GOVERNMENT OF MONGOLIA

MINISTRY OF ENVIRONMENT, GREEN DEVELOPMENT AND TOURISM

gef

UNDP

Empowered lives
Resilient nations

AN ECONOMIC VALUATION OF CONTRIBUTION OF ECOSYSTEM SERVICES OF THE NETWORK OF PROTECTED AREAS TO THE ECONOMY OF MONGOLIA

2015

GOVERNMENT OF MONGOLIA

MINISTRY OF ENVIRONMENT, GREEN DEVELOPMENT AND TOURISM

gef

UNDP

Empowered lives
Resilient nations

AN ECONOMIC VALUATION OF CONTRIBUTION OF ECOSYSTEM SERVICES OF THE NETWORK OF PROTECTED AREAS TO THE ECONOMY OF MONGOLIA

August 2015

Prepared by
Marlon Flores
Ganzorig Gonchigsumlaa
Khorolmaa Surenjav

DDC-330
Mar-29

ACKNOWLEDGMENTS

The authors wish to thank public and private institutions who made contributions at the various stages of the development of this document; particularly to the National Statistical Office of Mongolia, the Ministry of Food and Agriculture, and the support of the collaboration of the staff of the Ministry of Environment, Green Development and Tourism.

The authors are also thankful to UNDP Mongolia, which went to great lengths to facilitate the procurement process, provide research material, arranged meetings in Mongolia, and by provided office space for the team during the two in-country missions in October 2013 and September 2014.

AN ECONOMIC VALUATION OF CONTRIBUTION OF ECOSYSTEM SERVICES OF THE NETWORK OF PROTECTED AREAS TO THE ECONOMY OF MONGOLIA

THE STUDY TEAM:

Marlon Flores
Team Leader (Natural Resources Economist)
Senior Advisor, Environmental Economics & Finance
Ecologic Institute, Washington DC
marlon.flores@eius.us

Ganzorig Gonchigsumlaa
Environmental Economist, National Consultant
Mongolian State University of Agriculture,
Ulaanbaatar, Mongolia
ganjaa123@yahoo.com

Khorolmaa Surenjav
Economist, National Consultant
s_khorol@yahoo.com
khorolmaa.surenjav@greenresources.com.au

ISBN 978-99962-3-946-5

TABLE OF CONTENTS

ACRONYMS

BAU	Business As Usual
CRC	Crop Rehabilitation Campaign (GoM)
ES	Ecosystems service
GoM	Government of Mongolia
INC	Investing in Natural Capital
MEGDT	Ministry of Environment, Green Development and Tourism
MoFA	Ministry of Food and Agriculture
MNPAs	Mongolian Network of Protected Areas
NBT	Nature-based tourism
NGO	Non Governmental Organization
NSO	National Statistical Office Mongolia
OVNP	Orkhon Valley National Park
PAAD	Protected Areas Administration Department
TSA	Targeted Scenario Analysis
SPAN	UNDP "Strengthening of the Protected Area Network" Project
UNDP	United Nations Development Programme
GEF	Global Environment Facility

EXECUTIVE SUMMARY

The United Nations Development Programme (UNDP) sponsored the GEF Project "Strengthening of the Protected Areas Network of Mongolia (SPAN)" between 2010 and 2015 in support to the Ministry of Environment, Green Development and Tourism (MEGDT) The objective of the project is to catalyze the management effectiveness and financial sustainability of Mongolia's protected areas system. In order to achieve the overall project objective, an economic valuation of the contribution of the Mongolian Network of Protected Areas (MNPAs) to the economy was necessary. In addition, 3 site-level reports were conducted: Gorkhi Terelj, Ikh Nart and Orkhon Valley. This report corresponds to the MNPAs; the site-level reports are included in separate reports.

The study used a high-level "Targeted Scenario Analysis" (TSA) approach to assess the economic relations between production practices, ES, other inputs, and their respective sectoral outputs (values). TSA compares "poor" with "sound" protected area's ecosystem management practices vis-a-vis sectoral output; i.e., BAU and INC approaches; and by way of this comparison, the study attempts to respond two fundamental policy questions: a) Why it is sound for the Mongolian sustainable economic development to increase investment in ecosystems/ PAs management? and b) Why ecosystems and PAs management policy reform is a priority for sustainable development?

The study did not include a sectoral policy and institutional analysis. However, key sectors were identified with the participation of stakeholder from the government and the academia.

In Section 3, the core section of the study, the following key sectors are analyzed: nature-based tourism (NBT), irrigated agriculture, livestock, forests, mining, and drinkable water. This Section provides initial evidence that show how a shift from BAU to INC in PAs management may result in more sustainable sector productivity and improved human well-being.

In case of Mongolia, there are 21 provinces that comprise 330 Soums and the Capital City of Ulaanbaatar that includes 9 districts. The territories of 189 Soums and 4 districts overlap with territory of all 99 protected areas in Mongolia. The study assumes that the sectoral output of these Soums receive direct indispensable ecosystem services that are critical to sustain productivity. It is recognized however that ES provides one critical input. The study does not attribute the estimated values entirely to ES of PAs. It acknowledges that without the input of PA's ES, economic activity will not be possible.

In order to estimate economic values, the study used mainly the available data from the National Statistical Office and other secondary sources. The BAU and INC scenarios presented in the next sections were constructed using data from the NSO, additional sources, and interviews and consultations with stakeholders. To this end, two consultation workshops held in October 2013 and September 2014. The results of the study were presented and discussed with stakeholders in the latter. The key findings of the study, organized by sectors, are summarized below:

Nature-based tourism. NBT in Mongolia is still poorly managed, and therefore considered a BAU practice. Currently, BAU-NBT works against Mongolia's competiveness in the region and elsewhere. Nevertheless, under BAU, NBT delivers significant contributions to the economy. Further, in 2013, the tourism industry directly employed 21,500 jobs (2% of total employment) and sustained, both directly and indirectly, 8% of GDP in Mongolia.

Under BAU, the current use of accommodations facilities is low. It is estimated at 34%. Nevertheless, businesses in PA generate 11.7 million USD per year. Under the INC practices, the businesses in PA, could operate at 75% of the full capacity, the annual revenue could reach 25.7 million USD. Therefore, as a result of BAU practices, it is estimated that the annual loss was in order of USD 14 million. Further, when projecting spending, for example in the next 10 years, the potential loss is large; estimated at USD 57.6 million.

In 2011, international tourist arrivals reached 456.1 thousand. This level of visitation generated USD 218.1 million in tourism receipts. This is an example of the multiplier effect of tourism in Mongolia in 2011, under BAU.

Assessing the distribution of benefits resulting from NBT and other sectors was not in the scope of this study. However, in general terms, NBT companies operating in the MNPAs include basic backpackers type of *Ger* camps, mid range hotels. Unfortunately, there are no tourism-related financial mechanisms sponsored by the hotel industry to support national parks finance in Mongolia. International or regional companies own the great majority of *Ger* camps. *Ger* camps use locally owned suppliers wherever possible to provide and run services, to ensure that the local economy benefits directly.

Irrigated agriculture (crops). In Mongolia, sustainable agriculture practices are key to achieve sustainable development. The agricultural sector represents 4% of GDP and an estimated 8% of the labor force is engaged in agriculture in 2012 (NSO, 2014). The same year, about 415 thousand hectares of land are annually sown with seeds; and 723.1 thousand tons of crops, vegetables and oil plants were harvested. The majority of sown land is irrigated with surface water from rivers that originate in PAs.

The study analyzed 2012 data of 17 different products in six categories: hay, fodder, cereals (wheat, barley, oat and rye), rapeseed, vegetables (potato, carrot, onion, cabbage, neep, beet, and cucumber), and fruits (tomato, watermelon and sea buckthorn).

Income in the irrigated agriculture sector was addressed by the study. The analysis showed that the total income of the 26 thousand people working in crop farming is estimated at 45.2 billion MNT (33.2 million USD) in 2012. This is the income generation of subsistence crop farming in soums that overlap with PAs. Agriculture income has increased sharply since last two years, because of government support, mainly the 3rd CRC.

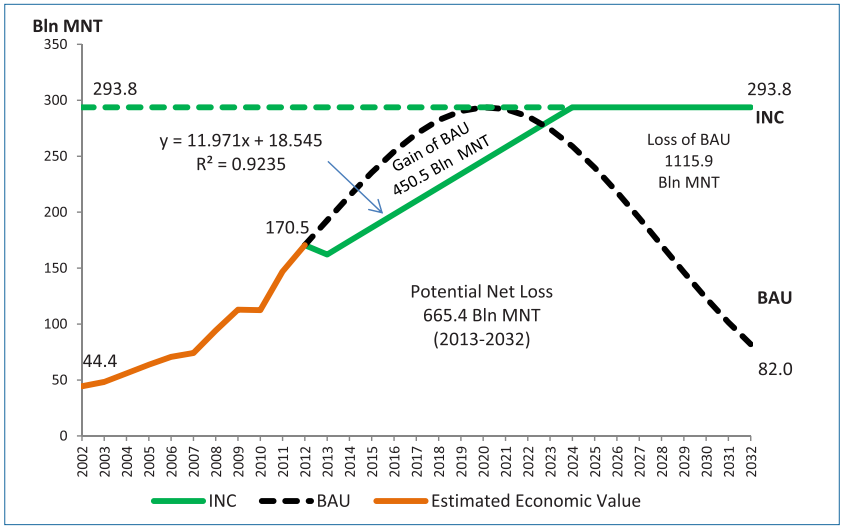
In addition, indirect benefits such as taxes paid by farmers to the GoM, and household's payments for agricultural insurance, and interest to banks for loans were analyzed. The analysis showed that in total, in 2012, the government, insurance companies, and banks earned 32.3 billion MNT (USD 23.8 million) from payments of taxes insurance and interests. The aggregated value from 2002 to 2012 is estimated at 142.8 billion MNT.

The study estimated that the estimated total value of the irrigated agricultural sector in 2012, including the net value of crops, income to farmers and other indirect benefits was 170.5 billion MNT (125.4 million USD). The benefit is significant in the 2002 – 2012 periods, i.e., 994.1 billion MNT or USD 731.3 million. Total economic value is highest in the Central Region that shares 31.8% of total economic value.

The total estimated value of the irrigated agriculture sectors was used to build BAU and INC scenarios that show potential losses and gains. Under BAU, gains may continue up to 2022 reaching 450.5billion MNT (USD 331.4 million). However, a decline in economic benefits may be visible from 2023 and the loss could reach 1115.9 billion MNT (USD 821 million). The net loss in this illustrative BAU scenario could reach 665.4 billion MNT (USD 489.5 million) over next twenty years (2013 and 2032)[1]. This is shown in the Figure below.

[1] The net loss is difference between gain and total loss 665.4=1115.9-450.5. The gain occurred 2013-2022, and total loss occurred 2023-2032.

Illustration of BAU and INC scenarios in the irrigated agricultural (crop) sector (Bln MNT)



Source: Author's estimation based on NSO data.

Under INC scenario, the total economic value of the irrigated agriculture sector could reach 293.8 billion MNT (USD 216.1 million) in 2032. However, intense policy reform will be needed to attempt to achieve such target. However, the 2008 3rd CRC (483.5 billion MNT or USD 414.7 million), still under implementation, excludes funding to support conservation and ecosystems management in/ around PAs.

Livestock. Natural grassland ecosystem services provide a direct input to sustain livestock productivity en Mongolia, and to support the livelihoods of millions of people. For example, in 2012, the livestock sector share of GDP was 12% and 27% of the labor force was engaged in livestock farming.

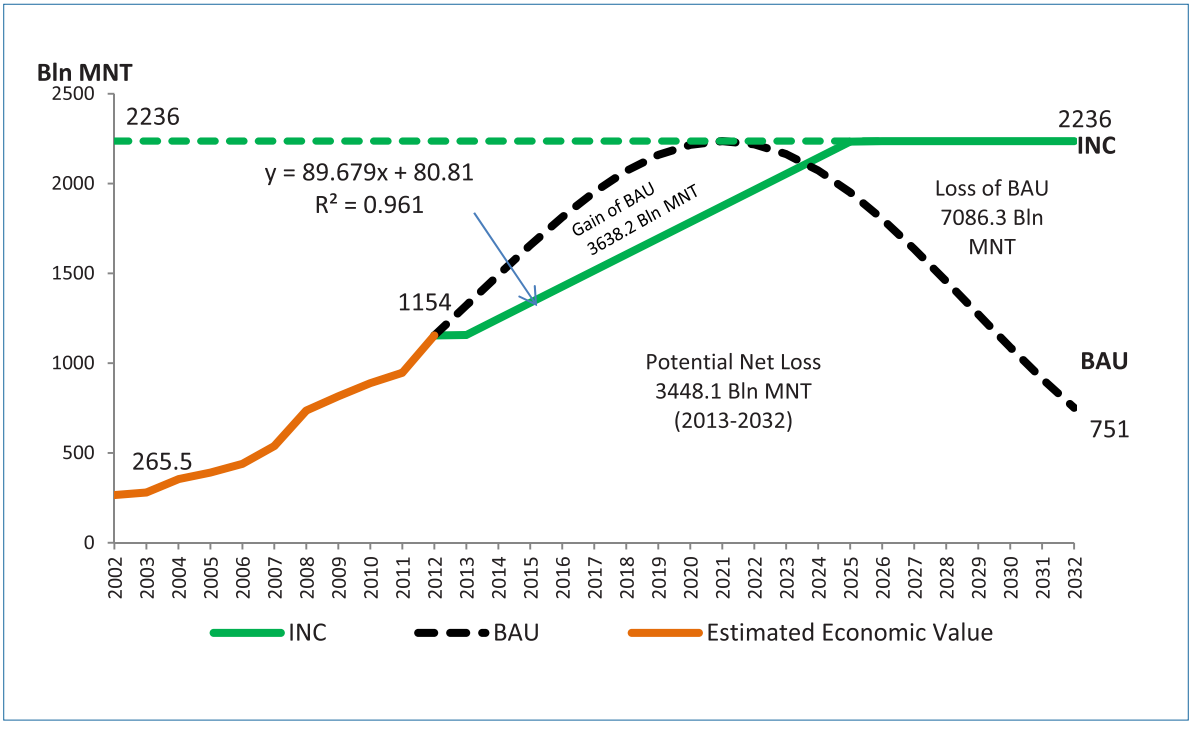
Goat, sheep, cattle, horse and camels are the main five types of livestock in Mongolia. Number of livestock reached to 45.1 million heads in 2013; a record number in history of Mongolia; and in 2012 there were 22.5 million of livestock in 189 Soums and 4 districts of Ulaanbaatar that overlap with all 99 PAs in Mongolia. In 2012, the number of livestock in Mongolia was estimated at 40.9 million; consequently, about 55% of total livestock exists in Soums that overlap with PAs.

The study considers grassland management to be in the BAU scenario. For example, in 2009, the GoM stopped the tax on herder households who had to pay taxes per head of livestock. The initial purpose of the tax was to reduce number of livestock and the negative effect on pasturelands, and to finance the improvement of grassland management.

Five types of livestock were assessed in five categories: meat, hides, milk, cashmere, and wool. In addition, the study reviewed livestock-related income, government income from taxes, and insurance and interest paid to banks for livestock loans. Income from livestock was reviewed also. In 2012, the income benefit is estimated at 472.1 billion MNT (USD 347.3 million) in Soums that benefit from PAs ecosystems. The total income benefit over eleven years between 2002 and 2012 is estimated at 2.74 trillion MNT or USD 2.02 billion.

The estimated total of the livestock sector, under BAU, is estimated at 1.15 trillion MNT (USD 849 million) in 2012, including the net value of production, income, and other benefits. The total benefit between 2002 and 2012 is estimated at 6.8 trillion MNT or USD 5.01 billion. This level of benefit will not be possible without the direct input from free grassland ecosystems in and around PAs. BAU and INC scenarios are shown in the Figure below.

BAU and INC trends in the livestock sector (Bln MNT)



Source: Authors' estimation based on NSO data.

Gains under BAU will most likely continue between 2013 and 2021. However, economic benefits could start decreasing thereafter; and the loss could reach 7086.3 billion MNT (USD 5.2 billion) by 2032. The net loss of this BAU scenario, which is difference between gain and total loss, could be as big as 3448.1 billion MNT (USD 2.5 billion) over next twenty years (2013 and 2032)[2]. This is illustrated in Figure above. Under INC scenario, the total economic benefit could be 2.24 trillion MNT (USD 1.6 billion) by 2032.

Forests. Forest ecosystems provide several services to economic sectors and contribute to the welfare rural households by providing "free" valuable resources such timber, and non-timber products and production of clean air through carbon storing. For example, there are approximately 2.6 million hectares of forest in the protected areas of Mongolia with a high value in terms of carbon sequestration. For illustrative purposes, the average carbon sequestration of the larch forests is 6.6 ton per hectare and 12.2 million metric tons of carbon annually could be stored in the 1.85 million ha of larch forests of the PA's. Using the current market value of 1.5 USD per t/CO_2, the estimated market value of the CO_2 sequestered by the Protected Areas larch forest ecosystem is USD 18.3 million (33.3 billion MNT).

Mining. The mining sector of Mongolia is becoming the strongest sector of the Mongolian economy. Approximately 90 per cent of Mongolian exports are natural resources, notably copper, gold and coal. The mining sector generates 20.7 percent of the GDP in 2013. The Oyu Tolgoi copper and gold mine alone is expected to account for as much as 30 percent of Mongolia's GDP once full commercial ore production starts.

The contribution of fresh water ecosystem from PAs to the mining sector is, without a doubt, indispensable. "Mining operations use water for mineral processing and metal recovery, controlling dust, and meeting the needs of workers on site. Further, the use of water in mining has the potential to affect the quality of surrounding surface water and groundwater. Currently, the mining sector is not contributing (investing) in off-site conservation of water resources.

Mines water consumption in the SGR is used to illustrate the contribution of fresh water ecosystems to the mining sector. The total projected mining sector water demand in SGR is 60.38 million m^3 per year in 2014. The water demand will be increasing over the next years to 104 million m^3, 119 million m^3 and 130 million m^3 in 2017, in 2019 and in 2022 respectivly. Currently, mines are paying 3,500 MNT (US$1.9) per cubic meter water in SGR (Energy Resource 2013)[3]. With these data the value of water was estimated.

The total economic (market) value of water used by the mining sector, under BAU, is estimated at 211,356 billion MNT (USD117 million) in 2014 and it will increase over the next decade, could be doubled by 2020. If we assume that the water price constant for over the period, total economic value of water would be 457,820 MNT (USD 254 million) by 2022. This is an important benefit (revenue) to the GoM. Under the INC scenario, with realistic water tariffs to cover service costs, sustainable water management policy and sufficient public investment in conservation of fresh water sources, Mongolia may meet the future water demand of the mining sector. Under INC, the total economic value of the water for EMC and miners in SGR could increase over the next decade and it will reach USD 285.1 million by 2022.

Drinkable water supply. The main drinkable water sources for rural and urban areas are river basins, lakes and aquifers; and these sources are directly linked to PAs. Rivers and aquifers are fed not only by rain but also by water from melting snow and glaciers during the warm seasons. For example, the main source drinkable water to Ulaanbaatar (UB) comes from groundwater wells that are fed by filtration of the Tuul River Basin that originates in the Khan-Kentii Protected Area and runs through the Gorkhi-Terelj National Park. Ulaanbaatar residents use about 53 percent of drinkable water in Mongolia.

The GoM heavily subsidizes the water price. This allows the water consumers to waste "cheap" water. Water price is a political matter in Mongolia and government and the water supply industry take heavy losses. This is a typical BAU practice.

Using a range of parameters related to prices and consumption, the study estimated that the total economic benefit of drinkable water that originates from PAs in Mongolia increased from 73 billion MNT (USD 65.8 million) in 2002 to 123.9 billion MNT (USD 91.2 million) in 2012; and the total market (economic) value for the period from 2002 to 2012 is estimated at 1.09 trillion MNT (USD 802.8 million), with an average annual growth rate of 5.4% for this period.

Under BAU, the total economic market value

2 So the difference of the gain and loss is called net loss, as loss is higher than the gain, which is 3448.1 (7086.3-3638.2). The point where the growth reaches to max is 2021, and then starts to decrease 2022 and so on. In 2022 BAU is still higher than INC, they become equal or crossing point is 2023. Since 2024 BAU is less than INC.

3 According to Energy Resource Company, the water price per m3 is $1.9 but an official water tariff $0.61 in SGR.

of drinkable water from PAs in Mongolia could decrease from 123.9 billion MNT (91.2 million USD) in 2012 to 127.6 billion MNT (USD 93.9 million) in 2032. This is mainly due to unsustainable BAU water management practices such as: unplanned increasing water demand, collapsing water supply infrastructure, water pollution and sanitary issues due to poor maintenance and funding.

Under INC, an average increase in a sustainable manner is estimated at a rate of 3.0% and its market value is stable at 1,789 MNT per cubic meter (USD 1.35). Therefore, the total economic benefit of drinkable water from PAs is estimated at 224.4 billion MNT (USD 165.1 million) by 2032. A shift from BAU to INC could eliminate potential economic loss in the next decades.

Conclusions and recommendations based on the findings of Sections 3 are included in Section 4. The study concluded that despite the challenge of having limited information for the analysis, the evidence found shows that ecosystems services (ES) of PAs, under BAU, make a significant contribution to the Mongolian economy. However, ecosystems wear and tear after decades of ecosystems neglect under BAU practices is now visible. The study concluded also that the shift to INC could secure sustainable economic benefits at sector level. The shift to INC can pave the way to sustainable development in Mongolia.

Mining, Livestock and irrigated agriculture are the sectors with the highest output values. These are also the sectors that represent the major threats to ES of PAs and therefore a threat to the long-term economic output of other sectors such as NBT. Finally, the study concludes that a) It is sound for the Mongolian sustainable economic development to increase investment in ecosystems management; and b) ecosystems management policy reform is a priority for sustainable development. A mix of both, increase public investment (fiscal policy) and management policy reform will provide an ideal path to follow.

It is recommended that the results of the study be communicated to policy makers in order to promote policy reform using a policy mix approach. This is because policies are intertwined and therefore a single-sector policy reform could achieve little or be of little use. The policy reform could be harnessed in a policy mix package that could address multi sector policies that affect one or more sectors.

The Mongolian policies contained in Table 34 (policy overlaps) could be initially used to plan the scope of the policy mix reform, i.e., Identifying key policy issues that require multi-sector policy reform to be resolved. For example, landscape pollution and capacity issues are critical to improve NBT and these aspects can de dealt with collaboration with the agriculture and livestock sectors, as well as mining.

A detailed policy and institutional review is recommended to further define the policy links between the findings of this study and specific policies. This could be done, as mentioned, when Mongolia engages in the UNDP sponsored BIOFIN Project. A short policy document could be prepared by combining the results of this study and the results of the completion of BIOFIN's institutional and policy review early in 2016.

Additional general recommendations are included at the end of this section 4.

1. INTRODUCTION

The United Nations Development Programme (UNDP) sponsored the GEF Project "Strengthening of the Protected Areas Network of Mongolia (SPAN)" between 2010 and 2015 in support to the Ministry of Environment, Green Development and Tourism (MEGDT). The objective of the project is to catalyze the management effectiveness and financial sustainability of Mongolia's protected areas system. The project aims develop the management and financial capacity of the Protected Area Administration Department (PAAD) under the MNET and strengthen the partnerships between PA authorities and local communities, local government, NGOs and the private sector to achieve the long-term sustainability of PA financing to allow Mongolia to cover the financing gap.

In order to achieve the overall project objective, an economic valuation of the contribution of the Mongolian Network of Protected Areas (MNPAs) to the economy was necessary. In addition, 3 site-level reports were conducted: Gorkhi Terelj, Ikh Nart and Orkhon Valley. This report corresponds to the MNPAs; the site-level reports are included in separate reports.

A conceptual framework for protected areas (PAs), ecosystems and ecosystem services and discusses how these elements are interlinked is included in Section 1; and, general information of the MNPAs, and its critical financial situation.

The study used a high-level[4] "Targeted Scenario Analysis" (TSA) approach to assess the economic relations between production practices, ES, other inputs, and their respective sectoral outputs (values). A summary of the TSA approach used in the study is included in Section 2. TSA compares two approaches to ecosystems management ("poor" with "sound" protected area's ecosystem management practices) vis-a-vis sectoral output; i.e., BAU and INC approaches[5]; and by way of this comparison, the study attempts to respond two fundamental policy questions:

a) Why it is sound for the Mongolian sustainable economic development to increase investment in ecosystems and PAs management?

b) Why ecosystems and PAs management policy reform is a priority for sustainable development?

It is expected that this report will inform policy makers and businesses in Mongolia about the economic risks and opportunities of undertaking productive activities that impact on the ecosystem services (ES) of the MNPAS. It is expected also that the MNET will internalize and communicate the results of this report in order to assist government officials and the private sector to incorporate ecosystems' management policy into PA investment, economic planning, and investment policies at sectoral level. The communication of economic and social arguments to mobilize political will include the MEGD, this is key to increase financial support the MNPAs' management plans and financial strategies.

[4] A high-level TSA refers to a basic study covering one or more sectors. The study was planned and programmed before the TSA official UNDP TSA methodology came available in December 2013.

[5] **Business as Usual (BAU)** - continuing under-investment in PAs: This corresponds to a situation where current trends in PA investment, management and use continue. As a result, although the area of the PAs expands as planned, existing and new PAs suffer from a chronic lack of funding, and weak management effectiveness. There may be progressive encroachment into PAs. The recreational use of PAs increases, as national tourism develops, at least initially, but over the longer-term stagnates as the quality of PAs and visitor experiences decline. Insufficient spending also translates into an inability to manage threats to biodiversity and ecosystems: while PAs continue to provide important ecosystem services (such as water supplies, watershed protection and flood control), the quality and impact of these services decreases progressively over time. **Investing in Natural Capital (INC)** - adequate investment in PA conservation and sustainable use: This corresponds to a situation where PA investment rises, policy implementation is improved, and management effectiveness increases. The recreational use of PAs continues to increase steadily, in line with development of the national tourism market, and visitor experience improves as the quality of both natural ecosystems and the facilities and services offered by PAs advances. Better management effectiveness means that the status and integrity of biodiversity and ecosystems in PAs and their broader landscapes is maintained and improved: the quality and impact of PA ecosystem services is sustained and in many cases grows.

1.1 PROTECTED AREAS, ECOSYSTEM SERVICES AND SUSTAINABLE DEVELOPMENT

Mongolia, as in many countries in Central and Eastern Europe that have recently transitioned from centrally planned economies to free market economies, is starting to generate benefits from conventional sector development activities; but this is causing considerable depletion of the countries' natural capital and ecosystems services. Ecosystem of protected areas services inputs into production processes in Mongolia are abundant and essentially free, and the negative effect of such development on ES is becoming increasingly visible across productive sectors. Reversing this situation is critical to achieve sustainable economic/social development in Mongolia.

Protected areas (PAs), ecosystems and ecosystems services are interlinked. It is recognized however that ES are not exclusively dependent from biodiversity and ecosystems within and around protected areas, for example, carbon sequestration, hydro cycles and erosion control. However, large and small ecosystems sometimes overlap and are often interdependent. Major global ecosystems are known as biomes, grasslands may be considered as a large-sized ecosystem, which contains a range of smaller ecosystems. These layers of ecosystems are in dynamic interactions with each other, and influence the balance of the services they provide[6]. This is particularly evident in grasslands in Mongolia, where ecosystems in and around PAs provide a wide range of services.

According to UNDP (2010), the benefits from ecosystems in the protected areas are known to be broadly distributed, long-term, and non-market (although some are market-driven such as tourism, water and carbon sequestration), while benefits from resource-depleting interventions are concentrated, immediate and market-driven, e.g. extensive agriculture, extensive cattle ranching, encroaching (by farming) and logging. Politicians often use this argument to justify making limited investment in protected areas (or investment in natural capital -INC). Table 1 provides a list of ESS in the MNPAs including those addressed in this report.

[6] The Sustainable scale project: http://www.sustainablescale.org/ConceptualFramework/UnderstandingScale/BasicConcepts/EcosystemFunctionsServices.aspx

Table 1: Ecosystem Services of the MNPAs

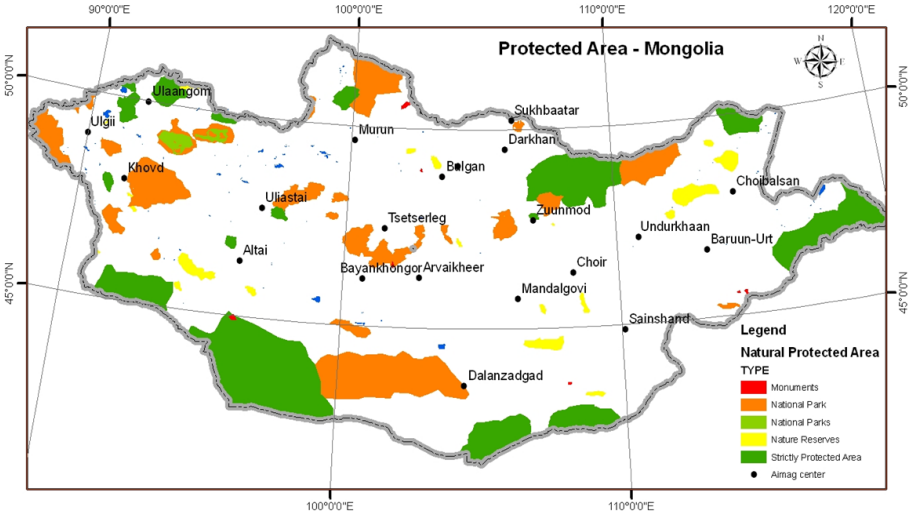
Ecosystem service in MNPAS	Covered in the study
Freshwater (watershed services)	•
Grasslands (hay)	•
Food (e.g. fodder, crops wild meat, fruits, greens)	•
Regulation/conservation of habitat for wild plants and animals	
Nutrient cycling	
Carbon sequestration	•
Human health (drinkable water)	•
Detoxification	
Cultural	•
Nature-based sports: fishing, hunting, skiing, hiking, nature & wildlife viewing	•

The GoM is committed to increase PA network to 30% of land to include viable representative and to prevent from adverse impacts of mining (Green Development Policy (2014)). Today the PA system consists of 99 PAs and covers 17.4% of total land territory or 27.2 million ha of land including representation of various ecosystems. There are 31 PA Administration offices. The PAA system provides the opportunity to share resources across the PAs.

The 99 PAs include: Strictly PAs (16), National Parks (30), Nature Reserves (30), and National Monuments (14). 59 are managed under PAA system, 31 under Province (Soum) authorities. There are also 9 new PAs under different categories.

The Law on PAs (1994) does not include a requirement to prepare PA Management Plans. However, the National Program on PAs specifies a need for management planning. 89 PAs are having a Management plan out of total 99. Further, in 2013, PAAD has planned very important and ambitious activity, to complete the development of master plans for 10 new sites and update MPs for existing PAs in accordance with newly approved guideline. For that, around USD 60,000 were allocated from the Mongolian Nature Conservation Fund for the first time. The SPAN project is requested to provide additional fund for 7 PAs.

Map 1. Distribution of PAs in Mongolia



Source: https://ecoriskmon.files.wordpress.com/2010/08/protected_area.jpg (2014).

Threats to ecosystems and protected areas

According to the UNDP's SPAN Project document (2009), despite its low population density, Mongolia's ecosystems biodiversity is under considerable threats. The most important include the following:

- *High, and increasing, numbers of domestic livestock (see Testimonial in Box 1)*
- *Illegal Hunting.*
- *Deforestation*
- *Mineral Resource Exploration and Exploitation*:
- *Urbanization and Development*
- *Unplanned Tourism*
- *Climate Change*

1.2 FINANCIAL CHALLENGES FACED BY PROTECTED AREAS

Sustainable financing of MNPAS remains a fundamental challenge to achieving its conservation goals in the next future. Historically, the MNPAS has been highly dependent on limited government funding, and without support of a trust fund and international projects. The major challenges to sustainable finance the MNPAS include the insufficient field-based capacity to realistically assess financial needs and gaps, develop and implement cost efficient financial plans and diversified income-generating strategies.

BOX 1. Grassland leasing in Inner Mongolia. Chaolu, a 36-year-old Mongolian herdsman, said he only had a faint memory of the nomadic life from his childhood. His family settled down on the grassland of Taipusi Banner in the heart of Inner Mongolia in 1980s, and started to lease a 66.6-ha. lot of grassland. "I can understand them. People love their own ranches like their own children, and care more about the environment," he said. The sense of responsibility has helped locals rethink about some practice, which were thought harmful for the grassland, for example, overgrazing. Chaolu's family used to have a herd double the current number of 200 cattle and sheep. "People for years blamed lingering droughts as the biggest cause of the degradation of the grassland. But now on reflection the overgrazing caused more harm than the weather," said Chaolu. "The land contract system has turned herdsmen into ranch owners, making them more responsible for protecting the prairie environment," said Tuya, a researcher with the Pasture Economy Research Institute under the Inner Mongolia Academy of Social Sciences. Previously people cared little about sustainability of the grassland because everyone could use it freely, Tuya said. However, some experts hold the opposite opinion. Liu Runshu, a professor with the Inner Mongolia Normal University, said the degradation of the grassland gathered speed after the grassland contract system took effect. Tuya said there were problems with the management of the grassland. For example, policies need be introduced to allow more flexible land transfers, and encourage ranch owners to make sustainable use of the leased grassland. Source: *Xinhua* (Peoples Daily on Line, July, 2010)

According to the SNP Financial Sustainability Scorecard (FSSC) applied in 2009, the current annual operating budget of the MNPAS is estimated at USD 1.3 million. The MNPAS financial needs were estimated at USD7.5 million and USD 10 million for the basic and optimal[7] level respectively. Therefore, the estimated gaps are USD 5 million and USD7.5 million for the basic and optimal conservation levels respectively. Based on the FSSC, the current financing of the SNP gives approximately 32% of what is needed to achieve basic conservation. This is a typical BAU scenario. An overview of the existing financing is provided in Table 2 below.

[7] The basic management scenario (basic level) describes the minimum level of funding required to operate key conservation programs while meeting basic program requirements to sustain functions of ecosystems in protected areas. The optimal management scenario (optimal level) describes the ideal level of funding required to operate all programs to reach and sustain optimal functions of ecosystems in protected areas. 'Optimal' describes the ideal state of the program if all necessary funding, personnel, equipment, and other resources were available to achieve that state (CPM, 2002). This ensures achievement of short-, medium-, and long-term goals for the protected areas, in accordance with the highest environmental, social, and economic standards (Flores et al., 2008).

Table 2. MNPS Financials

MNPS financials	Amount
Current Revenue (2008, Retained):	$2,432,083
Basic Need	$7,500,000
Basic Gap	$5,067,917
Optimal Need	$10,000,000
Optimal Gap	$7,567,917

According to the UNDP SPAM Project document, in 1992, Mongolia committed to increasing its protected area coverage to 30% (from the current 17.4% coverage) of its territory as one of its Millennium Development Goals. If this target is achieved then it can be assumed that the financial need gap for the PA system will double – requiring $10-15 million. If buffer zone and corridor management needs are also considered this gap could double again (or more) to $20-30 million.

With the amount of current funding (32% of what is needed for basic conservation, the MNPAs will not be able to address the current level of threats; and therefore the degradation of ecosystems and biodiversity may result in significant economic losses (decrease in sectoral output and revenue).

2. VALUATION APPROACH: TARGETED SCENARIO ANALYSIS (BAU AND INC)

This section provides evidence that show how increasing investing in ES management in the GTNP may result in greater sector productivity and other benefits related to human well-being. It includes a brief description of the methodology and discusses key sectors: nature-based tourism, irrigated agriculture, livestock and drinkable water.

2.1 METHODOLOGY

This study used a high level "Targeted Scenario Analysis" (TSA). TSA is not a traditional ecosystem-centered valuation approach; it is a sector-centered approach that became available in January 2014. TSA is more relevant to policy makers responsible for sector development and investment policies.

TSA explores the economic relations between production practices, ES, other inputs, and their respective sectoral outputs (values). The approach addresses for example: a) how ecosystem degradation lowers outputs and discusses the associated costs; and, b) ecosystem-friendly management practices that avoid damages and its economic benefits are highlighted. These two different approaches, "Business as Usual" (BAU) and "Investing in natural capital" (INC), are used to facilitate the analysis and demonstrate the value of ES to productivity. A sample of typical characteristics of BAU and INC in the drinkable water sector is included in the Table 3 below.

Table 3. Example of the characteristics of Drinkable Water Practices: BAU and INC

BAU	INC
• Unsustainable management of water sources; • Rapid degradation and dryness of the surface water including springs and lakes due to lack of management; • Unstable and uncontrolled number of people and livestock; • High loss in current business model for the State owned spa treatment; • Water shortage for the wildlife including Argali sheep especially during the natural disaster due to increase in number of livestock; and • Undervalued water price due to a lack of scientific and economic research on quantity and quality of water.	• Sustainable management of water sources; • Slow down in the degradation and dryness of surface water including springs and lakes due to best practice management; • Number of people and livestock will be stabilized and managed; • Profitable business model for the spa treatment; • Sustainable long term water source for wild life; and • Valuable water price based on total size and quality of water aquifer.

Steps and information flow

Depending on the availability of information, the following steps are recommended to apply the TSA valuation approach (GTNP case):

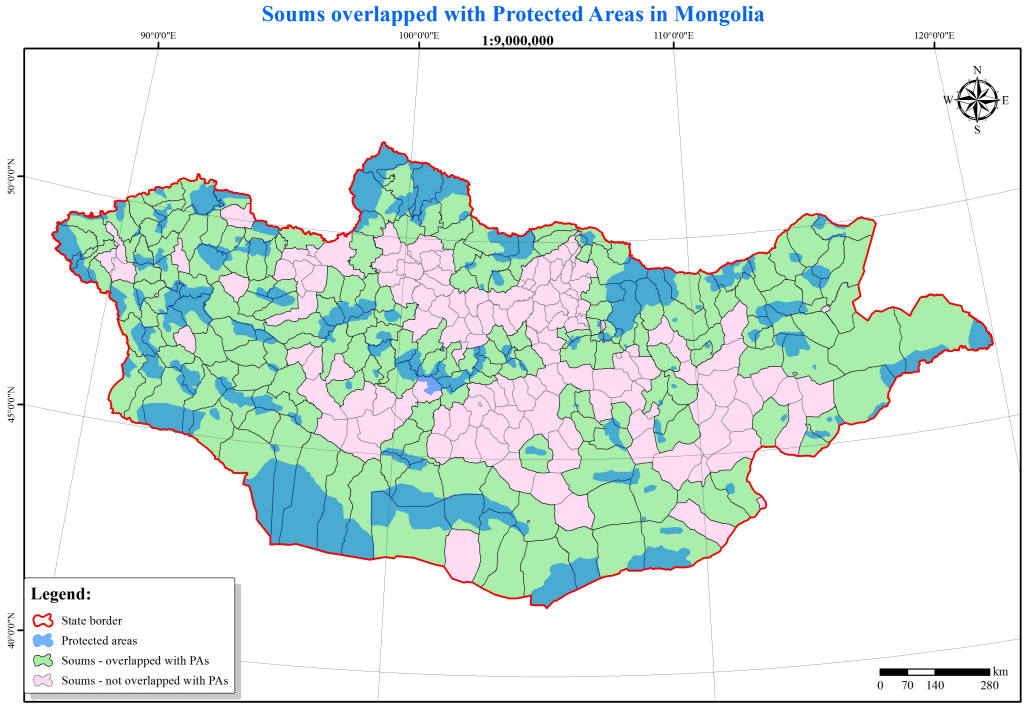
1. Definition of the scope of the analysis: MNPAs and policy questions: a) why it is sound for the economy to increase investment in ecosystems management? And b) why is sector ecosystem management policy reform a priority?
2. Definition of BAU baseline and potential INC intervention based on available information and first hand research: using data from the NSO of Mongolia on selected indicators.
3. Selecting indicators (based on available information and agreement with stakehold-

ers).

4. Constructing BAU and INC scenarios and values.
5. Formulation of informed policy and management recommendations.

The high-level TSA focused on sectoral productivity activities and link them with ecosystem services provided by PAs. In case of Mongolia, there are 21 provinces that comprise 330 Soums and one capital city Ulaanbaatar that consists of 9 districts. The territories of 189 Soums and 4 districts overlap with territory of all 99 protected areas of Mongolia (as shown in Map 2). The study assumes that the sectoral output of these Soums cannot be achieved without the indispensable input of ES. In order to estimate economic values, the study used mainly data from the National Statistical Office and other secondary sources.

Map 2. PAs overlapping 189 Soums and 4 districts in Mongolia in 2014



Source: State Administrative Information Data, the map is done by Altansukh, O.(2014)

Indicators

Depending on the availability of data, selected indicators are used to assess BAU and INC impact. Sample indictors are shown in the Table below. Not all indicators are suitable for all the selected sectors or subsectors. Therefore, indicators are used when applicable. Very limited information was available to the study, mainly statistical information from the Statistical Office of Mongolia. Indicators used in this study are marked with (*). This is included in Table 4 below.

Table 4. Sector Indicators typically used to construct BAU/INC scenarios
Employment increase (# of jobs) by sub-sector (direct, indirect and induced)*
Income, average annual increase by sub-sector*
Fiscal impacts (annual tax revenues to governments)*
Annual revenue from green taxes
Foreign exchange earnings (annual, from exports)
Sector investment (government)
Sector investment (private sector)*
Tourists spending*
Damage costs (as a result from BAU practices)*
Avoided damages costs (as a result from INC practices)
Production trend (volume and market value)*
Sector production trend (as percentage of GDP)
Changes in natural capital (e.g. # Ha under protection or INC practices and BAU)*

* Included in the study

Constructing BAU and INC scenarios

Traditional data on the value of ecosystems to the selected sectors is organized based on this BAU/INC framework. The values of biodiversity and ecosystems are not seen as static (time-bound) data points, but, rather, as variables that respond to degradation, sustainable management, and other interventions.

The term BAU refers not to all current activities but those activities that damage or depletes ecosystem services. The BAU approach is characterized by a focus on short-term gains (e.g., < 10 years), externalization of impacts and their costs, and little or no recognition of the economic value of ES, which are typically depleted or degraded. Under INC, the focus is on long-term gains (> 10 years); also under INC, the costs of impacts are internalized. Ecosystem services are maintained, thus generating potential for a long-term flow of ecosystem goods and services that can enter into decision making. Activities labeled as INC practices tend to support ecosystem sustainability, not for ideological reasons, but, rather, as a practical, cost-effective way to realize long-term profits. Common INC practices include watershed management, agro-forestry and silvo-pastoral production methods, low-impact logging and mining, nature-based income diversification, and organic farming (adapted from Bovarnick et al, 2010).

Formulation of recommendations

Once the relationship between interventions (BAU or INC) and the magnitude of the outcomes that may result from each intervention has been estimated, the information is presented to decision makers in order to assist them at choosing among different the policy options; the choice between BAU and INC. Some decision makers may want to know the analyst's opinion or seek a direct recommendation as to which policy intervention to choose on the basis of the TSA. Decision makers may promote debate before supporting one policy intervention over another. Others may prefer a more "factual approach" in order to come to their own conclusions as to the choice among policy interventions.

Limitations

- The analyses draw on few technically economic data from the published material available. Such data is still scarce in Mongolia; just a handful of studies are available and considered in the study.
- The sectoral approach disaggregates the economic value of each type of ESS and fragments system-wide values to show specific sectoral inputs.
- Lack of national and sector-level data has limited the applicability of a wide range of indicators to assess the impact of BAU and INC practices.
- When available data is mostly outdated, few current data from recent years was available.

The study does not aggregate sector values. Although sector values are evident but not all high as mining and livestock, it is important to recognize that giving the nature of this study, aggregating sector values is challenging and will only provide a partial estimate. Aggregating values also result in losing the richness of comparing BAU and INC scenarios at sector level. Further, as noted in UNDP (2012), there is still limited empirical data, and when available, data is incomplete, disperse over different years, and therefore difficult to aggregate; therefore, further research is needed.

Nature-based tourism, irrigated agriculture, livestock, forest, mining and drinkable water are discussed in the next sections.

3. VALUATION OF THE ECOSYSTEM SERVICES OF PROTECTED AREAS

3.1 NATURE-BASED TOURISM

This Section discusses the contribution of PAs to nature-based tourism (NBT) and how this contribution supports the growth of the tourism sector and the national economy.

Tourism is one of the world`s fastest growing industries reaching a 6.4% increase in 2010 and 4.6% in 2011 (WTO, 2012). It constitutes 5% of the worldwide gross domestic product (GDP) and its contribution mostly varies between 2% in countries where it constitutes small sector of economy to over 10% where is makes up an important sector of the economy (WTO, 2012).

"According to the latest UNWTO World Tourism Barometer, "international tourist arrivals grew by 4% in 2012 to reach 1.035 billion". "UNWTO forecasts international tourist arrivals to increase by 3% to 4% in 2013, much in line with its long term forecast for 2030: +3.8% a year on average between 2010 and 2020. This outlook is confirmed by the UNWTO Confidence Index that shows that the prospects for 2013 are similar to the evaluation of last year (124 points for 2013 against 122 for 2012). The growth prospect for Europe (+2% to +3%) is significant."

NBT offers and relies on experiences directly related to natural attractions. There are different types of nature-based tourism. For instance, ecotourism (guided nature interpretation and cultural heritage in nature); adventure tourism: (horse riding and kayaking); extractive tourism (fishing, hunting); wildlife tourism: (native wildlife viewing); and, nature retreats (eco-lodges)[8]. NBT is often combined with other categories of tourism.

PAs provide the natural attractions around which NBT is organized. Without the attractions, NTB will not be possible. PAs in Mongolia provide the continuous habitats with grasslands, wild horses, wild plants and other wild animals, exotic foods, fresh water and air, views capes, and cultural services essential to NBT. In general, tourists find NBT experiences more valuable when they take place in healthy ecosystems, such as those found in PAs (UNDP, 2010).

The main attractions of Mongolia are the traditional culture, which includes offering a unique pristine nature to tourists. Approximately, 50% of foreign tourists visit Protected Areas during their visit to Mongolia and this contributes 10-15% of total visitors of PA; and NBT, in the last ten years, has become more popular to Mongolians. For example, according to PAAD source (2013), 85-90% of total visitors to PAs were domestic tourists. A sample of Mongolia's top (10) most important natural attractions include[9]:

1. Gorkhi-Terelj National Park
2. Gun-Galuut Nature Reserve
3. Khorgo-TerkhiinTsagaan Nuur National Park
4. Chuluut River
5. Lake Huvsgul
6. Altai Tavan Bogd National Park
7. Bayanzag.
8. Khongor Sand Dunes
9. Yoliin Am Valley
10. Dornod Mongolia Steppe

[8] Nature-Based Tourism Strategy 2008-2012. Government of Victoria State, Department of Sustainability and Environment, Victoria Parks, Victoria Tourism Agency: tourismvictoria.com.au/nature based tourism.

[9] Natural attraction may vary depending of the source of information. The included natural attraction are linked to MNPS: http://theplacesmusttravel.blogspot.dk/2011/03/10-most-beautiful-places-in-mongolia.html

Altai Tavan Bogd National Park

Dornod Mongolia Steppe

Khongor Sand Dunes

Lake Huvsgul

For purposes of this report, it is assumed that NBT in PAs, is still poorly managed, and therefore considered a BAU practice. This is characterized by significant negative externalities; currently, BAU-NBT works against Mongolia's competiveness in the region and elsewhere. The characteristics of NBT policies BAU/INC are listed in Table 5 next.

Table 5. Characteristics of NBT policy in PAs in Mongolia (BAU/INC)

BAU Policies In Mongolia	INC
• Poor ecosystems management (pollution from mining, deforestation, poor livestock management (over grassing in and around PAs), water pollution). • Landscape pollution: garbage along road sides, riversides, lakes, and main tourism attractions). • Lack of visitation and visitor's safety programs. • Limited access: limited domestic train and bus routes, poor road infrastructure; and low quality transport service and safety. • Poor (basic) and limited hotels and sanitation infrastructure. • Limited and poorly managed family owned accommodation and non-trained staff or poorly trained staff. • Lack of information centers and information material; and limited web-based information. • Water and electricity shortages. • Poor or no investment in PA's tourism infrastructure. • Poor marketing and communications. • Limited access to health services (hospitals) • Unplanned infrastructure (e.g. housing) being constructed in areas with NBT potential. • Lack of sustainable tourism strategy, fragmentation of potential destinations /packages (e.g. natural, adventure, winter, health). • Unregulated and poorly managed land-use and zoning. • Lack of PA entry fees. • Poor access within natural attractions (lack trails and information signs). • Poor inter-institutional collaboration between Central tourism agencies, PA authorities and local governments; and local (community) organizations. • Limited service providers (tour operators). • Poor quality of services (local hotels, restaurants, family owned accommodation, tour operators). • In-country limited access to Internet.	• Sustainable tourism policy including ecosystems management and land use. • Strict waste management in PAs. • Visitation and visitor's safety programs available. • Improved access and transport to main attractions, and safety. • Suitable infrastructure for foreign visitors available in key destinations. • Well-trained and managed family owned accommodation and trained staff. • Information centers in appropriate locations and information material • Improved content in web sites (in English and other major languages). • Institutional coordination to avoid power cuts and water shortages during tourism seasons. • Basic financial needs of PAs covered by the state (incl. infrastructure). • Marketing and communications strategy in coordination with the Tourism Department. • Improved access to health services (hospitals) in key locations. • Land use policy within PAs regulates adequate infrastructure development (e.g. housing). • Sustainable tourism strategy implemented in full collaboration with the private sector operators. • Improved PA entry passes systems and fees retention by PAs. • Improved access within key natural attractions (lack trails and information signs). • Better in-country access to Internet and cell phone coverage in key tourism destinations.

NBT makes a significant contribution to the economy under BAU; this is analyzed in the next sub-sections.

Employment in NBT

In 2013, the tourism industry directly employed 21,500 jobs (2% of total employment) and sustained, both directly and indirectly, 8% of GDP in Mongolia[10]. Leisure travel spending generated 500.6 billion MNT (USD 278 mln), 57.2 percent of this amount is spending of foreign visitors' and 42.8 percent is spending of domestic visitors (World Travel & Tourism Council, 2013).

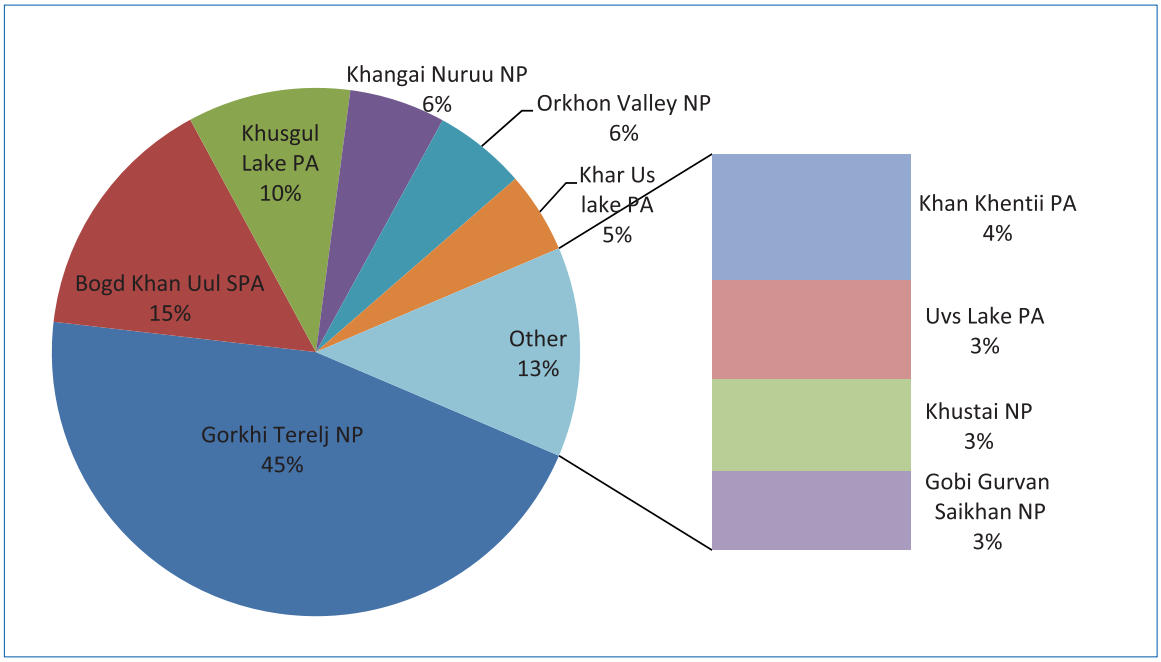
Long-term growth forecasts are extremely positive with travel and tourism's contribution to the country's GDP set to rise by 6% per annum over the next ten years. With government support this figure could be boosted even further and today's acceptance of the Open Letter by President Elbegdorj Tsakhia sends a strong signal of support to the Travel and Tourism industry, both within Mongolia and internationally. Although this is a positive signal, the lack of investment in sustainable tourism management could be a detrimental for NBT in the future.

[10] Mongolian statistic book 2013 by National Statistics office Mongolia

Visitation trends

PAs are becoming more and more attractive to Mongolians. For example, according to PAAD, 60% of total domestic tourists visited to the Gorkhi Terelj and Bogd Khaan protected areas in 2014. Other popular destinations include Khuvsgul Lake and Khangain Nuruu, These protected areas receives 10% and 6% of total visitors respectively. Further, Orkhon Valley, Khar Us Lake and Khan Khentii PAs are also popular place for the local tourists. Figure 1 shows that visitation trends as percentage of total domestic visitors to PAs.

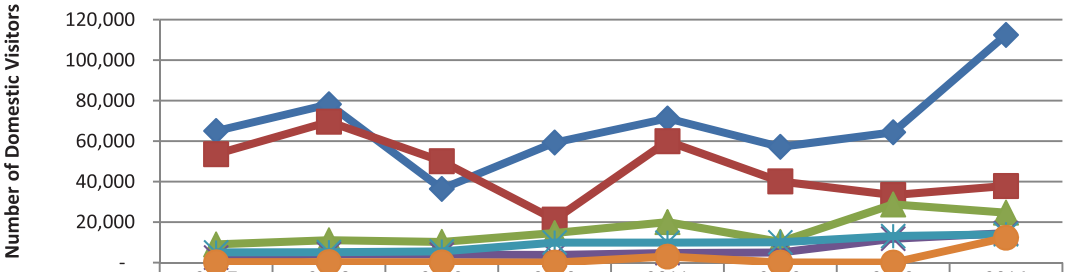
Figure 1. Most attractive PAs for domestic visitors and percentage of visits, 2014



Source: Protected Area Administration Department, Ministry of Environment, Green Development and Tourism, 2015

In 2008, visitation to Gorkhi Terelj and Bogd Khan reached the highest peak, approximately 147,830 visitors. However, visitation dramatically dropped in 2009 and 2010 because of tourism sector's downturn. In 2011, visitation partially recovered and sharply dropped in 2012. However, domestic number of tourists is raised again in 2014, sharply reached the peak. This is shown in Figure 2 below.

Figure 2. Domestic visitors trend 2007–2014



	2007	2008	2009	2010	2011	2012	2013	2014
Gorkhi Terelj NP	65,000	78,230	36,432	59,311	71,234	57,180	64,384	112,500
Bogd Khan Uul SPA	53,587	69,600	50,067	21,250	59,950	40,090	33,400	37,866
Khusgul Lake PA	9,000	11,038	10,233	14,590	20,036	10,197	28,761	24,700
Khangai Nuruu NP	2,500	4,188	3,922	3,786	4,739	4,970	11,792	14,584
Orkhon Valley NP	5,055	5,153	5,507	9,911	9,844	10,000	13,092	13,999
Khar Us lake PA	197	254	125	-	3,000	50	3	12,300

Source: Protected Area Administration Department, Ministry of Environment, Green Development and Tourism, 2015

According to the Protected Area Administration Department, Ministry of Environment and Green Development (2013), visitation to Bogd Khaan protected area, which is highly attractive to foreign tourists, reached a peak in 2007 (approximately 30,000 visitors). However, from 2008 it continued to drop reaching the lowest point in 2009 (10,000 visitors). From 2010 to 2012 number of foreign visitors had been steady. Great Gobi protected areas ranked as the second highest attractive areas for the foreign tourists, followed by Baga Gobi, Dornod and Mongolian Altai Mountains National Park.

Between 2008 and 2010, there was a significant fall in number of foreign tourists due to downturn of tourism sector when was affected by mining sector expansion in Mongolia. However, the mining sector provides the majority of business tourists to Mongolia. Unfortunately, no date was available with the estimated number of foreign visitors associated with the mining sector.

Table 6. Total number of leisure tourists and visitation to the PAs, 2007– 2012

	2007	2008	2009	2010	2011	2012
Total leisure tourists	127,055	103,762	100,039	97,023	111,217	115,395
Visited to PAs	61,034	55,399	35,242	52,740	50,999	45,409
Percentage	48%	53%	35%	54%	46%	39%

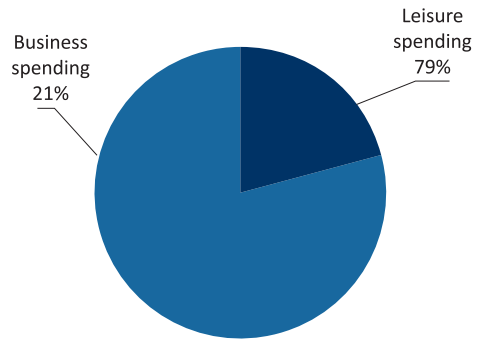
Source: Protected Area Administration Department, Ministry of Environment and Green Development, 2013

Since 2011 the number of the leisure tourists has increased gradually and reached 115,395 in 2012. Approximately, one in two of foreign tourists visit to the protected areas of Mongolia. Between 2008 and 2010, more than fifty percent of the foreign tourists visited to the PAs, However, the trend was not sustainable, and it has declined to 46% and 39% in 2011 and 2012 respectively. Table 6 illustrates this trend.

World Travel and Tourism Council report 2013 shows that leisure travel spending (foreign and domestic) in Mongolia has grown significantly. It reached 79% of direct tourism & travel GDP in 2012 (MNT 500.6 billion or USD 178 million), compared with 21% for business travel spending (MNT132.0 billion or USD73.3 million) the same year. 57.2% of leisure spending was by foreign visitors and 42.8% by domestic visitors (World Travel and Tourism Council,

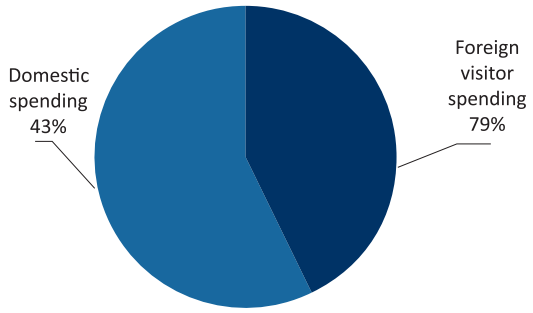
2013). These trends are shown in Figures 3 and 4. The majority of business travelers are associated with the extractive industry (mining) and when considering spending, business travelers are included in the above indicated 21%.

Figure 3. Leisure vs. business spending, 2012



Source: World Travel and Tourism Council, 2013.

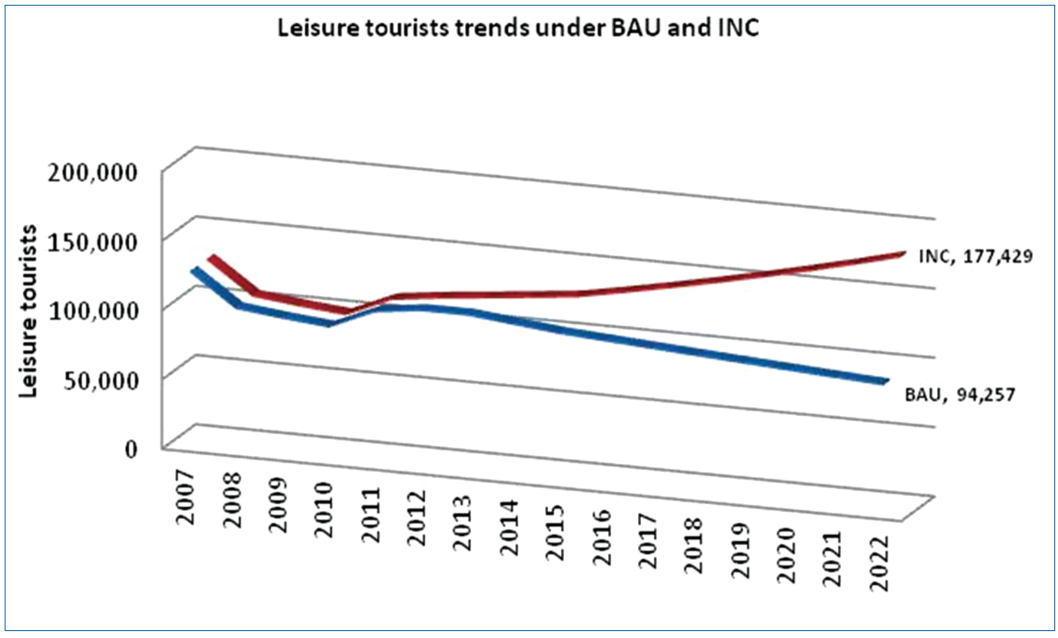
Figure 4. Travel & tourism spending as percentage of GDP: domestic vs. foreign, 2012



Source: World Travel and Tourism Council, 2013.

Visitation data was used for establishing and comparing BAU and INC scenarios. In the BAU scenario, both the number of visitors to PAs is declining at an average rate of 2%. This decline is related to the impact of BAU mining activities and limited funding to invest in PAs visitor infrastructure. It is important to notice that the decline could also be attributed to the overall financial decline during the financial crisis of 2008-2009. This decline has continued to date, as shown in Figure 5.

Figure 5. Forecast for Leisure tourists trend under BAU and INC



Source: Protected Area Administration Department, Ministry of Environment and Green Development, 2013

Under INC, if Mongolia invests to improve PA management (INC), i.e., tourism infrastructure development, sustainable management of visitation to PAs, and better services and marketing, the indicated decline could be reversed in the next years and progressively increase to number of foreign tourists. For example to 177 thousand by 2022 applying moderate increase rate of 5% annually. This is illustrated in Figure 5.

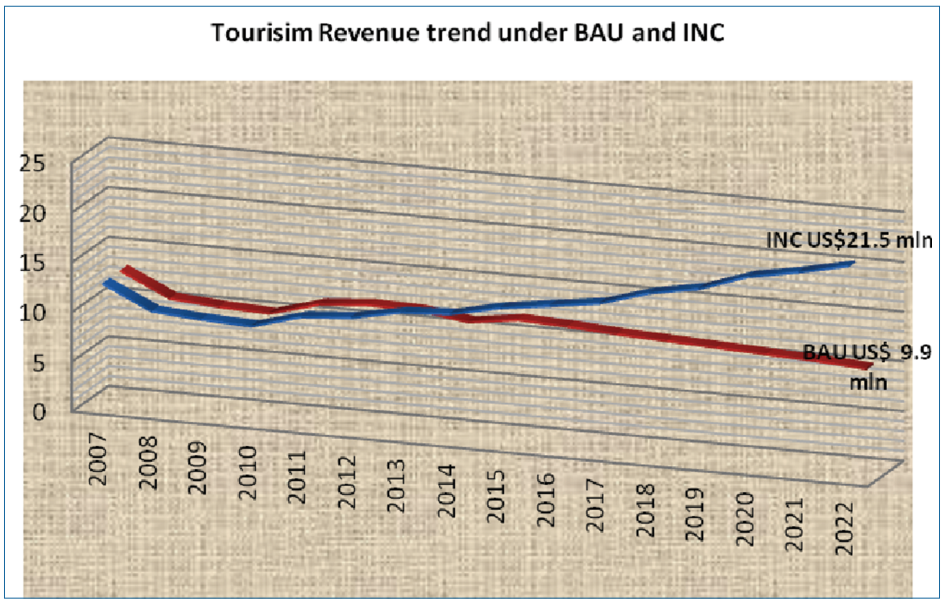
When adding tourism spending to the BAU and INC analysis, it is possible to illustrate the economic loss and potential gains under BAU and INC.

Data of the National Statistics Office of Mongolia 2012 shows that carrying capacity of accommodations in PAs is 14,770 beds. However, lack of infrastructure development and remoteness of PA, the current use of accommodations is rather low. Therefore, it is estimated that the current use rate under BAU is 34%. Nevertheless, businesses in PA generate 11.7 million USD per year.

Under the INC practices (e.g., increasing investment in improving tourist infrastructure, communications, marketing, safety), the businesses in PA, could operate at 75% of the full capacity, the annual revenue could reach 25.7 million USD. Therefore, as a result of BAU practices, it is estimated that the annual loss was in order of USD 14 million. This represents a significant loss, not only in terms of revenue but also in terms of employment and local taxes to the government; and dramatic reduction in the multiplier effect of tourism.

When projecting spending, for example in the next 8 years, the potential loss is large; and it could be even bigger if considering the cost of negative externalities. Figure 6 below show this projection and the potential 10-year period loss of USD 57.6 million.

Figure 6. Forecast of Revenue trend of Tourism sector under INC and BAU (estimated loss USD 57.6 million between 2013 and 2022)



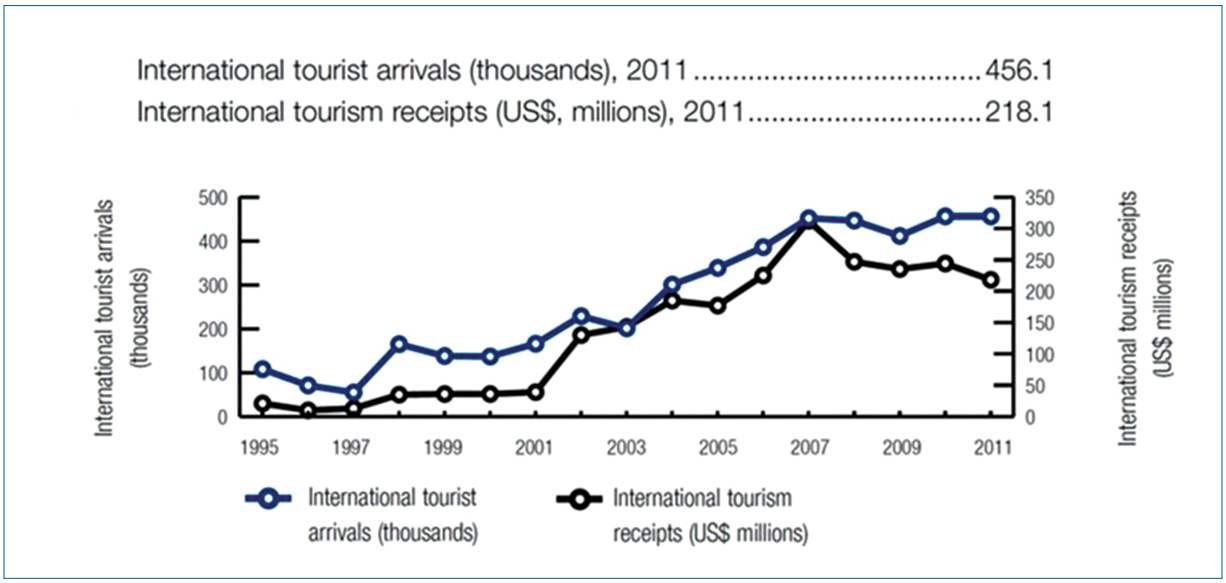
Sources: National Statistic Office of Mongolia, 2012, authors' estimation

The multiplier effect of tourism

In NBT countries, spending by tourists is a strong component of the economy. In Mongolia, visitors to PAs and other natural attractions spend on travel and local transport, accommodation, food, and souvenirs in- and outside of the park. Thus, tourists generate substantial revenue within a variety of sectors. Like any sector, tourism creates a chain of economic activities that affects both those delivering services directly to tourists (and their employees who earn more and can consume more) but also their suppliers, and the suppliers to the suppliers, in an endless economic chain that multiplies the initial amount spent by tourists. This is known as "multiplier effect" (UNDP, 2011)[11]. For example, according to PAAD[12], there are 202 businesses offering their services of accommodation and food for the visitors and tourists in protected areas of Mongolia.

[11] UNDP, 2011.Economic Valuation of the Contribution of Ecosystems in Protected Areas to Economic Growth and Human Well-Being in Georgia.
[12] Protected Areas Administration data 2013

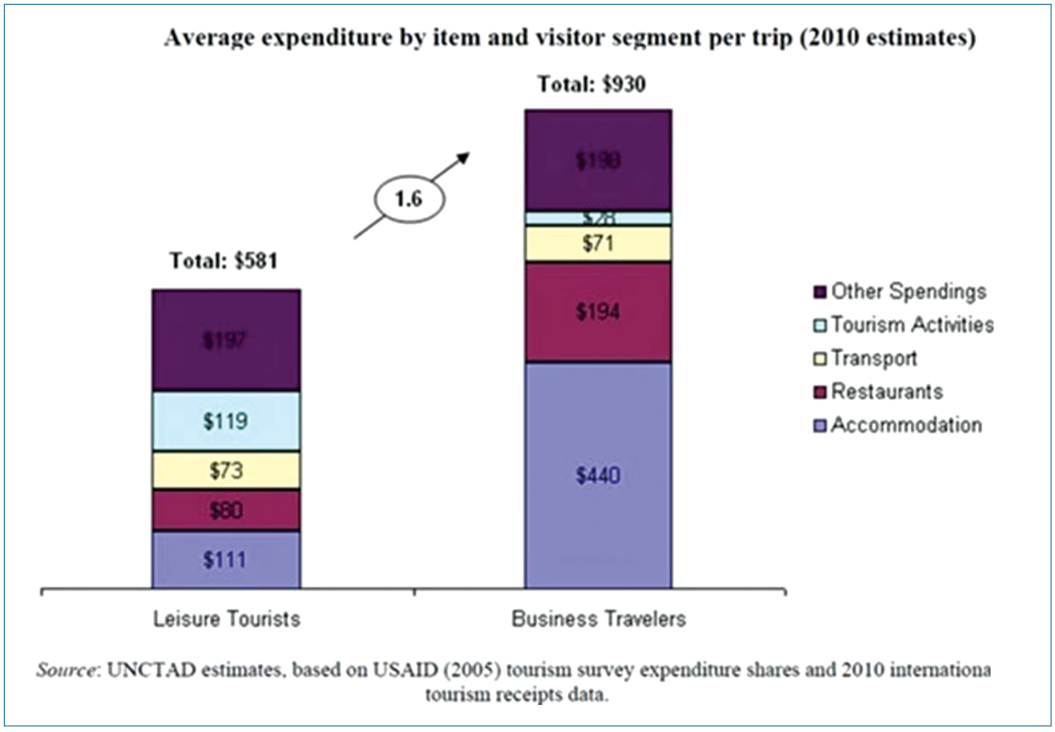
Figure 7. International tourist arrival and tourism receipts (2011)



Source: Mongolian Economy, The Tourism Industry in Mongolia 2013.

According to Mongolia Economy (www.mongolianeconomy.mn) (2013), in 2011, international tourist arrivals reached 456.1 thousand. This level of visitation generated USD 218.1 million in tourism receipts (as shown in Figure 7). This is an example of the multiplier effect of tourism in Mongolia in 2011, under BAU. In 2011, leisure and business tourists spent an average of USD 581 and USD 914 per trip respectively (2010 estimates), as shown in Figure 8. Under INC, if the government invests in tourism development, and achieves it s goal of bringing visitation to at least 1 million foreign visitors per year, the multiplier effect of tourism will be significantly large.

Figure 8.Leisure and business visitors spending in Mongolia (2010)



Source: Mongolian Economy, the Tourism Industry in Mongolia, 2013.

Finally, assessing the distribution of NBT benefits was not in the scope of this study. However, in general terms, NBT companies operating in the MNPAs include basic backpackers' type of *Ger* camps, mid range hotels such as the UB-2, and a high-end luxurious multiple award-winner hotel the Terelj Hotel and SPA in the GTNP, an internationally recognized 5-star hotel. This hotel is a preferred destination for wealthy Mongolians from Ulaanbaatar and high-end international visitors. Unfortunately, there are no tourism-related financial mechanisms sponsored by the hotel industry to support national parks finance in Mongolia.

International or regional companies own the great majority of *Ger* camps. *Ger* camps use locally owned suppliers wherever possible to provide and run services, to ensure that the local economy benefits directly. They also work with local suppliers to help them meet international standards, with particular consideration for the needs of foreign guests. In addition, community development is supported by organizations such as the Community Based Tourism Network (CBTN) of Mongolia, a non-profit and nongovernmental organization that aims at making tourism contribute to rural communities, without disrupting their culture or environment.

3.2 IRRIGATED AGRICULTURE

In Mongolia, sustainable agriculture practices are key to achieve sustainable development. The agricultural sector represents 4% of GDP and an estimated 8% of the labor force is engaged in agricultural activities in Mongolia as of 2012 (NSO, 2014).
There is a direct link between irrigated agriculture and ecosystems services that originate in PAs. Fresh water, pollination and natural grasslands services from ecosystems in and around PAs play an indispensable role at securing the productivity of cultivated land; both subsistence and commercial farming. Although natural grasslands are not planted areas (herders do not plant grass), grasslands are discussed in this section because of its importance in terms of productivity and market value.

Although farming in PAs is prohibited by law, neighboring subsistence farming areas benefit through ecosystem services that are generated from and preserved in PAs. Subsistence and commercial farming in Mongolia benefit from ES such as fresh water for irrigation and pollination.

1. **Water supply.** In Mongolia, the crop farmers use surface water sources for irrigating the cropland, mostly from rivers that originate from high mountains, some of them are in protected areas. For example, Bulgan River (actually Bulgan River basin already is PA in Mongolia) that takes origin from Munkh Khairkhan National Park in Bayan-Ulgii province runs through Bulgan soum of Khovd province and to Xingjian, China. In lower side of the river in Bulgan soum center area, most of the crop farmers use the Bulgan river water through irrigation channels to their crop fields. Bulgan soum of Khovd province is famous in Mongolia in producing watermelon and other fruits and vegetables.
2. **Pollination**: This is a critical service to support sustainable agriculture. *"Food security, food diversity, human nutrition and food prices all rely strongly on animal pollinators. The consequences of pollinator declines are likely to impact the production and costs of vitamin-rich crops like fruits and vegetables, leading to increasingly unbalanced diets and health problems. Maintaining and increasing yields in horticultural crops under agricultural development is critically important to health, nutrition, food security and better farm incomes for poor farmers"* (adapted from FAO, 2014). PAs in Mongolia provide the indispensable habitat for wild species of pollinators (e.g. honey and wild bees, and birds). Mongolian PAs are home of diverse wild plants and flowers where bees and birds exist that contribute to farming in neighboring areas.

Current trends in irrigated agriculture

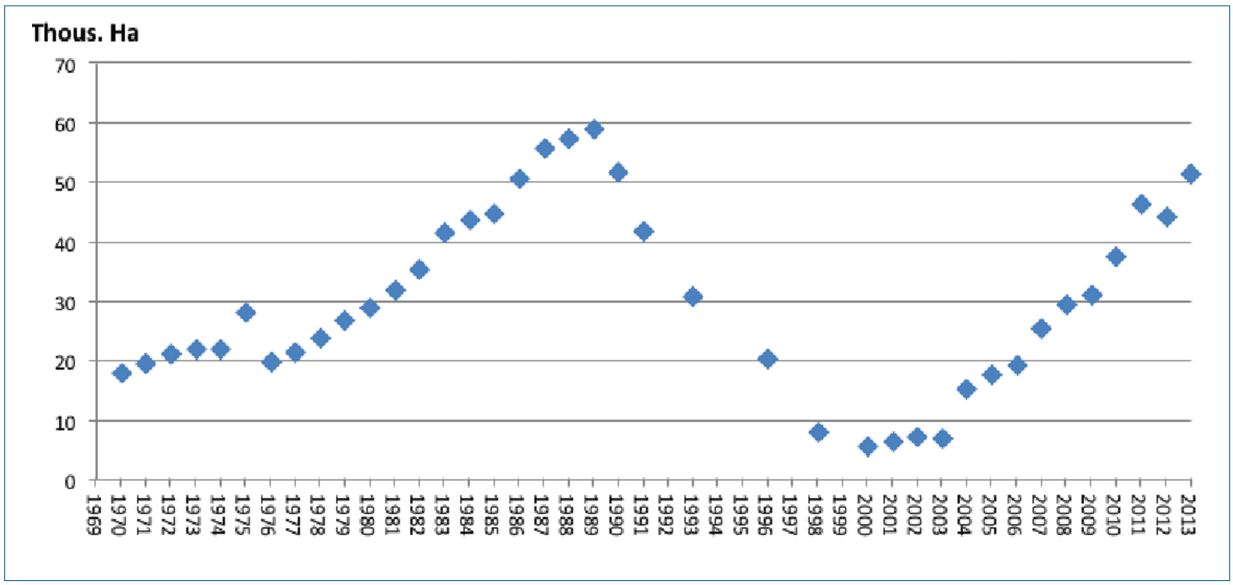
Weather conditions with little precipitation, short hot summers and long cold winters determines that farmers can grow crops and vegetables only for five months, i.e., from May to October; the actual growing season is only 95 – 110 days. The agriculture sector therefore remains heavily focused on nomadic animal husbandry with 75% of the land allocated to pasture, and only 3% of the population is engaged in cropping. Crops produced in Mongolia include corn, wheat, and potato.

According to NSO, 2012, in Mongolia, 415.4 thousand hectares of land were sown with seeds; and 723.1 thousand tons of crops, vegetables and oil plants were harvested. Out of the 415.4 ha sown, the majority of sown land is irrigated with surface water from rivers that originate in PAs. The total land under irrigation has increased in recent years. For example, in 1993, the total irrigated area was estimated at 84,300 ha. The total area equipped for irrigation amounted to 57,300 ha, out of which

43,400 ha under sprinkler systems (registered schemes) and about 13,900 ha of systems using surface irrigation methods (unregistered schemes). In addition, an estimated 27,000 ha of pasture benefited from traditional floodwater diversion[13]. In addition, more recent estimates by Baranchuluun, et al. (2011), have reported that the number of irrigated hectares in Mongolia, in 2013, was 51.4 thousand hectares. Figure 9 below provides an overview of the trend on irrigated land, using aggregated data from several sources.

[13] earth.org (2014)

Figure 9. Irrigated Agricultural Land in Mongolia (000 Ha) (1969–2013)



Source: Data 1970-2010: Baranchuluun, Luvsanbud, Nandintsetseg, & Kenjegul (2011);
Data 2011-2013: Ministry of Industry and Agriculture (2013); Authors' own Figure.
Note: Data of 1992, 1994, 1995, 1997, and 1999 is missing.

After the sharp decline between 1989 and 2000, land under irrigation has increased close to the 1989 level in 2013. The 1990s was the time of collapsing state cooperatives and the turn to free market economy. Because of lack of investment to support irrigation systems, subsistent farmers use traditional practices such as digging canals to divert water from the river to crop areas. Most of the rivers in Mongolia take origin from protected areas. According to a senior official[14] of the Ministry of Food and Agriculture, about 80% of total water used for crop irrigation is taken from surface water and the remaining 20% is taken from ground water.

Since 2008, the Government introduced the 3rdCRC to increase agricultural self-sufficiency through subsidies to support subsistence farming and crop and vegetable farming companies. This has had a positive impact to the economy and nutrition, for instance, in 2012 Mongolia produced sufficient potato to meet domestic demand (Didier & Lkhamjav, 2009). Water from protected areas used for irrigation was indispensable to achieve this goal, and contribute to reduce food imports.

The 3rdCRC however, did not include any investments in water resources management (protection of the indispensable water sources); a typical BAU approach. Therefore, because of unsustainable farming practices and poor investment in fresh water ecosystem management subsistence and commercial farming is considered a BAU practice. A sample of BAU and INC characteristics is shown in table 7 below.

14 Interview with Dr., Sh. Baranchuluun, Senior officer of Crop Production Policy Implementation and Coordination Department, Ministry of Industry and Agriculture of Mongolia, in 2014.

Table 7. Characteristics of Mongolian farming policy under BAU and INC

BAU	INC
• The 2008 3rd CRC (483.5 billion MNT or USD 414.7 million) excluded funding to support conservation management of ecosystems in PAs. • Lack of ecosystems management policy, poor extension services (non-trained or poorly trained extension workers /farmers, lack of information centers and information material, lack of on-site regulation for agro-business investment and development. • Poorly funded agricultural policy • Poorly planned and maintained irrigation infrastructure. • Excessive use of pesticides and chemical fertilizers. • Deforestation around river basins, in grasslands, and lack of silvo-pastoral systems. • Water pollution • Unregulated and poorly managed land-use and zoning; particularly in grasslands. • Poor preparation for Dzud years.	• Suitable farming policy and practices: ecosystems management policy, effective extension services (trained extension workers and farmers, information centers and information material available, on-site regulation for agro-business investment and development. • Investment supports sustainable agricultural policy, including preparedness for Dzud years. • Planned and maintained irrigation infrastructure. • Control and incentives to phase out or limit pesticides and chemical fertilizers use. • Reforestation strategy and funding. • Fiscal incentives (fines) to control/eliminate sources of water pollution. • Regulated and well managed land-use and zoning, including grasslands use planning.

Agricultural activities in 189 out of the 330 Soums and 4 of the 9 districts in Ulaanbaatar city are related to the 99 PAs in Mongolia. Hence, part of the agricultural output of these Soums is considered dependent of ES of protected areas.

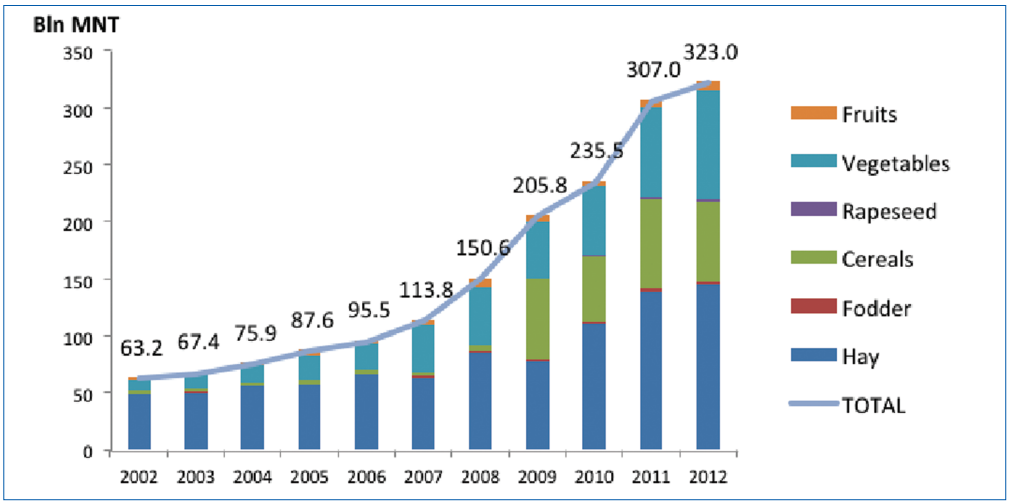
To estimate the value of the agricultural sector (crop production), available data from the NSO was used. However, some of provinces do not have Soum level data. Hence, we estimated the data to disaggregate province level data into Soum level.

Subsistence and commercial farming in Mongolia produce a variety of products. For the purpose of this analysis, 17 different products in six categories have been selected to estimate the economic contribution of ecosystems in terms of irrigated agricultural output: hay, fodder, cereals (wheat, barley, oat and rye), rapeseed, vegetables (potato, carrot, onion, cabbage, neap, beet, and cucumber), and fruits (tomato, watermelon and sea buckthorn). The aggregated gross and net values are discussed in the next section.

Gross and net economic value of irrigated agricultural products (IAP)

Based on the estimates above, between 2002 and 2012, the market value of IAP increased from approximately 63.2 billion MNT (USD 56.9 million) in 2002 to 323 billion MNT (USD 237.6 million) in 2012; and the estimated total gross value from hay, fodder, cereals, rapeseed, vegetables and fruits between 2002 and 2012 is 1.7 trillion MNT (USD 1.3 billion). The sharp increase in from 2009 can be the result of the 3rd Crop Rehabilitation Campaign (CRC). This is shown in Figure 10 below.

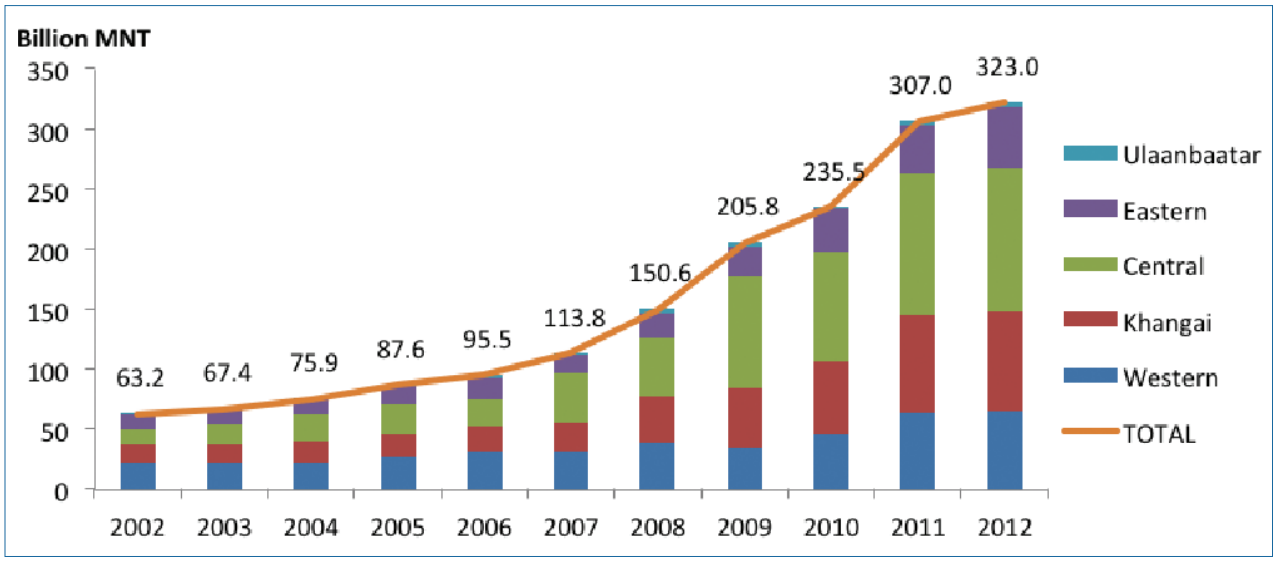
Figure 10. Total Gross Value of Crops Products in Soums overlapping PAs (billion MNT)



Source: National Statistical Office of Mongolia (2014).

The Gobi Baga, Baga Gazriin Chuluu, Gobi Gurvan Saikhan etc PAs in the Central region are particularly important because the central region is the most productive (35.4% or 610 billion MNT or USD 448.7 million of total aggregated value between 2002 and 2012). This is shown in Figure 11 below.

Figure 11. Total Gross Value of Crop Production in Soums overlapping PAs (by Soum) (Billion MNT)



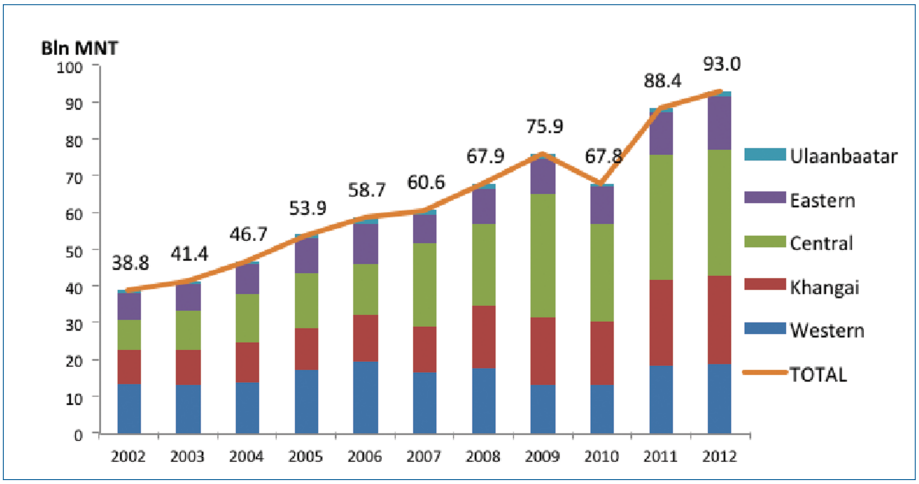
Source: Authors' estimation based on NSO data.

In order to estimate net value, the cost of the production is subtracted from total market value. The profit share of the total revenue, as reported in First State Census of Agriculture in 2011 (National Statistical Office of Mongolia, 2012), was 61.5% in 2006 (MNT 58.7 billion or USD 43.2 million), and 28.8% in 2010 (MNT 67.8 billion or USD 50 million) for irrigated agriculture[15].

The estimated total net value of the contribution of ecosystem services of PAs to the irrigated agriculture sector in Mongolia, for crop production was 93 billion MNT (68.4 million USD) in 2012. The net benefit is increased by 2.4 times from 2002 to 2012.The total estimated net benefit over the 2002-2012 period is 693.3 billion MNT (USD 510.1 million); this shown in Figure 12 below.

[15] Profit share percentage between 2007 and 2009 are estimated by authors under assumption that the same decrease rate from 61.5% in 2006 to 28.8% in 2010 (Annual decline is by 8.18%=(61.5%-28.8%)/4 years). This is 61.5% for years 2002-2006 assumed to be the same as 2007; and 28.8% for years 2011-2012 assumed to be the same as percentage in 2010 reported by National Statistical Office of Mongolia, 2012.

Figure 12. Net value of crop production in Soums overlapping PAs (Bln MNT)



Source: Authors' estimation based on NSO data.

The sustainability of a large part of the agriculture sector depends on ecosystem services (ES) of PAs (e.g., water and pollination). ES requires constant investment for improving the maintenance and conservation. The total investment amount approved by the GoM for the 3rd CRC was 483.5 billion MNT (USD 414.7 million) between 2008 and 2010 (Government of Mongolia, 2008). However, none of this investment has been allocated to support conservation and management of ecosystems in PAs.

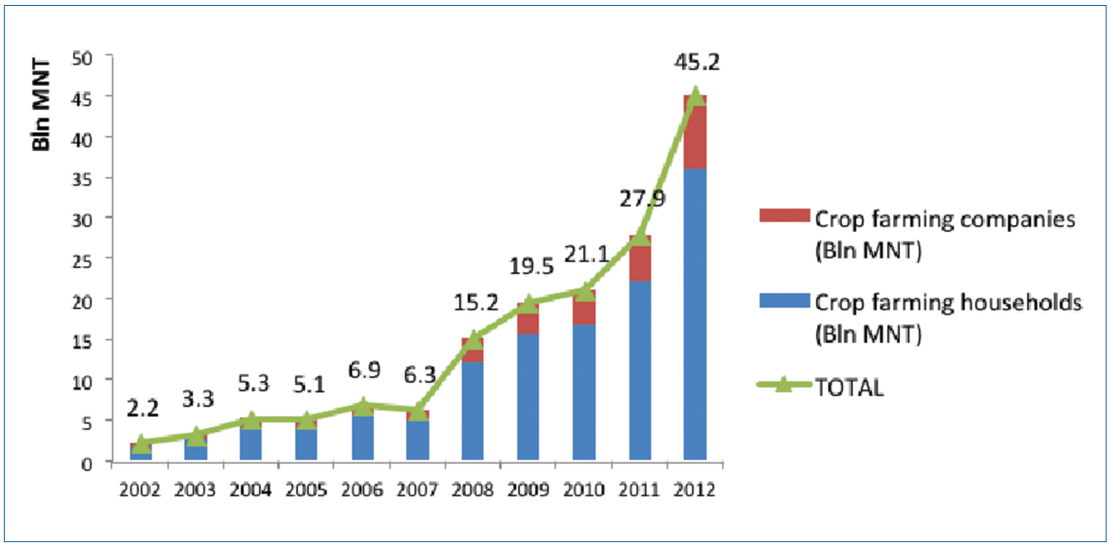
Income in the crop sector

In Mongolia the average number of people per household is 1.5 persons, and there are several enterprises engaged in crop farming. Atypical enterprise provides jobs to 4.4 persons. In order to divide total number of crop farmers into households and enterprises, it is estimated that about 95.2% of total crop farmers are households and remaining 4.8% shares for enterprise. Based on this estimate, 26 thousand people (22.6 thousand people for crop farming households and 3.3 thousand people for crop farming companies) were employed in subsistence crop farming around the PAs in Mongolia in 2012. For example, the Khangai region employs the about 42.2% of total employment which takes benefits of PAs in subsistence crop farming.

In order to estimate total income generated by people working in subsistence crop farming in PAs overlapped Soums, the annual income per person is multiplied by total number of people who work crop farming.

According to National Statistical Office of Mongolia (2014b), people who works for agriculture earned about 227.7 thousand MNT (167 USD) per month in 2012. It is assumed that people who work for crop farming household work during warm season for farming between April and October, i.e., seven months. For those who work for crop companies during whole year, i.e., twelve months. Using that assumption, total income of subsistence crop farming for employing people is estimated. This is shown in Figure 13.

Figure 13. Total income generated in irrigated agriculture in Soums overlapping PAs (Bln MNT)



Source: Author's estimation based on NSO data.

The total income of 26 thousand people working in crop farming is estimated at 45.2 billion MNT (33.2 million USD) in 2012. This is the income generation of subsistence crop farming in PAs protected Soums. About 80% of the income benefits crop farming households, and remaining 20% benefits people who work for crop farming companies. Agriculture income is increasing sharply since last two years, because of government support for irrigated agriculture.

Total benefit of employing people in subsistence crop farming in PAs overlapped Soums in Khangai region is 19.09 billion MNT (USD 14 million), about 42% of the total.

Other indirect benefits linked to irrigated agriculture: Taxes, Insurance and Loans interest

Other indirect benefits include taxes paid by farmers to the GoM, and farmer household payments for agricultural insurance to insurance companies, and

interest to banks for loans.

In order to calculate revenue of tax, insurance and bank loans, data from the First State Census of Agriculture in 2011 (National Statistical Office, 2012) on cost sharing of such services was used. Table 8 shows the percentage of costs for tax, insurance, and bank loans.

Table 8. Tax, insurance, and loan cost share in total revenue for Crop prduction sector

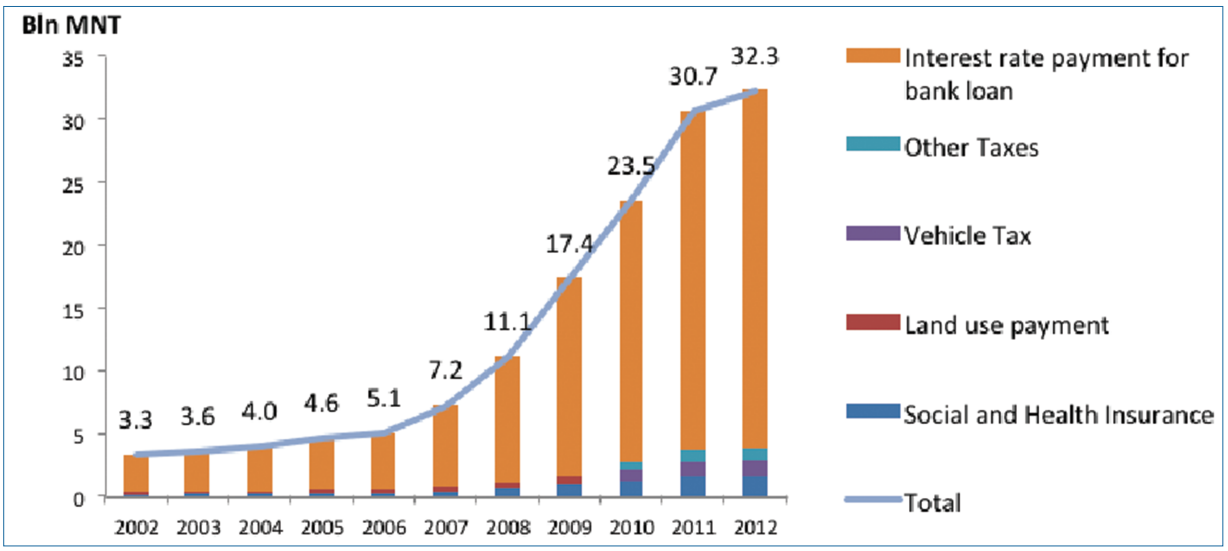
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Social and Health Insurance (%)	0.3	0.3	0.3	0.3	0.3	0.4*	0.4*	0.5*	0.5	0.5	0.5
Pastureland and land use payment (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
Vehicle Tax (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4
Other Taxes (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3
Interest rate payment for bank loan (%)	4.7	4.7	4.7	4.7	4.7	5.7*	6.7*	7.7*	8.8	8.8	8.8
Total (%)	5.3	5.3	5.3	5.3	5.3	6.4	7.4	8.5	10.0	10.0	10.0

Source: National Statistical Office of Mongolia (2012); *Numbers are estimated by authors assuming that it increases equally in the years where data is missing[16].

[16] For example, in order to estimate share of cost of Social and Health Insurance in total revenue: 0.3+(0.5-0.3)/4 years=0.35

Payments to commercial banks are higher than other payments including taxes, 8.8% of total revenue of the crop farmers. This is related to the fact that running subsistence crop farming business requires immense amount of investment comparing to livestock sector with short time of planting and harvesting between May and October. In 2012, about 10% of total revenue was paid to taxes, and insurances, and bank loan interests of subsistence crop farming enterprises and households. The benefit to government, banks, and insurance companies from irrigated agriculture is estimated by multiplying the total revenue of crop production by the cost percentage of tax, insurance, and bank loans. This is shown in Figure 14 below.

Figure 14. Indirect benefits: Taxes, insurance, and interest for loans, irrigated agriculture (Bln MNT)



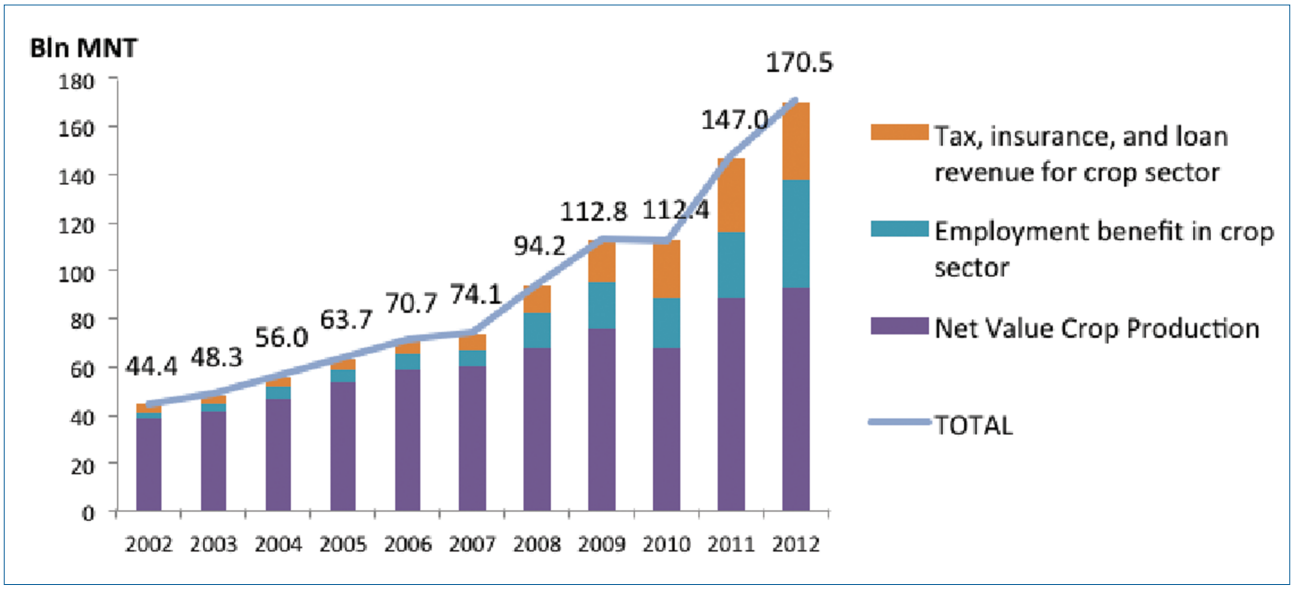
Source: (National Statistical Office of Mongolia, 2014b, 2014c); authors' estimation

In total, in 2012, the government, insurance companies, and banks earned 32.3 billion MNT (USD 23.8 million) from payments of taxes and insurance. As shown in Figure 14, from 2007 there has been a sharp increase. The aggregated value from 2002 to 2012 is 142.8 billion MNT.

Total Estimated Value of the Irrigated Agricultural sector

In 2012, the estimated total value of the irrigated agricultural sector, including`g the net value of crops, income to farmers and other indirect benefits is estimated at 170.5 billion MNT (125.4 million USD). This benefit will not be possible without the input of ecosystems services. The aggregation of values 2002 to 2012 is shown in Figure 15.

Figure 15. Total estimated value of the irrigated agriculture sector (170.5 Bln MNT)



Source: Authors' estimation based on NSO data.

Between 2002 and 2012, the total aggregated economic value of ES of PAs for irrigated agriculture in Mongolia is 994.1 billion MNT or USD 731.3 million[17]. Total economic value is highest in the Central Region that shares 31.8% of total economic value. Among all provinces, the Selenge Province (where three PAs exist overlapping with 8 Soum territories of the Selenge province; Tujiin Nars, Khan Khentii, and Zed-Khantai-Buteeliin Nuruu share the highest value, i.e., 22.6% of the total economic value. This is because the Selenge province has long history of crop farming and the largest croplands. The larger crop companies operate in this province that has the most fertile and flat land.

BAU and INC scenarios for irrigated agriculture

The total estimated value of the irrigated agriculture sectors was used to build BAU and INC scenarios to illustrate potential losses and gains. The average annual growth rate of the total value between 2002 and 2012 was used (14.8%) to project the BAU scenario; and o illustrate the potential negative impact of BAU practices, an annual decrease rate of 1.7% is applied from 2020 to 2032. This is assuming that the BAU unsustainable agricultural policies will not be reformed, and the little o no investment in PAs ecosystem management will continue.

Based on these assumptions, total economic value of the irrigated agriculture sector, under BAU practices, would decline to 82 billion MNT (60.4 million USD) by 2032; i.e., the 2012 value will decrease by 51.9%[18]. In the BAU scenario, at its peak in 2020, the economic value of PAs for irrigated agriculture would reach to 293.8 billion MNT in 2020 (USD 216.1 million[19]). However it could start decreasing from then because of negatives annual growth rate staring in 2021 (-0.5%) and continue to decline and reach to -19.2% in 2032.

Under BAU, gains may continue up to 2022 reaching 450.5 billion MNT (USD 331.4 million). However, a decline in economic benefits may be visible from 2023 and loss could reach 1115.9billion MNT (USD 821 million). The total net loss in this illustrative BAU scenario could reach 665.4 billion MNT (USD 489.5 million) over next twenty years (2013 and 2032). The net loss of BAU comparing to INC is difference between gain (2013-2022) and total loss (2023-32)[20]. This is shown in the Figure below.

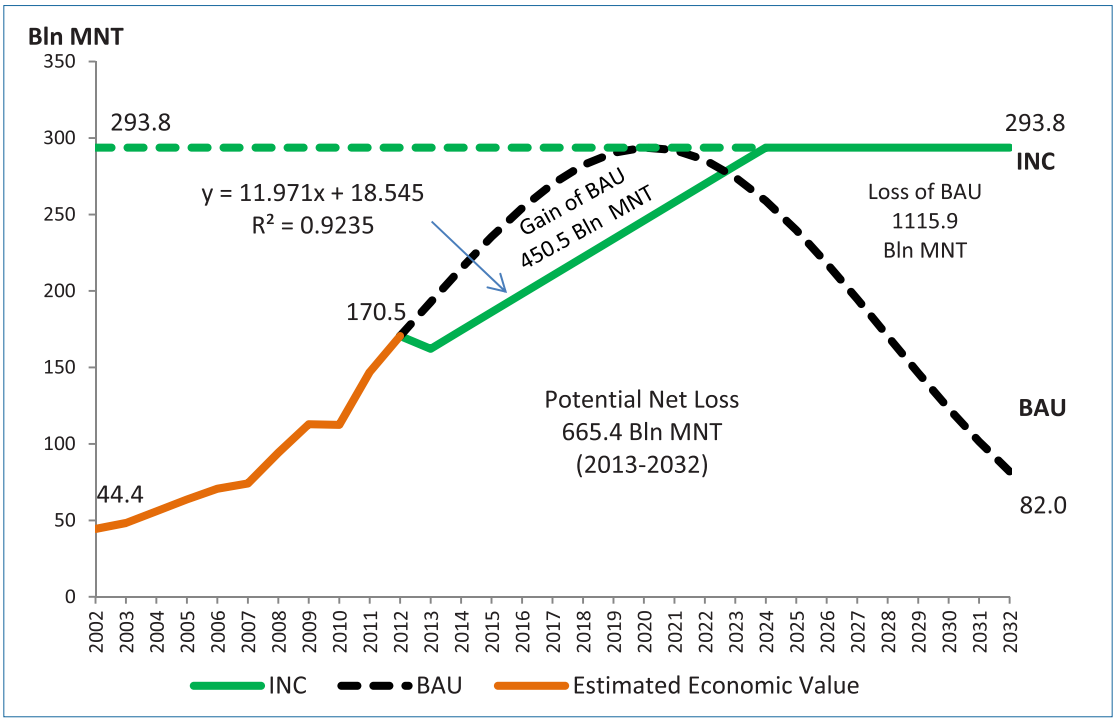
[17] Exchange rate of 2012 for MNT conversion to USD is used: 1USD=1359.24 MNT.

[18] 2012 exchange rate used.

[19] 2012 exchange rate used.

[20] The net loss is difference between gain and total loss 665.4=1115.9-450.5. The gain occurred 2013-2022, and total loss occurred 2023-2032.

Figure 16. Illustration of BAU and INC scenarios in the irrigated agricultural (crop) sector (Bln. MNT)



Source: Author's estimation based on NSO data.

In the INC scenario, if additional investment in PAs and Ecosystems is done, the economic value of irrigated agriculture sector could be increasing linearly[21] up to a sustainable level and continue constantly. This could be the result of agriculture policy reform in which adequate funding for PAs ecosystems managed is addressed.

Under INC scenario, the total economic value of the irrigated agriculture sector could reach 293.8 billion MNT (USD 216.1 million) in 2032, which is 1.7 times higher than the value in 2012. However, intense policy reform will be needed to attempt to achieve such target. For example, the 2008 3rd CRC (483.5 billion MNT or USD 414.7 million), still under implementation, excludes funding to support conservation and ecosystems management in and around PAs.

3.3 LIVESTOCK

Natural grassland ecosystem services provide a direct input to sustain livestock productivity en Mongolia, and to support the livelihoods of millions of people. For example, in 2012, the livestock sector share of GDP was 12% and 27% of the labor force was engaged in livestock farming (National Statistical Office of Mongolia, 2014a). Herders produce products such as meat, milk, wool, hide and cashmere and mostly they are self-sufficient smallholder households run livestock farming.

Mongolian natural grasslands are one of the most important ecosystem services. Mongolian grasslands are part of a large eco-region that includes more than a million square kilometers of temperate grasslands on the inland side of Manchuria's coastal mountain ranges and river basins. According to WWF, livestock privatization and the collapse of the urban economy have caused people to return to rural lifestyles, contrary to the global trend toward urbanization. As a result, the number of herdsmen in Mongolia has tripled in the past decade to more than 450,000 while the number of livestock has increased by 30 percent. This situation has determined an enormous pressure on the sustainability of natural grasslands. A 2010 survey by the Regional Agricultural and Animal Husbandry Bureau found that 66 percent of the 88 million-ha natural grassland in Inner Mongolia has become family ranches.

Livestock sector in Mongolia is mainly nomadic pastoral system in extreme climatic weather conditions. Pastureland is state owned and considered common property by law. Thus, for the herders there is no cost for feeding their livestock, which is from the natural grassland. This is fundamentally a free service from grassland ecosystems.

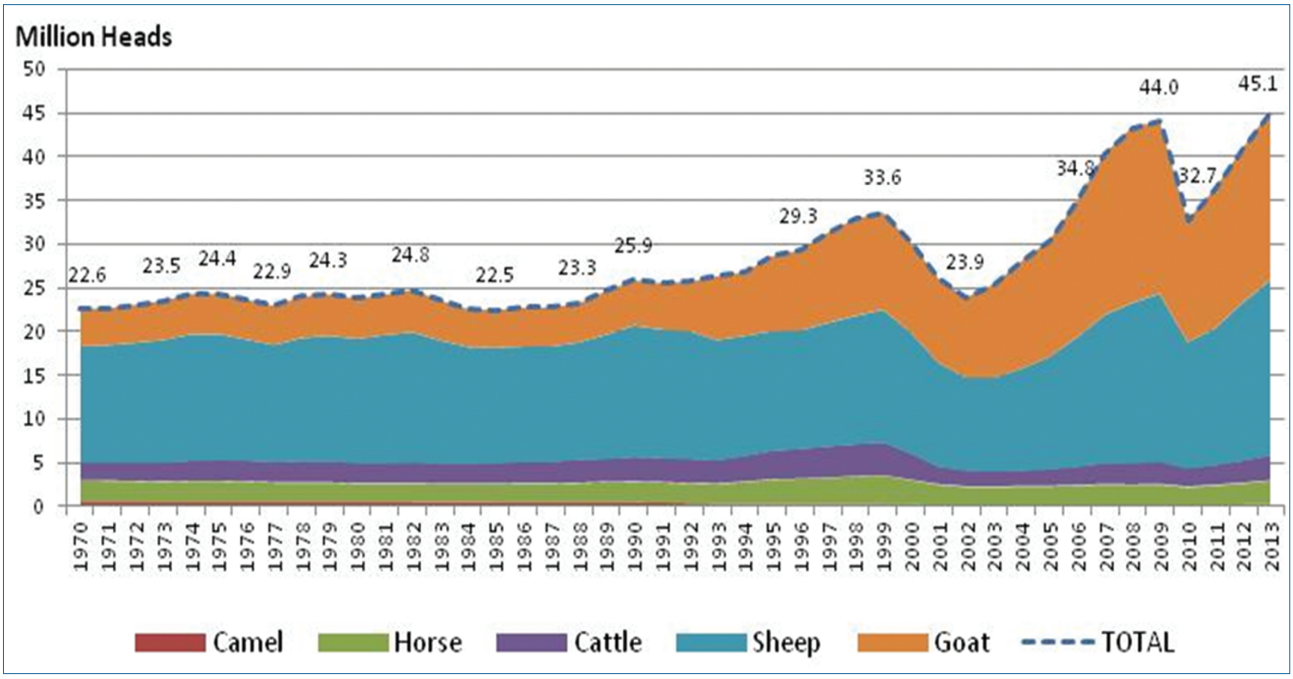
[21] Linear trend using data of previous 11 years 2002-2012, trend value for next 11 years 2013-2023.

The livestock sector in Mongolia benefits from two indispensable ecosystem services that are originated from protected areas: mainly grassland, and fresh water. In Mongolia, livestock is permitted in protected areas, except in strictly protected areas and natural reserve areas. PAs provide seasonal pastures for livestock. Water that originates from or run through PAs is the key for livestock husbandry.

Goat, sheep, cattle, horse and camels are the main five types of livestock in Mongolia. Number of livestock reached to 45.1 million heads in 2013, which is a record number in history of Mongolia. The 43% of the total number of livestock is goat and 44% is sheep, while horse and cattle shares 6% each but camel shares only 1% of total livestock number.

The number of goats is increasing rapidly and consequently, degradation caused by over grassing is also increasing. Mongolia is one of the three most important cashmere producers in the world. Consequently, goats make the most of the cash income in springtime when herders comb their goats and sell the cashmere. However, recently the debate about how goats destroys the grassland more than other types of livestock because they eat the root of the grass by digging the soil in dry land by their foot. The dramatic increase in the total number of livestock, as reported by the NSO (2014), is shown in Figure 17.

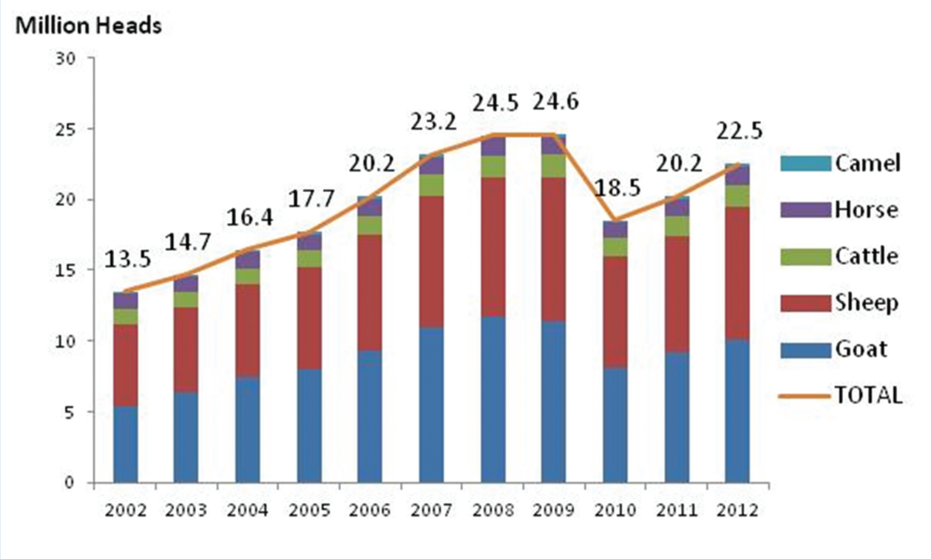
Figure 17. Total number of livestock in Mongolia (Million Heads) (1970–2013)



Sources: National Statistical Office of Mongolia (2014d)

According to data provided by NSO (2014d), in 2012 there was 22.5 millions of livestock in 189 Soums and 4 districts of Ulaanbaatar city which overlap with all 99 PAs in Mongolia. Total number of livestock at this year was 40.9 million in Mongolia; it means that about 55% of total livestock exists in Soums that overlap with PAs, this is shown in Figure 18 next.

Figure 18. Total number of livestock in PAs overlapped Soums in Mongolia (Million Heads)



Source: National Statistical Office of Mongolia (2014d), authors' estimation

Besides poor grassland ecosystems management (overgrazing) in Mongolia, Dzud is the most challenging hazard for Mongolian herder communities; it kills livestock and people losses their livelihood. The last Dzud in Mongolia occurred in the winter of 2009/2010, 8.5 million (20% of) livestock died, and it affected 28% of Mongolian population (ReliefWeb, 2010; Fernбndez-Gimйnez, Batkhishig, & Batbuyan, 2012).

The study considers grassland management to be in the BAU scenario. For example, in 2009, the GoM stopped the tax on herder households who had to pay taxes per head of livestock. The initial purpose of the tax was to reduce number of livestock and the negative effect on pasturelands, and to finance the improvement of grassland management. Table 9 below includes characteristics of livestock policies in Mongolia under BAU and a potential shift to INC.

Table 9.Characteristics of livestock management practices: BAU and INC scenarios

BAU	INC
• General grassland resource management for livestock grazing remains a key issue. Drought conditions of the last decade, and man-made drought, which comes with overgrazing, has brought home to the need for better grassland management of province-wide. • Lack of taxation/fees for grassland use. • Traditional grazing management (monadic grazing) frequently brings severe degradation to certain areas water sites, around villages). • In both of national and provincial levels, lack an overall system of monitoring and reporting grassland conditions. • There are limited agency resources to gather reliable information to manage the grasslands • Existing grazing policies (forbidden grazing, deferred grazing in the spring, etc.) may not reflect the complexity of demands now present on the grassland. • The style of traditional animal husbandry often leads to seasonal overgrazing, and there is a lack of incentives for adopting grazing strategies, which promote multiple-use benefits.	• Reintroduction of taxes or fees for grassland use. Possibly based on overall number of livestock and thresholds. • General grassland resource management policy addresses man-made drought by improving grass management at provincial level. • Provide extension services to improve nomadic husbandry practices and decrease degradation in water sites and villages. • Establish, at national and provincial levels, an effective system of monitoring and reporting grassland conditions. • Provide adequate funding to agencies responsible for grass land management and protected areas to gather reliable information to manage the grasslands • Better enforcement and control of grazing policies • Ineffective grazing policies are phased out. • New grazing strategy avoids seasonal overgrazing, and there are financial incentives for adopting grazing strategies, which promote multiple-use benefits.

For the purpose of this analysis, 5 types of livestock were assessed in five categories: meat, hides, milk, cashmere, and wool, as shown in Table 10 below. Due to limited or unavailable data at the NSO and the Ministry of Industry and Agriculture, the study excluded the value of dairy products linked to ecosystems services from PAs.

Table 10. Selected livestock and products

Livestock	Product				
	Meat	Hides	Milk	Cashmere	Wool
Goats	●	●	●	●	
Sheep	●	●			●
Cattle	●	●	●		●
Horses	●	●			
Cammels	●	●			

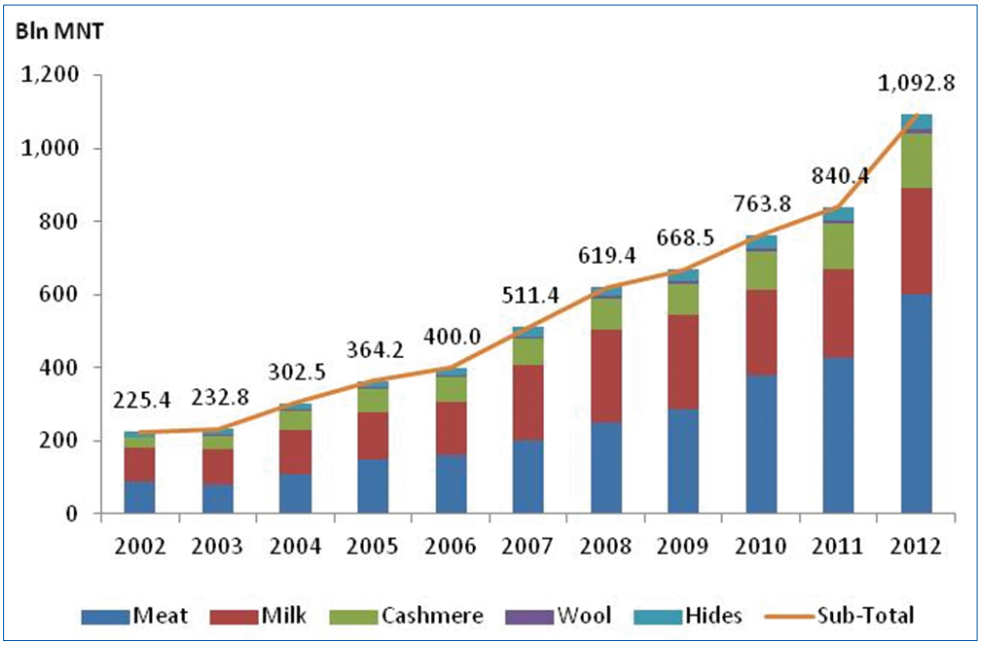
In addition to the net value of productivity, livestock-related income, government income from taxes, and insurance and interest paid to banks for livestock loans were considered to estimate the total value of the economic benefits generated by the livestock sector. The analyses of the value of meat, hides, milk, cashmere, and wool, as well as the method used to calculate values, are included in Annex 1 and 2. The estimated aggregated values are presented below.

Gross and net value of livestock production

The total estimated economic value (or market value) earned from producing meat, milk, cashmere, wool, and hides are1.09 trillion MNT (804.0 Million USD) in 2012. The total livestock production is increasing, constantly; meat and milk have the largest share of the increase. The increasing market value is due to increasing livestock product prices and government subsidy policies that exclude support to ecosystems management.

The Khangai regions is benefitting the most among other four regions which is about 37.4%, where the most of the livestock production activities operate, because this region is rich in grass and precipitation and there is more forest areas. These trends are shown in Figure 19 below.

Figure 19. Total gross value of livestock production in Soums that overlap with PAs (Bln MNT) (2002–2012)



Source: National Statistical Office of Mongolia (2014d), authors' estimation

In order to get a more accurate estimate, an estimated cost of livestock farming is subtracted in the calculation. However, estimating annual cost of livestock management and investment for herder households is difficult. Often, there is no data available for the costs, partly because households do not pay income tax.

For the purpose of this report, an average profit shares are used based on the information included in Table 11 below (National Statistical Office of Mongolia, 2012).

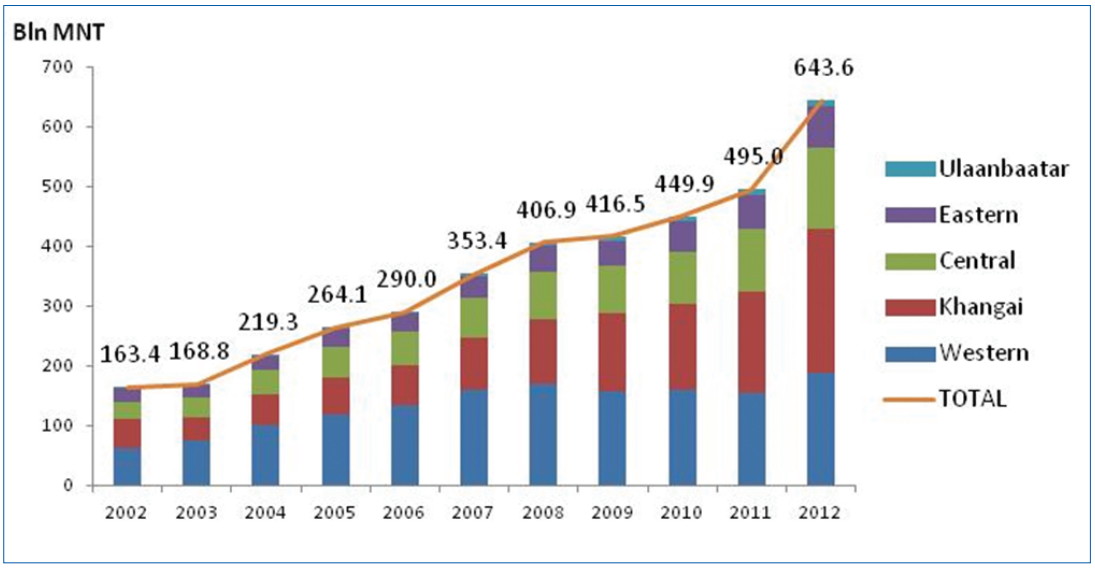
Table 11. Profit Share of Livestock Sector

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Profit share (%)	72.5	72.5	72.5	72.5	72.5	69.1*	65.7*	62.3*	58.9	58.9	58.9
Average for the period									67.0%		

Source: National Statistical Office of Mongolia (2012); *Numbers are estimated by authors under assumption.

Using profit share in each year, the estimated net value in 2012 increased from 163.4 billion MNT (USD 120.2 million) in 2002 to 643.6 billion MNT (USD 473.5 million). However, due to poor grassland ecosystems management, the current level of growth, this is considered not sustainable. This value is shown in Figure 20 next.

Figure 20. Net Economic value of the livestock sector in Soums that overlap with PAs, (Bln MNT) (2002–2012)



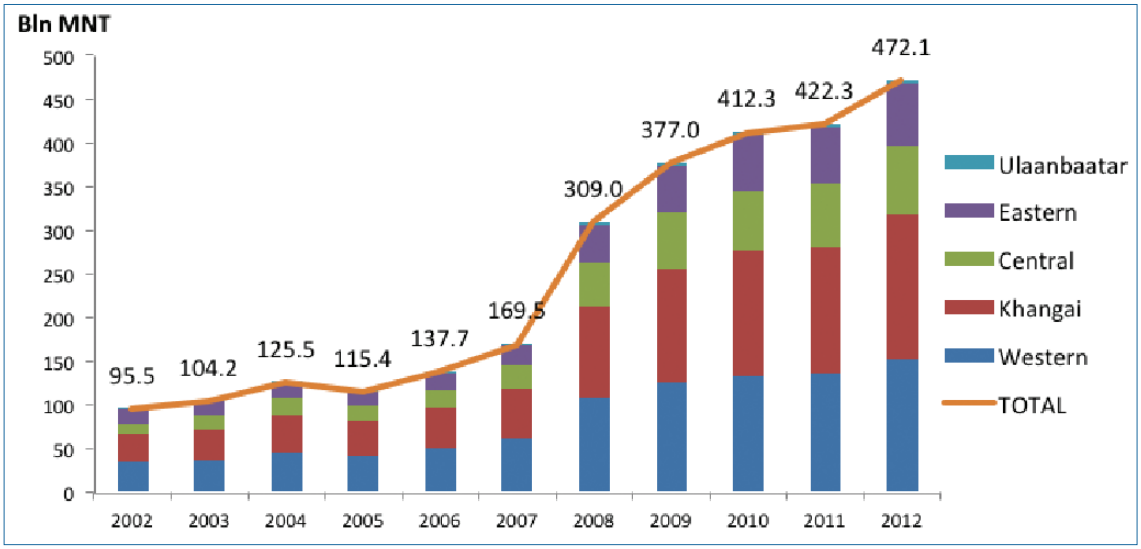
Source: National Statistical Office of Mongolia (2014d), authors' estimation

Income in the livestock sector

National Statistical Office of Mongolia (2014d) provided data on number of herder households for each Soum that overlap with PAs. The average number of people per herder household engaged in livestock farming is 2 according to NSO's statistical yearbooks 2009-2013. It is therefore estimated that number of people employed in livestock sector was 172.8 thousand in 2012.

Total income benefit to herder households is estimated by multiplying the number of people that are engaged on a full time basis by yearly average income. The average income reported by National Statistical Office of Mongolia (2014b) was used for the estimation of income benefits in livestock sector. Figure 21 shows the results of the analysis.

Figure 21. Total income generated by the livestock sector in Soums that overlap with PAs (Bln MNT) (2002–2012)



Source: National Statistical Office of Mongolia (2012-2014d), authors' estimation

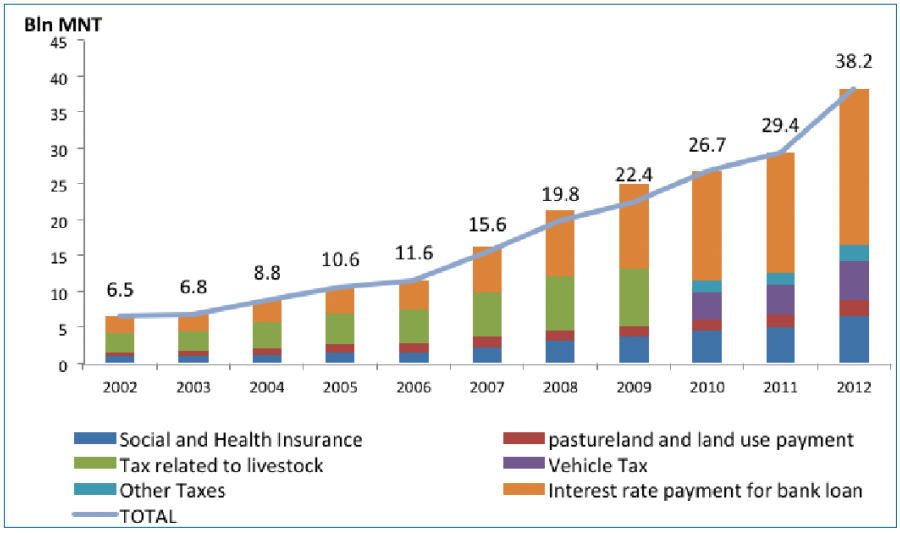
In 2012, the income benefit is estimated at 472.1 billion MNT (USD 347.3 million) in Soums that benefit from PAs ecosystems. The total income benefit over eleven years between 2002 and 2012 is estimated at 2.74 trillion MNT or USD 2.02 billion.

Taxes, Insurance and interest paid to bank Loans

The GoM benefits from income from taxes applied to the livestock sector: pastureland or land possession rent, personal income tax, vehicle tax, and tax of using natural resources e.g. fire wood etc. Few herders pay social and health insurance. In addition, commercial banks that provide loans to herders also benefit from interest paid on loans. In Mongolia, recently most of herder households obtained loans from the Khaan Bank, because they have branches in about every Soum of Mongolia.

According to First State Census of Agriculture (National Statistical Office of Mongolia, 2012), about 3.5% of total revenue was used to pay for taxes, insurances and interest on bank loans for livestock herders in 2012. Thus, the total economic benefit from taxes, insurance, and bank loans is estimated by multiplying the total economic value by average percentage paid by herders. The results of this analysis are shown in Figure 22.

Figure 22. Economic benefit from taxes, insurance, and interest paid on bank loans in the livestock sector (Bln MNT).



Source: National Statistical Office of Mongolia (2012); *Numbers are estimated by authors under assumptions.

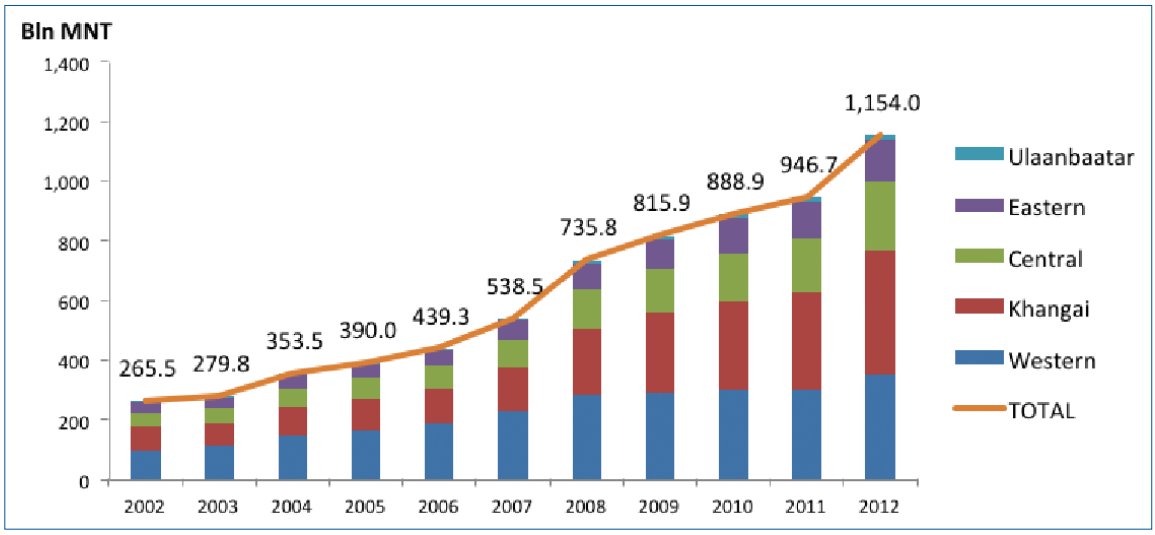
It is estimated that the revenue earned by the government, companies, and banks for livestock farming in 2012 reached 38.2 billion MNT (USD 28.1 million). The total economic benefit between 2002 an 2012 is estimated at 196.4 billion MNT or USD 144.5 million.

Total Value of ecosystem services of PAs in the livestock sector

The total value of the livestock sector, that benefits form ES of PAs, is estimated at 1.15 trillion MNT (USD 849 million) in 2012, including value of production, income, and others. This is illustrated in Figure 23 below. The total benefit between 2002 and 2012 is estimated at 6.8 trillion MNT or USD 5.01 billion. This level of benefit will not be possible without the direct input from grassland ecosystems services that are better protected by PAs in Mongolia.

Total economic benefit is higher in the Khangai region that shares 36.4% of total economic value for livestock sector. Among provinces, Bulgan province (where four PAs exist overlapping with its 8 Soum territories: PAs are Namnan Uul, Khan Jargalant Uul, Khugnu Tarna, Zed-Khantai-Buteeliin Nuruu) shares the highest value (9.5%) of the total economic benefit of PAs for livestock sector in Mongolia. This is because the Bulgan province has the higher precipitation per year.

Figure 23. Total economic benefit of ES of PAs in the livestock sector (Bln MNT)



Source: National Statistical Office of Mongolia (2014d), authors' estimation

Illustrative BAU and INC scenarios in the livestock sector

Benefits from ecosystems in Soums that overlap with PAs have increased rapidly in the 2002 – 2012 period. However, the economic benefits to the livestock sector may decrease if there is no action taken to improve grassland management or freshwater protection in PAs. The following benefit scenarios illustrate potential losses and gains under BAU and INC. In the BAU scenario, the average annual growth rate of the total value between 2002 and 2012 is 16.2%. In BAU scenario, it is assumed that annual average growth will be decreased by 1.7% every coming year until 2032. This is because of unsustainable grassland management policy and practice. Based on this assumption, total economic benefit of PAs to the livestock sector in Mongolia could reach 751 billion MNT (USD 552.5 million) in 2032; i.e., 65.1% of value in 2012. At the peak of the BAU scenario, the economic benefit of PAs in the livestock sector could reach to 2.24 trillion MNT in 2021 (USD 1.6 billion using exchange rate in 2012). However, it could decrease sharply afterwards because under BAU the annual rate could decrease (0.9% was applied in 2021) and then continue to decrease and become negative (-0.8%).

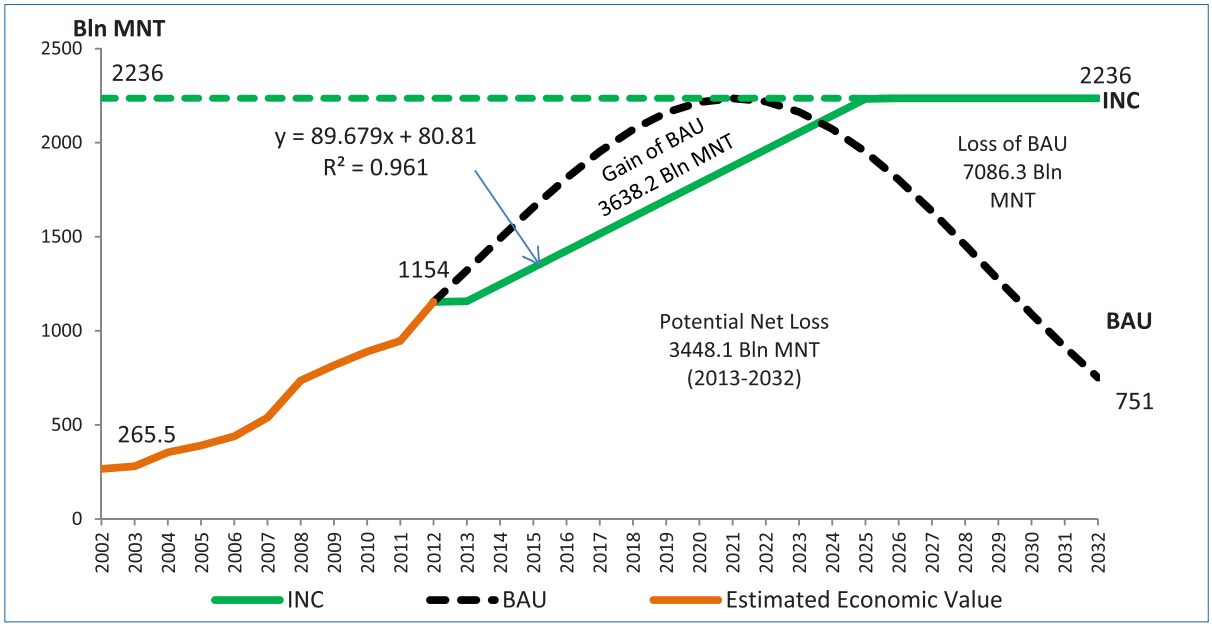
Gains under BAU could continue between 2013 and 2023. However, the economic value of BAU becomes less than INC from2024 to 2032. During period 2024-2032 the total loss of BAU equals to 7.1 trillion MNT (USD 5.2 billion). The difference between gain and loss of BAU is the estimated net loss, i.e., 3.4 trillion MNT (USD 2.5 billion) over next twenty years (2013 and 2032). This is illustrated in Figure 24 below.

Under INC, the economic benefit could increase more linearly. This may happen if grassland man-

agement policy addresses improvement the current gaps. Starting in 2026, the benefits under INC may reach the level of adequate carrying capacity of the grassland (assuming that maximum value of BAU scenario represents the maximum capacity of the grassland for livestock).

Under INC scenario, the total economic benefit would be 2.24 trillion MNT (USD 1.6 billion) by 2032, which is two times higher than the value in 2012.

Figure 24. BAU and INC trends in the livestock sector (Bln MNT)



Source: Authors' estimation based on NSO data.

3.3 FORESTS

Forest ecosystems provide several services to economic sectors and contribute to the welfare rural households by providing "free" valuable resources. The most important is the boreal forests (taiga) of Mongolia and especially in Khuvsgul. The main challenges of forests in and around PAs of Mongolia are related to illegal logging, diseases and forest fires.

The boreal forest is most valuable forest in the world in terms of important influence on climate is its influence on levels of atmospheric carbon dioxide (CO_2) and other greenhouse gases (GHGs). The carbon sequestration of boreal forest is higher than tropical forest.

There are approximately 2.6 million hectares of forest in PAs in Mongolia and key forest services such as soil erosion control, carbon storage, and non-timber forest products (NTFP). Timber production is prohibited in PAs, and data on NTFP was not available to the study team. Therefore this section provides an overview of carbon storage, based on estimated benefits of standing trees in the taiga forest in PAs.

Forest management is considered BAU. This is the result of gaps in forest policy and poor law enforcement. Key characteristics of forest policies under BAU and potential INC are listed in Table 12.

Table 12. Forest sector policy: characteristics of BAU and INC scenarios

BAU policy	INC
• Insufficient funding and investment for the forest protection including forest fire management (lack of sustainable forest management policy). • Poor law enforcement: Increased number of forest fires and illegal logging • Poor land use policy results in deforestation • Increasing degradation due to lack of Climate Change strategy	• Sufficient investment in sustainable forest management policy and enforcement. • Fire and illegal logging management strategy: decrease in number of forest fire and illegal logging and cost saving of the forest fire. • Sustainable land use and forest management-policy • Emission trading and carbon offset mechanism • Climate change policy is implemented.

Boreal forests in PAs play important role in mitigating the effect of climate change through storing carbon dioxide and reducing the potential for global warming. According to the Mongolia's forestry inventory, almost 74% of total boreal forest contains larch-*Larix Sibirica* hardwood, 12% is birch, 10% is pine and other mixed species.

An average carbon sequestration of the larch forests is 6.6 ton per hectare and 12.2 million metric tons of carbon annually could be stored in the 1.85 million ha of larch forests in PAs[22]. Using the moderate market value of 1.5 USD per t/$CO_{2,}$ the estimated market value of the CO_2 sequestered by PAs is USD 18.3 million (33.3 billion MNT) (Table 13 below).

[22] Methodology development by UNFCC CDM for measuring CO_2 storage was used to measure larch forest, the dominant specie. To this end, constant coefficients of a, b and c (0.2291, 1.7563, and 1.0453 respectively) were used.

Table 13.Value of the CO_2 sequestrated by the larch forests in PAs

Average Carbon sequestration per year	Total Carbon sequestration PA per year	Current market value CO_2	Total Value CO_2 sequestration PA	
Metric ton/ha	Million metric ton	Per metric ton	Million USD	Billion MNT
6.6	**12.23**	**$ 1.50**	**18.3**	**33.3**

These estimates assume that all factors including price of carbon credit and average stock change of carbon storage remain constant. If the current BAU practices of forest management in PA's continue, the carbon sequestration capacity and value of boreal forests will decline. To date, there are no emissions trading or carbon offset structures in Mongolia.

3.4 MINING

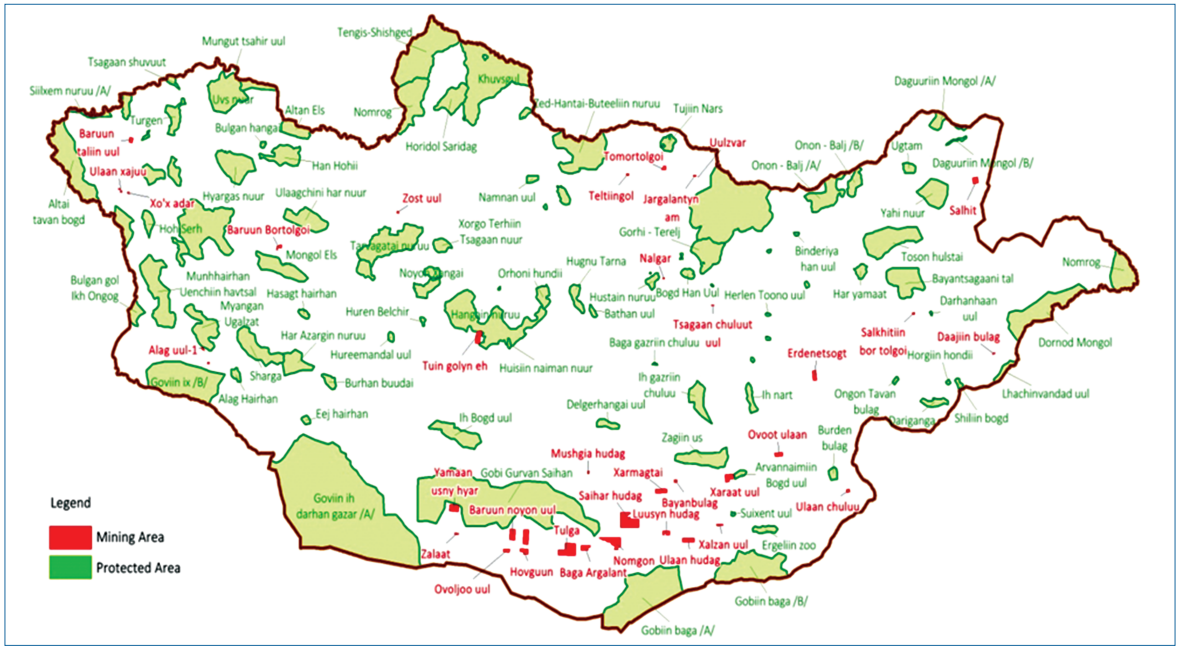
The mining sector of Mongolia continues to grow strongly, and approximately 90 per cent of Mongolian exports are resources, notably copper, gold and coal. The mining sector generates 20.7 percent of the GDP in 2013. The Oyu Tolgoi copper and gold mine alone is expected to account for as much as 30 per cent of Mongolia's GDP once full commercial ore production starts. Erdenet Mining Corporation's (EMC) contribution has been very important to the country's economy since establishment in 1978. In 2013, the contribution of Erdenet mine to the GDP was 7 percent (NSO, Statistics 2013).

The most important ES used by the mining sector is fresh water. The mining sector is by far the larger water user and is growing fast. A large amount of water is needed for their daily activities such as washing, cooling and dust suppression, directly and as a renewable energy source, or indirectly as drinking water for the mining towns. According to World Bank Ground Water Assessment, 2015 the estimated water demand of the mining industry in the Southern Mongolia will be around 220,000-250,000 cubic meters per day of which is mainly used by four big mining companies: OyuTolgoi60,000 m^3/day, Tavan Tolgoi 76,000 m^3/day and Shivee-Ovoo 50,000 m^3/day. This amount is higher than daily residential and non-residential water usage of Ulaanbaatar city that is 210,000 m^3/day approximately (Tuul River economic value, 2009).

The contribution of fresh water ecosystem from PAs to the mining sector is, without a doubt, indispensable. "Mining operations use water for mineral processing and metal recovery, controlling dust, and meeting the needs of workers on site. The amount of water required by a mine varies depending on its size, the mineral being extracted, and the extraction process used. For instance, metal mines that chemically process ore to concentrate metals such as copper and gold use much more water than non-metal mines such as coal, salt, or gravel mines"[23]. However, the use of water in mining has the potential to affect the quality of surrounding surface water and groundwater. This is the case in Mongolia. Map 3 shows the distribution of protected areas and mines in Mongolia.

[23] http://www.miningfacts.org/Environment/What-are-the-water-quality-concerns-at-mines-/

Map 3. Location of protected areas and mines in Mongolia.



In Mongolia most of rivers originate in mountains in PAs and riverheads are protected by the PAs Law. For instance, Orkhon and Ider rivers originate in the Khangai Nuruu protected area, Delgermoron, Eg rivers originate in the Khuvsgul Protected area, and Eroo, Kharaa, Tuul, Terelj rivers originate in the Khan Khentii Protected area. Therefore, PAs contribution to the mining industry is truly important. The Orkhon and Selenge rivers are cases in point; they supply water to the Erdenet Mining Corporation's operations. Despite this importance, PAs are poorly funded and can only partially address water resources protection. Table 14 shows the connections between PAs' rivers and the mining sector.

Table 14. Connections between PAs, rivers and the mining sector

Protected Areas	Rivers originate from PAs		Mining and mining related industries within and nearby the river basins
Khangai Nuruu Protected Area	Ider river Orkhon river Khanui	Selenge River	-Erdenet Mining Corporation -Shariin Gol coal mine -Tomortei
Khuvsgul Protected Area	Delgermoron Eg		-Burenkhaan -Aspire mine: Ovoot Nuramt coking coal proposal
Khan Khentii Protected area	Terelj Tuul Kharaa Eroo		-Nalaikh coal mine -Shariin Gol coal mine -Baganuur coal mine -Darkhan Iron ore -Boroo gold

For the purpose of the study, the mining sector is considered under BAU; because Mongolian Mining policy lacks ecosystem management vision and strategy, especially fresh water ecosystems management elements. Currently, the mining sector is not contributing (investing) in off-site conservation of water resources. However, mining companies apply strict conservation measures to minimize waste, mainly through recycling. The characteristics of BAU/INC mining policies are included in Table 15 below.

Table 15. Characteristics of Mongolian Mining policy under BAU and potential INC scenarios	
BAU policy	INC
• Limited or no investment in off-site fresh water conservation (surface and ground water sources); • Lack of scientific (reliable) research and data on ground water aquifer in SGR and other regions; • Unplanned mine town development; • Increased water pollution; • Low water tariffs and an unregulated water management in the mining sector; • Limited public investment in conservation of fresh water sources (surface and ground water); • Government funding to protect water sources in PAs is way below the PAs basic needs; therefore fresh water sources are at risk; • Poor regulation and enforcement of off-site water conservation and conservation in PAs.	• Sufficient investment or funding in off-site fresh water conservation (surface and ground water sources); • Reliable research and data source on water aquifer in SGR and other region; • Planned mine town development; • Decreased water pollution; • Accurate water tariff to cover service costs and sustainable water management; • Sufficient public investment in conservation of fresh water sources (surface and ground water); • Fresh water sources in PAs could be protected properly if government funding increases to cover the PAs basic needs; • Better regulation and enforcement of off-site water conservation and conservation in PAs

Because of BAU practices related to off-site fresh water management (water sources), the mining sector may not be sustainable in the long-term. For example, there are major mining companies located in Southern Gobi Region (SGR) where water availability is ten times less than the average in similar regions.

In the SGR, Oyu Tolgoi is the biggest copper mine; it relies on the ground water of the Gunii Hooloi aquifer. It has been estimated that this aquifer could only provide 60,000 m^3 per day for 30 years (WB source[24]).

A few mining companies play in important role to the national economy and Erdenet Mining Corporation (EMC) and Oyu Tolgoi. RMC is biggest copper and molybdenum mine within the mining industry and largest contributor to the country's economy for 36 years. EMC is joint venture of Russia (49%) and Mongolia (51%) and is fourth largest copper mine in the world. The contribution of EMC has been very important to the country's economy since 1978. In 2013, the contribution of Erdenet mine to the GDP was 7%. At present it is a fairly large complex processing 26 million tons of ore per year and producing around 530.0 thousand tons of copper concentrate and around 4.5 thousand tons of molybdenum concentrates annually (Erdenet corporate website).

The Oyu Tolgoi copper and gold mine has started in June 2013 and is expected to account for as much as 30 per cent of Mongolia's GDP once full commercial ore production starts. Besides mining, the expansion of mining related industries including railroad, road, and power station construction projects has contributed to the country's economic growth in last 3 years.

The mining industry also generates jobs. For example, the main source of income for residents of the Orkhon province is mining and mining related industry. In 2012, 90.4 percent of GDP of Orkhon province was generated from mining and mining related construction. Approximately, 10,000 people are employed by Erdenet Mining Corporation and 40,000 people employed by mining related industries (Orkhon province statistics 2012).

Mines water consumption in the SGR is used to illustrate the contribution of fresh water ecosystems to the mining sector.

For example, according to the World Bank (2009), the projected water demand in the SGR region is 468,000 m^3 per day by 2020. This represents 81 percent of the total demand. The remaining water demand is for Agriculture (12%) and Residential/non-residential (7%).

The total projected mining sector water demand in SGR is 60.38 million m^3 per year in 2014. The water demand will be increasing over the next years to 104 million m^3, 119 million m^3 and 130 million m^3 in 2017, in 2019 and in 2022 respectivly. Currently, mines are paying 3,500 MNT (US$1.9) per cubic meter water in SGR (Energy Resource 2013)[25]. With these data the value of water was estimated. This is shown in Table 16.

[24] http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/09/21.

[25] According to Energy Resource Company, the water price per m3 is $1.9 but an official water tariff $0.61 in SGR

Table 16. Mining water demand and value projection (SGR)

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Water demand projection in SGR '000 M^3/year	60,388	88,434	97,679	104,215	111,406	119,315	128,015	129,344	130,806
Water Value in SGR million MNT/year	211,356	309,518	341,875	364,754	389,920	417,603	448,054	452,704	457,820
Water Value in SGR million US$/year	117	172	190	203	217	232	249	252	254

Author's estimation based on World Bank data 2009[26]

The total economic (market) value of water is 211,356 billion MNT (USD117 million) in 2014 and it will increase over the next decade, could be doubled by 2020. If we assume that the water price constant for over the period, total economic value of water would be 457,820 MNT (USD 254 million) by 2022. This is an important benefit (revenue) to the GoM.

Under the BAU scenario, lack of sustainable water management policy, the mining sector may not be sustainable in the long-term. The undervalued water price, unregulated revenue collection mechanism and insufficient investment results in increasing production in mining costs and a highly negative impact on freshwater ecosystems.

Under the INC scenario, with realistic water tariffs to cover service costs, sustainable water management policy and sufficient public investment in conservation of fresh water sources, Mongolia may meet the future water demand of the mining sector. Under INC, the total economic value of the water for EMC and miners in SGR could increase over the next decade and it will reach USD 285.1 million by 2022, as shown in Table 16.

3.5 DRINKABLE WATER

In Mongolia, the main drinkable water sources for rural and urban areas are river basins, lakes and aquifers. These sources are directly linked to PAs. Rivers and aquifers are fed not only by rain but also by water from melting snow and glaciers during the warm seasons. Water sources are located in and around PAs.

The total water consumption of Mongolia is about 540 million m^3 annually; out of which the agricultural and industrial sectors consume over 80% on average (*Water Autority (2007): Initial Report on Integrated Water Resources Management* cited in Batimaa et al. 2011; UN-Water Web 2013). About 80% of drinkable water comes from aquifers and 70% of people in rural areas take the water from wells of their own; and from public kiosks in urban areas (Ministry of Nature and Environment (2007a): Annual report, Ulaanbaatar cited in cited in Batimaa et al. 2011).

Climate change (warming) has affected Mongolia since first half of 20th century; this has lead to lessening precipitation that feeds rivers and lakes. According to UN-Water Web (2013), in 2007, the number of dried up streams, lakes, and springs is increased by 30% comparing to 2003. However, according to National Statistical Office of Mongolia (2013), the combined number of water sources in Mongolia (rivers, springs, mineral waters, and lakes) increased from 18,610 in 2007 to 21,081 in 2011. The number of water sources may increase or decrease depending on precipitation and other factors. For example, 2011 was a year with increased precipitation.

The main source drinkable water to Ulaanbaatar (UB) comes from groundwater wells that are fed by filtration of the Tuul River Basin that originates in the Khan-Kentii Protected Area and runs through the Gorkhi-Terelj National Park.

About 53% of water consumption (or 278 liters per person per day) issued by people living in Ulaanbaatar in apartments or homes connected to central water system. Only 2% (or 7.5 liters per person per day) is used by people living in "*Ger*" districts which is 4-5 times lower than the accepted sanitary norms in 2007 (Emerton et al., 2009). Remaining water is used for power plants and factories (24%), industry (3%), businesses and institutions (14%), agriculture 4%, and individual houses (0.2%). About 40% of Ulaanbaatar residents live in accommodations with central water system, and the remaining 60% live in *Ger* districts with no central water system. This larger part of the population of UB have only access to water from water kiosks (Emerton et al., 2009).

In other regions the situation is more dramatic. For example, in the southern part of Mongolia (Gobi Desert), the water availability is 10 times less than the world average and less than northern part of the country. Consequently, for the purpose of this

[26] The International Bank for Reconstruction and Development / The World Bank, Southern Mongolia Infrastructure Strategy, 2009

study, drinkable water is considering BAU. Key characteristics of Mongolian drinkable water policy under BAU and potential INC are listed in the Table 17 next.

Table 17. Characteristics of Mongolian Drinking Water policy under BAU and potential INC

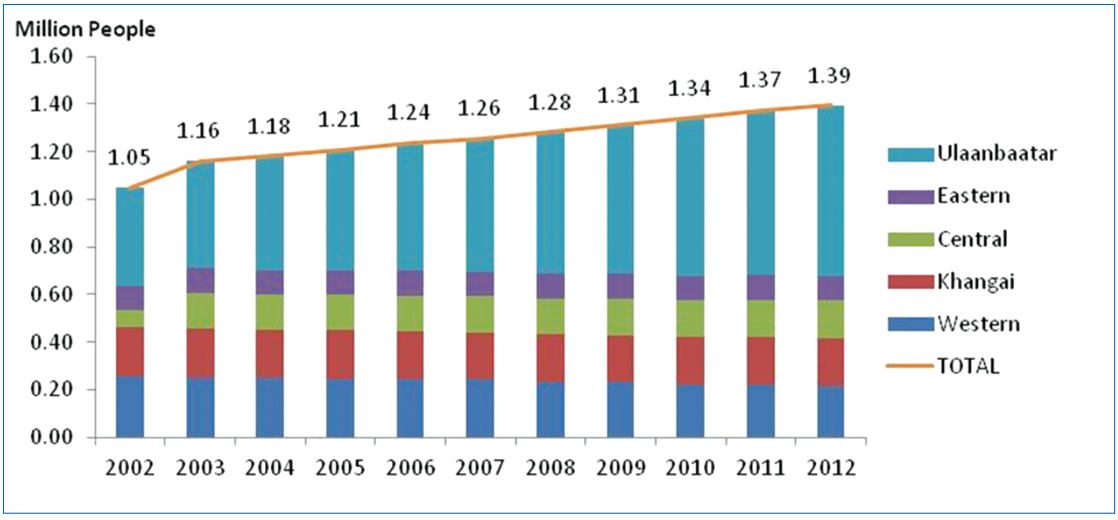
BAU policy	INC
• Unsustainable management of water sources • Unplanned increasing water demand in Urban areas • Limited access to water in GER districts and rural areas • Water pollution, poor treatment facilities • Increasing water born diseases due to low management water sanitation • Collapsing water supply system due to poor government investment and government regulated low water prices.	• Sustainable management of water sources, especially in PAs. • Planned and sustainable water supply in Urban areas • Reliable access to water in GER districts and rural areas • Functional water treatment facilities • Decreased water born diseases due to good management water sanitation • Water supply infrastructure and water sources are maintained and water prices are deregulated in order to cover a larger part of water supply and treatment costs.

The GoM heavily subsidizes the water price. This allows the water consumers to waste "cheap" water. For example, according to an estimate by the Water Supply and Sewerage Authority (USUG) in 2012, the total water sold to people who live in the *Ger* district (with pipeline) was 681.8 thousand cubic meters at 5,294.8 MNT (USD 3.9) per cubic meter. However, the actual price charged was only 911.6 MNT (USD 0.671) per cubic meter. The same report estimated that one cubic meter of water costs about 6,204.2 MNT (USD 4.56) and the charged price to people who live in *Ger* district (without pipeline connection, from water kiosks) was is 909.1 MNT (USD 0.669). Water price is a political matter in Mongolia and government and the water supply industry take heavy losses. This is a typical BAU practice.

In rural areas, the highest number of population living in PAs is near Ulaanbaatar City where four protected areas are located: *Bogd khaan Uul, Gorkhi-Terelj, Chingeltei Khair khan Uul* PAs. There has been an alarming increase of people living in PAs; from 25.49 thousand in 2002 to 185.3 thousand in 2012. The total area of the four districts in Ulaanbaatar is 3.63 thousand square kilometer, and of which an estimated 30% overlaps with PAs (authors' estimation). Annex 3 includes statistical information used to determine the number of people living in PAs.

The total market value of drinkable water considers the total population living in the 189 Soums and 4 districts of Ulaanbaatar City (UB). In 2012, there were 1.39 million people benefitting from drinkable water from ecosystem services that are linked with PAs in Mongolia, and most live in the four districts of Ulaanbaatar city. This is shown in Figure 25 below.

Figure 25. People benefitting from water from PAs in Mongolia (Million People)



Source: Authors' estimation, based on data of the National Statistical Office of Mongolia (2014d)

Estimated market value of drinkable water

In order to estimate the market value of drinkable water provided by PAs, an average rate of water consumption per person per day from several studies was used; and average prices for water in rural and urban areas. This is shown in the Table 18 next.

Table 18. Water Consumption in Mongolia (liter per capita per day)

	Urban	*Ger* district
World Bank 2003; and United Nations Development Programme (2004)[a]	230	5*
Human Development Report of Mongolia (2003)[a]	245*	9**
United Nations Children's Fund (UNICEF) (2003)[a]	203.2	5
Zandaryaa et al., (2003)[b]	278	-
World Bank & Public-Private Infrastructure Advisory Facility (2007)[b]	-	7.5
Average	**239.1**	**6.63**

*Water consumption from rivers, springs, ponds, ice & snow water;
**it was 240-250, we take average as 245;
*** it was 8-10; we take average as 9 liter per capita per day
Source: [a] cited in Basandorj & Singh (2009); [b] cited in Emerton et al., (2009)

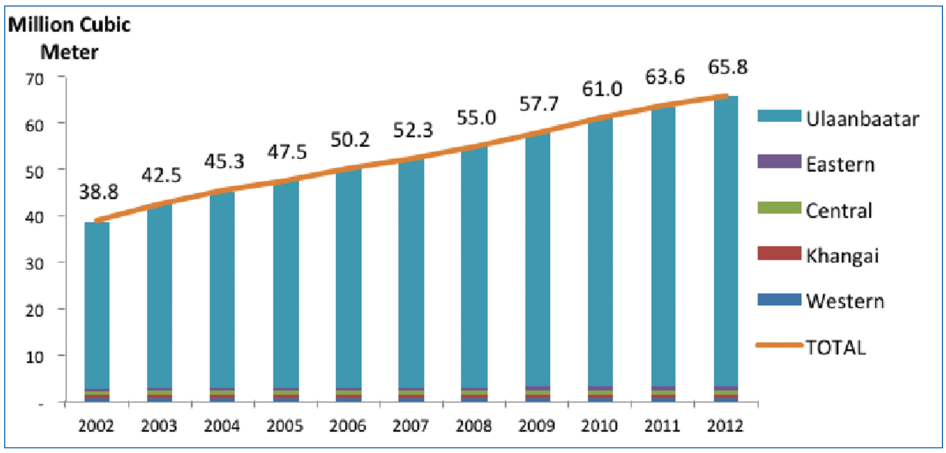
According to the National Statistics Office (2012), on average, a person who lives in *Ger* districts or places that are not connected to central water supply system consumes 6.6 liter water per day; and 239.05 liter is consumed by a person who lives in apartments or places that are connected with central water supply system).

The study estimated that water consumption of people who live in PAs overlapped four districts of Ulaanbaatar by 239.05 liter per person per day, which is 87.25 m^3 per year. To estimate the consumption of people who live in provincial centres, the proportion of people who are served with central water system (30.5%) was used (Table 18, Basandorj & Singh, 2009). Thus, the water consumption in provincial centres is 26.61 m^3 per person per year[27]. In all other Soums, that are not provincial centres, water consumption rates from areas that are not connected to central water system were used; i.e., 6.63 litre per person per day, and 2.42 m^3 per year.

Using the above averages for water consumption, it is estimated that the total water consumption for people who reside in soums overlapping PAs, in 2012, was 65.8 million m^3 per year in 2012, as shown in Figure 26 below. This represents 12% of total water consumption in Mongolia (the total consumption is 540 million cubic meters according to UN-Water Web, 2013, and Water Authority of Mongolia). In addition, people who live in Ulaanbaatar consume 95.1% of total water consumption in Soums that overlap with PAs.

[27] It is estimated that 87.25 cubic meter water consumption per person per year is multiplied by 30.5%. These are four Soums that are centres of the four provinces which exist overlapping with PAs: 1) Erdene bulgan Soum of Arkhangai province; 2) Sumber Soum of Gobisumber province, 3) Sain Tsagaan Soum of Dundgobi province, 4) Kherlen Soum of Khentii province.

Figure 26. Total water consumption of people who live in PAs overlapped Soums (000 cubic Meter)



Source: Authors' estimation

The average price of water was determined using different sources. For example, Emerton et al., (2009) used willingness-to-pay approach for drinkable water in Ulaanbaatar city to value Upper Tuul Ecosystem and reported that people's willingness-to-pay for one liter drinkable water is 1.36 MNT (USD 0.001). In addition, the GoM (2011) approved resolution of ecological and economic value of water in Mongolia. In the first appendix of the resolution, ground water price per liter of Tuul River is 0.944 MNT (USD 0.0007), for surface water it is 1.06 MNT (USD 0.0008)[28].

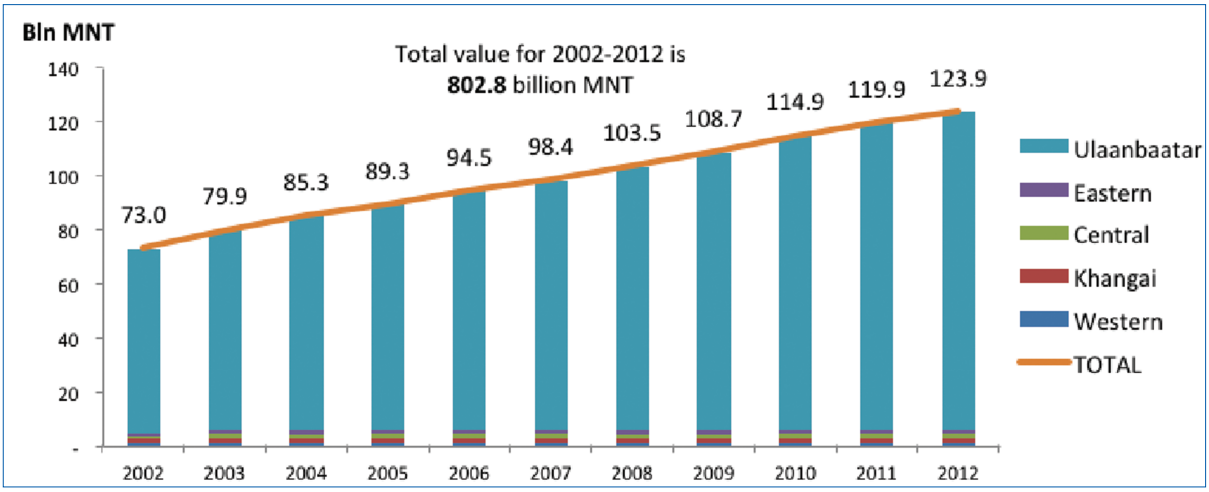
To estimate the total market value of drinkable water, the following was considered:

1. Ulaanbaatar residents drink water from groundwater sources; i.e., Tuul River basin (96.6%), (JIKA, 2008).
2. A weighted average of water value, stated in Water Value Government Resolution, in areas except Ulaanbaatar was applied (1,789 MNT or USD 1.36) (Appendix 1).
3. Number of people living UB
4. Number of people living in PAs/rural areas
5. Aggregated number of cubic meters consumed in PAs/rural areas
6. Aggregated number of cubic meter consumed in UB
7. Values are estimated by region.

Using these parameters, it is estimated the total economic benefit of drinkable water that originates from PAs in Mongolia increased from 73 billion MNT (USD 65.8 million) in 2002 to 123.9 billion MNT (USD 91.2 million) in 2012; and the total market (economic) value for the period from 2002 to 2012 is estimated at 1.09 trillion MNT (USD 802.8 million), with an average annual growth rate of 5.4% for this period. This is a low estimate because the prices used are below the real cost of water supply system. This trend is shown in Figure 27 below.

[28] In Annex 11 of the resolution of Government of Mongolia (2011), surface water value per cubic meter was **2,651 MNT (USD 1.95)**, and it is multiplied by **0.4** as a water equivalent for use of population using water, stated in Annex 4 of the same government resolution that is renewed in 2013. Then price per cubic meter was converted to per litre. The same approach was used for ground water value estimation, but water equivalent is **0.1** and water value per cubic meter was **9,440 MNT** or **USD 6.95** (Government of Mongolia 2011).

Figure 27. Estimated total market value of drinkable water that originates in PAs in Mongolia



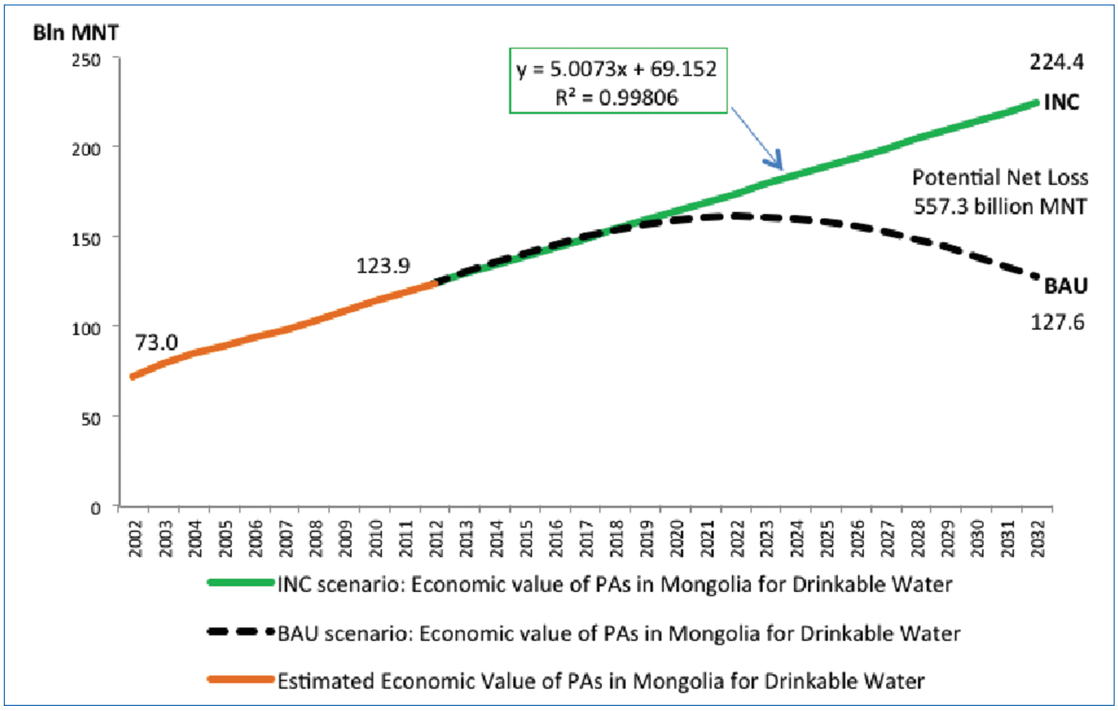
Source: Authors' estimation

BAU and INC scenarios in the drinkable water sector

In order to estimate the BAU scenario in the next 20 years, it is assumed that the annual growth of 5.4% (2002-2012) may decrease at 0.5%annually from 2013 to 2032, and the rate of decrease may vary in coming years depending on how severe the BAU would be in the future; no data was available for the study on future rates of decrease.

When applying the indicated decrease rate, the total economic market value of drinkable water from PAs in Mongolia would decrease from 123.9 billion MNT (91.2 million USD) in 2012 to 127.6 billion MNT (USD 93.9 million) in 2032. This is mainly due to unsustainable BAU water management matters such as: unplanned increasing water demand, collapsing water supply infrastructure, water pollution and sanitary issues due to poor maintenance and funding. The BAU and INC potential trends are illustrated in Figure 28 below.

Figure 28. Estimated potential loss and gain (market value of drinkable water) under BAU and INC scenarios



Source: Author's estimation

There is very small gain of BAU over INC in the short-term, between 2013 and 2017, because the economic benefit of BAU scenario is higher than INC. However, the economic benefit under BAU may decrease starting in 2018 and could reach 564.2 billion MNT (USD 415.1 million). The total loss under BAU between 2018 and 2032 may reach 557.3 billion MNT (410.0 million USD). This could be an important revenue loss for the GoM. This loss does not include the economic impact of water shortages in terms of productivity, health and other important factors. It merely refers to potential revenue.

Under INC, it is estimated that the economic benefit of drinkable water from PAs would increase more linearly. An average increase in a sustainable manner is about at a rate of 3.0% and its market value is stable at 1,789 MNT per cubic meter (USD 1.35). Therefore, the total economic benefit of drinkable water from PAs is estimated at 224.4 billion MNT (USD 165.1 million) by 2032.Based on these estimates, the above-indicated potential economic loss in the next years could be avoided by shifting from BAU to INC (increasing investment and management capacity for water infrastructure and ecosystems conservation). Supportive information related to the drinkable water sector is included in Annex 3.

4 CONCLUSIONS AND POLICY RECOMMENDATIONS

4.1 CONCLUSIONS

Despite the challenge of having limited information to the study, the evidence found shows that ecosystems services (ES) of PAs make a significant contribution to the Mongolian economy. However, ecosystems wear and tear after decades of ecosystems neglect under BAU practices are now visible. The study concludes that currently, there may be significant losses if BAU practices continue; and that the shift to INC could secure sustainable economic benefits at sector level. The shift to INC can pave the way to sustainable development in Mongolia. For example:

- With adequate investment in Nature-based tourism (NBT), NBT could become the subsector with the higher multiplier effect. Nevertheless, investment in INC nature-based tourism is lagging behind; there area no sutainable tourism strategy in Mongolia that includes ecosystems management. In the future, INC nature-based tourism may be the enabling factor to the establishment of a stronger economy in rural Mongolia and secure the livelihood for thousands of people lining in and around PAs. Further, the expansion of sustainable NBT could also contribute to reduce the negative impacts of livestock activities.
- Grasslands ecosystems are indispensable to sustain livestock and dairy production. This is central to support rural livelihoods. The economic benefits from livestock breeding, e.g. sheep and cow breeding, do not come without ecological damage, as is the case of erosion and overgrazing in the MNPAs.
- Rivers and streams originating in the MNPAS and the neighboring ecosystems play an important role in sustaining key economic sectors in Mongolia: mining, livestock and agriculture. These sectors are central to economic development, and poverty alleviation in Mongolia (sustainable development).
- Well managed watersheds in PAs are part of the solution to sustain water supply and meet future demand.
- Although MNPAS is considered under BAU management, PAs directly contributes to poverty alleviation and equity. These are key elements of sustainable development

Mining, Livestock and irrigated agriculture are the sectors with the highest output values. These are also the sectors that represent the major threats to ES of PAs and therefore a threat to the long-term economic output of other sectors such as NBT.

In this high-level TSA analysis, the estimated values represent, for example, value of sectoral output, in which an ecosystems service, such as fresh water or grasslands, is only one indispensable input. However, without this indispensable input, economic output will simply not be possible.

The economic benefit estimations contained in this report could significantly increase once more detailed sectoral baseline information is available. It is also important to note, that this study is not a total economic valuation (TEV); it is a high-level sector scenario analysis (TSA) as discussed in Section 2. The study did not include a sectoral policy and institutional analysis. However, key sectors were identified with the participation of government stakeholders.

Finally, the study concludes that a) It is sound for the Mongolian sustainable economic development to increase investment in ecosystems management; and b) ecosystems management policy reform is a priority for sustainable development. A mix of

both, increase public investment (fiscal policy) and management policy reform will provide an ideal path to follow.

4.2 RECOMMENDATIONS

A shift to INC will require substantial changes in legal and institutional frameworks that will gradually result in increasing quality of ecosystem services and socio-economic benefits. In addition to legal and institutional reform, enforcement and compliance is another critical element that must be considered under the INC institutional framework. Because policies are intertwined, single-sector policy analyses could of little use. The institutional and policy analysis could be harnessed in a policy mix package that could address multi sector policies that affect one sector. A policy mix package will map policies and prioritize policy reform needs to achieve a shift to INC. A policy reform strategy (policy mix reform) is indispensable in Mongolia.

The information in Table 19 next (policy overlaps) could be initially used to plan the scope of the policy mix reform, i.e., identifying key policy issues that require multi-sector policy reform to be resolved. A wide range of such issues is included in Table 34.

The information in the Table 34 shows that sectors like NBT is actually affected by most other sectoral policies; However, NBT is not the sector with the highest value (as per the findings of this report). Landscape pollution and capacity issues are critical to improve NBT and these aspects can de dealt with collaboration with the agriculture and livestock sectors, as well as mining. Therefore, working alone in NBT development policy may be fruitless unless critical aspects related to other sectors (agriculture, livestock, mining, and other sectors) are addressed.

For example, improving ecosystems management in the livestock and agriculture sectors will have a significant impact at advancing Mongolia's sustainable development strategy and improving NBT. Mining poses fewer threats to ES in PAs than agriculture and livestock. Policy reform in the livestock and agriculture sector are therefore a priority.

A detailed policy and institutional review is recommended to further define the policy links between the findings of this study and specific policies. This could be done, as mentioned, when Mongolia engages in the UNDP sponsored BIOFIN Project [29]. The participation in BIOFIN will also enable Mongolia to realign the Mongolian national Biodiversity Strategy and Action Plan (NBSAP) with sectoral sustainable development priorities. A short policy document could be prepared by combining the findings of this report and the results of the completion of BUIOFIN's institutional and policy review.

Additional general recommendations are included at the end of this section.

[1] In October 2012, UNDP launched the Biodiversity Finance Initiative (BIOFIN) as a new global partnership seeking to address the global biodiversity finance challenge in a comprehensive and systematic manner (see www.biodiversityfinance.net). The aim of this partnership is to enable governments to construct a sound business case for increased investment in the sustainable and equitable management, protection and restoration of biodiversity and ecosystems, including PAs. The BIOFIN approach comprises 4 parts: Part 1 focuses on reviewing biodiversity-related policies, institutions and expenditures; Part 2 focuses on calculating the costs of implementing each of the strategies within the revised NBSAP; Part 3 focuses on developing a resource mobilization plan (RMP); And Part 4 Implementation of the RMP.

Table 19. Key policy gaps and loopholes and overlaps

Mongolian Sectoral Policies Under BAU		Policy overlaps							
Sector	Key gaps /loopholes in Mongolian sector development policies that affect ES in PAs	NBT	Irrigated agriculture	Livestock	Forests	Mining	Water supply	Transport	Land zoning
NBT	Lack of regulation and enforcement on landscape pollution in and around main NBT attractions: garbage along roads leading to PAs, pollution from mining, deforestation, grassland degradation, water pollution in rivers and lakes.	◆	◆	◆	◆	◆	◆		◆
	Lack of visitation and visitor's safety programs.	◆							
	Limited access: limited domestic train and bus routes, poor road infrastructure; and low quality transport service and safety.	◆	◆	◆	◆	◆	◆	◆	
	Poor (basic) and limited hotels and sanitation infrastructure.	◆							
	Limited and poorly managed family owned accommodation and non-trained staff or poorly trained staff.	◆							
	Lack of information center, signs, trails, and information material; and limited web-based information.	◆							
	Water and electricity shortages.	◆	◆			◆	◆		
	Poor or no investment in PA's tourism infrastructure.	◆							
	Poor marketing and communications.	◆							
	Unplanned infrastructure (e.g. housing) being constructed in areas with NBT potential.	◆				◆			◆
	Lack of sustainable tourism strategy, fragmentation of potential destinations /packages (e.g. natural, adventure, winter, health).	◆							
	Underfunded PAs and lack of PA entry fees.	◆							
Irrigated agriculture	The 2008 3rd CRC (483.5 billion MNT or USD 414.7 million) excluded funding to support conservation management of ecosystems in PAs.	◆	◆	◆	◆		◆		◆
	Lack of ecosystems management policy/funding to address ecosystems degradation (poor extension services lack of on-site regulation for agro-business investment and development.	◆	◆	◆	◆		◆		
	Lack of on-site regulation for agro-business investment and development.	◆	◆	◆	◆		◆		◆
	Poorly planned and maintained irrigation infrastructure.	◆	◆				◆		
	Excessive use of pesticides and chemical fertilizers.	◆	◆				◆		◆
	Deforestation around river basins, in grasslands, and lack of silvo-pastoral systems.	◆	◆	◆	◆		◆		◆
	Water pollution	◆	◆	◆	◆	◆	◆		◆
	Unregulated and poorly managed land-use and zoning.	◆	◆	◆	◆	◆	◆		◆
	Funding and strategy to prepare for Dzud years.	◆	◆	◆					◆
Livestock	Lack of sustainable grassland management at national and Soum levels.	◆	◆	◆			◆		◆
	Lack of taxation/fees for grassland use.		◆	◆			◆		◆
	Special grassland use regulation around on water sites and villages.	◆	◆	◆			◆		◆
	Regulate and funding for law enforcement		◆	◆			◆		◆
	Lack of monitoring and reporting system on grassland conditions.		◆	◆	◆		◆		◆
Forests	Insufficient funding and investment for the forest protection including forest fire management (lack of sustainable forest management policy).	◆	◆	◆	◆		◆		◆
	Poor law enforcement: Increased number of forest fires and illegal logging	◆	◆	◆	◆		◆		◆
	Poor land use policy results in deforestation	◆	◆	◆	◆		◆		◆
	Linking PAs management with Climate Change management	◆	◆	◆	◆	◆	◆		◆
Mining	Limited or no investment in off-site fresh water conservation (surface and ground water sources)	◆	◆	◆	◆	◆	◆		◆
	Regulations of data collection on aquifers and rivers in SGR and other regions;	◆	◆	◆		◆	◆		◆
	Poorly regulated mine town development	◆				◆	◆		◆
	Financial incentives (environmental fines) and enforcement mechanisms to eliminate water pollution.	◆	◆	◆		◆	◆		◆
	Low water tariffs need revision; and limited water management regulation.					◆	◆		
	Lack of regulation on conservation of fresh in water sources (surface and ground water);	◆	◆	◆	◆	◆	◆		◆
	Poor regulation and enforcement of off-site water conservation and conservation in PAs.	◆	◆	◆	◆	◆	◆		◆
Fresh water	Unsustainable management of water sources	◆	◆	◆	◆	◆	◆		◆
	Unplanned increasing water demand in Urban areas	◆				◆	◆		◆
	Limited access to water in GER districts and rural areas	◆				◆	◆		◆
	Water pollution, poor treatment facilities	◆	◆			◆	◆		◆
	Increasing water born diseases due to low management water sanitation	◆	◆	◆	◆	◆	◆		◆
	Collapsing water supply system due to poor government investment and government regulated low water prices						◆		◆

GENERAL RECOMMENDATIONS:

- Establish an Ad hoc policy work group (with nonpartisan research institutions, local governments, sectoral ministries and private sector) to carry out policy mix assessment to support the introduction of ecosystem-based PA management programs at the MNPAS. This group may include environmental fiscal policy specialists; to assess policy reform needs in key economic sectors.
- Use the findings of this report to seek commitment from public and private sectors to introduce a phased, sector-based environmental fiscal reform (EFR)[30] package that will result from the policy mix assessment; including additional funding to PAs.
- Engage with BIOFIN. To this end, seek commitment of the Ministry of Economy and Finance and key sectoral authorities
- With BIOFIN support, introduce cost-effectiveness and a result-based budgeting system to PAs management; so that PAs could demonstrate return on investments; and develop an annual action plan and its cost; and seek funding to implement the action plan.
- In close cooperation with sector authorities and sector-based private enterprises, assess the feasibility and costs of establish a pilot INC Information System for the MNPAS to provide a timely flow of sector-level information to decision makers (public and private)
- Communicate the results of this TSA report valuations using conventional and virtual platforms. To this end, establish a communications support group formed with high-profile members of the society in Mongolia, who are willing to support ecosystems management and sustainable development (e.g., sportsmen, journalists, artist, scientists, and controversial individuals).
- Promote the creation of a PA business and valuation unit within the MEGD. This Unit could oversee the implementation all communications and the implementation of business plans for the PAs of the MNPAS; and, provide permanent reliable and updated information on ecosystems management vis-б-vis the impact of sector development policies and investments.
- As part of the shift from BAU to INC, develop agreements between grasslands and fresh water ecosystems' stakeholders to assess and eliminate inter-sector conflicts that could undermine productivity as a result from BAU practices.
- Conduct pastureland inventory and assess the carrying capacity, and introduce measures to promote rehabilitation of degraded pastures; and start pilot pasture restoration activities.

REFERENCES

Altansukh, O. (2014). Map of Soums Overlapped with Protected Areas in Mongolia. Ulaanbaatar.

Baranchuluun, B., Luvsanbud, T., Nandintsetseg, S., & Kenjegul, K. (2011). Development of Irrigated Agriculture. Ulaanbaatar: Ministry of Agriculture and Light Industry, FAO.

Basandorj, D., & Singh, S. (2009). Rural Water Supply and Sanitation in Mongolia. Ulaanbaatar. Retrieved from http://www.unicef.org/eapro/6_Mongolia_Rural_water_supply_and_sanitation.pdf

Batimaa, P., Myagmarjav, B., Batnasan, N., Jadambaa, N., & Khishigsuren, P. (2011). Urban Water Vulnerability to Climate Change in Mongolia. Ulaanbaatar.

Didier, K., & Lkhamjav, O. (2009). The Potential for Intensive Crop Production in the Eastern Steppe of Mongolia: History, Current Status, Government Plans, and Potential Impacts on Biodiversity. Current. USAID.

Emerton, L., Erdenesaikhan, N., Bastiaan, D. V., Tsogoo, D., Janchivdorj, L., Suvd, P., ... Enkhbaatar, A. (2009). Mongolia-The Economic Value of the Upper Tuul Ecosystem. Sustainable Development (pp. 1–108). Washington, D.C.

Fernández-Giménez, M. E., Batkhishig, B., & Batbuyan, B. (2012). Lessons from the Dzud : Adaptation and Resilience in Mongolian Pastoral.

Government of Mongolia. "АТРЫН ГУРАВ ДАХЬ АЯН"-ТАРИАЛАНГИЙН ХӨГЖЛИЙН УНДЭСНИЙ ХӨТӨЛБӨР (2008). Монгол улс.

Government of Mongolia. Resolution of Government of Mongolia No 302: Re-approval of Ecological and Economic Value of Water. , Pub. L. No. 302/2011 (2011). Mongolia.

JIKA. (2008). The Study on City Master Plan and Urban Development of Ulaanbaatar City (UBMPS). Ulaanbaatar.

Ministry of Industry and Agriculture. (2013). Annual Report of Irrigated Agriculutre. Ulaanbaatar.

National Statistical Office of Mongolia. (2012). First State Census of Agriculture in 2011. Ulaanbaatar.

National Statistical Office of Mongolia. (2013). Section 24. Environment. In Statistical Yearbook 2012. Ulaanbaatar: NSO.

National Statistical Office of Mongolia. (2014a). Mongolian Statistical Information Service. Statistical Information: by Sector. Retrieved from www.1212.mn

National Statistical Office of Mongolia. (2014b). Monthly Average Wages and Salaries, by divisions, sex, quarter. Retrieved from www.1212.mn

National Statistical Office of Mongolia. (2014c). The Unpublished Raw Data from NSO for SPAN project. Ulaanbaatar.

National Statistical Office of Mongolia. (2014d). Total Number of Livestock. Retrieved from http://1212.mn/contents/stats/contents_stat_fld_tree_html.jsp

ReliefWeb. (2010). Mongolia: Severe Winter - Dzud (Jun 2010). Retrieved from http://reliefweb.int/sites/reliefweb.int/files/resources/4E597847D9F7CD5685257751007620DC-SS-2010-MNG_0623.pdf

UN-Water Web. (2013). Mongolia: UN-Water Country Brief.

ANNEXES

ANNEX 1. METHODOLOGY TO ESTIMATE KEY SECTORAL VALUES

Sectors and subsectors	Method
1. Nature-based tourism	The estimation was done spending per tourist multiplied by number of visitors in PAs. Existing capacity of hotels in terms of bed is 34% currently under BAU, but it will increase up to 75% under INC scenario.
2. Irrigated agriculture (aggregated value)	Sum of net income of producing agricultural products, and benefit of creating jobs, plus other benefits such as tax income into budget, insurance and loan interest revenue for banks etc.
• Subsectors: hay, fodder, cereals, rapeseed, vegetables, and fruit.	Produced quantity of each product was multiplied by the market price. Then these are aggregated to estimate total income of agricultural production. Then, percentage of cost (NSO, 2012) in total income of production was used to estimate total cost. Total cost is deducted from the total income in order to estimate the net income in PAs overlapped 189 soums and 4 districts in Ulaanbaatar city.
3. Livestock (aggregated value)	Sum of net income of producing livestock products, and benefit of creating jobs, plus other benefits such as tax income into budget, insurance and loan interest revenue for banks etc.
• Subsectors: meat, hides, milk, cashmere, and wool.	Produced quantity of each product was multiplied by the market price. Then these are aggregated to estimate total income of agricultural production. Then, percentage of cost (NSO, 2012) in total income of production was used to estimate total cost. Total cost is deducted from the total income in order to estimate the net income in PAs overlapped 189 soums and 4 districts in Ulaanbaatar city.
4. Fresh Water Supply	Water consumption was estimated in two ways in 189 soums and 4 districts: 1) Water consumption in areas not connected to central water supply system (4 districts in Ulaanbaatar city, and soums in province centres); 2) areas connected to central water supply system. Then estimated water consumption was multiplied by ecological and economic value of water, approved by Government Resolution. The ecologic and economic value of water are given by all 29 water basins for ground and underground water, but the weighted average of the value per liter of water was estimated.

ANNEX 2. LIVESTOCK SECTOR SUPPORT INFORMATION

Annex Table 2.1. Total Number of Livestock in PAs overlapped Soums (Million heads)

Livestock	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Goat	Western	2.44	2.99	3.52	3.75	4.47	5.08	5.01	4.37	3.13	3.57	3.92
	Khangai	1.15	1.36	1.63	1.80	2.16	2.63	3.07	3.20	2.29	2.51	2.79
	Central	0.76	1.24	1.43	1.53	1.58	1.91	2.21	2.39	1.49	1.75	1.96
	Eastern	0.95	0.75	0.79	0.87	1.01	1.23	1.32	1.36	1.19	1.28	1.33
	Ulaanbaatar	0.03	0.03	0.03	0.03	0.04	0.05	0.08	0.08	0.04	0.04	0.04
	Total	**5.33**	**6.36**	**7.41**	**7.99**	**9.26**	**10.91**	**11.69**	**11.41**	**8.14**	**9.16**	**10.05**
Sheep	Western	2.37	2.48	2.81	3.09	3.61	4.00	3.89	3.60	2.49	2.70	3.18
	Khangai	1.36	1.30	1.47	1.65	1.97	2.33	2.67	2.93	2.32	2.38	2.80
	Central	0.90	1.03	1.08	1.16	1.22	1.41	1.60	1.81	1.29	1.42	1.60
	Eastern	1.13	1.13	1.17	1.26	1.39	1.57	1.65	1.76	1.66	1.70	1.81
	Ulaanbaatar	0.03	0.03	0.03	0.03	0.04	0.04	0.07	0.08	0.04	0.04	0.05
	Total	**5.80**	**5.98**	**6.58**	**7.20**	**8.24**	**9.35**	**9.89**	**10.18**	**7.80**	**8.23**	**9.44**
Cattle	Western	0.28	0.29	0.31	0.34	0.38	0.42	0.40	0.36	0.26	0.30	0.34
	Khangai	0.46	0.41	0.43	0.46	0.51	0.58	0.63	0.67	0.55	0.58	0.63
	Central	0.13	0.13	0.13	0.14	0.14	0.16	0.19	0.21	0.18	0.24	0.21
	Eastern	0.27	0.27	0.26	0.27	0.28	0.30	0.29	0.30	0.29	0.30	0.32
	Ulaanbaatar	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.04	0.04
	Total	**1.15**	**1.12**	**1.16**	**1.23**	**1.35**	**1.50**	**1.54**	**1.58**	**1.32**	**1.45**	**1.54**
Horse	Western	0.26	0.27	0.28	0.29	0.33	0.36	0.34	0.32	0.24	0.27	0.29
	Khangai	0.33	0.31	0.31	0.32	0.34	0.36	0.38	0.40	0.34	0.37	0.41
	Central	0.17	0.19	0.20	0.20	0.19	0.20	0.20	0.21	0.19	0.21	0.23
	Eastern	0.31	0.32	0.32	0.32	0.33	0.34	0.30	0.29	0.30	0.32	0.34
	Ulaanbaatar	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Total	**1.07**	**1.09**	**1.12**	**1.14**	**1.19**	**1.26**	**1.23**	**1.24**	**1.08**	**1.18**	**1.29**
Camel	Western	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.06
	Khangai	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
	Central	0.03	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09
	Eastern	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.12**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.18**	**0.18**	**0.18**	**0.20**
TOTAL		**13.48**	**14.71**	**16.42**	**17.72**	**20.20**	**23.18**	**24.53**	**24.58**	**18.51**	**20.20**	**22.52**

Annex Table 2.2. Meat Production in PAs overlapped Soums (000 Tons)

Meat type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Goat Meat	Western	5.8	7.2	8.3	10.7	11.5	12.5	13.7	16.5	13.0	8.0	9.0
	Khangai	4.2	2.9	4.2	4.6	4.4	5.2	6.3	11.7	10.1	8.6	11.4
	Central	2.4	3.1	4.0	5.1	5.5	4.3	5.1	7.2	6.0	4.9	5.6
	Eastern	2.3	1.2	1.5	1.9	1.7	1.6	1.8	2.5	2.7	2.0	2.1
	Ulaanbaatar	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1
	Total	**14.8**	**14.5**	**18.1**	**22.3**	**23.1**	**23.6**	**27.1**	**38.2**	**31.9**	**23.7**	**28.3**
Mutton	Western	13.9	11.7	11.9	11.8	12.9	15.9	17.3	18.5	15.2	11.7	9.6
	Khangai	11.4	7.5	7.6	7.3	6.6	8.5	9.5	13.6	14.1	14.4	13.9
	Central	5.7	5.6	5.2	5.2	5.5	5.1	5.3	5.9	6.3	6.0	5.4
	Eastern	3.4	2.9	2.7	3.1	2.5	3.0	3.1	3.6	4.2	3.8	3.2
	Ulaanbaatar	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.1
	Total	**34.5**	**27.8**	**27.6**	**27.5**	**27.6**	**32.6**	**35.5**	**41.9**	**40.0**	**36.0**	**32.3**
Beef	Western	8.5	7.7	7.9	7.7	7.4	8.1	10.8	10.0	8.2	5.6	6.0
	Khangai	20.0	12.5	12.0	12.0	10.0	10.3	12.7	15.5	13.8	15.0	14.9
	Central	4.3	3.0	3.2	3.6	3.4	2.8	3.4	3.0	4.0	4.7	5.4
	Eastern	5.1	4.0	3.9	4.1	3.3	3.4	3.7	3.8	3.9	3.5	3.6
	Ulaanbaatar	0.6	0.4	0.5	0.5	0.4	0.4	0.8	0.8	0.9	0.8	0.8
	Total	**38.5**	**27.7**	**27.4**	**28.0**	**24.6**	**25.1**	**31.4**	**33.1**	**30.7**	**29.7**	**30.7**
Horse Meat	Western	4.4	4.1	4.3	4.5	4.2	4.3	5.8	5.8	4.6	2.7	3.0
	Khangai	8.3	3.3	6.3	6.7	5.4	6.0	5.5	7.6	5.9	6.8	7.8
	Central	3.3	2.0	3.0	3.9	4.3	2.5	2.5	2.2	2.4	2.6	2.6
	Eastern	3.0	2.2	2.7	3.0	2.4	2.3	2.3	2.1	2.1	1.9	1.9
	Ulaanbaatar	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2
	Total	**19.0**	**11.6**	**16.4**	**18.2**	**16.5**	**15.1**	**16.1**	**17.8**	**15.2**	**14.1**	**15.5**
Camel Meat	Western	2.1	1.5	1.7	1.6	1.5	1.3	1.8	1.5	1.4	1.1	0.9
	Khangai	0.7	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.4
	Central	1.3	2.1	2.5	2.7	2.5	2.3	2.6	2.3	2.1	2.4	2.4
	Eastern	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
	Ulaanbaatar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**4.3**	**4.2**	**4.7**	**4.7**	**4.4**	**4.0**	**4.7**	**4.3**	**4.1**	**4.1**	**3.8**
	TOTAL	**111.1**	**85.7**	**94.1**	**100.7**	**96.3**	**100.3**	**114.7**	**135.3**	**122.0**	**107.6**	**110.5**

Annex Table 2.3. Price of Livestock products in PAs overlapped Soums (MNT)

Product	Livestock	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Meat (MNT/ KG)	Goat	718	829	1,020	1,226	1,361	1,626	1,916	1,772	2,454	3,380	4,693
	Sheep	892	1,021	1,322	1,689	1,811	2,115	2,377	2,300	3,186	4,021	5,445
	Cattle	980	1,094	1,408	1,789	1,855	2,192	2,500	2,461	3,481	4,666	6,038
	Horse	744	853	1,096	1,293	1,429	1,749	1,916	1,938	2,826	3,722	4,744
	Camel	595	690	815	1,004	1,232	1,579	1,825	2,110	2,947	3,313	4,247
Hides (MNT/ Unit)	Goat	4,285	5,717	6,909	7,544	9,546	9,866	7,630	9,282	12,201	13,571	14,005
	Sheep	4,021	6,119	5,627	3,843	4,015	5,312	4,240	4,475	6,445	9,845	9,258
	Cattle	9,377	16,416	16,508	15,752	17,695	20,676	15,721	13,146	14,412	19,669	24,577
	Horse	10,259	13,918	15,248	17,089	19,116	22,896	17,432	15,030	18,121	25,623	30,633
	Camel	4,636	4,905	5,617	6,474	10,910	11,149	11,413	9,360	9,689	11,987	10,924
Wool (MNT/ KG)	Sheep	148	165	227	294	302	323	343	355	446	555	614
	Camel	1,104	1,133	1,318	1,330	1,576	1,925	2,804	2,855	3,699	4,284	5,262
Cow Milk (MNT/L)		459	547	594	626	645	831	1,043	1,111	1,220	1,190	1,307
Goat Cashmere (MNT/ KG		17,136	17,992	23,029	26,637	24,950	23,982	24,666	24,739	39,325	44,945	42,619

Annex Table 2.4. Economic Value of Meat Production in PAs overlapped Soums (Bln MNT)

Meat type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Goat Meat	Western	4.3	6.2	8.6	12.8	16.3	20.9	22.9	23.8	36.2	31.8	42.9
	Khangai	2.9	2.3	4.2	5.3	5.8	8.3	12.8	21.1	24.0	27.7	55.6
	Central	1.8	2.6	4.2	6.4	8.3	8.1	10.8	13.7	14.9	16.6	27.0
	Eastern	1.6	0.9	1.3	2.0	2.1	2.5	3.6	5.7	6.9	6.6	10.8
	Ulaanbaatar	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.5	0.4	0.5
	Total	**10.6**	**12.1**	**18.4**	**26.6**	**32.7**	**40.0**	**50.5**	**64.9**	**82.5**	**83.1**	**136.9**
Mutton	Western	13.3	12.4	15.0	19.7	23.6	32.8	35.2	39.9	60.7	51.7	54.9
	Khangai	9.0	7.2	9.6	12.8	12.8	19.5	24.0	31.9	42.6	53.8	80.8
	Central	5.2	5.6	7.1	9.7	10.8	11.6	14.3	14.4	19.4	23.7	31.0
	Eastern	3.1	2.7	3.5	4.5	4.4	6.2	7.9	8.6	12.8	14.8	17.0
	Ulaanbaatar	0.2	0.1	0.2	0.2	0.2	0.3	0.6	0.8	0.8	0.7	0.9
	Total	**30.7**	**28.1**	**35.4**	**46.9**	**51.9**	**70.4**	**82.0**	**95.6**	**136.3**	**144.7**	**184.6**
Beef	Western	8.6	8.5	10.5	13.6	13.2	17.5	23.0	23.4	27.4	27.0	36.0
	Khangai	14.8	11.0	15.2	19.5	18.9	23.2	32.5	38.6	45.3	63.8	90.5
	Central	4.4	3.2	5.0	7.6	7.2	6.9	9.8	7.8	15.0	22.8	36.0
	Eastern	4.7	3.9	4.7	6.3	5.8	7.3	10.1	9.0	12.9	16.2	22.1
	Ulaanbaatar	0.6	0.5	0.7	0.9	0.8	1.0	2.1	2.6	3.9	4.3	5.5
	Total	**33.1**	**27.1**	**36.1**	**47.9**	**45.9**	**55.9**	**77.6**	**81.4**	**104.4**	**134.1**	**190.0**
Horse Meat	Western	3.8	3.9	5.1	6.1	6.5	8.5	10.7	11.2	14.7	11.6	14.9
	Khangai	4.1	1.9	5.1	7.7	7.7	10.5	10.7	13.8	15.4	22.9	38.3
	Central	2.5	1.7	3.4	5.2	7.2	4.6	5.4	4.7	6.5	9.1	12.7
	Eastern	2.1	1.7	2.6	3.3	3.1	3.8	4.6	4.0	5.1	6.5	9.1
	Ulaanbaatar	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.5	0.8
	Total	**12.6**	**9.2**	**16.4**	**22.4**	**24.6**	**27.5**	**31.6**	**34.1**	**42.3**	**50.7**	**75.9**
Camel Meat	Western	1.3	1.2	1.5	1.7	1.9	2.0	3.0	3.3	4.3	3.5	4.0
	Khangai	0.4	0.3	0.4	0.3	0.3	0.4	0.5	0.8	1.5	1.7	1.7
	Central	0.8	1.5	2.0	2.7	3.1	3.7	5.0	4.8	5.7	7.9	9.1
	Eastern	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2
	Ulaanbaatar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	**2.6**	**3.0**	**4.0**	**4.8**	**5.5**	**6.3**	**8.6**	**9.1**	**11.7**	**13.3**	**15.0**
Sub-Total		**89.6**	**79.5**	**110.2**	**148.6**	**160.6**	**200.0**	**250.2**	**285.0**	**377.3**	**425.9**	**602.3**
TOTAL (2002-2012)							**2,729.4**					

Annex Table 2.5. Milk production in PAs overlapped Soums in Mongolia (000 Tons)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	62.1	64.1	69.8	69.9	73.8	82.6	78.1	67.2	50.0	59.9	64.8
Khangai	70.7	39.9	45.1	53.7	59.1	71.4	78.5	80.2	69.0	71.7	74.8
Central	43.0	40.6	39.8	41.8	42.3	48.5	51.8	50.3	41.6	51.8	46.9
Eastern	28.2	25.8	25.2	25.1	26.0	28.1	26.2	26.7	26.3	26.4	27.4
Ulaanbaatar	3.4	2.9	3.4	3.8	3.8	4.4	6.3	6.2	5.9	6.4	6.3
TOTAL	**207.5**	**173.4**	**183.4**	**194.3**	**205.1**	**235.1**	**241.0**	**230.5**	**192.7**	**216.2**	**220.2**

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.6. Economic Value of Milk production in PAs overlapped Soums in Mongolia (Billion MNT)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	33.5	45.7	62.1	66.8	76.3	103.5	110.7	96.4	70.3	74.2	99.0
Khangai	24.9	17.6	20.1	22.6	25.4	38.5	52.2	69.1	73.6	71.1	90.2
Central	19.8	20.9	21.6	23.5	24.7	41.4	59.3	59.4	54.1	62.0	58.9
Eastern	12.4	13.9	14.3	15.0	16.1	21.4	26.1	29.5	30.2	30.6	34.2
Ulaanbaatar	1.6	1.6	2.0	2.4	2.4	3.7	6.5	6.6	6.9	7.4	8.0
Sub-Total	**92.2**	**99.7**	**120.1**	**130.4**	**144.9**	**208.5**	**254.9**	**261.1**	**235.1**	**245.4**	**290.3**
TOTAL (2002-2012)					**2,082.4**						

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.7. Cashmere production in PAs overlapped Soums in Mongolia (000 Tons)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	0.63	0.82	0.97	1.02	1.31	1.33	1.50	1.30	0.96	0.99	1.11
Khangai	0.30	0.36	0.43	0.48	0.56	0.69	0.81	0.82	0.64	0.68	0.73
Central	0.21	0.33	0.40	0.48	0.46	0.51	0.59	0.68	0.61	0.55	1.17
Eastern	0.30	0.25	0.27	0.29	0.34	0.41	0.43	0.45	0.39	0.42	0.43
Ulaanbaatar	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01
TOTAL	**1.45**	**1.77**	**2.07**	**2.28**	**2.68**	**2.96**	**3.36**	**3.27**	**2.61**	**2.65**	**3.46**

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.8. Economic Value of Cashmere Production in PAs overlapped Soums in Mongolia (Billion MNT)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	14.1	19.0	28.2	33.2	35.6	32.2	40.0	35.8	41.6	46.6	50.7
Khangai	4.8	6.4	9.8	13.3	15.2	19.9	23.1	26.6	27.1	33.6	35.1
Central	3.9	6.0	9.3	12.2	11.9	13.1	14.6	15.8	25.0	26.4	48.9
Eastern	4.2	3.3	3.8	4.8	6.1	7.3	7.4	6.3	12.6	15.5	14.2
Ulaanbaatar	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5	0.4	0.5	0.5
Sub-Total	**27.2**	**34.8**	**51.3**	**63.8**	**69.1**	**72.8**	**85.6**	**85.0**	**106.7**	**122.7**	**149.4**
TOTAL (2002-2012)					**868.5**						

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.9. Wool Production in PAs overlapped Soums (000 Tons)

Wool type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sheep Wool	Western	3.94	3.39	3.73	3.80	4.38	4.55	4.81	4.64	3.55	3.45	4.18
	Khangai	1.85	1.79	1.81	1.89	2.28	2.67	3.09	3.16	2.78	2.91	3.09
	Central	1.16	1.35	1.33	1.28	1.44	1.53	1.79	2.04	1.67	1.61	1.95
	Eastern	1.48	1.45	1.47	1.55	1.72	1.92	2.07	2.21	2.08	2.09	2.27
	Ulaanbaatar	0.05	0.04	0.04	0.04	0.04	0.05	0.09	0.09	0.05	0.05	0.06
	Total	**8.49**	**8.02**	**8.38**	**8.56**	**9.87**	**10.73**	**11.85**	**12.14**	**10.14**	**10.11**	**11.55**
Camel Wool	Western	0.28	0.26	0.26	0.23	0.24	0.24	0.24	0.24	0.25	0.22	0.25
	Khangai	0.09	0.10	0.10	0.10	0.10	0.11	0.12	0.13	0.14	0.14	0.15
	Central	0.09	0.28	0.24	0.23	0.23	0.23	0.24	0.36	0.34	0.33	0.37
	Eastern	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.52**	**0.70**	**0.66**	**0.63**	**0.63**	**0.64**	**0.65**	**0.79**	**0.78**	**0.74**	**0.81**
TOTAL		**9.01**	**8.72**	**9.03**	**9.19**	**10.50**	**11.36**	**12.51**	**12.93**	**10.91**	**10.85**	**12.37**

Annex Table 2.10. Economic value of Wool Production in PAs overlapped Soums (Bln MNT)

Wool type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sheep Wool	Western	0.52	0.56	0.77	1.08	1.14	1.25	1.49	1.53	1.58	1.81	2.46
	Khangai	0.24	0.29	0.41	0.52	0.67	0.84	1.05	1.10	1.27	1.52	1.88
	Central	0.21	0.24	0.33	0.38	0.53	0.60	0.81	0.93	0.80	0.97	1.26
	Eastern	0.17	0.16	0.22	0.36	0.44	0.56	0.57	0.62	0.76	1.12	1.27
	Ulaanbaatar	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.02	0.03	0.04
	Total	**1.15**	**1.26**	**1.75**	**2.35**	**2.81**	**3.27**	**3.95**	**4.21**	**4.43**	**5.45**	**6.91**
Camel Wool	Western	0.28	0.27	0.33	0.30	0.40	0.38	0.68	0.70	0.93	0.94	1.27
	Khangai	0.20	0.20	0.22	0.23	0.25	0.29	0.36	0.45	0.60	0.66	0.75
	Central	0.09	0.30	0.32	0.30	0.35	0.43	0.65	0.98	1.21	1.39	2.16
	Eastern	0.06	0.07	0.07	0.07	0.08	0.13	0.17	0.16	0.19	0.21	0.22
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.63**	**0.84**	**0.94**	**0.90**	**1.08**	**1.22**	**1.86**	**2.29**	**2.94**	**3.21**	**4.41**
Sub-Total		**1.78**	**2.10**	**2.69**	**3.25**	**3.88**	**4.49**	**5.80**	**6.50**	**7.36**	**8.66**	**11.32**
TOTAL (2002-2012)							**57.82**					

Annex Table 2.11. Total Hide Production in PAs overlapped Soums (Million Units)

Hide type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Goat	Western	0.40	0.37	0.45	0.54	0.55	0.61	0.71	0.85	0.73	0.43	0.48
	Khangai	0.21	0.17	0.22	0.24	0.23	0.25	0.31	0.52	0.44	0.38	0.41
	Central	0.13	0.17	0.22	0.28	0.29	0.26	0.30	0.29	0.32	0.24	0.25
	Eastern	0.17	0.11	0.14	0.16	0.15	0.14	0.16	0.23	0.22	0.18	0.19
	Ulaanbaatar	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
	Total	**0.92**	**0.82**	**1.04**	**1.23**	**1.22**	**1.27**	**1.49**	**1.90**	**1.71**	**1.23**	**1.33**
Sheep	Western	0.83	0.59	0.50	0.48	0.53	0.63	0.69	0.72	0.65	0.47	0.40
	Khangai	0.35	0.27	0.27	0.27	0.24	0.31	0.35	0.45	0.47	0.46	0.40
	Central	0.23	0.22	0.21	0.20	0.22	0.21	0.21	0.20	0.23	0.23	0.19
	Eastern	0.23	0.21	0.21	0.23	0.21	0.23	0.24	0.28	0.29	0.29	0.26
	Ulaanbaatar	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
	Total	**1.64**	**1.30**	**1.20**	**1.18**	**1.21**	**1.39**	**1.51**	**1.67**	**1.65**	**1.46**	**1.25**
Cattle	Western	0.07	0.05	0.05	0.04	0.05	0.05	0.06	0.06	0.05	0.03	0.03
	Khangai	0.08	0.06	0.05	0.05	0.04	0.05	0.06	0.07	0.06	0.06	0.06
	Central	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.04
	Eastern	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	Total	**0.22**	**0.17**	**0.16**	**0.15**	**0.15**	**0.15**	**0.19**	**0.19**	**0.17**	**0.16**	**0.18**
Horse	Western	0.05	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
	Khangai	0.04	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03
	Central	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.01	0.02	0.02
	Eastern	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.15**	**0.09**	**0.11**	**0.12**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.10**	**0.10**
Camel	Western	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00
	Khangai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Central	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Eastern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**
	TOTAL	**2.95**	**2.40**	**2.53**	**2.69**	**2.71**	**2.93**	**3.31**	**3.88**	**3.65**	**2.97**	**2.87**

Annex Table 2.12. Economic Value of Hide Production in PAs overlapped Soums (Bln MNT)

Meat type	Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Goat	Western	1.93	2.33	3.67	4.10	5.63	6.50	6.28	8.92	9.36	6.22	6.61
	Khangai	0.93	1.03	1.45	1.94	2.60	2.67	2.14	5.77	6.35	5.87	7.59
	Central	0.46	0.83	1.41	1.90	2.28	2.34	1.97	2.17	3.78	3.47	3.31
	Eastern	0.74	0.56	0.85	1.18	1.28	1.22	1.14	1.78	2.37	2.04	2.49
	Ulaanbaatar	0.02	0.03	0.04	0.05	0.07	0.07	0.10	0.16	0.13	0.10	0.11
	Total	**4.08**	**4.77**	**7.42**	**9.17**	**11.85**	**12.80**	**11.63**	**18.81**	**22.00**	**17.70**	**20.10**
Sheep	Western	3.63	3.53	2.59	1.97	2.25	3.45	3.14	3.65	4.27	4.17	3.53
	Khangai	1.45	2.07	1.67	1.16	1.15	1.79	1.43	2.16	3.49	4.92	3.82
	Central	0.95	1.33	1.27	0.70	0.66	1.05	0.88	0.96	1.39	2.57	1.92
	Eastern	0.71	0.83	0.84	0.77	0.74	0.95	0.87	0.98	1.53	2.41	2.14
	Ulaanbaatar	0.04	0.04	0.04	0.02	0.02	0.04	0.05	0.07	0.07	0.09	0.07
	Total	**6.78**	**7.79**	**6.41**	**4.62**	**4.82**	**7.29**	**6.38**	**7.82**	**10.76**	**14.15**	**11.48**
Cattle	Western	0.65	0.83	0.72	0.61	0.70	0.86	0.83	0.72	0.67	0.62	0.78
	Khangai	0.76	1.13	0.92	0.84	0.88	1.03	0.90	0.99	0.92	1.36	1.74
	Central	0.25	0.37	0.40	0.31	0.47	0.55	0.43	0.22	0.34	0.56	1.06
	Eastern	0.39	0.46	0.50	0.57	0.46	0.55	0.54	0.43	0.44	0.71	0.88
	Ulaanbaatar	0.04	0.05	0.05	0.06	0.05	0.07	0.09	0.07	0.09	0.11	0.14
	Total	**2.09**	**2.84**	**2.59**	**2.39**	**2.57**	**3.06**	**2.78**	**2.43**	**2.46**	**3.36**	**4.60**
Horse	Western	0.57	0.39	0.42	0.44	0.47	0.59	0.58	0.52	0.63	0.47	0.56
	Khangai	0.41	0.26	0.45	0.62	0.63	0.80	0.48	0.64	0.58	0.82	1.16
	Central	0.20	0.20	0.31	0.37	0.44	0.37	0.30	0.14	0.21	0.42	0.50
	Eastern	0.36	0.35	0.48	0.54	0.49	0.59	0.49	0.40	0.44	0.65	0.85
	Ulaanbaatar	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	Total	**1.54**	**1.21**	**1.67**	**1.98**	**2.05**	**2.36**	**1.86**	**1.72**	**1.88**	**2.39**	**3.10**
Camel	Western	0.04	0.03	0.03	0.03	0.05	0.05	0.06	0.05	0.05	0.04	0.04
	Khangai	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.02
	Central	0.02	0.04	0.05	0.07	0.09	0.10	0.12	0.05	0.06	0.09	0.08
	Eastern	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Ulaanbaatar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.08**	**0.08**	**0.10**	**0.12**	**0.17**	**0.18**	**0.21**	**0.12**	**0.15**	**0.18**	**0.15**
Sub-Total		**14.56**	**16.69**	**18.19**	**18.27**	**21.45**	**25.69**	**22.86**	**30.90**	**37.24**	**37.78**	**39.44**
TOTAL (2002-2012)							**283.1**					

Annex Table 2.13. Economic Value of Total Livestock Production in PAs overlapped Soums in Mongolia, by types (bln MNT)щ

Product type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Meat	89.6	79.5	110.2	148.6	160.6	200.0	250.2	285.0	377.3	425.9	602.3
Milk	92.2	99.7	120.1	130.4	144.9	208.5	254.9	261.1	235.1	245.4	290.3
Cashmere	27.2	34.8	51.3	63.8	69.1	72.8	85.6	85.0	106.7	122.7	149.4
Wool	1.8	2.1	2.7	3.2	3.9	4.5	5.8	6.5	7.4	8.7	11.3
Hides	14.6	16.7	18.2	18.3	21.4	25.7	22.9	30.9	37.2	37.8	39.4
Sub-Total	**225.4**	**232.8**	**302.5**	**364.2**	**400.0**	**511.4**	**619.4**	**668.5**	**763.8**	**840.4**	**1,092.8**
TOTAL (2002-2012)					**6,021.2**						

Annex Table 2.14. Total Economic Value of Total Livestock Production in PAs overlapped Soums in Mongolia, by regions (Bln MNT)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	86.5	104.8	139.7	162.4	184.1	230.5	258.7	249.9	272.6	260.7	317.7
Khangai	65.0	51.6	69.4	86.8	92.4	127.7	162.1	213.1	242.7	289.8	409.2
Central	40.4	44.8	56.7	71.3	77.9	94.8	124.3	126.0	148.5	178.0	233.8
Eastern	30.7	29.0	33.2	39.5	41.4	52.6	63.7	67.5	86.6	97.6	115.5
Ulaanbaatar	2.7	2.6	3.4	4.2	4.2	5.8	10.6	12.0	13.4	14.3	16.6
Sub-Total	**225.4**	**232.8**	**302.5**	**364.2**	**400.0**	**511.4**	**619.4**	**668.5**	**763.8**	**840.4**	**1,092.8**
TOTAL (2002-2012)					**6,021.2**						

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.15. Net Economic Value of Total Livestock Production in PAs overlapped Soums in Mongolia, by regions (bln MNT)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	62.7	76.0	101.3	117.8	133.5	159.3	169.9	155.7	160.6	153.6	187.1
Khangai	47.1	37.4	50.3	63.0	67.0	88.2	106.5	132.8	143.0	170.7	241.0
Central	29.3	32.5	41.1	51.7	56.5	65.5	81.6	78.5	87.4	104.9	137.7
Eastern	22.3	21.0	24.1	28.6	30.0	36.4	41.9	42.1	51.0	57.5	68.0
Ulaanbaatar	2.0	1.9	2.5	3.0	3.0	4.0	7.0	7.4	7.9	8.4	9.8
Sub-Total	**163.4**	**168.8**	**219.3**	**264.1**	**290.0**	**353.4**	**406.9**	**416.5**	**449.9**	**495.0**	**643.6**
TOTAL (2002-2012)				**3,870.9**							

Source: National Statistical Office of Mongolia (2012, 2014c), authors' estimation

Annex Table 2.16. Total Number of herder households who live in PAs in Mongolia (000 households)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	36.0	36.0	36.0	35.8	36.6	36.4	34.6	32.7	30.8	29.5	27.9
Khangai	35.4	35.7	33.0	32.7	33.0	33.5	33.8	34.1	33.0	31.5	30.2
Central	12.1	16.5	15.5	15.4	15.5	16.0	16.4	16.7	15.8	15.6	14.5
Eastern	17.9	14.9	14.2	14.0	14.1	14.2	13.8	13.9	14.9	14.3	13.0
Ulaanbaatar	0.8	0.7	0.7	0.6	0.7	0.7	1.0	1.0	0.8	0.8	0.7
TOTAL	**102.3**	**103.9**	**99.4**	**98.5**	**100.0**	**100.9**	**99.7**	**98.3**	**95.3**	**91.6**	**86.4**

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Annex Table 2.17. Total Number of working force employed full time in livestock farming who live in PAs in Mongolia (000 people)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	72.1	72.0	71.9	71.6	73.2	72.8	69.3	65.5	61.6	59.0	55.9
Khangai	70.8	71.4	66.0	65.4	66.0	67.0	67.6	68.1	66.0	63.0	60.4
Central	24.2	33.1	31.0	30.7	31.0	32.0	32.8	33.3	31.5	31.2	29.0
Eastern	35.8	29.8	28.5	28.0	28.3	28.4	27.7	27.7	29.8	28.5	26.1
Ulaanbaatar	1.7	1.5	1.3	1.3	1.4	1.4	2.0	1.9	1.6	1.5	1.4
TOTAL	**204.6**	**207.8**	**198.8**	**197.0**	**199.9**	**201.7**	**199.3**	**196.6**	**190.5**	**183.2**	**172.8**

Source: National Statistical Office of Mongolia (2014d), authors' estimation

Note: On average there are 2 people per herder household employed as a full time in livestock farming in Statistical Year Books 2009-2013. Hence, we estimated total number of people who for full time for livestock farming is that total number of herder households who live in PAs in Mongolia (Annex Table 38) is multiplied by 2 persons per household.

Annex Table 2.18. Total income generated by employing people in livestock sector in PAs overlapped Soums in Mongolia (Bln MNT)

Regions	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	33.6	36.1	45.4	41.9	50.4	61.2	107.4	125.6	133.3	135.9	152.6
Khangai	33.1	35.8	41.7	38.3	45.5	56.3	104.8	130.7	142.9	145.2	165.1
Central	11.3	16.6	19.6	18.0	21.3	26.9	50.8	63.9	68.2	71.9	79.3
Eastern	16.7	15.0	18.0	16.4	19.5	23.8	42.9	53.2	64.4	65.7	71.2
Ulaanbaatar	0.8	0.7	0.8	0.8	1.0	1.2	3.1	3.7	3.4	3.6	3.9
Sub-Total	**95.5**	**104.2**	**125.5**	**115.4**	**137.7**	**169.5**	**309.0**	**377.0**	**412.3**	**422.3**	**472.1**
TOTAL (2002-2012)				**2,740.4**							

Source: National Statistical Office of Mongolia (2012, 2014d), authors' estimation

Annex Table 2.19. Tax, insurance, and loan cost share in total revenue for livestock sector

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Social and Health Insurance (%)	0.4	0.4	0.4	0.4	0.4	0.5*	0.5*	0.6*	0.6	0.6	0.6
Pastureland and land use payment (%)	0.3	0.3	0.3	0.3	0.3	0.3*	0.3*	0.2*	0.2	0.2	0.2
Tax related to livestock (%)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0
Vehicle Tax (%)	0	0	0	0	0	0	0	0	0.5	0.5	0.5
Other Taxes (%)	0	0	0	0	0	0	0	0	0.2	0.2	0.2
Interest rate payment for bank loan (%)	1.0	1.0	1.0	1.0	1.0	1.3*	1.5*	1.8*	2.0	2.0	2.0
Total (%)*	2.9	2.9	2.9	2.9	2.9	3.1*	3.2*	3.4*	3.5	3.5	3.5

Source: National Statistical Office of Mongolia (2012); *Numbers are estimated by authors under assumption..

Annex Table 2.20. Economic value of Tax, Insurance, and Bank Loan Revenue for Livestock sector (bln MNT)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Social and Health Insurance	0.9	0.9	1.2	1.5	1.6	2.3	3.1	3.7	4.6	5.0	6.6
Pastureland and land use payment	0.7	0.7	0.9	1.1	1.2	1.4	1.5	1.5	1.5	1.7	2.2
Tax related to livestock	2.7	2.8	3.6	4.4	4.8	6.1	7.4	8.0	0.0	0.0	0.0
Vehicle Tax	0	0	0	0	0	0	0	0	4	4	5
Other Taxes	0	0	0	0	0	0	0	0	2	2	2
Interest Rate payment for bank loan	2.3	2.3	3.0	3.6	4.0	6.4	9.3	11.7	15.3	16.8	21.9
Sub-Total	6.5	6.8	8.8	10.6	11.6	15.6	19.8	22.4	26.7	29.4	38.2
TOTAL (2002-2012)				**196.4**							

Source: (National Statistical Office of Mongolia, 2012, 2014d), authors' estimation

Annex Table 2.21. Total Economic Value of Ecosystem Services of PAs in Mongolia for Livestock Sector (Bln MNT)

Economic value sources	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Net Value Crop Production	163.4	168.8	219.3	264.1	290.0	353.4	406.9	416.5	449.9	495.0	643.6
Employment benefit in crop sector	95.5	104.2	125.5	115.4	137.7	169.5	309.0	377.0	412.3	422.3	472.1
Tax, insurance, and loan revenue	6.5	6.8	8.8	10.6	11.6	15.6	19.8	22.4	26.7	29.4	38.2
Sub-Total	6.5	6.8	8.8	10.6	11.6	15.6	19.8	22.4	26.7	29.4	38.2
TOTAL (2002-2012)				**6,807.7**							

Source: Author's Estimation

Annex Table 2.22. Total Economic Value of Ecosystem Services of PAs in Mongolia for Livestock Sector, by region and provinces (Bln MNT)

Regions	Provinces	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Нийт
Western	Bayan Ulgii	1.93	2.33	3.67	4.10	5.63	6.50	6.28	8.92	9.36	6.22	6.61	518.2
	Gobi Altai	0.93	1.03	1.45	1.94	2.60	2.67	2.14	5.77	6.35	5.87	7.59	309.9
	Zavkhan	0.46	0.83	1.41	1.90	2.28	2.34	1.97	2.17	3.78	3.47	3.31	376.7
	Uvs	0.74	0.56	0.85	1.18	1.28	1.22	1.14	1.78	2.37	2.04	2.49	580.8
	Khovd	0.02	0.03	0.04	0.05	0.07	0.07	0.10	0.16	0.13	0.10	0.11	688.4
	Total	**4.08**	**4.77**	**7.42**	**9.17**	**11.85**	**12.80**	**11.63**	**18.81**	**22.00**	**17.70**	**20.10**	**2,474.0**
Khangai	Arkhangai	3.63	3.53	2.59	1.97	2.25	3.45	3.14	3.65	4.27	4.17	3.53	506.0
	Bayan Khongor	1.45	2.07	1.67	1.16	1.15	1.79	1.43	2.16	3.49	4.92	3.82	397.9
	Bulgan	0.95	1.33	1.27	0.70	0.66	1.05	0.88	0.96	1.39	2.57	1.92	479.8
	Uvurkhangai	0.71	0.83	0.84	0.77	0.74	0.95	0.87	0.98	1.53	2.41	2.14	388.6
	Kuvsgul	0.04	0.04	0.04	0.02	0.02	0.04	0.05	0.07	0.07	0.09	0.07	373.8
	Total	**6.78**	**7.79**	**6.41**	**4.62**	**4.82**	**7.29**	**6.38**	**7.82**	**10.76**	**14.15**	**11.48**	**2,146.0**
Central	Gobi Sumber	0.65	0.83	0.72	0.61	0.70	0.86	0.83	0.72	0.67	0.62	0.78	0.3
	Dorno Gobi	0.76	1.13	0.92	0.84	0.88	1.03	0.90	0.99	0.92	1.36	1.74	216.8
	Dund Gobi	0.25	0.37	0.40	0.31	0.47	0.55	0.43	0.22	0.34	0.56	1.06	361.2
	Umnu Gobi	0.39	0.46	0.50	0.57	0.46	0.55	0.54	0.43	0.44	0.71	0.88	240.0
	Selenge	0.04	0.05	0.05	0.06	0.05	0.07	0.09	0.07	0.09	0.11	0.14	214.6
	Tuv	2.09	2.84	2.59	2.39	2.57	3.06	2.78	2.43	2.46	3.36	4.60	220.7
	Total	**0.57**	**0.39**	**0.42**	**0.44**	**0.47**	**0.59**	**0.58**	**0.52**	**0.63**	**0.47**	**0.56**	**1,253.8**
Eastern	Dornod	0.41	0.26	0.45	0.62	0.63	0.80	0.48	0.64	0.58	0.82	1.16	174.7
	Sukhbaatar	0.20	0.20	0.31	0.37	0.44	0.37	0.30	0.14	0.21	0.42	0.50	214.9
	Khentii	0.36	0.35	0.48	0.54	0.49	0.59	0.49	0.40	0.44	0.65	0.85	461.5
	Total	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**	**0.03**	**0.04**	**851.1**
Ulaanbaatar		**2.8**	**2.7**	**3.4**	**3.9**	**4.1**	**5.4**	**10.4**	**11.5**	**11.8**	**12.5**	**14.2**	**6,807.7**
Sub-Total		**265.5**	**279.8**	**353.5**	**390.0**	**439.3**	**538.5**	**735.8**	**815.9**	**888.9**	**946.7**	**1154.0**	**6,807.7**
TOTAL (2002-2012)							**6,807.7**						

Annex Table 2.23. Annual Growth rate of Total Economic Value of Ecosystem Services of PAs in Mongolia for Livestock Sector (%)

Time ID	Year	Estimated Economic Value of PAs in Mongolia for Livestock sector (Bln MNT)	Annual Growth Rate (%)
t		Y_t	$R_t = (Y_t - Y_t\text{-}1)/Y_t\text{-}1$
1	2002	265.5	-
2	2003	279.8	5.4%
3	2004	353.5	26.4%
4	2005	390.0	10.3%
5	2006	439.3	12.6%
6	2007	538.5	22.6%
7	2008	735.8	36.6%
8	2009	815.9	10.9%
9	2010	888.9	8.9%
10	2011	946.7	6.5%
11	2012	1154.0	21.9%
Average	618.9	16.2%	

ANNEX 3. SUPPORT INFORMATION ON DRINKABLE WATER

Annex 3.1. Estimation of water value based on Government Resolution, 2011

№	Water Basins of Mongolia	Base Value of Water (MNT/M³)[A]		Water Equivalent Coefficient (WEC) for Human Drinking Consumption[B]		Value of Drinking Water after conversion by WE (MNT/M³)		Value of Cubic Meter Drinking Water linked to PAs (MNT/M³)[C]	
		A		B		C=A x B		D=C x 2	
		Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water
1	Selenge River Basin	1,050	4,072	0.8	0.2	840	814	1,680	1,629
2	Khuvsgul Lake and Egiin River Basin	1,507	1,438	0.6	0.6	904	863	1,808	1,726
3	Shishkhed River Basin	1,050	1,337	0.8	0.6	840	802	1,680	1,604
4	Delgermurun basin	1,050	1,510	0.8	0.6	840	906	1,680	1,812
5	Ider river basin	918	1,510	0.9	0.6	826	906	1,652	1,812
6	Chuluut river basin	918	1,510	0.9	0.6	826	906	1,652	1,812
7	Khanui river basin	1,347	2,311	0.8	0.4	1,078	924	2,155	1,849
8	Orkhon river basin	2,783	4,945	0.4	0.2	1,113	989	2,226	1,978
9	Tuul river basin	2,651	9,440	0.4	0.1	1,060	944	2,121	1,888
10	Kharaa river basin	2,183	2,764	0.5	0.3	1,092	829	2,183	1,658
11	Yeruu river basin	1,424	2,764	0.7	0.3	997	829	1,994	1,658
12	Onon river basin	1,225	1,663	0.7	0.5	858	832	1,715	1,663
13	Ulz river basin	1,478	2,780	0.7	0.3	1,035	834	2,069	1,668
14	Kherlen river basin	1,791	2,835	0.5	0.3	896	851	1,791	1,701
15	Buir lake and Khalk river basin	2,097	2,081	0.5	0.4	1,049	832	2,097	1,665
16	Menengiin Tal basin	1,013	3,700	0.8	0.3	810	925	1,621	1,850
17	Umard Gobiin Guveet-Khalkhiin Dundside basin	1,420	3,700	0.6	0.3	852	925	1,704	1,850
18	Galba-Uush doloodiin Gobi basin	1,420	3,996	0.6	0.3	852	999	1,704	1,998
19	Ongi river basin	2,240	3,250	0.4	0.3	896	975	1,792	1,950
20	Altain Uvur Gobi basin	1,410	4,433	0.7	0.2	987	887	1,974	1,773
21	Taats river basin	1,410	1,939	0.7	0.5	987	970	1,974	1,939
22	Orog lake and Guin river basin	1,410	1,939	0.7	0.5	987	970	1,974	1,939
23	Buun tsagaan lake and Baidrag river basin	1,522	2,352	0.7	0.4	1,065	941	2,131	1,882
24	Khyargas lake and Zavkhan river basin	1,675	2,716	0.6	0.3	1,005	815	2,010	1,630
25	Khuisiin Gobi and Tsetseg Lake basin	1,122	2,352	0.7	0.4	785	941	1,571	1,882
26	Uyench Bodonch river basin	800	2,506	1.0	0.3	800	752	1,600	1,504

27	Bulgan river basin	800	1,729	1.0	0.5	800	865	1,600	1,729
28	Khar Us Lake and Khovd river basin	1,747	2,506	0.5	0.3	874	752	1,747	1,504
29	Uvs lake and Tes river basin	1,195	2,506	0.7	0.3	837	752	1,673	1,504
Average value of water value[D]								**1,838**	**1,756.0**
Weight (Share of water consumption from surface and groundwater)[E]								**0.4**	**0.6**
Weighted average value of waterD (MNT/M³)								**1,789**	

[A] – Appendix 1 of Government Resolution, 2011
[B] – Appendix 2 (2013) of Government Resolution, 2011
[C] – It is stated that if the water consumed within any Protected Area in Mongolia then the water value is estimated to be two times higher (Appendix 2 (2013) of Government Resolution, 2011)
[D] – When estimating average value of water, we excluded the value of Tuul river basin. Because, the estimated weighted average value of drinking water is to be used for estimation of benefits of consumption of drinking water in areas except Ulaanbaatar, in which the Tuul river is the main water source.
[E] – 60% of the total water consumption in Mongolia is from groundwater and remaining 40% is from surface water (Tdashi & Maki, 2004)

Source: Authors estimation; Government Resolution, 2011

Annex Table 3.2. Total Population of PAs overlapped Soums in Mongolia (000 People)

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	254.4	250.3	248.5	245.3	245.6	242.7	235.4	230.1	219.0	217.8	214.4
Khangai	206.8	204.3	201.8	203.7	200.5	197.9	198.9	199.6	201.1	202.0	202.3
Tuv	70.8	152.2	149.2	149.2	150.2	150.5	150.4	154.0	154.1	155.4	156.6
Eastern	103.4	103.0	99.1	101.3	101.4	100.8	100.9	102.8	104.0	104.7	104.2
Ulaanbaatar	414.0	451.3	484.3	508.4	539.7	563.5	595.2	626.0	662.8	692.8	717.2
TOTAL	1,049.4	1,161.1	1,182.8	1,208.0	1,237.3	1,255.4	1,280.9	1,312.5	1,341.0	1,372.7	1,394.8
Нийт (%)*	2.9	2.9	2.9	2.9	2.9	3.1*	3.2*	3.4*	3.5	3.5	3.5

Source: Authors' estimation using total population number of 189 soums and 4 districts of Ulaanbaatar that overlap with PAs from National Statistical Office of Mongolia (2014d)

Annex Table 3.3. Total water consumption of people who live in PAs overlapped Soums (000 cubic Meter)

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	615.3	605.3	600.8	593.1	593.8	586.8	569.3	556.4	529.6	526.8	518.3
Khangai	934.2	925.5	913.6	923.0	917.8	913.5	917.0	912.5	971.4	980.6	990.5
Tuv	509.5	924.7	906.7	922.9	931.7	930.1	922.2	950.6	958.3	968.7	981.7
Eastern	646.2	653.0	648.9	651.1	664.0	666.9	659.0	704.8	712.5	725.2	719.4
Ulaanbaatar	36,119.5	39,373.1	42,255.4	44,360.3	47,088.7	49,169.1	51,932.7	54,623.3	57,829.1	60,447.7	62,577.6
TOTAL	38,824.7	42,481.6	45,325.4	47,450.3	50,196.1	52,266.4	55,000.2	57,747.7	61,000.9	63,648.9	65,787.5

Source: Authors' estimation

Annex Table 3.4. Total Economic Value of Drinkable Water of PAs in Mongolia, by region (Bln MNT)

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Western	1.10	1.08	1.07	1.06	1.06	1.05	1.02	1.00	0.95	0.94	0.93
Khangai	1.67	1.66	1.63	1.65	1.64	1.63	1.64	1.63	1.74	1.75	1.77
Tuv	0.91	1.65	1.62	1.65	1.67	1.66	1.65	1.70	1.71	1.73	1.76
Eastern	1.16	1.17	1.16	1.16	1.19	1.19	1.18	1.26	1.27	1.30	1.29
Ulaanbaatar	68.19	74.34	79.78	83.75	88.90	92.83	98.05	103.13	109.18	114.13	118.15
Sub-Total	73.03	79.90	85.27	89.28	94.46	98.37	103.54	108.72	114.85	119.85	123.89
TOTAL (2002–2012)					**1,091.16**						

Source: Authors' estimation

Annex Table 3.5. Total Economic Value of Drinkable Water of PAs in Mongolia, by region and province (Bln MNT)

Regions	Provinces	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Нийт
Western	Bayan Ulgii	0.24	0.24	0.25	0.24	0.24	0.24	0.23	0.23	0.21	0.21	0.21	2.53
	Gobi Altai	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.14	1.69
	Zavkhan	0.21	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.18	0.17	0.17	2.11
	Uvs	0.23	0.22	0.22	0.22	0.22	0.22	0.21	0.20	0.19	0.19	0.19	2.31
	Khovd	0.25	0.25	0.24	0.24	0.24	0.25	0.24	0.23	0.22	0.22	0.22	2.61
	Total	**1.10**	**1.08**	**1.07**	**1.06**	**1.06**	**1.05**	**1.02**	**1.00**	**0.95**	**0.94**	**0.93**	**11.26**
Khangai	Arkhangai	1.02	1.01	1.00	1.02	1.01	1.01	1.01	1.00	1.10	1.12	1.14	11.43
	Bayankhongor	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.59
	Bulgan	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	1.20
	Uvurkhangai	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	2.10
	Kuvsgul	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	2.10
	Total	**1.67**	**1.66**	**1.63**	**1.65**	**1.64**	**1.63**	**1.64**	**1.63**	**1.74**	**1.75**	**1.77**	**18.42**
Central	Gobi Sumber	0.00	0.43	0.42	0.44	0.46	0.46	0.46	0.49	0.51	0.53	0.54	4.73
	Dorno Gobi	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.71
	Dund Gobi	0.73	0.74	0.72	0.74	0.72	0.72	0.70	0.70	0.70	0.69	0.70	7.87
	Umnu Gobi	0.00	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	1.09
	Selenge	0.00	0.20	0.20	0.20	0.20	0.20	0.21	0.22	0.22	0.22	0.22	2.07
	Tuv	0.11	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	1.25
	Total	**0.91**	**1.65**	**1.62**	**1.65**	**1.67**	**1.66**	**1.65**	**1.70**	**1.71**	**1.73**	**1.76**	**17.72**
Eastern	Dornod	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.59
	Sukhbaatar	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.11	1.19
	Khentii	0.90	0.91	0.91	0.91	0.93	0.95	0.93	1.01	1.02	1.04	1.03	10.55
	Total	**1.16**	**1.17**	**1.16**	**1.16**	**1.19**	**1.19**	**1.18**	**1.26**	**1.27**	**1.30**	**1.29**	**13.33**
Ulaanbaatar		**68.2**	**74.3**	**79.8**	**83.8**	**88.9**	**92.8**	**98.0**	**103.1**	**109.2**	**114.1**	**118.1**	**1,030.4**
Sub-Total		**73.0**	**79.9**	**85.3**	**89.3**	**94.5**	**98.4**	**103.5**	**108.7**	**114.9**	**119.9**	**123.9**	**1,091.2**
TOTAL (2002–2012)							**1,091.2**						

Annex Table 3.6. Annual Growth rate of Total Economic Value of PAs for Drinkable water in Mongolia (%)

Time ID	Year	Estimated Economic Value of PAs in Mongolia for Drinkable water sector (Bln MNT)	Annual Growth Rate (%)
t		Y_t	$Rt = (Y_t-Y_t-1)/Y_t-1$
1	2002	73.0	-
2	2003	79.9	9.4%
3	2004	85.3	6.7%
4	2005	89.3	4.7%
5	2006	94.5	5.8%
6	2007	98.4	4.1%
7	2008	103.5	5.2%
8	2009	108.7	5.0%
9	2010	114.9	5.6%
10	2011	119.9	4.4%
11	2012	123.9	3.4%
Average		**99.2**	**5.4%**

Source: Authors' estimation

Annex Table 3.7. Total Economic Value of Ecosystem Services of PAs in Mongolia for Drinkable water: Trend of BAU vs SEM (Bln MNT)

Time ID	Year	INC scenario	BAU scenario			
		INC scenario Economic value of PAs in Mongolia for Drinkable water (Bln MNT)[a]	Annual Growth Rate Decline (%)	Annual Growth Rate (%)	Economic value of PAs in Mongolia for Drinkable water (Bln MNT)	Loss of BAU (Bln MNT)[d]
t		$Y^S_t=15.01*_t+ 69.15$	ΔR	$R=R_{t-1}-\Delta R$	$Y^B_t=Y_t-1*(100\%+R)$	$L=Y^S_t-Y^B_t$
11	2012	123.9 [b]	-	5.4% [c]	123.9 [b]	-
12	2013	129.2	0.5%	4.9%	130.0	-0.8
13	2014	134.2	0.5%	4.4%	135.8	-1.5
14	2015	139.3	0.5%	3.9%	141.1	-1.9
15	2016	144.3	0.5%	3.4%	146.0	-1.7
16	2017	149.3	0.5%	2.9%	150.3	-1.0
17	2018	154.3	0.5%	2.4%	153.9	0.3
18	2019	159.3	0.5%	1.9%	156.9	2.4
19	2020	164.3	0.5%	1.4%	159.2	5.1
20	2021	169.3	0.5%	0.9%	160.7	8.6
21	2022	174.3	0.5%	0.4%	161.4	12.9
22	2023	179.3	0.5%	-0.1%	161.3	18.0
23	2024	184.3	0.5%	-0.6%	160.4	23.9
24	2025	189.3	0.5%	-1.1%	158.7	30.7
25	2026	194.3	0.5%	-1.6%	156.2	38.1
26	2027	199.3	0.5%	-2.1%	153.0	46.4
27	2028	204.3	0.5%	-2.6%	149.1	55.3
28	2029	209.4	0.5%	-3.1%	144.5	64.9
29	2030	214.4	0.5%	-3.6%	139.3	75.0
30	2031	219.4	0.5%	-4.1%	133.7	85.7
31	2032	224.4	0.5%	-4.6%	127.6	96.8
TOTAL (2013–2032)		**3,536.2**	**–**	**–**	**2,978.9**	**557.3**
Average		**179.3**	**0.5%**	**–0.06%**	**149.9**	**29.4**

Source: Authors' estimation

Note:

[a] – Simple regression: when the time goes by one year, then economic value stays constant at 15.01 billion MNT when time does not change; and increased constantly by 69.15 billion MNT, R2=0.998.

[b] – Economic value of PAs for Drinkable water sector in Mongolia of 2012 is estimated but not a trend.

[c] – Annual average growth of economic value between 2002 and 2012 is 5.4%.

[d] – Loss that has negative sign means gains of BAU over INC.