

## Economic Analysis

### I. Introduction

1. The impact of climate change in Mongolia is two-fold and mutually compounding 1) climate change is having an overall drying effect on Mongolia, changing the availability or condition of land and water resources, and 2) the choices made by herders to protect their herds against extreme events (i.e. **increasing herd size to save from total loss during dzud**) are adding pressure to increasingly fragile land and water resources.
2. Recognizing this relationship, 3% of the national budget is allocated to support the National Mongolian Livestock Program<sup>1</sup> which sets ambitious livestock reduction targets, with an overall purpose of developing “a livestock sector that is adaptable to climate change and social development and to create an environment where the sector is economically viable and competitive in the market economy, to provide safe and health food supply to the population, to deliver quality raw materials to processing industries, and to increase exports.” The programme includes investments in livestock health and veterinary services (including measures to combat and prevent infectious animal diseases which currently prevent Mongolian livestock products from export), guidance for herders on herd structure, development of an animal registration database and network, construction of wells for livestock water supply, and development of industry marketing to capture the intended market.
3. This economic analysis is based on project intervention in four target aimags - Zavkhkhan, Khovd located in the western part of the country; Dornod and Sukhbaatar located in the eastern part of the country. These aimags are notorious for their harsh weather cycles with temperature above 40 degrees Celsius (100 degrees Fahrenheit) and below -30 degrees Celsius (-22 degrees Fahrenheit).
4. The objective of the proposed project is **to strengthen the resilience of resource-dependent herder communities in four aimags vulnerable to climate change**. The proposed project seeks an integrated approach to address climate change impacts on herder livelihoods and on the natural resources on which they rely. This will require strengthening capacity to generate climate models for longer term climate resilient planning, while reconciling the ambitious economic development goals of livestock sector with the limits of increasingly fragile land and water sources due to climate change. To do this, the project complements significant investment from the Government of Mongolia related to the livestock sector and natural resources management, while addressing the key barriers through strengthening the computing and capacity needs for long term climate-informed planning, investments in water access points, and support to the policy transformations needed to remove incentives for maladaptive herder practices.
5. The appraisal of the project was carried out in accordance with the Guidelines for the Economic Analysis of Projects of United Nations Development Program (UNDP 2015). This additional GCF intervention will assist 26,000 herder

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<sup>1</sup> Approximately US\$75 million against 2017 budget.

households (130,000 women, men and children) vulnerable to climate change in Mongolia.

6. An economic appraisal was carried out for the project. The investment comprises of three interventions that include: (i) Integrate climate information into land and water use planning at the national and sub-national levels; (ii) Scaling up climate-resilient water and soil management practices for enhanced small-scale herder productivity; (iii) Build herder capacity to access markets for sustainably sourced, climate-resilient livestock products. This section presents economic internal rate of return (EIRR) and economic net present value (NPV) for the project as an integrated outcome as the project has specifically been designed to generate benefits when these sub-projects are implemented together.
7. It is not possible to calculate ex ante economic rates of return for output 3 that includes activities such as identifying public-private-community partnerships for sustainably sourced, climate resilient livestock products (Activity 3.1) and Activity 3.2 that will generate information for information for private sector engagement and herder enfranchisement. It is not reasonable to guess in advance the benefits of this to herders and the society at large. However, investments of these nature are going to be beneficial and typically show returns to investment that are above the discount rate.
8. The economic desirability of the investments was determined by computing the EIRR and NPV and comparing the EIRR with the assumed 10% discount rate (as recommended in UNDP 2015). ***Discounted fund flows period is 20 years based on the lifespan of the investments.*** We conservatively assume that the benefits from the project become zero after 20 years.
9. For all interventions, costs and benefits are estimated by comparing the with-project and without-project scenarios during 2018–2028 in constant 2018 prices. The without-project scenario represents a continuation of the existing situation and climate hazard, while the with-project scenario represents the project investment scenario.

## II. Estimation of Benefits

10. Benefits estimated include a with-project scenario of improved animal health and reduction of damages due to dzud. FAO (2010) reported that with temperatures plunging to -50C, 1.7 million heads of livestock in Mongolia were killed, threatening the livelihoods of 21,000 most seriously affected herder families and putting them at risk of food insecurity, the Food and Agriculture Organization (FAO) warned today. This is an estimated loss of 50% per herder given an average of 80 livestock lost per herder based on 100 – 300 MSU per herder.

11.Reduction of losses during dzud will be as a result of different aspects of the project. Specifically, with the project:

- improvement in climate information services and planning, livestock farmers can effectively plan for occurrence of dzud in the regions. Both with and without the project scenarios include estimates of losses (in probabilistic terms) from potential dzud, which may affect herders in the aimags. It is assumed that without the project, current loss during the dzud will continue at a probability of 25% per annum.
- enhanced cooperation among herders on sustainable use and stewardship of shared land and water resources (formalized through Resource User Agreements) and ecosystems-based adaptation measures to protect land and water resources from the impacts of climate change will combine to improve the quality of livestock in the regions.
- given that due to losses farmers incur during dzud, they have strategically hedged against this loss by carrying higher numbers of livestock to have sufficient carrying capacity after dzud and as a maximizing behavior given government payout. The combination of change in policy with the project and various supports to the livestock farmers in the form of payment for ecosystem services - the farmers reduce or keep stable their livestock numbers in exchange for support and the society gets reduced environmental damages due to overgrazing.

12.We first estimate the annual expected loss per capita under the without-project scenario for the four aimags. Based on the above, we estimate an annual expected loss of about 772,000 livestock valued at about 60 million USD per annum based on 2018 price data in the region. This brings the annual expected value in 2018 to about 15 million USD for 1 in 4 dzud events. Hence, in the absence of the proposed project, expected annual losses amount will be 15 million USD in the 4 aimags of Mongolia. This estimate is then applied to the expected beneficiaries of the project. Assuming 70% effectiveness based on the combination of interventions described above, the annual benefit of the project is about 10 million USD.

13.Lastly, with the project, losses due to diseases of livestock will be reduced. This is a major interest of the government with investments put in place to prepare farmers to be able to export livestock and reduce losses due to diseases. We assume that with the project, 80% of the losses dues to diseases will be reduced to be conservative – the project’s target is 100% by 2020. For this project we concentrate on benefits of reducing loss of livestock due to diseases as a lower estimate of the benefits given that significant benefits will be derived from export potential based on a disease-free livestock country.

- The analysis did not consider positive externalities from project interventions such as the early warning system training and capacity building will be useful for all the other aimags in the country.

14. Other benefits of the project not considered in this analysis include that

- With the project, it is expected that productivity of the livestock will increase either through improved weight and carcass gain for the livestock. Different studies including Bovera et al (2013) show that water restriction reduces performance, nutrient digestibility, carcass traits and meat quality of livestock by about 7.5% for the entire growing period and about 22.4% post weaning. We do not include this estimate given limited evidence to separate the benefit from that of diseases losses.

### III. Estimated cost

15. The estimated capital cost of the project is presented in the table below with its distribution over the first 6 years of project implementation. Operating and maintenance plan is presented in the feasibility report of the proposal and highlighted in the economic analysis annex.

Capital cost	Total
<b>Output 1: Integrate climate information into land and water use planning at the national and sub-national levels</b>	5,186,575
<b>Output 2: Scaling up climate-resilient water and soil management practices for enhanced small scale herder resource management</b>	11,132,226
<b>Output 3: Build herder capacity to access markets for sustainably sourced, climate-resilient livestock products</b>	5,666,925
<b>Other Cost PMU</b>	1,115,550
<b>Co-financing</b>	56,200,000
<b>Total</b>	<b>79,301,726</b>

### IV. Net present value and sensitivity analysis.

16. Given the above estimates, the net present value of the project is 30 million USD upon using a 10% discount rate, with an internal rate of return of 21%.

17. Three sensitivity test cases were examined: (i) total cost decreased by 20%; and (ii) total benefits decreased by 20%; and (iii) total cost increased by 20% and total benefits simultaneously decreased by 20%. In all test cases, the project remains economically feasible. Results are presented below.

Table 1: Net present value (million USD)

	Benefits of Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia	Benefits of Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia
Base case	\$30.26M	21%
Cost +20%	\$18.23M	15%
Benefits – 20%	\$12.18M	14%
Cost +20% and benefit -20%	\$00.16M	10%

Reference:

Bovera, F., Lestingi, A., Piccolo, G., Iannaccone, F., Attia, Y. A., & Tateo, A. (2013). Effects of water restriction on growth performance, feed nutrient digestibility, carcass and meat traits of rabbits. *Animal*, 7(10), 1600-1606.

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National Statistics Office of Mongolia