Report:

Heilongjiang Dairy Project Environmental Impact Assessment

June 2004
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Abbreviations

BOD      Biological oxygen demand  
CEC      Cation exchange capacity  
CIP      Cleaning-in-place  
COD      Chemical oxygen demand  
DM       Dry matter  
EA       Environmental Assessment 
ECC      Environmental Clearance Certificate  
EIA      Environmental Impact Assessment  
EIL      Environmental Impact List  
EIR      Environmental Impact Report  
EIS      Environmental Impact Statement  
EMF      Environmental Management Framework  
EMP      Environmental Management Plan  
EPB      Environmental Protection Bureau  
EPM      Environmental Management Plan  
EPMR     Environmental Protection Management Regulation  
HACCP    Hazard Analysis and Critical Control Point  
HDP      Heilongjiang Dairy Project  
HEPB     Heilongjiang Environmental Protection Bureau  
HPHB     Heilongjiang Province Hydrological Bureau  
NE       North East  
NW       North West  
PMO      County or Municipal level Project Management Office  
PPMO     Provincial Project Management Office  
PRC      People’s Republic of China  
SEPA     State Environmental Protection Administration  

Weights and Measures

°C       degree Celsius  
ha       hectare  
meq      milliequivalent  
mu       land are unit (15 mu = 1 hectare)  
pH       acid/alkalinity : 7.0 is neutral  
sq.m     square meters  
sq.km     square kilometers
Executive Summary

A Introduction

This summary brings together the findings of the Environmental Impact Assessment (EIA). It is based on the assessment of project components proposed for the HDP by the project preparation team in accordance with World Bank guidelines on the conduct of EIAs.

B Project Environment

The project area comprises predominantly rural communities scattered across 27 Counties covering a total area of 120,000 sq. km. The terrain is mainly extensive plains with low sloping hills.

The most serious areas of environmental degradation are the overgrazing of pastures and the low level of soil fertility under natural pastures caused by unsustainable farming practices, along with the poor quality of surface and potentially ground water resources due to industrial and agricultural-sourced pollution.

The climate is continental monsoon characterized by a long and very cold winter which limits the growing season to 105-140 days with annual rainfall of 400-570 mm 70% of which falls in June through August.

The majority of soils in the project area are fertile, characterized by good organic matter on the deep slightly acid black soils in the eastern region to the strongly alkaline sandy soils of lower organic matter and cation exchange capacity (CEC) in the western sector. Soils under pastures are particularly low in fertility with concomitant low levels of annual pasture production.

C Project Description

The HDP is designed to increase dairy production and farmers’ income in the selected project areas of Heilongjiang Province. It will also strengthen the capacity and scope of support services to dairy farmers in the form of animal health, breeding, dairy cow nutrition and natural resource management services.

D Environmental Impact Identification and Assessment

The HDP can be classified as an environmental Category B and a safeguards policy S2 project in accordance with World Bank environmental assessment procedures. None of its proposed components are expected to have any major adverse environmental consequences and appropriate mitigation measures have been incorporated into the design of each component.

Under Chinese law, breeding farms and dairy parks proposed for the Project will be classified as construction projects with the potential to have major environmental impact on the environment and an EIA will need to be conducted. An Environmental Impact Report (EIR) will be required to be prepared, listing and evaluating the key potential environmental impacts with measures for preventing, minimizing, or mitigating for adverse environmental impacts detailed.
For HDP approval to be considered, all new breeding farm and dairy park proposals would be subject to a two stage environmental screening process which defines the required Environmental Management Plan (EMP) and the efficacy of each proponent’s proposal.

Collaborative arrangements are required between the Heilongjiang Environment Protection Bureau (HEPB), Animal Husbandry Bureau (AHB) and Provincial Project Management Office (PPMO) at all levels of government to give effect to the monitoring of breeding farms and dairy parks to ensure they comply with the requirements of the environmental protection legislation and the effectiveness of EMPs.

A single stage screening process is recommended for individual household dairy enterprises which would be strengthened by the provision of farmer training in environmentally sustainable farming practices and supported by improved delivery of livestock information services.

Whilst dairy processing plants are not a project component they are integral to the success of the HDP. Their compliance with environmental protection legislation and adoption of cleaner production practices to achieve economies in water use and acceptable waste water disposal must be mandatory if the quality and sustainability of surface and groundwater resources are to be maintained.

Environmental monitoring requirements are recommended for all dairy breeding production enterprises, with EMPs a mandatory requirement for all lending for breeding farms, dairy parks and milking stations. An environmental statement of individual dairy household enterprises giving details of the operational practices and environmental protection measures would be required for sub-project approval.

Institutional and training requirements for the provision of appropriate environmental services are described for the Project.
**Introduction**

This Environmental Impact Assessment (EIA) was made to assist the Government to prepare a feasibility study for the Heilongjiang Dairy Project (HDP). The study team worked closely with the Provincial Project Management Office (PPMO) staff and visited selected sites identified as representative of the components proposed for the Project. This study examined each of the project components proposed, determined their potential environmental impacts and suggested measures that could be adopted by the project design to mitigate any adverse environmental consequences. Technical recommendations for project development have been made for the project components proposed.

This EIA was prepared in accordance with World Bank Operational Policies 4.01 and World Bank Procedures 4.01 for Environmental Assessment, January.1999.

**Description of the Project**

**Location**

Heilongjiang Province is located in the far north east of China and lies between latitude 43-53° N, 121-135 °E. It has an area of 469,000 sq. km and a population of 38 million with about 70 percent found in the rural areas. It comprises 13 cities (prefectures) and 66 Counties.

The topography comprises extensive plains with areas of low gently sloping hills (maximum slope 10-15°) making up the majority of the Province. The total cultivated land area is about ten million ha, supporting one of the most important bases for maize grain and soybean production in China. The main crops grown are maize, soybean, rice, wheat and potatoes, with millet grown on less favorable soils. Heilongjiang’s natural grassland covers an area of about 6 million ha with the Songnen Grassland being amongst the world’s largest areas of natural pastures supporting sheep production. Pasture is also a source for some of the forage provided for the stall feeding of beef and dairy cattle and, where permitted, pastures are grazed.

The Province has a continental monsoon climate with clearly defined seasons and is characterized by a long and very cold winter with prevailing winds from the NW, average temperatures down to –23 °C and soil temperatures at freezing point to a depth of about 1.5m. As a result, the reliable growing season is limited from about the beginning of May for 105-140 days. In the peak of the summer (July through August) average temperatures can range up to 23° C with humid conditions.

**The Project**

The scope of the proposed HDP includes a project area that covers 120,000 sq. km with a total population of 20 million people that are supported by 2.67 million ha of cultivated land.
It extends from the eastern zone city of Qiqihaer, north to Heihe and through to the central zone centered on Harbin city to the western zone areas around the cities of Jiamusi and Mudanjiang.

The primary objective of the project is to increase dairy production and farmers’ income in these selected areas of Heilongjiang province. The HDP will raise the productivity of existing small householder dairy farmers, as well as establishing new small holder dairy farms and larger dairy parks and breeding farms of up to 1000 head. It will also strengthen the capacity and scope of support services to dairy farmers in the form of animal health, breeding, dairy cow nutrition and natural resource management services.

The project will be implemented in three regional areas. The first of these, the central dairy cattle production region, has been identified with 14 areas where maize grain production and forage crops predominate and includes the Harbin municipality and districts of Daoli, Nangang, Pingfang, Daowai and Xiangfang and the Counties of Hulan, Shuangcheng, Acheng, Bayan, Wuchang, Yilan, Shangzhi and Binxian.

Secondly, the proposed western region includes 23 areas with established dairy cattle enterprises being the Qiqihar municipality districts of Meilisi and Angangxi and Counties of Tailai, Kedong, Nehe and Baiquan; Daqing city and districts of Ranghulu and Datong; in the north west the City of Heihe and districts of Beian and Aihui and Counties of Wudalianchi and Nenjiang; and Suahua city, Beilin District and Counties of Anda, Wangkui, Qingang, Mingshui, Suiling, Lanxi, Qingan.

Finally, in the eastern region it is proposed to capture some of the natural pasture growing on hill land as a future source of forage for dairy production in cities and counties which include Jixi City, and Districts of Mashan, Jiguan, Didao, Lishu, Hengshann, Chengzihe, Counties of Mishan, Jidong and Hulin; Jiamusi City and suburb and Counties of Tangyuan, Huanang, Fujin, Huachuan.

The Provincial Breeding Farm and the Comprehensive Farm are included in the Project at the Heilongjiang Provincial level. A detailed list of dairy farm locations is contained in Annex 9.

Components

The Project comprises four components selected by the PMO which include the development of:

(i) Breeding Farms of 1000 cows
(ii) Dairy Parks with 50 individual households each with up to 10 cows
(iii) Assistance to individual households each with up to 10 cows
(iv) Support service systems for the dairy industry including the development of farmers’ associations, animal breeding services including herd recording, herd husbandry and management including herd health, information management and extension, environment management and the management and improvement of pasture areas.
Project Implementation

The PMO at each administrative level would be responsible for the implementation of the various project components. They would prepare a loan contract with the local finance bureau and raise counterpart funds for them.

Environmental Category of Project:

Environmental and safeguard issues are envisaged to be mainly concerned with management of natural and improved grassland areas; management of animal manure (quality and capacity of storage, composting treatment to organic fertilizer, land applications); discharge of dairy waste water from breeding farms, dairy parks, milk stations and households to land; excess nutrient loading of receiving land for animal manure and protection of surface and ground water resources; and the veracity of treatment and discharge of waste water from dairy processing plants.

Potential environmental impacts from dairy parks and beef breeding farms and dairy processing plants could also include smoke, airborne particles and gaseous discharges, transport and machinery noise. These would need to be mitigated to China National Standards (see Annex 10) and Bank Standards (see Annexes 3 and 4) by incorporating the necessary controls and treatment systems in the design and, during procurement, by specifying equipment and processes that meet these standards. Processors would also need to incorporate National safety measures for personnel in the vicinity of operating machinery.

The project is not expected to produce any significant environmental impacts from other aspects of the project components. However, some investments may involve minor environmental issues related to, for example, milk hygiene and milking techniques, the use and storage of agricultural chemicals and animal medicines, natural resources management in rural areas, biodiversity and location or site preparation for facilities for dairy cattle housing.

Selected Safeguard and Environmental Categories

The HDP is likely to have minimal or no potential adverse environmental impacts on important sites within the project areas and in all cases where risks are predicted, mitigation measures have been recommended to address the protection of the environment and improve environmental performance.

In view of this the environmental Category B and safeguards category S2 are considered appropriate for this project, and these categories are detailed in Annex 3 and Annex 4 respectively.

Description of the Environment

The health of the environment is based on such key issues as biological productivity (in agriculture, livestock raising, forests and natural ecosystems), biological diversity and the quality of soil, water and air for any given region. In order to accurately assess the impact
that any project activity may have on the environment of project areas, an understanding of prevailing environmental resources and the pressures placed on them are needed. The present population density for the project area is 0.13 persons per cultivated hectare. The activities of this large population continue to exert very significant pressure on the environment, in addition to any adverse impact that is imposed by natural climatic variability.

Climate

The climate across the project area is characterized by a severely cold winter that extends from November to the end of March, during which land is under a permanent cover of snow and the soil is frozen to a depth of 1.5m thereby limiting the reliable growing season from May to October. Rainfall varies from about 320mm at Qiqihaer and 390 mm at Daqing in the western region, 520mm at Harbin, to about 570mm at Jiamusi and Mudanjiang in the eastern region. Seventy percent of precipitation falls within the period June to August and relative humidity at this time is high, rarely dropping below 75%. Early Spring is often dry delaying the establishment of crops and pasture growth.

Due to the high evaporation, which exceeds annual rainfall by a factor of 2-3 particularly in the western region, the insulating effect of the blanket of snow is important for soil moisture retention during the low cold winter. In areas of predominantly fertile black clay soils, stored soil moisture made available following the thaw supports early growth of crops and pastures prior to reliable late spring/summer rain.

Annual average temperature ranges from \(-17^\circ C\) in January to \(20^\circ C\) in the summer months of July and August. Extremes of temperature reach \(-39^\circ C\) in January to \(36^\circ C\) in mid-summer.

Wind prevails in all months of the year, but generally at low speed averaging 2-3 km/hr in the central and eastern regions and 4-5 km/hr in the western region. The prevailing NE winds during the dry early spring period in the western region can result in sandstorms eroding the sandy loess soil. Established belts of protection forest have provided a stabilizing effect.

Air Quality

Generally, within the project area, air pollution has not become as serious a problem as in other areas of China. The low contamination reflects the fact that the majority of the area is primarily rural and open agricultural land. In Harbin city, however, the problem of air pollution remains as a result of dust emissions from the burning of coal by small and large-scale industries and households coupled with a windy climate and barren soils. Recent ambient air monitoring indicates the air quality in Harbin is assessed at level 3 on a standard scale of decreasing air quality to level 5 (poorest).

Physical Resources

\(^1\) PRC State Regulation GB 3095-1996.
Soil

The main soils of Heilongjiang Province are black soil, meadow soil and chernozem, which account for 31%, 26% and 19% of the total cultivated land respectively. The majority of soils in the project area are fertile, characterized by organic matter levels of 3.5% and up to 6% on the deep (40-60cm) black soils, slightly acid to neutral at pH 6.5-7.0, with cation exchange capacities (CEC) ranging from 15 to 30meq/100g being reported. These soils are generally committed to grain production and include some areas cropped for greenfeed maize whilst the less fertile and degraded soils (e.g. low organic matter, saline and sodic soils) remain under natural grassland. Whilst a substantial body of field research has been focused on soil fertility and the fertilizer requirements of cropping soils, less is known about the soil fertility of pasture land and how it would respond when grazed and fertilized, compared to continuing to be utilized under cut and carry systems of pasture management.

In the western area bounded by Qiqihaer, Ziran, Daqing soils are derived from loess deposited by wind from origins in Mongolia. They are of sandy texture and generally strongly alkaline with pH in the range 7.5-10. As a consequence, the soils are low in available phosphorus and zinc. Selenium is an important supplement for livestock health.

In the eastern region centered on Jiamusi City, soils are generally good quality deep brown earth, black clay, meadow and swamp soils. The black soils are generally more than 20 cm deep and up to 1m and in some locations have an impermeable layer of white clay at 30-50cm depth.

They are slightly acid (pH 6.5-7.0), with an average organic matter content commonly in the range 4-7 percent but at some sites reported at 16 and 19 per cent.

Soil Erosion

Wind erosion of exposed soils can occur in early spring prior to planting of annual crops, but is less likely in grassland areas unless severely overgrazed. In the Sanjiang Plain area centered on Yilan and Jiamusi, cultivated land can be affected by wind erosion to various degrees with concomitant decline in soil fertility from loss of organic matter in topsoils.

Soil Pollution

Soil pollution becomes an increasingly serious concern with rapid economic growth. In the past, virtually all waste, both urban and rural, was easily recycled into organic manure. The rapid increase in the use of plastics, batteries and other non-biodegradable materials caused by the acceleration of industrialization, however, requires the proper disposal of urban rubbish to avoid the dumping of harmful materials on agricultural land. The increasing use of plastic film as a mulch technique in production of vegetable crops for city markets, unless of

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3 Regional Development, Environmental change and Improved Resource Management in the Sanjiang Plain. Liu Xingtu et al, Chinese Academy of Sciences, Changchun, Jilin Province and He Yongqi, Institute of Natural Resources, Harbin, Heilongjiang Province.
a biodegradable type, leads to an accumulation of its residue in the soil, and this has a negative effect on plant growth and soil water relationships

The widespread use of chemical fertilizer and pesticides can also have potentially adverse impacts where excess application rates lead to pollution of surface runoff during the summer rain season.

Resources

Surface Water

There are three main rivers in the project area – the Songhua, Heilongjiang and Wusuli – that drain from southwest, northwest and southeast respectively across the border to Russia. The Hulan and Lalin, are all tributaries of the Songhua river with all year round flows. Other rivers in the project area are either small streams or tributaries of these 3 major river systems.

In People’s Republic of China (PRC) surface water quality is assessed according to five classes, with Classes I and II being of best quality and suitable for human consumption because of low coliform, low biological oxygen demand (BOD) and/or chemical oxygen demand (COD) and suspended sediment. Class V is the lowest quality. Virtually no surface water can be placed in Classes I and II, and rivers of inner cities are severely polluted. In Heilongjiang Province all rivers are either class III (suitable for municipal drinking water with treatment) or class IV (water that can be used for industrial purposes). In the Suishua and Daqing project areas the principal rivers are class V indicating the severe state of degradation due to mainly industrial pollution from chemical and brewery industries and from domestic sewage outfalls. Ambient water quality conditions data for the various rivers are shown in Table 1.

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4 PRC Regulation 3838-2002.
Table 1: River Classifications in HDP Project Areas

<table>
<thead>
<tr>
<th>Project Area</th>
<th>River</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harbin</td>
<td>Songhua</td>
<td>III or IV</td>
</tr>
<tr>
<td></td>
<td>Hulan</td>
<td>IV or V</td>
</tr>
<tr>
<td></td>
<td>Lalin</td>
<td>III or IV</td>
</tr>
<tr>
<td></td>
<td>Ashi</td>
<td>IV or V</td>
</tr>
<tr>
<td>Qiqihaer</td>
<td>Nen</td>
<td>III or IV</td>
</tr>
<tr>
<td></td>
<td>Wuyuer</td>
<td>IV or V</td>
</tr>
<tr>
<td></td>
<td>Nuo Men</td>
<td>III or IV</td>
</tr>
<tr>
<td>Jiamusi</td>
<td>Songhua</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>Tongwang</td>
<td>IV or V</td>
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<td></td>
<td>Wutong</td>
<td>IV</td>
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<tr>
<td>Suishua</td>
<td>Helong</td>
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<td>Tongken</td>
<td>II or IV</td>
</tr>
<tr>
<td></td>
<td>Zhaolan</td>
<td>V</td>
</tr>
<tr>
<td>Daqing</td>
<td>Zhaolanshi</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Anzhaoxin</td>
<td>V</td>
</tr>
<tr>
<td>Jixin</td>
<td>Muleng</td>
<td>IV or V</td>
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<tr>
<td>Heihe</td>
<td>Nemoer</td>
<td>IV or V</td>
</tr>
<tr>
<td></td>
<td>Nen</td>
<td>III</td>
</tr>
</tbody>
</table>

Source: Mr Huo Bing Jang, hydrological engineer, Heilongjiang Provincial Hydrological Bureau. Personal communication May 2004.

The Songhua River in Harbin receives pollution from several major upstream cities – Changchun, Daqing, Jilin, Qiqihar - and as a result water quality is classified as Class IV or worse. Monitoring of the water quality of major rivers and associated regulatory activities are the responsibility of both the Heilongjiang Province Hydrological Bureau (HPHB) and the HEPB illustrating the complexity of water resource administration by government.

The government is pursuing a rigorous campaign to clean up the Songhua River, however control over industrial and municipal pollution will not be achieved in the medium term.

Table 2: Average Water Quality Conditions Heilongjiang Major Rivers

<table>
<thead>
<tr>
<th>River</th>
<th>pH</th>
<th>COD (mg/l)</th>
<th>BOD5 (mg/l)</th>
<th>NH4-N (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Songhua-Harbin</td>
<td>7.1-7.3</td>
<td>6.0-7.9</td>
<td>2.0-4.3</td>
<td>0.32-0.52</td>
</tr>
<tr>
<td>Songhua-Jiamusi</td>
<td>7.3-7.5</td>
<td>7.3-7.6</td>
<td>1.7-2.4</td>
<td>1.15-1.59</td>
</tr>
<tr>
<td>Ashi</td>
<td>6.8-7.1</td>
<td>5.8-17.0</td>
<td>2.5-4.0</td>
<td>0.15-0.19</td>
</tr>
<tr>
<td>Lalin</td>
<td>7.0-7.1</td>
<td>4.2-4.7</td>
<td>2.0-2.2</td>
<td>0.15-0.28</td>
</tr>
<tr>
<td>Class III/IV</td>
<td>6.0</td>
<td>6.0</td>
<td>4.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Groundwater

Groundwater resources from rainfall are at comparatively shallow levels in many parts of the project area being at no more than 10m at Jiamusi. Further ground water is contained in aquifers at a depth of more than 80 metros. In all project areas the ground water is generally of good quality although in Jiamusi it requires treatment for removal of high levels of iron and manganese for use as potable water.

In some areas, notably Harbin, groundwater pollution due to the infiltration from uncollected wastewater and polluted urban waterways is a serious and increasing public health concern. Indications are that in some areas groundwater use may also exceed the sustainable yield. In both central Jiamusi and Harbin overuse of groundwater has been known to lead to land subsidence.

Elsewhere in the project areas the likely sources of ground water pollution also include rapid growth of large-scale industries, agricultural fertilizer and chemical pesticide use as well as the expanding presence of the dairy industry.

Although the regulations exist to control such pollution, stricter enforcement and adoption of appropriate environment management systems by industries are needed to continue to improve the quality of surface waters and protect the environment.

For any project proposals for the development of ground water resources to be approved by the HEPB, a thorough hydrological assessment in terms of the sustainable yield and environmental effects on the nearby existing wells and surface waters is required to be completed by consultants accredited by the HPHB.

Land Use and Farming Systems

The entire landscape is intensively used, with very little surplus land available. Of the total land area of 45.4 million ha, arable land makes up 10 million ha with the average arable land per capita being 0.13 ha, compared with the figure of 0.085 for China. The main crops grown are maize, soybean and rice with sown areas in 2002 of 2.237, 3.006 and 1.571 million hectares respectively. Crops of wheat and potatoes are also produced with millet grown on less favorable soils.

Dairy farm systems

Animal wastes produced by poultry and livestock farms across the nation in 1999 amounted to 2.4 times the amount of industrial waste, the State Environmental Protection Administration (SEPA) found in a recent survey. It has been found that 90 percent of animal farms nationwide were built without any thought of their possible effect on the environment, and 60 percent of the farms lack pollution-prevention facilities. The SEPA plans to increase efforts in this field through trial projects for pollution control and with comprehensive utilisation of animal waste in some key areas. www.english.peoplesdaily.com.cn 21 February 2004.
Heilongjiang has a history of dairy production dating back to 1980, with the number of dairy cattle increasing at varying rates over the 24 year period since, to average 11% growth on an annual basis. In 2002 the dairy herd growth rose to 20 percent, giving a total dairy cattle population of 933,000 head, of which about half to two thirds are estimated to be cows in milk. This increase appears to be continuing notwithstanding the more than threefold increase in cow prices in the past two years.

The majority of cows are managed in small herds in village based small holder operations. From a survey by the mission of 300 households in project areas whilst the average herd size for the 107 household with dairy cattle was 4-5 cows there were several herds in the range from 6-15 cows. More recently in Heilongjiang Province there has been a shift to the development of medium scale herds of 50-100 cows with some of these farmers planning to invest in further herd expansion to 300 cows based on the allocation of significant parcels of land. This has been concurrent with dairy processing companies investing in company managed and staffed milking stations in a quest for higher standards of milk hygiene and hence milk quality from small holder herds milked through the station.

To date household dairy farms are almost self contained for herd feed supplies being supplemented by bought in concentrate feeds. Maize stover (crop residue) forms an important source of roughage and whilst maize silage from ensiling the whole plant is an excellent source of energy in daily rations of lactating cows the household survey indicated the use of this feed is less than expected in the project areas. Similarly a minority of the households surveyed (25 in Daqing) had access to pasture resources for grazing or cut and carrying either as greenfeed or hay to stall-fed cows. Pasture hay is generally of low quality and of little value to milking cows. However, it could become a valued component of feed supplies if farmers are trained to harvest hay earlier in spring at higher moisture levels and conserve as plastic wrapped haylage.

Whilst dairy farming in Heilongjiang Province has relied on the feeding of dairy animals by exploiting the excess production of maize grain, maize stover and soybean as the sources of energy and protein this has been in the context of historically high milk prices relative to corn and soybean prices. Frequently milking cow diets are based on too much low quality feed such as maize stover and hay (of low digestible energy and protein) restricting animal performance. This may not persist as the Government introduces policies to correct the oversupply of maize grain and the concomitant change in its price takes effect on the costs of milk production.

In addition to the use of maize stover as a source of feed roughage it has been the traditional practice for very substantial amounts of maize stover from the large areas committed to maize grain production to be burnt with estimates of 30 million tons annually causing significant environmental pollution (HDP August 2004).

Whilst there is an urgent need to limit this practice to avoid the serious environmental effects that result, proposals for the development of a project aimed at demonstrating improvement in the digestibility and feed value of crop residues particularly maize stover by treatment with urea and ensiling have limited merit. At best this treatment will result in a bulky forage suited only to maintenance levels of nutrition for dairy cattle due to its low digestible energy value per unit of forage fed (7 MJ of metabolizable energy per kg of dry matter [Rolston 2004 Annex 4 Page 25]).

It is critical that the feeding of lactating cows at least cost is based on high energy density feeds balanced with adequate protein density to maximize milk yield within the overall constraint of cow dry matter intake. This will be achieved by offering a diet in which maize stover is not over represented and high energy feeds rations, particularly maize silage, are emphasized. Alfalfa pasture and grasses are also important and cost effective substitutes that need to be considered to replace a proportion of the concentrates more commonly offered.

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8 Dr Phil Rolston: Feeding Dairy Cows for Milk Production  HDP June 2004.
The dominance of maize as a grain crop in Heilongjiang is well documented (2237 million hectares in 2002) and although estimates report only 187000 hectares of maize silage are currently grown traditional practices of feeding maize grain and stover are already changing to that of feeding whole maize plant.

A more widespread choice amongst farmers to produce whole maize silage as a high energy dairy ration immediately reduces the potential area of maize stover burnt delivering an environmental benefit in reduced carbon released to the atmosphere whilst enhancing milk production.

This awareness amongst some dairy farmers of whole maize as an important energy ingredient in dairy rations indicates an acceptance of the need to improve the quality of feed provided to lactating cows for higher milk production. It is important that this is achieved whilst maintaining a satisfactory level of income over the costs of production, principally feed costs. Disproportionate quantities of maize stover and purchased concentrates will not secure profitable and higher levels of milk production.

Maize silage will become the major feed resource for dairy production and considerable investment will be required in training and extension for farmers in maize silage technology especially as a pre-condition for loans to new entrant project farmers.

To overcome the inadequate protein supplied in maize silage, protein based feed will still need to be purchased to meet animal performance since most dairy households are severely limited in the available area of crop land. However, where it is possible the value of alternating soybean and alfalfa as legume crops in a rotation with maize needs emphasis to provide both protein supply whilst at the same time ensuring soil nitrogen benefits accrue and mitigating any potential adverse environmental impacts from the transfer of soil fertility.

To avoid the adverse greenhouse gas enhancement effects arising from the burning of excess crop residues such as maize stover consideration could be given to research into the utilization of this stover as a significant fuel resource in a biomass co-generation plant for electrical power generation. Another option is its use for steam generation at dairy processing plants with straw-fired boilers a consideration for use in the supply of dairy park heating requirements.

Pasture Production and Management

The total area in natural and artificial (improved sown) pasture is assessed at six million ha. The area of individual pasture blocks may vary from a few, to several thousands of hectares and in areas to the west can be largely fragmented on land regarded as wasteland from an agricultural viewpoint. Generally unsuited to cropping because of unfertile soils, the grassland areas do, however, have potential for pasture improvement. Pasture yields are low, typically less than 1.5-2.0 ton dry matter (DM) per ha per year. Pasture condition ranges from good, around ungrazed border regions and on larger State farms, to the degraded and unproductive pastureland often found around human settlements.

An area of 1.0 million ha of natural pasture has been improved. Principal improved species include Medicago sativa, Astragalus melilotoides, Puccinellia tenuiflora, Stipa baiculensis, Aneurorepidium chinense, Chloris virgata and Clinelymus excelsus. Pasture improvement is almost exclusively achieved through ploughing, secondary cultivation and sowing of improved species and planted areas are often fenced. There has been little effort as yet to develop direct seeding technology for pasture improvement or to strengthen community management of

9 CADDET Center for Renewable Energy, Denmark March 2001 at www.cad-...
common pasture resources. The management of the provincial pasture resource is in a period of transition as government consolidates a policy of long-term pasture lease to private farmers. Under the new “Contract and Development Plan of the Grassland Resource”, farmers, either individually or collectively, are eligible to lease State and collectively owned pastureland for periods of at least 30 and up to 50 years.

The recently introduced State Pasture Law\textsuperscript{10} defines rights and responsibilities of pasture ownership, access to and use of pasture and establishment, utilization and environmental protection measures. The requirements of county and state agencies for the supervision of pasture use permits and pasture land management together with the legal responsibility of all parties involved in pasture use are comprehensively described. (Annex 1)

The Mission has defined the role of grasslands in the expanding Heilongjiang dairy industry as confined to alfalfa pastures utilized as greenfeed or as silage/balage at least in the medium term. This would secure a source of protein and provide a substitute for soybean in least cost cow diets.

There are a number of significant environmental issues relating to degraded grasslands and soil salinity identified by the Mission. These concern not only amelioration of impoverished soils but also aspects of pasture ecology and agronomy and training for project farmers in improved pasture management practices and dairy cattle feeding. It is the Mission’s view that these matters will require a well coordinated multi-discipline integrated field research approach to grassland management before these grasslands can make an effective contribution to dairy cattle nutrition. (Rolston 2004).

**Dairy Farm Waste Management**

With the increasing number of village households entering the dairy industry and the expansion of herd numbers in existing individual households there are serious levels of pollution within the village environment. Discharge of wastewater or animal manure from individual households, dairy parks and milk stations without adequate regard for protection of surface or ground water resources is evident. Whilst existing design for collection and storage of animal effluent is often inadequate, responsible manure management is also lacking.

This is especially important at dairy parks, milk stations and breeding farms where large dairy cattle numbers are concentrated and generate substantial quantities of animal manure without access to farmland within close proximity.

Runoff from village manure heaps is visibly polluting nearby water courses and has the potential to pollute groundwater upon which villages depend for potable water. Where attempts are made to spread liquid effluent on farmland with effluent pumping systems without an appropriately designed effluent irrigation plan, there is also the very real risk of excess nutrient loading of soils. There is an urgent need for science based prescription of soil nutrient requirements since the limitations of some soils (eg low CEC) within the various project areas, suggest soil build up of organic matter can be enhanced with farm manure or organic fertilizer derived from it.

\textsuperscript{10} PRC Pasture Law effective from 1st May, 2003
In warmer climates where minimum temperatures do not fall below 22°C, small or medium-scale biogas production systems at the household and farm scale can be used to generate energy and produce a high quality organic fertilizer as a valuable by-product.

Whilst this has not proven to be a practical farm level solution year round in Heilongjiang, the EPB at Harbin is supporting further field research into modified biogas plants utilizing solar heating to enhance temperature in the biogas digestion chamber for manure treatment.

Recently the Harbin Institute of Technology has completed the commercial development of a bacterium specifically cultured for basic farm level composting of dairy cattle effluent to produce a good quality organic fertilizer. Composting requires include a simple, low cost sealed storage unit within the cowshed, temperatures maintained at or above 20°C, an optimum moisture level over 60% and the regular daily turnover of composting material. This can produce a quality organic fertilizer from raw effluent over a one-week period. Providing winter lagging insulation can protect composting temperatures, this system could offer the most cost effective solution to manure management and disposal for village based dairy farms of 10-20 cows.

For larger dairy park and demonstration farm developments this concept could be commercialized with regular tanker collection and delivery to a central composting enterprise where organic fertilizer production could be locally marketed for use in agriculture and on degraded pasture areas. An example of this arrangement was in place in one dairy visited by the Mission.

Alternatively medium scale plants for the controlled biological and anaerobic digestion of manure at individual dairy parks offer the option to produce both organic fertilizer and biogas (methane) which acts as a temperature sub-system to sustain the temperature requirements of the biological digestion throughout the year. Surplus methane gas for electricity generation provides the added advantage of a cost effective stand alone power supply to the milking station to meet milking plant power and hot water requirements independent of the reliability of local authority electric power supply.

Primarily these type of biodigestor systems offer an environmental and economically sustainable on-farm solution year round in the Heilongjiang dairy industry. By dealing with large volumes of dairy waste and producing a certifiable organic fertilizer that can be returned to meet the soil nutrient requirements of areas supplying maize and other forage crops to the dairy park farming system continuous biodigester units are an environmental neutral option. The production of biogas within the sealed digester and its use in the heating support sub-system is an integral part of the suitability of these under the long and severe cold winter period experienced in Heilongjiang. The small farm composting system developed by HIT has yet to be proven as a year round solution for treatment of dairy waste.

Whilst such integrated manure biodigestors are commercially proven and available internationally for medium and large scale dairy farms, local business initiatives would be required to develop licensed manufacture of patented designs or similar concepts in the PRC.

**Forestry Resources**

Forty two percent of the Heilongjiang Province is classified as forestland. Predominately indigenous forest is located throughout the Da Xingan Lang (Greater Khingan Range), the Changbai Mountains and some of the counties and cities in the low mountain areas. This forest is an integral part of the north-eastern continental ecological system and serves as natural protective barrier for the north western plain and livestock activities on the Buir Grassland areas.
Land Classification

China’s land resources are being mapped at a scale of 1:1,000,000 in order to compile and present land survey data and research to date, evaluate the quantity and quality of the nation’s land resources and to provide guidelines for their current and potential use for farming, forestry and animal production. Experimental mapping and classification has been conducted on the land resources of Harbin and Qiqihar regions of the Project area, but given that the mapping project is still at a preliminary stage of development further revisions can be expected.

This is work, nevertheless, that will become an important and essential prerequisite to determining the sustainable use of land for the HDP purposes. Identification of site limits for various project components, farming practices appropriate for environmentally sustainable grazing management regimes, the application of organic fertilizers to pasture rehabilitation and pasture utilization methods could all be developed with greater certainty with the availability of this land classification system information.

It can also highlight those soils, that whilst limited for sustained cultivation for agriculture use, are suited to natural pasture or replanting to improved pastures particularly where available water is sufficient to support livestock. Priorities and methods for amelioration of soil salinity or sodicity, or where poor drainage exists, could also be defined in terms of the project requirements for land use.

Ecological Resources

The pressure on land resources for food production has led to the modification of large areas of natural habitat and diminished biological diversity (biodiversity). Additional threats to once viable populations of local flora and fauna come from hunting, fishing and collection activities.

The Heilongjiang Government has attached great emphasis to ensuring that remnant areas of high biodiversity are protected and conserved in future. There remains a complete ban over any forest removal and the exploitation of wasteland areas is discouraged. Only ecologically sustainable farming practices are permitted with no cropping activities permitted on slopes greater than 25°.

In Heilongjiang Province there are three national conservation reserves, Tongjiang Ecological and Environmental Reserve at the confluence of the Songhua and Heilongjiang rivers in the northeast, the Sangjiang Wildlife Reserve and the Zhalong Ziran Baohuqu Nature Reserve near Qiqihaer in the western region of the Province. The latter is one of China’s first nature reserves and, has been developed as a sanctuary for cranes, four of six found here being on the endangered list, notably the red-crowned crane. None of these nature reserves are likely to be impacted by Project activities.

There are, however, a further 74 nature and wildlife reserves located in the HDP area under the management of various city and county level administrations. Principal amongst these conservation areas, the Lianshan, Jheran and Swachuang Wetlands in the eastern region and the Wudalian Chi Nature Reserve in the northwest. Their proximity to proposed project activities would need to be

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11 Classification Scheme for the 1:1,000,000 map of China’s Land Resources. Shi Yulin. Commission for Integrated Survey of Natural Resources, Chinese Academy of Sciences, Beijing 2003.
considered in any screening of potential adverse environmental impacts required of a project component.

**Environmental Impact Identification and Assessment**

**Background and Methodology**

The primary objective of the Project is to enhance the dairy production and farmers income in selected areas of Heilongjiang province. This would be achieved by raising the productivity of small holder dairy farmers and the development and strengthening of livestock support services. Investments including smallholder farmers supported by the project would be expected to adopt environmentally sustainable farming practices.

**World Bank Environmental Assessment**

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, EA evaluates a project’s potential environmental risks and impacts in its area of influence and examines project alternatives (re. Annex 3). It identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts including the process of mitigating and managing adverse environmental impacts throughout project implementation.

EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property); and transboundary and global environmental aspects. EA considers natural and social aspects in an integrated way.

The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

**World Bank Safeguard Policies**

The World Bank’s commitments to environmental and social protection are reflected in its ten safeguard policies. These are tabulated below together with their relevance to this project. It is the responsibility of the PPMO to ensure that all loan applications are compliant with these policies. Annex 4 details the World Bank’s Safeguard Policies.
### Table 3: Bank Safeguard Policies

<table>
<thead>
<tr>
<th>Policies</th>
<th>Relevance to this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment</td>
<td>Highly likely</td>
</tr>
<tr>
<td>Natural Habitats</td>
<td>Possible</td>
</tr>
<tr>
<td>Forests (rain forests)</td>
<td>None</td>
</tr>
<tr>
<td>Pest Management</td>
<td>Likely</td>
</tr>
<tr>
<td>Involuntary Resettlement</td>
<td>Possible</td>
</tr>
<tr>
<td>Indigenous Peoples</td>
<td>Unlikely</td>
</tr>
<tr>
<td>Cultural Property</td>
<td>Unlikely</td>
</tr>
<tr>
<td>Safety of Dams</td>
<td>None</td>
</tr>
<tr>
<td>Projects on international</td>
<td>Unlikely</td>
</tr>
<tr>
<td>waterways</td>
<td></td>
</tr>
<tr>
<td>Projects in Disputed Areas</td>
<td>Possible</td>
</tr>
</tbody>
</table>

### Project Safeguard Category

The Bank requires screening of each project to determine the appropriate category for the project. The Bank’s four safeguard categories are summarized below. The Project team has screened this project and has determined that the HDP be classified as Safeguard Category $S_2$.

### Table 4: Safeguard Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Potential environmental impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td>$S_1$ for projects with potentially severe impacts</td>
</tr>
<tr>
<td>$S_2$</td>
<td>$S_2$ for projects with lower impact potential</td>
</tr>
<tr>
<td>$S_3$</td>
<td>$S_3$ for projects with no safeguard issues</td>
</tr>
<tr>
<td>$S_F$</td>
<td>$S_F$ for Financial Intermediaries, social development funds, community driven development or any other projects involving on-lending activities.</td>
</tr>
</tbody>
</table>

### World Bank Environmental Assessment

The HDP can be classified as a Category B project in accordance with World Bank environmental assessment procedures, as its potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, rivers and other natural habitats - are less adverse than those of Category A projects. These impacts are of lower impact potential; site-specific; few if any of them are irreversible; and in most cases, mitigation measures can be readily designed. The EA examines the project's potential negative and positive environmental impacts and
recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

PRC Environmental Legislation

The Environmental Impact Assessment (EIA) legislation for the People’s Republic of China (PRC) is utilized by the HEPB for environmental assessments of project components and is based on a prescriptive regulatory framework. Various types of projects are categorized in terms of their mandatory levels of environmental assessment requirements. In accordance with the provisions of the Environment Protection Management Regulations (EPMR) of the HEPB, a number of dairy processing companies accepting milk in the project areas have completed EIAs and prepared Environmental Impact Reports (EIRs). Local environmental specialists accredited by the HEPB conducted these studies.

Mitigation measures proposed in these EIRs emphasize the form of environmental management interventions required in the designs that should be incorporated in major components of the HDP.

In the case of the development of breeding farms and dairy parks proposed for the Project, because their herd size is greater than 400 cows and they have the potential to have major impact on the environment, these are classified under the EPMR as “construction projects”. An EIA will need to be conducted and an EIR prepared listing and evaluating the key potential environmental impacts and any forms of pollution and the consequences on the environment. Measures for preventing, minimizing, or mitigating for adverse environmental impacts are required to be detailed.

Whenever applicable, they would be included in the design of the proposed breeding farm or dairy park. All these units proposed by the Project are required to meet national environmental standards, and none of these should be approved for project financing without an Environmental Clearance Certificate (ECC) from the HEPB.

Additionally, many special laws relevant to pasture land, land degradation, water resource and other environmental protection regulations such as waste discharges of livestock and poultry breeding industries exist. Their application, however, is fragmented and enforcement is executed by various agencies, thus causing considerable problems in the move towards integrated ecosystem management.

In the past, emphasis has been on pollution control and not on sustainable ecosystem maintenance, rehabilitation rather than prevention, and has been urban oriented. For the HDP it is imperative to ensure that technical support, farming practices and project component

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12 PRC Environmental Assessment Legislation, 2001
13 2001 Management Method to Control Pollutants caused by Livestock and Poultry Breeding
GB 18596 – 2001 Discharge Standard for Pollutants of Livestock and Poultry Breeding
HJ/T81- 2001 Technical Standard for Preventing Pollution from Livestock and Poultry Breeding
designs are based on ecologically sustainable principles, and the precautionary principle of ecologically sustainable development is applied in all cases\textsuperscript{14}.

In this assessment, the potential for adverse environmental impacts in implementing various Project components are discussed, and mitigation measures recommended for representative project components.

**Project Components**

The Project components and their various locations as selected by the PMO, at the request of local farmers, officials and investors include seven 1000-cow breeding farms, 85 50-cow dairy parks and 5500 individual households, which together, will receive a total of 76500 dairy cattle (Annex 9).

**Breeding Farms**

*Nature and scope*

Seven 1000 head breeding farms/parks would be established, most probably with each initially receiving 500 imported yearling dairy heifers - a total of 3,500 head.

For the purposes of environmental assessment the design and operational features for breeding farms are the same as those for dairy parks and accordingly they have been treated as a larger scale version of a dairy park in terms of cow numbers.

**Dairy Parks**

*Nature and Scope*

This component supports the establishment of 85 dairy park enterprises that will contain household dairy herds of various sizes with a final combined total of 500 dairy cattle at each park. Cows owned by households participating in the park will be milked through a milking station at the dairy park at which refrigerated milk storage and milk transfer facilities will be installed. In addition, farm households located in nearby villages may also choose to bring their cows for milking at the dairy park milk station. An EA matrix of potential environmental impacts and possible mitigation measures with costs for a typical dairy park is set out in Annex 6.

**Potential Environmental Impacts Identified and Mitigation Measures Proposed**

(i) **Site selection.** The selection and acquisition of sites for the location of dairy parks and breeding farms will not involve the resettlement of any households. It will also endeavor to avoid or minimize the need to acquire land held by existing landowners or land tenants. Any acquisition that does take place will have a significant but short-term impact for a small number of affected people. None will be required to move out of their respective areas. Those affected in this way would be compensated by being allocated alternative farmland according to the provisions established by the Government\textsuperscript{15}.

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\textsuperscript{14} Precautionary Principle of Ecologically Sustainable Development states that “Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”

\textsuperscript{15} Land Control Law of the Peoples Republic of China.
As far as is possible, dairy parks and breeding farms would be sited away from city centers, residential areas and public places such as hospitals and schools. Preferably they would be serviced by good quality roads and conveniently linked to transport centers and, where possible, within walking distance appropriate for village households who wish to bring their cows to the park for milking on a daily basis.

A mandatory requirement of site selection will be the minimum setback zone for the park boundaries of 400 m from any watercourse including local drains, ephemeral streams and rivers in accordance with Government regulations.

(ii) Project Design and Construction. Due to the concentration of a large number of dairy cattle, the most significant potential adverse impact on the environment of breeding farms and dairy parks concerns the substantial amount of animal manure and waste water generated on a daily basis, and the management of its collection, storage, safe disposal and use.

Water systems for daily wash down of cowsheds and the milking station would be deployed with drainage through stone traps to a sealed concrete sump and aerobic pond. Effluent would be pumped from the pond and applied as organic manure to nearby farmland with a tractor drawn effluent spreader.

The design of the system would account for the limitations of the receiving land in terms of the area, the soil type and its key characteristics. Assessment and design would consider the texture of the soil, its nutrient status, cation exchange capacity, water holding capacity and ground water levels in the area.

An appropriate plan would be prepared for the management of the effluent disposal system within the limits described in the environmental management plan for the dairy park or breeding farm to avoid adverse impacts such as ponding of effluent, runoff to watercourses or nutrient overload leading to pollution of groundwater.

Provision would be made in the design for a pond storage capacity for up to 30 days as a contingency during periods of high rainfall when field application is not possible or temporary breakdown of the pump and distribution system.

A further contingency plan would provide for disposal by a contractor certified by the HEPB. Collection would be with a tanker truck and then transport to other receiving land areas or to an integrated self-supporting biological transformation (biodigestion) treatment system producing biogas and organic fertilizer. Such a system, which could transform the biogas to an energy source for the heating of the biodigester, overcomes the minimum temperature constraint on this process during the long cold winter period and also that of crop production when application to farmland is not possible.

(iii) Project Operation. There are three principal areas of operation for which potential for adverse impacts on the environment arise. Firstly it is important that hygienic milking practices are followed and that the design and operation of the milk station ensures this happens. Maintenance of in-place cleaning systems and regular milking machine plant cleaning are essential measures to avoid adverse impacts, particularly mastitis disease outbreak and thermudric bacteria contamination of milk.
Secondly, operation of the effluent collection and disposal system must be in accord with the environmental management plan protocols as discussed earlier.

The third area of environmental risk is where pasture is utilized as a source of forage either by cutting and carrying pasture to barn fed cows or grazed *in situ*. In either case if pasture is cut or grazed too severely, recovery growth of species will be retarded allowing weed invasion and possibly exposing soils to erosion in severe cases. Where no grazing is permitted the impoverishment of soil organic matter and nutrients will continue unless farmyard manure is returned or chemical fertilizer is applied to the land.

Practical measures to mitigate these risks involve farmer training in sustainable pasture management practices, alternating grazing of pasture with cutting, and regular applications of farm yard manure following cutting, based on recommendations supported by practical field-based comparative experiments and periodic sampling and testing of pasture soil for nutrient levels. Land classification information would be consulted where available.

Extension workers and technical specialists must provide ongoing technical support to dairy park farmers on soil and manure fertilizer management practices, pasture utilization and management and various other herd husbandry and milking management practices to ensure the environmental objectives are achieved. Training in these areas would be a mandatory for project beneficiaries.

(iv) **Environmental Monitoring and Management Plan.** HEPB environmental protection management regulations for various categories of construction projects classify animal husbandry and grazing as having the potential to significantly affect the environment. Under recently introduced EIA legislation it is understood that the previous animal husbandry and grazing project category for the purposes of EIA has been more closely defined to separate two intensive livestock production categories. Firstly, a category of intensive livestock breeding farm that can be applied to the individual household component under this project. Secondly the intensive livestock breeding area which is relevant to the dairy park and breeding farm components. (Table 5)

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16 PRC EIA Regulation effective September 2003
Table 5: Categories of Environmental Assessment of Intensive Livestock and Poultry Breeding Enterprises

<table>
<thead>
<tr>
<th>Type</th>
<th>Intensive livestock and poultry breeding farm</th>
<th>Category</th>
<th>Intensive livestock and poultry breeding area</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cow</td>
<td>Over 200 head</td>
<td>I</td>
<td>Over 400 head</td>
<td>I</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>Over 400 head</td>
<td>I</td>
<td>Over 800 head</td>
<td>I</td>
</tr>
<tr>
<td>Dairy cow</td>
<td>100-200 head</td>
<td>II</td>
<td>200-400 head</td>
<td>II</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>200-400 head</td>
<td>II</td>
<td>400-800 head</td>
<td>II</td>
</tr>
<tr>
<td>Dairy cow</td>
<td>Less than 100 Head</td>
<td>III</td>
<td>Less than 200 Head</td>
<td>III</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>Less than 200 head</td>
<td>III</td>
<td>Less than 400 Head</td>
<td>III</td>
</tr>
</tbody>
</table>

1. Intensive livestock breeding enterprises at the household scale with ample labor and material inputs and the adoption of improved livestock husbandry and management practices.

2. Intensive livestock breeding enterprises some distance from urban residential areas which will involve several individual household livestock breeding enterprises [e.g. dairy park] and established in accordance with local administrative plans.

3. Category I requires an EIA to be completed and the preparation of an EIR; Category II requires an Environmental Statement and, Category III requires a Registered Statement.

An EIA is therefore mandatory for intensive livestock farms with over 200 dairy cattle and for intensive breeding areas where more than 400 dairy cattle are managed as a unit. From this it may be interpreted that dairy parks and breeding farms would be required to complete an EIA and prepare an EIR, together with environmental management plan (EMP), to comply with this regulation and conditions for loan approval.

(v) Environmental Screening. The Guidelines for Environmental Screening and Monitoring of the Project, discussed in Annex 5, defines a procedure for two stage screening by the PMO (or contracted environmental specialist) of each project component to determine (a) the relevant EMP associated with the activities of the proposed project and to compare this with that proposed by the proponent; and (b) by site inspection, the veracity of environmental data provided by the proponent. This provides a basis for the local PMO to accept or reject the proposal on environmental grounds.

The EIR and associated EMP completed for breeding farms and dairy parks would support their proponent’s project proposals through the screening process of the local PMO.

This EMP should incorporate: (i) measures to protect the environment from the farm or dairy park operations, (ii) environmental monitoring procedures, (iii) environmental reporting, (iv) integration of environmental improvement plans with quality management, (v) occupational health and safety standards (vi) appointment of a designated environmental officer, and (vii) annual budget provisions to finance implementation of the EMP.
The PMO, in collaboration with HEPB and AHB staff at the county level, would be required to regularly monitor the effectiveness of EMPs. Environmental screening formats are described in Annexes 10-12.

Individual Households

Nature and Scope
About 5,500 household farms will benefit under the project by receiving credit for the purchase of 2-6 dairy cows to enter the industry or to purchase additional cows to expand existing herd numbers. A total of about 42,500 dairy cattle for individual households are to be financed under the project. Project benefits which will accrue to households, in addition to loans advanced, include employment opportunities in dairy parks, milking stations and possibly milk processing plants; training in a range of skills including animal husbandry and dairy cow breeding management, animal health and the feeding of dairy cattle, all of which will build on existing farmer training. Sustainable and practical farm practices, which are in accord with the protection of natural resources, will also be included in farmer training.

An EA matrix of potential environmental impacts and possible mitigation measures with costs for a typical individual household is set out in Annex 7.

Potential Environmental Impacts Identified and Mitigation Measures Proposed
(i) Site selection. The selection of participating households would not involve any resettlement issues. However, with the exception of those households entering dairying for the first time, existing households within reasonable proximity to a milking station or existing dairy park would be better positioned to cope with the husbandry and breeding needs arising from expanding herd numbers and benefit from support services and information on livestock management available from these facilities. Ownership of and access to pasture areas for grazing or cutting and carrying of forage to stall fed dairy cattle, as well as return of manure, is relevant and beneficial to households participating in the project.

Where possible, as households expand their herds, they would be encouraged to either milk cows through a milking station, provided it was within reasonable walking distance for cows from the village household, or to eventually transfer their herd permanently to a dairy park.

(ii) Project Design and Construction. With the increase of the number of dairy animals at participating households it is imperative that the collection, storage, safe disposal and use of animal manure and wastewater generated on a daily basis be managed to protect the environment.

Both existing households with dairy cattle and those entering the dairy industry will be encouraged to construct sealed manure storage pits and a small sealed and insulated fermentation bin for treatment of raw effluent. Cow manure can be transformed in simple and safe manner by cost-effective aerobic bacterial action to produce a dry organic fertilizer within 7-10 days, which can be easily stored or directly applied to crop or pastureland as required.

Other alternative design aspects to enhance the environment of stall managed dairy cattle include low cost improvements to ventilation and insulation systems of cow sheds and, where
practical, passive solar heating of these areas. Design and construction of feeding troughs should also ensure ease of access for feeding cows but avoid shallow trough designs with concomitant and costly waste of concentrated feeds and forage through spillage and soiling/trampling of feeds.

(iii) **Project Operation.** Environmentally sustainable farming practices and natural resource use would be encouraged. Use of water wash down for clean stalls and hygienic milking practices including evaporative cooling in summer, manuring of crop and pasture land based on soil nutrient analysis to avoiding excessive applications, and sustainable pasture grazing and harvesting practices would all be included in farmer training and encouraged to be provided through existing technical support services at the village level.

(iv) **Environmental Assessment and Screening.** The HEPB environmental protection regulations defines EA category III to include livestock farms with less than 100 dairy cattle. This category of project is required to complete a Registered Statement of the enterprise activities. No further EA is required. In the HDP, the Guidelines for Environmental Screening and Monitoring (Annex 5) define a procedure for simple screening by the PMO (or contracted animal husbandry specialist) of each individual householder. This would determine the (a) relevant sustainable farming practices applicable to the activities of the individual householders proposed dairy herd expansion and to compare this with that stated by the householder and (b) by site inspection, check the veracity of environmental data provided by the householder. This provides a basis for the PMO to accept or reject the proposal on environmental grounds.

This process would assist individual households with less than 100 dairy cattle to meet the requirements to file a registered statement.

**Dairy Processing Plants**

The present growth of dairy production in Heilongjiang Province has been accompanied by significant consolidation in the number of processing companies some of whom have continued to invest in new processing capacity. Existing and future milk production is likely to result in increased throughput at existing plants as they seek to gain economic efficiencies by taking up unutilized processing capacity.

As a consequence of HDP and other investments in dairy production, present and future processing plants must ensure their design of plant and organization meet the requirements of both Hazard Analysis and Critical Control Point (HACCP)\textsuperscript{17} processes and State Environment Protection Laws and Regulations.

The mission visited several processing plants and checked that provision had been made in plant design for the treatment of wastewater and solids and control over emission of boiler gases and particulate matter. In one case waste treatment facilities were not completed yet the plant was operating and proceeding with plans for further plant extensions. In another case

\textsuperscript{17} Hazard Analysis and Critical Control Point is an internationally recognized system for ensuring food safety, which places responsibility and accountability on the food producer to identify and control hazards to safe food production. This should be applied on farm to market basis.
dissolved air flotation equipment installed for removal of solids was by-passed with wastewater being directed to sedimentation ponds before being discharged.

The majority of plants have aeration systems as the primary form of wastewater treatment with discharge of treated water to municipal sewage treatment systems where available. Whilst the aerobic treatment of waste has the capacity to better respond to BOD levels than anaerobic treatment, in extreme cases the potential exists for the organic load of waste milk products to cause an overload of the sewage system.

(i) **Project Design and Operation.** The processing of milk to produce dairy products is a significant potential contributor to the overall environmental demand on natural resources during the life cycle of milk production and consumption. The key environmental issues of concern for the project associated with dairy processing are the high consumption of water and the generation of high strength wastewater streams. Consumption of energy and, for some sites, noise and odor may also be significant.

Dairy processing effluent contains milk and milk products lost from the process, detergents and acidic and caustic cleaning agents. Constituents present in dairy effluent are milk fat, protein, lactose and lactic acid as well as sodium, potassium, calcium and chloride. Milk loss can occur when pipe work is uncoupled during tank transfers or equipment is being rinsed. Therefore wastewater treatment is necessary to reduce organic loading to receiving waters or land to a level that avoids or minimizes environmental damage and does not constitute a health risk. Minimum treatment is neutralizing of pH, solids sedimentation and removal of fat.

Consideration could also be given to the spray irrigation of wastewater from dairy processing to land with nutrients benefitting pasture. This, however, must be done in strict accordance with an environmental management plan that is cognizant of the land’s classification for this activity to avoid dissolved salts in the effluent adversely affecting soil structure, causing soil salinity or leaching into underlying ground water and affecting its quality.

Demand on the environment through rates of water consumption for processing can vary considerably depending on such factors as the scale of the plant, type of processing and the ease with which plant can be cleaned. A typical range of water consumption in reasonably efficient plants is 1.3-2.5 litres of water/kg of fresh milk intake. By adopting best practice systems such as automated cleaning-in-place (CIP) and control measures for water flow during manual cleaning water consumption can be reduced to 0.8-1.0 litres water/kg milk intake.

A survey of dairy processing plants by the PPMO\(^\text{18}\) in the project area estimated that waste water produced per ton of milk processed was commonly in the range 1.3 to 3.3 tons indicating there is room to improve water consumption efficiencies at many of these companies.

(ii) **Environmental Management and Monitoring.** The State environment protection regulations regard plants that process foods as having the potential to cause a significant impact on the environment and must therefore be subject to an EIA and produce an EIR.

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\(^{18}\) PMO survey of 67 dairy processing plants in HDP project areas March/April 2004.
All processing plants are the subject of screening for environmental issues by the planning authorities and based on data provided by the proponent an environmental assessment category is allocated to the plant in accordance with the State EIA regulation. The environmental report and environmental management plan are then required to be submitted to the relevant planning department and to the local EPB office with the project proposal. Only when the EPB has issued a clearance certificate should plans for a construction or extension of a processing plant proceed to appraisal and approval.

Clearly any environmental problems associated with the dairy processing sector stem not so much from inadequate legislation or lack of good intentions as from inadequate enforcement. The new environmental laws under consideration will only achieve their aims based on the efficacy of their enforcement. Government agencies must be offered the required training and institutional strengthening to ensure the industry accepts its responsibilities as set out in the environmental laws and regulations and meets the required environmental protection standards.

Support Service System

Technical advisory services, which are almost exclusively provided by government, are barely adequate to meet the demands of the rapidly expanding dairy industry. Impact mitigation and environment enhancement measures have been recommended for all HDP components, but ultimately, the implementation of these recommendations requires close cooperation between and within the concerned agencies and at all levels of government. This can be problematic for the PPMO where several government agencies have various responsibilities for the use and protection of a particular natural resource. In the case of water resources the State Ministry of Water Resources, Heilongjiang Provincial Hydrological Bureau, HEPB, Heilongjiang Provincial Agriculture Commission and Department of Construction all share various responsibilities across water catchment management planning, water resource management and monitoring, conservation and protection. The most likely contact point for the individual household dairy farmer is the village or County level animal husbandry technician who may not be informed on water resource management and protection regulations.

Most county and township level advisors would benefit from additional training, particularly concerning farm management and environmentally sustainable farming practices as well as dairy cattle husbandry nutrition, whole herd health management and milk quality control. Training in sustainable farming practices should include practical measures of pasture yield and growth rate and how these link to assessment of livestock carrying capacity, frequency of grazing and the maintenance of pasture cover following grazing or cutting to sustain pasture regrowth and longevity.

The government should also support a more diversified information base for farmers to include soil management, manure management and disposal, and organic fertilizer practices to ensure that the environmental protection objectives of the HDP are achieved. Milk factories have a vested interest in farmers producing more, cleaner milk with a consistent fat and solids-not-fat content and can play a key role in providing technical and production information to farmers. The recent development of factory-owned village milking stations provides a focal point for the delivery of company-based services.
Institutional and Training Requirements

Institutional Requirements
Impact mitigation and environment enhancement measures have been recommended for all Project components, but ultimately the implementation of these recommendations requires close cooperation between and within the concerned agencies and at all levels of government.

The Provincial and County level Environmental Protection Bureaus have been involved with the planning stages of the Project and will be intimately involved in monitoring the construction activities and environmental impact assessments. The EPB’s present strength is in their mandate for a command and control approach to regulation of environmental pollution and rehabilitation. Limited emphasis has been placed on prevention approaches and sustainable ecosystem-based use of natural resources.

The future interaction between the HEPB, Animal Husbandry Bureau, Agriculture Commission and Hydrological Bureau, all of whom have an interest in supporting ecologically sustainable resource use, is the key to the delivery of environment sustainable development outcomes for all Project components.

No project will be approved for Project financing without an environmental clearance certificate from the HEPB. Each breeding farm and dairy park will be required to complete an EIA and submit an EIR and EMP with the proposal for financing and be subject to periodic environmental audits by the HEPB. The HEPB will monitor dairy processing plant wastewater and farm effluent discharges at all sites at least on an annual basis.

The Animal Husbandry Bureau will have a role in monitoring the incidence and effects of organic fertilizer and pesticide run off from Project sites on surface and groundwater quality at strategic locations and the report on the uptake of environmentally sustainable farming practices by Project farms developed under the project.

Training Requirements
1. Recommendations are made for all project livestock components with the exception of household farmers to prepare environmental management plans (EMP) as confirmation of their commitment to compliance with environmental protection measures and mitigation of potentially adverse environmental impacts. It is not clear whether or not the HEPB has the required staff trained to provide advice and practical training on the preparation of environmental management plans.

2. It is recommended that an appropriate training course in EMP be offered to selected staff of the HEPB and PMOs, which will equip them to act as trainers in EMP preparation at industry management level. The course selected should have accreditation at ISO 14000 series standard and should be offered in-country in Heilongjiang Province to capture the opportunity for field based case studies relevant to participants.

3. It is recommended that county and township level advisors be provided with training in farm management and environmentally sustainable farming practices as well as dairy cattle husbandry nutrition whole herd health management and milk quality control. Training in sustainable farming practices should include practical measures of pasture yield and growth rate and how these link to assessment of livestock carrying capacity, frequency of grazing and the maintenance of pasture cover following grazing or cutting to sustain pasture regrowth and longevity.

19 ISO the International Organization for Standardization.