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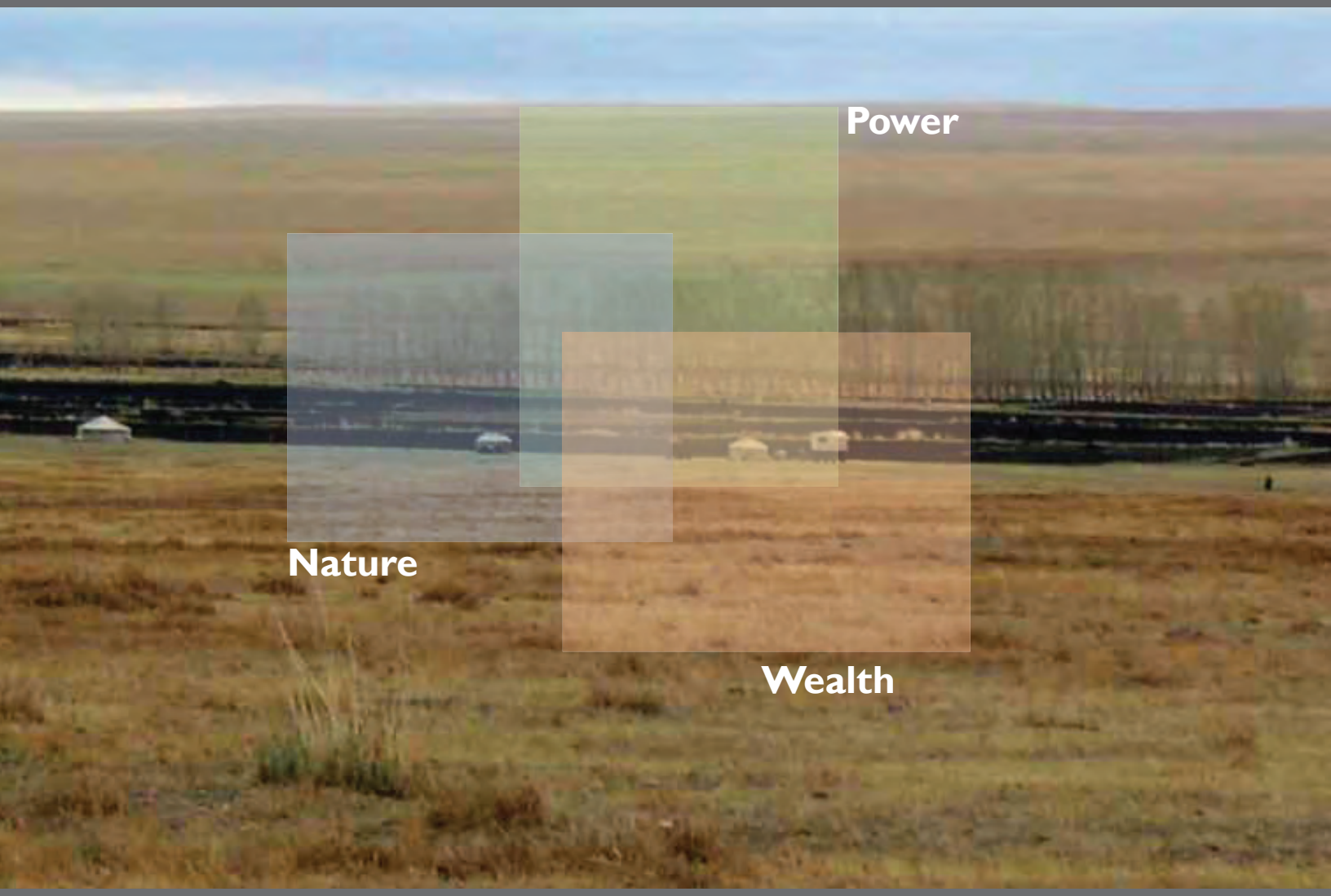

Case Study:

The Potential for Intensive Crop Production in the Eastern Steppe of Mongolia: History, Current Status, Government Plans, and Potential Impacts on Biodiversity

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The Potential for Intensive Crop Production in the Eastern Steppe of Mongolia:
History, Current Status, Government Plans, and Potential Impacts on Biodiversity

Report prepared for WCS TransLinks Program

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The Potential for Intensive Crop Production in the Eastern Steppe of Mongolia:
History, Current Status, Government Plans, and Potential Impacts on Biodiversity

Table of Contents

Introduction 4

Historical Context: Changes in Mongolian Crop Production 1921-Present 5

The Composition of Crop Production 10

Lands Currently in Crop Production 10

Plans for Developing Crop Production: The Third Atar Campaign to Reclaim Arable Land 12

Resources Supporting the Atar Campaign and Crop Development 13

Preliminary Assessment of Risks to Biodiversity and Ecosystem Health from the Atar Campaign 14

Possible Future Activities 22

References 24

Endnotes 27

Appendix: The 3rd Atar Campaign 29

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Introduction

The temperate grassland, savanna, and shrubland biome is perhaps the most threatened and least protected biome on earth. About three-quarters of this biome has been converted for human use (mostly crop or livestock production), and little evidence suggests that this conversion is slowing (Halls et al. 2006). Only 5% of the biome has been incorporated into protected areas, the least of any biome on earth (Brooks et al. 2004). The grasslands of Mongolia comprise a large proportion of the remaining "unconverted" temperate grasslands, and, therefore, are immensely valuable for both biodiversity and humans.

In recent years, concerns within the conservation community have arisen about possible large-scale increases in crop-based agriculture in Mongolia. Ongoing or past attempts to grow crops on large scales in other similar arid systems (e.g., Inner Mongolia in China, Kazakhstan) have not generally been viewed as successful and have had, by many accounts, serious negative consequences for biodiversity and ecosystem health, including most notably desertification (Sheehy 1992; Saiko 1998). The mistakes made in these systems in the name of obtaining self-sufficiency in food production should be avoided in Mongolia.

As most of us involved in conservation in Mongolia are not intimately familiar with crop-based agriculture, this report is an attempt to better understand the issue, and to answer a few basic questions:

1. What is the historical context for crop-based agriculture in Mongolia, over the past 100 years or so? How important has it been? What crops have been tried and to what extent?
2. What is the current extent of crop production in Mongolia? What areas are being farmed and what crops are being grown?
3. What are the Mongolian government's plans for crop production?
4. What initial concerns for biodiversity conservation and ecosystem health do these plans raise?

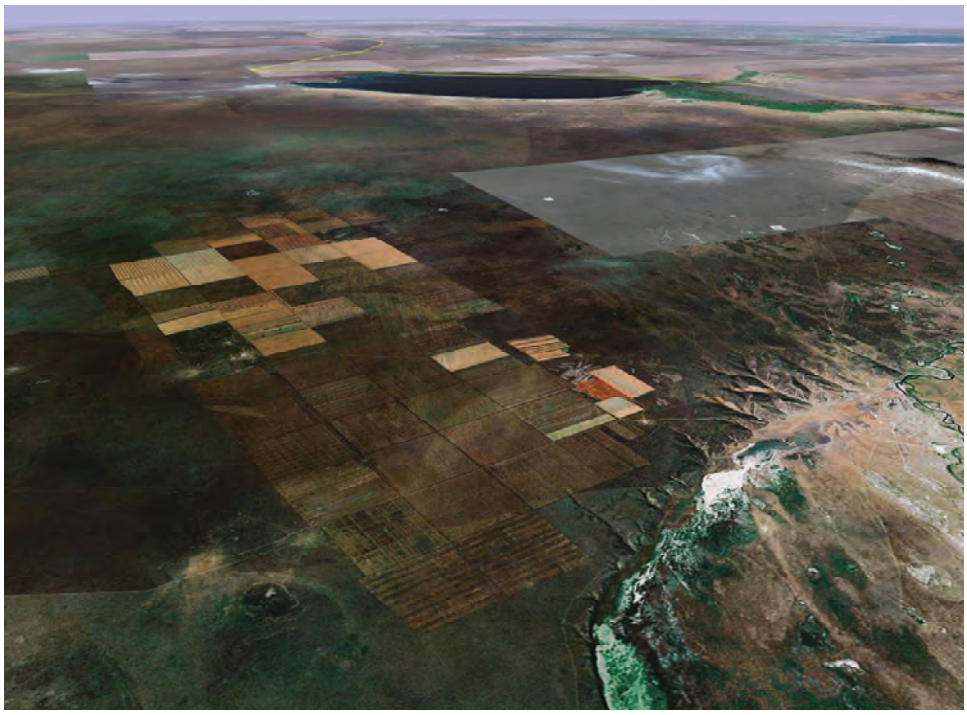
In addition to providing some answers to these basic questions, an objective of this report is to help guide further examination and research. At the end of this report, we discuss possible next steps for years 2 and 3 of the project, including what activities might be implemented and what further questions we, as the broader conservation community, can answer. Although our project is meant to focus on the Eastern Steppe, for the purposes of this report, most of the information we used was available for the entire country and was not necessarily separated out for the Eastern Steppe.

It is important to note that this report does not attempt to answer questions about livestock-based agriculture, which has been discussed at length elsewhere (e.g., Reading et al. 2007). In many circumstances,

however, crop-based agriculture has been considered an option in conjunction with livestock farming, as a means to: (1) supplement natural feed for livestock with cultivated fodder (2) improve crop production by grazing livestock in fallow or seasonally-dormant fields (i.e., adding manure as a fertilizer and removing unproductive crop tissue); and (3) provide an additional source of income for farmers where overgrazing is occurring and livestock densities need to be reduced (Kawanabe et al. 2001).

Historical Context: Changes in Mongolian Crop Production 1921-Present

Over the last century, crop production has always been an important but relatively small part of the Mongolian economy. For example, from 1961-2005, crops accounted for only about 12% of gross economic agricultural production, while livestock accounted for most of the remaining 88% (FAO 2008). In 2002, the crop sector comprised only 4% of Mongolia's GDP (Tokeshi 2004). In terms of land, crops have never been produced on more than 1% of the total land area of Mongolia, while in neighboring China, cereal production alone occupies nearly 9% of the land surface (average 1961-2005) (FAO 2008). Emphasis on livestock rather than crop production is certainly due in part to the generally poor and highly variable climate in Mongolia. Worden and Savada (1989) note that "any population attempting to support itself by cereal agriculture could expect to lose its entire crop once every ten years, or every seven years, or every other year, depending on the localities they were farming." This ecological driver is certainly reinforced by cultural preference for pastoralism over sedentary agriculture and meat over vegetables.



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An active crop area in eastern Dornod Aimag. The size of this area is about 30x15 km (about 400 km^2).

Although it remains a small part of the economy, there has been substantial growth in the crop sector since the Communist revolution in 1921. Little official information on agriculture or crop production is available for the period from 1921-1960, but crop production probably grew slowly with the emergence of centralized planning, agricultural collectives, and state-run farms, especially after 1950 (Worden and Savada 1989; Suttie 2000). In 1960, official statistics on agriculture production became available, and in 1962 Mongolia began to receive substantial financial assistance for agricultural development from the Soviet Union (Worden and Savada 1989). In terms of crop production, the time since 1960 can be divided into 3 distinct periods: 1960-1980, 1980-1990, and post-1990 (Figures 1 and 2).

In 1959, Mongolia commenced on the first of three "Campaigns to Reclaim[1] Abandoned Arable[2] Land," known as the Atar Campaigns[3]. As a result, from 1960 to 1980, total crop production grew slowly and erratically (the erratic nature is due, in large part, to variations in climate), and appears to have been driven primarily by increased land reclamation rather than increases in efficiency (Worden and Savada 1989). From 1974-1979, the amount of land harvested for crops grew from about 420,000 ha to more than 580,00 ha (~40% increase), although the tonnage of crops produced grew by only 5%. During this period, production was characterized by highly centralized government regulation of farm production and management practices, but modern farming technology and training remained hard to come by.

In 1979, the country announced the far more successful Second Atar campaign. Over the following decade several government-led development initiatives combined to create a dramatic increase in the amount of land in production, and a more moderate increase in total production and yield (i.e., efficiency) (Bayarsaihan and Coelli 2003; FAO 2008). At the peak of agricultural production in 1989, approximately 1.38 million hectares of land was classified as arable or planted in permanent crops, and about 700,000 ha (50%) of this was actively harvested (FAO 2008). During this period, crop production also became a larger proportion of total agricultural production (Figure 3). According to Bayarsaihan and Coelli (2003), three categories of development initiatives were important:

> "(i) increased use of conventional inputs such as land, labour, machinery, and fertilizers; (ii) the development and importation of new technology and increased emphasis on education and skills; and (iii) a series of policy reforms aimed at improving farm efficiency, through greater management autonomy and incentives."

The period since the collapse of the Soviet Union in 1990 has been characterized by a 70% crash in total crop production across Mongolia, and similar declines in land in production and yield. The contribution of crops to the agricultural sector of the Mongolian economy dropped from 23% in 1989 to 10% in 1992 (Tokeshi 2004). Shortages of fuels, fertilizers, seed and parts for agricultural equipment are the proximate causes of this crash, although more indirect causes

can be attributed to the liberalization of the economy and increased costs of production, limited credit availability, inadequate extension services and training for farmers, and limited technical innovation and research (Tokeshi 2004). The use of fertilizers collapsed from 1990-1993, but according to Earthtrends (2003) steadily rose after, although this recovery has yet to have any discernable impact on total production (FAO 2008). Much of the land that has fallen out of production is now fallow but is considered “recoverable” (see Plans for developing crop production below) (Suttie 2000).

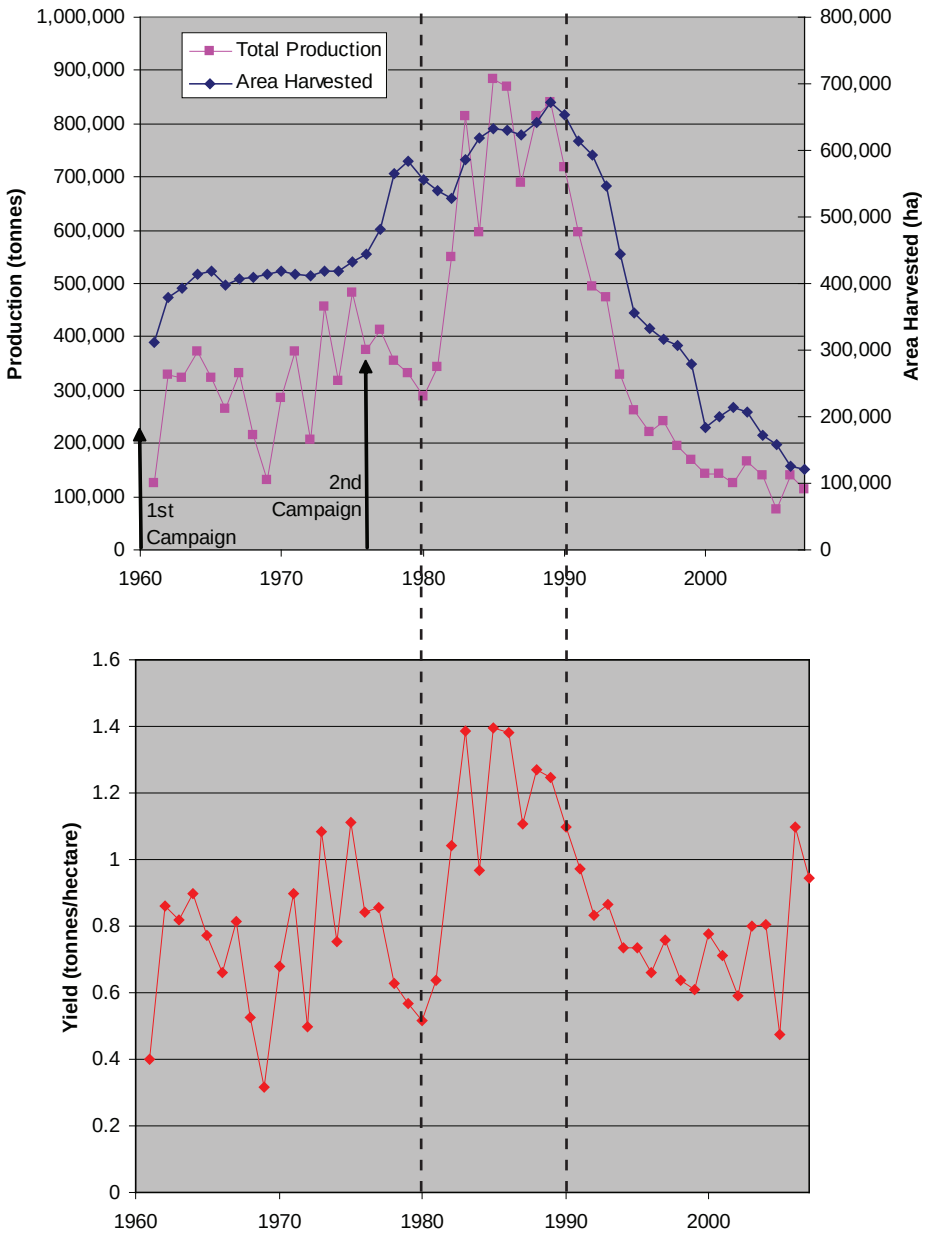

Figure 1. Trends in cereal production and area harvested (upper graph) and yields (i.e., land efficiency; lower graph) in Mongolia. The first (1959) and second (1979) Campaigns to Reclaim Arable Lands may have increased the amount of land in production, but appear to have had no clear impact on total production or efficiency. Dotted lines indicate the 3 periods into which we divide our discussion. Source of data: FAO (2008).

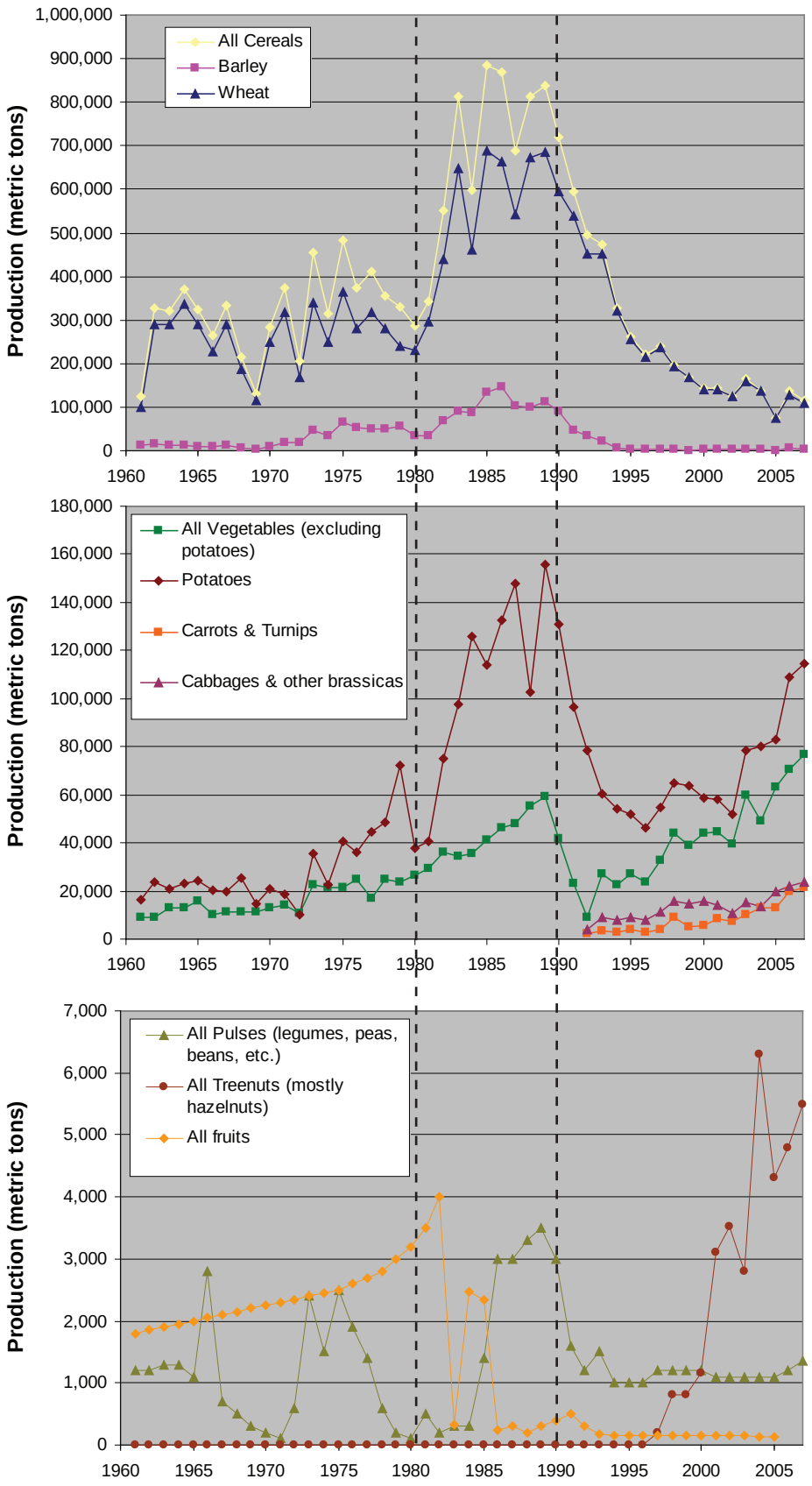

Figure 2a. Breakdown of crop production. Cereal production (top graph) is the largest component, followed by potatoes (middle graph), other vegetables (middle graph), and fruits and legumes (bottom graph). Note, the y-axis scale is different in the 3 graphs. Source of data: FAO 2008.

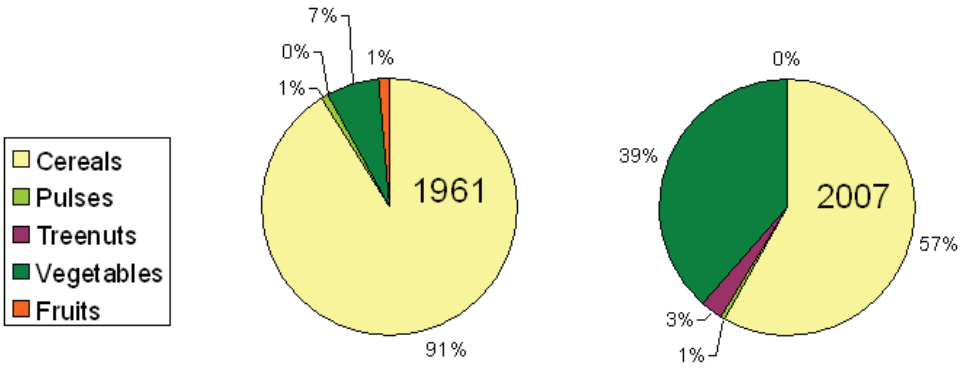

Figure 2b. Breakdown of crop production, 1961 and 2007. Source: FAO 2008.

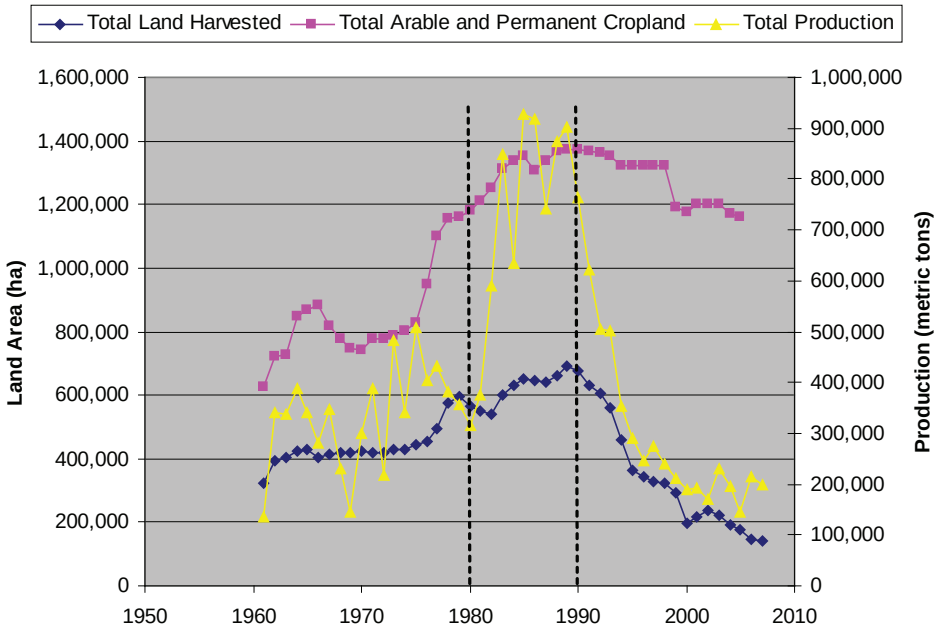

Figure 3. Trends in the amount of land in crop production and the amount of land harvested. While the amount of arable land has stayed relatively high in the last two decades, the amount of land actually harvested and total production has crashed (i.e., a lot of arable land is fallow).Source of data: FAO (2008).

During the collective farming period (1950-1990), consumption of agricultural crops, especially cereals, was generally met by domestic production. Since 1990, however, this has not been the case as much of the grain supply is now imported. According to the Asian Development Bank (Tokeshi 2004), as of 2002, total domestic production met only 32.7%, and vegetable production only 30%, of local demand. According to Earthtrends (2000), about 40% of domestically consumed cereals is now imported, and about 4% of this is food aid. These trends and reliance on imports are considered risks in terms of Mongolian food security[4].

The Composition of Crop Production

Crop production in Mongolia has historically been dominated by cereals, especially wheat with some barley and oats, although there have been shifts in the balance of crops through time (Worden and Savada 1989, FAO 2008). In 1941, cereals comprised 95.1% of sown areas, while 3.4 % was devoted to potatoes and 1.5 percent to vegetables (Worden and Savada 1989). Cultivation of fodder crops (hay, primarily oats) began in the 1950s, and comprised 17.7% of all production by 1985 (FAO 2008, Suttie 2000), and has since followed the fate of crops in general, with a major crash after 1990.

In 2008, vegetables (and especially potatoes) comprised a much larger proportion of total crop production. Potatoes now comprise 6.3% and other "direct consumption" vegetables 3.4%. An additional 6.4% of production in 2008 was from vegetables used to produce cooking oil, such as sunflower and rape seed (FA0 2008, Worden and Savada 1989). Cereals have decreased to about 81.5% of production, while fodder crops have decreased substantially, to 2.4%. These fodder crops, grown to provide feed for livestock, include alfalfa, soybean, millet, and peas (Worden and Savada 1980). In addition to the staple crops mentioned, Mongolia also produces small quantities of other fruits and vegetables, such as sea buckthorn, apples, European black currants, watermelons, muskmelons, onions, and garlic (Worden and Savada 1980).

Lands Currently in Crop Production

In 2005, approximately 11,600 km^2 of the land in Mongolia (0.74%) was classified as being arable or having permanent crops, a fairly small amount compared to the 1,293,000 km^2 (83.5%) classified as pasture land (FAO 2008). Approximately 1,780 km^2 of land was actually harvested for crops (15% of the arable land, and 0.11% of the total land area), the vast majority of which was harvested for wheat (86%). These numbers have varied significantly in the past (Figure 3). Although broad temporal patterns generally match those for production, two differences are notable. First, the 1980s were marked by large increases in production without dramatic increases in the amount of land harvested for crops, underscoring that increasing efficiency (e.g., better farm technology, more fertilizers) primarily drove the production increases seen during this time. Second, the collapse of production since 1990 has been accompanied by dramatic decreases in both the amount of land harvested and efficiency. As of 1999, approximately 6.4% of the cropland in Mongolia is irrigated (Earthtrends 2003).

Arable land is generally distributed in the northern part of the country, where precipitation is higher (Figure 4). Most cropland (~63%) is located in the four north-central Aimags of Selenge, Bulgan, Tuv and Arkhangai. As of 1990, the three eastern Aimags (Khentii, Dornod, Sukhbaatar) contained over 200,000 ha of cropland, or slightly more than 16% of the total.

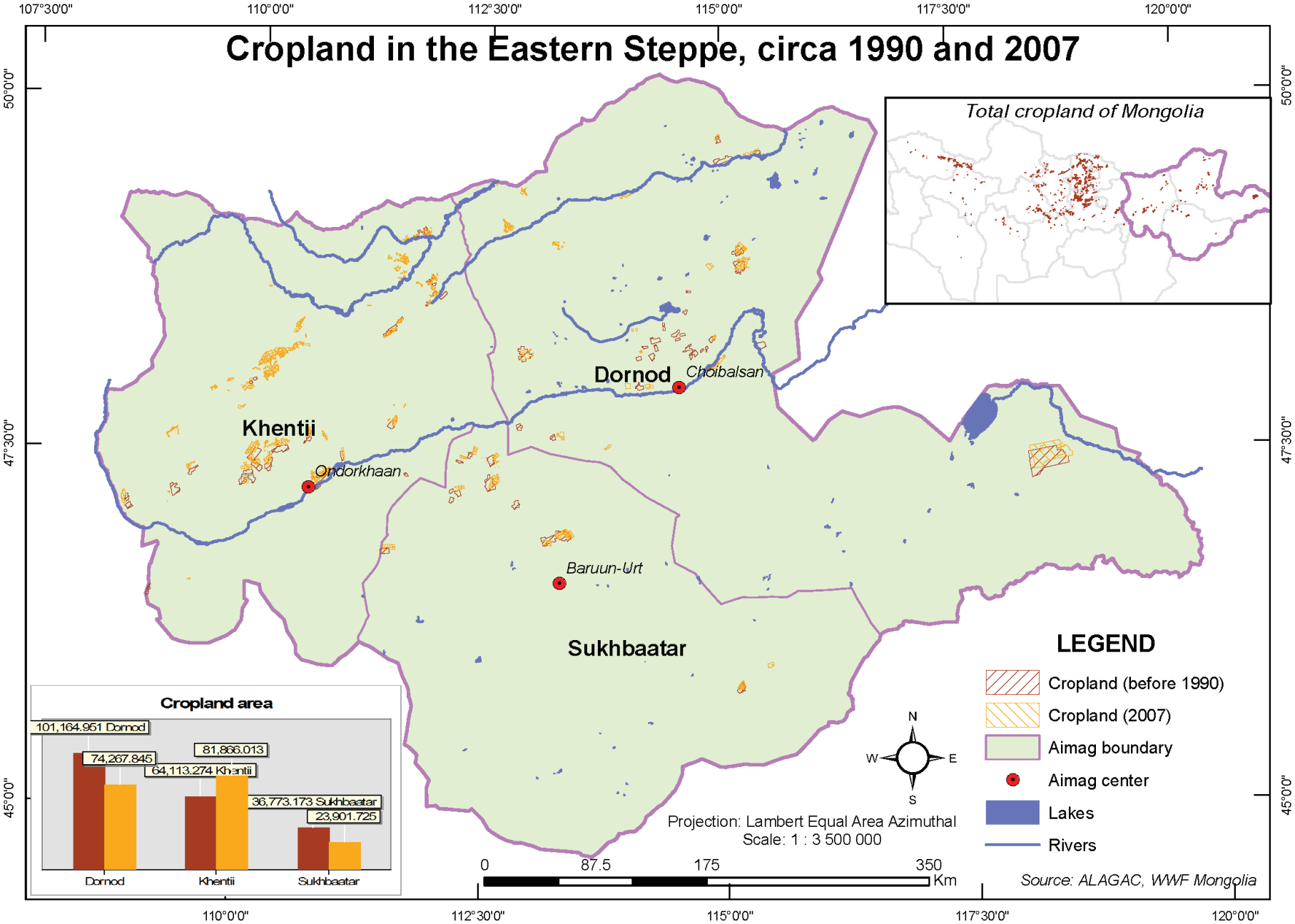

Figure 4. Distribution of cropland across the eastern 3 Aimags of Mongolia, as it stood in 1990 (brownish red) and 2007 (yellow). Units of the bar graphs are in hectares. The inset shows all of Mongolia.

Plans for Developing Crop Production: The Third Atar Campaign to Reclaim Arable Land

In early 2008, the Mongolian government announced the start of the Third Atar Campaign, to be implemented, at least preliminarily, from 2008-2010 (for the full description of the Third Atar campaign, see MOFALI 2008 in the Appendix). The overall goal of this campaign is:

> "to intensify development of the arable land of Mongolia, by creating legally and economically favorable conditions for engaging in farming and steadily supplying the population with safe products (thus eliminating dependence on imports)."

The main impetus for the campaign seems to be concerns about food security and Mongolia's reliance, especially since 1991, on imports from other countries to meet domestic demand for cereals, fruits and vegetables.[5]

The Campaign will attempt to achieve this goal through five major objectives:

1. "Creating legally and economically favorable conditions for engaging in farming," including changing laws, providing economic incentives for people to produce wheat (e.g., low-rate loans), purchasing unsold supplies of wheat, and even possibly creating a national bank solely focused on agriculture.

2. "Improving human capacity through conducting trainings and refresher trainings," by creating and supporting existing vocational programs for farmers, and training new agricultural engineers and agronomists, among other activities.

3. "Increasing the area of arable land through re–attending the abandoned arable (atar) land."[6]

4. "Improving and increasing supply of grains [seed] for basic crops" by importing and nursing drought-resistant (i.e., those that do not require irrigation) and productive strains of wheat and bolstering the national seed reserve, among other activities.

5. "Intensifying farming land industry by introducing advanced techniques and technology," by supporting a program to produce bio-fertilizers, improving and expanding irrigation systems, supporting the purchase and repair of farm equipment, introducing advance farming techniques and technology to avoid erosion and land degradation, supporting the building of fences and planting of forest strips (wind breaks).

Resources Supporting the Atar Campaign and Crop Development

Although we have not performed an exhaustive search of the existing or likely sources of funding to support the Atar campaign, or crop development in general in Mongolia, we have come across some recent agricultural projects in Mongolia funded primarily from sources external to the country (Table 1). These include some projects and funds to support livestock and pastureland management.

Table 1. Organizations supporting or implementing projects related to crop development in Mongolia. This table is not an exhaustive list.[7] Primary source: MOFALI (2008).

№	Project Topic	Donor or Implementing Org	Period
1	Loans to support purchase of farming equipment, supplies, and to improve farming techniques (300 M)	Russian Agriculture & Development Bank (Rosselkhozbank)	2009-2010
2	Sustainable livelihoods	World Bank	2002-2009
3	Reducing poverty of rural people	IFAD (International Fund for Agricultural Development)	2003-2009
4	Recovery of abandoned cropland in the Khalkgol River Basin (Dornod)	KOICA (Korean Development Agency)	2008-2009
5	Development of croplands integrated with animal husbandry	European Union -Tacis	2001-2005
6	Improve rural services at the local level	European Union -Tacis	2003-2006
7	Improved rural services	European Union -Tacis	2003-2006
8	Farmer to farmer project – No till wheat production	ACDI/VOCA (Development NGO)	1998-2003
9	Grassland management	UN FAO (Food and Agricultural Organisations)	2001-2002
10	Privatized veterinary service	GTZ (German Development Organization)	2000-2005
11	Self-financed rural communities	GTZ	1998-2003
12	Local capacity building	ADB	2002-2003
13	Development of agricultural policy	ADB	2004
14	Development of agriculture	ADB	2002-2007
15	Sustainable grassland development	UN, Netherlands government	2003-2005
16	Green gold-pastureland	Swiss Development Cooperation	2004-2007
17	Capacity building for rural development	Canadian International Development Agency	2004-2010
18	Development of dairy agriculture and food security	Japan government, UNDP	2004-2006
19	Modern dairy farm, vegetable production, and improved veterinary services	JSC Joine Community Services	1996-present
20	Gobi Initiative- Market & extension information for farmers & herders	Mercy Corps – USAID	1998-present

Of particular interest is a recent announcement that the state-owned Russian Agriculture and Development Bank (Rosselkhozbank) will be loaning a consortium of Mongolian banks $300M to support the Atar campaign (Moscow Times 2009). The money is earmarked for purchasing farming equipment and supplies (e.g., seed, fertilizers) and to support livestock development. It is expected that about half the loan will be received this year to support the upcoming sowing season. If this funding is indeed focused on the 1.2M hectares of registered arable land and not on lands which have never been farmed, the loan amounts to an investment of approximately $250/ha.

Preliminary Assessment of Risks to Biodiversity and Ecosystem Health from the Atar Campaign

The 3rd Atar campaign and plans to develop crop-based agriculture in general raise some concerns for the persistence of biodiversity in Mongolia. We focus on six important ways that these plans could negatively affect biodiversity and ecosystem health:

- By directly converting species habitat
- By reducing water availability
- By degrading land and habitat through desertification and erosion
- By increasing species mortality and reducing ecosystem health through the use of pesticides, herbicides, and fertilizers
- By importing exotic species or strains of crops that are invasive or strongly compete with native species
- By reducing species' abilities to move by erecting fences and constructing roads and railroads

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A test site for flooded rice production, in Dornod Aimag, just east of Soumber village, July 2009. Water for the field was drawn from the Khalk River.

It is important to note that these six points represent risks to biodiversity, and that the extent and probability that negative impacts will occur in any area depend entirely on how cropland development occurs there. For example, if irrigation is used extensively and without regard for biodiversity's need for water, it is likely that severe negative impacts will occur. In the more arid regions of Mongolia, the risk of negative impacts is even higher. Our objective here is only to present the major risks and those impacts likely to occur, given how cropland development has historically occurred in other similar parts of the world. Future work should outline the best practices for avoiding entirely, or at least minimizing the extent of, these negative effects and also estimating biodiversity offsets for any impacts that cannot be mitigated (BBOP 2009).

It is important to note that crop development is not always a negative for biodiversity. For certain species and communities, crop development can be a real benefit. For example, in Mongolia, conversion of native grassland or pasture to fields of cereal crops can be and often has been a positive change for small to medium-sized mammals and particular species, including great bustards, cranes, and even wolves. For many species, and bustards and cranes in particular:

- crop fields can provide high quality food, especially in fallow or dormant periods for crops, *if* excessive hazing of animals does not occur and *if* herbicide and chemical usage does not negate these benefits (e.g., by killing insects that are the major food source).
- the vegetation structure provided by crops can be good for nesting *if* tilling does not coincide with this period.
- *if* the animals are not persecuted by farmers themselves, crop fields can be refuges from humans (e.g., hunting and disturbance) because they often have low densities of humans and livestock, are difficult to access and drive through, and create impediments for moving.
- the vegetation structure of crop fields can be a refuge from natural predators, such as birds of prey.

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Recently renewed tilling of an abandoned farm field for wheat production in Dornod aimag, southwest of Soumber village, July 2009. This field is in the same 400 km^2 area shown on the Google Earth image on page 4.

However, even these positive impacts are clearly tied to some conditions (the "*if*s" above). If the above conditions are not in place, negative impacts are much more likely to occur.

Additionally, although crops may have a positive impact on some species or communities, we think it would be difficult to make the case that cropland development will be a positive impact for the native biodiversity of Mongolia on the whole. Crops simply represent a major change in the type of habitat that most Mongolian species have adapted to, and the potential for other non-habitat changes is also large (e.g., introduction of pesticides). In the majority of cases, we believe that the choice to pursue increased crop production, with its resulting human benefits, will represent an explicit or implicit choice by decision-makers to reduce the extent and quality of habitat for the native biodiversity of Mongolia. We recognize that for many people, the right decision may, in the end, be to trade-off the welfare of biodiversity for human-welfare. Our hope is that this decision is an informed decision, where the true trade-offs are known and recognized. We also hope that, where the decision to increase crop production moves forward, all possible efforts are made to mitigate the negative impacts of cropland agriculture on biodiversity, and that biodiversity offsets are implemented to compensate for those losses of biodiversity which are unavoidable (BBOP 2009).

Direct Habitat Conversion. Initially, our biggest concern about crop development in Mongolia was the potential for massive direct conversion of species habitat. For example, conversion of large areas of the steppe (e.g., tens of thousands of hectares) could essentially destroy a large proportion of the existing habitat for many species and fragment currently connected and intact ecosystems, resulting in severe population declines. After reviewing the description of the Atar campaign, however, we are less concerned about this possibility, as the campaign's goals and objectives appear to focus on developing lands that were, some time in the past, actively used for crop production, as opposed to clearing new "virgin" lands. Lands that previously supported agriculture amount to less that 1% of the land area of Mongolia, and much of this land as it exists today is probably of degraded value for biodiversity. Although reclamation of fallow lands is unlikely to be a major problem for most species, it could be a problem for a few. In particular, species that make wide use of fallow crop areas (e.g., for nesting) and that are naturally rare or already have reduced populations (e.g., the great bustard, certain songbirds) could be severely impacted by implementation of the Atar campaign. Species that use abandoned crop land as "corridors" between quality habitats might also be affected. To avoid such impacts, it will be important to first enumerate which species are of particular concern, and then to either avoid converting the areas where these species occur or find ways to mitigate or minimize (e.g., using specialized farm equipment) any negative impacts.

It is important to mention that our concerns about direct habitat conversion are relatively mild only if crop development in Mongolia indeed follows the path outlined in the description of the Atar campaign and is restricted to only those lands that have been previously cultivated. If the campaign is more ambitious than is written or is a stepping stone to a wider campaign that will include conversion of new lands, direct habitat destruction will become a serious issue for many species. Already, discussions of converting native grass and pasture lands in parts of Dornod province raise concerns that habitat conversion will be a problem.

Reduced Water Availability. Currently, our biggest concern about the Atar campaign is its potential to seriously reduce water availability for biodiversity. In particular, it is unclear how the plan for improving or installing new irrigation systems on approximately 300-400,000 hectares (MOFALI 2008, sections 10.8-10.9) will occur without negatively affecting local wildlife's access to above- and below-ground water reserves. Much of the area of interest for crops is already arid, especially the Eastern Steppe, and any decrease in water availability could have dramatic impacts on both plants and animals. Even if cropland development is focused in areas of Mongolia that receive relatively high precipitation, removal of water from aquifers or rivers can reduce river flow and water availability in arid areas located downstream (e.g., crop development in the upper reaches of the Kherlen River affect huge portions of the Eastern Steppe). Because mining activity (and its associated, often extensive, use of water) is increasing throughout Mongolia, increased removal of water for crops has the potential to seriously impact many species.

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Circular, mechanized irrigation techniques in use in Dornod aimag, west of Choibalsan, July 2009. These fields were only a few hundred hectares in size. Water was periodically drawn from the Kherlen River during particularly dry periods.

Further examination of how much water will likely be used by new crop areas and proposed irrigation systems is needed. Additionally, it is critical that systems for quantifying the status and monitoring changes in above- and below-ground water resources, especially aquifers, be established in crop areas and downstream.

Habitat/Land Degradation through Desertification, Erosion, and Salinization. Lands that are used for crops can continue to be useful for some biodiversity, both during and after active production (i.e., fallow periods). However, degradation of land by erosion and desertification can reduce the productivity of regions for livestock, crops, and biodiversity (Huang et al. 2007). Both erosion and desertification have been serious issues in the arid and semi-arid regions of northern China and Kazakhstan (Sheehy 192, Wang et al. 2005, Liu et al. 2007). Cultivation, especially plowing (i.e., tilling), is one of the main causes of erosion and desertification in arid, sandy ecosystems (Zha and Gao 1997; Liu et al. 2007; Fang et al. 2008). Although appropriate techniques for avoiding erosion (e.g., non-tilling) may, in theory, be available, appropriate equipment and training must first be made available. Salinization of soils can also occur when cropland is irrigated (using groundwater) rather than rain-fed (Thomas and Middleton 1993; Zha and Gao 1997; Wang et al. 2008), and has been a serious issue in parts of northwestern China that border Mongolia (Wang et al. 2005; Fang et al. 2008). Salinization of some drinking water supplies (e.g., in Matad soum) in the Eastern Steppe of Mongolia is already occurring (A. Winters, pers. comm.), and prior to instituting irrigation schemes in areas in Mongolia, the potential for salinization to occur should be completely understood.

Often methods and equipment to avoid erosion and desertification (such as no-till machinery) are very costly (often requiring more intensive chemical weed control) and can reduce crop yields, especially in initial years of farming. However, if these methods are necessary to maintain ecosystem health and sustain crop productivity into future, they should be implemented or crops should not be planted.

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A view of a degraded steppe landscape.

Pesticides, Herbicides, and Fertilizers. Though few details are given in the Atar campaign, plans to use fertilizers and "chemicals to protect plants" from diseases and insects (i.e., herbicides and pesticides) are clearly central to the idea. In general, encouraging the use of pesticides, herbicides and fertilizers seems at odds with the Atar campaign's recognition of the "dominant interest of consumers in use of organic foods" (MOFALI 2008, Section 2). Besides this, the use of pesticides, herbicides, and fertilizers could have serious impacts on biodiversity and human health. Clay (2004) gives an overview of the effects of pesticides and herbicides on human and biodiversity including, for instance, effects of agricultural chemicals on drinking water quality.

The disastrous impacts of several agricultural chemicals on biodiversity across the globe have been widely reported, such as the impacts of DDT (a pesticide) on birds, Diclofenac (a anti-inflammatory drug used to treat injured cattle) on Asian vultures, and Furadan (an insect pesticide) on African lions. The misguided use of bromadiolone in Mongolia to control Brandts' voles provides an example of how Mongolia is as susceptible to the problem as other countries. Not only did the chemical have seriously negative consequences for Brandt's vole populations, it had negatively impacts on many non-target species as well (Dolgormaa L. 2004, Wingard and Zahler 2006, Winters 2007), for example, in central Mongolia, animals from 37 non-target species were suspected of being killed by bromadiolone, including Pallas' cat, saker falcon and other raptors, and cranes (Tseveenmyadag and Batbayar 2003; Winters 2006). For species like great bustards, the use of pesticides can kill off the insects that they rely on as a food base, reducing or eliminating any positive effect of crop-based agriculture (M. Kessler, pers. comm.).

Based on these examples, extreme caution is warranted when allowing or encouraging the use of pesticide, herbicides, or other agricultural chemicals. As a part of the Atar campaign, the Mongolian government should erect a strict system to monitor and regulate agricultural chemicals, and to ensure that those chemicals harmful to humans or biodiversity do not gain popular use.

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Mechanized application of an herbicide in Dornod aimag, July 2009. The herbicide is used to control a weed that invades crop fields soon after tilling.

Invasive and Exotic Species. Invasive and exotic species have the potential to seriously impact ecosystems and can cost countries billions of dollars in lost revenue and remediation (Pimentel et al 2004; Matthews et al. 2005). Many plants that are deliberately introduced as a part of crop-based agriculture or are accidently mixed with crop seeds can escape from agricultural fields (Pimentel et al 1989, Raybould and Gray 1994; Wittenberg 2001). These species can compete directly with native species, form strongly invasive hybrids with native species, and lower productivity of native pastureland and cropland (Wittenberg 2001), and some exotic species are even toxic to livestock (Pimentel et al. 2004). In the temperate grasslands of the US, examples of introduced crops which have become economic and ecological catastrophes include tall fescue (*Festuca arundinacea*) and European cheatgrass (*Bromus tectorum*) (Wittenberg 2001; Pimentel et al. 2004). In a possibly more dramatic example, several species of African grasses have been introduced in Brazil as livestock forage (e.g., Buffelgrass - *Pennisetum ciliare*; lovegrass - *Eragrostis plana*), have spread through both intentional and unintentional mechanisms, are reducing pasture-land productivity by excluding native species of superior nutritional quality, and are having serious effects on ecosystem processes (e.g., increasing fire incidence) (Matthews et al. 2005). One species, Pará grass (*Brachiaria mutica*) is now one of the most widespread species in Brazil.

Certainly the risk of introduction and spread of exotic species will increase under the Atar, campaign, especially as most of the seed for growing crops will be imported. The risk can be minimized by strategically selecting species and strains of crops which have low potential for becoming invasive (Anderson et al. 2006), developing policies and enforcement mechanisms to prevent the use of unauthorized species, monitoring agricultural and surrounding areas for the spread of exotic species, and developing plans for managing and

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An abandoned potato field in Dornod province, west of Choibalsan, July 2009. The field was probably last planted around 1990, is dominated by an invasive weed, and is distinctly different from the surrounding native grassland.

controlling “outbreaks” if they occur. Wittenberg et al. (2001) provide an excellent toolkit for planning and implementing these steps. As of yet, we believe plans to minimize risks from exotic species have not been sufficiently considered under the Atar campaign.

Fencing, Transportation Infrastructure, and Fragmentation. Although few details are provided in the description of the Atar campaign, fence building in the Eastern Steppe is a concern, especially if the practice becomes particularly common or spreads beyond reclaimed croplands. Movements of gazelle, in particular, can easily be restricted by fencing. The use of fencing might also preclude the use of fallow and dormant fields by livestock and, therefore, increase the need for using chemical fertilizers to maintain productivity.

Although not specifically mentioned in the description of the Atar campaign, improvement of the transportation infrastructure in Mongolia may be a prerequisite for crop development and it, like fencing, can fragment critical habitat for species that move significant distances, such as gazelle and wolves. Another potential indirect impact of improved infrastructure is increased hunting, poaching, and capture of species (Wingard and Zahler 2006) as roads provide improved access to wild areas. A wide variety of species would likely be impacted by this, including, in particular, gazelle, wolves, Siberian marmots, great bustards, and Saker falcons. Although the Atar campaign seems focused on production for local and domestic consumption, attempts to grow crops for the exporting to other countries (e.g., China) will increase the need for building or improving roads. Maintaining the existing system, where crops are grown for local consumption (i.e., the wheat grown in Dornod is consumed within the Aimag) would reduce the need for improved transportation infrastructure as well as the overall carbon footprint of Mongolian agricultural expansion.

Environmental Indicators and Monitoring. One final concern we have about the Atar campaign campaign is the conspicuous lack of environmental monitoring and use of environmental indicators to judge the success of the campaign. Although the first guiding principle of the campaign is “preserving ecological balance” (MOFALI 2008, Section 3), there is virtually no mention of how the potentially negative ecological effects of the campaign will be monitored (see “Evaluation Criteria”, section 21). In particular, water resources need to be quantified and monitored closely, including the height of the water table, above-ground water availability for wildlife, and water quality in crop areas. Additionally, erosion, salinization, and exotic species should be monitored in and around crop areas. Direct monitoring of sensitive and indicator biodiversity (grassland birds, great bustard, marmots, gazelle, amphibians) in agricultural areas would also be useful to guard against the possible impacts we have recognized here, as well as any other unforeseen impacts.

Possible Future Activities

This report represents a preliminary assessment of the potential for crop development in Mongolia and its impacts. Possible activities and questions for future research and action include.

1. **Examining more closely what the impacts of the development of abandoned arable lands will be for biodiversity and ecosystem health.** Which species currently use these areas and how will they be affected by crop development? What are the current farming practices in these areas, and which ones might affect biodiversity? What will the impact of crop development on these lands be for critical ecosystem services, such as water availability and quality? How can negative impacts be minimized? These questions could be answered broadly using a literature review or through a field-based assessment and monitoring program focused on a few areas.

2. **Using remote-sensing to monitor changes in the amount and location of crop areas.** Which abandoned arable lands are being developed? Are the crop areas remaining limited to abandoned arable lands (as the description of the Atar campaign suggests), or are crops being planted on “virgin” lands?

3. **Assessing the likely impacts of irrigation on above- and below- ground water availability.** How much water is needed to meet the Atar campaign’s irrigation objectives? What are the sources of water and what is their current status (e.g., level of the water table)? What up- and down-stream areas are likely to be negatively impacted, and who suffers (biodiversity, herder communities, etc.)? We would likely need outside expertise to complete this (e.g., a hydrologist).

4. **Mapping which areas, beyond abandoned arable lands, may be the object of crop development over the next 10-25 years, and identify which biodiversity may be impacted by this development.** Assuming that crop development does not remain focused on abandoned arable land (the objective of the Atar campaign) but expands to lands which have never been used for crops, where are development efforts most likely to focus first? What biodiversity use these areas and how are they likely to be impacted? With this information in hand, “pre-emptive” conservation activities (e.g., obtaining land-use rights for local communities, educating herders about sustainable techniques to grow crops) and monitoring could be designed to minimize negative impacts of the development. Such an analysis would most likely be based on spatially-explicit soils and environmental information (e.g., precipitation).

5. **Comparing alternatives for improving livelihoods on the Eastern Steppe, in terms of economic and biodiversity impacts: livestock, crops, tourism, or a mix?** What are the positive and negative benefits of each option (either determined from the literature or from field studies)? What is the current domestic demand for crops, and what will it be in the future? Is the independence attained by domestic crop production a less risky option than relying on imports? What are the global implications, especially in terms of carbon production, of cropland development in Mongolia for domestic or international consumption?

6. **Holding a workshop(s) to discuss the advantages and disadvantages of crop production.** Rather than answering the above questions ourselves, we could organize a workshop to discuss these issues and educate policy-makers and funders. We could hold such a workshop in UB and/or in Aimags where crop development is more likely to occur.

7. **Producing educational materials for policy-makers and local communities, summarizing the advantages and disadvantages of crop production, its potential negative impacts, and ways to avoid these.**

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*Demoiselle Crane (*Anthropoides virgo L.*) on the Eastern Steppe.*

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Endnotes

1 Note, the term "reclamation" in the US tends to imply improvement of lands previously degraded by an activity (e.g., mining), although in the Mongolian and Chinese contexts, it seems to imply "conversion" of one land type to another, such as the conversion of rangelands to croplands, or in some cases returning land to a previous use (e.g., replanting crops in areas that were once used for crops but are now reverting to pasture).

2 Note, the definition of "arable" can be somewhat counterintuitive as it implies "land that is potentially cultivatable", but this is inaccurate (Earthtrends 2005). A commonly used definition of arable land is land that is or recently has, within the past 5 years, supported crops. Arable land may be currently rotated out of crops, for some temporary alternate use like producing hay or just remaining fallow. While the current ATAR campaign (see below) is apparently focused on "reactivating" crop production on lands that are officially registered as "arable," many of the lands under consideration and officially identified as "arable" in the graphs here have out of production for long periods of time (e.g., since the early 1990s). In this sense, the phrase "ATAR campaign" might best be translated as "campaign to reclaim abandoned agricultural lands," without the "arable" modifier.

3 In 1959 and 1979, the government started the first and second national Atar campaigns, which were pushes to increase the amount of land in agricultural production (see Figure 1). To achieve the historically high levels of land area in production observed during these periods, the first and second campaigns likely converted large areas that had never been in crop production. The third Atar campaign, at least in terms of the official government policy, appears to focus on land that has previously been in crop production with the goal of returning to levels seen during the 1980s (see the section on Plans for Developing Crop Production).

4 The basic assumption that relying on imports of crops is a risk to Mongolian food security is probably worth exploring further. One has to wonder whether domestic production would be any more "secure" because of the serious challenges posed by annual variations in weather in Mongolia. As Suttie (2000) states, "considerable seasonal risk is involved" in crop production in Mongolia, and "harvest can be difficult through dull summers delaying ripening, early frost or snow."

5 Excellent questions for further analysis would be to figure out: (1) how much cropland would be needed for Mongolia to be self-sufficient; and (2) whether reliance on domestic production is truly "more secure" than reliance on imports?

6 The description of the ATAR does not actually list activities that will be implemented to achieve this objective, with the exception of studying the amount and fertility of abandoned arable lands. We can assume that the other four objectives are meant to support this objective. The ATAR does list some numerical targets though, which seem to include “re-attending” 50, 80, and 100 thousand hectares of arable land by 2008, 2009, and 2010 respectively. As written, the numerical targets are unclear and we are not certain we’ve interpreted these correctly.

7 If you have additional information about recent past, current, or future projects or funding resources in support of crop-based agriculture in Mongolia, please contact the authors.

TRANSLINKS

Case Study

The Potential for Intensive Crop Production in the Eastern Steppe of Mongolia: History, Current Status, Government Plans, and Potential Impacts on Biodiversity

Appendix: The 3rd Atar Campaign

Translated from Mongolian by Orgilmaa Turiinjargal, February 2009

THE NATIONAL PROGRAMME ON DEVELOPING ARABLE LAND: "THE THIRD ATAR CAMPAIGN"

One. The Current Situation of Arable Land of Mongolia

1. Mongolia conducted its first ever Atar campaign in 1959 and the second in 1979 and, as the result of those campaigns, the area of arable land in production had reached 1.2 million hectares and the country had become capable to supply its domestic demand of crops, potatoes and other types of vegetables. However, in the last few years, Mongolia has been using only 30 percent of the total registered arable land area and supplying only 24.9 % of the total domestic demand of crops, 86.0 % of potatoes and 47.0 % of other types of vegetables, due to factors such as climate change, global warming, lack of financial resources of existing agricultural farms and reduced number of personnel specialized in agriculture.

Also, the National Reserve of Arable Land Techniques has been abandoned and the number of tractors and combines has sharply reduced. At the beginning of 2008, there were only 701 tractors, 486 combines and 1500 seeding machines at the national level, which have the technical capacity to sow, reap and prepare area of only 170.0 – 175.0 thousand hectares. Due to insufficient financial resources, agricultural farms were not able to use fertilizers, as well as other chemicals, to protect plants as they should have, which resulted in increased of growth of weeds, spread of insects and disease and degraded soil fertility in addition to increased drought risk. These factors are certainly manifesting themselves in overall inefficiency in the use of agricultural land and worsened quality of its product. Because of an increase in oil prices on international markets (henceforth "shortage of energy"), developed countries began to produce biofuel from crops, and some countries that export crops lost their production due to climate warming. The demand for products originating from plants and crops is increasing.

Two. Justification for Developing the National Programme

2. The increased price of flour and wheat, as well as the dominant interest of consumers in use of organic foods, have created in Mongolia the need to re–attend abandoned arable land by taking advantage of lessons learned from previous years and mobilizing its own resources. Hence the urgent need to implement specific objectives on developing the arable land of Mongolia stated in the "Government Policy on Food and Agriculture" approved by the Resolution 29 of the State Great Khural in 2003 and "General Guideline on Economic and Social Development" approved in 2008. Also, the Government of Mongolia declared the year 2008 to be "The Year of Food Safety and Supply" and, in support of this year, the National Programme on Developing Arable Land is to be conducted (starting in 2009), part of which is the Third Atar Campaign.

Three. Conducting of the Campaign

3. The Campaign shall be conducted based on the following principles:

3.1. Preserving ecological balance;
3.2. Using modern techniques and technology;
3.3. Efficient use of resources;
3.4. Mobilizing local communities and entities.

Four. The Overall and Specific Objectives of the Campaign

4. The overall objective of the campaign is to intensify development of the arable land of Mongolia, by creating legally and economically favorable conditions for engaging in farming and steadily supplying the population with safe products (thus eliminating dependence on imports).

5. The Specific Objectives of the Campaign are:

5.1. Creating legally and economically favorable conditions for engaging in farming;
5.2. Improving human capacity through conducting trainings and refresher trainings;
5.3. Increasing the area of arable land through re-attending the abandoned arable (atar) land;
5.4. Improving and increasing supply of grains for basic crops;
5.5. Intensifying farming land industry by introducing advanced techniques and technology.

Five. Activities To Be Conducted within the Campaign

6. The following activities shall be conducted in order to achieve objectives specified by 5.1:

6.1. Developing proposals on amendments to the Law of Mongolia on Arable Land, including supporting production of wheat (which is the strategic product);
6.2. Drafting Law of Mongolia on Insurance of Arable Land and implementing policy on insurance fees for citizens and economic entities which cultivate wheat;
6.3. Drafting Law on exemption or discount of techniques, equipment and their spare parts to be used for land cultivation; irrigation system equipment; fertilizers and chemicals to protect plants from custom and Value Added Taxes;
6.4. Implementing projects on introducing scientific discoveries related to arable land (into production);
6.5. Giving incentives (from Government) to citizens and economic entities which supply wheat to the state fund (in accordance with a certain criteria);
6.6. Strengthening economic capacity of Land Cultivation Fund and defining its functions;
6.7. Establishing system which purchases (from economic entities) and stores unsold wheat of the year;
6.8. Granting bank discounts to economic entities engaged in land cultivation; and studying the possibility of establishing a Bank to invest solely in agriculture;
6.9. Supporting and providing advice for those who want to create cooperatives or companies to use arable land;
6.10. Ensuring that economic entities engaged in alcohol production produce at least 50 % of their own demand for raw materials.

7. The following activities shall be conducted in order to achieve objectives specified by 5.2:

7.1. Conducting training and refresher training on management and methodology for those who are engaged in land cultivation;
7.2. Conducting long- and short-term vocational trainings, with apprenticeships on techniques and equipment;
7.3. Producing engineers, grain agronomists and other specialists in charge of soil and plant protection and irrigation technology;
7.4. Organizing study tours for managers, specialists and mechanics to other countries at their own expense;
7.5. Supporting vocational training, colleges and economic entities (which also contribute to piloting and introducing new techniques and technology) at the policy level;
7.6. Developing management and capacity of crop production.

8. The following activities shall be conducted in order to achieve objectives specified by 5.3:

8.1. Conduct a study on the size and soil fertility of abandoned arable land;
8.2. Based on the study findings, increasing the turnover of the total arable land at least to 600.0 hectares in accordance with the plan:
- 50,000 hectares by 2008;
- 80,000 hectares by 2009;
- and 100,000 hectares by 2010.

9. The following activities shall be conducted in order to achieve objectives specified by 5.4:

9.1. Importing 6000 tons of wheat grain that are resistant to drought and adaptable to conditions with or without irrigation, and with high production in 2008; 5000 tons in 2009 and 4000 tons in 2010;

9.2. Establishing Grain Nursery and ensuring Government support for economic entities engaged in raising different types of grains;

9.3. Reserving (in the domestic fund) grains through purchase of grains from economic entities;

9.4. Supporting citizens, organizations and economic entities engaged in production of grains such as cereals, barley, groats, alfalfa, corn and peas for rotation purpose;

9.5. Planting domesticated types of potato and other vegetables and grains.

10. The following activities shall be conducted in order to achieve objectives specified by 5.5:

10.1. Supporting bio-fertilizer production and introducing ecologically friendly technology in order to increase soil fertility and yield per hectare;

10.2. Introducing an advanced technology to protect soil from erosion and degradation; and replacing 70-80 percent of the agricultural techniques in the country;

10.3. Giving citizens and economic entities engaged in land cultivation discounts on the purchase of tractors, combines, irrigation system equipment, fertilizers and chemicals to protect plants;

10.4. Establishing workshops on repair of equipment and improving the supply of spare parts;

10.5. Establishing Service Centers for individuals (households) engaged in land cultivation;

10.6. Establishing a facility for sorting (cleaning) grains and a (mechanized) warehouse for reservation purposes; and they shall charge for their services;

10.7. Supporting all activities on fencing arable land, forming forest strips (belt) and protecting cultivated plants from diseases and insects;

10.8. Doubling the amount of arable land area with irrigation systems, to 54.2 thousand hectares;

10.9. Renovating old irrigation systems for arable land area of 100,00 hectares, installing irrigation system for arable land area of 220,00 hectares and building up water reserve with capacity of 15 million cubic meters;

10.10. Increasing the area of arable land with soil protection and introducing drop water irrigation system;

10.11. Supporting establishment of basement storage facilities;

10.12. Developing “Guidelines on Technology in Agricultural Fields” for economic entities;

10.13. Evaluating the impacts of investments put into renovating techniques and technology; as well as irrigation systems.

11. The State Central Organizations in charge of implementation of the National Programme:

11.1. Provisions of 6.1.- 6.3 of this National Programme shall jointly be implemented by the State Central Organization in charge of Internal and Legal Affairs and the State Central Organization in charge of issues related to Agriculture;

11.2. Provisions of 6.5; 6.7-6.8; 9.2; 10.1; 10.3; 10.6, 10.8; 10.10 and 10.11 of this National Programme shall jointly be implemented by the State Central Organization in charge of Finance and the State Central Organization in charge of issues related to Agriculture;

11.3. Provisions of 6.4, 7.1-7.5 and 10.1 of this National Programme shall jointly be implemented by the State Central Organization in charge of Education, Culture and Science and the State Central Organization in charge of issues related to Agriculture;

11.4. Provisions of 8.1 - 8.3 of this National Programme shall jointly be implemented by the State Central Organization in charge of issues related to Environment and Land and the State Central Organization in charge of issues related to Agriculture;

11.5. Provisions of 7.4, 9.1 and 10.5 of this National Programme shall jointly be implemented by the State Central Organization in charge of External Affairs and the State Central Organization in charge of issues related to Agriculture.

Six. Duration, Organization and Monitoring of Implementation of the Programme.

The National Programme on Developing Arable Land: "The Third Atar Campaign" shall be implemented from 2008 to 2010.

13. The National Steering Committee on implementation of this Programme shall be led by the Prime Minister and the Minister in charge of issues related to Agriculture shall be his Deputy. The Committee shall consist of Government Members in charge of issues related to Finance and Agriculture and Governors of some Aimags, as well as representatives from other ministries, agencies, research institution and Non-Governmental Organizations.

14. The State Central Organization in charge of issues related to Agriculture shall facilitate in overall implementation of this Programme at national level.

15. Sub-committees on implementation of this Programme shall be established in each respective Aimag and Soum, led by the respective Governor, and consist of representatives from local governmental and Non-Governmental Organizations and economic entities.

16. Annual Action Plan on implementation of this Programme at the national level shall be approved by the National Steering Committee and at the local level by the respective Governor.

17. Implementation of relevant provisions of this Programme shall be monitored based upon the Performance Agreement made between the Portfolio Ministers and Governor of the Capital City as well as Governors of respective Aimags.

18. Performance of each Annual Action Plan of this Programme shall be reported to the Government within the 1st quarter of the next year.

Seven. Financing of this Programme

19. The Third Atar Campaign shall be financed through the following resources:

19.1. own resources of citizens and economic entities;
19.2. state budget;
19.3. local budget;
19.4. bank loans;
19.5. grants and loans with discounts from foreign countries and international organizations;
19.6. investment from national and foreign citizens and economic entities.

20. The amount of the state budget shall be reflected in an annual budget package of the Minister in charge of Finance.

Eight. Evaluation Criteria

21. Implementation of this Programme shall be evaluated based on the following results:

21.1. Establishment of the legal and economic environment stated in this Programme;
21.2. Number of specialists and mechanics covered by long and short term trainings;
21.3. Volume of crop produced from the total arable land area, as well as area per hectare (yield);
21.4. Increase in arable land area with irrigation systems and volume of crop produced per hectare;
21.5. Number of replaced agricultural techniques and equipment;
21.6. Number of job opportunities created in arable land;
21.7. Increase of flour, potato and other types of vegetable in terms of supply (percentage).

22. The evaluation shall be made with consideration of climate condition, macro- and micro-economic condition and price increase of the year.

TRANSLINKS

TransLinks is a 5-year Leader with Associates cooperative agreement that has been funded by the United States Agency for International Development (USAID) to further the objective of increasing social, economic and environmental benefits through sustainable natural resource management. This new partnership of the Wildlife Conservation Society (lead organization), the Earth Institute of Columbia University, Enterprise Works/VITA, Forest Trends, the Land Tenure Center of the University of Wisconsin, and USAID is designed to support income growth of the rural poor through conservation and sustainable use of the natural resource base upon which their livelihoods depend.

The program is organized around four core activities that will be implemented in overlapping phases over the life of the program. These are:

1. Knowledge building including an initial review, synthesis and dissemination of current knowledge, and applied comparative research in a number of different field locations to help fill gaps in our knowledge;
2. Identification and development of diagnostic and decision support tools that will help us better understand the positive, negative or neutral relationships among natural resource conservation, natural resource governance and alleviation of rural poverty;
3. Cross-partner skill exchange to better enable planning, implementing and adaptively managing projects and programs in ways that maximize synergies among good governance, conservation and wealth creation; and
4. Global dissemination of knowledge, tools and best practices for promoting wealth creation of the rural poor, environmental governance and resource conservation.

Over the 5-year life of the program, TransLinks aims to develop a coherent, compelling and, most importantly, useful corpus of information about the value of, and approaches to, integrating Nature, Wealth and Power. To do this, TransLinks is structuring the work around two core issues – 1) payments for ecosystem services and 2) property rights and resource tenure.

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TRANSLINKS

A partnership of NGOs, Universities and USAID led by The Wildlife Conservation Society, dedicated to finding and sharing practical ways to generate benefits from conserving natural resources that are of global importance, and that serve as the supermarkets, bank accounts and insurance for many of the poorest people on earth.

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For more information please visit our website at www.translinks.org or contact Dr. David Wilkie, the program director, at dwilkie@wcs.org.

WILDLIFE CONSERVATION SOCIETY

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

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