	0.08
India	0.9	0.39	0.00	0.12	0.02	0.33	0.05

Source: Global Footprint Network, 2010. Ecological footprint atlas of the World 2010.

make sure that such increase in HDI does not come with an increase in ecological footprint; (ii) policies will be needed to de-couple development from carbon emissions; and (iii) decisions concerning pasture land management and herding will be crucial to have any impact on Mongolia's ecological footprint.

Investing resource revenues

An important indicator of sustainability especially for mineral resource rich nations is the extent to which such mineral revenues are invested. As minerals are non-renewable, inter-generational fairness requires that benefits from minerals are equitably distributed across generations. Under the weak sustainability approach and Solow's (1992) definition of sustainability, fairness is not violated if present generation uses mineral wealth but the capacity of future generations to be well-off is maintained. This requires that mineral rents should be invested and not consumed (Box 1.3).

There is little disagreement that rents from natural resources must be invested. However, the debate is mainly about how best to invest.

The Human Development Fund (Box 1.3) in Mongolia appears to be modelled on the Alaska Permanent Fund which has been built up from oil revenues. The market value of Alaska fund is estimated to be around US$ 40 billion (May 2011). Based on returns from investing the fund, every citizen of Alaska is paid a dividend. In recent years, these were around US$ 1,200 per person. The Sovereign Wealth Funds of Abu Dhabi and Kuwait are examples where natural resource revenues are held in state controlled investment accounts. The Government Pension Fund of Norway and Timor Leste's Petroleum Fund are examples of highly transparent and arm's length mechanisms to manage resource revenues. In both cases, most of the funds are invested abroad (to minimise adverse macro-economic effects by way of appreciation of local currency). There are numerous institutional checks and balances to prevent appropriation of the funds.

Direct cash distribution to all citizens was recommended in the case of Nigeria by Sala-i-Martin and Subramanian (2003). Their argument is that pooling all resource revenues into a wealth fund would exaggerate the accountability and governance problems and create further incentives for government capture. They argued that distributing oil revenues directly to all citizens helps in

Box 1.3: The Human Development Fund

In July 2009, the State Great Khural passed the Law on Human Development Fund. The intention appears to be to create a sovereign wealth fund from mining revenues. The sources of the fund are:

- Income from selling shares and dividends of state property in legal entities who own mines of strategic significance;
- Fees for exploration and processing activities in the mining sites;
- Advance payments and loans in regards to using the mining with strategic significance;
- Income from bonds, loan certificates and savings interest which were offered into both international and domestic financial markets by the human development fund;

The Human Development Fund is expected to provide benefits to citizens in terms of: pension and health insurance contribution; contribution to buy a house; health and educational costs; and cash. In 2010, the State Great Khural (Parliament of Mongolia) Resolution No. 99 of December 30, 2009, the HD Fund allocated MNT 328 billion as a cash grant of MNT 120,000 (approximately US$ 92) for each citizen of Mongolia. The Law on the 2011 Budget of Human Development Fund stipulates that MNT 805 billion should be distributed to citizens thus: MNT 20.2 billion for health insurance payment; MNT 702.5 billion as cash. (MNT 21,000 per citizen); MNT 82.5 billion for tuition fees for students. Cash payment accounts for nearly 87 percent of all benefits. Though per capita amount distributed is small, nationally, these are significant. For instance, the amount distributed in 2010 is equivalent to 16 percent of state budget; and in 2011 it is equivalent to nearly 40 percent of state budget.

Source: Based on the Law and further verbal interviews

curtailing the influence of government. The main advantages of a cash transfer programme is that it is universal; it reduces scope for leakage and corruption; it allows for individuals to invest in "...what they value and have reason to value". However, opponents of cash transfers argue that they can reduce incentive to save or invest, increase 'unnecessary' consumption, can contribute to inflation, and reinforce inequality of power within household or family. There is also a concern that the annual payments could be subject to swings depending on election cycles.

From a review of political economy of resource funds, Humphreys and Sandbu (2007:227) argued that "...designers of natural resource revenue funds should look first to the political incentives in their country, and attempt to design fund rules that not only approximate the optimal fiscal policy, but more importantly, create political incentives for abiding by that policy".

Investing in education and health is considered crucial. Pineda and Rodriguez (2010) find that resource rich countries did indeed have better rate of growth than non-resource rich countries in non-income aspects of human development, especially enrolment and literacy.

The Extractive Industries Transparency Initiative (EITI) is a global and voluntary mechanism to encourage resource rich countries to improve transparency of resource revenues. Mongolia became a compliant country in October 2010.

This brief review of issues suggests that with Human Development Fund and EITI compliance, Mongolia has already taken important steps to ensure that benefits from mineral revenues are delivered to citizens. However, there is a need for creating necessary institutions with a mandate and independence to study international best practice and use this in the management of Human Development Fund.

1.6 Summary

Since its transition to democracy in 1990, Mongolia has made steady and significant progress in improving human development. Human development is recognised and given priority in the MDG based Comprehensive National Development Strategy adapted since 2008. This strategy also identifies a vision of graduating to high human development level by 2015.

While economic growth faltered during the 1990s, since 2000, there has been a steady and significant growth. Notwithstanding the steady progress, income inequality appears to have increased. There is some debate on whether or not Mongolia's economic growth resulted in poverty reduction. This debate is mainly about how poverty should be measured and compared between two points in time. Corresponding with economic growth performance, human development index value for Mongolia steadily increased during the period 1990-2010. The growth rate of HDI between 2000 and 2010 has been nearly 1.5 percent per annum.

A comparison with 'HDI neighbours', namely other countries also at or about the same level of HDI as Mongolia suggests that maintaining steady progress over a long period of time is essential to increase HDI significantly, making steady progress in all components of HDI, namely economy, education and health. The inequality adjusted HDI suggests that inequality is eroding away the gains made from any increases in especially in relation to life expectancy and more significantly in material standards of living. Focusing on improving access to various basic services and housing conditions and reducing inequality in these dimensions is crucial.

However, these impressive gains in human development are at the risk of environmental sustainability. Various alternative indicators are considered. On the basis of adjusted savings, Mongolia's

growth path appears only marginally sustainable. Adjusted savings rate is only 5 percent compared with gross savings rate of above 26 percent. Much of the difference is due to consumption of fixed capital, mineral and energy depletion. With regard to investing natural resource revenues, Mongolia has already passed the HD Fund law and has become a complaint country of the global scheme of EITI. However, at present a majority of the HD Fund is delivered through cash transfer than through investment in human development.

On the basis of ecological footprint also, Mongolia appears to have a footprint significantly higher than almost all of its HDI neighbours. Though its ecological footprint of about 5 global hectares per capita is well within its bio-capacity of about 15 global hectares per capita, the gap between these two indicators has steadily declined during the last 50 years. On a third indicator in terms of population living on degraded lands also, Mongolia comes out as being highly vulnerable as compared to many of Mongolia's HDI neighbours. From all these indicators, it is clear that environmental impacts should be carefully considered. It is essential that further progress in human development indicators takes place without compromising on environmental sustainability objectives.

CHAPTER 2

CLIMATE CHANGE AND VULNERABILITY

2.1. Introduction

In the 1920s, Mongolia became the centre of attention of palaeontologists with the discovery of a large numbers of fossilised dinosaurs. Nearly a century later, Mongolia is amongst the top ten producers in the world for another fossilised substance, namely, coal. The Gobi desert of today would have been a dense forest over 300 million years ago. In the process of extracting fossilised carbon worldwide and burning it to release energy, there is a danger that climate change could increase peoples' vulnerability.

This Human Development Report (HDR) is about Mongolia's environmental challenges and moving from vulnerability to sustainability. Globally climate change is a major source of present and future vulnerability.

The urgency to act now is clearly identified by the Global HDR 2007/2008 on climate change:

> *"Climate change is the defining human development issue of our generation... Climate change threatens to erode human freedoms and limit choice...How the world deals with climate change today will have a direct bearing on the human development prospects of a large section of humanity. Failure will consign the poorest 40 percent of the world's population – some 2.6 billion people – to a future of diminished opportunity. It will exacerbate deep inequalities within countries."* (UNDP, 2007)

Climate change in Mongolia manifests itself in many forms such as rising temperatures, increasing variability of precipitation, melting of permafrost, and changes in the pattern of soil moisture. All of these have significant impacts on ecosystems in general and agriculture and pastures in particular. These in turn will impact livelihoods and human development outcomes. Recognising these issues, the Prime Minister addressed a Cabinet meeting in the Gobi desert in August 2010 to highlight climate change and its potential contribution to desertification. This chapter attempts to summarise some of the key issues in relation to climate change in Mongolia and assess its effects on human development.

2.2. Climate change in Mongolia

Mongolia faces a unique situation both as a victim of global climate change and yet in some way contributing to increased use of carbon as a major producer and exporter of coal. The Mongolian Assessment Report on Climate Change (MARCC) issued by the Government of Mongolia in September 2009 and the Second National Communication (SNC) to UN Framework Convention on Climate Change provide a comprehensive assessment of various aspects of climate change, its impacts and mitigation issues. In this section, some important aspects of climate change in Mongolia are briefly summarised. Much of this discussion presents evidence on observed climate change.

Increasing trend in mean temperatures

Mongolia's climate is described as continental climate. Winter temperatures vary between minus 15^0C and minus 30^0C and summer temperatures range between plus 10^0C and 27^0C. Records indicate that there has been considerable long-term rise in both summer and winter temperatures. The annual mean temperature has increased by 2.14^0C since 1940. MARCC and SNC documents present data to suggest a long-term secular increase in mean temperatures.

Increased variation in rainfall

Much of Mongolia is semi-arid to arid. Average annual precipitation is 300–400 mm in the Khangai, Khentii and Khovsgol mountainous regions; 150–250 mm in the steppe; 100–150 mm in the steppe-desert; and 50–100 mm in the Gobi-desert.

About 85 percent of total precipitation falls from April to September, of which about 50–60 percent falls in July and August. It is predicted that winter is becoming milder while summer is becoming hotter and drier.

As per the projections by Inter-Governmental Panel on Climate Change (IPCC), precipitation in the Northern and Central Asia is likely to increase. The fourth Assessment Report of IPCC (2007) noted that for Mongolia, there has been 7.5 percent decrease in summer precipitation and 9 percent increase in winter precipitation. This trend of decreased rain in summer and increased rain in winter has also been highlighted in the SNC.

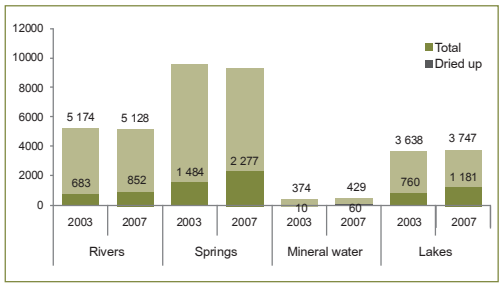
IPCC observed that throughout Asia, intensity of rain has been increasing. In Mongolia too, observations from Arvaikheer (in Ovorkhangai *aimag*) for the period 1979–1996 indicate that the frequency of heavy rain increased by 18 percent (SNC:184). In a qualitative study, herders in the Gobi reported that rain is increasingly falling over small patches of area – thus described as 'silk embroidery rain' (*torgonii hee boroo*) (Marin, 2010). The increasing intensity of rain is captured in the vocabulary of 'hard' rain (*shiruun boroo*) rather than 'soft' rain (*shivree boroo*) which is thought to be essential for grass to recover after a prolonged dry period.

Variability and drying of surface water resources

Total freshwater resources of Mongolia are estimated to be about 599 cubic km in 1999. Of this, 83.7 percent of all freshwater is contained in 3,500 lakes (with Khovsgol lake alone accounting for more than two thirds of this). Another 10.5 percent of freshwater exists in the form of glaciers. With the melting of glaciers and permafrost, water levels in snow-fed lakes are likely to rise. Studies during the period 1963–1995 indicate that water levels in lakes Uvs and Khovsgol have already increased by 1 to 2 m (Batnasan, 2003).

A further 5.8 percent of freshwater is in 3,811 rivers and streams. The long-term data do not show a significant trend in the volume of flow of surface waters. However, surface water flow volume increased by a small extent from the mid 1970s until the early 1990s and then dropped from 1993 onwards. Though these rivers and streams contain only a small share of all freshwater in Mongolia, they are the life-blood of rural communities in much of Mongolia. Both qualitative perceptions and census data of water sources (Figure 2.1) indicate that surface water sources, especially rivers and streams are reported to be drying up.

Figure 2.1: **Surface water sources drying up, Mongolia, 2003 and 2007**



Source: NSO, 2011. Mongolian Statistical Yearbook 2010.

Shrinking of permafrost and glaciers

Some 63 percent of land in Mongolia has some type of permafrost. MARCC noted that data of last 30 years showed snow cover depth in the mountains of northern Mongolia to be decreasing. Changes in cryosphere in general and in glaciers in particular are important indicators of climate change. A global assessment of glaciers notes that Russian studies show that in Altay "...glaciers have been shrinking continuously since the mid 19th century accelerating from seven percent ice loss between 1952 and 1998 to four percent between 1998 and 2006" (UNEP, 2009:45). Melting of snow cover is correlated with air temperature. Using projected air temperatures, it has been estimated that glacier melting in Tsambagarav mountain will increase from 89 cm observed in 2005 to 131 cm for

the period 2010-2039 and 371 cm for the period 2040-2069 (MARCC, 2010:60). These results also suggest that there is a high probability that snow cap of up to 50 metre depth would have completely melted by 2040.

MARCC projections based on trends suggest that by the area of continuous permafrost will decrease from 14 percent in in 2010 to less than 5 percent in 2039. The area of non-permafrost land could increase from 50 percent to 80 percent by 2080.

The MARCC includes a brief discussion on potential impacts of shrinking of glaciers and permafrost on landslides and also increased annual variation in riverflows. Their projections suggest an increase in river flow by 10 mm in the Khentii mountains by 2020 and by 2 to 5 mm in other mountains but a decrease in rivers elsewhere. This is likelt to have an impact on water resource distribution and consequently on productivity and carrying capacity of pastures, availability of water for livestock and human consumption.

Ecosystem boundary shift and landscape change

Data from satellite imagery suggest significant land surface changes in Mongolia between 1992 and 2006. Barren areas (i.e. areas without grass) increased by 46 percent from 1992 to 2002. This area almost tripled by 2006 and that forest area decreased by more than 26 percent (MARCC, 2010). Changes in temperature and precipitation raise questions about the ability of native plant species to adapt and survive.

Extent of desertification

Mongolia is a signatory to UN Convention to Combat Desertification. Some 78 percent of Mongolia's territory is considered to have been affected by medium to high rate of desertification (SNC, 2010). In the desert and semi-desert areas, thinness or lack of snow cover, dryness of soil, lack of rainfall in summer and increased sand content of soil result in inadequate vegetation and soil being blown away by winds continuously. Reversing or halting desertification requires efforts to increase vegetation and reduce water loss by evapotranspiration. Human activities that contribute to land degradation include monotonously increasing livestock heads and overgrazing on the one hand, and mining on the other. Land degradation is examined in detail in Chapter 3.

Increasing intensity of dust storms

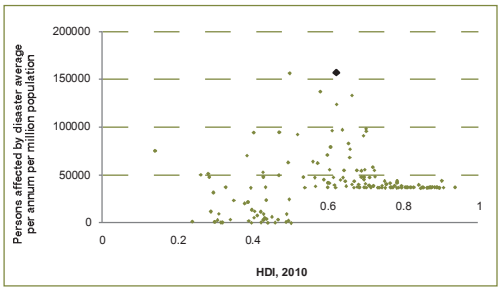
North Eastern Asia is prone to dust storms. However, severe dust storms seem to occur mainly in Mongolia and in Inner Mongolia (Shao and Dong, 2006). Dust storms are classified on the basis of visibility: floating dust can occur at low wind speeds while blowing or drifting dust occurs with strong winds. In both cases, visibility is between 1 to 10 km. Dust storms occur with strong winds and in such cases visibility is reduced to less than 1 km. In case of severe dust storms, visibility is down to less than 200 m. Dust storms appear to be becoming frequent in and near urban areas due to soil erosion (MARCC, 2010:195).

Dust storms can have significant health and economic impacts. Health impacts include breathing difficulties and increased risk of pneumonic disorders. Economic impact can include productivity losses due to diversion of labour from productive activity to take preventive action against dust storm, increased housekeeping effort and impact on the price of wool of sheep affected by dust. For example, Ai (2003) estimated that the economic impact of yellow dust storms in 2000 on the regional economy of Beijing to include immediate impacts to the tune of US$ 66 million and delayed impact of US$ 198 million. The overall impact on the regional economy of Beijing was calculated to be 3.5 percent.

Natural disasters

A significant proportion of the Mongolian population is vulnerable to natural disasters. As per data presented in the Global HDR 2010, Mongolia is the second most vulnerable country after Swaziland in terms of the number of persons per 1 million population affected by natural disasters. If we express this as percentage, 15 percent of population in Swaziland, 12 percent of population in Mongolia, 10 percent of population in Tajikistan and 9.6 percent of population in China were affected on average every year during the period 2000–2009 by natural disasters (Figure 2.2). Landlocked countries tend to have more persons per 1,000 population affected by disasters (Cohen and Werker, 2008).

Figure 2.2: **Human Development Index by number of persons per 1 million population, affected by natural disasters during 2000–2009, all countries**



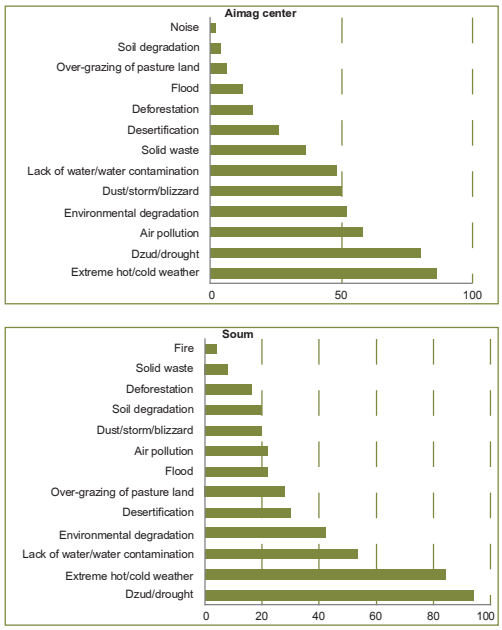
Source: Estimated based on data from UNDP, 2010a.
Note: Mongolia shown as black dot.

According to the MARCC (2010:62), Mongolia has experienced approximately 25–30 atmosphere-related natural phenomena since 1970. About a third of these were considered natural disasters. The frequency of atmosphere-related natural disasters that occurred in Mongolia over the period 1980–2005 suggests an increasing trend.

2.3. Stakeholder perspectives on climate change

One of the main challenges for a human development perspective on climate change is whether the subject is considered too technical for engaging in public deliberation. In our survey of 100 households from four *aimags*, namely, Khovsgol, Ovorkhangai, Tov, and Orkhon, we asked the respondents what the five top environmental issues for them were. These four *aimags* are by no means representative of Mongolia; however, they cover some of the variation in ecosystems and human development indicators. As can be seen from Figure 2.3, disaster or *dzud* is a top priority issue; but almost all the high priority issues are connected with climate change.

Figure 2.3: **Climate change and environmental factors that affect the daily life of people, by percentage, Mongolia**



Source: Urban 100 households and rural 100 household surveys for the Mongolia HDR, 2011.

More specifically, a majority of respondents in our 100 resident's survey in the four *aimags* disagree that climate change is not an important issue for Mongolia (Figure 2.4a).

Climate change is not merely an issue for the rural households. In our survey of 100 urban households in the *ger*[6] districts

6 *Ger* – the traditional, circular Mongolian house can be assembled in a matter of hours from wooden frames, felt insulation, and exterior cloth. *Ger district* refers to parts of Ulaanbaatar where many households continue to live in gers. In these areas, poverty incidence is high and access to urban services is limited. See Chapter 4.

Figure 2.4a: **Responses from 100 rural residents**

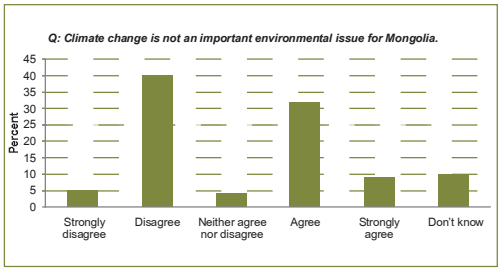
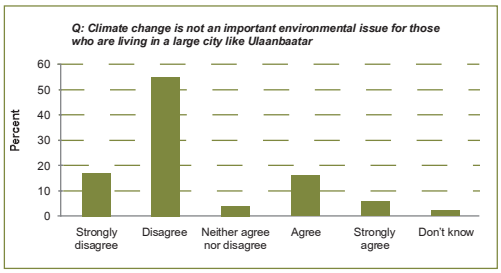


Figure 2.4b: **Responses from survey of 100 urban households**



Source: Urban 100 households and rural 100 households surveys for the Mongolia HDR, 2011.

of Ulaanbaatar also, climate change is considered to be an important issue (Figure 2.4b).

Though climate change is recognised as an issue, it is not clear if this leads to change in behaviour. This may be an example of the working of so called Giddens's paradox, namely, "... since the dangers posed by global warming aren't tangible, immediate or visible in day to day life, however awesome they may appear, many will sit on their hands and do nothing of a concrete nature about them" (Giddens, 2009). Based on what we have observed in Mongolia, we may propose an extension to Giddens's paradox (let us call this HDR paradox) namely that "climate change is invoked often and presented as a cataclysmic event of such magnitude that any motivation to do anything about it is completely deflated". However, we need not despair as there is some reason for optimism. Again from our 100 rural respondents' survey, there is a clear recognition that climate change is something that requires actions by government as well as other agents.

2.4 Climate change projections

The Second National Communication (SNC) report provides a summary of the projected summer and winter temperatures and precipitation based on various models. These projections suggest that mean air temperatures are likely to continue to increase and while winter precipitation may increase, summer precipitation is likely to decrease. The MARCC report notes:

"Generally, the climate of Mongolia is anticipated that winter will become mild and summer become drier based on overall climate change assessment. Dryness, as expressed by percentage, will be more intensified due to high evaporation and small increase in summer precipitation as compared to the normal climate" (MARCC, 2010:48).

The SNC report uses Hadley Climate Model (CM3) as the most suitable model for the conditions of Mongolia. Based on these projections, the following points have been highlighted:

- During the next two decades (2011–2030), annual mean temperatures are expected to increase by between 0.8^0C and 1^0C. During the medium term (2046–2065) annual temperatures are likely to increase by between 2.1^0C to 3^0C; and during the long term (2080–2099), annual mean temperatures could rise by up to 3.1^0C to 5^0C.

- Winter temperatures could increase by between 0.2^0C and 0.7^0C in the short term; by about 1.6^0C to 2.3^0C in the medium term; and by about 3.0^0C to 4.2^0C in the long term. Summer temperatures could increase by a great magnitude.

- Average annual precipitation could increase slightly between 2 and 3 percent in the short term but increase

quite significantly by up to 9 percent in the medium term and up to 15 percent in the long term.

- Much of the increase in precipitation is likely to occur in winter (up to some 23 percent in medium term and nearly 50 percent increase in the long term). In the short term, summer precipitation could actually be less than its present level and in the medium or long terms, it could gradually increase to slightly higher level than now.

These projections highlight that climate change will entail increased variability in Mongolia and that adaptation capacity needs to be developed to withstand these various possibilities.

As the Stern Review (2005) noted, for colder countries, warming due to climate change can bring some benefits in terms of milder winters, savings on heating costs and increase the possibility to diversify and grow more crops than at present. However, the MARCC (2010:53) notes that for Mongolia any benefits from climate change are likely to be dwarfed by potential negative impacts.

2.5 Impact of climate change on human development

Climate change can impact on human development in a number of different ways. Natural environment as well as human societies adapt to changes. However, climate change is a human development issue essentially because these changes are in turn curtailing freedoms of those who are presently alive and imposing serious restrictions on freedoms of present and future generations. Long term data and observations are needed to fully trace the impact of climate change on human well-being and freedoms. In the absence of such long term data, few examples are illustrated below.

Economic impacts

Climate change can impact on agriculture sector of the economy directly and other sectors such as forestry, hunting, tourism, and fishing indirectly. Climate change may appear not to have direct impacts on other economic activities such as mining, industry, urban services. However, urban and rural economies are closely related and any significant impacts on agriculture sector can have economy-wide repercussions.

At present, agriculture accounts for nearly 18.1 percent of GDP and more than 38.5 percent of employment. In 2010, there were over 216,574 households with livestock including 160,265 herder households (NSO, 2011). Climate change is contributing to reduction in productivity of pasture lands due to increased variability, changing precipitation patterns and increased frequency or intensity, or both, of drought conditions. Trends in normalised difference vegetation index (NDVI) suggest that overall biomass on pastures is showing a downward trend. At the same time, livestock population has steadily increased. Projections considered in the SNC suggest that increased droughts and *dzuds* in the future could lead to loss of up to 12 percent of animals in the medium term and up to 18 percent of animals in the longer term. All of this can lead to a reduction in incomes in the agriculture sector putting at risk the livelihoods of a third of the nation's population. This can lead to a reduction in income i.e., 'resources for a decent standard of living'.

Climate change has induced change in water resources patterns that can put at risk food security. At present one single *aimag*, namely Selenge *aimag* is the 'cereal bowl' of Mongolia producing some 177,658 tonnes of cereals – more than 50 percent of national cereal production (NSO, 2010). Permafrost melting and other changes can affect the flow patterns of water resources in the Selenge river basin and in turn impact on cereal production.

Impact on access to water

Climate change may increase variability, diminish water resources, and increase vulnerability especially of the poor people curtailing many of their freedoms. The number of water sources drying up could increase significantly putting at risk both human settlements and also livestock. For urban residents climate change can increase vulnerability to water shortages and increased heat conditions during summer months. It can also contribute to fluctuations in food prices and availability, increased energy costs and consequently an increased urban footprint in terms of diminished bio-energy sources and increased threat of deforestation in areas close to the city.

Climate change induced disasters can also further impoverish the most vulnerable households. Vulnerable population would include: some 24,680 households with livestock in 2010 had less than 30 animals. Such households are in turn likely to be a part of the 46.6 percent rural population considered to be poor. Climate change can exacerbate vulnerability or impact on those who are already affected by extreme events.

Health impacts

Climate change can impact the 'freedom to live a long and healthy life' in many ways. Various studies by World Health Organisation (WHO) on climate change and global human health highlight three important kinds of impacts. First a direct impact due to heat and increased warming in summer months; second an impact due to increased risk of spread of certain vector borne diseases as climate change opens up new areas for the spread of disease vectors; and third impact due to changes in water resources and water availability and potential for spread of water-borne diseases due to the lack of adequate sanitation in and around urban areas. Though some of these risks are not significant in the case of Mongolia, the need to anticipate and reduce health impacts of climate change remains a relevant priority.

At present 'certain infectious and parasitic diseases' account for 2 percent of all deaths. This proportion could increase. Urban households living in *ger* districts without safe water and sanitation are likely to be particularly at risk.

The SNC considers the risk of increase in cardio-vascular diseases due to increased hypertension as a result of climate change. Cases of cardiovascular disease have increased from around 160 per 10,000 persons in 1990 to nearly 640 per 10,000 persons in 2008 (SNC 2010:119). There is a possibility that some of this increase could be simply due to better reporting due to increased availability of health services and affordability. Between 1990 and 2008, real GDP per capita increased significantly and due to increased incomes consumption patterns could have changed which may have also contributed to higher incidence of cardiovascular disease.

Educational and cultural impacts

Already, there is evidence that *aimags* far away from Ulaanbaatar are losing population and *aimags* closer to Ulaanbaatar are gaining population. This rural-urban migration is likely to further exacerbate spatial or regional variations in economic opportunities and in turn retard or reduce human development potential. Climate change induced movement erodes knowledge of tradition and culture that has been built up over a long period and threatens the very basis of cultural identity of Mongolian nomadic pastoralism.

Some herders may have already become 'climate refugees' as they give up herding and migrate to cities. Without detailed surveys it is difficult to estimate precisely what proportion of rural to urban migration is caused by climate change (We will return to this issue briefly in Chapter 3). Due to climate change rural herder households may have to move frequently and over longer distances and in some cases, especially for those with very small herds, even permanent migration to urban settlements. These can impact on their

children in terms of access to education and thus affect 'freedom to learn'. Thus, out of 120,127 children of herders who are studying in general educational schools, a significant proportion can be affected.

On the other hand, climate change can also accelerate 'sedentarisation' whereby the nomadic pattern of life is gradually being replaced by limited movement. Humphrey (1999:189) observed that throughout Inner Asia there has been "...a change towards more sedentary household living complexes and increase in population of the administrative centre settlement of the district". Such sedentarisation can further threaten the quality of pastures in particular locations close to *soum* centres and also contribute to 'land grabbing' and conflicts[7].

Gender impacts

Each of the climate change impacts has significant gender dimensions. For example, with regard to economic impacts, climate change could exacerbate poverty of women headed households as pastures may become further degraded and the capacity of rural economy to sustain income earning opportunities for such households can be significantly reduced by climate change.

Increased risk of disasters can impact families and communities in many ways. Though disasters hit the entire family, they can particularly hit hard the income earning opportunities for rural women. The study by Gender Centre for Sustainable Development (2009) found that in their sample, with regard to post-disaster difficulties faced, nearly 32 percent women mentioned financial difficulties as an issue as compared with 22 percent of men. More women than men faced psychological stress in post-disaster context.

With regard to health impacts also, increased risk of infectious diseases can pose greater risks especially during pregnancy and child birth for women in rural areas. Already neo-natal mortality rate is high for households living in remote regions. Climate change can exacerbate the existing vulnerabilities of such groups and increase the existing 'horizontal' inequalities.

Impact on biodiversity

Mongolia contains several of world's major biomes from the Gobi desert to the boreal forest with their unique flora and fauna (Box 2.1). Climate change may damage or degrade biodiversity and impoverish communities and households such as those living in Western *aimags* and those in taiga forest eco-regions in the northern and eastern *aimags* who are particularly dependent on such resources.

Box 2.1: Mongolia's biodiversity

According to World Wild Fund (WWF), Mongolia's biodiversity includes: 139 species of mammals, 119 species of domestic birds and 330 species of migratory birds, 22 species of reptiles, 6 species of amphibians and 76 species of fish. The rare endangered species include mammals such as snow leopard, wild Argal sheep, Siberian Ibex, Mongolian Saiga, black tailed gazelle and red deer; birds such as Golden Eagle, spoonbills, Dalmatian pelicans and great white egrets. The Mongolian Red Book – the document that lists endangered species – includes 30 species of mammals and 5 species of reptiles.

Source: WWF Mongolia

In the 1996 National Biodiversity Conservation Action Plan, the Government of Mongolia commits itself to protect 30 percent of the land area by the year 2030.

Protected areas are established primarily to conserve biodiversity. However, many of the protected areas are vast areas. Whether the necessary staff and financial resources are available is an issue. By 2011, 14.3 percent of the area was included in the protected area network, while 10.3 percent was designated as the local protected areas. Mongolia is also a party to several international conventions including the UN Convention on

7 Conflicts can also be human-induced specially in relation to mining activity in terms of competition for access to mines and conflicts between licensees and local people.

Biodiversity, Washington Consensus, Ramsar Convention, Bonn Convention, CITES, etc.

Habitat quality changes, ecosystem boundary shifts and disappearance of suitable habitats caused by climate change and subsequent chain events make biodiversity conservation in Mongolia a challenging task. In most areas, processes of climate change interact with other pressures on ecosystems and biodiversity.

Because of warming and drying trend of climate change in Mongolia, along with adverse human activities, some of the wetland areas listed under the Ramsar Convention, especially the Lakes in the Depression of Lakes are being affected the most. Due to changes in the surrounding areas in terms of decline in permafrost, there has been a decline in productivity of pastures in those areas. Studies by National University of Mongolia researchers observed that herders are moving closer to the lake even though this violates Mongolian Law.

The Mongolian gazelle (*zeer*) is one of the last largest migratory large herbivores of Eurasia. Approximately three million Mongolian gazelles are estimated to inhabit the Daurian steppe across China, Russia and Mongolia. Over 70 percent of these animals are thought to be in Eastern region of Mongolia. While climate change is affecting the habitat that supports these migratory animals, human actions may be exacerbating the threats. Hunting is common. The three Eastern region *aimags* (Dornod, Sukhbaatar and Khentii) accounted for 1,800 of the 2,025 licenses issued in 2010 for hunting white tailed gazelles. While we do not have data on licenses for hunting of grey wolf, such hunting can interfere with prey-predator balance and can contribute to increased numbers of gazelles in the short run and ecological disturbances in the long run[8]. Fencing of international borders and road construction projects can interfere with corridors of movement of migratory species such as gazelles.

A significant increase in livestock can create competition for the same ecological niches in terms of types of plants and grass eaten by different herbivores. As wild animals and domesticated livestock share common areas of pastures, there is increased risk of spread of infectious diseases from one population to another. Conservation oriented non-governmental organisations have been calling for greater trans-boundary co-operation and co-ordination to address many of these issues. Both international as well as local actions are needed. Involving local communities and sharing benefits with them is crucial to achieving participatory bio-diversity conservation. The Hustai Nuruu National Park experience suggests that managing protected areas, creation of buffer zones and conserving wildlife can co-exist with livestock herding by local communities by involving such communities in the management of the park.

2.6. Greenhouse gas emissions

Estimating greenhouse gases requires a considerable amount of data. For many countries including Mongolia, such data is not available. Using various sources and methods, the First National Communication (FNC) estimated that in 1990, Mongolia's total greenhouse gas emissions in CO_2 equivalent (CO_2e) were 24,803 Gg and these decreased steadily to approximately 15,600 by 1998. According to the Second National Communication (SNC), greenhouse gas emissions steadily decreased during 1990–2000 at a rate of 3.3 percent per annum but have since increased during 2000–2006 period at a rate of 1.9 percent. Total emissions in 2006 were estimated to be 18,868 Gg.

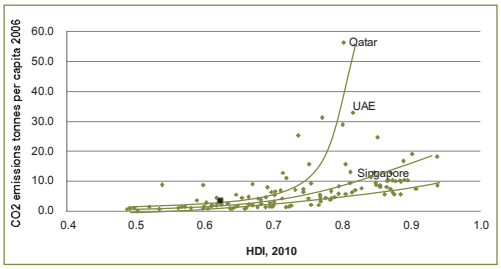
Based on data from the World Resources Institute for 2005, among 185 countries, on the basis of total CO_2 emissions, Mongolia

8 Data from CITES database suggests that during 2004 to 2010 every year between 20 and 60 grey wolf (canis lupus) skins are exported. Also, a number between 20 and 40 dead animals are exported as hunting trophies.

takes the 96th place. The world's largest CO_2 emitters at that time were USA and China. Mongolia's total emissions were approximately about 0.16 percent of the total emissions of USA. Mongolia's 'HDI-neighbours' had different trajectories - Moldova's total CO_2 emissions were slightly less than Mongolia's but Egypt's total CO_2 emissions were almost 16 times the total emissions of Mongolia. Philippines has 30 times the population of Mongolia but only 7 times the total CO_2 emissions of Mongolia.

According to the SNC document (2010:60), per capita net emissions of CO_2 in Mongolia decreased from 10.72 tons in 1990 to about 6 tons in 2006. However, according to the Global Human Development Report per capita emissions in Mongolia were estimated to be 3.6 tons per capita in 2006. Due to differences in data and estimation methods, it is difficult to reconcile different sources. However, if Global HDR 2010 data were to be used, it appears that until about HDI value of 0.7, the human development index and CO_2 emissions per capita are positively correlated (Figure 2.5). However, beyond 0.7 HDI, it appears that the relationship between HDI and CO_2 emissions per capita has three alternative trajectories. CO_2 emissions per capita are significantly high for energy-intensive economies of Qatar, Bahrain, UAE and Trinidad and Tobago each with more than 25 tons of CO_2 per capita. For another group of high HDI countries such as Luxembourg, USA, Australia and Canada, emissions are high with over 16 tons of CO_2 per capita. A third group of high HDI but lower CO_2 emission (between 10 and 8 tons per capita) economies are: Netherlands, Belgium, Japan, Denmark and Norway. This suggests that as Mongolia pursues high HDI status, there are choices to be made.

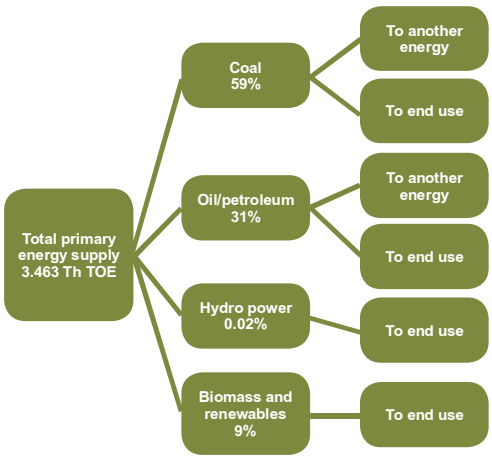
Figure 2.5: **Human Development Index and CO_2 emissions per capita, selected 122 countries**



Source: Estimated based on data from UNDP, 2010a.
Note: Mongolia shown as black dot.

Like many of the transition economies, Mongolia too entered the 1990s with a highly carbon intensive economy. Coal has been and continues to be the major source of primary energy consumption in Mongolia accounting for 59 percent of all primary energy (Figure 2.6).

Figure 2.6: **Primary energy in Mongolia**

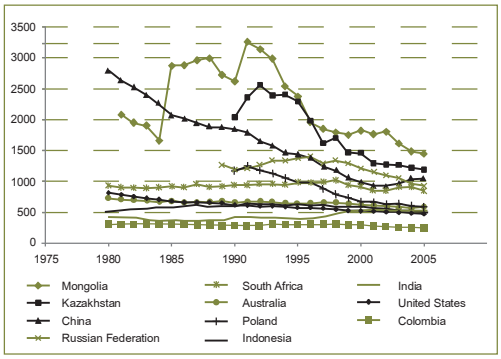


Source: Based on "Mongolia: Assessment Report on Climate change 2010" (MARCC).

Though carbon intensity in terms of CO_2 emissions per dollar of GDP has been steadily decreasing, it still remains high. For instance, among the world's top 10 hard-coal producing countries, Mongolia tops the table for being the most carbon intensive economy (Figure 2.7).

These trends suggest that further human development in Mongolia should be 'climate smart'. For this, efforts would be needed to reduce CO_2 intensity of GDP significantly and achieve advances in human development without increasing CO_2 emissions further.

Figure 2.7: **Carbon intensity of GDP among top 10 hard coal producing countries (PPP 2005 prices), 1980-2005**



Source: Based on data from Earthtrends by World Resources Institute, 2005

2.7 Greenhouse gas mitigation and adaptation measures

Article 4 of the UN Framework Convention on Climate Change requires all parties to take necessary actions to mitigate climate change by reducing anthropogenic greenhouse gases and to take necessary steps to develop strategies for adaptation. As a signatory, Mongolia is required to take measures for both mitigation and adaptation.

Mitigation measures

Energy use is the main source of Mongolia's greenhouse gas emissions. In 2006, energy use was responsible for 65.4 percent of all greenhouse gases. Agriculture contributed 41.4 percent of greenhouse gases; industry contributed 5.6 percent and waste disposal's share was 0.9 percent. These add up to more than 100 percent. This is because while these are sources of greenhouse gases, changes in land use and forestry acted as a sink and absorbed 13.3 percent of all greenhouse gases. Any mitigation measures will thus have to focus on both sources and sinks and include measures to reduce emissions and increase absorption or sequestration.

In 2010, Mongolia submitted to UNFCCC the Nationally Appropriate Mitigation Actions (NAMA). This list of actions identified specific actions in each of the sectors.

- With regard to energy, of total installed capacity, nearly 96 percent comes from thermal power plants; renewable energy sources, namely hydro, solar and wind together contribute to less than 5 percent of all energy. The national policies for mitigation therefore, include supply side measures such as improving energy efficiency, promoting clean coal technology, national renewable energy programme, 100,000 solar *ger* programme, and exploring the nuclear energy option. NAMA includes proposals for introducing coal beneficiation (coal washing) and coal briquetting technologies, improving energy efficiency of heat only boilers, installing new boilers, improving energy efficiency of six combined heat and power (CHP) plants. On the demand side, policy measures include energy conservation, installing heat metres, promoting insulation and promoting energy efficiency in industry.
- On renewable energy, NAMA includes proposals to increase PV and solar heating and developing wind energy systems that can use 100–150kW turbines. Hydro-electricity, wind energy and solar energy are considered as possible renewable energy options. Various locations in the northern and western parts of Mongolia have been identified for hydro-electricity generation potential. Two hydro-electric plants (with a total capacity of 23 MW) are operating as approved Clean Development Mechanism (CDM) projects.
- With regard to the transport sector, NAMA includes proposals to promote fuel efficient vehicles, expansion of public transport and efficient management of roads.

- With regard to agriculture, livestock population is the main source of greenhouse gas (methane) emission. Hence, strategies here aim to focus on limiting the number of livestock. NAMA includes two proposals, one to improve agro-technology and agricultural production, and the second to regulate livestock numbers through intensification of animal husbandry.
- With regard to waste, NAMA does not mention anything. However, national policies for sustainable development aim to focus on reducing waste and promoting reuse and recycling.
- As regards to land use changes and forestry, one of the key issues concerns forest fires. NAMA specifically identifies two sets of actions regarding forests – one to improve forest management and the other to reduce emissions from deforestation and forest degradation.

Mitigation measures can also be an opportunity for Mongolia to emerge as renewable energy hub of north eastern Asian region. Nearly 47 percent of Mongolia's area is considered to have high potential for generating electricity from wind energy (MARCC, 2010:117). Many *aimags* in the Southern and South Eastern parts of the country have been assessed to have the necessary wind speeds of 5m/s for 4,000-5,000 hours per annum. With regard to solar energy, almost the entire territory of Mongolia is assessed to have good potential. The southern part of Mongolia (consisting of Gobi *aimags*) is assessed to have a solar energy potential of above 1,400 kWh/square metre. Of the remainder, much of the country is assessed to a solar energy potential of between 1,200 and 1,400 kWh/sqm. The overall potential for solar energy is assessed to be $2.2x10^6$ GWh. In comparison, the total electricity generation in 2010 was $4.575x10^3$ GWh (NSO, 2010:244).

While the image of *gers* of individual herder households with a single solar panel is quite widely known, exploiting solar energy potential in a big way would require very large scale PV cell technology to be developed. The 100,000 solar *gers* programme was initiated by the Government of Mongolia by resolution number 158 in 1999. Approximately, 73,000 rural households already received benefits from this programme by 2008.

Conversion of forests and other biomass areas contributed approximately 1,150 Gg of CO_2 in 2006. However, CO_2 removal from other land use change, namely, abandonment of managed lands contributed -3,200 Gg of CO_2. As a result, forestry and land use change is net absorber of CO_2 to the tune of approximately 2,000 Gg of CO_2. Mongolia has not attracted any REDD+ projects but given that nearly 900 Gg of CO_2 is released due to conversion of forests, there is some scope for REDD+ actions (Box 2.2).

Box 2.2: Being 'green' to join REDD

A United Nations collaborative programme for "Reducing Emissions from Deforestation and Forest Degradation in Developing Countries" REDD is aimed at supporting developing countries "...to protect, better manage and wisely use their forest resources" which will also contribute to combating climate change.

The UN-REDD programme works both at national and international levels. Nine countries in Asia, Africa and Latin America have been part of the initial country programmes. In November 2010, three more countries joined the programme. The programme aims to create a financial incentive by helping countries benefit from financial value of carbon stored in standing forests. As of December 2010, some US$ 27 million has been disbursed to national programmes.

REDD+ is expected to be included in any post 2012 climate change treaties and aims to include incentives for conservation and sustainable management of forests and enhancing forest carbon stocks. Funding of up to US$30 billion could be available under this scheme.

Source: UN-REDD website

Among the mitigation measures to reduce greenhouse gases (GHG) from the energy sector include: supply side measures such as: improving the efficiency of existing boilers at the power plants; reducing the 'own use' of energy by power plants, and improving the quality of coal used. The coal beneficiation programme included in National Environmental Action Plan is to improve quality control at the coal mining sites such as Baganuur and Shivee-Ovoo by installing 'selective' crushers and screening equipment to reduce the content of inert material in coal.

Adaptation strategies

Climate change is a classic case of a public goods problem whereby the possibility of free riding prevents individual countries from taking remedial action. A conflict between protecting the private interests of a nation versus promoting collective or common good acts as a major barrier for action.

The Government of Mongolia prepared the National Adaptation Programme for Climate Change (NAPCC) in 2000. More recently, in January 2011, the second NAPCC has been developed. This covers the period 2011–2021 with two phases. During the first phase of 2011–2016, the emphasis is on strengthening national mitigation and adaptation capacities and setting up necessary legal and institutional systems. During the second phase of 2016–2021 it is expected that adaptation measures will have been implemented and greenhouse gas mitigation actions will be in progress.

Projected temperatures and precipitation suggest that the present trends will continue and all Mongolians will need to adapt to a range of different stresses. In some areas in the northern and western parts near the mountain ranges such as Khangai and Khentii and in major river basin areas, the local communities need to be supported in their ability to adapt to increased precipitation and flooding risks; elsewhere, in particular in the Gobi and south eastern part of the country, they need to be supported in being able to adapt to increasing water scarcity and dryness. Adaptation here means increasing the preparedness of communities, anticipating risks and preparing appropriate risk mitigation measures and enhancing their resilience. A survey conducted by Gender Centre for Sustainable Development (2009) for a UNDP study of disaster vulnerability of 139 households affected by different types of disaster indicated that

Box 2.3: Disaster preparedness

The Tohoku earthquake in Japan in March 2011 left some 28,000 people dead or missing. Though the magnitude of the Haiti earthquake in January 2010 was comparable to the Tohoku earthquake, the number of people who died in Haiti was over 200,000 (Government of Haiti, 2010). An article in *Nature* published in January 2011 argues that it is corruption rather than earthquake which should get the main blame for deaths in building collapse in earthquakes (Ambraseys and Billham, 2011). Others find that natural events of similar magnitude produce more fatalities in low income countries than in high income countries due to a combination of factors including institutional quality (Kahn, 2005; Stromberg, 2007).

Given that Japan is in a region prone to earth quakes, disaster preparedness and information and training given to all citizens to cope with disasters and what to do in the event of a disaster must have played a part in reducing fatalities in Japan. However, in a world where resources are scarce, governments have to choose between spending on preparedness and on post-disaster recovery. However, spending on preparedness is like taking an insurance policy- how much to spend depends on various factors including probability of risk and valuation of disaster impact. Government could spend far too much and yet not eliminate disaster risk entirely. On the other hand, post disaster spending can be easier to target funds to affected regions. Cohen and Werker (2008) argue that if aid is easier to obtain for disaster relief than for prevention, governments may have perverse incentive to do nothing about disaster until it occurs and then appeal for relief. They propose four recommendations mainly for aid agencies to overcome the 'political economy' of disasters: "...invest in prevention, decentralise relief [i.e., reach affected people directly], encourage political development and reward non disasters".

36 percent of respondents had financial difficulties during the disaster; 23 percent had no knowledge how to react to disaster; 19 percent had no information to respond to disaster. This suggests that the first step towards adaptation is to develop public awareness of how to respond to disasters. However, many factors can influence how governments respond to disaster preparedness (Box 2.3).

There will be various health impacts especially in terms of increased risk of infectious diseases or heat and dust effects (including pneumonic disorders). Pressures on water resources also may lead to increased pressure on grazing lands near water points causing further land degradation. Lands close to urban areas are likely to be further degraded as more and more herders migrate and adapt 'sedentary' lifestyles closer to urban areas.

Given that the nature of impacts of climate change varies significantly from one ecological region to another within Mongolia, adaptation strategies need to be locally developed, participatory and flexible. This assumes that local level institutions, namely *aimag* and *soum* level administrations have the necessary technical and management capabilities.

Climate change to 'Green growth'

The Mongolian Action Programme on Climate Change mentions very briefly the intention to pursue 'green growth' (Box 2.4).

Green growth means moving from simple economic growth to environmentally sustainable, low carbon and socially inclusive growth and development. The emphasis on 'socially inclusive' means green growth has to be pro-poor growth as well. The environment ministers of governments of the member countries of the Asia Pacific at the Fifth Ministerial Conference on Environment and Development adopted a 'green growth' approach. This approach includes six steps:

Box 2.4: Mongolia Action Programme on Climate Change (MAPCC)

Mongolia ratified the UN Framework Convention on Climate Change in 1993 and the Kyoto Protocol in 1999. Addressing climate change has been mentioned in various national policies, but most importantly in priority 5 of the Millennium Development Goals based Comprehensive National Development Strategy. The strategy included the objective "to create a sustainable environment for development by promoting capacities and measures on adaptation to climate change halting imbalance on the country's ecosystems and protecting them."

The *State Great Khural* adopted the Mongolia: Action Programme on Climate Change on 6 January 2011. This programme aims that by the time of its completion in 2021, Mongolia would have developed the capacity for adaptation to climate change and laid the foundation for green growth. A number of outcomes are expected as a result of the implementation of the MAPCC by 2021:

- Strengthened capacity of early warning system;
- Better ability to respond to impacts of climate change on human health and improved health assistance and service;
- Developed a combination of extensive and intensive animal husbandry;
- Reached 20 percent of renewable energy in energy balance; and
- Expanded and increased number of citizens, cooperatives and organisations who are engaged in actions to respond to climate change and implement relevant projects and programmes.

Citizens are expected to change their habits and behaviour to protect and conserve environment and natural resources; save energy, improve their accommodation heating, reducing heat loss; produce less waste and increase recycling and reuse; use public transportation as much as possible; prefer to produce and consume environmentally friendly products with ecological brands and marks; engage actively in actions and campaigns on climate change mitigation and adaptation and to monitor of government functions and natural resources users; and transfer and share knowledge, experience and skills on climate change adaptation to and mitigation to their children, families and communities.

Organisations and economic entities are expected to develop strategies to run business and production using environmentally friendly advanced technology and use energy and raw material efficiently; and inform all stakeholders regularly on compliance of any environmental regulations and fulfill their commitment to environment protection and climate change.

- Sustainable consumption and production (SCP): Focusing on whole life cycle of various products and services and promoting sustainability in every step.
- Greening business and markets: This includes making all firms to become more environmentally sustainable and also promoting firms producing environmentally sustainable products and climate-friendly goods and services.
- Sustainable infrastructure: Providing high quality services using less resources and with fewer or smaller environmental impacts.
- Green tax and budget reform: Changing fiscal policy to promote sustainability through green taxes and reducing and eliminating 'counter-productive' subsidies.
- Eco-efficiency indicators: The need to develop appropriate 'eco-efficiency indicators' to measure and compare eco-efficiency of economic growth.
- Investment in natural capital: This is to recognise the values of ecosystem services and to promote 'payments for ecosystem services' (PES).

To implement 'green growth' in Mongolia, strategies are needed in each of these six areas. Government can play a significant role in all the steps but especially through green tax reform and sustainable infrastructure development. The National Report of Mongolia on Sustainable Development (MNET, 2010a) notes that the Mongolian Chamber of Commerce and Industry is implementing a project on 'development of green products and eco-labelling'. However, green growth will not happen unless there is wide-spread awareness among citizens about environmental impacts of various production and consumption decisions.

As the Global Human Development Report 2007/2008 and the World Development Report 2010 (World Bank, 2010) both indicate, pursuing pro-poor growth and pursuing sustainability are not mutually exclusive. Decoupling emissions and growth would not be easy.

2.8. Summary

Climate change is already a major source of vulnerability to all Mongolians. Without any action now, environmental factors can have a significant impact on Mongolia's economy in the medium and long terms. This will have various human development impacts including potential restrictions on freedom to have a decent standard of living. Climate change induced health impacts in terms of greater risks to infectious diseases and also increased risks of non-communicable diseases such as cardio-vascular disease can significantly impact on freedom to live a long healthy life and diminish the advances that have been achieved in human development.

Climate change affects all Mongolians but poor households are likely to face significant threats to their livelihoods as well as well-being. Climate induced variability is likely to increase water stress and lack of access to improved water and sanitation facilities is likely to put poor people at greater risk of infectious diseases. Lack of access to health services for remote rural communities is likely to put certain vulnerable groups such as pregnant women during prenatal and neonatal stages and the infants and the elderly members at greater risk.

Climate change is also likely to contribute to increased frequency and intensity of disasters. Mongolia is already highly vulnerable to natural disasters. In terms of persons affected by disasters per 1 million population Mongolia takes first position in Asia. The economic, social and health costs of such disasters can impact on economic

performance and human development outcomes.

The Government of Mongolia has already recognised various strategies by way of mitigation and adaptation measures. Increasing energy efficiency and the use of renewable energy within overall energy mix are crucial steps. Capture and storage of carbon and developing further sinks in terms of pasture as well as forests which can absorb and retain Carbon will be crucial to improving on Mongolia's performance with regard to CO_2 per capita or CO_2 per dollar of GDP. At present, Mongolia's economy is very carbon intensive and steps are needed to de-couple economic development and carbon and promote low carbon development choices.

'Climate-smart' policies will be necessary in both rural and urban contexts. In this context, 'climate smart' human development would include: promoting sustainable agriculture, forest conservation, reducing degradation of steppe, promoting sustainable consumption patterns, investing in education, health and community development services that contribute to mainstreaming sustainable development. Empowering individual households and communities to be able to choose climate smart decisions should be at the centre of such strategies. Such policies would require a combination of approaches including incentive mechanisms, market based instruments including the development of appropriate cap and trade Carbon markets, promotion of technologies, creating greater awareness and making people the real champions of the fight against climate change.

Internationally, Mongolia can play a key role to highlight climate change impacts on land-locked countries. Beyond 2022, Mongolia should aim to play a global role working in co-operation with its two neighbours and other countries in the region.

There is also a need for significant work in strengthening the capacity of local level institutions including government as well as community institutions in both mitigation and adaptation strategies. Promoting participation of communities and local level deliberations to set policies are crucial.

There is a need for creating rights based policy instruments to citizens and to create incentives for *aimags* and *soums* based on environmental performance. One policy that can be tried is that Carbon budgets are set for national and *aimag* levels taking into account conditions of *aimags* and then introduce cap and trade mechanisms including incentives for *aimags* which perform better. This is not a Carbon market as such but an internal 'quasi' Carbon market in terms of allocating 'green' investments.

A mechanism to promote local participation in mitigation and adaptation to climate change is to promote the preparation of *aimag* level *human development and climate change* reports periodically. Training and capacity building of *soum* and *aimag* governors and other local government staff members on issues related to climate change and human development is also necessary.

CHAPTER 3

VULNERABILITY AND SUSTAINABILITY IN THE RURAL CONTEXT

3.1 Introduction

Nomadic pastoralism has been practised in Mongolia for millennia. However, recent economic and demographic transformation is threatening the survival of pastoralism as a viable economic activity and cultural identity. In addition to climate change, human induced changes to environmental resources are also contributing to vulnerability and threaten human security. An essential element of any strategy for sustainable human development in Mongolia will need to address vulnerability faced by rural population.

The aim of this chapter is to examine the main forms of vulnerability in rural context, namely, land degradation, pasture degradation, threats to forests and water insecurity and the impact of vulnerability on human development. An innovative 'multidimensional environmental vulnerability' (MEV) indicator is developed and proposed as a tool for tracking changes in vulnerability and guiding policies and action.

3.2 Rural poverty and vulnerability

Human development is aimed at enhancing substantive freedoms of all people. Human security is related to protecting existing freedoms. Economic security is related to 'freedom from want' while social and human security relate to 'freedom from fear'.

Rural households account for 36.7 percent of Mongolia's population. In terms of employment, agriculture accounts for 34 percent of all workers and 23 percent of national income. From the 2008 Household Socio-Economic Survey (HSES) it is seen that 29.7 percent of those living in soum centres and nearly 82.3 percent of residents in the countryside are employed in agriculture.

Estimates of poverty by NSO in 2010 suggested that 47.8 percent of rural population are below the national poverty line. The corresponding figure for urban areas is 32.2 percent (NSO, 2011). It is evident that poverty is concentrated in rural areas. HSES-2008 data also indicated that soum centres and country-side together have only 39.2 percent of population but have 56 percent of all the poor people in Mongolia. This proportion increased from 53.6 percent in 2002-2003. Thus, during 2002-2008 when Mongolia's economy witnessed high growth rates, rural poverty actually increased.

Aimag level GDP calculations need to be interpreted with caution. However, these also indicate that on the whole the less urban *aimags* have lower income. Lowest GDP per capita in 2010 was in Bayan-Olgii, a remote and mainly rural *aimag*; highest GDP per capita in the same year was in Orkhon with nearly 95 percent population in urban areas. Cash transfers such as pensions and social welfare payments from the state and remittances from friends and family can play a role in augmenting income of the poor households. HSES (2008) data indicates that nearly 23.8 percent of urban poor households receive private transfers while this proportion is 10.2 percent among rural poor households. Similarly, proportion of those receiving pension is also much higher among the urban poor households (30 percent) as compared to the rural poor households (17.1 percent).

Poor households tend to be disadvantaged in terms of education. On average, they have fewer years of education. For instance, the national average of those with no education or only primary education is 13.6 percent. However, among the poor households this proportion is 20.5 percent. The corresponding figures for the rural area were 31.0 percent among the poor and 37.5 percent among all residents of the countryside, respectively. At the top end, for the national population as a whole, 28.7 percent have vocational qualification, diploma or a university degree. This proportion among the poor households was

15.0 percent and for the poor households in the countryside this was just 5.7 percent.

Vulnerable households tend to have fewer assets. 73.8 percent of rural poor households lived in a *ger*. Living in a *ger* itself need not be an indicator of vulnerability. However, there is correlation between living in a *ger* and incidence of poverty. The HSES 2007-2008 noted that 'incidence of poverty is higher in *gers*, lower in houses and least in apartments' (2008:42). The report also noted that around half of those living in *gers* were poor whether they live in urban areas or rural areas.

Livestock is another form of asset. 92.0 percent of those living in the countryside had livestock as compared with 54 percent of those in *soum* centres and 17 percent of households in *aimag* centres. HSES 2007-2008 (2008:39) noted that "...although the population owning livestock is better-off compared to those that do not in both urban and rural areas, among livestock owners, the more livestock they hold, the less poverty they experience".

With regard to financial assets, HSES 2007-2008 data indicates that nationally a quarter of all Mongolians have savings accounts but 14.3 percent of rural poor have such accounts[9]. Our analysis suggested that the average deposit outstanding per capita increases along with an increase in urban population in an *aimag* and decreases with average size of livestock per herder household. This suggests that as an *aimag* becomes more urbanised, the nature of assets also go through transition from more livestock based to more financial.

These features of rural population in general and of the rural poor households in particular highlight that poor households face multiple deprivations. The key determinants of economic dimensions of vulnerability of rural households and communities include: distance and lack of access to markets, constraints related to employment opportunities, access to training and skills, limited financial assets, and variability in access to local government services. Data on savings or the activity of financial institutions clearly show that there is considerable variation from one *aimag* to another. Similarly, local government spending varies from 2.2 billion MNT in Govisumber *aimag* to 158.2 billion MNT in Ulaanbaatar. In per capita terms, the variation is by a magnitude of 10 from 42.5 million MNT in Bayan-Olgii to 478.9 million in Orkhon (NSO, 2011).

Social dimensions of vulnerability include gender related inequality and inequality in access to various services. While gender inequality manifests in many forms, with regard to income poverty among the rural households, there is little difference on the basis of gender alone. The HSES (2008:32) noted that "poverty in households headed by a woman is about the same as in households headed by a man". However, the Gender Centre for Sustainable Development (2009) survey in the context of disaster indicated that among the 36 percent of respondent families who were in financial debt, nearly 60 percent were women. As we saw in chapter 1, nearly 80 percent of all local level leadership positions are occupied by men. There is also variation between different *aimags* in access to services such as health services reflected for example in the variation in number of persons per physician.

3.3 Environmental vulnerability

Vulnerability can be considered in terms of changes in key environmental resources and how these impinge on well-being. In the context of Mongolia, key dimensions of environmental vulnerability include land, pasture and forest degradation, and water insecurity.

9 Having a bank account does not mean they are not poor. Here, data from table 2.14 in HSES 2008 is used. Rural poor could include poor households in soum centres as well as those living in the countryside. Similarly, those depending on state pension can have a bank account but have income below poverty threshold.

Land degradation

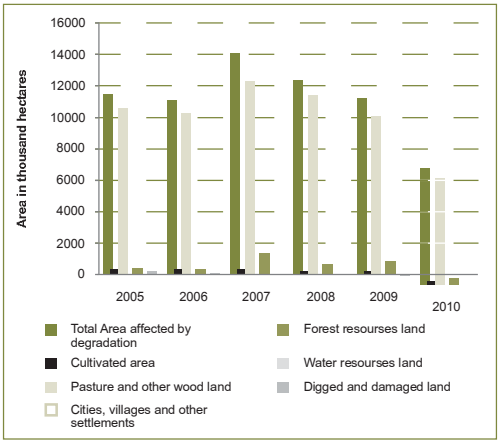
Land degradation curtails human freedoms by limiting opportunities and increasing vulnerability. Land degradation can have numerous impacts on human development. These include direct impacts on loss of incomes and employment resulting in deterioration in material standards of living, diversion of time from educational and social opportunities to production activities to increase labour input and compensate for deterioration in land productivity, and indirect impacts in terms of undermining rural economic and social base and health impacts from risks of exposure to degraded land.

There are many causes of land degradation. Natural or external factors include direct effect of climate change and the associated long term secular trend in decline in precipitation and increasing aridity. Human decisions and actions can also contribute to land degradation. As discussed earlier in chapter 1, more people in Mongolia seem to be living on degraded lands than other countries of similar level of HDI as Mongolia. Among 150 countries for which data on the extent of population living on degraded lands is available, Mongolia is ranked 12th. Eight out of the 10 countries with most significant land degradation are in Africa. Only two other Asian countries, namely Cambodia and Yemen, a greater proportion of people are living on degraded lands than in Mongolia.

According to the Land Law of Mongolia, approximately 1.15 million sq km or 74 percent of all land in Mongolia is classified as 'agricultural land' including pastures. Forests account for 0.14 million sq km or 9 percent of all land and special use lands account for 16 percent of all lands. Cities and human settlements occupy less than 0.4 percent of land and water resources occupy 0.4 percent of land.

Land degradation in Mongolia occurs in many ways including in the form of pasture degradation, clearing of forests, damage of land due to mining and geological exploration, and chemical pollution. Between 2006 and 2009, every year, approximately, 110,000 sq km of land, approximately 7 percent of Mongolia's territory, is degraded. The total area of land degraded peaked in 2007 and has since decreased to the same level as it was in preceding two years. Pasture degradation accounts for bulk of this degraded land (Figure 3.1).

Figure 3.1: **Land degradation trends, Mongolia, 2005-2010**



Source: NSO, 2009 and 2011. Mongolian Statistical Yearbook, 2008 and 2010.

Whether climate change is contributing to change in growth of pests and in turn leading to land degradation is a moot point (Box 3.1). Climate change can also impact pastures through change in rainfall pattern and water resources distribution.

In reality, to what extent pastures are degraded may depend on all these factors, namely direct and indirect effects of changing climate, human decisions and institutional measures (Box 3.1) for sustainable use of pastures.

Land degradation is occurring in all *aimags*. However, bulk of land degradation is occurring in five *aimags*, namely, Sukhbaatar, Dornogovi, Dundgovi, Ovorkhangai and Khovsgol (Figure 3.2). These five *aimags* together account for

Box 3.1: Possible causes of pasture degradation

There appear to be different view-points regarding the causes of pasture degradation.

One view is that climate change and associated warming and lack of rain is the main cause of pasture degradation. Some others consider desertification as the main threat to pastures.

Another view is that due to climate change the populations of species such as field mice and grasshoppers is increasing significantly and these in turn are leading to degradation of pastures. However, this argument is refuted on the grounds that degradation of pastures and plant diversity is what leads to increased populations of grasshoppers (Samiya, 2010).

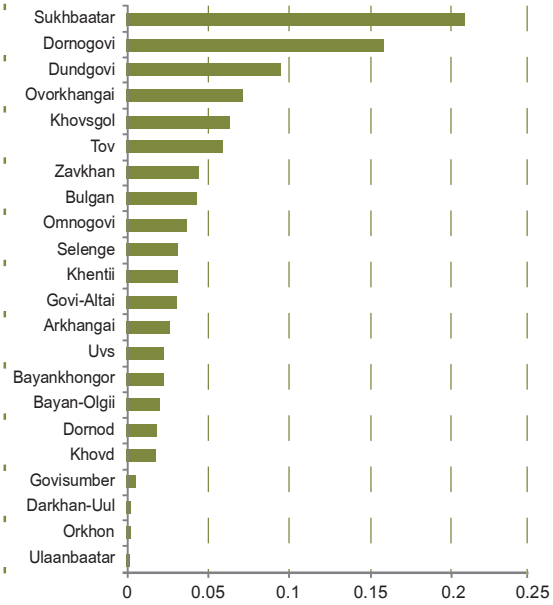
An alternative view is that pastures are being degraded mainly due to human decisions and rapid increase in the livestock numbers, particularly the number of goats. The debate surrounding goats and desertification has already been examined 27 years ago in an article by Robin Dunbar (1984) in the *New Scientist*. After discussing various cases, Dunbar concludes: "despite the repeatedly expressed opinion that goats have been responsible for desertification of rangelands in Africa and the Mediterranean, goats in in fact be beneficial members of a grazing community". On the other hand, the Environment Department of the Australian government (2004) proclaimed feral goats to be an agricultural pest and suggested that they can cause significant ecological as well as animal health impacts.

A fourth argument is that mining activities and 'reckless' actions such as digging, driving of vehicles, or burning are also contributing to pasture degradation. Total area in which mining activity is taking place is fairly small compared to the total area of pastures.

nearly 60 percent of all land degraded in Mongolia. In each case, a combination of natural and human made factors together result in land degradation.

Pasture degradation accounts for over 95 percent of all land degraded in seven *aimags*: Dundgovi, Bayan-Olgii, Govisumber, Sukhbaatar, Khovd, Bayankhongor,

Figure 3.2: **Share of *aimags* in land degradation (average 2005-2009), Mongolia**



Source: Based on data from MNET, 2009.

Khentii and in Ulaanbaatar[10] (see Appendix 2). Forest degradation accounts for a significant extent of all land degraded in Selenge, Orkhon, Arkhangai and Bulgan. Degradation of urban land or water bodies or digging of land (mining) activity contribute less than 20 percent of all land degraded and this too only in four *aimags*, namely, Omnogovi, Dornod, Darkhan-Uul and Tov. In Darkhan-Uul, damage to farming land is the main form of land degradation.

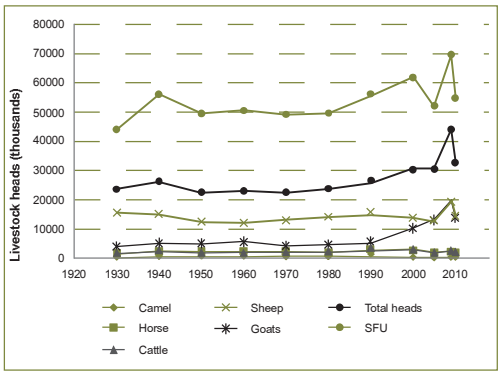
Statistics on land degradation are not easy to verify and there is also scope for subjectivity (for example is distinguishing whether damage is to cropland or pasture). Notwithstanding such limitations, the data on land degradation seem to suggest that crucial priorities to reduce or reverse land degradation are: reducing damage to pasture land, farm land, controlling degradation of forests, and protecting water resource land.

10 The total extent of land degraded in Ulaanbaatar has been around 10 to 11 thousand hectares during the years 2005 to 2009. In comparison, total land area degraded nationally has been 11 to 13 million hectares. However, of all the land degraded in Ulaanbaatar, much of it is in relation to pasture and other woodland degradation. Therefore, Ulaanbaatar contributes a very tiny share of all land degraded nationally in Figure 3.2 but is in a group where bulk of land degradation is in relation to pastures.

Livestock herding and sustainable use of pastures

Though herding has been prevalent in Mongolia for millennia, the nature of livestock herding has changed significantly during the last 80 years or so. During the socialist era, livestock was managed in the form of state-owned collectives. Such collectives regulated the total stock, its composition and movement, and also co-ordinated veterinary services. Historical data suggests that after peaking at about 26 million animals in 1940, the total livestock remained more or less constant between 22 and 25 million animals in 1945-1990 (Figure 3.3).

Figure 3.3: **Livestock growth, Mongolia, 1930-2010**



Source: Based on data from NSO, 2011.

With the transition to democratic and market oriented economy in 1990, collectives were abolished and support mechanisms including veterinary care for livestock sector deteriorated. However, some residents entered into rental contracts with collectives in the early 1990s anticipating privatisation. Also, with de-industrialisation after the collapse of socialist system, a number of urban workers who lost their employment took up livestock herding as a natural fall back option. The number of households with livestock thus increased from 250,000 in 1989 to 300,000 by 1992 but since then has decreased and stabilised at around 226,000 for all years during 2005-2009.

The total livestock in Mongolia increased steadily from around 25 million animals in 1990 to about 34 million animals in 1999. Due to the *dzud* of 1999-2002, total number of animals had decreased to around 24 million by 2002. Since then, there has been a steady increase and prior to the onset of 2010 *dzud*, the number of animals reached 44 million heads in 2009.

There is an opinion that this significant increase in livestock is a main contributor to pasture degradation as the levels of livestock exceed carrying capacity of pastures. From Figure 3.3, we can see that much of the substantial increase in livestock between 1990 and 2009 has occurred mainly in the significant quadrupling of the number of goats from less than 5 million to nearly 20 million numbers. Appendix 2 provides *aimag* level data on livestock growth rates. This data indicates that growth has been widespread.

Three questions on livestock growth and its impact

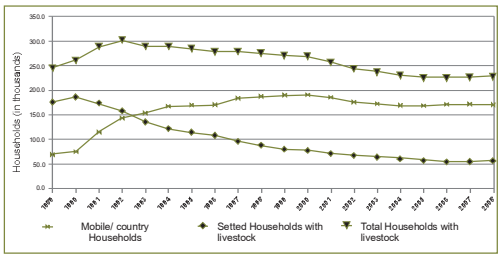
Three questions can be asked in this regard: (i) Despite herders' well-developed knowledge about sustainability and carrying capacity of pastures, why has there been such an increase in livestock? (ii) Why has the number of goats increased so significantly? (iii) What have been the economic and ecological impacts of such growth? The first two questions are examined in this section while the third question is addressed in the following section.

With regard to the first question, though the total number of households with livestock is around 220,000, the number of herder households is around 170,000, the remainder being 'absentee' herders. The number of herder households (also described as 'mobile households') increased from 69,000 in 1990 to close to 200,000 in the year 2000 but has decreased and stabilised at around 170,000 for every year during 2005-2009.

This data suggests that nearly 100,000 out of 170,000 herder households (i.e., mobile/country households) have been in herding activity only during the last

20 years. Thus, not all herders have long experience of herding or accumulated knowledge (Figure 3.4).

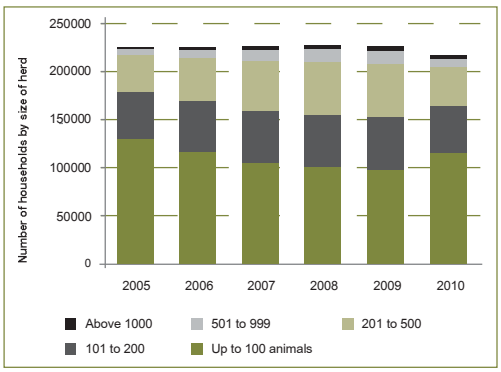
Figure 3.4: **Households with livestock, Mongolia, 1989-2008**



Source: UNDP, 2010b. Dzud report, September 2010, Ulaanbaatar, Mongolia.

Though the overall number of households with livestock has been more or less stable, the composition in terms of number of animals per household has been changing. Between 2005 and 2009, the number of households having up to or less than 100 animals has decreased from around 130,000 to nearly 99,000. During the same period, the number of households with 200 to 500 animals has increased from 38,000 to nearly 54,000 (Figure 3.5).

Figure 3.5: **Households with livestock by size of herd, Mongolia, 2005-2010**



Source: NSO, 2011. Mongolian Statistical Yearbook 2010.

A herder's decision concerning herd size and composition depends on numerous factors including the marginal or additional labour costs and potential benefits. With the collapse of collectives, pastures became 'open access' resources whereby individual incentives can play a major role than collective or long term interests. This could result in a 'tragedy' where each herder arrives at a decision to increase livestock levels but collectively the total livestock exceeds a pasture's capacity. In the absence of co-ordination mechanisms to manage the pastures, the open access nature of pastures results inevitably in overall livestock levels exceeding sustainable levels (Box 3.2). In the absence of alternative rural income generation, herders, however knowledgeable about sustainability, have few options than to increase livestock.

Box 3.2: From tragedy to common property resource institutions

Open access resources are those where it is costly or difficult to enforce entry regulations. Pastures will be open access resources if there are no mechanisms governing their use. In such cases, individuals will have no incentive to invest or spend energy to care for such a resource. After all, while one person (or a group of persons) invests energy to protect the resource, a person who has made no contribution at all can walk in (because there are no entry restrictions) and reap the benefits. For Garrett Hardin (1968), 'the tragedy of the commons' is inevitable for open access resources such as pastures or woodlands. As each herder faces little by way of additional cost to graze one more animal as compared to benefits they can get, each herder continues to increase their own herd size. The result is that there will be too many animals than can be supported by the pasture (resulting in degradation of the pasture and permanent loss to everyone- hence, the tragedy). The solution suggested is private property rights.

Mancur Olson (1965) in the 'logic of collective action' suggests that whether a group will emerge to do something that benefits all the group members (i.e., public goods) depends on four factors, namely, costs to the group, benefits to the group, cost to the individual, and whether non-contributors can be excluded. In this view, group size matters – as the cost of organising a large group can be significant. To some extent, this explains why a small group of herders may be more effective than a large group of herders.

Nobel Prize winning economist Elinor Ostrom (2009) proposed the idea of 'common-pool' goods as opposed to public and private goods. Pure public goods have two properties, namely, (unlike an ice cream or a meal, one person's consumption of the public good does not diminish the availability of the good to another person – known as 'non-rivalry' or 'subtractability')

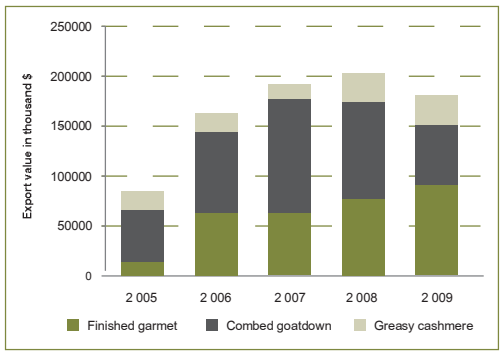
Box 3.2 continued

and once the good is provided, it is not possible to exclude anyone ('non-exclusion'). Ostrom and her co-authors pointed out that common pool goods are like other private goods with regard to rivalry (one herder's use of pastures means less grass available for the livestock of another herder) but are like public goods with regard to difficulty to exclude. In the institutional analysis and design (IAD) framework developed by Ostrom and her colleagues, includes three sets of external factors, namely biophysical conditions, attributes of community, and rules in use. Her work on water use institutions in Nepal suggested that communities that can develop flexible but graduated system of sanctions are better able to manage the common pool resource than others with fixed or rigid rules. Her work also suggested that successful common pool institutions developed various kinds of rules in relation to various kind of property rights and that the users in such institutions were able to meet face to face and monitor the arrangements or devise new rules where this became necessary. One of the main results from her work is that a 'tragedy' is not inevitable. Her work also suggests that while costs and benefits may be important, whether a group forms and successfully manages a common-pool resources also depends on the nature of community and evolutionary learning and trust (from repeated transactions) and thus a much broader form of rationality than one suggested by cost benefit calculus alone.

These discussions suggest that private property rights alone are not a panacea to sustainability of pastures. Transforming open access resources to commons, creating necessary rules of use and monitoring mechanisms, facilitating the formation of groups and making the distribution of costs and benefits to group members transparent will be necessary in creating participatory institutions to manage the pastures.

The second question about the increase in the number of goats can be answered with one word: cashmere. Mongolia has emerged as the second largest producer of cashmere. Between 1990 and 2009, as the number of goats in Mongolia increased, the production of raw cashmere also increased from about 1,500 tons to 6,700 tons (UNIDO, 2011:55). Mongolian cashmere fibres are supposed to have the advantage in terms of length and softer texture while the main disadvantage is supposed to be their darker colour. Cashmere is exported as raw greasy cashmere or as combed fibre or as finished garments. Export of greasy cashmere increased from 381 tons in 2005 to about 3,600 tons in 2009 in volume and from about US$ 3 million in 2005 to about US$ 91 million in 2009 in terms of value. Export of cashmere in combed fibre form also increased from 919 tons in 2005 to 1,433 tons in 2009 with corresponding export earnings increasing from US$ 53 million to US$ 60 million. Though export of finished garments increased from around US$ 18 million in 2005 to around 29 million in 2009, its relative contribution to total exports of cashmere remain small (Figure 3.6).

Figure 3.6: **Composition of cashmere exports, Mongolia, 2005-2009**

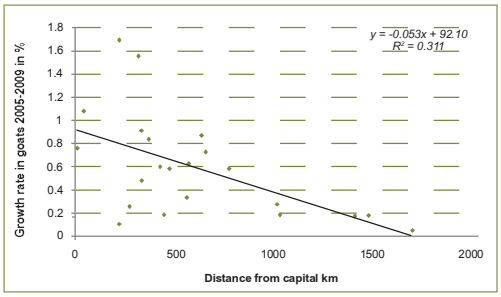


Source: UNIDO, 2011. Strategic directions on industrial policy in Mongolia.

However, to benefit from cashmere prices, herders must be able to access the market. The market structure is also quite diverse with some vertically integrated firms which have the capacity to process raw cashmere, clean the fibres, spin and knit the fabric, and produce final consumer products such as jumpers. Many other buyers simply export raw cashmere or simply export combed 'goat down'. Distance from the capital city (and thus, access to market) does clearly influence growth rate of goats (Figure 3.7).

The vast increase in the number of goats may have come at the cost of quality of cashmere. To maintain quality, herders need to ensure that goats are well-nourished and looked after. This would require training of herders and developing incentive mechanisms that can reward better quality

Figure 3.7: **Growth rate of goats in an *aimag* and distance from the capital city, Mongolia, 2005-2009**



Source: Estimated based on data from NSO, 2010.

cashmere with premium prices. Various studies on cashmere industry have pointed out the need for developing a cashmere exchange, taking the market closer to where herders are and encouraging more value added by further developing domestic processing and final production capacity.

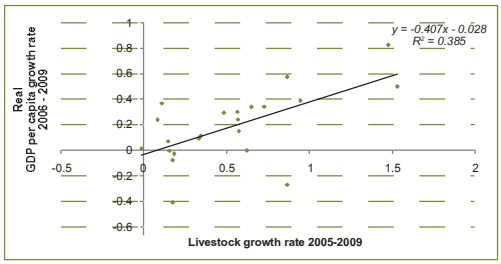
Economic impacts of livestock growth

Nationally, gross output from livestock sector and its share of GNI increased between 2005 and 2009 (Table 3.1). However, while the rate of increase in total livestock was 45 percent, the rate of increase in value of output was just 30 percent (from 738 billion MNT to 1001 billion MNT).

Overall meat production increased from 184 thousand tonnes in 2005 to 269 thousand tonnes in 2009. Less than ten percent of this is processed or exported. Thus, domestic consumption must have increased from 158 thousand tonnes to 248 thousand tonnes in the same period.

At the *aimag* level, the rate of growth in livestock numbers and real GDP per capita growth are significantly correlated (Figure 3.8). However, we cannot deduce whether growth in livestock numbers has had any significant impact on either the incomes or nutritional status of the poor

Figure 3.8: **Livestock growth rate and *aimag* GDP per capita growth rate, Mongolia, 2005-2009**



Source: Estimated based on data from NSO, 2010.

households. For example, notwithstanding the 20 percent increase in total livestock between 1990 and 2005, the number of undernourished people in Mongolia more or less remains at about 0.6 million from 1990-1992 to 2005-2007 (FAO, 2010). Intensity of food deprivation also remains at 14 percent of national population and did not change in that period. Thus it appears that the significant increase in livestock numbers and

Table 3.1: **Some indicators of livestock sector output, Mongolia, 2005-2010**

	Units	2005	2006	2007	2008	2009	2010
Total livestock heads	millions	30.3	34.8	40.3	43.3	44.0	32.7
Meat production- slaughter weight	Thousand tonnes	183.9	170.7	191.2	211.3	269.1	204.4*
Industrial output- Meat	Thousand tonnes	4.8	7.8	6.8	12.0	18.3	12.0
Industrial output-Canned meat	Thousand tonnes	0.2	0.3	0.1	0.5	0.3	0.2
Industrial output- sausages	Thousand tonnes	1.3	1.2	1.4	1.8	1.6	1.7
Hide and skin	Thousand pieces	6,927.1	6,374.0	7,218.4	9,762.4	13,076.3	16,784.7*
Industrial output- goat skin and hide skin	Thousand sqm	5.9	2.0	31.3	4.9	3.2	2.8
Industrial output-Large hides	Thousand tonnes	2.1	1.0	0.5	1.1	1.0	0.8
Export-various hides	Thousand pieces	281.3	311.7	237.5	278.3	281.9	346.6
Gross output from livestock (in 2005 prices)	Billion MNT	738.5	785.7	919.7	962.3	1001.6	810.9

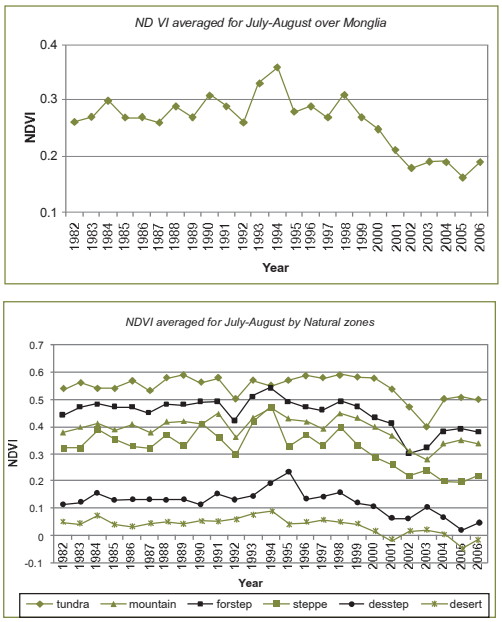
Source: NSO, 2011. Mongolian Statistical Yearbook 2010.
Note: * preliminary results

domestic meat consumption did not have an impact on food insecurity and malnutrition prevalence. This could be caused by the fact that meat consumption could have increased mainly among the richer households while malnutrition prevails mainly in the poorer households.

Ecological impacts of livestock growth

The carrying capacity of a pasture is the number of animals that can be supported. This is however, dynamic – grass and vegetation can react to long term threats by developing resilience. In the short term, the volume of biomass can be thought to be a fixed quantity. If all other things remain unchanged, increasing the number of livestock the Mongolia project of the Netherlands Climate Assistance Programme (NCAP) analysed normalised difference vegetation index (NDVI) over the period 1982-2006. The study noted that since 1994, there has been significant and secular downward trend in all natural zones (tundra, mountain, forest steppe, steppe, desert steppe, and desert) in Mongolia (Figure 3.9).

Figure 3.9: **Normalised difference vegetation index (NDVI) for July and August, Mongolia, 1982-2006**



Source: Netherlands Climate Assistance Project (NCAP), 2007.

Further, the NCAP study also calculated the ZNDVI that is the normalised values of NDVI. The slope of ZNDVI was negative for all *soums*. The lowest values (i.e., largest decline or negative change in vegetation index) were in Uvs, Arkhangai, Bulgan, Khovsgol, Tov, Selenge, Dornod and Omnogovi *aimags* (Figure 3.10). With the exception of Uvs, all the remaining seven *aimags* have livestock growth during 2005-2009 significantly greater than national average (see Appendix 2).

Figure 3.10: **Slope of Z Normalized Difference Vegetation Index (ZNDVI), Mongolia, 2007**

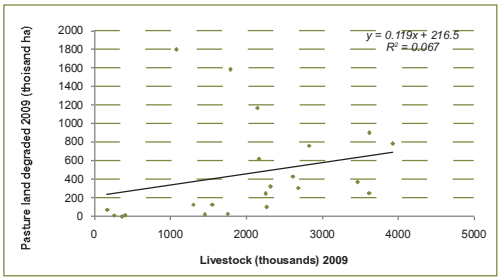
Source: Netherlands Climate Assistance Project (NCAP), 2007
Note: Negative values indicate decrease in vegetation.

This suggests a direct link between rapid increase in livestock numbers and a significant reduction in vegetation in the pastures.

However, there is no overwhelming evidence to provide a direct link between livestock numbers and land area degraded. Our analysis based on *aimag* level data for the period 2005-2009 on livestock size, growth rate and extent of land area degraded in the *aimag* showed only weak relationships (Figure 3.11).

Thus, on the whole, the significant increase in livestock numbers appears

Figure 3.11: **Livestock numbers of extent of pasture land degraded in 2009, Mongolia**



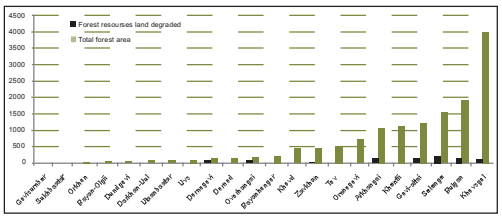
Source: Estimated based on NSO, 2010 and MNET, 2009.

to have had limited impact on human development. Livestock growth during 2005-2009 had some modest economic impact (and improving material standards of living) and less limited impact on prevalence of malnutrition (and improving freedom from hunger). However, it correlates with overall decline in vegetation and may have had some impact on pasture sustainability.

Forest degradation

Forests in Mongolia occupy around 143,000 square kilometres - an area about the size of Bangladesh. Much of this is primary forest area. Six *aimags*, namely, Khovsgol, Bulgan, Selenge, Govi-Altai, Khentii and Arkhangai account for nearly 76 percent of all forest area in Mongolia (Figure 3.12). Most of the forests are of Siberian taiga ecosystem and much of the forest area is in permafrost region. Some 140

Figure 3.12: **Forest area and forest area degraded (thousand hectares) in *aimags*, Mongolia, 2009**



Source: Estimated based on data from MNET, 2009.

different plant varieties exist though Siberian pine, saxaul and birch are more prevalent. In recent years, on average about 7,160 sq km of forest has been degraded annually. In comparison, re-plantation was about 100 sq km during the years 2000 to 2004 but dropped to around 50 sq km for most of the years between 2005 and 2010. Degradation can take many forms including logging, clearing, burning and mining activity.

Degradation of about 5 percent of forest area annually may appear harmless. The concept of sustainable harvest presumes that an equivalent area of plantation taking place. However, if degradation continues and re-forestation does not take place, then forests become a non-renewable resource. In that case, degradation rate is also an indicator of how many years it will take before forests are exhausted. Nationally, 5 percent forest degradation rate translates to 20 years to exhaust all forests. However in some *aimags* such as Orkhon, Dornod and Darkhan-Uul, at the present rate of degradation in those *aimags*, there will be no forests left in three years' time. For Arkhangai this is 10 years; for Bayan-Olgii this is 15 years and even in very forested Khovsgol, at the current rate of degradation, there will be no forests left in 30 years.

A closely related issue is of forest fires. The number of such fires and area affected appear to be decreasing (Table 3.2). Every year forest fires account for loss of approximately 4,550 square kilometres of forests – about the same size as the area of Ulaanbaatar. More than half of the extent of forest area burnt was in just one *aimag*, namely, Khentii. Another five *aimags*, namely, Selenge, Bulgan, Khovsgol, Dornod and Tov account for bulk of the rest. The value of damage caused by forest and steppe fires together was estimated to be MNT 1,289 million in 2006 and MNT 196,310 million in 2007.

There are alternative views as to the cause of forest fires. In some countries, a view is held that 'periodic' or 'controlled'

Table 3.2: **Forest fires and area affected, Mongolia 2005-2010**

	2005	2006	2007	2008	2009	2010
Number of forest fires	47	90	216	148	91	54
Forest area and field burnt Million hectares (% of total forest area)	4.4 (29.9%)	5.6 (39.2%)	1.3 (9.2%)	1.0 (7.0%)	0.4 (2.8%)	1.0 (7.0%)
Total forest area million hectares	14.7	14.3	14.2	14.2	14.3	14.3

Sources: NSO, 2010 and data from MNET, 2009.

or 'benevolent' fires can actually help clear the grasses, weeds and debris on forest floor while leaving the taller pine and larch trees intact whereas 'uncontrolled' or 'malevolent' fires can destroy entire forest. With climate change and projected longer spells of warm summers, there are greater risks of forest fires but interventions such as education, awareness creation, involving local stakeholders in forest management and increasing the capacity of local forest rangers and local governors can help reduce the human contributory factors.

Forest degradation can also occur from logging activity. Approximately, around 600 thousand cubic metres of timber is harvested every year from forests in Mongolia (Table 3.3). A lot of timber is likely to be consumed within domestic construction sector. Some timber may be used as fuel wood. HSES (2008) data indicated that nearly 90 percent of rural households depend on 'simple units' for heating – these simple units use firewood, coal or dung cake. A recent survey suggests that 29 percent of all households use firewood frequently for heating and that an average household uses about 4 cubic metres of fuel wood in one year (World Bank, 2011).

Government revenue from timber and hunting fee represents less than 0.3 percent of government revenue from all sources. However, these two streams of income together were greater than general government expenditure on 'forest and other environment expenditure'.

Forests provide a vast range of environmental services. In environmental valuation, total economic value is obtained by estimation and summation of use values and non-use values. Further, use values can include direct and indirect use values.

Timber and other forest produce are examples of direct use values. For example, benefits of hunting wild animals such as marmot or gazelles for household consumption can also be considered a direct use value. A recent survey suggests that only about 4 percent of households reported to have consumed wild animal meat (World Bank, 2011). In the same survey mentioned above, nearly 90 percent of respondents thought that there has been an increase in illegal logging activity in their *soum*. Over 94 percent of respondents also thought that it is acceptable for people to fell pine trees to collect their nuts.

Recreational benefits are indirect use values. Hunting, trekking, tourism and forest lodge accommodation are examples of elements that reflect recreational values of forests.

However, forests also provide many other services and non-use values including: acting as sinks absorbing CO_2, acting as a genetic pool for biodiversity, and as a crucial element of historical and cultural landscape. Markets do not exist for many of these dimensions.

Globally, the value of ecosystem services is estimated to be almost twice the world GDP (Costanza et al, 1997). Those who favour a 'payment for ecosystem services' (PES) think that at present many services

Table 3.3: **Indicators of forest related economic activity, Mongolia, 2005-2010**

	2005	2006	2007	2008	2009	2010
Total forest harvest (thousand cubic m)	606.0	574.8	580.5	612.0	571.6	687.5
Industrial output- sawn wood – thousand cubic m	13.2	9.6	11.0	17.4	14.5	20.2
Industrial output- railway sleeper – thousand cubic m	19.4	18.8	16.7	16.7	14.3	12.5
Export of sawnwood thousand cubic m	0.5	1.1	0.3	0.1	---	0.6
Government revenue from fee on use of timber million MNT	793.1	1167.4	1481.5	1550.5	1758.2	1981.9
Government revenue from hunting fees million MNT	2818.0	2940.1	3091.9	3628.4	4601.7	3698.0

Source: NSO, 2011. Mongolian Statistical Yearbook 2010.

provided by forests remain unrecognised because there is no direct payment. As a result, such resources will be over-consumed. For PES to work, the users of ecosystem services should be distinct from those who are contributing in some way to maintaining the services and there should be real cash transfers between the parties. PES is difficult to implement if those who benefit from ecosystem services are also contributors to its conservation.

On the whole, some of the human development impacts of forest degradation in Mongolia can be summarised: (a) Forest degradation reduces the amount of CO_2 absorbed and thus contributes to further climate change. (b) Forest degradation increases the risk of over-hunting of wild animals. This can lead to some species of wild animals becoming extinct. At present, some households augment their food sources with wild animals. This may not be possible in the future. (c) Cultural aspects of identity related to hunting certain wild animals may become threatened. (d) Degradation of forests can threaten or exacerbate problems related to protection of water resources. This can have an impact of water insecurity. (e) Forest fires can put livestock and property at risk. (f) Forest degradation can limit the extent of firewood available for 'simple units' and this may increase the risk of households having to use more smoke-causing fuels for heating.

Mining activity impact on land

Mining has been an important driver of Mongolia's economic growth and investment. During 2005-2009 period, mining sector accounted for about a fifth of national GNI and about 5 percent of all employment. Much attention has focused on large scale mining projects such as Oyu Tolgoi, Tavan Tolgoi and Ukhaa Khudag all in the south Gobi region. However, mining is not limited to Gobi region.

Contribution of mining to extent of land area degraded appears rather small. Nationally, land degradation from mining and exploration has decreased from about 193.1 thousand square km in 2005 to about 19.4 thousand square km in 2010. More than two thirds of such degraded land is in Dornogovi and Omnogovi. However, significant extents of land area are degraded in Tov, Bulgan, Selenge, Khentii and Bayankhongor *aimags* as well.

Though extent of area affected by mining is small, impact from mining can be very intensive due to the use of dangerous chemicals. Hence, it can take a lot of effort to clean up and can have potentially serious health and ecological consequences. From the Ministry of Nature, Environment and Tourism (MNET) data on inspections in 2007, it was noted that 37.3 hectares of land was contaminated by mercury used in gold mining and altogether some 200 thousand hectares of land area became contaminated in Bayankhongor, Omnogovi, Dornogovi, Tov, Selenge, Bulgan and Darkhan-Uul *aimags*.

Both formal and artisanal mining activities affect the environment. Regulation and enforcement are the main instruments of controlling mining related pollution, particularly in the context of formal sector. Articles 37, 38 and 39 of the minerals law provide for environmental protection measures. A mining license holder needs to obtain permission from the relevant environmental agency. The license holder is required to prepare an environmental impact assessment and an environmental protection plan. According to the Environmental Impact Assessment (EIA) law issued in 2001, EIA is required prior to undertaking a project or before obtaining the license to explore minerals. Though formal mining projects are required to conduct an environmental impact assessment, mining operations can lead to downstream issues such contaminated land or waste disposal. The July 2009 amendment to the Mineral law also includes restrictions on mining exploration and exploitation in river catchment areas, water and forest reserves.

While EIA is effective ex ante, the country can be left with large extent of polluted land at the end of the mining license period if effective measures are not taken throughout the life of a mining contract. Humphreys et al (2007) recommend that mining companies be required to deposit large amount of money sufficient to cover any post operational clean-up costs in the form of bonds with the government. At the end of the license, the Environment regulators can certify that the land has been returned to safe condition before signing the release of the bond.

Dealing with informal or artisanal mining can be difficult as regulatory approaches alone may not be adequate. There is a large extent of artisanal or informal mining activity in Mongolia. According to a World Bank (2008b) study, some 67,000 people were employed in artisanal and small scale mining (ASM). Estimates of informal mining are difficult but according to Ministry of Mineral Resources and Energy surveys, the number of artisanal miners seems to have gradually decreased from about 72 thousand in 2006 to about 35 thousand in 2009. Artisanal activity is difficult to monitor and regulate. A fieldwork visit by NHDR team to Uyanga *soum* in Ovorkhangai *aimag* indicated that ASM activity can develop into almost the scale of a small township of about 400 to 500 households.

These observations are consistent with previous studies. A baseline survey of informal mining in Bornuur and Zaamar *soums* in Tov *aimag* conducted for the ILO (2006) indicated that children were involved in a number of informal gold mining operations. That survey also clearly showed that those with no education or only primary education formed nearly 30 percent in Bornuur *soum* and nearly 48 percent of respondents in Zaamar *soum*. 72 percent of respondents in Bornuur and 93 percent of those in Zaamar had no electricity. Some 50 percent miners live at the mining site itself and many of the services were available at the mine site. A significant number of the miners in both sites have lived there for more than 2 years.

Amnesty International's 2008 report on Mongolia highlights the magnitude of the issue regarding the use of mercury and sodium cyanide: "Large amounts of these chemicals were reportedly used in more than 20 *soums* (districts) in 9 *aimags* (provinces), polluting the local water supply. According to the National Human Rights Commission, in Khongor *soum* mercury contamination was 100 to 125 times higher than recommended levels and sodium cyanide was 900 times higher than recommended levels."

At the macro-level, mining can have a significant positive impact on human development. Mining driven economic growth can create jobs, increase incomes and help improve material standards of living. Mining can generate substantial tax revenues which can be used to improve education, health and other infrastructure services. Cross-country evidence suggests that well-managed revenues from mining sector played a role in improving human development outcomes in Norway, Australia, Botswana, Chile, Kazakhstan and a number of countries in the Middle East and North Africa region.

However, at the micro-level, mining especially unregulated mining can have some short term benefits to those who engage in such activities but can create significant long term health and environmental impacts.

Water and vulnerability

An important aspect of reducing vulnerability concerns protection and sustainable management of water resources. The total water resources endowment of Mongolia is estimated to be 608.3 cubic kilometres (km^3). Just for simplicity this volume can be envisaged by imagining that if all this water were to be spread up on the entire area of Ulaanbaatar, the water column will reach 129 metres high – or roughly three

times the height of the statue of equestrian ridden Chingis Khan at Tsonjin Boldog. Though this is a vast quantity of water, given the vastness of the surface area of Mongolia, and given that much of the water resources of Mongolia are concentrated in the lakes in the northern part and the snow-covered mountains, for much of Mongolia water scarcity is a concern.

Approximately 500 km^3 of water is concentrated in lakes and further 63 km^3 of water is locked up in snow on the mountains. Khovsgol lake alone accounts for some 68 percent of all lake water. The total volume of water from renewable surface water resources (from rivers) is estimated to be 34.6 km^3.

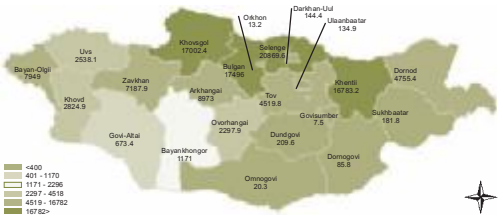
Protecting water resources and developing integrated management regimes are crucial policy issues. The SNC (2010) document identifies various water policy proposals. These include: implementation of integrated river basin management (IRBM) policies and plans; protecting upper reaches of rivers in Altai, Khangai, Khentii and Khovsgol *aimags* which account for 70 percent of river water resources; collecting melting water of glaciers by constructing reservoirs; rain water harvesting especially for non-consumptive uses in urban areas, reducing water losses in transmission and so on.

Distribution of water resources

The second dimension of water concerns distribution of water resources. Mongolia's water resources situation can be summarized as the "70-30 paradox". Though national average for Mongolia does not place the country into the group of countries facing water stress or scarcity, much of this water is located in a few *aimags*. Some 76 percent of surface area has only 36 percent of all water resources (hence the 70-30 paradox). While some *aimags* such as Khentii, Khovsgol, Selenge, Zavkhan and Arkhangai are better endowed with water resources (and together account for more than 60 percent of all surface water sources by volume), water is scarce in many of the Gobi *aimags*.

Water scarcity or insecurity is a relative concept. The same quantity of water can be perceived as adequate by one group of people and quite inadequate by others. Physical quantity of water alone is only one part of the picture. Population, intensity of use of water, competition by different uses, pollution and the capacity of institutions and regulatory mechanisms to deal with these issues all play a role. Therefore, there is a need for caution in interpreting data on quantity of water available. An aspect of water insecurity is usable water resources per capita. Falkenmark index suggests that a society is in a situation of 'water stress' is when this is below 1,000 cubic metres per capita; water scarcity is defined as having water resources below 600 cubic metres per capita (see Anand,2007; Brown and Matlock,2011). From Figure 3.13, it is clear that in Govi-Altai *aimag* is in' water stress' and seven *aimags*, namely, Orkhon, Omnogovi, Dornogovi, Ulaanbaatar, Darkhan-Uul, Sukhbaatar and Dundgovi are in chronic 'water scarcity' (see Appendix 2). Though water availability in many other *aimags* is well above the cut off point, the aggregate indicator of availability does not tell us how many people actually have access to water in those *aimags*.

Figure 3.13: **Usable water resources cubic metres per capita, Mongolia, 2007**

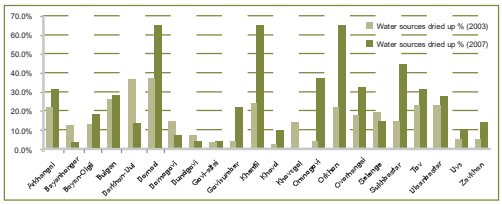


Source: Estimated based on Water Census 2007 (MNET) and NSO, 2010.

Another dimension of water insecurity that is much more relevant especially in the context of climate change analysis concerns the number of water sources that dry up. Nationally, there were 18,786 water sources, namely, lakes, rivers, springs, and mineral water in 2003. During that year, 15 percent or one in six of these dried up whereas in

2007 this proportion increased to almost one in four[11] (Figure 3.14).

Figure 3.14: **Water sources dried up, Mongolia, 2003 and 2007**



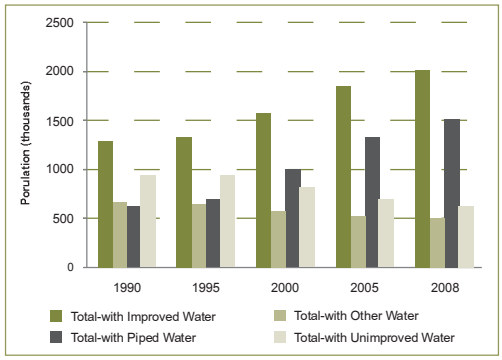
Source: Based data from Water Census 2007 (MNET) and NSO, 2010.

The situation appears to be very serious in Orkhon, Khentii and Dornod *aimags* where two out of three water sources have dried up. In Sukhbaatar, Omnogovi and Ovorkhangai also more than one out of every three water sources dried up in 2007. Drying up of water sources is part of a larger picture of regional climate and interaction between soil conditions and water cycle. Drying up of sources is consistent with long term decline in precipitation. Other contributing factors include: pasture degradation, especially due to increasing growth of weeds and unsuitable plants, and increasing number of livestock having to share a given number of water sources. Measures are required to understand the causes of drying up of water sources and to protect and conserve remaining sources. For example, protection of watersheds and water harvesting programmes can be linked with tree planting programmes to protect aquifers and surface water sources. As with the case of pastures and other natural resources, clarifying human rights and rights of access to water resources and creating community based water management structures would be crucial.

Access to water and sanitation

Another dimension of water security concerns access to safe drinking water and sanitation included as target 10 of the Millennium Development Goals. According WHO-UNICEF Joint Monitoring Programme data, nationally, the proportion of population with access to improved[12] sources of water increased from 58 percent in 1990 to 76 percent in 2008. In absolute terms, population with access to improved sources of water increased from 1.2 million in 1990 to nearly 2 million in 2008 (Figure 3.15a).

Figure 3.15a: **Total population with access to water, Mongolia, 1990-2008**



Source: WHO-UNICEF, 2009. Joint Monitoring Programme.

However, among the rural population, the corresponding figures changed from 27 percent in 1990 to 49 percent in 2008. 93 percent of the 623 thousand people without access to improved sources of water in Mongolia live in rural areas.

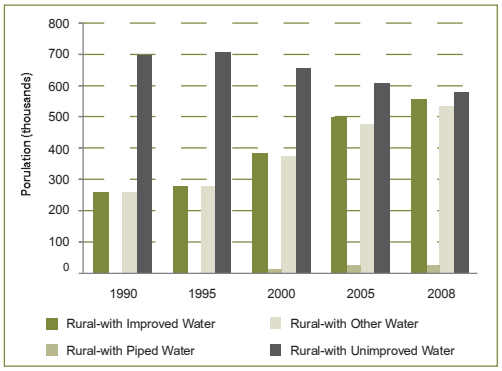
In 1990, hardly anyone in the rural areas had access to piped water. By 2008, only 22,000 persons in rural areas have gained access to piped water. The number of persons with access to 'other improved sources' in rural areas increased from 257,000 persons in 1990 to 532,000 persons in 2008 (Figure 3.15b).

Collecting water from water points or by tanker trucks has become the reality for a significant proportion of urban residents. This is also evident from the Household Socio-Economic Survey (2007-2008) data. As per this data, 33 percent of all rural

11 Water Census is conducted once every four years by the water authority of MNET. If a source dried up continuously for five years, it is recorded as dried up.

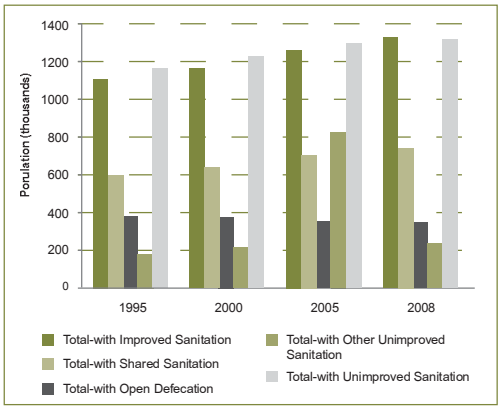
12 According to WHO-UNICEF Joint Monitoring Programme, improved sources of water include: piped water into dwelling or yard, public tap, standpipe, protected tube well, borehole, dug well, protected spring and rainwater collection. Unimproved sources include: water from unprotected dug well, unprotected spring, cart with a small tank/drum, surface water, and bottled water.

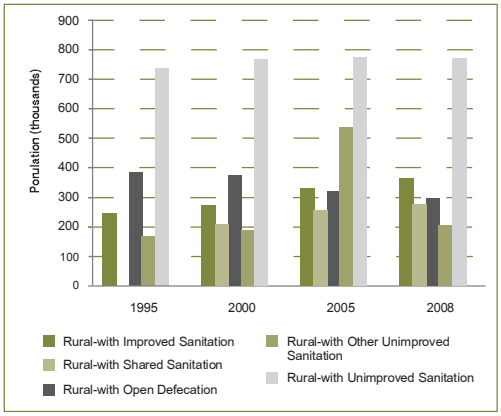
Figure 3.15b: **Rural population with access to water, Mongolia, 1990-2008**



Source: WHO-UNICEF, 2009. Joint Monitoring Programme.

Figure 3.16: **Total population (top) and rural population (bottom) with access to sanitation, Mongolia, 1995-2008**





Source: WHO-UNICEF, 2009. Joint Monitoring Programme.

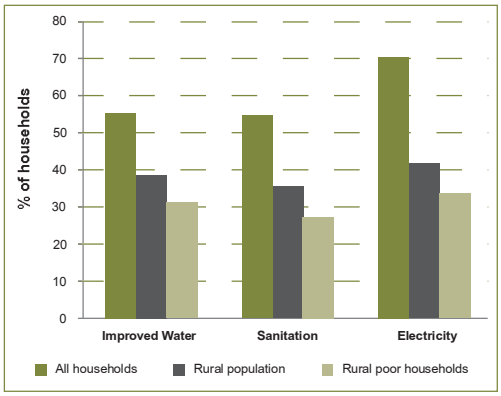
respondents had access to improved sources of water, but only 29 percent of the rural poor households had access to improved water sources. Some 41 percent of rural households depend on unimproved sources such as 'river, snow, ice, others'.

The issue of access to sanitation is equally a matter of concern with regard to health and well-being. WHO-UNICEF JMP data (Figure 3.16) is available only from 1995 onwards at which time just under 50 percent of population or some 1.1 million persons had access to improved sanitation. This number has increased slightly to 50.3 percent or 1.3 million persons by 2008. However, one out of every two Mongolian citizens does not have access to improved sanitation. As per HSES data also, some 27 percent of urban population and nearly 65 percent of rural population do not have access to sanitation. Yet another source of data is the Reproductive Health Survey 2008 conducted on behalf of the UNFPA. In that survey also, more than 50 percent of households in both urban and rural areas reported to be using non-standard pit latrine without a slab; a further 40 percent of rural households are reported to have no facilities at all or to be using field or bush (open defecation) for sanitation purposes.

One of the major constraints to analysing access to water and sanitation issues is the lack of data at *aimag* level. Though surveys such as the Household Socio-Economic Survey (HSES), and Reproductive Health Survey include questions on water and sanitation, their sample design does not permit *aimag* level statistics. As a result, it is very difficult to know which *aimags* are doing better in terms of improving access to water and sanitation for the citizens and which ones are off-track. There is an urgent need to include water and sanitation related questions in water census or develop an independent water and sanitation survey.

HSES 2010 does provide some data to compare access to services by poor households with access to services by non-poor households (Figure 3.17). While urban-rural gap is clear, rural poor household come out being worse off.

Figure 3.17: **Access to services by rural poor households, Mongolia, 2010**



Source: NSO, 2011. Household Socio-Economic Survey 2010.

Potential health impacts of lack of water and sanitation

Globally, water borne diseases such as diarrhoea, typhoid, cholera and certain other infectious diseases are associated with lack of access to water and sanitation. Assessing the so called environmental burden of disease requires good quality data. In the absence of detailed data, we can only make preliminary conjectures. HSES data on illnesses suggests that lack of water and sanitation may be contributing to increased health burden (and thus impede human development outcomes). Nationally some 11 percent of men and 13 percent of women reported to be suffering from chronic illness. Nearly a fifth of those two categories of respondents reported to be suffering from illnesses of the digestive system. National level data on number of deaths as per international classification of diseases also indicated that out of some 15,665 deaths in 2006, diseases of the digestive system and certain infectious and parasitic diseases together accounted for 1,890 deaths (12.1 percent of all deaths). The corresponding figures for 2010 are some 1,832 deaths (10.6 percent) due to these causes out of all deaths of 17,276.

Another dimension of health impact of water and sanitation concerns infant mortality. Data from reproductive health survey suggests that much of the infant mortality rate comes from high level of neo-natal (28 days within birth) and post neo-natal (PNN) mortality rates. Notwithstanding a decline in child mortality (i.e., between the ages of 1 and 4 years), the overall under 5 mortality continues to be high because of high level of infant mortality (below 1 year). One of the contributing factors to neo-natal mortality is considered to be lack of emergency health facilities in rural areas. Reproductive health survey 2008 shows that average time taken to access emergency health services in rural areas is 138 minutes while in urban areas it is 75 minutes. Our conjecture is that lack of access to improved water and sanitation can be a contributing factor to higher level of neo-natal mortality as hand-hygiene of mothers can be an important step to minimize infection routes.

Improving access to water and sanitation are highly pro-poor interventions. A significant majority of poor households at present lack these services in both urban and rural areas.

Gender dimensions

A stereo-typical view of gender issues of water tends to focus on the gender dimensions of intra-household labour allocation in which the burden of collecting water invariably falls on women and children. A recent study based on household surveys in Ulaanbaatar and Omnogovi *aimag* by Canadian researchers (Hawkins and Seager, 2009) supports some of these stereotype views and also challenges other views. Some 73 percent of urban households and 54 percent of rural households identified women to be solely responsible for water-related tasks within the household. However, the study also points out that in both urban and rural areas men are much more involved in water collection than would be suggested by stereotypical views of gender roles. On the other hand, Gender Centre for Sustainable Development (2009) study showed that both men and women in urban and rural

areas take responsibility for carrying water. These studies suggest that gender dimensions are more complex than one would think based on widely held beliefs.

A more important gender dimension of water is not related to who collects water or who uses water but in terms of (a) gender representation in water governance institutions and (b) 'paradigm of masculinity' of water policy interventions (Anand, 2007). As the UNDP-UNICEF Joint Water Programme study indicates, water governance institutions in Mongolia are centralized and dominated by male policy makers. While the composition of water governance institutions is one issue, paradigm of masculinity means that water policy interventions and investments are dominated by 'hard' investments such as constructing wells or water treatment plants as opposed to 'soft' investments such as water user groups and co-operative water management institutions. Masculinity thus creates a bias towards physical interventions rather than institutional development.

3.4 Multi- dimensional Environmental Vulnerability (MEV)

The discussion so far points to various aspects of vulnerability. Like poverty, vulnerability is also multi-dimensional. To capture the relative importance of the different dimensions of vulnerability, a multi-dimensional environmental vulnerability (MEV) indicator is proposed to stimulate discussion. The process of developing an indicator should be based on participation of all the relevant stakeholders who will be using the indicator. Otherwise, the development of an indicator becomes a technocratic exercise which that can further disempower the very stakeholders who are supposed to be the final users of information contained in such an indicator.

A national workshop of relevant stakeholders should be convened to develop appropriate multi-dimensional indicators. Still some questions remain. These are briefly addressed in Box 3.3.

Box 3.3. Some questions in developing a new indicator

Why do we need an indicator? There are numerous environmental issues which require policy and regulation. The issues affect different *aimags* in different ways. While individual indicators may be useful to inform policy concerning a specific issue, their interactions and multiple deprivations are not captured in that approach. A multi-dimensional indicator can be useful in identifying whether people in some locations are vulnerable to several issues and if so whether a co-ordinated approach rather than an individual sector-focused approach is better.

Why do we need a 'new' indicator? A number of global studies focus on such indicators based on national level data. Examples include the Yale University's environmental performance index (EPI) or the adjusted savings mentioned in chapter 1 or the happy planet index. However, most of these indicators are developed mainly for international cross-country comparisons. Some of the indicators can be extended to sub-national levels provided data is readily available. For national policy purposes, sub-national indicators are more useful. Where existing indicators do not provide such information, there may be a case for developing new indicators.

How to develop an indicator? Developing a multi-dimensional indicator is not difficult- any number of dimensions can be added. Both the content of such an indicator and the process by which it is developed are important. The content of an indicator must provide policy-relevant information. The indicator must measure what is intended; it should be possible to observe variation in the values of indicator across different cases in relation to some variation in external circumstances or policy inputs and outcomes.

Source: Anand, 2011

An illustration

An illustration developed and discussed in Anand (2011) is presented. An indicator-set comprising 3 dimensions representing economic, social and environmental aspects is proposed.

Indicators of economic vulnerability could include: unemployment, access

to markets, access to capital or financial support, the ability of local government to support individuals, education, growth in local economy and jobs.

Indicators of social vulnerability include: horizontal inequality, ethnic and gender inequality, health inequality, breakdown of social units including family, problems such as drug use or trading, sense of insecurity, gangs and violence, social exclusion.

Indicators of environmental vulnerability include: land degradation, water and air pollution, lack of access to water, sanitation and energy, increased competition for local resources such as pastures and so on.

For this illustration, variables were chosen as indicators for which information is readily available from the NSO or MNET. For each indicator, an index is constructed by considering the maximum and minimum values of the variable concerned. The indexes are constructed in such a way that the most negatively affected *aimag* will have highest value (1) and the least negatively affected *aimag* will have lowest value (0). The dimensions and indicators used in our illustration are listed in Table 3.4.

Table 3.4: **Illustration of indicators included in Multi-dimensional environmental vulnerability indicator**

Economic dimensions	• Local government finance per capita (deviation from average) • Non-performing loans outstanding per capita • Unemployment • Distance from Capital city
Social dimensions	• Untrained persons among those unemployed • Divorce rate • Offences per 1000 population • Persons per physicians
Environmental dimensions	• Land degradation (total land area degraded) • Forest fires (area affected) • Steppe fires (area affected) • Surface water sources dried up (% of sources dried up) • Water scarcity index (high score means small amount of usable water per capita) • Livestock density (livestock per area) • Air pollution NO_2 level (compared to acceptable standard) • Air pollution SO_2 level (compared to acceptable standard)

Source: Anand, 2011

Each dimension represents an aspect which contributes to vulnerability – thus an aimag which has high values on these will score 1 and an *aimag* with least vulnerability will score zero. These indicators were chosen because data was readily available. To avoid correlation with HDI, variables directly related to HDI or its components were not included.

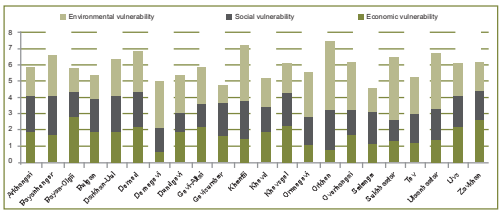
- On economic dimensions, unemployment, non-performing loans proportion in total lending by banks, and distance from city are self-explanatory. Local government finance is used as an indicator of local government's capacity to provide services and reduce vulnerability. This indicator takes higher values the lower an *aimag's* local government expenditure per capita is.
- On social dimensions, 'number of persons per physician' is indicator of inequality in access to health services. Crime rate is an indicator of human security. While unemployment is already included as indicator of economic vulnerability, among those who are unemployed, the proportion of those without training is an indicator of underlying issues related to access to vocational and higher education. Divorce rate is chosen mainly because it is an indicator of breakdown of family. The CNDS places a lot of importance on the structure of the family.
- The environmental dimensions are self-explanatory- they cover issues related to land, air, water, forests, and pasture use.

In this illustration, to give greater emphasis to environmental issues, 8 indicators were chosen for this dimension.

Aggregation: A multi-dimensional index can be developed from the 16 individual indicators. Various alternative statistical methods are available for developing such indicators. For simplicity, an arithmetic

aggregation has been used here. Therefore, the multi-dimensional environmental vulnerability (MEV) index has a range of values between 0 and 16 - a score of 0 meaning an *aimag* is not vulnerable in any of the 16 indicators and the maximum score of 16 means that the *aimag* concerned has highest level of vulnerability in all 16 indicators. We find that the actual values range between 4.3 and 7.2 (Figure 3.18).

Figure 3.18: **Multi-dimensional Environmental Vulnerability Index- illustration, Mongolia**



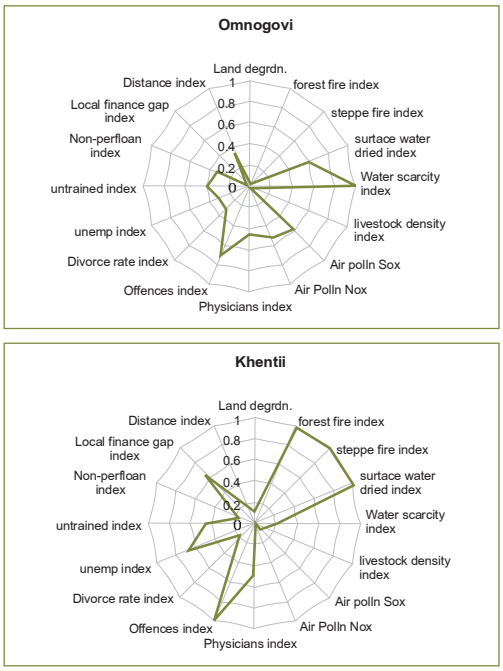
Source: Calculation for Mongolia HDR, 2011.

From this summary, it appears that in this illustration and for the 16 dimensions chosen, Khentii amongst the more rural *aimags* and the three large urban areas Ulaanbaatar, Darkhan-Uul and Orkhon come out as being more vulnerable. This can be expected given that we have two air pollution indicators out of 16 (contributing one eighth of the overall index value). Air pollution levels are higher in the more urbanised *aimags*. Selenge and Govisumber appear to have lower values of MEV index. The above illustration suggests that developing a multi-dimensional indicator can be useful in identifying key challenges for each *aimag*.

Further, we can also examine performance on each of the 16 dimensions as baseline. This is illustrated in Figure 3.19 below (Similar spider diagrams for all *aimags* are presented in Appendix 3).

We can see that Khentii scores maximum possible value on three environment dimensions and one social dimension (offences) and fairly high value for one other social dimension (unemployment rate). On the other hand, Omnogovi scores high on only one of the environmental dimensions,

Figure 3.19: **Performance on various dimensions- Omnogovi and Khentii *aimags*, Mongolia**



Source: Calculation for Mongolia HDR, 2011.

namely, water resources available per capita. This illustration suggests that addressing both social and environmental issues will be a priority to reduce vulnerability in Khentii whereas in the case of Omnogovi, addressing water insecurity will be crucial.

In this illustration, indicators were chosen mainly on the basis of data availability. However, the potential usefulness of such an index for policy is quite clear. One issue concerns *aimags* which have high MEV values i.e., those *aimags* are vulnerable on several indicators. Second issue is to look at individual indicators and identify *aimags* for priority actions.

MEV and HDI: Since the MEV does not have variables which are also in HDI, to some extent these are independent of each other. This allows us to test the conjecture whether *aimags* that do well on HDI also are better at reducing vulnerability.

From Figure 3.20 it is apparent that once we exclude the three urban *aimags*, a fairly strong negative correlation between multi-

Figure 3.20: **Human Development Index and Multidimensional Environmental Vulnerability by *aimags*, Mongolia**

Source: Calculation for Mongolia HDR, 2011.

dimensional environmental vulnerability and HDI exists. This supports the view that promoting human development and reducing vulnerability are consistent with each other.

The main advantage of the MEV is that it highlights that vulnerability is multi-dimensional and that different *aimags* may have different priority issues. The tool can be used to design appropriate risk management and institutional capacity development policies for each *aimag*. The main criticism is that the indicators are *aimag* based and do not capture variation within an *aimag*. As an illustration, this exercise focused on *aimag* level because of data availability. The methodology can be easily replicated with *soum* level data for comparative analysis within an *aimag* also. Another potential criticism relates to gender inequality. In this illustration, divorce rate was chosen as an indicator; alternative approaches can include maternal mortality rate or other indicators of gender inequality (briefly discussed in Anand, 2011).

3.5 Summary

Mongolia is a fast urbanising country but though only 37.5 percent of all households live in rural areas, national and cultural identity is closely related to the nomadic pastoralist way of life.

All people in the rural areas and the poor households in particular are vulnerable to many risks including economic, social and environmental risks. Human development is about promoting substantive freedoms including freedom from want and freedom from fear. Vulnerabilities are manifestations of human insecurity.

Poverty is concentrated in rural areas. Poor people also have fewer assets in terms of livestock or financial assets. In a country that is very vast, those living in rural areas are subject to 'economic distance' – the economic disadvantage of being far away from markets. Distance manifests as a disadvantage in many aspects of rural life most importantly in terms of access to health care and emergency services. Unemployment is widespread and due to distance from urban centres, opportunities to re-train or develop new skills can be limited to rural residents. Reducing economic vulnerabilities include 'shrinking the economic distance' through policies such as market access policies, improving access to skilling and training opportunities for the rural residents. Risk minimising measures by rural residents can manifest in many ways including other risk-increasing activities such as engaging in artisanal and small scale mining activity or extracting natural resources such as forests or wildlife to augment their consumption.

Land degradation is significant in many *aimags* – pasture degradation is usally the most prevalent form of land degradation. Though climate change may have some role, human decisions concerning livestock population and maintaining this within carrying capacity can be crucial. Livestock population in Mongolia increased significantly from around 25 million in 1990 to just under 45 million by the beginning of 2010. Sheep and goats contributed to much of the significant increase. The significant increase in livestock population appears to have had some positive economic impact in terms of livestock related products and their export. However, a very small part of overall livestock related production is exported. In the case of cashmere too, much of cashmere is exported in the form of raw cashmere or simply combed fibres with limited value addition. Transition from collectives to private ownership of livestock also accentuated the open access nature of pastures whereby present system of incentives in terms of market prices and profits emphasise individual rather than collective interests.

Forest degradation is another threat to sustainability. In three *aimags*, namely. Orkhon, Darkhan-Uul and Dornod, at present rate of degradation there will be no forests left in just under three years. Logging is an important contributor to forest degradation. Forest fires are another major cause of forest degradation – nationally some one million hectares of forest area is burnt (NSO, 2011). Nearly half of this was burnt in just one *aimag*- namely- Khentii – another five *aimags* account for the bulk of the rest of the forest area that was burnt.

Water insecurity is another major dimension of environmental vulnerability, particularly for rural residents. On the basis of usable water available per capita, at least seven *aimags* are facing chronic water scarcity. The amount of water available per capita in these *aimags* is much below the international norm for 'absolute water scarcity'.

Due to long term changes in precipitation patterns, many surface water sources have been drying up. The proportion of sources drying up has increased from about 15 percent in 2003 to about 24 percent in 2007. However, in Orkhon, Khentii and Dornod more than two thirds of all water sources have dried up (MNET, Water Census 2007).

Another dimension of water insecurity concerns access to water and sanitation. Of the 623 thousand residents who do not have access to improved sources of water, nearly 92.8 percent are in rural areas. Similarly, out of 1.3 million people without access to improved sanitation, some 58.6 percent are in the rural areas (WHO – UNICEF- JMP data).

A multi-dimensional environmental vulnerability indicator has been developed for possible use as a tool for tracking changes in environmental vulnerability and policy formulation. In an illustration, a total of 16 indicators, across three dimensions were used- 4 social indicators, 4 economic indicators and 8 environmental indicators. This approach highlights the scope of a multi-dimensional tool that can highlight multiple vulnerabilities and at the same time help identify key policy priorities for each *aimag*.

CHAPTER 4

FROM VULNERABILITY TO SUSTAINABILITY - THE URBAN CONTEXT

4.1 Introduction

With six out of every ten Mongolians living in urban areas, reducing vulnerability and increasing sustainability in urban areas will have a significant impact on national level. The aim of this chapter is to summarise the state of urban environment in Mongolia and identify key challenges to reducing vulnerability and pursuing sustainable human development. The Census clarifies as urban, all population living in Ulaanbaatar, the two secondary cities of Orkhon and Darkhan-Uul and all *aimag* centres. Where data is available, we will look at all urban areas; but for most part, the discussion is focused on Ulaanbaatar as of the 1.7 million urban dwellers in Mongolia, nearly 65 percent or about 1.2 million of them live in Ulaanbaatar.

Though Ulaanbaatar has only 34.9 percent of all employees and 41.4 percent of population, it accounts for 62.7 of Mongolia's GDP (Table 4.1). In 2007-2010, GDP of Ulaanbaatar grew at a slightly faster rate than GDP of Mongolia even as the total number of employees decreased. This suggests that labour productivity in Ulaanbaatar is increasing at a faster rate than labour productivity nationally.

At the same time, the negative environmental impacts of city growth are apparent: urban air pollution caused by increased energy use, pressure on water resources, accumulation of solid wastes, impact on forests and protected areas nearby. While the negative impacts are physical and hence can be touched, felt or measured easily, the positive impacts of urbanisation on economic growth and incomes can be difficult to demonstrate.

Yet, rural and urban economies are close inter-connected. As in most land-locked countries, the capital city is a node between domestic and international markets. While rural economy is much more vulnerable to the vagaries of weather, the urban or metropolitan economy is more vulnerable to the vagaries of the markets-domestic and international. For many individuals, urban areas can offer opportunities to make a new start and pursue knowledge-based employment opportunities or offer a range of services in one place.

However, just as each herder's decision imposes externalities on others, the addition of person to urban areas contributes to the economies of scale and agglomeration on the one hand but place a burden on the urban services on the other hand. When an individual moves from rural to urban areas, most of the advantages or benefits go mainly to the individual concerned while the costs of infrastructure services and congestion affect everyone. The key challenge from a human development perspective is to manage urban areas such that they remain drivers for sustaining or improving freedom to achieve a decent standard of living and freedom to learn without compromising the freedoms of others now and in the future.

Table 4.1: **Ulaanbaatar in comparison with selected national economic indicators, Mongolia, 2010**

	Ulaanbaatar	Mongolia	Ulaanbaatar's share in national figure
GDP in million MNT	5174108.4	825,5060.9	62.7%
Employees - thousand persons	360.9	1033.7	34.9%
Population	1151.5	2,789.0	41.4%
GDP per employee million MNT	9,16	6,02	184.1%
GDP per capita million MNT	4571.1	2992.8	152.7%

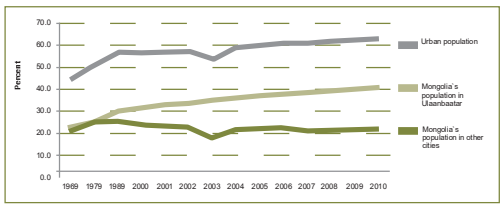
Source: Based on data from NSO 2010.

4.2 Urbanisation and city growth

Mongolia remained a nation of mainly rural population until the late 1970s when for the first time more than 50 percent of Mongolians were residing in urban areas. At the turn of the millennium, 56.6 percent of the overall population of Mongolia lived in urban areas. By 2010, this proportion is estimated to have increased to 63.3 percent. Share of Ulaanbaatar in national population steadily climbed from 22.3 percent in 1969 to around 41.4 percent by the end of 2010. Ulaanbaatar is the only 'million plus' city in Mongolia. At the next level are Erdenet city in Orkhon *aimag* and Darkhan city in Darkhan-Uul *aimag*. Erdenet was built to house copper mining and related industry in the 1970s and is estimated to have a population of 85.8 thousand in 2010. Darkhan city built in the 1960s, is estimated to have a population of about 74,000. All the other *aimag* capital cities have fewer than 40,000 persons. Orkhon, Darkhan-Uul, Govisumber, Dornogovi and Dornod are the five *aimags* with more than 50 percent of population living in urban areas.

During the period 2000 - 2010, while the population of Ulaanbaatar increased that of other cities appears to have decreased slightly (Figure 4.1).

Figure 4.1: **Urbanisation, Mongolia, 1969-2010**



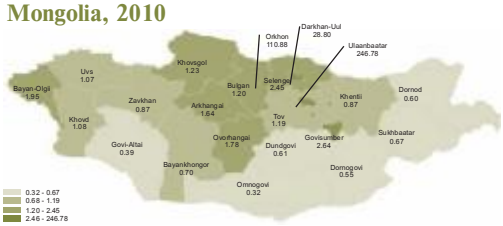
Source: Based on data from NSO, 2011.

Rural to urban migration

Both natural increase and migration contribute to population growth of urban areas. In 2010, population of Ulaanbaatar population increased by approximately 47,000 with both natural increase and migration contributing roughly equal number of persons. Population decreased in nine *aimags*, namely, Uvs, Zavkhan, Dundgovi, Khovsgol, Dornod, Govi-Altai, Khovd, Arkhangai and Govisumber. In these *aimags*, outmigration was greater than natural increase. In Tov and Darkhan-Uul, natural increase was just equal to number of people outmigrating. As a result, population did not change at all. In the remaining 10 *aimags* and Ulaanbaatar, there has been a population increase.

The population density of Ulaanbaatar in 2010 was 246.8 persons per square kilometre (sq km). In comparison, some of the Asian capital cities are much more densely populated: Beijing 11,500; Shanghai 13,400; Singapore 8,350; Bangkok 6,450; Tokyo 4,750; Dubai 2,650. Much of Mongolia is sparsely populated. Ironically, the second and third cities are more densely populated than Ulaanbaatar. Erdenet city has a population density of 1,051 persons per sq km and Darkhan has a population density of 290 persons per sq km. Most *aimags* have a population density of less than 5 persons per sq km (Figure 4.2).

Figure 4.2: **Population density of *aimags*, Mongolia, 2010**



Source: NSO, 2011. Mongolian Statistical Yearbook 2010.

In general migrants moving from locations farther away to more urbanised locations and from locations with low HDI to those with higher HDI values. At present, the distribution of social and private costs and benefits of decision to migrate to Ulaanbaatar are complex and not easy to isolate. Many of the costs and risks during initial period of migration to city are predominantly borne by the migrants themselves – these include uncertainty

in employment and income prospects, increased costs, unfamiliarity with urban systems and ways to access services to which they are entitled, lack of support mechanisms in terms of family and kinship networks.

The social costs of migration include additional impact on services or increasing the *ger* area, additional energy use and CO_2 and other air pollution emissions. However, it is also important to remember that there are social benefits also in terms of increased demand for products and services, a marginal increase in productivity of the migrant (as they move from low productivity region to Ulaanbaatar) and contribution to taxes.

According to a study by the Metropolitan Governor's office (2009), the 'carrying capacity' of Ulaanbaatar city was mentioned as 600,000 people. In reality the population is already twice that number. However, carrying capacity arguments need to be interpreted with care as these can be subjective and based on underlying assumptions about capacity of infrastructure services and alternative options available. Also, few cities in the world have ecological impacts within their carrying capacity. Cities are nodes in a global a flow of resources and energy. This discussion highlights the need for pursuing a sustainable urban development strategy. An ecological footprint analysis, undertaken in Section 4.4, is likely to be more useful for policy purposes than a carrying capacity analysis.

4.3. Urban poverty, housing and access to services

As of 2010, nationally, 39.2 percent of Mongolians were considered to be poor (with income below the poverty line of MNT 88,156 per person per month). Nearly 32.2 percent of of urban residents and 47.8 percent of rural residents were poor (Table 4.2). In comparison, 29.8 percent of residents of Ulaanbaatar had incomes below the poverty line. Though Ulaanbaatar has 41.4 percent of the country's population, it had only 26.3 percent of all poor persons. While urban poverty exists, in general poverty in Mongolia is more prevalent in the countryside. However, inequality in living standards is more pronounced in urban areas.

Poverty reduction depends on both growth and inequality. For example, between 2002-2003 and 2007-2008, poverty[13] in Mongolia decreased by 0.9 percentage points. Due to economic growth, poverty decreased by 5 percentage points but due to inequality, poverty increased by 4.2 percentage points resulting in a net reduction of 0.9 percent only. Decomposition of poverty impacts of growth and inequality components makes clear that economic growth component had a significant impact on poverty

13 Recall the debate on measuring poverty in Mongolia in Box 1.2 in Chapter 1. Therefore, there is a need for caution when comparing HSES 2002-2003, 2007-2008 and 2010.

Table 4.2: **Poverty by settlement, Mongolia, 2002-2010**

	Poverty				Change in poverty as compared to 2002-2003		
	2002-2003	2007-2008	2009	2010	2007-2008	2009	2010
National average	36.1	35.2	38.7	39.2	-0.9	2.6	3.1
Urban	30.3	26.9	30.6	32.2	-3.4	0.3	1.9
Rural	43.4	46.6	49.6	47.8	3.2	6.2	4.4
Ulaanbaatar	27.3	21.9	26.7	29.8	-5.4	-0.6	2.5
Aimag centres	33.9	34.9	37.0	36.2	1.0	3.1	2.3
Soum centres	44.5	42.0	42.6	38.8	-2.5	-1.9	-5.7
Rural areas	42.7	49.7	53.2	54.2	7.0	10.5	11.5

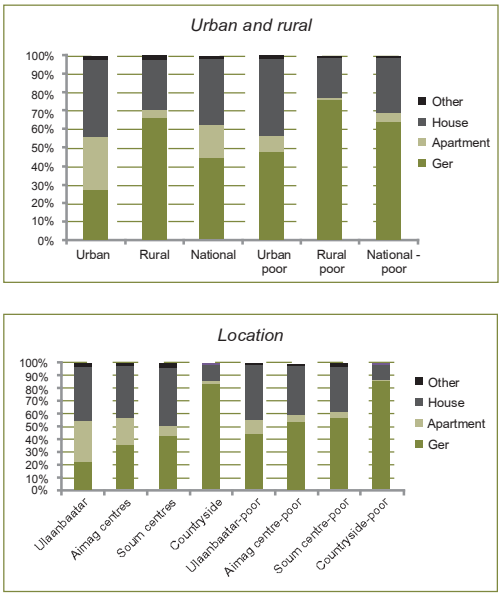
Source: NSO, Household Socio-Economic Survey, 2002-2008, 2007-2008, 2009 and 2010.

in Ulaanbaatar (contributing to 7.3 percentage point reduction in poverty). However, in the countryside, there was an increase in poverty of around 7 percentage points. Thus, growth between 2002-2003 and 2007-2008 was pro-poor but with significant urban bias. Data from 2010 HSES is not yet available to conduct such analysis. However, the broader point that inequality can erode the growth impact on poverty remains valid.

Housing

A quarter of population of Ulaanbaatar live in *gers*. However, 45.1 percent of poor households in Ulaanbaatar and 87.4 percent of poor households in the countryside live in *gers* (Figure 4.3).

Figure 4.3: Dwelling characteristics of population and poor households, Mongolia, 2010



Source: NSO, 2011. Household Socio-Economic Survey 2010.

As the population of Ulaanbaatar city increased during 1992-2010, the population in '*ger* district' (Box 4.1) also increased. An estimate suggests that out of 273 thousand households living in Ulaanbaatar in 2010, the number of households living in *ger* districts is approximately 168 thousand households.

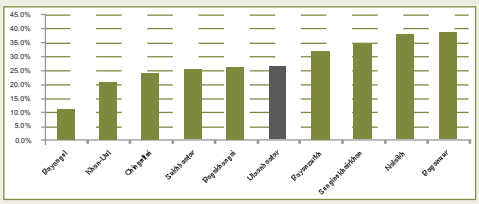
Box 4.1: What are the 'ger districts'?

Ger district can mean many different things to different people. It may be used to mean any one or a combination of the following:

- Areas of city where many *gers* co-exist along with other forms of dwelling.
- Areas of city where the urban form includes high density but low rise form of dwellings which once started out from yards with a *ger*.
- Areas of city not connected to centralised services such as heating or water supply or sanitation.
- Peri-urban areas where new houses are appearing initially in the form of *gers*.

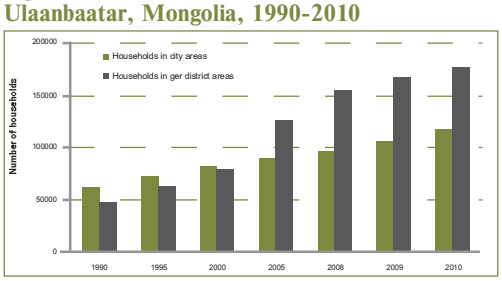
In reality, in every district a significant proportion of households do live in '*gers*' (Figure 4.4). Therefore, caution is needed in interpreting any references to '*ger* districts'.

Figure 4.4: **Proportion of households living in *gers* in Ulaanbaatar and its districts, Mongolia, 2010**



Source: Based on data from Ulaanbaatar City Statistical Office, 2010

Figure 4.5: **Growth in number of households in Ulaanbaatar, Mongolia, 1990-2010**



Source: Based on data from Ulaanbaatar City Statistical Office, 2010

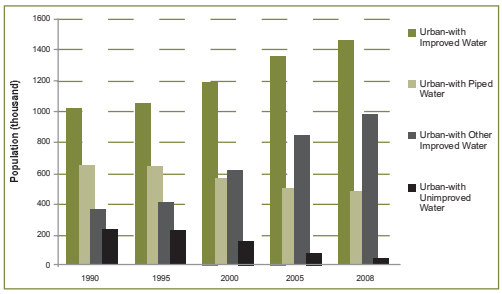
Access to water supply

Insecure access to water can be a source of insecurity and vulnerability in urban area. Data is not readily available to conduct a disaggregated analysis to look at access to water by different groups of population. This analysis relies on three different data sources (i) the WHO-UNICEF Joint Monitoring

Programme data is used for MDG monitoring and gives us a picture of the proportion of residents with access to improved sources of water; (ii) Data from Ulaanbaatar City Statistical Office helps in getting a comparative picture of residents in different districts within Ulaanbaatar; and (iii) HSES data provides us a comparative picture of access to improved water by household poverty levels.

According to the WHO-UNICEF Joint Monitoring Programme data, the proportion of urban population in Mongolia with access to improved sources of water increased from 81 percent in 1990 to 97 percent in 2008. However, both the number and proportion of those with access to piped water has actually decreased during the period. In absolute terms, the population served with piped water decreased from 657 thousand to 483 thousand during that period. Those with access to other improved sources increased from 367 thousand (29 percent of urban population) in 1990 to 980 thousand (65 percent of urban population) in 2008 (Figure 4.6).

Figure 4.6: **Urban households with access to water, Mongolia, 1990-2008**

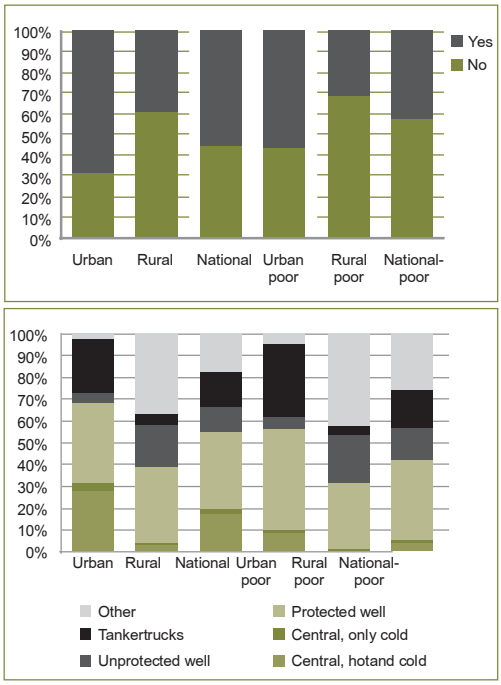


Source: WHO-UNICEF, 2009. Joint Monitoring Programme.

Ulaanbaatar City Statistical Office confirms that over 94 percent of all households in Ulaanbaatar have access to safe water in 2010. The proportion of households with access to water is: between 85 and 90 percent in Nalaikh, Bayanzurkh and Baganuur districts; between 90 and 95 percent in Bagakhangai district; above 95 percent in Songinokairkhan, Sukhbaatar, Khan-Uul, Chingeltei and Bayangol districts. Residents in *ger* areas rely on some 500 public water kiosks. Some of these kiosks are connected with mains and others are supplied by tanker trucks. Many *ger* residents appear to be satisfied with water supply (Kamata et al, 2009).

An alternative source of data is the Household Socio-Economic Survey (HSES). According to HSES (2010), some 54 percent of urban population had access to improved sources of water. Only 33.7 percent of rural population had access to improved water sources. The corresponding proportions for poor households were 35.7 and 29.1 percent respectively (Figure 4.7). Nearly 58 percent of urban poor households depend on tanker trucks for water; 47 percent of rural poor households depend on 'other sources' of water, namely, spring, river, snow, ice and other unprotected sources. Whether tanker trucks are considered as 'improved' source may explain much of the difference between HSES and the NSO and WHO-UNICEF estimates. According to MDG definitions, however, access to water from tanker trucks should not be considered as access to 'improved sources of water'.

Figure 4.7: **Access to water supply, Mongolia, 2010**



Source: NSO, 2011. Household Socio-Economic Survey 2011.

Box 4.2: What Ulaanbaatar can learn from New York in conserving forests to protect water resources

One of the main sources of water for Ulaanbaatar is the Tuul river. However, a number of studies indicated that water flows have been declining and the river is becoming increasingly polluted as it flows through the city. A World Bank (2009) study estimated that at present, the economic value of services generated by the Upper Tuul ecosystem include MNT 28 billion from tourism, herding and forest based services and MNT 90 billion from water use in Ulaanbaatar. The study finds that benefits from conservation of two protected areas in the upstream, namely Gorkhi-Terelj National Park and Khan-Khentii Strictly Protected Area, will be worth MNT 1,370 billion. For MNT 1 invested in conservation, potential benefits from the Upper Tuul ecosystem are estimated to be in the range of MNT 15-40.

New York is one of the few large metropolitan cities without expensive water filtration or treatment plants. A major source of water to New York is the Catskill-Delaware catchment area some 160 km north of the city. In 1986, due to increased public health concerns related to drinking water quality, the United States Congress passed a law amending provisions on drinking water quality and the requirements to be met where water is unfiltered. Subsequent changes in environmental regulations in 1989 meant that New York city had two options- either to build expensive filtration plants (estimated to cost between US$4-8 billion at that time) or secure protection measures in upper catchment areas of the Catskill-Delaware basins. The latter option was chosen both from economic and environmental viewpoints.

There are suggestions to introduce payment for ecosystem services (PES) and to use real payments as way to reward conservation efforts by forest communities and herders in the Upper Tuul systems. This can be achieved by an ecosystem levy on water consumption in Ulaanbaatar. The key message from the New York case study is to develop institutional mechanisms where all the stakeholders including Ulaanbaatar city government, the water supply utilities, forest administration, the concerned *aimag* and *soum* governments, herders and other relevant stakeholders work together for mainstreaming ecosystem protection in water management plans.

Sources: World Bank, 2009 and NYCDEP, 2011

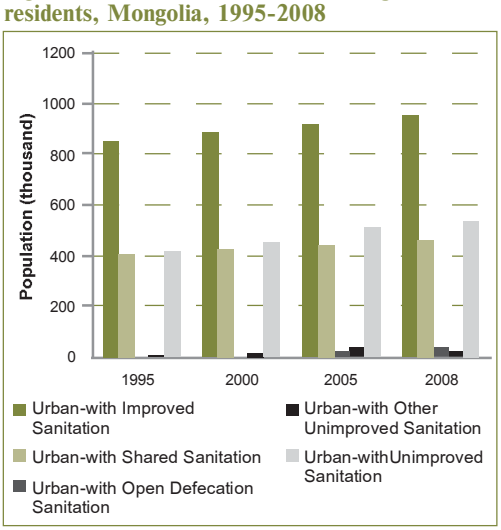
These various figures do not adequately convey the variations in access in terms of amount of water per person, the direct cost in terms of payments and indirect costs in terms of cost of waiting or collecting water.

Absolute water scarcity in terms of quantity of water will continue to be crucial. Total water resources potential of Ulaanbaatar is 962 cubic metres per person and usable amount of water person is just 135 cubic metres per person. With climate change and variability in precipitation, the quantity of water resources available can be affected. The extent of usable water per person is likely to reduce with population growth, urban-rural migration and increased economic activity. Protecting the upper reaches of the Tuul river, improving re-charge rates and reducing potential for contamination are all priorities. There is scope for using a range of policy instruments including: creation of integrated river basin management institutions, and changing incentives to promote water conservation and more efficient use of water (Box 4.2).

Access to sanitation

WHO-UNICEF JMP data suggests that the proportion of urban population with access to improved sanitation actually decreased slightly from 67 percent in 1995 to 64 percent in 2008. In absolute terms, the number of people with access to improved sanitation increased from 863 thousand to 965 thousand in this period, while those without access to improved sanitation increased from 425 thousand in to 543 thousand in the same period (Figure 4.8).

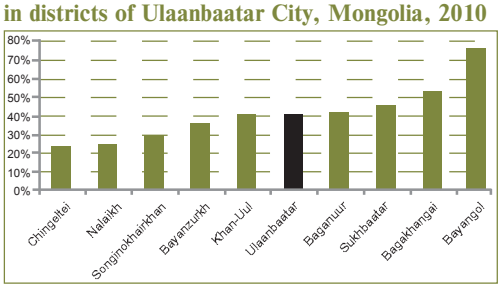
Figure 4.8: **Access to sanitation among urban residents, Mongolia, 1995-2008**



Source: WHO-UNICEF, 2009. Joint Monitoring Programme.

According to the Ulaanbaatar City Statistical Office data, about 41 percent of households in Ulaanbaatar had access to sanitation in 2010 (Figure 4.9). The proportion of households with access to sanitation was between 20 and 30 percent in Nalaikh and Chingeltei; 35 percent in Bayanzurkh; around 41 percent in Khan-Uul and Baganuur; 45 percent in Sukhbaatar district; 52 percent in Bagakhangai and 75 percent in Bayangol district.

Figure 4.9: **Households with access to sanitation in districts of Ulaanbaatar City, Mongolia, 2010**



Source: Based on data from Ulaanbaatar City Statistical Office, 2010

As per the HSES data, a quarter of the urban population and two thirds of the rural population did not have access to 'improved' sanitation facilities. The corresponding proportions among poor households are 44.4 percent and 71.5 percent.

Electricity

According to HSES, nationally, 69.1 percent of households had access to electricity supplied by central grid system with 93.6 percent of urban households and 35.8 percent of rural households having such access. While 89.8 percent of urban poor households also had access to electricity from the central grid, only 30.8 percent of rural poor households had access to electricity from central system. More than a third of rural households and rural poor households depend on solar cells to generate electricity.

Education services

With regard to most of the education related macro-indicators, there is little variation among *aimags* and the capital city. This clearly indicates that income per capita is not correlated with educational outcomes.

However, assessing the quality of education is much more difficult. Perceptions and also non-systematic but qualitative evidence suggests that quality of education varies significantly. A simple measure of access is distance to school and whether pupils in certain districts need to travel farther. However, HSES 2007-08 data does not show this to be the case. In that survey, for non-poor households in Ulaanbaatar the average distances to primary school and lower secondary school were 2.1 km. For the Ulaanbaatar poor households, these distances were also 2.1 km in each case. Kamata et al (2009) noted with regard to *ger* area households: "...The poor condition of unplanned and unstructured earthen roads in *ger* areas is one of the most serious concerns expressed by *ger* residents...Poor access to public transport places *ger* residents at a disadvantage due to their long commuting times to work and schools." Distance is usually not an issue for middle and high income households; nor is distance an adequate measure of access to quality of education.

There is however, a significant difference when it comes to time to travel to tertiary or vocational education institutions. The poor in Ulaanbaatar need to travel longer distance for vocational educational institution or college and university. However, the proportion of students in such institutions from poor households is considerably smaller than students from non-poor households. This suggests that while there is considerable equality in access to primary and secondary education, it appears that tertiary education is mainly reached by the non-poor[14].

In the context of reducing vulnerability and promoting sustainability, some educational institutions have already been playing an important role. As part of the National Action Plan to Combat

14 According to HSES, only 4 percent of students in college and university are from the poorest quintile; another 11 percent from the second quintile. That is, the bottom 40 percent of population accounts for only 15 percent of students in colleges and universities. Nearly 40 percent of students in such institutions are from the richest quintile. The top two richest quintiles of population account for 65 percent of all students in colleges and universities.

Desertification also environmental education has been stressed. There is a need to further develop locally appropriate and culturally relevant environmental education programme and support this as an essential mechanism to involve locally knowledgeable persons and communities in the management of local environmental resources.

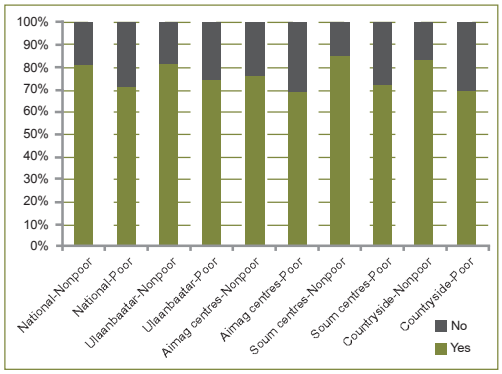
Health services

In terms of health services, in general Ulaanbaatar is better served than rural areas. For instance, there were 7,497 physicians in all of Mongolia but 4,565 of these were in Ulaanbaatar itself. Thus, the number of persons per physician varies from 248 in Ulaanbaatar to 771 in Khovsgol and 768 in Bayankhongor in 2010 (NSO, 2011). As an ADB (2008:18) evaluation study noted: "Most district hospitals lack complete, functioning basic sets of diagnostic equipment, and pharmaceutical supplies appeared to be very limited." The study 2008: also noted that "...none of the district hospitals seen have functioning indoor toilets, and only one has functioning piped water. This is a highly unsatisfactory situation. Health facilities should be models for personal hygiene, with showers, indoor plumbing, and piped water."

However, according to the Household Socio-Economic Survey (2010), nationally and in Ulaanbaatar as well as in *aimag* centres and in the countryside, in general, the poor households make fewer health related complaints. Nationally, while 8.7 percent of the non-poor households reported a health complaint, only 4.5 percent of the poor households reported a health complaint (Figure 4.10). Of those, who do complain, among the poorer households many do not seek treatment. Of those, who do seek treatment, a great majority (over 93 percent) use public health facilities.

Health accounts for 2 percent and education accounts for 5 percent in the monthly per capita consumption expenditure of the poor households (HSES, 2010).

Figure 4.10: **Seeking health treatment – poor and non-poor households by location, Mongolia, 2010**



Source: NSO, 2011. Household Socio-Economic Survey 2010.

These patterns suggest that there could be considerable under-reporting of health needs of the poor, especially among those living in the countryside.

Human security issues

Freedom from fear is an important dimension of human development. Crime rate can provide an indication of overall level of criminality. Nationally, the number of offences per 100,000 persons in 2010 is 712. However, crime rate is much higher in Ulaanbaatar at around 943 crimes per 100,000 persons. In our analysis, we find that there is some positive correlation between the proportion of urban population in an aimag and the crime rate.

Based on data from NSO, we have also analysed crime rate within Ulaanbaatar. We find that crime rate varies from 432 offences per 100,000 persons in Bagakhangai district to 1,185 offences per 100,000 persons in Sukhbaatar district. In our analysis, we did not find any correlation between crime rate and population size, population density or unemployment. We did not find any relationship between proportion of population in a district living in *gers* and crime rate in terms of offences per 100,000 persons. This seems to challenge a stereo-type that ger areas will have higher crime rate.

While the overall level of crime itself can affect human security in many ways, of great

significance to personal safety is the extent of assaults. International comparison by UN Office of Drugs and Crime (Harrendorf et al, 2010) suggested that Mongolia is in the third quartile with a rate of 144 assaults per 100,000 persons in a comparative analysis of some 98 countries. Countries in top quartile had assault rates in the range of 350 (Netherlands) to 1,655 (Scotland). Countries in the lowest quartile had assault rates ranging from 0.5 (Bangladesh) to 32 (Moldova).

What is the relevance of human security issues in a report on environment and human development? There are two very important implications. First, as emphasised in chapter 1, the focus of human development as enhancing substantive freedoms includes both 'freedom from want' and 'freedom from fear'. A city must be a 'safe city' for it to be a 'sustainable city'. A safe city is "...one that promotes the elimination of gender-based violence, while at the same time promoting equal opportunities for men and women in all the spheres of social, economic, cultural and political life" (Lambrick and Rainero, 2010). Secondly, there is some evidence from Australia which suggests that women feel less safe in any transport other than their own car (Bell,1998). Concerns about personal safety can contribute to increased use of car even where public transit alternatives exist.

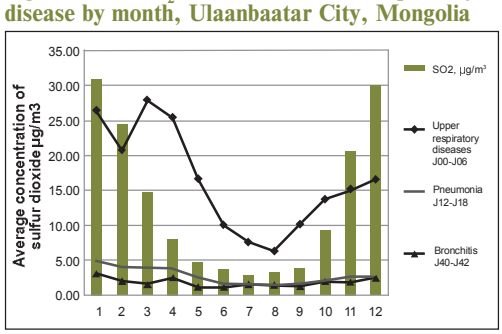
4.4 Environmental impacts and footprint of city growth

In this section, a brief summary of some of the key environmental impacts of urban growth in Ulaanbaatar and other big cities is provided.

Air pollution and impacts

Air pollution in Ulaanbaatar has been well researched and well-reported. Numerous studies over the last 15 years have recognised and highlighted the problem – it may be partly a result of topography and the location of Ulaanbaatar between the mountains, partly due to conditions that favour thermal inversion in winter months trapping the polluted air over Ulaanbaatar for extended periods of time, partly due to the extent and the nature of energy used by households in *ger* districts for heating, partly due to automobiles and so on. Air in Ulaanbaatar fluctuates seasonally and exceeds the safe limits in winter months. For example, the level of sulphur dioxide in the ambient air significantly increases during winter months with some association with regard to the number of cases per 10,000 population of upper respiratory diseases, pneumonia, and bronchitis (Figure 4.11).

Figure 4.11: **SO_2 concentration and respiratory disease by month, Ulaanbaatar City, Mongolia**



Source: Saijaa, 2010. Health impact assessment of air pollution in Ulaanbaatar City, background paper to Mongolia HDR 2011.

Morbidity in terms of cases of respiratory diseases per 10,000 persons is moderately correlated with levels of sulphur dioxide, nitrogen dioxide and particulate matter PM10 (Saijaa, 2010). The main source of sulphur dioxide is the burning of coal whereas the main source of nitrogen dioxide is automobile emission.

Water quality and water pollution

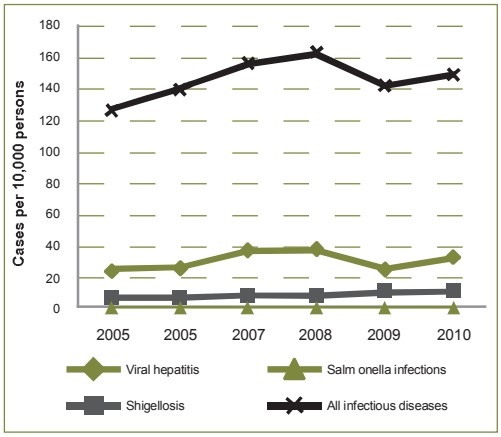
According to the Ministry of Nature, Environment and Tourism (2008), 85 percent of all rivers and lakes were categorized as "very clean" and "clean". However, these are not in Ulaanbaatar. The sections of Tuul river near Ulaanbaatar were categorised as being polluted or highly polluted. Main pollutants include: nitrogen and phosophrous compounds, organic matter and other chemicals such as chromium and copper. The State of the Environment report (MNET,

2008) noted: "...Ammonium nitrogen level in Tuul rive around Tuul-Songino bridge is approximately 25 times higher than the allowable level of ammonium nitrogen stated in water quality standards (0.5 mg/litre)".

Inadequate sanitation infrastructure, disposal of industrial and trade wastes, disposal of solid wastes contribute to water pollution in Ulaanbaatar. As we have already seen, some 27 percent of households in Ulaanbaatar do not have access to improved sanitation. Among the poor households, this proportion is 47 percent. Many households in areas not connected with sanitation systems build and use simple pit latrines. With increasing density of population, these can be a source of contamination. A survey of water sources by WHO in 2005 indicated that 67 percent of spring water sources in Ulaanbaatar were not safe for drinking and domestic use (i.e., had significantly high level of E-coli).

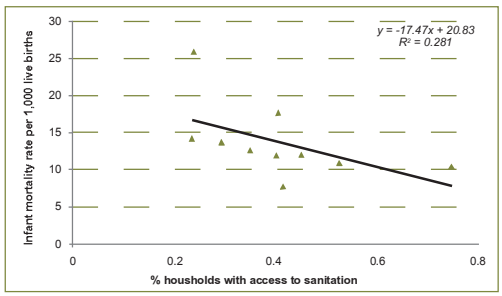
As of 2010, there were nearly 41,373 cases of infectious diseases at the national level. Approximately 21,424 (or 51.8 percent) of these cases were in Ulaanbaatar. As per national data, among the main water borne infectious diseases, hepatitis and shigellosis (bacillary dysentery) remain significant (Figure 4.12). Eighty five percent of those with hepatitis A are children of 0-14 ages and the disease had its sources in kindergartens, schools and summer camps. Infant mortality rate in the 7 districts of Ulaanbaatar significantly decreases with increase in the proportion of population with access to improved sanitation (Figure 4.13).

Figure 4.12: **Infectious Diseases –cases per 10,000 population, Mongolia, 2005-2010**



Source: Based on data from NSO, 2011.

Figure 4.13: **Access to Sanitation and Infant Mortality Rate within Ulaanbaatar City, Mongolia**



Source: Based on data from Ulaanbaatar City Statistical Office, 2010.

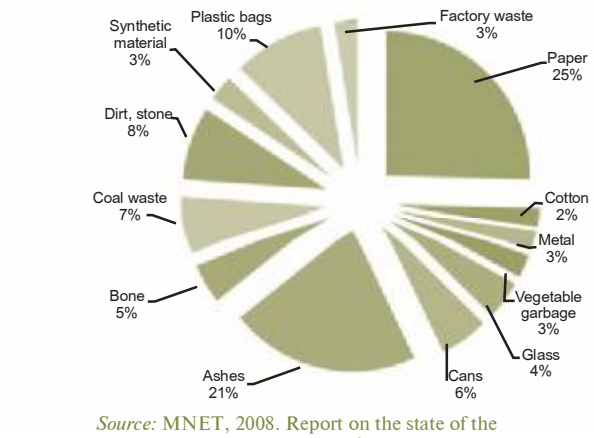
Solid waste

As per WHO survey, on average a resident of Ulaanbaatar produces somewhere between 0.35 to 0.54 kg of waste per day. According to the Ministry of Nature, Environment and Tourism (MNET, 2010a:29) some 75 percent of waste is collected by the waste management organisations; 15 percent of all waste is transported by firms themselves and some 5-10 percent of waste is left uncollected. The amount of waste generated per day is approximately 393 to 595 tonnes of which somewhere between 290 to 440 tonnes of waste are collected by the waste collection services.

A solid waste management master plan for Ulaanbaatar has been developed (JICA, 2008). Various initiatives include the promotion of a 3R approach that is 'reduce-reuse- recycle'. The composition of waste in 2007 (Figure 4.14) indicated that there is scope to recover material such as cans, paper and glass. Approximately 43 percent of all waste can be recycled or reused. At present, a small extent of waste is already recycled by individual waste collectors who collect mainly plastic bottles and plastic bags. In January 2010, the law on 'prohibition of use and importing of some plastic bags' was approved by *State Great Khural*. This law

prohibits the import and use of plastic bags thinner than 0.025 mm. While this is an important step, there is progress to be made to moving towards completely eliminating plastic bags and promoting the use of bio-degradable plastic bags where they are needed.

Figure 4.14: **Composition of solid waste in Ulaanbaatar City, Mongolia, 2006-2007**



Source: MNET, 2008. Report on the state of the environment of Mongolia, 2006-2007.

As part of implementation of the provisions of the Law on household and industrial waste, residents and firms pay a user charge for waste collection. The proceeds of this charge are collected as the 'Ulaanbaatar Waste Service Fund'. Some of the residents in *ger* district may not be able to pay these charges. This may contribute to opting out of the service in *ger* districts and to wastes being improperly disposed of by such households.

An issue of significant health risks is that of medical or heath waste disposal. A study of heath care waste in Ulaanbaatar by WHO (2005) indicated that 171 government and 379 private health care establishments operating in Ulaanbaatar generated approximately 2.65 tonnes of healthcare wastes daily. A joint strategic plan for medical waste management is currently being implemented by the Ministry of Health, MNET and Ulaanbaatar City Municipality.

Land degradation and impact on forests

Chapter 3 discussed land degradation in the rural context. Urbanisation process can also significantly contribute to degradation of land surrounding the city.

Growth of new human settlements is an important factor. 78.7 thousand new households were added to Ulaanbaatar between 2005-2010 or some 15.7 thousand new households per annum. Assuming each new dwelling occupies 0.07 hectares, this works out to around 910 hectares of new land used per annum.

Proliferation of 'summer houses' can also contribute to land degradation. Since the introduction of the land privatisation law, every resident is allocated 0.07 hectares of land. A number of Ulaanbaatar residents have been seeking to obtain land close to Ulaanbaatar where the summer houses are being built. As these are meant to be 'summer houses' there are no infrastructure facilities yet. Most of these houses have pit latrines and there is hardly any solid waste collection system in place. It is ironic that beautiful, modern and well-designed houses sit right next to piles of garbage and plots containing several individual toilets.

The vast amount of fly ash left from burning of nearly 4 million tonnes of coal in the CHP power plants can be significant. Apart from contributing to increased levels of PM2.5 and PM10, fly ash can also contain radio-active substances and other heavy metals which are all environmental toxins. Disposal of fly ash in landfills away from the city is one option. Fly ash can be used in stabilisation of soil or production of cement or in road construction. However, the degree of toxicity of fly ash would determine the safe uses to which it can be put.

Light industry in and around Ulaanbaatar also contributes to significant wastes which

contribute to land degradation. These include: 19 brick factories, 32 stone quarries, 76 animal skin processing factories, 314 centres for automobile workshops, 4 asphalt factories and 166 gasoline stations.

Waste disposal and landfill activities themselves can contribute to some extent of land degradation. Currently, the Solid Waste Management Master Plan is being implemented. As part of a project funded by JICA some 4 hectares of area in Ulaanchuluut disposal point was cleaned and restored.

Urban growth can threaten biodiversity in the surrounding areas. Mongolia's fourth national report on the implementation of the Convention on Biological Diversity noted that Siberian Frog is now extinct in the outskirts of Ulaanbaatar.

Another indirect impact of urban area on nearby forests is the harvesting of timber and forest produce. Nationally, some 687.5 thousand cubic metres of timber and forest produce were harvested in Mongolia in 2010 (NSO, 2011). Within Ulaanbaatar, 3.9 thousand cubic metres of such resources were harvested. In the neighbouring Tov *aimag*, the amount of forest produce harvested increased from 29.8 thousand cubic metres in 2006 to over 33.1 thousand cubic metres in 2010. Some of this increase is likely to have been driven by demand for firewood and construction timber from Ulaanbaatar.

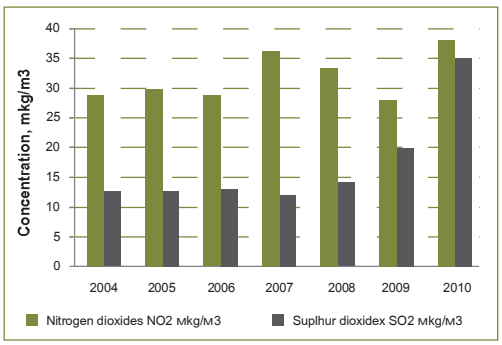
One of the oldest protected forest area in the world is the Bogd Khan Uul special protected area next to Ulaanbaatar city. In recent years, a significant growth in construction of houses in the Zaisan valley and tourism development projects have raised concern about the impact of urban activities on protected areas. As the GEF (2010) document noted: "...in recent years the lower parts of many of Bogd Khan's 21 major valleys have become the sites for developments that are technically illegal according to the Protected Area Law (2000). They include high rise apartment blocks, a ski resort with artificial snow, an 18-hole golf course, residential complexes, and various tourist accommodation facilities." Some of the construction licenses have been recently revoked and many of these projects themselves have not involved any felling of trees. However, this highlights the pressure that urban growth can put on protected areas nearby.

Air pollution[15] in Ulaanbaatar

Air pollution is becoming an increasing problem in Ulaanbaatar, Erdenet and Darkhan affecting human health, particularly of children. In the winter, concentrations of oxides of sulphur and nitrogen, carbon monoxide and dust sometimes exceed WHO and Mongolian standards.

As per WHO air quality guidelines the annual concentration levels for nitrogen oxide and sulphur dioxide (over 24 hours) are 40μg/м^3 and 20μg/м^3 respectively. Though annual mean concentration levels vary from year to year, in Ulaanbaatar the pollution levels appear to be within these guidelines (Figure 4.15). However, from the data for *aimag* centres (Figure 4.16), it appears that the Nitrogen Oxide levels exceeded the WHO standard in Khovd,

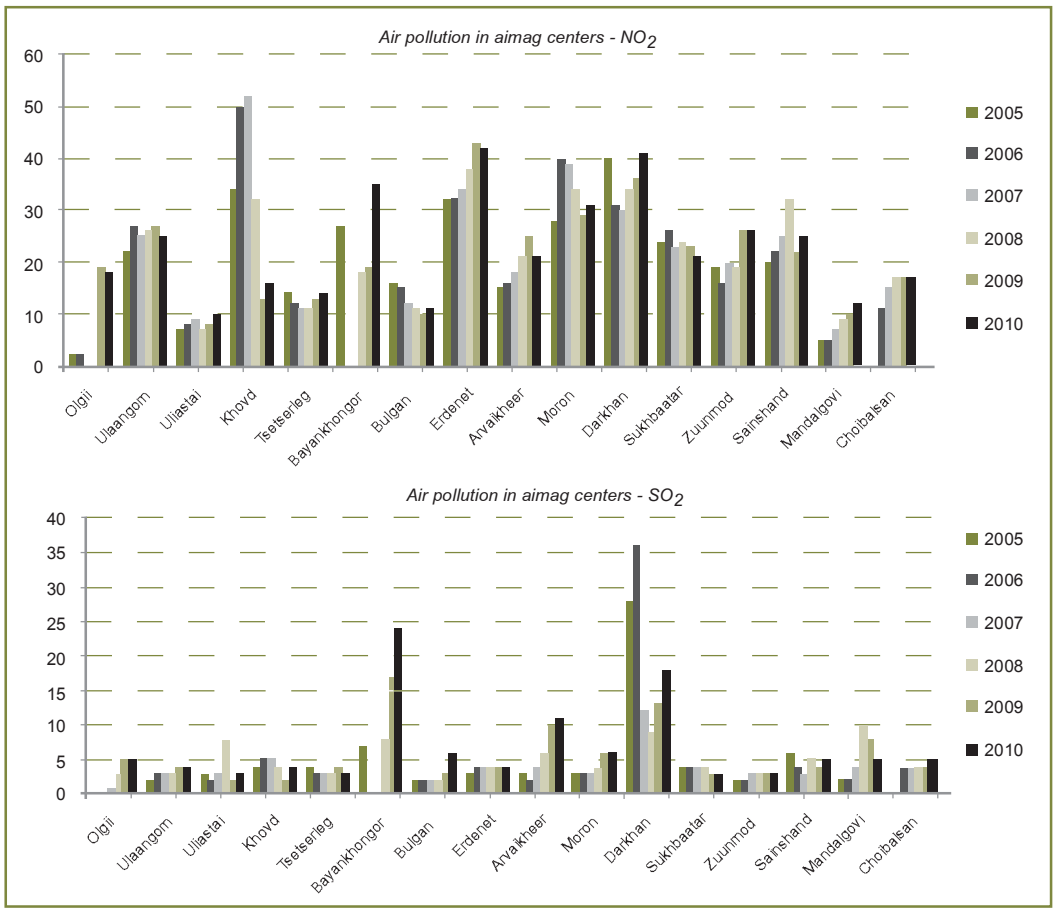
Figure 4.15: **Annual average mean concentrations of Sulphur oxides (SO_2) and Nitrogen oxides (NO_2) in Ulaanbaatar, Mongolia, 2004-2010**



Source: NSO, 2005-2011. Mongolian Statistical Yearbook 2005-2010.

15 For analysis of health impacts of air pollution related morbidity and mortality, see background paper to Mongolia HDR 2011 by Saijaa, 2010.

Figure 4.16: **Annual average mean concentrations of SO_2 and NO_2 in *aimag* centres, Mongolia 2005-2010**



Source: Based on data from MNET, 2010 and NSO, 2011.

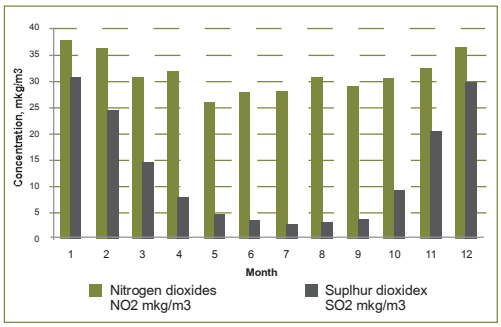
Erdenet, Moron and Darkhan in some years. For sulphur dioxide, the levels appear to have exceeded WHO guidelines for Darkhan in 2006 though seems to be within the established norms since then.

The main source of air pollution in general and sulphur dioxide in particular in Ulaanbaatar is the burning of lignite coal in poorly designed, poorly maintained, government operated CHP plants, around 180 heat only boilers and 1200 low pressure boilers within the city and the use of coal or firewood for heating by many households. HSES (2010) indicated that 61.8 percent households in Ulaanbaatar use simple units for heating. Policies are needed to make clean energy sources accessible to the poor households especially in urban areas.

Aggravating air quality in Ulaanbaatar and other urban centres is the widespread location of cities and towns on river valleys. Here the air is subject to winter inversions that trap pollution emissions near the ground. The problem is magnified in Ulaanbaatar by the location of successive CHP plants on the windward side of the city. Seasonality mainly affects nitrogen oxides – their concentration increases in winter months when thermal inversion can be an issue. Sulphur oxide concentrations exceed the WHO guideline during the winter months of December, January and February though fluctuate less widely than nitrogen oxides (Figure 4.17).

The main source of nitrogen dioxide is vehicular exhaust. Other urban air pollution sources include windblown dust

Figure 4.17: **Air pollution indicators in Ulaanbaatar City - monthly average mean concentrations of Sulphur dioxides (SO_2) and Nitrogen dioxides (NO_2) (average 2004-2008), Mongolia**



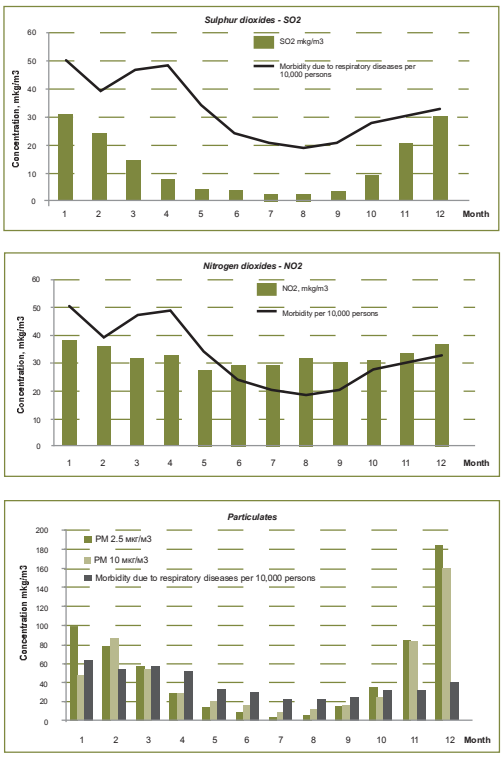
Source: Saijaa, 2010. Health impact assessment of air pollution in Ulaanbaatar City, background paper to Mongolia HDR 2011

and vehicle exhaust emissions. WHO 2005 Guidelines noted that as a result of various activities and due to natural factors such as dust storms, dust particle levels in the atmosphere in Mongolia and China are generally high. WHO air quality guidelines for PM10 particles is 20μg/м^3 and for PM2.5 this is 10μg/м^3. Mongolia national standards are much higher than these figures. However, in the winter months especially in December and January, the levels of particulate matter in Ulaanbaatar exceed even the national standards (Saijaa, 2010). The health impact of air pollution is evident from the apparent correlation between different pollutant and morbidity due to respiratory diseases (Figure 4.18).

There is limited evidence to show a correlation between air pollution and mortality. However, air pollution can be indirectly affecting other risk factors and aggravating those. A recent study indicated that air pollution in urban areas can contribute up to 12 percent of heart attacks worldwide (Nawrot et al, 2011). WHO in Mongolia recently highlighted the importance of non-communicable diseases (NCD). While genetic and life style factors play a very important role, air pollution and traffic congestion can also contribute to mortality due to NCDs.

The issue of geo-climatic factors and thermal inversion need to inform land use and transport planning within large cities. Decisions on the siting of CHP plants and industrial activities, should take into account wind direction also. In the run up to the first UN High Level Meeting on Non-communicable diseases in September 2011, there is a need to identify the role of air pollution and other environmental factors in contributing to overall burden of disease.

Figure 4.18: **Morbidity due to respiratory diseases and air pollution in Ulaanbaatar City, by month, (average 2004-2008)**



Source: Saijaa, 2010. Health impact assessment of air pollution in Ulaanbaatar city, background paper to Mongolia HDR 2011

Carbon footprint of Ulaanbaatar: A first attempt at estimation

Estimating carbon footprint of a city is not easy. Such an exercise requires detailed information on material and energy flows. Here, an initial attempt is made using available data and making some reasonable assumptions for illustrative purposes.

The main sources of CO_2 emissions of Ulaanbaatar include power stations,

energy use by households for heating, energy used in transportation, green house gases from solid wastes and land conversion.

CO_2 from Power stations: The three CHP power plants in Ulaanbaatar produce around 3,360 Giga watt hours of electricity (compared to 4,200 Giga watt hours produced nationally). Since, nationally electricity production uses up 5 million tonnes of coal, approximately 4 million tonnes of coal are used by the three power plants in Ulaanbaatar per annum. Though some of this electricity is exported the pollution load remains in the Ulaanbaatar. The CO_2 generated from this is approximately 11.44 million tonnes.

CO_2 from Coal used: Nationally, another 1.6 million tonnes of coal is used by households and industry. The corresponding share of coal used by households and industry in Ulaanbaatar would be at the very least about 0.6 million tonnes. The CO_2 generated is approximately 1.72 million tonnes.

CO_2 from Biomass used: According to HSES, nationally some 58 percent of households in Ulaanbaatar use 'simple units' for heating fuelled by firewood, coal or dung. Since we have already accounted for those using coal, we can assume that approximately 38 percent of all households (i.e. 106,000 households) use 'traditional' fuels such as firewood and dung. We know that traditional fuels account for 326 thousand tonnes of oil equivalent (TOE) nationally – or approximately 1.6 TOE per household. This works out to approximately 166 thousand TOE (or approximately 516 thousand tonnes) per annum. Wood and biomass contains moisture and hence it is not easy to estimate CO_2 emissions but approximately one tonne of biomass generates 1.5 tonnes of CO_2. Thus, biomass consumed for household simple units generates approximately 0.77 million tonnes of CO_2.

CO_2 from vehicles: The number of vehicles in Ulaanbaatar increased from 42,500 in 2000 to over 162,710 by 2010. Nearly 44 percent of these vehicles are 11 years or older; another 38 percent of these vehicles are between 8 and 11 years old. Nationally, transport sector uses 729 thousand tonnes of oil equivalent (TOE). The total number of vehicles is over 254,486. Approximately 162,710 are registered to be in Ulaanbaatar. From this, we can estimate that transport sector in Ulaanbaatar approximately uses some 404 thousand TOE annually. Nationally, transport sector emissions are estimated to be 1,874 Giga grams. The corresponding figure for Ulaanbaatar works out to 1099 Gg or 1.099 million tonnes.

Methane from solid waste: According to MARCC, nationally, methane emissions from 117 thousand tonnes of municipal solid wastes were estimated to be 2.43 Gg in 2006. The solid wastes disposed through landfill in Ulaanbaatar are estimated to be approximately 135 thousand tonnes (average) and the methane generation from this is estimated to be about 2.8Gg of Methane or 0.057 million tonnes of CO_2-equivalent.

CO_2 from land conversion: In the previous sub-section, we estimated that 910 hectares of land is converted annually due to human settlements. Assuming that this land is converted from grass land into urban housing purposes, the approximate CO_2 emissions from such land conversion works out to approximately 159 tonnes.

From these sources, it appears that Ulaanbaatar's CO_2 footprint is likely to be in the region of 15,000 thousand tonnes or about 13.5 tonnes per capita (Table 4.3).

For Ulaanbaatar to reduce its carbon footprint, various steps can be taken. Priorities include: reducing emissions from energy use; improving the energy efficiency and reducing losses from the CHP plants and heat-only boilers; improving access

Table 4.3: **CO_2 footprint of Ulaanbaatar City –an illustration, Mongolia**

Activity	Source	Extent	CO_2 emissions thousand tonnes	CO_2 emissions tonnes per capita
Electricity generation	CHP plants	4 million tonnes of coal	11440.000	10.285
Heating	Households	0.6 million tonnes of coal	1716.000	1.543
Traditional fuels	Households	166 thousand TOE	774.495	0.696
Transport	Vehicles	131,447 vehicles in 2009	1099.361	0.988
Solid waste	180462.3	tonnes	57.925	0.052
Land conversion	Residences	910 hectares	0.000	0.000
Total	**All sources**		**15087.781**	**13.564**

Source: Based on NSO, 2010; MNET, 2008; and MARCC, 2010.

to cleaner forms of energy especially for the urban poor and residents in peri-urban districts; reducing emissions from transport sector through a combination of public transport improvements on the one hand and clever use of market based instruments such as congestion charging, parking levies and other forms of incentives to reduce the use of automobiles.

MARCC (2010) notes that about 50 percent of energy generated from fuel burning is lost during production, transmission and consumption, and that only 45 percent of energy generated from overall fuel burning is used. At present, incentives are not aligned to efficient use of energy. Improving the efficiency of energy use is an important mitigation measure. In some cases, existing plants may be using obsolete technology and there is an urgent need to review and renew such plant and equipment with more modern and less energy-intensive technologies. The Second National Communication submitted to UNFCCC identifies this as a priority.

Mongolia is rich in renewable energy resources. Solar, wind and hydro power can be used for power generation. Policies are needed to promote both technology research and investment into such energy sources. A large wind energy farm is being developed on the outskirts of Ulaanbaatar. Promoting energy efficiency and renewable sources of energy should be priorities for climate change mitigation plans and reducing carbon footprint of Ulaanbaatar.

4.5 Harnessing the urban economy for human development

Moving from vulnerability to sustainability in urban context requires the harnessing of economic, social and ecological potential of the city and minimising the social and environmental impacts. Often cities are seen as threats to biodiversity protection. However, cities can also play an important role in biodiversity conservation. The Conference of Parties to the Convention on Biological Diversity (CBD) in their ninth meeting at Bonn recognised that urban areas which are home to more than 50 percent of human population should play a major role.

In 2008, Singapore proposed a city biodiversity index (CBI). As of September 2010, 15 cities including Bandung in Indonesia, Nagoya in Japan, and Bangkok, Chiangmai, Krabi and Phuket (all in Thailand) have test-bedded the index which includes 23 indicators. Another 20 cities worldwide (of which 13 cities are in Asia in Cambodia, Indonesia, Lao PDR, Malaysia, Philippines and Vietnam) have agreed to test-bed the indicators.

Members of the ICLEI, an international association of local governments for sustainability, have been networking since 2006 on promoting biodiversity in cities. This became known as 'local action for biodiversity' (LAB). Alongside COP10 of CBD in Nagoya in October 2010, the LAB members organised a 'city biodiversity summit'.

Urban areas also appear to have greater demands on energy due to concentration of population and significant travel demand. However, a recent study published by the Brookings Institution (Brown et al, 2008) which examined the CO_2 footprint of 100 US metropolitan areas finds that residents in the 100 largest cities emitted less CO_2 than the USA national average. The per capita national average in 2005 was 2.6 tonnes whereas their estimate of average for 100 metropolitan areas was 2.24 tonnes. The authors argued that cities can offer opportunities for more efficient use of energy and more energy efficient forms of transport such as Metro trains.

Sydney became the first local government to become carbon neutral in 2008. Four cities worldwide, namely Arendal in Norway, Rizhao in China, Vancouver in Canada and Vaxjo in Sweden are aiming to become completely carbon neutral. Many other cities have joined these in the global carbon neutral network - a forum for exchange of ideas set up by UNEP. Vancouver already has the lowest CO_2 emissions per capita among all large cities in North America.

As estimated in the previous section, Ulaanbaatar generates about 15 million tonnes of CO_2 annually. Reducing emissions especially from energy use will be crucial to reducing the CO_2 footprint of Ulaanbaatar and bringing it closer to carbon neutrality.

However, if emissions were to continue at the same level, achieving carbon neutrality would require absorbing an equivalent amount by planting trees. For boreal forests, the carbon sequestration rate is in a range of 0.4 to 1.2 tonnes of carbon per hectare (IPCC 2000). At this rate, boreal forest area of approximately 5.1 million hectares would be needed to absorb the 15 million tonnes of CO_2 generated by Ulaanbaatar. Thus, an area equivalent to 76 times the Bogd Khan Uul reserve would be needed to absorb the amount of CO_2 generated by Ulaanbaatar every year. Even though the President is encouraging tree plantation in the country (Box 4.3), this alone will be insufficient to reduce the carbon footprint. Clearly, carbon emission reduction strategies must be pursued along with encouraging sequestration strategies through further tree plantation and forest growth.

Box 4.3: National tree planting days

President Ts.Elbegdorj issued a decree in 2010 calling for second Saturdays in the months of May and October to be recognised as national tree planting days. With this decree, Mongolia joins a number of countries around the world that celebrate a national 'arbor day' dedicated to tree planting. Mongolia is unique in highlighting the importance of tree planting to counter desertification and climate change effects. During the first national tree planting day on 15th May 2010, the President honoured Jameke Bahit, a citizen of Bayan-Olgii *aimag*, with the order of the Polar Star for services to the nation through planting and growing of trees.

Source: Ch.Sumiyabazar, Mongolia Marks Tree Planting Day Calls for End of CO, Tuesday, May 18, 2010

Existing policy initiatives and programs to reduce pollution

A number of projects and programmes addressing different aspects of urban environment and air pollution are already in progress. The need to reduce air pollution has been recognised in various programmes including the CNDS, the 2010 report of Mongolia's sustainable development by MNET, and the National Human Rights Action Program of Mongolia.

The government approved the national program of "Environmental Health" for 2006-15 with its Resolution 245 of 2005 which aims to create a healthy and safe environment. There has been some progress in terms of collaboration among the related organisations but further co-operation among the various sectors needs to be institutionalised.

A number of projects have been focusing on reducing urban air pollution. In 2007,

"Master Plan to reduce the Air Pollution of Ulaanbaatar" was developed and it is estimated that the various activities to achieve this would cost US$2.4 billion [in domestic resources and not international aid]. A World Bank study on urban air pollution was completed in 2009. A project proposal at a cost of US$ 23 million in relation to this is nearing finalisation. At the request of the Mongolian government, JICA supported a project for "capacity building to reduce the air pollution of Ulaanbaatar" in 2009. The project aimed to measure the amount of smoke emitted from the household stoves and to build capacity for the monitoring and analysis of the capital city's air quality. A World Bank project is also at the early stages of implementation.

A "Strategy and investment plan development to improve *ger* district conditions" was developed with the assistance of the UN Human Settlement program (Habitat) and was adopted by the Resolution 132 of Metropolitan Civil Representative Conference in 2007. In 2008 the government approved the "Program to develop the *ger* district areas of Ulaanbaatar as residential areas with apartments." The program plans to rebuild 22 *ger* district areas in 6 districts of Ulaanbaatar as residential complexes with apartments on 472 hectares of land. MNT 1059.0 trillion is estimated to be spent for accommodation, social and physical infrastructure in the first phase and to construct on 299 hectares of land and MNT 982.7 trillion is estimated to be spent in the second phase. The programme is in progress and 5 areas are under construction.

In order to protect the water sources in and around Ulaanbaatar and to reduce the drying up, "The second water program for Ulaanbaatar," "Protection and maintenance of Tuul river water bank," "Regional development program for Ulaanbaatar," and "Government policies and action plans to work on prospects of the current and new water sources of Ulaanbaatar" are being implemented along with the "National Program of Water". These programs are aimed at promoting measures to conserve surface and underground water reserves in and around Ulaanbaatar, developing appropriate water related information systems, reducing water pollution and protecting the river bank areas from land degradation and flood risk.

Various programmes to deal with waste management are being developed by the Metropolitan Governor's Office. These include a JICA project to create the waste disposal points for categorizing and recycling of the factory waste, and develop specific garbage disposal points for clinical and health care wastes and hazardous chemical and other harmful waste.

The strategies proposed in the MDG based CNDS and in the Second National Communication to UNFCCC suggest that in the future all *aimag* centres will be better connected with Ulaanbaatar and that a number of *aimag* centres can be developed to become more fully-fledged urban centres.

4.6 Summary

As in rural areas, reducing vulnerability and promoting sustainability are closely related in the urban context as well. Though in general, poverty is more pronounced in rural areas, inequality particularly in access to various services is higher in urban areas. Urban households are vulnerable to economic forces and commodity price movements triggered by both national or domestic events as well as international events. On social aspects, their vulnerability especially in terms of crime rate and possibility of assaults is an issue. While Mongolia is a safe country in that on many crime indicators it comes fairly low down in bottom quartile, only on rapes it comes in the second quartile from the top. With regard to environmental aspects, access to water, sanitation and energy, air pollution and potential health impacts from this are key issues.

A number of individual sector specific policy recommendations have been identified. A targeted programme should be introduced to gradually increase the share of renewable energy in overall energy use in Ulaanbaatar. Contributing factors such as use of coal in CHP power plants, use of coal and biomass by simple units for heating by residents, should be targeted for significant reduction in emissions. In the short run, some forms of incentive mechanisms such as zone based licensing schemes, congestion charges or 'polluter pays' approach to tax vehicles based on unit emission levels need to be considered. In the medium to long run, green transport alternatives in the form of mass public transport such as light rail networks could be developed.

The most important message from this chapter is that urban environmental issues cut across sectors. Therefore, if well managed, urban development strategies can contribute significantly to deliver various goals, namely, the economic development, climate change mitigation, sustainable development and human development.

Synergies between these various goals are more directly visible in the context of urban development. It is necessary to promote 'green jobs' and innovations related to energy efficiency. This will help in achieving both economic development and climate change mitigation. A range of policy instruments will need to be used including incentives, introducing market based instruments including energy taxes, road pricing mechanisms, congestion charging, positive incentives to promote public transport use, financial as well as regulatory measures to promote energy efficiency especially for large energy users, improving household access to cleaner fuels especially for those who are not presently connected with the central heating system, and so on.

The discussion on CO_2 footprint of Ulaanbaatar clearly highlights the urgency and the magnitude of the task. Ulaanbaatar has the potential to join other cities committed to 'cooling' rather than warming the planet by becoming carbon neutral. Given the significance of Ulaanbaatar to Mongolia's national economy and energy consumption, what happens in Ulaanbaatar determines the extent to which national plans for mitigation of greenhouse gases are realised.

Improving the energy efficiency of the CHP power plants and retrofitting them with carbon capture and storage or other carbon mitigation strategies can help in reducing the CO_2 footprint of Ulaanbaatar and also deliver significant health benefits to local residents. Improving access to energy and other services by *ger* district residents and other urban poor communities can help improve the well-being of such households, improve their health status and human development. It can also generate external benefits including reducing air pollution induced morbidity in Ulaanbaatar in general and to improving the quality of water in the Tuul river.

A multi-dimensional environmental vulnerability (MEV) index can be developed for different districts within Ulaanbaatar to track progress. This was not possible as data on many of the environmental vulnerability indicators is not readily available at the district level. A city-wide workshop parallel to the national workshop suggested in the previous chapter would greatly assist in bringing together relevant stakeholders to develop appropriate indicators for MEV analysis within the city.

A human development emphasis means putting people at the centre of urban development planning and focusing on the equity aspects of urban development strategies. A clean, green and healthy Ulaanbaatar must be one where all sections of the community irrespective of household income feel safe and are able to participate fully in its economic dynamism as well as in its governance institutions.

CHAPTER 5

CONCLUSIONS AND POLICY RECOMMENDATIONS

In Mongolia, a concern about the environment is almost as old as nomadic pastoralism. However, there are now additional concerns due to global and regional climate change, increasing frequency of natural disasters, a rapid change in livestock population and its composition, and unprecedented mining-driven economic growth all taking place within a short period of time. It is, therefore, not surprising that environmental sustainability considerations have moved higher up on the national policy agenda.

This report is about environment and human development. Its main message is that promoting human development should be at the centre of strategies for achieving sustainability and reducing vulnerability. Without an emphasis on human development, any attempts to preserve natural resources for future generations may remain unfair and impractical. Economic growth is no doubt essential to increase material standards of living but growth is in essence a means to achieve human development. Thus, a commitment to maintain economic growth is useful but such a commitment must be read as a part of a deeper commitment to improve human development and quality of life for all Mongolians.

Human development is not merely about health and education. It is about enhancing substantive freedoms including 'freedom from want' and 'freedom from fear'. Environmental changes of the kind mentioned above increase the nature of risks faced by many ordinary Mongolians. Environmental vulnerability can slow down further progress in human development and cancel out some of the significant gains that have been made already.

5.1 Conclusions

This report began with a discussion on human development and sustainability indicators of Mongolia. Reducing vulnerability, promoting sustainability and pursuing human development are all closely related. The concept of vulnerability is related to fragility of a society and its ability to absorb risks and external and internal shocks. Historically, Mongolians have adapted to a harsh environment and developed nomadic pastoralism and associated cultural values. However, rapid changes in social, economic and environmental dimensions are raising new forms of vulnerabilities. A brief discussion focused on alternative views on sustainability. Three indicators of sustainability are considered in the context of Mongolia. These indicated that Mongolia's adjusted savings are low mainly because of energy and mineral depletion; Mongolia's ecological footprint is considerably greater than its HDI-neighbours; though mineral revenues are beginning to be spent on welfare, there is a need to examine international best practice to take forward the idea of Human Development Fund to become more effective. The detailed analysis in each chapter raised numerous issues. Here, some of the main conclusions are summarised.

Progress on human development indicators

Since its transition to democracy in 1990, real GDP per capita has more than doubled. According to the global HDR 2010, Mongolia has a human development index value of 0.622. It takes 100th rank in a list of 169 countries. Mongolia is in a group of countries where HDI increased by over 1 percent per annum in 2000-2010.

A mixed picture on sustainability indicators

On the basis of macro level indicators such as adjusted savings and ecological footprints there is some positive result but there are also serious concerns. Though Mongolia's gross savings rate was well over 26 percent, once this is adjusted for consumption of fixed capital, energy and mineral depletion, the adjusted savings rate is much lower at just around 3 percent (World Bank, 2010). With regard to

ecological footprint, though Mongolia's bio-capacity is still above its ecological footprint, making it a net creditor of ecological services, the concern is that bio-capacity decreased steadily and significantly over the last fifty years. These macro-indicators suggest that on some of the key issues concerning sustainability, there is an urgent need to improve performance.

High level of vulnerability

Based on macro-level indicators, a previous study in 2005 assessed Mongolia to be highly vulnerable to external shocks. This vulnerability was evident during the global food and fuel price increases in 2007 and the financial crisis in 2008. Mongolia is vulnerable to food insecurity. Notwithstanding impressive growth in GNP per capita and HDI, the number of persons under-nourished remained unchanged at 0.6 million during 1990-2007 (FAO, 2010). Compared to many of its HDI neighbours, Mongolia has a high number of persons affected by disasters.

Vulnerability to climate change

Climate change is well under way in Mongolia. The annual average temperatures have already increased by around 2.1^0 Celsius between 1940 and 2005. Further climate change is likely to increase the variability of annual rainfall and assessments suggest that winter precipitations are likely to increase while summer precipitations decrease. Water resources are unevenly distributed with absolutely water scarcity in at least 6 *aimags*.

The number of climate related disasters has been steadily increasing. The most recent *dzud* of 2010 resulted in the loss of over 11.3 million livestock whereby many herders lost a significant share of their animals.

The potential human development impacts of further climate change include increased threat to nomadic pastoralism, reduction in material standards of living, pasture deterioration which may require more frequent movements which can interfere with educational outcomes of herders' children, and increased probability of 'sedentarisation' or permanent migration to urban areas by herders.

Challenges in adaptation to climate change

There is high level commitment to address climate change issues. The National Action Programme on Climate Change and the Second national Communication to UNFCCC both identify many programmes and projects concerning adaptation to climate change. The key challenges are in prioritising the proposed projects, finding mechanisms and instruments to make sure that private sector, civil society and individual citizens are all able to play their roles effectively.

Challenges in climate change mitigation

Among the top 10 hard-coal producers in the world, Mongolia remains the most CO_2 intensive and has high level of CO_2 emissions per capita. The MAPCC and the Second National Communication identify several mitigation measures. The success of 100,000 solar *gers* programme is an indication of mainstreaming renewable energy in relation to improving energy access. However, energy intensity of the economy and dependence on fossil fuels despite the existence of renewable energy potential remains a key challenge. Developing appropriate market and regulatory institutions to achieve energy transition to reduce CO_2 emissions remains a priority.

Land degradation

Within Asia, Mongolia has the highest proportion of people living on degraded lands. Land degradation is occurring in all *aimags*. However, bulk of land degradation is occurring in five *aimags*, namely, Sukhbaatar, Dornogovi, Dundgovi, Ovorkhangai and Khovsgol. These five

aimags together account for nearly 60 percent of all land degraded in Mongolia.

Degradation of agricultural lands or grasslands is the main form of land degradation. Forest and steppe fires and mining account of a smaller share of all land degradation.

Overall livestock number did not change much between 1930 and 1990 and remained under 25 million. However, in 2010, livestock has increased to nearly 32.7 million. Much of this growth is in the number of goats (due to the nature of incentives related to cashmere exports) and sheep. Livestock growth may have contributed to exceeding the carrying capacity and subsequent degradation of pastures in some *aimags*.

Forests under threat

Though overall the extent of forest area degraded is around 5 percent per annum. At the current rates of degradation there is a significant risk of forests in some *aimags* such as Orkhon, Dornod, Darkhan-Uul, Arkhangai and Bayan-Olgii completely disappearing within a short period of time. Urgent steps need to be taken to address this. Annual revenues from logging use and hunting are very significant and have been on the increase. Approximately, 600 thousand cubic metres of timber is consumed from forests. Forest area about the size of Ulaanbaatar gets burnt every year. With climate change and increased periods of dryness, there will be greater risk of forest fires in the future.

Human development impacts of forest degradation include direct loss of hunting and forest produce which at present supplements household food production, indirect losses due to drying up of water resources or loss of firewood and consequently having to spend a greater proportion of household income or time on securing energy to keep warm. Other losses also include reduction in biodiversity which can further threaten the health of pastures and loss of species and accumulated knowledge.

Access to water remains insecure

In seven *aimags*, the amount of useable water resources per capita is well below the international norm that defines absolute water scarcity. Many water sources have dried up especially in Dornod, Khentii, Orkhon, Sukhbaatar and Omnogovi. Though the proportion of population with access to improved sources of water increased from 58 percent in 1990 to 76 percent in 2008, a significant number of residents especially in large cities such as Ulaanbaatar remain dependent on tanker trucks. Forty one percent of rural households depend on unimproved sources of water. Nearly one half of the population does not have access to improved sanitation. At present, there is little data available at *aimag* level to assess the proportion of people with access to improved water and sanitation.

The direct impact on human development is from increased health risks and increased risk of water borne diseases. Indirect impacts include reduction in freedoms, having to move over longer distances to obtain adequate water, with potential impacts on school attendance or completion of some children.

Multidimensional environmental vulnerability (MEV)

The illustration presented in this report shows that even while many issues remain equally important priorities at national level, there is significant variation from one *aimag* to another. Thus, forest fires are a key issue in Khentii but not so in Omnogovi where water scarcity is a major issue. In some *aimags*, social or economic issues appears to contribute a lot more to overall multi-dimensional vulnerability while in others environmental quality indicators contribute to much of the vulnerability. On the whole, *aimags* that score high on human development index appear to have slightly less vulnerability.

Urban poverty and environmental vulnerability

Nationally 39.2 percent of population is considered to be poor while in Ulaanbaatar this proportion is 29.8 percent. In general, poverty is concentrated in rural areas. However, urban poor households also face multiple vulnerabilities. Lack of access to clean sources of energy and heating, lack of access to improved water and sanitation remain key challenges to many households. Urban air pollution and increased levels of concentration of sulphur and nitrogen oxides as well as particulate matter increases health risks including morbidity due to respiratory systems. Also, urban areas such as Ulaanbaatar have a significant CO_2 footprint as they rely significantly on fossil fuels.

5.2 Key policy recommendations

The essence of a commitment to human development is that policies are made in a transparent manner with participation of all stakeholders. Therefore, the following recommendations must be considered as inputs to starting a discussion within deliberative policy making. Throughout the report various issues for policy have been raised. These can be summarised into five main recommendations:

A. Reduce environmental impacts.
B. Invest in conserving resources.
C. Empower citizens to participate in decision making at all levels.
D. Strengthen the capacity of national and local institutions.
E. Lead and mobilise international co-operation.

Some key priorities under each of these 'headline' recommendations are presented below. In each case, suggested timeframe is also indicated to highlight urgency to act.

A. Reduce environmental impacts

(A-1) Prepare a time-bound plan to transform Ulaanbaatar to reduce CO_2 emissions significantly. For this, consider strategies to reduce emissions from energy sector, improve energy efficiency in all sectors including office buildings, transport, industry and commerce, and create incentives for energy-saving and CO_2-saving technologies. Set a deadline for Ulaanbaatar to become carbon neutral.

Who to act: Mainly Ulaanbaatar governor's office – in consultation with all district governors, NSO, Ministry of Minerals and Energy, Ministry of Transport, MNET, Private sector, CHP plants
Priority: Very high
Time frame: within one year (to be able to showcase the pan in 'Rio+20' related activities throughout the year 2012) –implementation in two phases- phase 1 during 2012-2015 and phase 2 during 2015-2020

(A-2) Publish government's carbon and ecological footprints and aim to reduce these by 20 percent within five years. In consultation with international organisations and the UN agency, develop a common strategy for achieving significant CO_2 reductions, CO_2 offsetting mechanisms and independent verification mechanisms. Though, the direct impact of this on CO_2 emissions would be rather small, this would increase moral legitimacy of the Government of Mongolia's ability to influence firms and citizens locally and other governments and international organisations externally.

Who to act: MNET
Priority: Very high
Time frame: within one year

(A-3) Reduce vulnerability of urban residents to urban air pollution in

Ulaanbaatar, Orkhon, Darkhan and the *aimag* centres by improving energy use industries including CHP plants, heat only boilers and road transport – focusing on issues that are not covered but can complement programmes by other international or national agencies. Reduce the vulnerability of those who are most exposed to air pollution.

Who to act: Ulaanbaatar and concerned city governments – in consultation with Ministry of Health
Priority: High
Time frame: to be determined by stakeholders

B. Invest in conserving resources

(B-1) Design and develop Sainshand and other new large scale urban development projects to become carbon neutral and go further to be net-contributors to bio-capacity. Apply these principles in relation to regeneration of Erdenet and Darkhan where this is relevant.

Who to act: NDIC
Priority: High
Time frame: Ongoing

(B-2) Take necessary steps to secure access to water to all citizens. Develop systematic collection of data at the *aimag* level on persons with access to water and sanitation. Organise a consultation workshop on introducing *human right to water* as a mechanism to improve water security.

Who to act: Water agency – in consultation with NSO, national and local water related agencies and civil society
Priority: Very high
Time frame: within one year

(B-3) Build on the success of 'national tree planting day' with institutional measures to promote tree planting activities as part of wider efforts to combat desertification, promote biodiversity and conserve water resources. Develop the necessary organisational capacity to deliver these outcomes.

Who to act: MNET – involve local environmental action NGOs
Priority: High
Time frame: Annually

(B-4) Develop a rapid response mechanism to control forest and steppe fires with the involvement of a number of relevant stakeholders at the *aimag* level in the first instance in the following *aimags*: Khentii, Selenge, Khovsgol, Bulgan, Sukhbaatar, Tov and Arkhangai.

Who to act: MNET in consultation with NEMA, MOFALI and *aimag* governments
Priority: High
Time frame: Two to three years

C. Empower citizens to participate in decision making at all levels

Participation of all stakeholders in decision making is crucial to sustainable human development. This corresponds to 'agency freedoms' i.e., freedom to participate in civic and community life, to be valued as a person, to have the ability to express opinions.

(C-1) Develop a better understanding of citizens' vulnerability. Organise a national workshop of stakeholders to discuss, design and develop a Multi-dimensional Environmental Vulnerability indicator based on international practice and national conditions. The workshop may consider the proposal presented here as a starting point, consider various factors including data availability and choose relevant dimensions and indicators. Based on this, selected indicators may be piloted by the National Statistical Organisation and MNET

and the results presented via national and local workshops to mainstream the indicators.

Who to act: NDIC, MNET and NSO with the involvement of members from *aimag* and *soum* governments, relevant ministries, academic, civil society institutions
Priority: High
Time frame: within one year

(C-2) Consolidate the progress already being made with regard to gender equality law and the ideals of equality mentioned in Comprehensive National Development Strategy. There is an urgency to constitute a 'multi-*stakeholder-group on human security*' with the aim to analyse, educate and reduce the rape rate and assaults on women as a step to improve human security and in turn to lay foundations to social and environmental sustainability.

Who to act: National government-involving women's rights NGOs and civil society institutions.
Priority: Very high
Time frame: within one year

(C-3) Support the educational institutions and NGOs already doing pioneering work in environmental education and create *aimag* and *soum* level 'citizen environmental councils'. Encourage and facilitate such councils to prepare local human development and environment reports periodically. As a starting point, facilitate one *aimag* in each of the four regions to prepare '*Aimag* Human Development and Environment Report' (AHDER).

Who to act: Ministry of Education – in consultation with MNET and *aimag* governors.
Priority: Very high
Time frame: within two years

D. Strengthen the capacity of national and local institutions

(D-1) Constitute a *National Human Development Commission* with members drawn from key ministries and two external members (drawn from academia and civil society) with a responsibility to mainstream human development in all national level policies. The NHDC should be provided necessary institutional support to enable it to issue reports periodically (such as once in two years). While the National Human Rights Council focuses on protecting human rights such as right to life, the NHDC will focus on aspirational goals and enhancing and protecting substantive freedoms and reducing vulnerability – social, economic and environmental.

There are alternative models to consider. One approach is for the Prime Minister to chair the National Human Development Commission. This has the advantage of giving a visible priority to human development issues. The disadvantage is that it can become an organ of the national executive branch of the government.

Another alternative approach is to constitute NHDC as an independent body with a person of eminence as its chair. This Commission can then report either to the Prime Minister through NDIC or directly to a committee of the *State Great Khural*. In the latter approach, a Parliamentary Committee on Human Development needs to be established.

Who to act: National government; start with a resolution of the government
Priority: Very high
Time frame: within one year

(D-2) To reduce vulnerability of rural households, develop and strengthen local common property institutions and common oversight mechanisms such as

'rules of use of the steppe' and the size of livestock using insights from the work of Nobel prize winning Elinor Ostrom and the centuries old knowledge and wisdom of nomadic herders.

Develop further the role of community based forest conservation and biodiversity protection institutions especially in the case of special protected areas but in all *aimags* with considerable forest land area.

Also, promote research in (a) impact of climate change and other environmental factors on human well-being and (b) natural resources management such as developing grass and plant varieties with seeds that can be easily propagated by livestock.

Who to act: MNET and Mongolian academy of Sciences to come out with more detailed terms of reference; various universities to compete for research funds
Priority: High
Time frame: Two to five years (including time to develop technologies)

(D-3) Develop the organisational and leadership capacity of bag and *soum* level institutions in the *aimags* and *khoroo* and district level institutions in the Capital city to use human development approach in policy making.

Who to act: National training institute
Priority: Very high
Time frame: within one year

(D-4) Support the National Statistical Organisation to develop necessary statistical measures including poverty and environmental statistics, access to water, sanitation and energy and the key indicators of human development to enable the *bagh* and *soum* level organisations to monitor progress.

Who to act: NSO, relevant goverment ministries
Priority: Very high
Time frame: within one year

E. Lead and mobilise international co-operation

(E-1) Consolidate Mongolia's position in international climate change negotiation by hosting a meeting on 'Climate change adaptation by the Land-locked and less developed countries' (CCA-LLDC) between 2012 and 2015 and aim to host a global summit of the Environment Ministers of all the Conference of Parties of a post-2012 climate change treaty between 2015 and 2020.

Who to act: For CCA-LLDC – the 'Think Tank' chaired by Mongolia
Priority: High
Time frame: within one year

For the Environment Ministers conference – MNET and Ministry of Foreign Affairs
Priority: High
Time frame: Participate in Rio+20 with these plans

(E-2) Use international co-operation to promote technology transfer and developing internal market and fiscal instruments.

Who to act: Ministry of Foreign Affairs with MNET and Ministry of Minerals and Energy
Priority: High

Sustaining economic growth and making progress on various environmental and social dimensions is crucial to enhance substantive freedoms of all people in Mongolia. While evidence-based policy making is crucial for accountability and effectiveness, even the best scores on various indicators cannot fully capture the normative dimensions of what makes a good society and what it means to

live in one. Analysts of human development readily recognise the limitations of indicators such as the human development index which does not have adequate normative content. Thus, it is possible for a country to be described as a 'very high human development country' even though its citizens lack fundamental freedoms or democratic institutions are missing. Similar limitations apply to indicators of sustainability such as the adjusted savings or ecological footprint and vulnerability such as the MEV indicator.

Mongolia already has good record in using evidence-based policy analysis as seen in the Second National Communication to the UNFCCC and the MDG-CNDS. However, this emphasis on detail in policy making process can sometimes result in 'missing the woods for the trees'. There is a need to complement the already-existing strength in evidence-based policy making with approaches to deal with normative issues. It is for this reason that a number of recommendations in this report focus on the stakeholder based consultation processes. Such consultations should include discussions on the fundamental normative aspects concerning the issue of discussion and the role of values in creating a collective vision of what would amount to real progress with regard to human development in Mongolia.

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Appendix-1

Consultations shaping this report

1. Public deliberation is at the heart of this report. The work on this report began in 2008 with a series of consultation meetings to select the theme of this report. A number of candidate themes including sustainability, climate change and human security were identified. After several rounds of voting and ranking, the consensus was to focus on 'environmental challenges of human development'.
2. Environmental challenges can be numerous. Stakeholders were consulted in May 2009 to identify priority issues: present and former political leaders (members of *State Great Khural)*; senior civil servants and technical experts within government; academic experts; leaders of selected non government organisations; governor of one *aimag;* governors of two *soums* where considerable mining activity is in progress; randomly selected herders in those *soums*. These discussions helped us in narrowing down issues of focus.
3. An Advisory Board was set up as a peer review and approval mechanism. Based on these consultations, a first outline of the report was presented to the Advisory Board in May 2009. Ever since, the Advisory Board met several times to consider draft papers and suggest alterations.
4. A number of stakeholder consultations continued throughout the writing of this report. For the first time, 21 *aimag* governors and 320 *soum* governor have been consulted to develop a better understanding of how much they know about human development reports. This survey was conducted between December 2009 and February 2010.
5. Two small sample surveys called '100 urban voices' and '100 rural voices' were conducted in February-April 2010. These are two surveys with a specific aim to seek the views of those whose views are often not represented in conventional surveys.
6. A survey of elders was conducted in October 2010. In addition, we have spoken to herders in selected *aimags* such as Ovorkhangai, Dundgovi and Tov; we have visited and where possible spoke with those engaged in artisanal mining.
7. We visited and interviewed staff members in the following mining companies: Oyu Tolgoi, Energy Resources, Tavan Tolgoi, and Boroo Gold.
8. Interviews were conducted with employers association, and representatives of various trades union.
9. University students and youth have been consulted for their view of the future. Children participated in painting competition on the themes of the report in the run up to World Environment Day in 2010.
10. We had discussions with representatives of a number of civil society institutions and individuals including Transparency International, MonFemNet, Xamo, Hustai Nuruu national park, and monks at Gandan Monastery.

Appendix-2

Table A1: **Population profile, Mongolia, 1990-2010**

Indicators	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Resident population as of the end of year (thous. persons)	2 153.4	2 243.0	2 407.5	2 442.5	2 475.4	2 504.0	2 533.1	2 562.4	2 594.8	2 635.2	2 683.5	2 735.8	2 780.8
Male population (%)	49.9	49.7	49.5	49.5	49.6	49.6	49.6	49.6	48.8	48.7	48.8	48.9	48.6
Female population (%)	50.1	50.3	50.5	50.5	50.4	50.4	50.4	50.4	51.2	51.3	51.2	51.1	51.4
Annual population growth rate (%)	2.6	1.6	1.4	1.5	1.3	1.2	1.2	1.2	1.3	1.6	1.8	1.9	1.6
Urban population (%)	54.6	51.6	57.2	57.2	57.4	58.5	59.1	60.2	60.9	60.8	61.8	62.6	63.3
Population under 15 years age (%)	41.5	38.0	33.1	32.8	32.6	32.7	32.6	32.7	28.5	28.6	28.2	27.6	27.3
Population 15-64 years age (%)	54.4	58.2	63.0	63.7	63.9	63.8	63.9	63.8	67.3	67.3	67.7	68.3	68.8
Population 65 years age and older (%)	4.1	3.8	3.9	3.5	3.5	3.5	3.5	3.5	4.2	4.1	4.1	4.1	3.9
Infant mortality rate (per 1000 live births)	64.4	44.4	32.8	29.5	29.6	23.0	22.3	20.7	19.1	17.6	19.4	20.0	20.2
Economically active population (thous. persons)	-	812.7	847.6	872.6	901.7	959.8	986.1	1 001.2	1 042.8	1 054.0	1 071.5	1 137.9	1 147.1
Employed population (thous. persons)	-	767.6	809.0	832.3	870.8	926.5	950.5	968.3	1 009.9	1 024.1	1 041.7	1 006.3	1 033.7
Registered unemployment rate* (%)	-	5.5	4.6	4.6	3.4	3.5	3.6	3.3	3.2	2.8	2.8	-	-
Unemployment rate** (%)	-	-	-	-	-	-	-	-	-	-	-	11.6	9.9

Source: NSO, Mongolian Statistical Yearbook, 1990-2010.
Note: * Estimated by registered unemployed
** By results from the Labour Force Survey

Table A2: **Main economic indicators, Mongolia, 2000-2010**

Activities	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*
GDP (at 2005 prices, billion togrogs)	2 221.7	2 287.3	2 395.5	2 563.3	2 835.7	3 041.4	3 301.6	3 640.0	3 964.0	3 913.7	4 154.0
GDP (at current prices, billion togrogs)	1 224.1	1 391.9	1 550.6	1 829.1	2 361.2	3 041.4	4 027.6	4 956.6	6 555.6	6 590.6	8 255.1
GDP, by sector (%)											
Agriculture	30.9	26.4	21.5	20.8	22.6	22.1	19.6	20.5	21.4	19.6	18.1
Industry	25.0	25.2	25.6	28.4	32.0	36.2	43.0	41.9	34.4	33.0	36.8
Services	44.1	48.5	52.9	50.8	45.4	41.7	37.4	37.7	44.2	47.4	45.1
GDP growth rate (%)	1.1	3.0	4.7	7.0	10.6	7.3	8.6	10.2	8.9	- 1.3	6.1
Composition of GDP, by expenditure approach (%)											
Final consumption	85.7	90.2	92.5	83.5	78.7	67.3	58.5	60.6	70.0	72.8	68.0
Gross investments	27.5	24.6	24.4	31.9	31.0	37.5	35.6	38.0	43.0	34.5	41.4
Net export	- 13.2	- 14.8	- 16.9	- 15.4	- 9.7	- 4.8	5.9	1.3	- 13.0	- 7.3	- 9.4
Budget revenue (billion togrogs)	351.1	439.3	477.0	553.9	713.1	837.9	1 360.4	1 880.5	2 170.4	1 994.0	3 078.4
Budget expenditure (billion togrogs)	429.7	489.7	548.6	615.8	752.5	764.6	1 237.0	1 747.3	2 466.8	2 336.6	3 076.3
Overall budget deficit (billion togrogs)	- 78.6	- 50.4	- 71.6	- 61.9	- 39.4	73.3	123.4	133.2	- 296.4	- 342.6	2.1
Government revenue as of % of GDP	28.7	31.6	30.8	30.3	30.2	27.5	33.8	37.9	33.1	30.3	37.3
Government expenditure as of % of GDP	35.1	35.2	35.4	33.7	31.9	25.1	30.7	35.3	37.6	35.5	37.3
Overall budget deficit, as % of GDP	- 6.4	- 3.6	- 4.6	- 3.4	- 1.7	2.4	3.1	2.7	- 4.5	- 5.2	0.0
Trade balanace, million USD $	- 78.7	- 41.5	- 166.4	- 175.6	- 150.2	- 113.4	107.0	- 114.3	- 710.0	- 252.3	- 291.6
Broad money (M2), billion togrogs, end of the year	258.8	331.1	470.1	703.3	847.0	1 140.1	1 536.5	2 401.2	2 270.0	2 880.0	4 680.0
Total loan outstanding (million togrogs)	66 756.7	135 070.7	231 449.8	442 148.1	606 798.6	859 851.8	1223 287.3	2056 060.8	2635 551.6	2655 000.4	3264 778.0
Growth of total loan outstanding (%)		102.3	71.4	91.0	37.2	41.7	42.3	68.1	28.2	0.7	23.0
Total loans issued outstanding from outside of Ulaanbaatar	1 793.0	15 666.2	38 039.3	69 754.2	107 815.1	177 959.1	274 394.4	445 501.7	551 982.6	480 277.7	662 376.9
Share of non-Ulaanbaatar loans in total	2.7	11.6	16.4	15.8	17.8	20.7	22.4	21.7	20.9	18.1	20.3
Consumer price index (%)	8.1	8.0	1.6	4.7	11.0	9.5	6.2	17.8	22.1	4.2	13.0
Exports (US$, millions)	535.8	596.2	524.0	615.4	869.1	1 063.9	1 542.0	1 947.5	2 534.5	1 885.4	2 908.5
Imports (US$, millions)	614.5	637.7	690.4	790.9	1 019.3	1 177.3	1 435.0	2 061.8	3 244.5	2 137.7	3 200.1

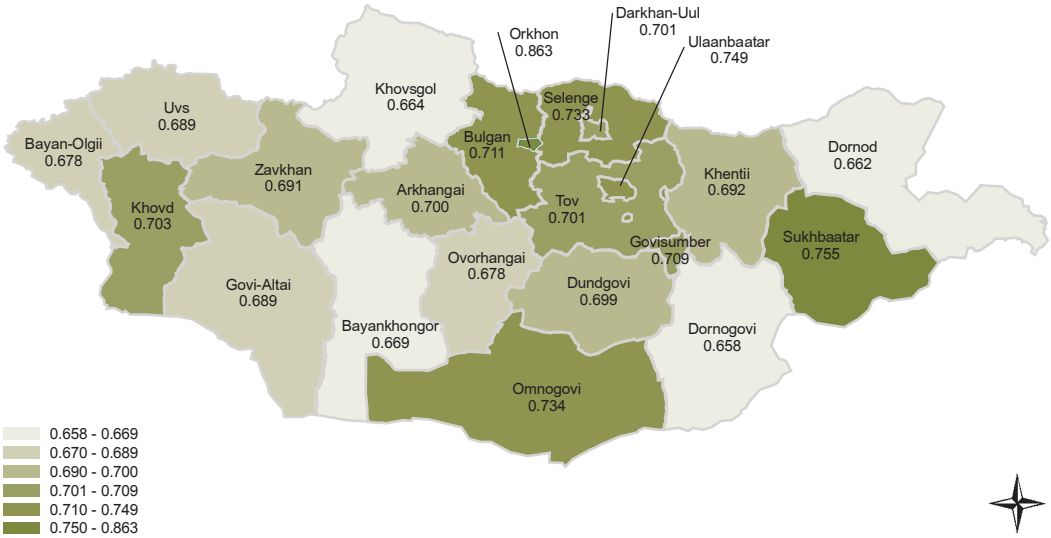
Source: NSO, National Statistical Yearbook, 2003-2010.
Note: * Preliminary estimates

Table A3: **Human Development Index (based on old methodology), by aimag and the Capital, Mongolia, 2007, 2010**

Aimags, the Capital	Life expectancy index		Education index		GDP index		Human development index (HDI)		HDI rank	
	2007	2010	2007	2010	2007*	2010**	2007*	2010**	2007	2010
Orkhon	0.690	0.716	0.939	0.966	0.898	0.853	0.842	0.845	1	1
Ulaanbaatar	0.697	0.722	0.926	0.928	0.643	0.718	0.755	0.790	2	2
Omnogovi	0.700	0.725	0.923	0.915	0.586	0.680	0.736	0.774	4	3
Govisumber	0.722	0.748	0.964	0.982	0.423	0.590	0.703	0.773	7	4
Selenge	0.707	0.732	0.950	0.907	0.536	0.611	0.731	0.750	5	5
Tov	0.721	0.747	0.877	0.887	0.499	0.584	0.699	0.739	10	6
Darkhan-Uul	0.654	0.679	0.974	0.985	0.480	0.554	0.703	0.739	8	7
Bulgan	0.713	0.739	0.913	0.901	0.507	0.575	0.711	0.739	6	8
Sukhbaatar	0.705	0.731	0.903	0.889	0.656	0.583	0.755	0.734	3	9
Arkhangai	0.686	0.711	0.920	0.917	0.491	0.536	0.699	0.722	11	10
Dundgovi	0.728	0.754	0.892	0.903	0.467	0.489	0.695	0.715	12	11
Khovd	0.704	0.730	0.927	0.934	0.475	0.471	0.702	0.711	9	12
Khentii	0.692	0.717	0.911	0.917	0.465	0.497	0.690	0.710	14	13
Uvs	0.651	0.675	0.947	0.972	0.469	0.476	0.689	0.708	16	14
Zavkhan	0.665	0.689	0.932	0.948	0.476	0.463	0.691	0.700	13	15
Bayan-Olgii	0.721	0.747	0.911	0.926	0.405	0.420	0.679	0.698	17	16
Govi-Altai	0.659	0.684	0.930	0.938	0.477	0.463	0.689	0.695	15	17
Ovorkhangai	0.689	0.715	0.904	0.902	0.438	0.467	0.677	0.694	18	18
Bayankhongor	0.660	0.685	0.916	0.916	0.442	0.477	0.673	0.693	19	19
Dornogovi	0.680	0.705	0.915	0.900	0.375	0.471	0.657	0.692	22	20
Khovsgol	0.620	0.644	0.896	0.903	0.473	0.507	0.663	0.685	20	21
Dornod	0.626	0.650	0.904	0.912	0.457	0.484	0.662	0.682	21	22
National mean	**0.692**	**0.718**	**0.922**	**0.925**	**0.596**	**0.648**	**0.737**	**0.763**	**-**	**-**

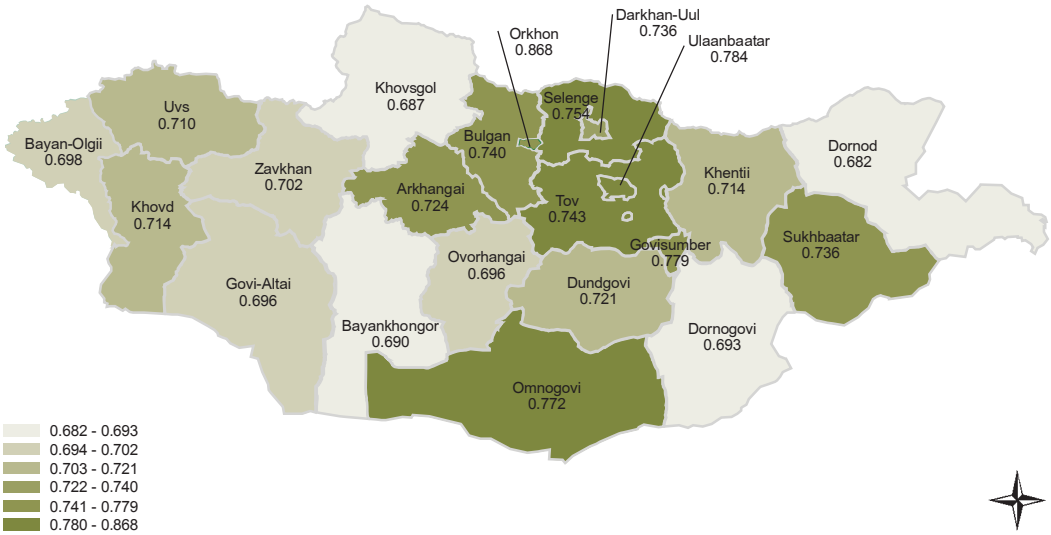
Source: NSO, National Statistical Yearbook, 2010.
Note: * Data benchmarked by Input-Output Table, 2005
** Preliminary estimates

Sketch map A1.1: **Gender development index, by aimags and the Capital, Mongolia, 2007**



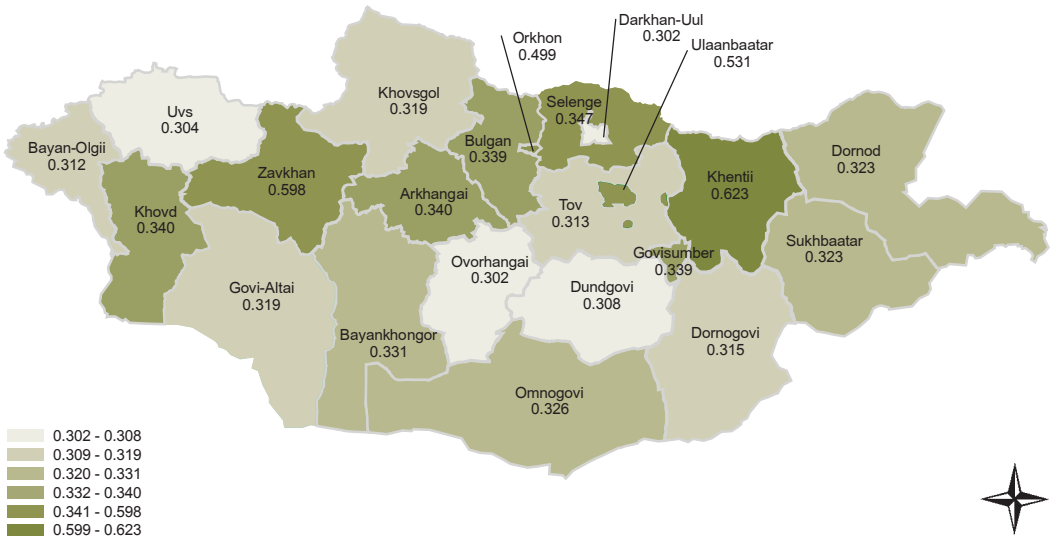
Source: NSO, National Statistical Yearbook, 2010

Sketch map A1.1: **Gender development index, by aimags and the Capital, Mongolia, 2010**



Source: NSO, National Statistical Yearbook, 2010

Sketch map A2.1: **Gender empowerment measure, by *aimags* and the Capital, Mongolia, 2007**



Source: NSO, National Statistical Yearbook, 2010

Sketch map A2.2: **Gender empowerment measure, by *aimags* and the Capital, Mongolia, 2010**

Source: NSO, National Statistical Yearbook, 2010

Table A4: **Human Development Index of the countries in transitional economy, 2010**

	HDI value	Life Expectancy at birth (years)	Mean years of schooling (years)	Expected years of schooling (years)	Gross national income per capita (PPP 2008 US$)	Inequality-adjusted HDI		Gender Inequality Index		Multi-dimensional Poverty Index	HDI rank
						value	rank	value	rank		
Albania	0.719	76.9	10.4	11.3	7,976	0.627	44	0.545	61	0.004	64
Armenia	0.695	74.2	10.8	11.9	5,495	0.619	46	0.570	86	0.008	76
Azerbaijan	0.713	70.8	10.2	13.0	8,747	0.614	48	0.553	62	0.021	67
Belarus	0.732	69.6	9.3	14.6	12,926	0.664	36	-	-	0.000	61
Bosnia and Herzegovina	0.710	75.5	8.7	13.0	8,222	0.565	54	-	-	0.003	68
Bulgaria	0.743	73.7	9.9	13.7	11,139	0.659	37	0.399	36	-	58
Czech Republic	0.841	76.9	12.3	15.2	22,678	0.790	15	0.330	27	0.000	28
China	0.663	73.5	7.5	11.4	7,258	0.511	68	0.405	87	0.056	89
Estonia	0.812	73.7	12.0	15.8	17,168	0.733	26	0.409	39	0.026	34
Georgia	0.698	72.0	12.1	12.6	4,902	0.579	51	0.597	64	0.003	74
Hungary	0.805	73.9	11.7	15.3	17,472	0.736	25	0.382	-	0.003	36
Kazakhstan	0.714	65.4	10.3	15.1	10,234	0.617	47	0.575	67	0.002	66
Kyrgyzstan	0.598	68.4	9.3	12.6	2,291	0.508	71	0.560	63	0.019	109
Lao People's Democratic Republic	0.497	65.9	4.6	9.2	2,321	0.374	93	0.650	88	0.267	122
Latvia	0.769	73.0	10.4	15.4	12,944	0.684	33	0.316	22	0.001	48
Moldova (Republic of)	0.623	68.9	9.7	12.0	3,149	0.539	61	0.429	40	0.008	99
Mongolia	0.622	67.3	8.3	13.5	3,619	0.527	62	0.523	57	0.065	100
Poland	0.795	76.0	10.0	15.2	17,803	0.709	29	0.325	21	-	41
Romania	0.767	73.2	10.6	14.8	12,844	0.675	34	0.478	30	-	50
Russian Federation	0.719	67.2	8.8	14.1	15,258	0.636	42	0.442	41	0.005	65
Slovakia	0.818	75.1	11.6	14.9	21,658	0.764	22	0.352	31	0.000	31
Slovenia	0.828	78.8	9.0	16.7	25,857	0.771	19	0.293	17	-	29
Tajikistan	0.580	67.3	9.8	11.4	2,020	0.469	84	0.568	65	0.068	112
Turkmenistan	0.669	65.3	9.9	13.0	7,052	0.493	78	-	-	-	87
Ukraine	0.710	68.6	11.3	14.6	6,535	0.652	39	0.463	44	0.008	69
Uzbekistan	0.617	68.2	10.0	11.5	3,085	0.521	63	-	-	0.008	102
Viet Nam	0.572	74.9	5.5	10.4	2,995	0.478	82	0.530	58	0.075	113

Source: UN, Human Development Report, 2010.

Table A5: **Adjusted savings – Mongolia and selected countries**

Selected countries	Gross National Saving (various methods used) GNS	Consumption of Fixed Capital CFC	Net National Saving NNS	Education Expenditure EDE	Energy Depletion END	Mineral Depletion MIN
Bhutan	60.7	9.21	51.49	3.35	0	0
Botswana	46.3	11.48	34.82	6.58	0.54	3.2
China	53.89	10.08	43.82	1.8	6.74	1.7
Philippines	30.3	8.38	21.91	2.19	0.53	0.81
Mongolia	26.5	9.67	16.83	4.61	5.94	9.24
Kazakhstan	46.21	13.46	32.75	4.41	31.28	1.83
Chile	24.23	12.86	11.37	3.6	0.26	14.32
Saudi Arabia	48.33	12.46	35.88	7.19	43.51	0
Trinidad and Tobago	41.83	13.14	28.69	4.01	50.54	0
Congo, Rep.	26.68	14.08	12.6	2.25	71.19	0

Selected countries	Net Forest Depletion NFD	CO_2 damage CO_2	PM10 damage (2002 and 2004 WHO data) PM10	Adjusted Net Saving (including PM10 damage) ANS_I	Adjusted Net Saving (excluding PM10 damage) ANS_E
Bhutan	4.08	0.3	0.06	50.4	50.46
Botswana	0	0.28	0.21	37.17	37.39
China	0	1.26	0.81	35.11	35.92
Philippines	0.1	0.35	0.06	22.26	22.32
Mongolia	0	1.66	1.58	3.02	4.6
Kazakhstan	0	1.42	0.11	2.52	2.63
Chile	0	0.31	0.45	-0.36	0.08
Saudi Arabia	0	0.62	0.73	-1.8	-1.06
Trinidad and Tobago	0	1.17	0.16	-19.17	-19.01
Congo, Rep.	0	0.16	0.61	-57.11	56.5

Source: World Bank, 2010. World development report 2010.

Table A6: **Significant components of land degradation (2009) in different aimags, Mongolia**

Extent of all land degraded in the aimag	Farming land damaged	Pasture damaged	In human settlements	Forest area damaged	Water/wetlands damaged	Mining, dug out land
Above 95%		Dundgovi, Bayan-Olgii, Govisumber, Ulaanbaatar, Sukhbaatar, Khovd, Bayankhongor, Khentii				
80 to 95%	Darkhan-Uul	Dornogovi, Ovorkhangai, Dornod, Uvs, Tov, Zavkhan, Khovsgol, Govi-Altai				
60-79.9%		Omnogovi, Bulgan, Arkhangai				
40-59.9%		Orkhon		Selenge, Orkhon		
20-39.9%		Selenge		Arkhangai, Bulgan		
10-19.9%	Zavkhan				Omnogovi	
1 - 10%	Selenge, Tov, Uvs, Orkhon, Dornogovi, Sukhbaatar, Khovsgol	Darkhan-Uul	Dornod, Darkhan-Uul		Darkhan-Uul	Omnogovi, Dornod, Tov

Source: Estimates based on data from MNET (2009).

Table A7: **Growth rate of livestock, Mongolia, 2005-2010**

Aimags and the Capital	Total	Goats	Sheep	Horse	Cattle	Camels
Dundgovi	-14.66	-10.77	-17.52	-24.56	-17.95	-12.42
Govi-Altai	-1.65	-3.76	10.31	-41.92	-17.89	31.25
Uvs	8.83	9.72	13.09	-2.19	-9.52	-1.33
Zavkhan	-19.89	-18.18	-21.34	-18.42	-22.52	-8.11
Khovd	-16.53	-17.63	-15.51	-16.15	-14.36	-3.32
Bayan-Olgii	-39.23	-40.26	-35.38	-57.08	-57.57	-8.89
Ovorkhangai	29.98	42.82	38.11	-16.66	2.12	-7.91
Omnogovi	-28.28	-26.28	-32.58	-28.90	-40.03	-2.62
Govisumver	29.06	38.46	36.56	-15.98	6.39	-27.25
Ulaanbaatar	-18.29	-2038	-16.30	-7.71	-31.25	-7.49
National	7.67	4.64	12.39	-5.36	10.82	6.05
Dornogovi	13.79	14.14	17.21	5.90	8.06	-5.32
Dornod	-9.92	-11.21	-13.62	-12.10	-12.42	18.31
Arkhangai	23.84	20.32	31.12	0.47	22.57	-4.71
Orkhon	-12.62	-8.37	-15.37	-16.69	-23.54	12.27
Khovsgol	6.43	-0.60	7.83	23.73	9.82	129.00
Bayankhongor	22.06	12.93	33.87	0.87	19.25	29.29
Khentii	26.37	32.46	21.62	5.02	4.92	31.90
Sukhbaatar	23.23	11.67	30.99	37.35	34.60	82.00
Tov	63.88	58.56	71.20	34.05	79.52	113.00
Bulgan	52.26	54.03	58.79	11.39	59.10	1.23
Selenge	101.69	87.42	120.52	66.57	94.66	97.00
Darkhan-Uul	74.82	56.09	95.13	35.93	67.37	617.00

Source: Calculations based on NSO (2011).

Table A8: **Water resources distribution, Mongolia, 2007**

Aimag name	Total km^3	Usable km^3	Ground km^3	Usable km^3	Total water resources (S +G) km^3	Usable (S+G) km^3	2009 -Population in thousands	Total water resources cum per capita	Usable water resources cubic metres per capita
Arkhangai	2.83	0.2	1.06	0.63	3.89	0.83	92.5	42054.1	8973
Bayankhongor	0.45	0.05	0.1	0.05	0.55	0.1	85.4	6440.3	1171
Bayan-Olgii	2.39	0.29	1.05	0.52	3.44	0.81	101.9	33758.6	7949
Bulgan	1.75	0.94	0.5	0.15	2.25	1.09	62.3	36115.6	17496
Darkhan-Uul	0.044	0.01	0.01	0.003	0.054	0.013	90	600	144.4
Dornod	1.51	0.15	0.3	0.2	1.81	0.35	73.6	24592.4	4755.4
Dornogovi	0.05	0	0.01	0.005	0.06	0.005	58.3	1029.2	85.8
Dundgovi	0.12	0	0.08	0.01	0.2	0.01	47.7	4192.9	209.6
Govi-Altai	0.058	0.01	0.1	0.03	0.158	0.04	59.4	2659.9	673.4
Govisumber	0.01	0	0.001	0.0001	0.011	0.0001	13.3	827.1	7.5
Khentii	6.69	0.4	2.7	0.8	9.39	1.2	71.5	131328.7	16783.2
Khovd	1.1	0.19	0.25	0.06	1.35	0.25	88.5	15254.2	2824.9
Khovsgol	6.59	0.16	2.49	1.95	9.08	2.11	124.1	73166.8	17002.4
Omnogovi	0.038	0	0.01	0.001	0.048	0.001	49.3	973.6	20.3
Orkhon	0.005	0.001	0.001	0.0001	0.006	0.0011	83.1	72.2	13.2
Ovorkhangai	0.56	0.22	0.1	0.05	0.66	0.27	117.5	5617	2297.9
Selenge	3.2	1.77	0.97	0.39	4.17	2.16	103.5	40289.9	20869.6
Sukhbaatar	0.14	0	0.03	0.01	0.17	0.01	55	3090.9	181.8
Tov	1.91	0.2	0.59	0.2	2.5	0.4	88.5	28248.6	4519.8
Ulaanbaatar	0.77	0.05	0.3	0.1	1.07	0.15	1 112.3	962	134.9
Uvs	1.2	0.12	0.23	0.08	1.43	0.2	78.8	18147.2	2538.1
Zavkhan	3.16	0.2	1.14	0.37	4.3	0.57	79.3	54224.5	7187.9
Total	**34.6**	**4.96**	**12**	**5.6**	**46.6**	**10.56**	**2735.8**	**17033.4**	**3859.9**

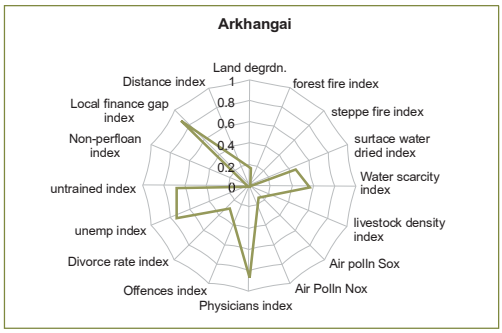
Source: Water Census 2007, MNET.

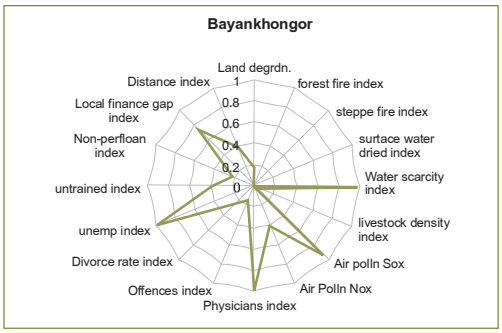
Appendix-3

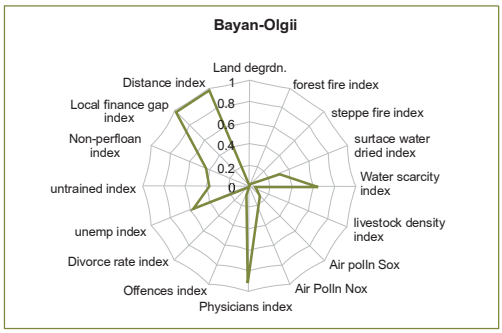
Multidimensional environmental indicators for all aimags

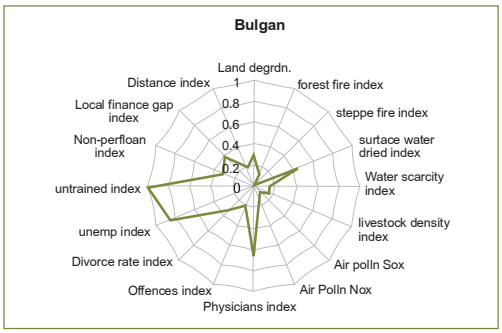
The data for the 16 indicators is mainly based on NSO, 2010 and data provided by MNET.

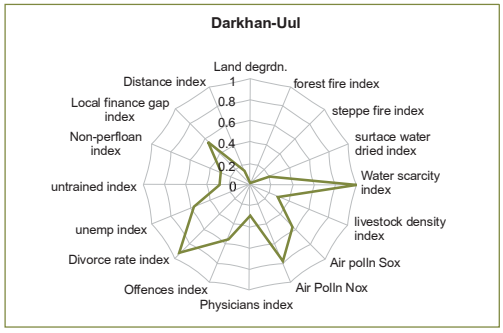
Index is calculated using normalisation procedure. Suppose there are m variables and n = 1 to N *aimags*. Comparing the values for the 21 *aimags*, the highest value of the indicator x_m is x_{mMax} and the smallest value is x_{mMin}. The index value is calculated using: $(x_{mMax} - x_m)/(x_{mMax} - x_{mMin})$. The index values will range from 0 to 1. Since each variable is defined as an indicator of vulnerability, larger value means greater level of vulnerability.

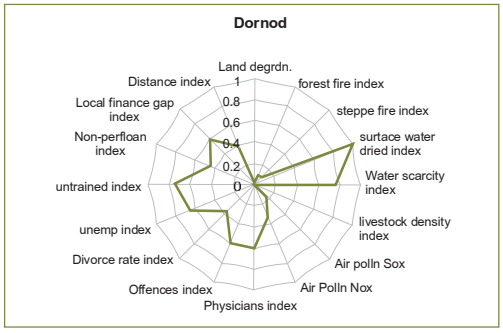




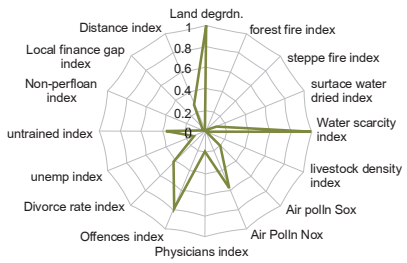




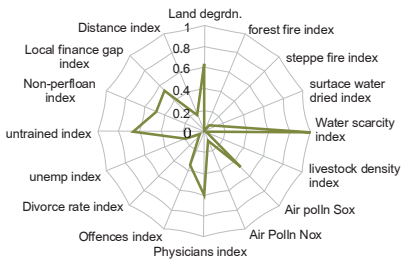




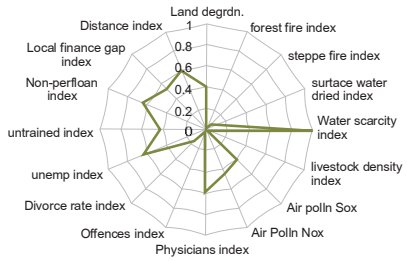
Dornogovi



Dundgovi



Govi-Altai



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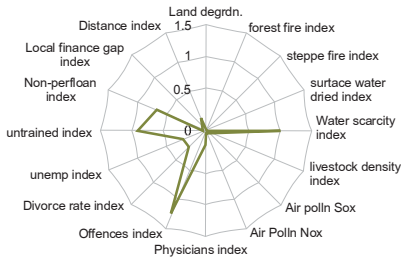

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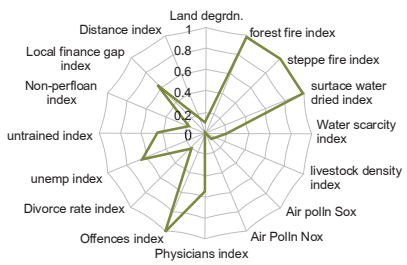
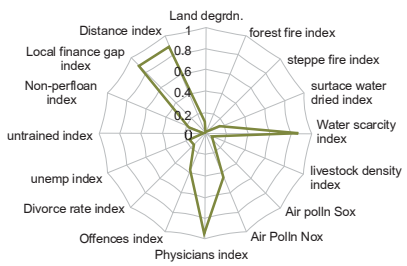
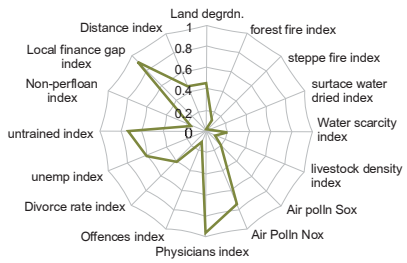


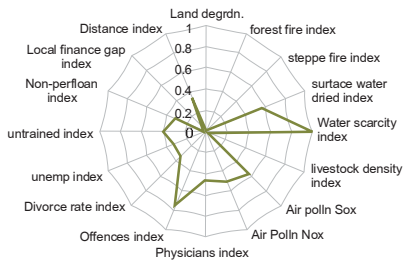
Khovd



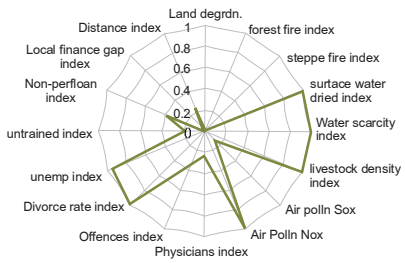
Khovsgol



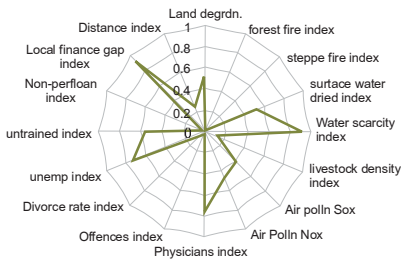
Omnogovi



Orkhon



Ovorkhangai



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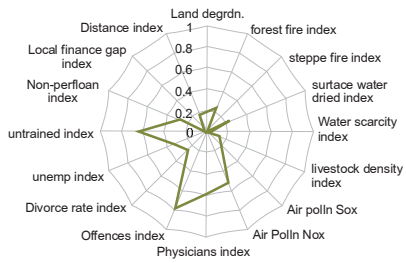

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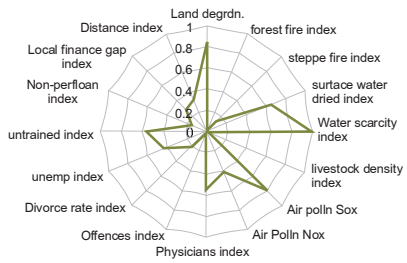

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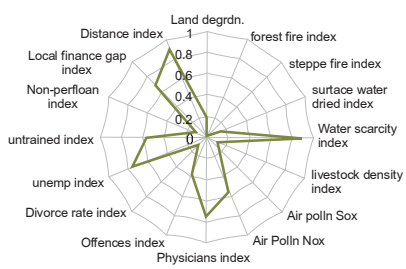

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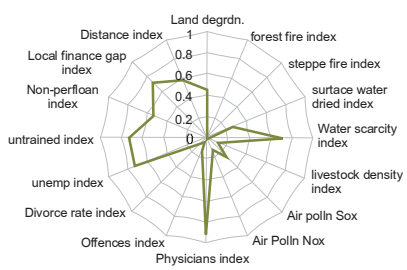

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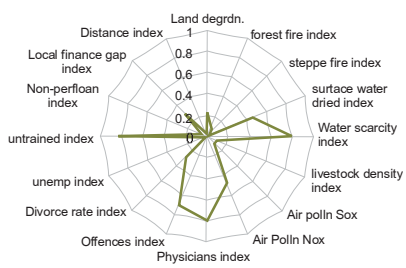

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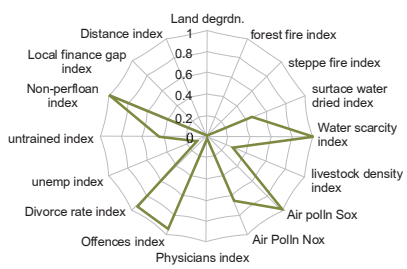
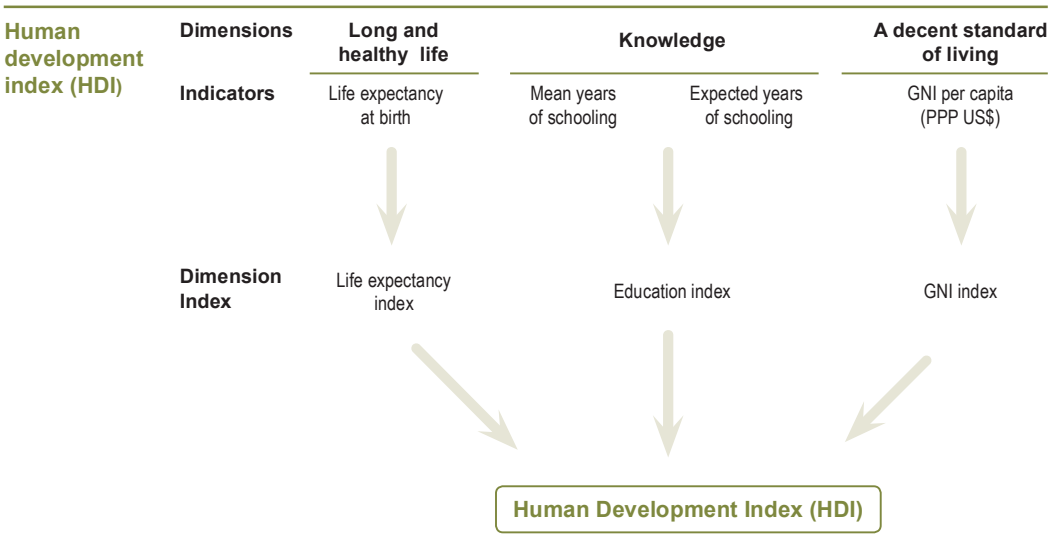
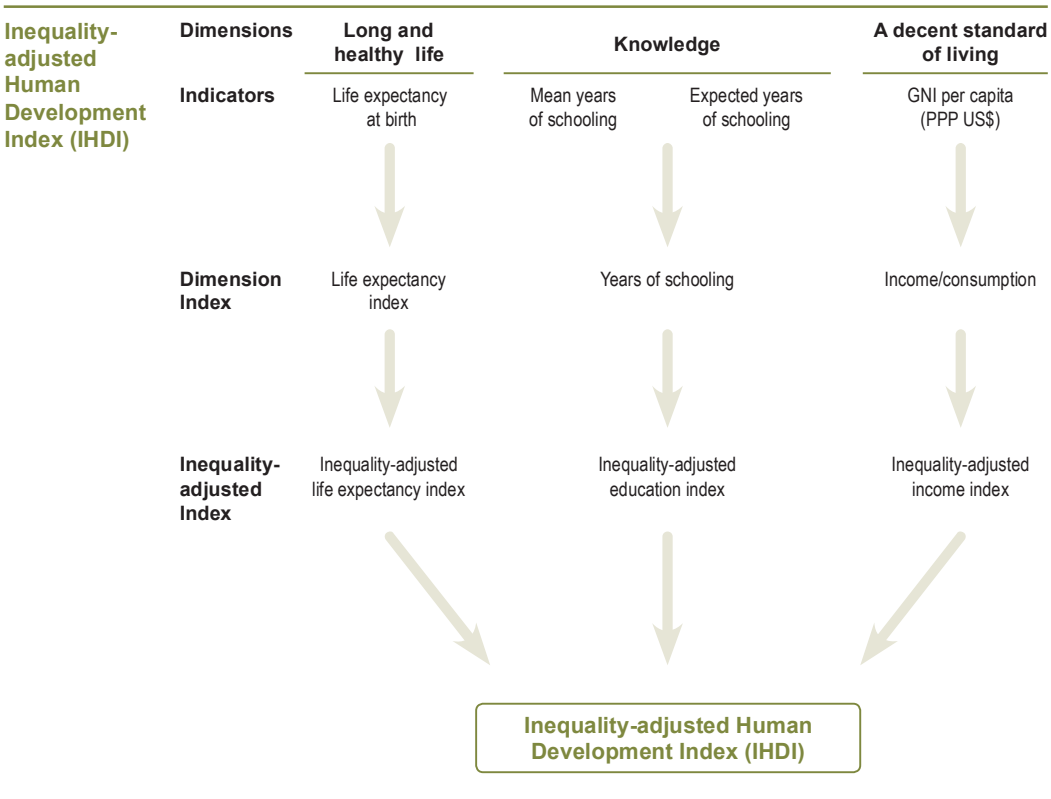
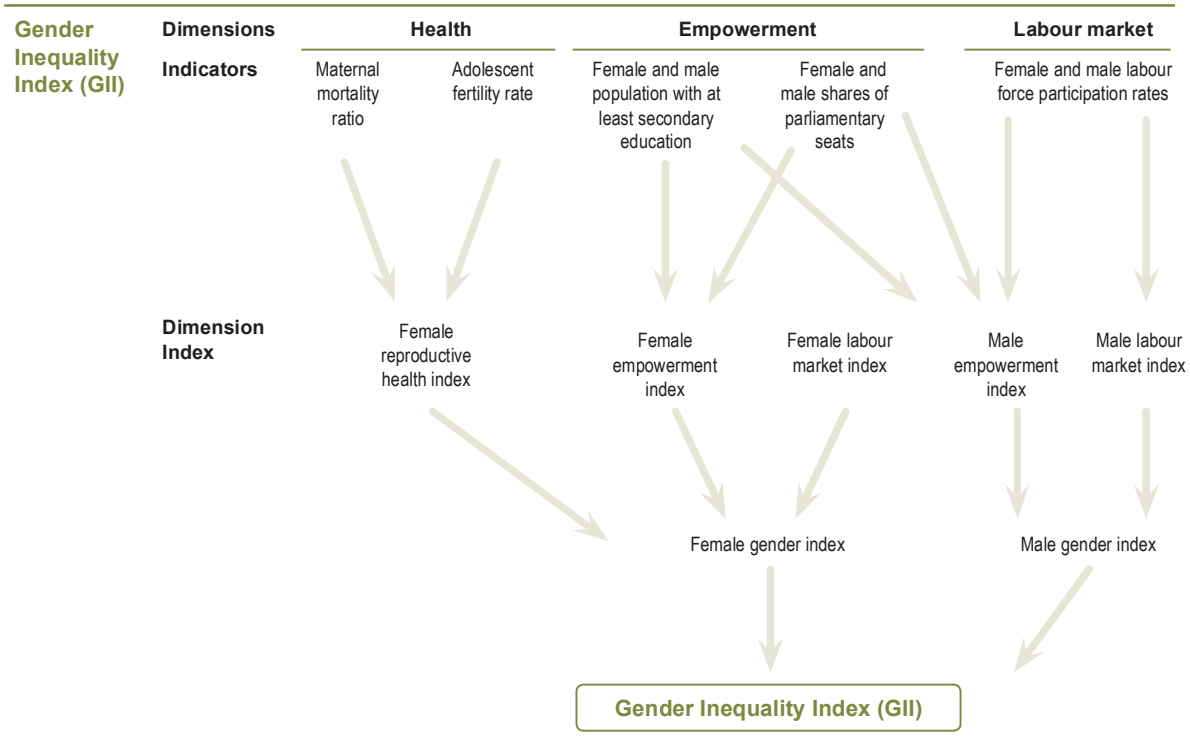
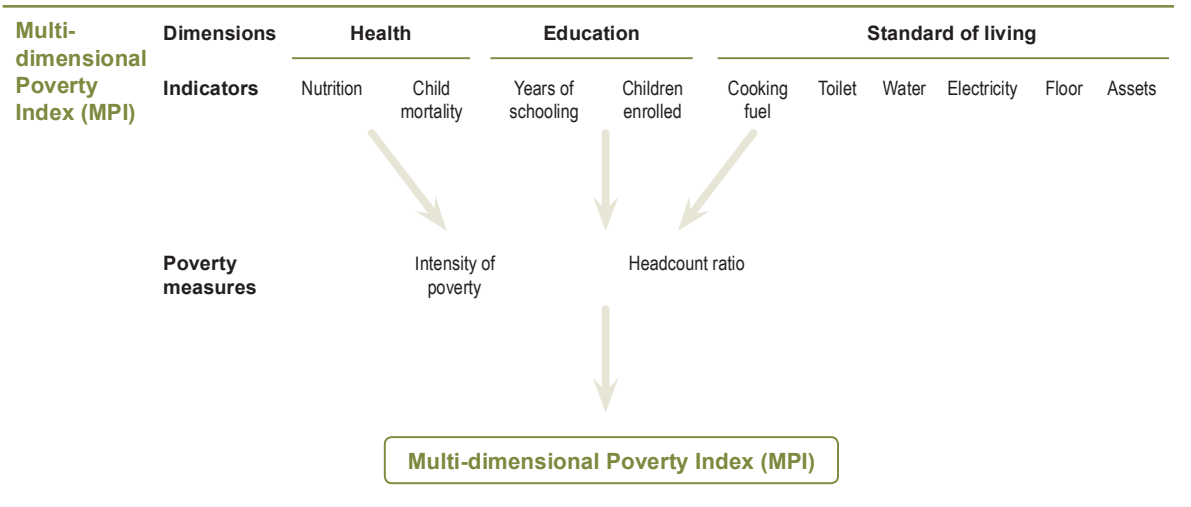


Scheme-1: **Calculating the human development indices-graphical presentation**






Gender Inequality Index (GII)
Dimensions
Health
Empowerment
Labour market
Indicators
Maternal mortality ratio
Adolescent fertility rate
Female and male population with at least secondary education
Female and male shares of parliamentary seats
Female and male labour force participation rates
Dimension Index
Female reproductive health index
Female empowerment index
Female labour market index
Male empowerment index
Male labour market index
Female gender index
Male gender index
Gender Inequality Index (GII)


Multi-dimensional Poverty Index (MPI)
Dimensions
Health
Education
Standard of living
Indicators
Nutrition
Child mortality
Years of schooling
Children enrolled
Cooking fuel
Toilet
Water
Electricity
Floor
Assets
Poverty measures
Intensity of poverty
Headcount ratio
Multi-dimensional Poverty Index (MPI)

Calculating New Human Development Index

Some changes have been made in the methodology used to calculate HDI indicators in the 2010 Global Human Development Report. These changes provided opportunity to combine newly developed package information and further perfect the composite HDI statistical expression. Here we present the newly calculated HDI methodology in the 2011 National Human Development Report.

Changes made in the human development index methodology

The HDI measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

It is necessary to convert indicators measured in different units to a dimension without any definite unit between 0 and 1. To do this conversion, the maximum and minimum values of each indicator of dimension are used and the HDI component indicators' index is formulated as follows.

$$\textit{Dimensions index} = \frac{\textit{Actual value - Minimum value}}{\textit{Maximum value - Minimum value}} \quad (1)$$

Table A shows comparison of the maximum and minimum values of the indicators used in HDI calculation by comparing the changes made in the old and new methodologies.

Table A: **Difference of the minimum and maximum values of old and new methodologies for calculating HDI**

Dimension	Old methodology			New methodology		
	Indicators	Minimum	Maximum	Indicators	Minimum	Maximum (observed)
Long and healthy life	Life expectancy at birth	25	85	Life expectancy at birth	20	83.2 (Japan, 2010)
Knowledge	Adult literacy rate (%)	0	100	Mean years of schooling	0	13.2 (USA, 2000)
	Gross enrolment rate (%)	0	100	Expected years of schooling	0	20.6 (Australia, 2002)
		-		Combined education index	0	0.951 (New Zealand, 2010)
A decent standard of living	GDP per capita (PPP US$)	100	40,000	GNI per capita (PPP US$)	163 (Zimbabwe, 2008)	108,211 (United Arab Emirates, 1980)
Computing dimension indices	**Arithmetic mean**			**Geometric mean**		

Life expectancy index: It is measured by level of average expectancy calculated on the population birth of a given country. No changes have been made in the methodology to calculate the life expectancy index.

Education index: The common education index used to be calculated by weighting the adult literacy index (LI) (with two-thirds) and the combined primary, secondary, and tertiary gross

enrolment index (GEI) (with one-third weighting). But the new methodology measures education of adults by 1) average number of years of education received by people ages 25 and older in their lifetime (MYS) 2) number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates were to stay the same throughout the child's life. These two dimensions that measure knowledge show clearly changes in understanding about education and difference between countries as compared to the previously used indicators and make it easier to express quality of education.

Old methodology: $$I_{education} = \frac{2}{3}(ALI) + \frac{1}{3}(GEI)$$

New methodology: $$I_{education} = \frac{\sqrt{MYSI \cdot EYSI} - minimum\ value}{maximum\ value - maximum\ value}$$

Income index: Standard of living used to measured in GDP per capita (PPP in US$) whereas under the new methodology it measures the GNI per capita (PPP in US$). Though GDP expresses economic output of a given country it doesn't express the total income used by the nation. It is necessary to consider that large chunk of income of a country is generated abroad and some citizens receive remittances from abroad and flow of aid is substantially more in some countries. Thus, it is now feasible to express the level of income of a given country more realistically by factoring these factors in GNI.

Old methodology: $$I_{income,\ GDP} = \frac{log(actual\ value) - log(100)}{log(40.000) - log\ (100)}$$

New methodology: $$I_{income,\ GNI} = \frac{ln\ (acual\ value) - ln(163)}{ln\ (108,211) - ln(163)}$$

HDI: The old methodology created the most appropriate condition to substitute indicators with each other using arithmetic mean of the composite three indices when calculating the HDI. In other words, the results are neutralized when calculating HDI with gaps and discrepancies in one dimension and with achievements in the other dimension. But the new methodology used geometric mean to aggregate the three composite indices and thus limited mutual automatic substitution among the composite indices and made it possible to determine how one percent change in a given composite index affected HDI.

Old methodology: $$HDI = \frac{1}{3}(I_{life} + I_{education} + I_{income})$$

New methodology: $$HDI = \left(I_{life}^{1/3} \cdot I_{education}^{1/3} \cdot I_{income}^{1/3}\right) \qquad (2)$$

Example for calculating HDI, Mongolia:

Let us use the new methodology that calculates HDI in the case of Mongolia using the data provided in the 2010 HDR.

Indicators, Mongolia, 2010	Value
Life expectancy at birth (years)	67.3
Mean years of schooling (years)	13.5
Expected years of schooling (years)	8.3
GNI per capita (PPP US$)	3,619

$$Life\ expectancy\ index = \frac{67.3 - 20}{83.2 - 20} = 0.748$$

$$Mean\ years\ of\ schooling\ index = \frac{8.3 - 0}{13.2 - 0} = 0.689$$

$$Expected\ years\ of\ schooling\ index = \frac{13.5 - 0}{20.6 - 0} = 0.655$$

$$Education\ index = \frac{\sqrt{0.689 \cdot 0.655} - 0}{0.951 - 0} = 0.675$$

$$Income\ index = \frac{ln(3,619) - ln(163)}{ln(108,211) - ln(163)} = 0.477$$

$$HDI = \sqrt[3]{0.748 \cdot 0.675 \cdot 0.477} = 0.622$$

The HDI calculated using the new methodology is 0.622 for Mongoila which ranks it at 100 among 169 nations.

New indices

Inequality-adjusted Human Development Index

Since HDI is the average measure to express basic achievement in human development for a given country it obscures inequality faced to distribute human development benefits to the total population like all other average measures. Thus, a new measure i.e. inequality-adjusted Human Development Index (IHDI) was calculated in the 2010 HDR. It was computed by adjusting for inequality for each of the three composite dimensions "in detail". As IHDI expresses in detail the actual level a country attains for each of HDI composite dimension indices in line with the level of inequality, it is the main indicator to express the average level of human development.

There are three steps to computing the IHDI.

Step 1: Measuring inequality in underlying distributions

The IHDI draws on the Atkinson (1970) family of inequality measures and sets the aversion parameter ∈ equal to 1. In this case the inequality measure is A=1-g/μ, where g is the geometric mean and μ is the arithmetic mean of the distribution.

$$A_x = 1 - \frac{\sqrt[n]{X_1, \ldots X_n}}{\bar{X}} \quad \textbf{(1)}$$

where $\{X_1, \ldots, X_n\}$ denotes the underlying distribution in the dimensions of interest. A_x is obtained for each variable (life expectancy, years of schooling and consumption per capita) using household survey data and the life tables.

The geometric mean in equation (1) does not allow zero values. Income per capita outliers—extremely high incomes as well as negative and zero incomes—were dealt with by truncating the top 0.5 percentile of the distribution to reduce the influence of extremely high incomes and by replacing the negative and zero incomes with the minimum value of the bottom 0.5 percentile of the distribution of positive incomes.

Step 2: Adjusting the dimension indices for inequality

The mean achievement in a dimension $\bar{X}$ is adjusted for inequality as follows:

$$\bar{X}^* = \bar{X} \cdot (1 - A_x) = \sqrt[n]{X_1, \ldots X_n}$$

Thus $\bar{X}^*$, the geometric mean of the distribution, reduces the mean according to the inequality in distribution, emphasizing the lower end of the distribution.

The inequality-adjusted dimension indices, I_{i_x}, are obtained from the HDI dimension indices, I_x, by multiplying them by $(1 - A_x)$, where A_x is the corresponding Atkinson measure:

$$I_{i_x} = (1 - A_x) \cdot I_x$$

The inequality-adjusted income index, $I^*_{I_{income}}$, is based on the unlogged gross national income (GNI) index, I^*_{income} . This enables the IHDI to account for the full effect of income inequality.

Step 3: Computing the Inequality-adjusted Human Development Index

The IHDI is the geometric mean of the three dimension indices adjusted for inequality. First, the IHDI that includes the unlogged income index (IHDI*) is calculated:

$$IHDI^* = \sqrt[3]{I_{I_{life}} \cdot I_{I_{education}} \cdot I^*_{I_{income}}} =$$

$$\sqrt[3]{(1 - A_{life}) \cdot I_{life} \cdot (1 - A_{education}) \cdot I_{education} \cdot (1 - A_{income}) \cdot I^*_{I_{income}}}$$

The HDI based on unlogged income index (HDI^*) is then calculated.

$$HDI^* = \sqrt[3]{I_{I_{life}} \cdot I_{I_{education}} \cdot I^*_{I_{income}}} =$$

The percentage loss to the (HDI^*) due to inequalities in each dimension is calculated as:

$$loss = 1 - \frac{IHDI^*}{HDI^*} = 1 - \sqrt[3]{(1 - A_{life}) \cdot (1 - A_{education}) \cdot (1 - A_{income})}$$

Assuming that the percentage loss due to inequality in income distribution is the same for both average income and its logarithm, the IHDI is then calculated as:

$$IHDI = \left(\frac{IHDI^*}{HDI^*}\right) \cdot HDI$$

which is equivalent to

$$IHDI = \sqrt[3]{(1 - A_{life}) \cdot (1 - A_{education}) \cdot (1 - A_{income})} \cdot HDI$$

In case of assumption that there is no inequality and no limit to inequality for each of composite index of HDI, the average level of human development index of a given country is expressed in HDI. In this sense, the HDI can be viewed as an index of "potential" human development and the IHDI is the actual level of human development. The "loss" in potential human development due to inequality is given by the difference between the HDI and the IHDI and can be expressed as a percentage

Example for calculating IHDI, Mongolia:

	Indicator	Dimension index	Inequality index	Inequality-adjusted index
Life expectancy	67.3	0.748	0.226	$(1-0.226)\cdot 0.748 = 0.579$
Mean years of schooling	13.5	0.655		
Expected years of schooling	8.3	0.629		
Education index	-	0.675	0.058	$(1-0.058)\cdot 0.675 = 0.636$
Logarithm of GNI	8.19	0.477		
GNI	3,619	0.032	0.164	$(1-0.164)\cdot 0.479 = 0.027$

	Human Development Index	Inequality-adjusted Human Development Index	Percent loss
HDI with unlogged income	$\sqrt[3]{0.748\cdot 0.675\cdot 0.032} = 0.253$	$\sqrt[3]{0.579\cdot 0.635\cdot 0.027} = 0.214$	$1-\frac{0.214}{0.253} = 0.152$
HDI	$\sqrt[3]{0.748\cdot 0.675\cdot 0.477} = 0.622$	$(\frac{0.214}{0.253})\cdot 0.622 = 0.527$	

In 2010 the Mongolian HDI was 0.622. It goes down to 0.527 if it is adjusted for inequality. It means that the index will reduce by 15.2 percent if each HD composite index is adjusted for inequality.

Gender Inequality Index

The Gender Inequality Index (GII) is a new indicator that reflects women's disadvantage in three dimensions—reproductive health, empowerment and the labour market. The index shows the loss in human development due to inequality between female and male achievements in these dimensions. Reproductive health is measured by maternal mortality ratio, adolescent fertility rate and empowerment dimension is by female and male shares of parliamentary seats and the labor market is measured by level of labor participation by female and male labour force participation rate respectively. This new index will replace the previously used Gender development indexes and the Gender empowerment index. The GII expressed how "potential" level of human development decreases in each of composite dimensions of HDI due to gender inequality. It ranges from 0, which indicates that women and men fare equally, to 1, which indicates that women fare as poorly as possible in all measured dimensions.

There are five steps to computing the GII.

Step 1: Treating zeros and extreme values

The maternal mortality ratio is truncated symmetrically at 10 (minimum) and at 1,000 (maximum). The maximum of 1,000 is based on the normative assumption that countries where the maternal mortality ratio exceeds 1,000 are not different in their ability to create conditions and support for maternal health. Similarly, it is assumed that countries with 1-10 deaths per 100,000 births are essentially performing at the same level.

The female parliamentary representation of countries reporting 0 percent is coded as 0.1 percent because the geometric mean cannot have zero values and because these countries do have some kind of political influence by women.

Step 2: Aggregating across dimensions within each gender group, using geometric means

Aggregating across dimensions for each gender group by the geometric mean makes the GII association sensitive.

For women and girls, the aggregation formula is:

$$G_F = \sqrt[3]{\left(\frac{1}{MMR} - \frac{1}{AFR}\right)^{1/2} \cdot (PR_F \cdot SE_F)^{1/2} \cdot LFPR_F}$$

MMR - Maternal mortality ratio
AFR - Adolescent fertility rate
PR_F - Female share of parliamentary seats
SE_F - Female attainment at secondary and higher education
$LFPR_F$ - Female labour market participation rate

and for men and boys the formula is:

$$G_M = \sqrt[3]{1 \cdot (PR_M \cdot SE_M)^{1/2} \cdot LFPR_M}$$

PR_m - Male share of parliamentary seats
SE_m - Male attainment at secondary and higher education
$LFPR_m$ - Male labour market participation rate

Step 3: Aggregating across gender groups, using a harmonic mean

The female and male indices are aggregated by the harmonic mean to create the equally distributed gender index.

$$HARM(G_F, G_M) = \left[\frac{(G_F)^{-1} + (G_M)^{-1}}{2}\right]^{-1}$$

Using the harmonic mean of geometric means within groups captures the inequality between women and men and adjusts for association between dimensions.

Step 4. Calculating the geometric mean of the arithmetic means for each indicator

The reference standard for computing inequality is obtained by aggregating female and male indices using equal weights and then aggregating the indices across dimensions:

$$G_{\overline{F,M}} = \sqrt[3]{\overline{Health} \cdot \overline{Empowerment} \cdot \overline{LMPR}}$$

where, $\overline{Health} = \left(\sqrt{\frac{1}{MMR}} \cdot \frac{1}{AFR} + 1\right)/2$

$\overline{Empowerment} = \left(\sqrt{PR_F \cdot SE_F} + \sqrt{PR_M \cdot SE_M}\right)/2$

$\overline{LMPR} = \frac{LFPR_F + LFPR_M}{2}$

$\overline{Health}$ - should not be interpreted as an average of corresponding female and male indices but as half the distance from the norms established for the reproductive health indicators—fewer maternal deaths and fewer adolescent pregnancies.

Step 5: Calculating the Gender Inequality Index

Comparing the equally distributed gender index to the reference standard yields the GII,

$$GII = 1 - \frac{Harm(G_F, G_M)}{G_{\overline{F,M}}}$$

Example for calculating GII, Mongolia:

	Reproductive health		Empowerment		Labour market
	Maternal mortality rate	Adolescent fertility rate	Parliamentary representation	Attainment at secondary and higher education	Labour market participation rate
Female	46	16.6	0.042	0.830	0.700
Male	-	-	0.958	0.818	0.795
(F+M)/2	$\left(\sqrt{\frac{1}{46}\cdot\frac{1}{16}}+1\right)\Big/2 = 0.518$		$(\sqrt{0.042\cdot 0.830}+\sqrt{0.958\cdot 0.818})/2 = 0.536$		$\frac{0.700+0.795}{2} = 0.748$

$$G_F = \sqrt[3]{\left(\frac{1}{46}-\frac{1}{16.6}\right)^{1/2}\cdot(0.042\cdot 0.830)^{1/2}\cdot 0.700} = 0.168$$

$$G_{\overline{F,M}} = \sqrt[3]{\overline{0.518}\cdot\overline{0.536}\cdot\overline{0.748}} = 0.592$$

$$G_M = \sqrt[3]{1\cdot(0.958\cdot 0.818)^{1/2}\cdot 0.795} = 0.889$$

$$GII = 1 - \frac{0.282}{0.592} = 0.523$$

$$HARM(G_F, G_M) = \left[\frac{(0.168)^{-1}+(0.889)^{-1}}{2}\right]^{-1} = 0.282$$

The GII for Mongolia is 0.523 and ranks at 57 among 138 countries.

Multidimensional Poverty Index

The Human development reports measured human poverty index (HPI) that factors many non-income factors since 1997. Though HPI was useful to understand the issue of poverty at macro level it failed to express well internal factors at micro level i.e. indivduals, families and households. Multidimensional poverty index (MPI) was calculated in the 2010 Human development report to express gaps in health, education and standard of living at household or family level. Factors of education and health were selected in two indicators each and factors of standard of living were selected in 6 indicators and these 10 composite indicators were derived from the household survey data. The indicators are weighted and scores are given to the households involved in the survey. Each person is assigned a score according to his or her household's deprivations in each of the 10 component indicators. The maximum score is 10, with each dimension equally weighted (thus the maximum score in each dimension is 3 (1 / 3). For instance, a cut-off of 3, which is the equivalent of one-third of the indicators, is used to distinguish between the poor and non poor. Households with a deprivation count between 2 and 3 are vulnerable to or at risk of becoming multi-dimensionally poor.

The MPI value is the product of two measures: the multidimensional headcount ratio and the intensity (or breadth) of poverty. The headcount ratio, H, is the proportion of the population

who are multidimensionally poor:

$$H = \frac{q}{n}$$

where q is the number of people who are multi-dimensionally poor and n is the total population.

The intensity of poverty, A, reflects the proportion of the weighted component indicators, d, in which, on average, poor people are deprived. For poor households only, the deprivation scores are summed and divided by the total number of indicators and by the total number of poor persons:

$$A = \frac{\sum_1^q c}{qd}$$

where q is the total number of weighted deprivations the poor experience and d is the total number of component indicators considered (10 in this case).

$$MPI = H \cdot A$$

MPI represents the share of the population that is multidimensionally poor, adjusted by the intensity of the deprivations suffered.

Example of poverty indicators, Mongolia:

	Indicators	Value	Interpretation
Population in Multidimensional Poverty	Headcount ratio (%)	15.8	15.8 percent of people live in poor household in Mongolia
	Intensity of deprivation (%)	41.0	The average poor person is deprived in 41 percent of weighted indicators.
Multidimensional Poverty Index	$0.158 \cdot 0.410 = 0.065$		6.5 percent of total population is multidimensional poor, adjusted by the intensity of the deprivations suffered.
Population with at least one severe deprivation in	Education	6.8	6.8 percent of the total population is deprived of education.
	Health	19.0	19 percent of the total population is deprived of health.
	Living standard	39.6	39.6 percent of the total population is deprived of income .
Population below income poverty line	PPP $1.25 a day	2.2	2.2 percent of the total population has income below 1.25 PPP $ a day.
	National poverty line	36.1	36.1 percent of the total population has income below the poverty line set by the government.

Definition of Terms

Adjusted net savings: Rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution, expressed as a percentage of gross national income (GNI). Negative adjusted net saving implies that total wealth is declining and that the economy is on an unsustainable path.

Adolescent Fertility Rate: Number of births to women ages 15–19, expressed per 1,000 women of the same age.

Degraded land, people living on: Percentage of people living on severely and very severely degraded land. Land degradation is based on four aspects of ecosystem services: biomass, soil health, water quantity and biodiversity. Severe degradation indicates that biotic functions are largely destroyed and that land is nonereclaimable at the farm level. Very severe degradation indicates that biotic functions are fully destroyed and that land is non-reclaimable.

Ecological footprint: Measure of human demand on the Earth's ecosystems, comparing human demand with planet Earth's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area needed to regenerate the resources a human population consumes and to absorb and render harmless the corresponding waste.

Expected years of schooling: Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates were to stay the same throughout the child's life.

Gross Domestic Product (GDP): The sum of the value added by domestic and foreign enterprises, and citizens located in the country, or the sum of the values of final products during a one-year period.

GDP per capita: Gross domestic product (GDP) during the a one year period, divided by mid-year population.

Gender Inequality Index: A composite index measuring loss in achievements in three dimensions of human development—reproductive health, empowerment and labour market, due to inequality between genders. For details on how the index is calculated, see *Technical note.*

Gini Coefficient, income: This is a measure of income inequality. It shows the extent to which the distribution of income (or consumption) among individuals of households within a country deviates from a perfectly equal distribution. A value of 0 represents perfect equality, a value of 1 perfect inequality.

Gross National Income (GNI) per capita: Sum of value added by all resident producers in the economy plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad, divided by mid-year population. Value added is the net output of an industry after adding up all outputs and subtracting intermediate inputs.

Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions of human development — a long and healthy life, knowledge and a decent standard of living. For details on how the index is calculated, see *Technical note.*

Inequality-adjusted Human Development Index: Human development index value adjusted for inequalities in the three basic dimensions of human development. For details on how the measure is calculated, see *Technical note*.

Income poverty line, population below: Percentage of the population living below the specified poverty line (PPP $1.25 a day and the national poverty line).

Labour force participation rate: Percentage of the working-age population (ages 15–64) that actively engages in the labour market, by either working or actively looking for work.

Life expectancy at birth: Number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth were to stay the same throughout the infant's life.

Mean years of schooling: Average number of years of education received by people ages 25 and older in their lifetime based on education attainment levels of the population converted into years of schooling based on theoretical durations of each level of education attended.

Infant Mortality Rate: The probability of dying by exact age 1 expressed per 1,000 live births.

Maternal Mortality Ratio: Number of maternal deaths, expressed per 100,000 live births. Maternal death is defined as the death of a woman while pregnant or within 42 days after terminating a pregnancy, regardless of the length and site of the pregnancy, due to any cause related to or aggravated by the pregnancy itself or its care but not due to accidental or incidental causes.

Multidimensional poverty, headcount: Percentage of the population that suffers deprivation in at least 3 of the 10 weighted indicators used to construct the Multidimensional Poverty Index.

Multidimensional Poverty Index: The share of the population that is multi-dimensionally poor adjusted by the intensity of the deprivations.

Multidimensional poverty, intensity of deprivation: Average percentage of deprivation experienced by people in multidimensional poverty.

Purchasing power parity (PPP): An adjustment performed to reflect international variations in the price of goods and services. The purchasing power of a country's currency: the number of units of that currency required to purchase the same representative basket of goods and services that a US dollar would buy in the United State.

Population density: The number of people per a unit of area.

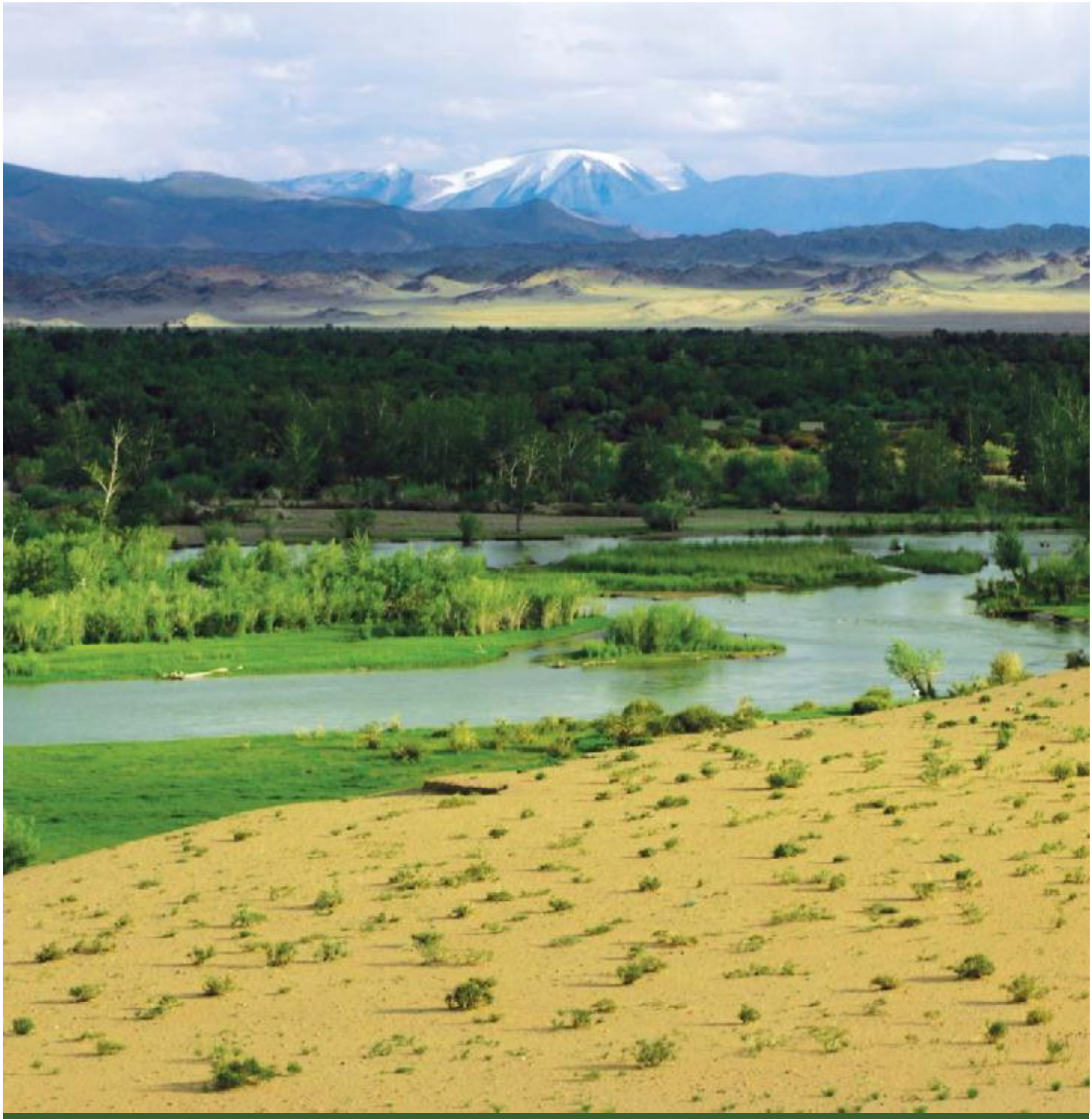
Unemployment rate: Percentage of the labour force (the employed and unemployed population) ages 15 years and older who are not in paid employment nor self-employed but who are available for work and have taken specific steps to seek paid employment or self-employment.

Urban area: The Law on "Legal status of the cities and villages in Mongolia" defines a town as a settlement "with no less than 15 thousand residents, the majority of which works in industrial and service sector, with developed infrastructure and local governance". The same law states that "a town with more than 50 thousand residents (or up to 50 thousand in some case) can be given a national status (degree or grade) with regard to the role the given torn plays in economic and social development of the country, its urbanisation and level of infrastructure development." According to this definition there are 3 towns (namely, Ulaanbaatar, Darkhan and Erdenet) in Mongolia that have national status. At the international level, economists

determine a city as a settlement characterized by high population density, and sustainable regular activities such as industry and trade, by which their economic features are defined and which are based in highly developed infrastructure. Sociologists define a region as an urban area if it is characterized by isolated social relationships and lifestyles, and by the non-transparency and interests of an individual.

Urbanisation: A process whereby the share of urban residents in total population is growing.

NOTE



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