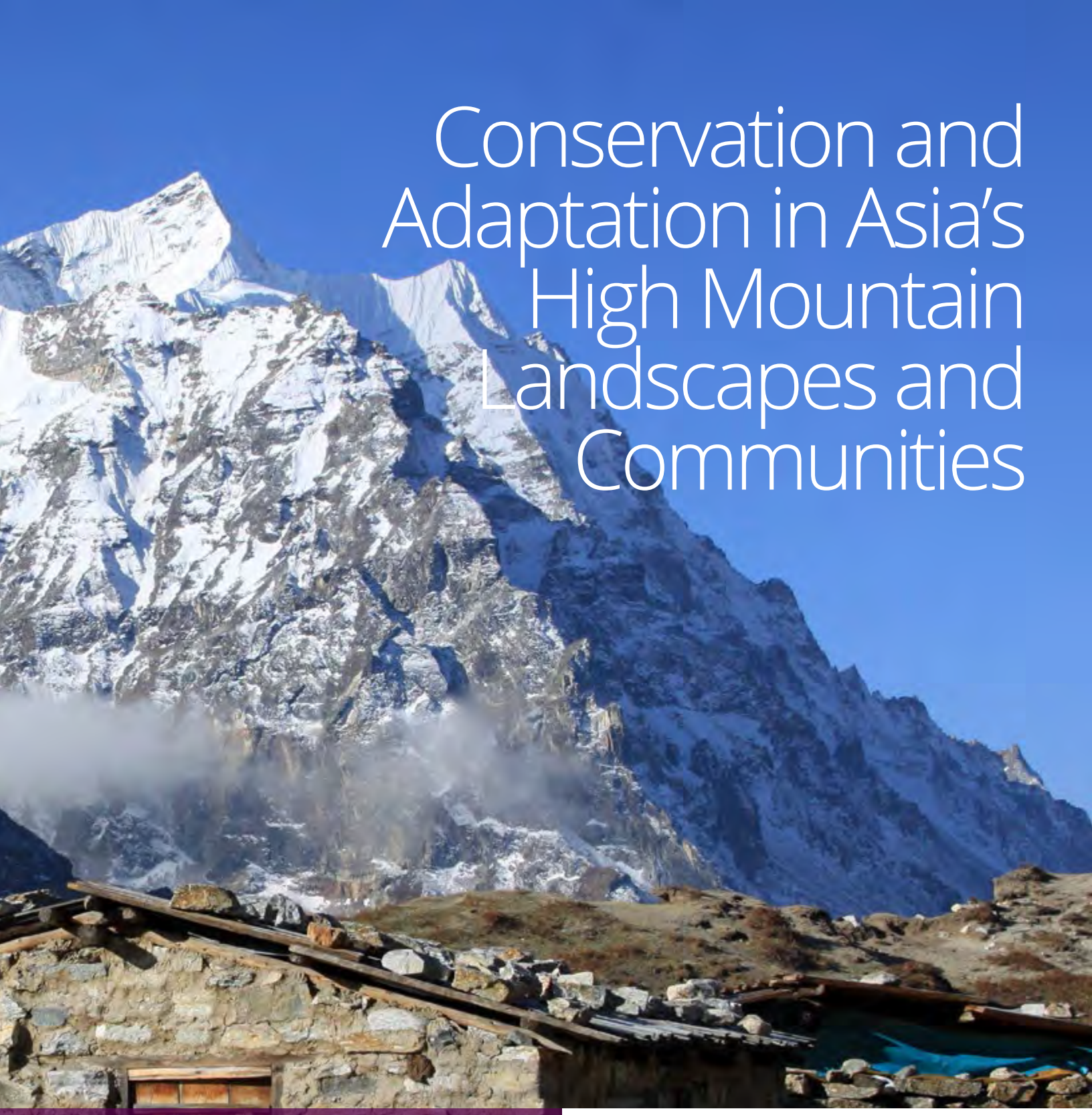

Conservation and Adaptation in Asia's High Mountain Landscapes and Communities

Final Report

February 28, 2018

WWF

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Conservation and Adaptation in Asia's High Mountain Landscapes and Communities

Final Report

World Wildlife Fund
Date Submitted:
February 28th, 2018

Submitted by:
World Wildlife Fund
1250 24th St. NW, Washington D.C. 20037

Associate Cooperative Agreement Award
No. AID-0AA-LA-12-00003
Leader with Associates Cooperative Agreement
EM-A-OO-09-00006-00

Project Partners
Snow Leopard Trust, Seattle, Washington, USA
CARE-Nepal, Kathmandu, Nepal
TRAFFIC, Cambridge U.K.

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of WWF and do not necessarily reflect the views of USAID or the United States Government.

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List of Acronyms

AHM	Asia High Mountains Project
Aimag	Province
CARE	Cooperative for Assistance and Relief Everywhere
CBAPO	Community-based Anti-poaching Operation
CBO	Community-based Organizations
CKNP	Central Karakorum National Park
DCC	District Conservation Committee
DNA	Deoxyribonucleic Acid
DNPWC	Department of National Parks and Wildlife Conservation
DoHMS	Department of Hydromet Services
Dzongkhag	Province
Dzumsa	Village Council
ECOSS	Ecotourism Society of Sikkim
EM	Effective Microorganisms
FEWMD	Forest, Environment and Wildlife Management Department
FPED	Forest Protection and Enforcement Division
GB	Gilgit-Baltistan District
GB-EPA	Gilgit-Baltistan Environmental Protection Agency
GBFWPD	Gilgit-Baltistan Forests, Wildlife and Parks Department
GCF	Green Climate Fund
GEF	Global Environment Facility
Geog	County
GIGO	Garbage-In Garbage-Out
GIS	Geospatial Information Systems
GLOF	Glacial Lake Outburst Flood
GPS	Global Positioning System
GSLEP	Global Snow Leopard and Ecosystem Protection
Ha	Hectare
HCDO	Hoper Conservation and Development Organization
HDPE	High-density Polyethylene
ICIMOD	International Centre for Integrated Mountain Development
HEROES	Himalayan Environmental Rhythm Observation and Evaluation System
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resource Management
KCA	Kanchenjunga Conservation Area
KCAMC	Kanchenjunga Conservation Area Management Council
KCC	Khangchendzonga Conservation Committee
KIU	Karakoram International University
KP	Khyber-Pakhtunkhwa Province
KPFD	KP Forest Department
KVDEC	Kitam Village Development and Ecotourism Committee
LFMP	Local Forest Management Plan
LPA	Local Protected Area
LTDC	Lachen Tourism Development Committee
MAP	Medicinal and Aromatic Plants
MPU	Milk Processing Unit
MEGDT	Ministry of Environment, Green Development and Tourism
NGO	Non-governmental Organization
NOLS	National Outdoor Leadership School
NTFP	Non-timber Forest Products
NTNC	National Trust for Nature Conservation
PCOS	Photography Club of Sikkim
RNR	Rural Natural Resources
SAEPF	State Agency for Environmental Protection and Forestry
SCAPES	Sustainable Conservation Approaches in Priority Ecosystems
SHL	Sacred Himalayan Landscape
SLCC	Snow Leopard Conservation Committee
SLT	Snow Leopard Trust
SMART	Spatial Monitoring And Reporting Tools
Soum	County
TRAFFIC	The Wildlife Trade Monitoring Network
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
UWICE	Ugyen Wangchuck Institute for Conservation and Environment
VCC	Village Conservation Committee
VDC	Village Development Committee
VWG	Village Wildlife Guards
WCNP	Wangchuck Centennial National Park
WECS	Water and Energy Commission Secretariat
WMD	Watershed Management Division
WUA	Water Users Association
WWF	World Wildlife Fund


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Executive Summary

The goal of AHM was to galvanize greater understanding and action at local, national and regional levels across the snow leopard range.

The snow leopard's vast high-altitude range spans parts of 12 countries in the interior of Asia, namely Afghanistan, Bhutan, China, India, Kazakhstan, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan. This territory includes the world's highest mountains, the most extensive glacier cover on earth outside the poles, and a wide array of flora and fauna. It is notable for being the source of Asia's great rivers, including the Yellow, Yangtze, Mekong, Salween, Brahmaputra, Ganges, Indus, Syr Darya, and Amu Darya. The region is also home to a broad range of peoples and faiths that includes Buddhism, Christianity, Hinduism, Islam, and various indigenous faiths. At present both direct human activities and climate change are having severe impacts on this fragile high mountain landscape that will increase in magnitude as the world warms.

The Conservation and Adaptation in Asia's High Mountain Landscapes and Communities Project (hereafter the AHM Project), which ran from October 1, 2012 to November 30, 2017 and was funded by the United States Agency for International Development (USAID), sought to address these threats holistically by improving local livelihoods, building community resilience, and improving transboundary cooperation. The overall goal of the AHM Project was to galvanize greater understanding and action at local, national and regional levels across the snow leopard range states to conserve this iconic and endangered species, and to connect snow leopard conservation to a broader set of environmental, economic, and social issues with consequences for Asia's future sustainability, namely local livelihoods, water and food security, and climate change adaptation.

Specific direct threats to snow leopards, wildlife and habitat cited in the AHM Project's 2012 threat analysis included wildlife poaching, retaliatory killing of snow leopards and other wildlife, prey base decline, pasture degradation, and mining. Exacerbating all these issues throughout its range is the pervasive threat posed to wildlife, ecosystems, and humans by climate change, which is irreversibly altering the ecology of this high-altitude region, by some measures twice as fast as the rest of the world. It is also significantly affecting the hydrology of Asia's great rivers, impacting the billions of people and major economies that rely on them downstream.

The AHM Project strategy for achieving this ambitious goal was two-part: 1) a field approach implementing suites of activities at 10 model demonstration sites in six countries that integrate biodiversity conservation and climate-resilient sustainable development; and 2) a regional approach scaling up successes from these sites across the snow leopard range through the 12-nation intergovernmental Global Snow Leopard and Ecosystem Protection (GSLEP) Program.

Researcher checking camera traps, Yangma, Kanchenjunga Conservation Area, Nepal.

Field Approach

This first approach built upon the successful model of the earlier USAID-funded Sacred Himalaya Landscape Sustainable Conservation Approaches in Priority Ecosystems (SCAPES) Project that was active in the Kanchenjunga Region of Nepal and India from 2010 to 2014.

In the AHM Project, activities at the 10 model demonstration sites included snow leopard research and conservation combined with climate adaptation interventions to improve rural livelihood security and water, natural resource, and ecosystem management. Local community participation in every step of all field activities, from initial project stakeholder consultations to high level snow leopard research, was critical. Residents learned about the interconnection between healthy wildlife populations, healthy ecosystems, water provision, local livelihoods, and the negative impact of human activities and climate change on all these systems. In this way, tremendous support was built for snow leopard conservation; improved water, natural resource, and forest and grassland ecosystem management; and for efforts to enhance sustainability of both traditional and newly introduced livelihood activities.

The net result was an improved model for integration of conservation and adaptation in high mountain landscapes that provides benefits for wildlife, ecosystems, and people and that will help all three adapt to a warming planet that is rapidly changing mountain environments. This model was proven successful at the 10 AHM project sites and is highly suitable for replication elsewhere in the snow leopard's fragile high mountain range. Through the various climate adaptation and conservation activities described below, 1.4 million hectares of land at high mountain AHM Project demonstration sites has been brought under improved management. At the same time, 26,966 people received a total of 146,078 person-hours in training at AHM conservation awareness events and climate adaptation and natural resource management sessions over the 5-year project period. An average of 7,500 people per project year received economic benefits from project activities.

The 10 AHM Project demonstration sites across snow leopard range were: in Bhutan, the Nikka Chu, Chamkar Chu, and Kuri Chu River basins of Wangchuck Centennial National Park; in India, North Sikkim District, including parts of the Khangchendzonga Biosphere Reserve; in the Kyrgyz Republic, the Sary-chat-Ertash State Reserve and the adjacent Chon Kyzyl Suu River basin in Issyk Kul Province; in Mongolia, the Khajingiin, Baatar Khairkhan, Bumbat Khairkhan, Jargalant Khairkhan, Sair, and Turgen Mountains in Khovd, Bayan Olgii, and Uvs Provinces; in Nepal, the entire Kanchenjunga Conservation Area in the northeast corner of the country; and in Pakistan the Hoper Valley area of Gilgit Baltistan and the combined Laspur and Rumboor Valley areas of Chitral District, Khyber Pakhtunkhwa Province.

Snow Leopard and Climate Change Research

To enhance the knowledge base of what is a very poorly understood, data deficient species (the "Ghost of the Mountains" as it is called), field-based research and science was carried out at each site across the range. Activities included camera trap, sign, and prey species surveys; human-wildlife conflict surveys; DNA analysis of snow leopard scat samples from the Kyrgyz Republic, Mongolia, and Nepal; and in Nepal, the collaring of four snow leopards in

Snow Leopard, Kanchenjunga Conservation Area, Nepal. © WWF Nepal/Sanjog Rai

the first snow leopard global positioning system (GPS) tracking collar study conducted in the Eastern Himalayas. These research activities were also accompanied by extensive training of 220 citizen scientists to assist field work and build support for snow leopard conservation in their home communities. As a result of these efforts over five years, considerable advances were made in better understanding snow leopard distribution, population dynamics, behavior, and habitat use at diverse sites across the snow leopard's range.

To better understand the impacts of a rapidly changing climate in a historically data poor region, numerous climate risk reports and assessments were carried out to inform both local activities and larger scale planning efforts. These included landscape-level assessments of hydrology and habitat under multiple climate scenarios through geospatial mapping and literature reviews; downscaled climate projections for each demonstration site landscape; five new climate vulnerability assessments for the Nikka Chu and Kuri Chu River basins in Bhutan, North Sikkim District in India, the Central Tian Shan Region of the Kyrgyz Republic, the Altai Region of Western Mongolia, and the Hoper Valley in Gilgit-Baltistan District, Pakistan. Findings of these vulnerability assessments guided design of climate adaptation activities for water resources, natural resources, ecosystems, and livelihoods (as discussed below) and improved understanding of how a shifting climate is affecting snow leopard habitat and the numerous ecosystem services—especially water—it provides to hundreds of millions of people downstream.

Water

Based on the climate change assessments, field project activities were designed to address the most important impacts, including changes to precipitation seasonality and intensity that are already negatively affecting water quantity, water quality, and water security in general in communities throughout snow leopard range. Interventions to address declining water security fell into two broad categories, namely watershed management and drinking and irrigation water source protection and delivery systems. Six watershed management plans were developed for AHM demonstration sites, including the Kuri Chu and Nikka Chu River basins in Bhutan, the Chon Kyzyl Suu River basin in the Kyrgyz Republic, the Khuisiin Gobi-Tsetseg Lake basin in Mongolia, the Tamor River Basin in Nepal, and the Phargram GoI watershed in the Laspur Valley of Pakistan's Chitral District. Across these sites, watershed management interventions included extensive tree plantings, erosion-control bioengineering work, and improved drainage systems for unpaved village roads. Numerous actions were taken to address water source protection and improve water delivery systems, including fencing off spring source areas, tree planting, installation of pipes to deliver water to settlements and to

replace leaky irrigation canals, and construction of water tanks to store water. These activities were essential to improving access to drinking water and irrigation at demonstration sites, significantly improving domestic water security and in many cases livelihood security.

Forest and Grassland Ecosystems

To enhance resilience to a rapidly warming, more extreme climate, AHM implemented a number of activities to reduce pressures on forests and high altitude pastures also important for watershed management and snow leopards and their prey. WWF worked with livestock herders to design and enact improved pasture rotation practices for high altitude pastures to increase their resilience by reducing grazing pressure and halt the general ongoing decline in alpine pasture productivity. Improved pasture rotation plans were supplemented by establishment of both seasonal and long-term grazing set-asides to permit recovery of important pastures.

WWF also supported establishment of 421,721 hectares of local and national-level protected areas in Mongolia and the Kyrgyz Republic that will have improved and/or reduced livestock grazing regimes with benefits for both grassland ecosystems and wild snow leopard prey species such as blue sheep and ibex. In Bhutan and Pakistan, demonstrations of fodder crop planting on degraded lands accompanied by winter stall feeding of livestock are ongoing, which have the potential to greatly reduce winter grazing pressure around villages, simultaneously reducing erosion and landslide risks that are increasing with more frequent and intense storms. Overall, the AHM Project made significant impacts in creating the conditions for improved grassland health in the coming decades.

Direct actions to build resiliency of forest ecosystems included planting community forests to eventually reduce wood cutting pressure on natural forests, fencing to keep out livestock and allow natural regeneration of forests, and forest management trainings. Additional indirect actions, including reducing fuel wood consumption through distribution of 360 improved cook stoves, six bio-briquette making trainings, and demonstration of 12 solar hot water heating systems, are also significantly reducing forest pressure across the demonstration sites.

Livelihoods

AHM supported actions to improve livelihood resilience tailored to the highly diverse contexts of each demonstration site. In Bhutan, for example, planting of household bamboo plots, training on making bamboo crafts, and improved marketing of these crafts, helped reduce reliance on agriculture. In India, training helped ecotourism guides improve and promote their services. In the Kyrgyz Republic, a yak herding demonstration is ongoing as a more profitable, climate-smart alternative to keeping sheep and goats. In Mongolia, herders were helped with improving marketing of traditional livestock products to boost incomes without increasing livestock numbers. In Pakistan, a large-scale campaign to start home fruit and nut tree orchards was launched, which, if ultimately successful, should improve both nutrition and cash incomes at demonstration sites in the coming years as trees begin to bear fruit.

Perhaps the most lucrative livelihood activity was promotion of water efficient sprinkler irrigation for cardamom farming in Nepal, which increased production and suppressed cardamom disease for this highly profitable cash crop, increasing annual household incomes by about USD $1,325, or 73 percent,

WWF supported establishment of 421,721 hectares of local and national-level protected areas in Mongolia and the Kyrgyz Republic.

on average. Most AHM Project field country teams also worked to train farmers on improved, climate-smart farming techniques; how to run homestays for tourists; and women-targeted production and marketing of local handicrafts as alternative sources of income to reduce reliance on climate-dependent herding and farming.

Regional Approach

The second approach in the AHM Project strategy was to scale the demonstration site interventions to the entire snow leopard range through core and technical support of the Global Snow Leopard and Ecosystem Protection (GSLEP) Program. Launched in October 2013, the GSLEP is an initiative of the Kyrgyz president with an overall goal of securing 20 snow leopard landscapes by 2020.

AHM provided extensive technical expertise for GSLEP trainings on conservation landscape management planning, in particular on integrating climate risks and adaptation actions into model GSLEP landscape management plans. AHM funded development of two GSLEP management plans for Nepal and the Kyrgyz Republic based on integrated adaptation and conservation actions at AHM demonstration sites and these are now serving as models for replication by other GSLEP member states. These plans will scale up AHM successes at the 203,500 hectare Kanchenjunga Conservation Area in Nepal to the entire 1,151,600 hectare Nepal Eastern Himalayas GSLEP Priority Landscape and the 149,117 hectare Sarychat-Ertash State Reserve in the Kyrgyz Republic to the entire 1,320,100 hectare Kyrgyz Central Tian Shan GSLEP Priority Landscape.

Other regional outputs included development of range-wide reports on climate vulnerability and water provision, development of future climate scenarios for snow leopard range areas as well providing training on their use in developing GSLEP landscape management plans. An updated report on the current status of snow leopard killing and trade throughout the 12 snow leopard range states was completed and published, providing critical information for renewed GSLEP member state efforts to tackle poaching and illegal trade across the range.

With AHM support, the GSLEP brought together ministers and other high-level representatives of the 12 snow leopard range states in a concerted effort to improve conservation across Asia's high mountains, and greatly raised the profile of snow leopard conservation issues in the 12 range states and globally. Working closely with the Snow Leopard Trust and other funding partners, the AHM Project provided critical wide-ranging support for the GSLEP, including planning, organizing, and funding GSLEP events such as high-level meetings and technical trainings.

The GSLEP process overall has convened ministers, government conservation agency workers, leading scientists, and conservation NGOs from all 12 snow leopard range states to take a unified approach to snow leopard conservation for the first time. This process has provided a unique opportunity to share lesson learned from the AHM Project with all these sectors across the entire snow leopard range, influencing development of conservation management plans for 23 GSLEP Priority Landscapes covering 60,360,000 hectares (approximately 230,000 square miles, an area roughly equivalent to the state of Texas).

Sustainability

An important impact of AHM's two-pronged approach—and critical to the longer term sustainability of these efforts—has been the broadening of the dialogue on snow leopard conservation beyond biology and direct threats to include planning for climate change effects on fragile high mountain snow leopard landscapes and the underserved, highly vulnerable and isolated communities who live in them. It has raised global awareness of the plight of snow leopards and their critical role as keystone guardian species of the headwaters of Asia's most important rivers, including the Yangtze, Yellow, Brahmaputra, Mekong, Ganges, and Indus. This has already led to follow-on funding for similar integrated climate change and biodiversity projects, but perhaps most importantly, creates opportunities for accessing large-scale climate adaptation funds from the UN, GEF, and GCF, among others, moving forward.

A second major project impact contributing to its sustainability has been the widespread community participation and continued engagement in snow leopard research, anti-poaching work, awareness raising, and conservation-linked livelihood improvement activities, demonstrating how these can generate tremendous support for snow leopard conservation.

Perhaps the most important enduring legacy at the international scale of AHM is the initial progress and success of the GSLEP process in raising the profile of snow leopard conservation, leading many range state governments to make snow leopard protection a national conservation priority. This process has also created opportunities for transboundary discussions on broader environmental issues affecting shared high mountain landscapes, including climate change, wildlife trade and the rapid pace of development in these regions.

Although the AHM Project has created substantial progress in improving conservation and climate adaptation efforts in the snow leopard's fragile high mountain range, much work remains. In particular, activities established through AHM support will continue to require long term monitoring and maintenance to ensure their success. While model landscape management plans built on the successes of demonstration activities were developed for two GSLEP landscapes, truly achieving scale across the enormous snow leopard range will require additional funding to support widespread replication, continued support for the GSLEP, and, most importantly, support for their implementation. WWF staff in the six AHM Project countries are committed to continuing their multi-faceted conservation work in snow leopard landscapes in the years to come following the AHM model, but there is no question larger efforts are needed across the entire range to ensure a future for this charismatic species and the millions of people living in and around its habitat and the hundreds of millions downstream depending on the water it provides.

Farmer with a demonstration greenhouse, Sephu Geog, Wangdue Phodrang Dzongkhag, Bhutan. © WWF Bhutan

Project Overview

Introduction

The WWF Conservation and Adaptation in Asia's High Mountain Landscapes and Communities Project (hereafter the Asia High Mountains or AHM Project) was a 5-year project funded by USAID that commenced on October 1, 2012 and concluded on November 30, 2017. The overall project goal was to galvanize greater understanding and action at local, national and regional levels across the snow leopard range states to conserve this iconic and endangered species, and to connect snow leopard conservation to a broader set of environmental, economic, and social issues with consequences for Asia's future sustainability, namely local livelihoods, water and food security, and climate change adaptation.

To achieve this, the project focused on an integrated set of conservation, climate adaptation, water resource management, natural resource management, and livelihood activities at ten field demonstration sites in snow leopard range areas of six mountainous countries, Bhutan, India, the Kyrgyz Republic, Mongolia, Nepal, and Pakistan, creating local models for interventions to be scaled up through landscape- and range-wide efforts.

The project also supported several broad regional activities that addressed snow leopard conservation issues in all 12 snow leopard range states (the remaining six snow leopard range states being Afghanistan, China, Kazakhstan, Russia, Tajikistan, and Uzbekistan). These regional activities included research on

Figure 1. Map of Snow Leopard Range. Source: World Bank Global Tiger Initiative.

climate change impacts on high Asia, preparation of a research report on snow leopard killing and trade, and providing support for the 12-nation intergovernmental Global Snow Leopard and Ecosystem Protection (GSLEP) Program. Alongside logistical and core support to the GSLEP, AHM also provided critical technical support through trainings on integrated conservation management planning and developed two model climate-smart snow leopard landscape management plans to translate the local efforts of the demonstration sites into management plans covering the larger national GSLEP landscapes.

The AHM Project was both ambitious and innovative in that it was the first large-scale snow leopard project to look beyond snow leopard research and direct human threats to snow leopards to address climate change impacts on both ecosystems and the livelihoods of poor herders and farmers residing in snow leopard range areas. Given the enormous scope of the project and the diverse array of environmental issues affecting snow leopard habitat in each range state, the AHM Project proved to be a remarkable success, with AHM activities and strategies now being widely replicated across the snow leopard's fragile high mountain range. Details of these successes

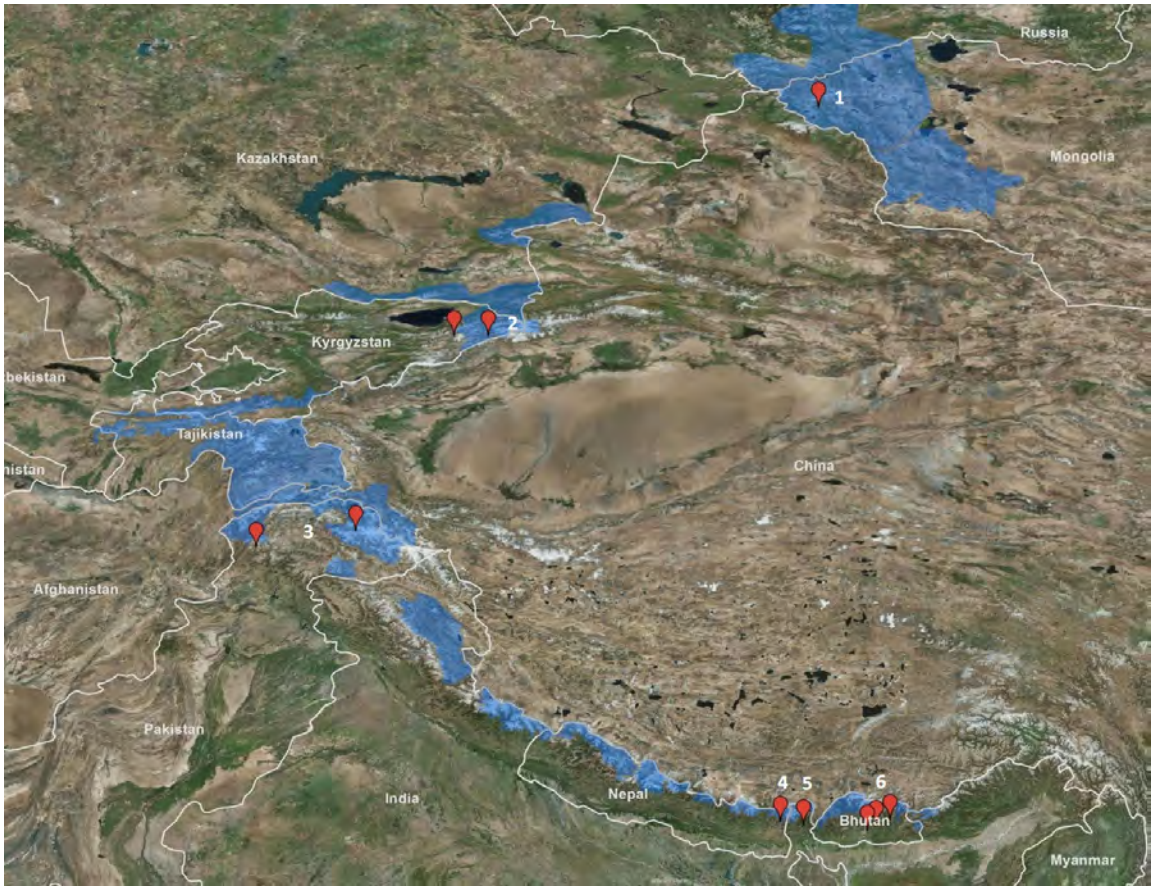

Figure 2. Location of primary project field sites for the Asia High Mountains Project (Red Dots) and GSLEP Priority Landscapes (shaded in blue).

are documented below. Throughout this ambitious endeavor, principal implementing partners receiving AHM Project funding were the Snow Leopard Trust, TRAFFIC, and CARE, without whom the project's successes would not have been possible on the scale achieved.

The Landscapes

The Asia High Mountains Project field demonstration sites were in high mountain protected areas and gateway communities to snow leopard range in a diverse set of landscapes. In Bhutan, three demonstration sites were located in the dense forests, river gorges and alpine meadows of Wangchuck Centennial National Park in the nation's central Himalaya. Project work in India focused on the Khangchendzonga National Park and Biosphere Reserve and the high plateau areas of North Sikkim District. Bordering this area, the AHM Project site in Nepal focused on the Kanchenjunga Conservation Area. Both the India and Nepal project sites centered on the 8,586 m (28,169 ft) high Kanchenjunga Peak, the world's third highest mountain, which harbors a wide array of ecosystems, from impenetrable subtropical forests to permafrost controlled alpine grasslands.

Steel jaw traps collected by school eco-club members from Jargalant Khairkhan Mountain, Khovd Aimag Mongolia. © WWF Mongolia

Sites in Pakistan were in the alpine grasslands of the snow and glacier-bound Karakorum Mountains of Gilgit-Baltistan and in the arid Hindu Kush Mountains of Chitral District, which have significant areas of sparsely growing open conifer forests. In the Kyrgyz Republic, the high altitude arid steppe grasslands of the Sarychat-Ertash State Reserve and the humid alpine meadows and spruce forests of the Chon Kyzyl Suu River basin in the Central Tian Shan were the focus. Finally, in Mongolia, AHM Project activities were conducted at 6 mountain locations amongst the steppe grasslands of the Altai Mountains in Mongolia's far west, with the most intensive AHM conservation work occurring at Jargalant Khairkhan Mountain in Khar Us Lake National Park.

Geographically, all 10 sites are centered on high mountains ranging from about 13,000 to over 28,000 ft in height with most of these mountains having perennial snow and ice cover at higher elevations. Ecologically, all 10 landscapes have extensive alpine grassland ecosystems home to snow leopards and a variety of snow leopard prey species. And all 10 are home to headwater areas of locally and internationally important rivers, with those in Bhutan and India draining to the Brahmaputra, in Nepal to the Ganges, in Pakistan to the Indus, in the Kyrgyz Republic to the Syr Darya and Tarim Basin, and in Mongolia to the Khar Us Lake basin. These sites are also home to diverse ethnicities, including Mongolian, Kazakh, Kyrgyz, Pakistani, Kalash, Sherpa, Limbu, Rai, Bhutia, and Bhutanese, who practice a variety of faiths, such as Islam, Hinduism, Buddhism, and indigenous beliefs. In general, these communities subsist by livestock herding, farming, or some combination of the two, with many residents also engaged in trading. Importantly, all landscapes are fragile high mountain areas severely impacted by climate change and are currently undergoing profound ecological changes.

Threats

Major direct threats to snow leopards, wildlife, and habitat in the AHM Project region cited in the project's 2012 threat analysis included wildlife poaching, retaliatory killing of snow leopards and other wildlife in response to human-wildlife conflict, prey base decline, pasture degradation from overgrazing, and mining, which is a particularly large issue in Mongolia and the Kyrgyz Republic. Contributing to these threats is a lack of manpower and funding to properly patrol the vast mountain spaces the snow leopard inhabits as well as a general lack of awareness of the importance of wildlife for ecosystems amongst residents of high mountain communities.

More intractable, though, is the threat posed to wildlife, ecosystems, and the human inhabitants of snow leopard range areas by climate change. Climate change is already severely affecting high mountain areas in snow leopard range states through rising temperatures and the melting of glaciers, perennial snows, and permafrost. At the same time, formerly predictable summer monsoon rain patterns are becoming highly erratic while the intensity of individual rainfall events has increased dramatically in recent years. This has been accompanied by an increase in severe weather events such as droughts, floods, and heavy snowfalls. The combination of these factors has resulted in an increased risk of other types of disasters, such as landslides, mudflows, avalanches, and catastrophic glacial lake outburst floods (GLOFs).

Threats posed by these climatic changes to ecosystems, wildlife, and local communities are diverse. In the Himalaya-Karakorum region, alpine meadow snow leopard habitat is expected to be lost to a rising tree line as high altitude areas grow warmer. In all project areas, warming temperatures are reducing snow cover and permafrost, which is reducing surface water sources and may result in more arid, less productive alpine grassland ecosystems. Communities in project sites are already reporting the negative consequences of increased drought and flooding events on farming and herding livelihoods, while both crop and livestock diseases are reported to be on the rise with warming temperatures. These developments now threaten the water, food, and livelihood security of these generally subsistence-based mountain communities long bypassed by major development initiatives conducted in more densely populated areas.

The Project Approach

The AHM project followed two central approaches to achieving the overall project goal: 1) conducting an integrated set of snow leopard research and climate-smart conservation, water resource management, natural resource management, and livelihood field activities at ten demonstration sites in six target landscapes; and 2) working with the twelve nation GSLEP Program to bring range state governments together to garner high-level government support for snow leopard conservation and build capacity of government workers with respect to climate-smart snow leopard landscape management planning, climate adaptation, and combatting snow leopard crime.

While working at both local and regional scales, AHM sought to connect these two approaches to achieve a larger impact. This involved using the "demonstration" site field activities as models of integrated climate change adaptation and conservation work that can be scaled across the larger landscapes they sit within, both nationally and range-wide, through the GSLEP process. To this end, AHM made great progress by supporting development of integrated, climate-smart snow leopard landscape management plans for two GSLEP Priority Landscapes in Eastern Nepal

and the Kyrgyz Central Tian Shan that build upon AHM field activities. These landscape management plans are now serving as models for replication across the remaining GSLEP Priority Landscapes.

Field Activities

For the field approach, demonstration sites were defined as relatively localized areas where an integrated set of snow leopard research and climate adaptation activities for ecosystems, water resource management, natural resource management, and livelihoods were conducted. At these locations, as an initial step WWF conducted snow leopard monitoring field surveys to determine the distribution and status of snow leopards at each site, which provided necessary information for designing snow leopard conservation activities. This work included snow leopard sign, camera trap, and prey species surveys as well as human-snow leopard conflict surveys with local herders to determine the presence or absence of snow leopards in a given area. In Nepal, WWF also supported a snow leopard GPS tracking collar study. A key feature of all WWF snow leopard research activities was the training of local residents as citizen scientists to assist with this work, many of whom were livestock herders. Through the participation of these citizen scientists, great support was built for snow leopard conservation both among the citizen scientists themselves as well as in their home communities where they act as champions of snow leopard conservation and are very protective of their local snow leopard populations.

Activities to build resilience in ecosystems to a warmer, more extreme climate focused on removing or reducing direct human pressures from surrounding communities by establishing and expanding protected areas and improving pasture and forest management. This included creation of both local and national-level protected areas that will greatly improve protection of grasslands and wildlife at these sites, removing some pressures so they can better respond to various direct climate change impacts like increasing drought, heavy rains, highly variable precipitation, landslides, and erosion, among other hazards. Several approaches to addressing pasture management were employed across the demonstration sites. These included improving pasture rotation rates, establishing seasonal or longer term grazing set asides closed to livestock grazing, and planting of fodder crops that were stall fed to livestock in winter to reduce grazing pressure on pastures. At many project locations, field teams also carried out assessments to determine pasture carrying capacity to improve management planning.

Forest management was improved through a combination of direct and indirect methods to increase sustainable management and reduce pressures to build back forest resilience. These included reforestation, such as planting of new community forests on degraded lands, and fencing off areas of forest to improve protection from livestock grazing. Indirect methods included trainings on forest and forest fire management, bio-briquette making, biogas, and improved cook stove activities to demonstrate effective ways for reducing fuel wood consumption. As a result of these conservation and adaptation activities in forests and grasslands, 1.4 million hectares of land at high mountain AHM Project demonstration sites has been brought under improved management.

Activities to improve water resource management addressed increasingly erratic, unreliable, and extreme precipitation on both larger scale watershed and water source management and also addressed water supply and storage system improvements for local communities. Actions included fencing off water source areas to improve their protection, tree planting, and improved forest and pasture management near water sources; planting of grass hedgerows on mountain-side agricultural terraces to

As a result, 1.4 million hectares of land at high mountain AHM Project demonstration sites has been brought under improved management.

reduce erosion, and improving drainage and erosion control along unpaved village roads. Water supply systems improvements included lining irrigation canals with concrete to reduce seepage loss, replacing leaking irrigation canals with pipes, water efficient sprinkler and drip irrigation systems, and construction of water storage tanks as insurance against increasingly frequent spring droughts. While upstream interventions to improve watershed management will take years to properly assess impacts on downstream flows and quality, there is no question water security has been improved for households in each demonstration site. Across all AHM demonstration sites, 2,141 households adopted water smart technology involving simple methods that are currently being replicated by both individuals and local governments in neighboring communities.

To adapt community livelihoods to a warmer, more variable climate with increasingly unreliable precipitation patterns, AHM supported two basic approaches: improving productivity of traditional herding and farming practices and introduction of new, more diverse sources of income generation to reduce reliance on climate-dependent activities like livestock rearing and farming. Farmers received training on practices to increase agricultural production, such as composting and production and use of non-chemical bio-fertilizer to improve soil fertility. Farmers were also introduced to new, more efficient irrigation systems, such as pipe, sprinkler, and drip irrigation, and new production methods, such as orchard farming and greenhouses, which extended growing seasons and allowed highland residents to grow fresh vegetables for the first time, significantly improving local nutrition and supplementing local incomes.

AHM also worked to adapt traditional herder livelihoods, training them on improved practices to increase production through vaccination, improved pasture rotation practices, predator proofing of corrals, and improved marketing of livestock products, all of which aimed to enhance both livelihood and pasture resilience to climate change. For example, fodder crops planted on degraded and marginal lands for winter stall feeding of livestock in Bhutan and the Kyrgyz Republic should both increase milk production, creating additional income for herders, while also stabilizing slopes increasingly at risk to erosion and landslides with increasingly intense storms. Farmers and herders also benefited from training on production and marketing of handicrafts and ecotourism services as alternative sources of income to reduce reliance on herding and farming.

Throughout the AHM Project, farmers and herders received training on the impacts of climate change on their local areas and livelihoods and how AHM Project activities were intended to help them adapt to these new climatic conditions. In addition, herders and farmers were taught about threats to snow leopards and other rare wildlife in their home areas, and how AHM Project activities were intended to improve incomes and help participants co-exist with local wildlife to discourage retaliatory killing and commercial poaching of snow leopards and other species. Through these grassroots field activities, significant progress was made towards improving the water, food and livelihood security and adaptive capacity of highland residents long bypassed by major development initiatives. Similar progress was made towards changing negative attitudes towards wildlife, many of whom are now conservation champions. These champions include active citizen scientists, volunteer rangers, and local conservation group members.

At a higher level, AHM Project activities also targeted staff of government wildlife, forest, protected area, environment, and agriculture departments to influence longer term change toward enhanced protection and ecological and livelihoods resilience. AHM built their capacity in numerous topics essential to enduring success of AHM initiatives, through trainings in climate change impacts and adaptation strategy development, improving protected area patrolling and management, wildlife law enforcement, and monitoring and research techniques. Both government workers and community leaders were also actively consulted and involved in broader environmental planning at AHM Project sites, participating in stakeholder meetings on climate vulnerability assessments, adaptation strategies, and watershed and pasture management plans.

Regional Activities

The WWF AHM Project played a leading role in providing sustained support for the Global Snow Leopard and Ecosystem Protection (GSLEP) Program over the first five years of this process from 2012-2017. An initiative of the former president of the Kyrgyz Republic, Almazbek Atambayev, it brought together the governments of the 12 snow leopard range states (Afghanistan, Bhutan, China, India, Kazakhstan, The Kyrgyz Republic, Mongolia, Nepal, Pakistan, Russia, Tajikistan and Uzbekistan) to scale up snow leopard conservation efforts across this species' vast 3 million km^2 range. The stated goal of the GSLEP Program is to secure 20 snow leopard landscapes by 2020, and the principal strategy for doing this is through development and implementation of 20 climate-smart snow leopard landscape management plans for GSLEP Priority Landscapes in the 12 GSLEP member states.

Partnering with the Snow Leopard Trust, GSLEP Secretariat, and other organizations AHM support included coordinating planning, funding, and organization of high-level GSLEP member state meetings. The most significant of these meetings was the October 2013 Snow Leopard Conservation Forum, which saw the unanimous adoption of the Bishkek Declaration on snow leopard conservation by all 12 snow leopard range states and the launch of the GSLEP Program. WWF also provided extensive technical support for the GSLEP process, including holding trainings on conservation landscape management planning and incorporating climate change impact, future climate scenarios, and climate adaptation considerations into these plans. In addition, the AHM Project funded range-wide studies on climate vulnerability, water provision from snow leopard habitat, and the illegal killing and trade of snow leopards, findings of which were shared at GSLEP events. Importantly, the AHM Project supported development of climate-smart snow leopard landscape management plans for Nepal and the Kyrgyz Republic, which will serve as models for replication by other GSLEP member states.

AHM support for the GSLEP process provided a ready-made platform for disseminating lessons learned from AHM field activities to all 12 snow leopard range states. This included thematic presentations on a variety of topics from the six project countries, including snow leopard research, community conservation, climate adaptation, and livelihood activities as well as the broader regional studies discussed above. As a result, lessons learned from AHM field activities were widely shared with governments, development organizations, NGOs, and researchers working throughout snow leopard range, scaling impact of the project beyond the boundaries of the demonstration sites or national landscapes. With close of the AHM Project, primary funding and support for this process is now being provided by the Global Environment Facility (GEF) and the United Nations Development Program (UNDP).

A summary of notable accomplishments of the AHM Project includes the following (for full indicator tables, see Appendix 1. Project Indicator Summary):

- **The first snow leopard GPS tracking collar study in the eastern Himalayas collared four snow leopards in Nepal and revealed a wealth of information on the transboundary movements of these animals between Nepal, India, and China**
- **220 citizen scientists trained to assist snow leopard field research work who are also building tremendous support for snow leopard conservation in their home communities**
- **Five new climate vulnerability assessments were prepared and are now informing landscape management in the Nikka Chu and Kuri Chu River basins in Bhutan, North Sikkim District in India, the Central Tian Shan Region of the Kyrgyz Republic, the Altai Region of Western Mongolia, and the Hoper Valley in Gilgit-Baltistan District, Pakistan.**
- **Six watershed management plans developed and being used to inform watershed management for the Kuri Chu and Nikka Chu River basins in Bhutan, the Chon Kyzyl Suu River basin in the Kyrgyz Republic, the Khuisiin Gobi-Tsetseg Lake basin in Mongolia, the Tamor River Basin in Nepal, and the Phargram Gol watershed in the Laspur Valley of Pakistan's Chitral district.**
- **Launch of a long-term high altitude hydro-meteorological monitoring study in the Bhutan Himalaya to better understand changing weather patterns and resulting impacts.**
- **2,141 households adopted water smart technology for irrigation and drinking water at AHM demonstration sites with these activities being replicated by both individuals and local governments in project areas**
- **73% average increase in household incomes (about USD $1,325) of farmers adopting water efficient sprinkler irrigation for cardamom farming in the Kanchenjunga Conservation Area (KCA)**
- **An average of 7,500 people per project year received economic benefits from project activities.**
- **Total 5-year attendance of 26,966 people at AHM-supported conservation awareness events and climate adaptation and natural resource management trainings who received 146,078 person-hours of training and education**
- **Establishment of 411,622 hectares of new national and local-level protected areas in critical snow leopard habitat areas of the Kyrgyz Republic and Mongolia**
- **1.4 million hectares of land at high mountain AHM Project demonstration sites brought under improved management.**
- **AHM demonstration site successes in the 203,500 hectare KCA in Nepal are now planned to be scaled up over the entire 1,151,600 hectare Nepal Eastern Himalayas GSLEP Priority Landscape through the government approved "Snow leopard and ecosystem management plan (2017-2026)" for the Eastern Himalaya Landscape.**
- **AHM demonstration site successes at the 149,117 hectare Sarychat-Ertash State Reserve and the 34,000 hectare Chon Kyzyl Suu Basin in the Kyrgyz Republic are now planned to be scaled up over the entire 1,320,100 hectare Kyrgyz Central Tian Shan GSLEP Priority Landscape through the Central Tian Shan landscape management plan.**
- **Guidance documents and training for development of climate-smart landscape management plans is enabling managers to develop plans for all 23 GSLEP Priority Landscapes covering 60,360,000 hectares of snow leopard habitat.**

Enduring Impacts

Perhaps the largest impact of the AHM Project has been to broaden snow leopard conservation beyond basic research and mitigation of direct threats to addressing climate change impacts on both fragile high mountain snow leopard habitat and on the water, food, and livelihood security of poor herders and farmers who reside in snow leopard landscapes. This has expanded the dialogue to include the larger importance of the snow leopard as the "guardian of the headwaters" of Asia's major rivers in the context of a rapidly changing climate. The resulting actions to plan for and address climate-related threats have occurred at the local, national, and regional levels and with a range of actors, including governments, NGOs, universities, and community groups. Without AHM, there would be no model for how to plan for and address these issues in an integrated, climate-smart, landscape-level approach, as demonstrated by GSLEP landscape management plans prepared for Nepal and the Kyrgyz Republic with AHM support.

A second major impact of the AHM Project has been to show how community-driven snow leopard conservation efforts are a critical factor in garnering community support for snow leopard protection. Community participation in camera trapping and tracking collar research, anti-poaching work, and conservation-linked livelihood improvement activities was central to not only overall project success, but the ultimate long term sustainability of project interventions. There is no question AHM built resilience in local livelihoods that will endure in the face of climate change. Over the five years of the AHM Project, an average of approximately 8,000 people per year participated in activities to build their capacity to adapt to warmer, more extreme, and rapidly changing weather patterns across the 10 AHM demonstration sites.

The most significant international impact of AHM has been the initial success of the GSLEP process in securing unified, transboundary high-level support for snow leopard conservation across the range. This effort has shone an international spotlight on snow leopard conservation for the first time, with GSLEP events receiving large media coverage both in snow leopard range states and beyond. It has raised global awareness of the plight of snow leopards and their critical role as keystone guardian species of the headwaters of Asia's most important rivers, including the Yangtze, Yellow, Brahmaputra, Mekong, Ganges, and Indus. Global awareness has also been raised about the severe, rapid impacts climate change is having on the snow leopard's high mountain range that now threaten the hydrology and water supplies of hundreds of millions of people residing downstream that are directly dependent on these waters.

Challenges

Challenges in implementing the AHM Project were diverse. Perhaps the most dramatic were natural disasters such as extreme flooding in both AHM project valleys in Chitral, Pakistan; a severe flash-flood at the AHM climate-smart village demonstration site in eastern Bhutan; flooding leading to road closures affecting AHM Project sites in India; and the April 2015 Nepal earthquake that resulted in numerous landslides in the AHM Nepal project site. These events caused long delays in implementing project activities due to impacts on transportation infrastructure and humanitarian relief taking top priority over conservation in their immediate aftermath. Unexpectedly heavy snowfalls also cut short winter snow leopard research expeditions in Bhutan, Nepal and Pakistan, delaying completion until spring.

A second set of challenges for the project concerned wildlife. With the success of wildlife protection and protected area initiatives in the eastern Himalayas, wildlife populations are

This effort has raised global awareness of the plight of snow leopards and their critical role as keystone guardian species of the headwaters of Asia's most important rivers.

rebounding and are losing their fear of humans, in some cases resulting in widespread crop raiding by wild boar, monkeys, porcupine, deer, black bears, and even blue sheep. Some project site farmers are currently losing up to 50 percent of harvests to wildlife. At the same time, early in the AHM Project wolves suddenly re-appeared in large numbers along the Himalaya and are now a leading source of human-wildlife conflict, rendering many snow leopard conflict mitigation efforts irrelevant and requiring the re-thinking and redesign of a human-wildlife conflict strategies.

A third challenge was the complexity involved in locating, scheduling, and organizing meetings with the attendance of government representatives from all 12 GSLEP member states. In the end, these were held in countries with relatively streamlined visa procedures, namely The Kyrgyz Republic and Nepal, as well as on the side-lines of United Nations Framework Convention on Climate Change (UNFCCC) and Convention on International Trade in Endangered Species (CITES) conferences in the knowledge that many government officials participating in the GSLEP process would be attending these conferences as part of their broader duties. At a minimum, there was generally a quorum of the 12 parties at each GSLEP event. Importantly, there was excellent high-level participation by all 12 GSLEP member governments at both the 2013 and 2017 snow leopard forums hosted by Kyrgyz President Atambayev in Bishkek.

An internal challenge initially amongst many project field staff, partners, and beneficiaries has been broadening the mindset of conservationists to include climate change considerations in their snow leopard work. However, over the five years of the AHM Project, substantial progress has been made in this regard as a result of regular engagement from technical adaptation experts providing extensive training, data, analysis and practical guidance to explicitly and comprehensively plan for a rapidly shifting climate in one of the most vulnerable regions on the planet.

Way Forward and Sustainability

Although the AHM Project achieved substantial successes despite many challenges over its five years, continued action in the years ahead will be required to consolidate these conservation gains and ensure the sustainability of conservation and livelihoods interventions. This will require further funding for demonstration sites and further technical support, particularly with respect to climate adaptation activities. In general, all activities will require further monitoring to determine their long-term effectiveness while successful small-scale activities will require scaling up and replication at appropriate new sites to have a broader impact. The model landscape management plans will need to be scaled across the entirety of the range if the GSLEP goal of 20 landscapes protected by 2020 is to be achieved.

While the challenges of sustaining the successes of AHM Project field activities are large, WWF teams in all 6 AHM Project countries are committed to the continuation of these activities and view implementing climate adaptation strategies for snow leopard range areas as a long-term process that is well underway. Specific recommendations on next steps in the countries are included in the detailed country report section below.


Save the
SNOW LEOPARD
Feel...Care...Commit
Save the
SNOW LEOPARD
Feel...Care...Commit
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SNOW LEOPARD
Feel...Care...Commit
www.wildlife.org/species/snow-leopard
Snow Leopard
Facts
- Scientific Name: Panthera uncia
- Estimated Global Population: Approx. 4,000
- Estimated National Population: 100-200
- Size:
Head-Body length: 90-130 cm
Adult shoulder height: About 60 cm
Tail length: 80-100 cm
Female weight: 35-40 kg
Male weight: 45-55 kg
- Preferred Prey: Blue Sheep
Status: Endangered
Snow leopards are sparsely distributed across 12 countries in Central Asia: China, Bhutan, Nepal, India, Pakistan, Afghanistan, Tajikistan, Uzbekistan, Kyrgystan, Kazakhstan, Russia and Mongolia.
The Himalayas shelter the largest proportion of snow leopards in the world.
Estimates vary significantly but it is thought there might be only as few as 4,000 snow leopards remaining in the wild, following a decline in the population of 20% over a 16-year period.
The snow leopard is a priority species. WWF treats priority species as one of the most ecologically and/or culturally important species on our planet. WWF is working to ensure species can live and thrive in their natural habitats.
USAID

Review

Range-wide and Country Activities

Regional Activities

In addition to field activities in the six participating project countries, WWF also undertook several important regional activities to improve conservation and increase awareness of climate change impacts and adaptation strategies across the snow leopard range. These included extensive climate vulnerability assessment and adaptation training, geospatial mapping of habitat and ecosystem services, a thorough review of the current state of snow leopard killing and trade, and support for the GSLEP program and GSLEP landscape management planning processes.

WWF US Climate Activities

Over its five years, AHM made significant contributions to understanding climate change impacts and future risks to snow leopards, their habitat, water resources, and isolated, highly vulnerable communities across high Asia. WWF collaborated with climate scientists at Columbia University and the University of Colorado, Boulder, leading experts in spatial ecology and hydrology, and updated an important review of the latest science of hydrology and climate change (Malone 2010) that was seminal in launching the AHM project. It developed new, innovative means of communicating climate impacts, risks, and connections between habitat, water security, and climate change across the range, creating new interactive tools for researchers, practitioners, and the public. Capacity building was a critical component throughout, with hundreds of field staff, government counterparts, and partner organization staff trained in climate change adaptation and scenario planning, GIS (geospatial information systems) analysis of ecosystem services and snow leopard habitat, and climate-smart landscape planning. Over five years, through these efforts, substantial progress was made to sensitizing initially skeptical snow leopard biologists to the profound changes and future risks facing snow leopards, their habitat, and surrounding communities in high Asia.

Major Achievements

- A comprehensive, updated assessment of climate change impacts and vulnerabilities across the major mountain ranges of high Asia, including recommendations for addressing them moving forward (Smith, 2014).
- Substantial advances in understanding of the connections between snow leopard habitat, water provision, and climate change in the "Third Pole" headwaters of Asia's great rivers, demonstrating the reliance of more

International Snow Leopard Day Celebration, Paro, Bhutan. © WWF Bhutan

than 300 million people on water flows from snow leopard habitat (Forrest et al., 2014)

- Improved higher resolution habitat, water provision, and climate change modeling for each of the six GSLEP landscapes of the AHM project, demonstrating the relative importance of these landscapes in providing water downstream, and how they are likely to change under future climate scenarios. These models also identify areas most important for conservation interventions to address both direct human impacts and future climate change making an entirely new contribution to snow leopard science (Forrest et al., 2017).
- An innovative, interactive platform to communicate the results of these analyses, and demonstrate the importance of snow leopards and their habitat beyond their conservation value, first developed in 2014 and updated in 2017, at www.thirdpolegeo-lab.org (see Appendix)
- Climate scenario analyses for all six GSLEP landscapes of the AHM project, including future changes in temperature and precipitation and potential impacts under low and high greenhouse gas emissions scenarios These scenarios were directly incorporated into the GIS analyses, above, to determine changes in habitat and water provision and were used in development of GSLEP landscape management plans for Nepal and the Kyrgyz Republic (Peters et al., 2016)
- Direct science support of the first climate-smart snow leopard landscape management plan for Nepal's Eastern Himalaya Landscape, which relied on results of improved habitat, water, and climate modeling to identify priority areas for conservation efforts, which are explicitly outlined in the government-approved plan (Gov. of Nepal, 2017)
- A range-wide science symposium on snow leopards and their habitat, featuring more than 30 presentations over two days highlighting innovative research, new findings in population dynamics, genetics, habitat, climate risks, and ecosystem services, among other topics, to inform government ministers and policy decisions of the International Snow Leopard and Ecosystem Forum, and ongoing conservation efforts across the range.

TRAFFIC

Through AHM support, TRAFFIC completed a new report on the illegal killing and trade of snow leopards in October 2016. Titled "An Ounce of Prevention," it provides a comprehensive update to TRAFFIC's earlier 2003 report "Fading Footprints: The Killing and Trade of Snow Leopards." Research involved a thorough review of available data and media stories on snow leopard killings and trade, interviews with relevant wildlife law enforcement officials, an expert questionnaire, and expert interviews conducted across all 12 range states. Original market research was also conducted by a TRAFFIC staff member in large wildlife product markets in Afghanistan with support from the Wildlife Conservation Society. Report findings included an estimate of between 221-450 snow leopards having been poached annually since 2008, a minimum of 4 per week (however, this number could be substantially higher since many killings in remote areas go undetected). The report also provided recommendations for combatting snow leopard killing and trade as well as a comparative analysis with tiger crime. TRAFFIC presented findings directly to range state government officials responsible for snow leopard conservation at the Second GSLEP Steering Committee Meeting held in Kathmandu in January 2017 and to snow leopard experts at the International Snow Leopard and Ecosystem Forum Science Symposium and Exposition in Bishkek in August 2017. TRAFFIC also collaborated with INTERPOL throughout

Improved higher resolution habitat, water provision, and climate change modeling.

Results of an online Call to Action to Save Snow Leopards circulated by WWF and Snow Leopard Trust that was presented to the Minister of Foreign Affairs of the Kyrgyz Republic at the August 2017 International Snow Leopard and Ecosystem Forum in Bishkek. © WWF

the AHM Project to raise the profile of snow leopard poaching and trade issues with range state governments at various wildlife law enforcement events.

The Global Snow Leopard and Ecosystem Protection (GSLEP) Program

The GSLEP Program is a coalition of the 12 snow leopard range state governments (Afghanistan, Bhutan, China, India, Kazakhstan, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan) and funding partners dedicated to the improved conservation of snow leopards throughout their range.

Working in close cooperation with Snow Leopard Trust, the WWF AHM Project was a leading funder and driving force behind GSLEP from its beginnings in 2012 until 2017. Following a year of preparatory discussions, meetings, and organization, in October 2013 representatives of the 12 snow leopard range countries came together and signed the historic Bishkek Declaration on Snow Leopard Conservation endorsing the need to go beyond protected areas and conduct snow leopard conservation efforts at the landscape level. As a result, the GSLEP was launched with the unanimous support of all 12 range states with a goal of securing 20 landscapes by 2020 through development and implementation of robust, climate-smart landscape management plans for priority landscapes selected by range state governments.

Kyrgyz President Almazbek Atambayev (far right) addresses delegates of the October 2013 Global Snow Leopard Forum in Bishkek. © WWF

In support of this effort, AHM worked closely with the Snow Leopard Trust, World Bank Global Tiger Initiative, UNDP, GEF and other partners to help strengthen member state capacity to organize and deliver on respective national snow leopard and ecosystem protection programs. This support has included funding numerous GSLEP planning, technical training, and steering committee meetings held since 2012, as well as providing funding and organizational support for both the October 2013 and August 2017 GSLEP snow leopard forums held in Bishkek. AHM also provided extensive technical support for the GSLEP Process through training on climate-smart snow leopard landscape management planning for GSLEP Priority Landscapes (see below). Nearly all field activities in the six AHM Project countries were carried out in GSLEP Priority Landscapes and are serving as model demonstration sites for larger landscape management planning. AHM also provided critical salary and and office equipment support for GSLEP Secretariat staff based in Bishkek.

GSLEP Climate-smart Snow Leopard Landscape Management Plans

Since the launch of the GSLEP Program in 2013, its central focus has been building the capacity of member states to develop and implement climate smart snow leopard landscape management plans for their priority landscapes. AHM provided extensive support for training workshops on the landscape management planning process, incorporating climate change and water resource concepts into management plans through GIS mapping and scenario planning efforts. Climate change and conservation planning experts from WWF and Columbia University's Center for Climate Systems Research also guided GSLEP country teams through the process of incorporating future climate and water scenarios into their landscape management plans, building national capacity for climate adaptation in high mountain areas. In support of national GSLEP landscape management planning efforts, SLT and AHM launched a catalyst grant program,

A Timeline of Support for GSLEP Activities by the WWF AHM Project and Partners

Summer 2012
Launch of planning discussions for what would become the GSLEP Process.

December 4-6, 2012
Global Snow Leopard Conservation Workshop
Bishkek, Kyrgyz Republic

May 29-30, 2013
Drafting Meeting of the Global Snow Leopard Forum
Moscow, Russian Federation

October 22-23, 2013
Global Snow Leopard Forum
Bishkek, Kyrgyz Republic

June 5-11, 2014
GSLEP National Action Planning, Leadership, and Capacity Development Workshop
Issyk Kul, Kyrgyz Republic

March 19-20, 2015
GSLEP Steering Committee Meeting
Bishkek, Kyrgyz Republic

December 7, 2015
2015 Briefing Meeting of the GSLEP (held on the sidelines of UNFCCC COP 21)
Paris, France

April 20-27, 2016
GSLEP Capacity Building Workshop for Landscape Management Planning
Kathmandu, Nepal

January 19-20, 2017
Second GSLEP Steering Committee Meeting
Kathmandu, Nepal

August 24-25, 2017
International Snow Leopard and Ecosystem Forum
Bishkek, Kyrgyz Republic

Figure 3. Timeline of major GSLEP meetings supported by the AHM Project.

Winning entry for an International Snow Leopard Day student drawing contest, Paro, Bhutan.

where USD 5,000 grants were provided to interested national teams to get them started with their GSLEP planning processes. The AHM Project also supported two landscape management planning experts who coordinated writing of the management plans for the Nepal Eastern Himalaya and Kyrgyz Central Tian Shan GSLEP Priority Landscapes.

To date, one completed GSLEP landscape management plan has received full government endorsement for implementation, the Nepal Eastern Himalaya plan. Complete draft landscape management plans have been prepared for an additional four GSLEP Priority Landscapes, now under review for approval by respective governments: the Wakhan National Park landscape in Afghanistan, the Bhutan Himalaya landscape, the Central Tian Shan Landscape in the Kyrgyz Republic, and the Pamir Landscape in Pakistan. The Snow Leopard Trust and WWF are currently working closely with the government of Mongolia to prepare climate-smart landscape management plans for Mongolia's South Gobi and Altai GSLEP Priority Landscapes. Completion of five GSLEP climate-smart snow leopard landscape management plans is a major milestone in achieving the GSLEP goal of securing 20 snow leopard landscapes by 2020, as well as being major conservation milestones for the respective snow leopard range state governments. These GSLEP management plans are serving as models for replication by the other 10 GSLEP member states.

Recommended Next Steps

From a regional perspective, the way forward with sustaining AHM Project conservation successes will necessarily need to focus on completing preparation and implementation of climate-smart snow leopard landscape management plans for GSLEP Priority Landscapes. At present, a UNDP GEF Project will soon be providing support for this work in the Central Asian states, but additional support will be needed in other range states. All landscape management plans prepared will need expert review and feedback, particularly with respect to climate adaptation, green infrastructure, and combatting wildlife trafficking. GSLEP member states will also need further technical assistance with respect to applying for further funding for snow leopard conservation activities, such as from GEF, GCF, and other large donors. Solely based on the vast size of snow leopard range and the ambitious GSLEP goal of securing 20 landscapes by 2020, similarly large-scale funding is critical to addressing the multitude of threats AHM began to address, from climate change and illegal wildlife trade to green infrastructure development.

Bhutan: Wangchuck Centennial National Park

Gangkhar Puensem, Wangchuck Centennial National Park, Bhutan.

In Bhutan, WWF worked with Wangchuck Centennial National Park (WCNP), the Watershed Management Division, and the Ugyen Wangchuck Institute for Conservation and Environment (UWICE) to design and implement a comprehensive set of integrated climate adaptation and conservation activities in WCNP and its gateway communities. These focused on climate change adaptation training, watershed and water resource management, caterpillar fungus management, general park management, species conservation, community participation in conservation, and local livelihoods. An integrated suite of AHM Project activities was conducted at each of three demonstration sites in isolated river basins of WCNP: 1) in the Nikka Chu River watershed of western WCNP, 2) in the Chamkar Chu River Watershed of central WCNP, and 3) in the Kuri Chu River watershed of eastern WCNP.

Major Achievements

- **Improved management of the entire 491,400 hectare Wangchuck Centennial National Park, Bhutan's largest protected area, through field activities and extensive staff trainings.**
- **The first systematic snow leopard camera trap survey of Bhutan's largest protected area, showing a healthy population supported by a large prey base**
- **Launch of two climate-smart village demonstrations in Shawa and Nimshong Villages in eastern WCNP that demonstrated an integrated set climate adaptation actions for farmers which included improved water source protection, improved water delivery systems,**

Figure 4. Map of the Bhutan GSLEP landscape (shown in light green) and AHM demonstration site locations in Sephu Geog, Chokhor Geog, and Eastern Wangchuck Centennial National Park.

greenhouse farming, electric fencing to prevent crop-raiding by wildlife, and installation of biogas digesters to reduce woodcutting.

- **The establishment of Bhutan's first high altitude automatic weather station network, adding critically needed data on changing conditions in the high Himalaya**
- **Preparation of two watershed management plans that explicitly account for increasingly erratic and extreme flows in a changing climate**
- **The establishment of four village conservation committees in the western, central and eastern areas of Wangchuck Centennial Park, improving local management and contributing to long term sustainability**

Landscape Overview and Major Threats

In Bhutan, the AHM Project focused on Wangchuck Centennial National Park (WCNP), the nation's largest protected area, covering 4,914 km² along the northern border with China. The park's territory encompasses the headwaters of Bhutan's largest river system, the Manas, which flows into the Brahmaputra River in India, from the highest point of 7,570 m Ganghar Phuensum Peak to Gangzur Village in eastern WCNP buffer zone at about 1,275 m. Land cover includes glaciers and perennial snow cover; alpine grasslands; rhododendron shrublands; extensive conifer, broadleaf, and mixed forests; and pastures and farmlands. WCNP is Bhutan's single most important snow leopard range area, home to an estimated

one-quarter of Bhutan's total snow leopard population and habitat. AHM Project activities in WCNP were conducted at three demonstration sites in Western, Central, and Eastern Wangchuck Centennial National Park and their respective gateway communities.

A primary threat to this landscape and its residents is climate change, which is causing increasingly erratic summer monsoon seasons, contributing to the drying up of village water sources, increasing frequency of extreme weather events like alternating spring droughts and summer flooding, rapidly melting glaciers and permafrost, increasing glacial lake outburst flood (GLOF) and landslide risks. Climate change is also threatening ecologically and economically important alpine meadows, exacerbated by direct threats from human activities. The largest threat to the inhabited areas of the park is expansion of the unpaved farm road network, which has led to extensive soil erosion and siltation of local waterways in conjunction with increasing intensity of rainfall events. Other threats include overgrazing by livestock and deforestation, both leading to increased soil erosion and decreased rainfall infiltration. Threats to wildlife include unstainable caterpillar fungus harvesting practices that rapidly degrades important, fragile alpine meadow snow leopard and prey habitat. A second threat to wildlife is rampant musk deer poaching using snares set at tree line in WCNP, which have a large potential to capture all species living at tree line, including snow leopards and their prey, with camera trap photos documenting one snow leopard with a snare cord around its leg in central WCNP.

Snow Leopard Research

The AHM Project provided support for conducting two of three phases of the first systematic snow leopard camera trap and prey species survey conducted in WCNP. The entire survey covered a total area of 183,600 hectares as follows: Phase 1 in Autumn 2011 and Spring 2012 in the upper Chamkar Chu River basin in WCNP's Central Park Range (Survey Area: 79,700 ha), Phase 2 in Autumn 2012 and Spring 2013 in the upper Nikka Chu River basin in WCNP's Western Park Range (Survey Area: 62,100 ha), and Phase 3 in Spring 2014 in the upper Yangrigang Chu River basin in WCNP's Eastern Park Range (Survey Area: 41,800 ha). Findings revealed the presence of nine, five, and one adult snow leopard individuals in the Central, Western, and Eastern Park Ranges, respectively, as well as 638 blue sheep in the Central Park Range and 330 blue sheep in the Western Park Range, proving a significant snow leopard population and supporting prey base (WCNP and WWF 2016). This survey also provided the methodology and scientific training for WCNP staff to play a leading role in carrying out Bhutan's subsequent national snow leopard and prey species survey which was conducted from 2014-2016 and captured 63 snow leopard individuals on camera along the length of the Bhutan Himalaya.

Western WCNP Demonstration Site

The Western WCNP demonstration site was focused on the farmer and herding villages of Sephu Geog along the Nikka Chu River in WCNP as well as southern Nubi Geog to the east. Project site elevations ranged from about 2,650 m in along the Nikka Chu River below Busa Village in Southern Sephu to about 5,100 m in the Methachutha cordyceps collection area in northern WCNP.

Camera trap photo of a snow leopard in western Wangchuck Centennial National Park, Bhutan. © WWF Bhutan and WCNP

Watershed Management

WMD conducted an exhaustive series of five stakeholder consultation meetings with residents and representatives of village, geog (county), and dzongkhag (province) level governments in western WCNP. The goal of these consultations was to delineate watershed management challenges in the Nikka Chu River basin of Sephu Geog in western WCNP, pinpoint critically important tributaries of the Nikka Chu for climate-smart management improvements, and educate participants about climate change impacts on the basin and the goals of the watershed management planning process. These consultations were supplemented with a climate vulnerability assessment social survey of 144 residents in Sephu and Tangsibji Geogs that identified the following impacts: increasing temperatures; more erratic rainfall patterns; higher rainfall intensity; less snow; increasing frequency of flash floods and wind storms; increasing crop disease, particularly in potatoes; pastureland degradation; and a decline in caterpillar fungus, perhaps as a result of declining snow cover. WMD also conducted a rapid watershed field assessment to classify the degree of degradation of individual tributaries and main river channels in the basin and discuss hydropower planned for the Nikka Chu.

These processes led to development of a watershed management plan for the Nikka Chu River and two critical watersheds were identified for AHM watershed management activities: the Nimdrokhang Chu and Sang Chu tributaries. Both streams are used for drinking water and irrigation and both have been degraded by overcutting of wood for timber and fuel, soil erosion from agricultural terraces and farm roads, and high livestock grazing pressure. To address these issues, WMD undertook a comprehensive set of activities suitable for replication and scaling up elsewhere in the basin. These included constructing permanent road drains along unpaved

farm roads in Lamji Village and Wangdi Gompa road, which now channel road runoff onto multiple hillside locations rather than directly into local streams, reducing increasing rates of soil erosion during monsoon rains increasing in intensity as a result of climate change, reducing the rates of sedimentation of the Nikka Chu River and subsequent road closures due to storm runoff damage.

WMD and partners also carried out a five hectare reforestation activity on a deforested area above Busa Village, Sephu, Geog, where 7,300 native seedlings were planted. WCNP worked with 82 families in Sephu Geog to plant household bamboo plots which are reducing erosion from household compounds and providing a ready source of fodder and raw material for handicraft manufacture while reducing cutting pressure on natural bamboo stands with benefits for local wildlife. WMD additionally worked with local partners to fence off 20 hectares of degraded pastureland in Busa Village that was replanted with 700 kg of local fodder crop seeds to address overgrazing and reduce erosion from degraded pasture land increasing due to the increasing intensity of monsoon rainfalls. At the same time, fodder crop production for winter stall feeding of livestock will also reduce grazing pressure on natural pastures around villages in Sephu, increasing the resilience of these grasslands to climate change impacts.

Water Resource Management

Preliminary AHM Project inquiries revealed that residents of many communities in western WCNP were concerned about declining water flows from local springs used as their drinking water sources, likely due to a combination of shifts in summer monsoon patterns and local land cover degradation. To address a water shortage at Rabji Gompa, Sephu Geog, the local spring source was fenced to keep out free grazing livestock and wildlife as well as local woodcutters, and water was piped from the spring source to the Gompa. At Simphu Village, Sephu Geog the village spring sources were also fenced off to improve their protection while degraded areas of the local springshed were reforested to increase infiltration. Similarly, at Thangyul Village, Nubi Geog, the village's spring source was fenced off to protect it from contamination and degradation caused by free grazing livestock, wildlife, and woodcutters while degraded areas of the local springshed were reforested to increase infiltration. In addition, to improve both water quality and quantity, the dug earth channel which formerly transported water from the spring source to Thangyul Village was replaced with an HDPE water pipe.

In Busa Village in Sephu Geog, where the local water source was heavily degraded by grazing livestock, a new water source was tapped and fenced and a new water delivery system installed that is supplying clean water to both Busa and the Sephu Community School. Through the efforts of WCNP staff working in cooperation with the geog governments, spring source protection is being complemented with the establishment of village water user associations in Simphu Village, Sephu and Thangyul Village, Nubi Geogs. These associations will be responsible for continued protection and management of local drinking water sources, including the periodic maintenance of local water source fencing and reforestation sites. All these activities help build climate resilience as drinking water sources become increasingly variable with shifting monsoon rains.

Caterpillar Fungus Management

Caterpillar fungus *(Ophiocordyceps sinensis),* also known as cordyceps, only grows in alpine meadows of the eastern Himalayas and the eastern Tibetan Plateau. It is highly prized for its medicinal value, retailing for up to USD 100,000 per kilogram in cities across east Asia. During the harvesting season each spring, hundreds of people flood into WCNP's high

Household bamboo plot in Sephu Geog, Wangchuck Centennial National Park, Bhutan. Planted bamboo is being used to make bamboo handicrafts, increasing the livelihood security of local resident while reducing cutting pressure on wild bamboo stands, with benefits for forest ecosystems, wildlife, and watershed management. © WWF Bhutan

altitude meadows in search of this fungus, putting a tremendous strain on a fragile alpine environment already threatened by climate change. To address this issue, UWICE held caterpillar fungus trainings to help local harvesters minimize their ecological impact on collection areas and ensure sustainability of the resource. Trainings were conducted both in Sephu Geog before collectors departed as well as in collectors' camps at high-altitude caterpillar fungus collection sites in western WCNP. Through this effort, it is hoped that resilience of alpine meadows to the combined impacts of both climate change and caterpillar fungus harvesters will be increased.

General Park Management

WCNP and WMD made progress improving trash disposal practices in western WCNP, which included construction of a trash separation and storage shed in Busa Village, in Sephu Geog where local recyclers will collect recyclables and non-recyclables will be stored until transported to a local landfill. A campaign was also conducted in Sephu Geog to stop the usual local practice of dumping trash directly into the nearest stream or gully and direct outreach was made to cordyceps collectors to inform them that they are required to remove their camp trash from the park. In the spring of 2017, these activities were accompanied by a week-long trash cleanup campaign along the scenic Snowman Trek route that ends in Sephu Geog, during which 36 farmers from Sephu Geog and 8 WCNP rangers collected and hauled out 600 kg of trash left behind by cordyceps collectors, trekkers, and residents of the area in the first large-scale trash cleanup of its kind in the park. In addition, WMD oversaw the relocation of 12 outhouse-type

toilets in Sephu Geog that had been built directly along stream banks to reduce fecal contamination of local waterways.

Species Conservation

In Thangyul Village, Nubi Geog, agricultural livelihoods are threatened by both an increase in crop disease and pest outbreaks, resulting from warmer temperatures at higher altitudes. Crops in the village are also threatened by escalating levels of crop raiding by wild boar, Asiatic black bears, deer, monkeys and other protected wildlife inhabiting WCNP, which can result in losses of up to 50 percent of total annual harvests if farmers fail to guard their fields 24 hours a day before the harvest in late summer and early autumn. To curtail crop loss in Thangyul and improve food security against climate-caused losses, WCNP provided support to erect a solar-powered electric fence around Thangyul's agricultural fields, which has sharply curtailed crop loss to wildlife in the village and improved the food and livelihood security of local farmers.

In the Somji and Khekha areas of Sephu Geog, since establishment of WCNP, Asiatic black bears have become increasingly aggressive with respect to raiding herders' cabins in search of food. To improve the food and livelihood security of affected livestock herders and reduce the likelihood of retaliatory killing of black bears, WCNP supported the construction of centrally located bear-proof food storage facilities for 8 herding families. WCNP also educated herders about methods for reducing human-wildlife conflict with bears, snow leopards, and other wild predators

Community Participation in Conservation

To educate residents about snow leopards and methods for preventing and mitigating human-snow leopard conflict, WCNP conducted a two-day snow leopard awareness raising program for herders in Sephu Geog. This led to the formal establishment of a snow leopard conservation committee with 30 founding members who are all yak herders from Somji and Khekha Villages in Sephu. SLCC members are now participating in snow leopard and other conservation activities in WCNP, such as anti-poaching reporting, wildlife monitoring, and awareness raising activities.

Local Livelihoods

To reduce pressure on the local natural resource base and increase economic resilience to climate change, and build support for AHM conservation activities in WCNP, the AHM Project supported many livelihood diversification activities for both farmers and livestock herders residing in western WCNP. As a companion activity to the fodder crop planting activity discussed above, WMD provided training on winter stall feeding of livestock and silage making to preserve excess fodder crops and increase winter dairy production and farmer incomes while at the same time reducing grazing pressure on natural pastures around villages. To diversify the local dairy product production and improve marketing of dairy products, WMD organized a two-day stakeholder consultation meeting and evaluation to investigate why the local Busa Village milk processing unit (MPU) had fallen into disuse and what would be needed to relaunch the MPU. The findings of this process led to the successful re-organization and relaunch of the MPU with improved marketing of dairy products produced which are now being sold in the Wangdue Phodrang Dzongkhag center, thus improving the incomes of participating dairy farmer in Sephu.

WMD also supplied villages in Sephu with four demonstration greenhouses to further diversify livelihoods and improve local nutrition during winter months through increased household vegetable production, with surplus produce sold in local markets, supplementing

household income. WMD also organized a 4-day training on the production and use of bio-fertilizer and bio-pesticide for 63 farmers in Sephu. This training demonstrated low cost methods for making bio-fertilizer and bio-pesticides from manure, chili peppers, and other locally available ingredients, as well as their use in local crop production. Lastly, WMD arranged a training for 12 young farmers in Sephu with low education levels to learn the art of bamboo handicraft making from local elders and helped negotiate terms between producers and a local businessman to market bamboo products at his shop on Bhutan's main east-west national highway, significantly increasing their incomes with high sales.

Central WCNP Demonstration Site

The Central WCNP demonstration site was focused on the farmer and herding villages of Chokhor Geog along the Chamkar Chu River in WCNP as well as neighboring Tang Geog to the east. Project site elevations ranged from about 2,630 m along the Chamkar Chu River in Kharsa Village to about 5,200 m at the Serjithang caterpillar fungus collection area in the upper Chamkar Chu River basin.

Watershed Management

WCNP conducted a detailed survey of pasture-lands in Chokor and Tang Geogs and selected 19 ha of land belonging to 57 households around local settlements to plant with fodder crops to increase fodder production that is now stall fed to milk cows in winter. Erosion from degraded pastures around villages has been reduced, as has grazing pressure on natural pastures around villages, which will increase the resilience of pastures to increas-ingly extreme rainfall, erosion, and landslides.

Water Resource Management

WCNP provided support to Thangbi Village, Chokhor Geog to tap a new, cleaner water source and make improvements to the village's water delivery and storage system. This support included construction of a water delivery system collection tank at the new source, new HDPE water pipes, and fencing around the water source area to keep livestock and wildlife out of the source spring. This has benefited all households in Thangbi through improved water security and quality. WCNP conducted a second springshed protection and water delivery system improvement activity for Gorche Village, Chokhor Geog, where there was a shortage of clean drinking water. This included fencing off the water source area to keep out livestock and wildlife, planting of trees on bare areas around the water source, and construction of a new water intake tank. Similarly, at the yak herding community of Lungsepong Village, located at 4,100 m in northern Chokhor Geog, water security was improved by erecting a fence around the local village spring source and installing an HDPE that now delivers water directly to the village. Lungsepong residents also dug a small water pond for their yaks which is also used by blue sheep, the primary wild snow leopard prey species in WCNP. At Mangdiphu Village, Chokhor Geog, two village spring sources were fenced off to improve their protection while degraded areas of the local springshed were reforested to increase infiltration. WCNP staff also worked in cooper-ation with the local Chokhor Geog government to establish a model water users association in Mangdiphu Village that will be responsible for periodic maintenance of local water source catchments areas, such as erecting and repairing fences to keep livestock out of water

Erosion has been reduced, as has grazing, which will increase the resilience of pastures to extreme rainfall, erosion, and landslides.

sources, planting trees and vegetation as needed to maintain water provision. Water security and adaptive capacity of these rural households has been increased as a result.

Caterpillar Fungus Management

As in western WCNP, UWICE worked in cooperation with WCNP and the Chokhor Geog government to conduct sustainable caterpillar fungus harvesting trainings at collector camps in the highland areas of WCNP's Central Range. Participants were trained on the lifecycle of caterpillar fungus, the need to protect alpine meadows by replacing turf patches in extraction holes, carrying kerosene camp stoves to eliminate cutting of slow growing alpine shrubs for fuel, regulations requiring collectors to carry all camp trash out of the park, the need to avoid open defecation near camp drinking water sources, management of pack animals, reducing disturbance to wildlife, including snow leopards and their prey, and recognition and treatment of altitude sickness. UWICE staff also took the opportunity to monitor vegetation in caterpillar fungus collection areas and set up long-term vegetation monitoring plots to establish a baseline for gauging future ecological changes in these heavily travelled high-altitude areas. This management is essential to increasing pasture resilience by reducing impacts in the most high-traffic areas of these sensitive ecosystems.

General Park Management

WCNP constructed a new park checkpoint cabin at the strategic Zampa Nyepa Bridge on the Chamkhar Chu River, a 10 km walk north of WCNP Headquarters in Nasiphel Village. This location is the main entry point to highland areas of Central WCNP, which all caterpillar fungus collectors, yak herders, and trekkers (as well as illegal loggers and poachers) must pass to enter the alpine areas of the park. The cabin will also be used as a base camp for rangers conducting anti-poaching patrols in the park and as a site for enforcement of WCNP's garbage-in, garbage-out (GIGO) regulations. It is anticipated that the new checkpoint will reduce illegal activities as well as trash dumping in the central region of the park. To address the growing trash problem from caterpillar fungus collectors in central WCNP and generate public awareness about this problem, WCNP conducted an 18-day long trash cleanup campaign along the main trekking route in central WCNP. Twenty-four local farmers participated in this cleanup, carrying out over 1,000 kg of trash that was sorted for recycling with the non-recyclables being transported by truck to a local landfill south of Jakar.

To teach local residents one method for reducing firewood consumption as one possible strategy to reduce forest degradation and increase resilience of local forests to climate change impacts, a bio-briquette making training was held for livestock herders from Chokhor Geog. Instruction was given on types of dead forest litter and agricultural waste that are appropriate for making briquettes, production of charcoal, equipment for molding charcoal into briquettes, and cook stoves designed to use them.

Species Conservation

As a companion study to the WCNP snow leopard camera trap survey, in 2014, WCNP staff conducted a human-wildlife conflict survey in Chokhor Geog in central WCNP. This survey found that during the 2009-2013 period, 38 affected livestock herders lost a total of 521 head of livestock, 472 head of which were yaks. Notably, these herders only attributed 9 percent of livestock kills by wild predators to snow leopards, while 90 percent of livestock kills were attributed to Dhole (Asiatic wild dog), Asiatic black bears and Tibetan wolves. Findings have been used by WCNP to develop wildlife conflict education campaigns for locals. To reduce conflict with

Asiatic black bears in WCNP, WWF and WCNP conducted a successful trial black bear camera trap study in central WCNP. This study will permit future delineation of Asiatic black bear distribution in WCNP, establish the home range size of these bears, help in the identification and control of problem bears causing economic losses to herders and farmers in the park, and reduce the likelihood of retaliatory killing.

Community Participation in Conservation

As in western WCNP, WCNP staff held a snow leopard conservation awareness training for herders residing in central WCNP. Participants agreed to establish a new snow leopard conservation committee (SLCC) to participate in snow leopard conservation activities in WCNP's Central Range. Members of this SLCC now report poaching activities and participate in wildlife monitoring and awareness raising activities. WCNP held International Snow Leopard Day celebrations for school children residing in WCNP and its buffer zone. International Snow Leopard Day is generally held on October 23rd, each year, marking the date in 2013 that the 12 snow leopard range states came together in Bishkek to sign the Bishkek Declaration on Snow Leopard Conservation. In WCNP, snow leopard day celebrations for children include speeches by local dignitaries and talks by experts on snow leopard biology and research. Children also participate in competitions between schools involving snow leopard-themed debates, quizzes, skits, and drawing contests.

WCNP also secured the participation of the monks of Petseling Monastery, located near Jakar, Bumthang, in WCNP's wildlife conservation activities. Monks from this monastery are now assisting WCNP by incorporating biodiversity conservation messages into their public teachings and ceremonies and are also engaged in anti-poaching work, including searching for and dismantling snares and traps set for wildlife. WCNP staff anticipate that the monks' efforts will build greater support amongst residents for park conservation efforts.

Local Livelihoods

As in western WCNP, the AHM Project supported many climate smart and alternative livelihood activities for both farmers and livestock herders residing in central WCNP. These livelihood activities form one part of an important adaptation strategy to reduce pressure on the local natural resource base and the environment in general, as well as to build support for conservation activities in WCNP. Notably, the fodder crop planting activity in Chokor and Tang Geogs, described above, has been a great success, with winter stall feeding of livestock in participating villages having increased both winter milk production and winter availability of dairy products in the Bumthang provincial center of Jakar. To diversify and further enhance local livelihoods, WWF and WCNP organized an 8-day study tour exchange to Sikkim for 8 Bhutanese homestay operators from central WCNP to learn about the successful homestay programs in and around Sikkim's Khangchendzonga Biosphere Reserve. During the AHM Project period, WWF also worked with Lonely Planet to have Central WCNP's homestays listed in the last two editions of Lonely Planet Bhutan.

Participants agreed to establish a new snow leopard conservation committee (SLCC) to participate in snow leopard conservation activities in WCNP's Central Range.

Eastern WCNP Demonstration Site

The Eastern WCNP demonstration site was focused on the farming villages of Gangzur and Kurtoe Geogs along the Kuri Chu River in WCNP and its southeast buffer zone. Project site elevations ranged from about 1,200 m along the Kuri Chu River in Gangzur Village to over 5,000 m in the eastern snow leopard camera trap survey area northeast of Ney Village.

Climate Adaptation

UWICE's key action under the AHM Project was the launch of two climate-smart village initiatives in eastern WCNP, where integrated series of climate adaptation activities were undertaken to address increasingly erratic summer monsoon rainfall, with increasing frequency of occurrence of spring drought and summer flooding. Both droughts and floods contribute to declining infiltration and flows from local springs and streams used as water sources, and consequently declining water security. In addition, warming temperatures are also believed to be causing an increase in crop disease and pest outbreaks, affecting farmer livelihoods.

The first climate-smart village, Shawa Village in Gangzur Geog, was designed to address current climate vulnerabilities through a variety of adaptation actions. Solar-powered electric fencing was installed to mitigate crop losses to wildlife that can reach up to 50 percent of total harvest, which is increasingly important for offsetting losses to climate-related crop disease and pest outbreaks. Since installation, crop raiding has virtually stopped and farmers no longer have to guard fields 24 hours a day in the run up to harvest season. Three demonstration greenhouses for growing vegetables were also built in Shawa to extend the local growing season and improve both diets and food security. To improve water security, a fence was built around the local village spring source to prevent grazing and contamination by livestock and wildlife. Additional improvements were made to the village water delivery system, including installing five additional water taps in the village that will save time spent collecting and hauling water. Residents also reforested 2.8 hectares of degraded land near the village to reduce soil erosion and increase runoff infiltration and create a future source of timber to reduce woodcutting pressure on natural forests. As a final experiment, UWICE developed trial cardamom growing plots, a lucrative cash crop in the eastern Himalaya, and if successful will oversee expansion of this activity in Shawa to diversify local livelihoods.

Climate adaptation activities were also implemented in a second climate-smart village, Nimshong, 8.5 km west of Shawa. These included water-saving improvements to the village irrigation system, such as renovation of the village irrigation channel to prevent leakage and replacement of particularly deteriorated sections of this channel with 750 m of water saving HDPE pipe. The volume of available irrigation water has been doubled, allowing farmers to start planting again on fallow fields that had fallen into disuse due to a lack of water. A solar-powered electric fence was also installed in Nimshong to prevent crop losses to wildlife and enhance food security in the face of climate extremes. A third activity tapped a cleaner water source and improved the water delivery system for Jangcholing Monastery near Nimshong, which is improving water security at this monastery. To demonstrate one cost-effective method for reducing wood cutting pressure on local forests and the need for imported bottled natural gas, installation of four demonstration biogas digesters at Nimshong was supported. At both villages, UWICE provided preliminary training to farmers on local climate change impacts and

adaptation strategies for farmers. While good progress has been made in climate-smarting daily life at these two model villages, both are considered works in progress that UWICE will continue to monitor.

Watershed Management

WMD conducted an exhaustive series of six stakeholder consultation meetings with local residents and representatives of village, geog, and dzongkhag level governments along the Kuri Chu River in eastern WCNP and its buffer zone. The goal was to delineate watershed management issues in the Kuri Chu River basin of Gangzur and Kurtoe Geogs, pinpoint critically important tributaries of the Kuri Chu for conducting demonstration improved climate-smart watershed management activities, and to educate participants about climate change impacts and the goals of the watershed management planning process for the Kuri Chu. These stakeholder consultations were supplemented with a climate vulnerability assessment social survey of local residents in the Kuri Chu basin to gauge climate change impacts on this basin, during which survey respondents noted increasing temperatures; more erratic rainfall; decreasing snowfall; increasing frequency of extreme weather events such as flash floods, windstorms, and hailstorms; and an increase in crop pest and diseases, in particular affecting potatoes.

Through these processes a watershed management plan for the Kuri Chu river was developed, and two critical watersheds in Gangzur Geog were identified for implementing demonstration AHM watershed management activities: Gangzur Chu and Lekpagang Chu tributaries of the Kuri Chu River. To address degradation by overcutting of wood for timber and fuel, soil erosion from agricultural terraces and farm roads, and high livestock grazing pressure, WMD undertook a comprehensive set of watershed management activities suitable for replication and scaling up elsewhere in the Kuri Chu basin. These included constructing permanent road drains along 1.25 km of unpaved farm roads in Jang Village, which was supplemented with demonstration bioengineering below roads where loose road excavation material was dumped during road construction. Short gabion erosion control walls were built at key locations along the Jang Village farm road to stabilize hillslopes above road cuts, preserve agricultural terraces next to the farm road, and prevent road closures from roadcut slides and falling rocks. All of this was supervised by WMD-coordinated farm road users groups that will organize timely farm road repairs and strive to minimize farm road closures caused by intense rainfalls, landslides and severe erosion. These activities are demonstrating effective methods for reducing increased soil erosion from farm roads that is occurring during monsoon rains which are increasing in intensity due to climate change. Importantly, this work will also reduce sedimentation rates in the Kuri Chu River and is expected to reduce road closures resulting from severe rainstorm runoff damage.

To address forest degradation impacts on watersheds caused by woodcutting and livestock, WMD and partners carried out reforestation activities at several sites in the Lekpagang Chu and Gangzur Chu watersheds. This included replanting of 10 hectares of degraded forests with native tree species in the Gangdekha State Reserve Forest and Merculing Community Forest just above Jang Village, in the Gangzur State Reserve Forest next to Gangzur Village, and in the Denkaling Community Forest between Ngar and Denkaling Villages.

To address the issue of soil erosion and rapid rainfall runoff from mountain slope agricultural terraces in Gangzur Geog, WMD organized a series of demonstration activities in the Lekpagang Chu and Gangzur Chu River basins that improved watershed management

These activities are demonstrating effective methods for reducing soil erosion from farm roads that occurrs during monsoon rains which are increasing in intensity due to climate change.

features of 6.4 hectares of agricultural terraces. These included planting of grass hedgerows between terraces and planting of trees along terrace borders, with grass and trees species planted also being valuable sources of livestock fodder. Selected agricultural terraces were also reinforced with stone retaining walls while check dams to control erosion sediments were built in terrace runoff drainages. To address degradation and erosion from overgrazing, WMD worked with local partners to plant 30 hectares of degraded, abandoned land around Ngar, Jang and Gangzur Villages with perennial grasses and willow and fig trees to be used as fodder for stall feeding cows. WMD is also promoting the planting of oats and peas on fallow rice paddy terraces after the rice harvest that will be used for stall feeding of cows to reduce grazing pressure on local pastures and create collection points for cow dung and urine that can be used to fertilize crops. As a result, watershed management and water quality will be improved, and dairy productivity and water, food, and livelihood security in these villages will increase.

To limit the loss of rice paddy terraces to increasingly frequent flash floods, WMD oversaw the construction of two flood protection walls to both protect active rice paddies as well as paddy terraces that had fallen into disuse due to the threat of flooding which will now be farmed again. In total, 174 m of flood wall was built in two sections. To help stabilize river banks along the flood protection wall, bamboo was planted that will also provide valuable fodder and material for handicrafts. To address the growing pressure from timber extraction and fuelwood cutting in state reserve forests in Gangzur Geog, WMD organized a 2-day training for local residents on compliance with the 2017 national Forest and Nature Conservation Rules and the national Environment Policy of Bhutan.

Additional climate adaptation and watershed management activities conducted by WCNP in the Kuri Chu River basin in Kurtoe Geog included organization of a second fodder crop planting activity in Thimpay Village, where 1.2 hectares of fallow agricultural land was fenced and planted with fodder. As in Gangzur Geog, fodder harvested will be stall fed to cows in winter, increasing dairy productivity and reducing grazing pressure on natural pastures as one strategy to increase the resilience of these pastures to climate change impacts and improve food and livelihood security. WCNP also oversaw the development of a local forest management plan (LFMP) for Jasibe, Wai Wai, and Tabi Villages in Kurtoe Geog through mapping of 416 hectares of forest, carrying out a detailed non-timber forest products (NTFP) survey and setting of an annual sustainable timber harvest quota. The LFMP is now guiding issuing of permits to local residents for sustainably extracting timber for firewood and home construction and renovation.

Water Resource Management

WMD sought to improve water security of residents in Gangzur Geog with respect to both drinking and irrigation water. To improve water quality from five drinking water sources for Ngar, Gangzur and Jang Villages that are threatened by livestock and wildlife grazing, woodcutting, and subsequent erosion, WMD organized a water source protection campaign. This involved fencing off of a total 1.5 hectares of land around the 5 water sources to keep out animals and woodcutters and allow regeneration of forest and undergrowth around these springs. In Ngar, Jang, and Gangzur Villages, WMD addressed irrigation water shortages likely caused by shifting monsoon patterns, local land degradation, and primitive irrigation channels that lose large volumes of water to seepage by upgrading 450 m of irrigation channels with HDPE water pipes to prevent losses to leakage and seepage. To ensure that these irrigation systems will be maintained and that irrigation water will be equitably shared, WMD coordinated the establishment of two

An old village irrigation canal in the process of being replaced with a water-efficient irrigation pipe, Gangzur Geog, Wangchuck Centennial National Park, Bhutan. © WWF Bhutan

irrigation water users associations in Jang and Ngar Villages. WMD also moved an intake to reduce contamination from agricultural runoff and funded the repair and replacement of 100 meters of damaged municipal water pipes and pipe fittings on the Lhuntse municipal water system to reduce loss of water to system leakage, improving both water security and water quality for Lhuntse residents.

To improve water quality, WMD provided residents of Gangzur with a training on proper use of chemical fertilizers and pesticides which are heavily overused on nearly all crops grown in Gangzur Geog. Participating farmers were educated about the negative impact of agricultural chemicals on the local environment, the benefits of organic farming and proper methods for disposing of household trash. To increase broader awareness about the need to halt dumping of household trash into the Lekpagang Chu, WMD organized a river cleanup campaign along the river in Lhuntse Town and put up two signboards discouraging dumping of trash in rivers. In Kurtoe Geog, WCNP fenced off a spring and its springshed area that serves as a main village water source, and constructed a new water delivery system pressure tank and village water tap at the Dungkar Village School.

General Park Management

In Ney Village, Kurtoe Geog, WCNP funded installation of a demonstration biogas digester to illustrate one effective renewable method for reducing consumption of both fuel wood and imported bottled cooking gas that can serve as an adaptation strategy for reducing woodcutting pressure on local forest. Digester waste slurry produced is also suitable for fertilizing agricultural fields.

Community Participation in Conservation

In Dungkar and Ney Villages, Kurtoe Geog, WCNP organized two wildlife poaching awareness workshops. Building upon lessons learned from other AHM Project countries, WCNP staff set up two village conservation committees (VCC) in Dungkhar and Ney Villages to combat poaching of musk deer and other forms of wildlife poaching. Committee members will serve as volunteer rangers and citizen scientists to improve protection of musk deer and other wildlife that are indiscriminately caught by snares set for musk deer, including snow leopards and their prey. In addition, WCNP staff also conducted awareness raising programs at the Dungkhar and Ney primary schools to teach school children about the problem of wildlife poaching in WCNP.

Local Livelihoods

As in western and central WCNP, the AHM Project supported several climate smart and alternative livelihood activities for residents of eastern WCNP, including fodder crop planting to increase winter dairy production and food security of villagers. At Shawa Village, greenhouse vegetable production was introduced to increase both food security and nutrition in the village. In Dungkar Village, Kurtoe Geog, WCNP organized a comprehensive training for farmers on climate change impacts on agriculture, controlling pest infestations with bio-pesticides, improving soil fertility with bio-fertilizers, water efficiency for agriculture, soil erosion control, and seed harvest and storage.

Cross-cutting Activities

WWF supported a number of cross-cutting activities with the participation of project partners and beneficiaries in WCNP as well as interested participants from elsewhere in Bhutan.

Climate Adaptation Trainings

WWF supported a number of climate adaptation trainings in Bhutan throughout the AHM Project. The first was a training led by the WWF US Climate Adaptation Team for staff of various government institutions in Bhutan, including protected areas, the Department of Forest and Park Services, Department of Hydromet Services, and the Watershed Management Division. Training topics included climate trends in Bhutan; adaptation strategies for freshwater ecosystems, forest ecosystems, and species; and climate-smarting conservation planning documents. UWICE and WCNP organized a second climate change adaptation training in Bumthang Dzongkhag for government Rural Natural Resource Extension agency (agriculture, livestock, and forest) workers, local basic health units (village medical clinics) and teachers from geog centers. Topics discussed during this training included climate change and its impacts; climate change mitigation and adaptation; identifying climate adaptation options with respect to local infrastructure and livelihoods; mainstreaming

Downloading data from a high-altitude automatic weather station in the UWICE research preserve, Bumthang, Bhutan. © WWF Bhutan

climate adaptation into development plans; and climate change-induced disasters and disaster management.

UWICE organized two additional climate adaptation trainings for farmers from Thangbi, Kharsa, Goling, Nasiphel, Chokhortoe, Dhur, and Lusbee Villages in Chokhor Geog, central WCNP. Topics discussed included climate change impacts on the WCNP region and water resources, and possible climate adaptation strategies for agriculture in WCNP. Participants also shared recent climate change impacts on their communities, which included drying up of water sources, increased frequency of agricultural pest and disease outbreaks, and appearance of invasive plant species.

Climate Research

To build the first long term climatic record along a high-altitude gradient in WCNP, UWICE established a network of four permanent automatic weather stations between elevations of 3,077 and 4,141 m in the UWICE research preserve above its campus near Jakar. These four stations are complemented by a government hyrdomet station located nearby in Jakar at an elevation of about 2,575 as well as a sixth station at a local school between Jakar and the UWICE campus that is teaching students about hydrometeorological monitoring as part of UWICE's Himalayan Environmental Rhythm Observation and Evaluation System (HEROES) program. WCNP received additional support to work with the

Department of Hydromet Services (DoHMS) to install two automatic weather stations in remote locations in WCNP, at 4,033 m near Khangdang in Chokhor Geog in central WCNP and near Dungkar Village at an elevation of 1,765 m in eastern WCNP.

WCNP conducted a survey of 498 households throughout the park to assess local perceptions of climate change to guide development of park climate adaptation strategies. Respondents reported a variety of impacts in the region, including warming temperatures; decreasing snowfall; increasing intensity of rainfall; more unpredictable monsoon rains; emergence of invasive plants, weeds, and crop pests; and an increased incidence of crop and livestock disease outbreaks.

With AHM support, UWICE completed mapping of 1,070 wetlands in Wangchuck Centennial National Park using satellite imagery. This study revealed recent climate change-related impacts on high-altitude wetlands in WCNP, such as increases in size of glacial lakes, that has provided important information needed to prepare for potential glacial lake outburst floods (GLOFs). Field validation of results was carried out in the Gangkar Phuensum area of WCNP and findings are being used to guide national water and climate change policies.

To further understand climate change impacts at these high altitudes, WWF provided support to UWICE to organize the Bhutan International Glacier Symposium in Bumthang. This symposium featured presentations on glacier research and climate change impacts on glaciers by scientists from the Bhutan Water Partnership, Columbia University's Lamont-Doherty Earth Observatory, Bhutan's Department of Geology and Mines, ICIMOD, the University of Utah, Brigham Young University, the University of Bern, the Geological Survey of India, and the University of Jammu.

These efforts are contributing to building an important climatic record for WCNP and will assist in developing future climate adaptation strategies across a wide elevation range in the region as well as building the experience and capacity of local researchers with respect to climate research.

Other Research

WWF provided support to UWICE for organizing the second Bhutan National Water Symposium in Thimpu. This symposium brought together water resource professionals from various government agencies and institutes as well as NGOs to take stock of the current state of water resource knowledge in Bhutan, identify priority areas for cooperation on water resource management and development, and determine areas where further research is needed on improving sustainability of water resource management in Bhutan. A large part of this discussion focused on current and future threats to water security in Bhutan, such as climate change impacts. Findings of the symposium are currently guiding government agencies and research institutes with respect to setting water resource management and research priorities in Bhutan.

WCNP, in collaboration with the Institute of Traditional Medicine Services (ITMS), carried out a survey of high-altitude medicinal plants in the Chokortoe, Tshampa, Gankar Puensum, Toleygang, Juleyla and Dhur Tshachu areas of central WCNP. A total of 113 medicinal plants species of were found in the survey area, of which over fifty are used on a regular basis by traditional medicine practioners in Thimphu. Findings are being used to improve the sustainability of medicinal plant collection practices in the park, including by restricting livestock grazing in alpine meadows with particularly rare or valuable medicinal plants, setting quotas for harvest of rare medicinal plant species to prevent overharvesting, promoting home cultivation of certain high

Capacity-building training for rangers on wilderness medicine and evacuation taught by NOLs instructors with support from the AHM Project, Wangchuck Centennial National Park. Photo: UWICE and WCNP.

value species to reduce collection of wild growing plants; and educating medicinal plant collectors about threats to these plant resources and ways to minimize these threats.

Trainings for Protected Area and Natural Resource Agency Staff

The AHM Project also supported a series capacity building trainings for WCNP and other protected area and government staff on how to conduct research, strengthen law enforcement, improve patrolling, and engage local communities in conservation efforts. The first of these trainings was for WCNP staff on the installation, maintenance, and data collection and management for the two automatic weather stations (AWS) installed in the Khangdang and Tapgang areas of WCNP. This was followed by a second training on automatic weather stations organized by UWICE for climate focal persons from UWICE, Bumdeling Wildlife Sanctuary (BWS), Jigme Dorji Wangchuck National Park (JDWNP), WCNP, College of Natural Resources (CNR), Royal Manas National Park (RMNP), Jigme Khesar Strict Nature Reserve (JSNR), Renewable Natural Resources Research and Development Center (RNR RDC) Phibsoo Wildlife Sanctuary (PWS) and Royal Thimphu College (RTC). This training focused on hydro-meteorological monitoring, data management and analysis, climate change monitoring, and the use of hydro-meteorological data in development of climate change scenarios, vulnerability assessments, and adaptation strategies.

Additional trainings for park staff included: 1) a GIS training for WCNP Staff to improve field research and design and implementation of conservation activities in the park; 2) a snow leopard camera trap survey training for WCNP staff, staff of Bhutan's other three northern protected areas with snow leopards (Jigme

Dorji Wangchuck National Park, Bumdeling Wildlife Sanctuary, and Jigme Khesar Strict Nature Reserve), and staff of the Wildlife Conservation Division and UWICE; and 3) a SMART (Spatial Monitoring And Reporting Tools) Patrol training for 30 WCNP staff members to improve protected area patrolling effectiveness and reduce illegal poaching activities in WCNP.

With AHM support, WCNP and Bhutan's Forest Protection and Enforcement Division (FPED) organized a training on detection of illegal wildlife trade for staff of the Royal Bhutan Police, the Regional Revenue and Custom Office, the Royal Court of Justice and WCNP. Topics of discussion included identification of genuine and fake wildlife parts that are commonly trafficked in South Asia, such as skins, bones, tusks, teeth, paws, musk pods, bear bile, skulls, and rhino horn; protected wildlife species listed on the IUCN Redlist and in Bhutan's 2006 Forest and Nature Conservation Rules; an overview of illegal wildlife trade in South Asia; wildlife trade originating in Bhutan and transiting across Bhutan; and the importance of conserving protected species.

To improve ranger safety and their ability to conduct emergency rescues while on patrol, WWF supported two trainings on high-altitude and wilderness first aid for WCNP staff as well as other protected area and hospital staff. Both trainings were held in Bumthang and taught by experienced wilderness emergency medical technicians from the National Outdoor Leadership School (NOLS). Particular emphasis was placed on altitude sickness, hypothermia, emergency evacuation, and necessary contents of medical kits for rangers on patrol. NOLS instructors also taught the use of several donated pieces of medical and emergency equipment.

WWF supported two study tours for project partners in Bhutan. The first was an exchange for WCNP staff members to the Kanchenjunga Conservation Area (KCA) of Nepal for WCNP staff to meet with members of the KCA's successful Ghunsa Village Snow Leopard Conservation Committee (SLCC). In the KCA, rangers learned about SLCC community snow leopard conservation activities for future replication in WCNP, including human-snow leopard conflict reduction strategies, community-based anti-poaching operations, community snow leopard and prey species monitoring, community conservation education work, improved pasture management, and participation of SLCC members in the recent WWF-led snow leopard GPS tracking collaring work. Over the course of their 10-day visit to the KCA, WCNP staff members also learned about other community conservation work in the KCA, including gaining first-hand experience on trekking ecotourism and homestay operations, trash management, sustainable community livelihood enterprises, and the work of other community groups such as local mothers' groups.

The second study tour was an exchange to Nepal for WMD, WCNP, RNR extension, and Territorial Division offices responsible for implementing AHM watershed management activities in Bhutan. The visit was organized by the Soil and Water Conservation Society, Nepal, and exposed participants to various watershed management programs in Nepal. Participants were also able to interact with the rural communities that are implementing successful integrated watershed management activities. Topics of discussion during this exchange included watershed management policy and strategies, bioengineering and erosion control, landslide area rehabilitation, and other ongoing watershed management activities in Nepal.

General Park Management

In order to reduce trash dumping in highland areas of WCNP by caterpillar fungus collectors and others, park staff have launched a campaign to enforce the park's Garbage In Garbage Out (GIGO) policy, educating permit-holding fungus collectors about the GIGO policy before they enter the park, and enforcing park regulations and penalties.

Recommended Next Steps

In Bhutan, ground-breaking work on watershed management included extensive planting of trees, grass hedgerows, and bioengineering works for erosion control. These plantings will all require continued monitoring and, if necessary, replanting in the case of failure. These activities only occurred in small areas of two important watersheds and will require extensive scaling up along the length of settled areas of these river basins to have a widespread benefit for watershed management. Other activities that will require further monitoring to assess benefits include the two climate-smart demonstration villages in eastern WCNP to ensure that climate adaptation activities are working as intended, and, if not, will require community consultation and redesign. A third activity requiring long term monitoring and maintenance is the UWICE hydro-meteorological monitoring program with respect to both instrument maintenance and proper management of data collected at these remote mountain sites. And as a new generation of caterpillar fungus collectors comes of age, these novice collectors will also require training on sustainable fungus collection practices.

India: Sikkim

Kanchenjunga, Sikkim India. © WWF India

In India, WWF worked with a variety of government and NGO partners in Sikkim, including the Sikkim Forest Department, the Lachen Dzumsa (village council), the Lachen Tourism Development Committee (LTDC), Ecotourism Society of Sikkim (ECOSS), the Khangchendzonga Conservation Committee (KCC), and Zero Waste Himalaya, to design and implement a comprehensive set of integrated climate adaptation and conservation activities in North Sikkim. These activities included: a climate vulnerability assessment for North Sikkim, snow leopard and wildlife research, improving partner capacity to conduct wildlife field research and anti-poaching patrols, improving management of caterpillar fungus collection, improving trash management at ecotourism sites, improving agricultural practices, and promoting ecotourism as one climate adaptation strategy to diversify household incomes.

Major Achievements

- **Completion of a comprehensive climate vulnerability assessment for North Sikkim that will inform development of climate adaptation strategies and climate-smart conservation plans for this region**
- **Design and implementation of climate-smart sustainable caterpillar fungus harvesting practices in North Sikkim that are improving management of 20,000 hectares of collection areas**
- **Completion of the first systematic snow leopard camera trap survey of North Sikkim District that captured the first images of snow leopards taken in the district and photographed a total of 10 snow leopard individuals during the 2016 portion of the survey.**

Figure 5. Map of the Sikkim GSLEP landscape (shown in light green) and AHM demonstration site Lachen Village, bordering the Nepal site of Kanchenjunga Conservation Area.

- **Training of a core team of four citizen scientists to conduct snow leopard and prey species surveys as well as other wildlife conservation activities who are now champions of snow leopard conservation in their home villages**
- **Completion of a human-wildlife conflict survey that found that feral dogs in Sikkim kill a far larger number of livestock each year than snow leopards and all other wild predators combined and are conservation threat that needs to be addressed**
- **Advocacy work that has improved the sustainability of ecotourism practices in Sikkim, including by establishing responsible tourism guidelines and improving trash management practices at tourism centers in North Sikkim**

Landscape Overview and Major Threats

The main AHM Project demonstration site in India was in North Sikkim District and focused on the mountain village of Lachen (2,700 m), neighbouring areas of the Khangchendzonga National Park and Biosphere Reserve (notable for being the location of Kanchenjunga, 8,586 m, the world's third highest mountain), and alpine snow leopard habitat to the north. Additional activities were conducted in Lachung Village (2,675 m), 20 km to the east of Lachen, as well as at ecotourism sites in the buffer zone of Khangchendzonga National Park in West Sikkim District and at the Kitam Bird Sanctuary (750 m) in South Sikkim District. The Lachen demonstration site lies in the headwaters of the Teetsa River, Sikkim's largest river and a tributary of the Brahmaputra.

The extreme elevation range in this region has created a wide variety of microclimates and ecosystems distributed over a relatively small area with some of the highest biodiversity of any region in the world. Land cover includes glaciers and perennial snow cover; alpine grasslands; rhododendron shrublands; extensive conifer, broadleaf, and mixed forests; alpine pastures and some limited mountain agricultural terrace farming. North Sikkim District and the Kanchenjunga Region form important habitat for snow leopards and blue sheep—the primary prey species in the eastern Himalaya—as well as the last remaining population of Tibetan argali in the eastern Himalaya and a variety of other wildlife.

As in Bhutan, a primary threat to this landscape and its residents is climate change, especially the melting of glaciers that forms GLOF lakes which can rupture and cause catastrophic flooding. Climate change is also causing increasingly erratic summer monsoon rainfall and increasing the frequency of extreme weather events, such as alternating spring droughts and summer flooding, as well as increasing intensity of rainfall itself. One of the largest threats to the project region is the rapid pace of development that has led to extensive road building on unstable mountainsides, which are frequently washed away by summer flooding. While forests are relatively well managed and yak herding a rapidly disappearing way of life, poaching of wildlife and overharvesting of valuable medicinal plants, including caterpillar fungus, remains a concern.

North Sikkim Demonstration Site

The North Sikkim demonstration site was focused on Lachen Village, the most important ecotourism center in North Sikkim District, as well as neighboring Thangu Village, about 20 km to the north, where residents of Lachen have their main summer agricultural fields. A number of parallel adaptation activities were also conducted in Lachung Village, 20 km to the east of Lachen. Project site elevations ranged from about 2,675 m in Lachung Village to over 5,000 m in highland areas where snow leopard research and other activities were carried out in the upper Teetsa River watershed.

Climate Research

In order to gauge the impact of climate change on North Sikkim, WWF conducted a climate vulnerability assessment for Lachen and Lachung Villages and areas to the north that was based on consultations with local farmers, reviews of existing scientific literature, and workshops with community and state experts in wildlife, forests, animal husbandry and agriculture. Increased frequency of natural disasters such as floods, decreasing snow fall, and the appearance of new agricultural pests and diseases were identified as the most significant impacts to address. The final vulnerability assessment report is now being used by the local government and WWF to guide design of future conservation, development, and climate adaptation strategies for the region.

Climate Adaptation Training

WWF organized a meeting in Lachen for local government staff on mainstreaming climate adaptation concepts into district planning processes, including representatives of the state Horticulture, Food Security and Agricul-

Village sustainable caterpillar fungus collection training supported by the AHM Project, Lachen Village, Sikkim, India. © WWF India

ture, Animal Husbandry, and Health Care Departments as well Lachen Dzumsa Pipons (headmen) and staff of the Krishi Vigyan Kendra Farmer's Science Institute. Stakeholders were informed about the WWF climate vulnerability assessment for North Sikkim and WWF climate adaptation work being conducted in both Lachen and Lachung Villages, such as improving sustainability of caterpillar fungus harvesting, fuel wood-use reduction, climate smart agricultural practices, and alternative livelihood development.

Water Resource Management

In Lachen, WWF worked with the state Rural Management and Development Department, to conduct a field survey to develop a long-term community water resource management plan for the village. This survey identified and mapped all springs and their recharge areas around Lachen, determined the number of households dependent on each, and also determined their status and threats.

Caterpillar Fungus Management

WWF worked with the Lachen Dzumsa (village council) and Lachen Tourism Development Committee (LTDC) to improve sustainability of the lucrative spring caterpillar fungus harvest at Lachen, which for many Lachen families is their single largest source of cash income. As a first step, the dzumsa voted to limit fungus collection to two family members per household. WWF then worked with the dzumsa to design and distribute an educational brochure to community members on improving the sustainability of the harvest that included instruction on reducing harvester impacts on alpine meadows and wildlife to increase the resilience of this fragile high-altitude ecosystem. As a next step, the dzumsa instituted the requirement that collectors carry kerosene stoves to collection areas to eliminate the need to cut rhododendrons, and these portable stoves are available for collectors to check out during collection season. Notably, with the success of this activity, the state Forest, Environ-

ment and Wildlife Management Department (FEWMD) has now assumed the lead on implementing further sustainable caterpillar fungus initiatives in North Sikkim.

Sustainable Tourism

The Green Lake Trek is the primary trekking route for tourists in North Sikkim District and starts northwest of Lachen and follows a valley into the eastern Kanchenjunga Massif. In early 2016, permits for this trek began to be issued in Sikkim for the first time, not New Delhi, a move that is expected to increase tourism sharply along this route in coming years and in Lachen itself, the gateway community for this trek. To prepare for increased visitation of this area, WWF provided support to the Lachen Dzumsa and the LTDC to organize a stakeholder consultation meeting of NGOs, government, and tourism workers to ensure that the Green Lake Trek continues to be managed in a sustainable manner. A code of conduct for the trek prepared by the Lachen Dzumsa was adopted that prohibits burning of firewood along the trekking route and strictly penalizes illegal activities, such as poaching and unpermitted plant collection. An environmental protection fee for tourists was also proposed that will be applied towards rubbish management, maintenance of camp sites and trails, and used for emergency situations.

WWF worked in close cooperation with the Lachen Dzumsa and the LTDC to resolve the growing issue of trash disposal at Lachen and surrounding ecotourism destinations, particularly at Gurudongmar Lake, a sacred high-altitude lake and important tourism site north of Lachen. Steps taken included enforcing a ban on selling water in disposable plastic bottles, the major type of trash found along the shore of Gurudongmar Lake; establishment of a village recycling center; and a village campaign on trash cleanup, recycling, and proper disposal. In support of this campaign, the Lachen Dzumsa announced establishment of a village trash management committee and a small village-wide trash management fee for all households and businesses that is used to underwrite trash cleanup and recycling activities in Lachen. The dzumsa also made household segregation of waste mandatory, banned the use of synthetic prayer flags and disposable plates and cups in the village, and is promoting the use of re-usable water bottles amongst tourists. WWF, the LTDC, ECOSS, and the Lachen Dzumsa marked World Environment Day in 2016 by organizing a cleanup campaign of Gurudongmar Lake, the first such cleanup of the lakeshore since 2011. Only one disposable plastic water bottle was found, demonstrating the effectiveness of the Lachen bottled water ban.

Other sustainable tourism initiatives included a training for tour company drivers to enlist their support in complying with zero-waste initiatives in Lachen Village and North Sikkim tourist centers; and two bio-briquette making trainings at Lachen Village and a third training in Lachung, showing residents one low-cost, carbon-neutral alternative to fuel wood cutting by making charcoal briquettes from agricultural and other plant waste.

Species Conservation

In 2013, WWF conducted a preliminary snow leopard sign and prey species survey in the Gurudongmar Lake, Tsho Lhamo, and Kerang and Lashar Valleys areas of North Sikkim which guided site selection and design of more comprehensive snow leopard camera trap survey work in the region. A series of subsequent camera trap surveys began in 2015 with the assistance of 8 trained citizen scientists from Lachen Village that covered an 800 km^2 area of the Cefu La, Tsho Lhamo, Muguthang and Lashar Valley areas of North Sikkim District. The two surveys conducted in 2015 produced the first camera trap photos of snow leopards ever taken in North Sikkim District,

International Snow Leopard Day field trip for students to snow leopard habitat, Sikkim, India. © WWF India

and in total photographed 6 snow leopard individuals as well as numerous other mammal species. WWF staff and citizen scientists also conducted a prey species survey in the camera trap study area. In the autumn of 2016, WWF and 4 trained citizen scientists from Lachen conducted 3 additional snow leopard sign, camera trap, and prey species surveys in the study area of North Sikkim, resulting in photos of 10 snow leopard individuals and counts of 85 Tibetan argali and 70 blue sheep in the survey area. The 4 participating citizen scientists are now promoting the importance of snow leopard conservation in their home village of Lachen.

WWF also conducted two human-wildlife conflict social surveys amongst yak herders in snow leopard range areas of North Sikkim, the results of which were intended to be used to design human-snow leopard conflict mitigation measures. However, findings indicated that from 2014-2015, feral dogs killed 5 times more yaks than snow leopards and that these dogs pose a far greater threat to herding livelihoods than snow leopards. Findings are being used to develop a strategy for reducing the feral dog population in North Sikkim.

Trainings for Protected Area and Natural Resource Agency Staff

WWF organized two trainings on biodiversity field survey techniques for staff of the FEWMD in North Sikkim District. Topics discussed during these trainings included the importance of Sikkim as a biodiversity hotspot, important flora and fauna in Sikkim, design of field surveys, use of GPS units for field surveys, use of camera traps for monitoring snow leopards

and other wildlife, habitat assessment, analysis of field data, and WWF's snow leopard research work in North Sikkim.

Community Participation in Conservation

To increase community awareness and participation in conservation activities in North Sikkim, WWF held citizen scientist trainings for Himal Rakshaks (volunteer Mountain Guardians) and Lachen villagers to build their capacity with respect to snow leopard ecology and monitoring of snow leopards and their habitat in high-altitude areas of Sikkim. Topics covered included conducting snow leopard sign surveys, prey species counts and use of handheld GPS units and camera traps.

WWF also held a series of public awareness raising events and trainings, including a two-day International Snow Leopard Day celebration in Lachen co-organized with the Lachen Dzumsa, LTDC, and Sikkim Forest Department. The first day featured presentations on the distribution of snow leopards, biodiversity, and key conservation challenges in North Sikkim; a photo exhibition and a panel discussion about conservation in Sikkim. The second day was a field trip to snow leopard habitat in North Sikkim for students, teachers, and LTDC members, where participants were introduced to snow leopard sign and camera trap surveys and observed snow leopard prey species such as Tibetan argali, blue sheep, and Tibetan gazelle.

Other events held were a 3-day nature camp for students from Lachen to mark World Environment Day that introduced students to the flora and fauna of Sikkim, particularly snow leopards and their prey, as well as conservation and environmental issues in the district; a 3-day long environment camp for teachers from North Sikkim which also taught teachers about snow leopards, Sikkim flora and fauna, and conservation and environmental issues in the district, including local climate change impacts; and a wildlife conservation education stall at the Lachen Village Losar (lunar new year) Festival, which featured an exhibit of wildlife camera trap photos taken during the recent WWF snow leopard survey of North Sikkim.

Local Livelihoods

To improve farming livelihoods in North Sikkim in response to declining yields from climate change and mandated organic farming, WWF worked with DLR Prerna to organize stakeholder consultations in Lachen, Thangu, and Lachung to design several subsequent climate-smart agriculture trainings. Training participants were taught about the importance of soil fertility for crop health, making bio-fertilizer from cow manure and bio-pesticides from cow urine, and use of effective microorganisms (EM) for increasing crop productivity. Follow up monitoring revealed anecdotal improvement in crop health reported by farmers using techniques learned in these trainings.

To build up ecotourism as an important, less climate-vulnerable source of income, WWF worked to improve ecotourism practices and promotion in Lachen Village, the gateway village for the popular Gurudongmar Lake tourist excursion and the Green Lake Trek. This included trainings on nature guiding, cooking for homestays and trekking groups, environmental and cultural impacts of tourism, conservation issues, safety and security for tourists, and proper trash management. WWF, ECOSS, LTDC, and the Photography Club of Sikkim (PCOS) prepared ecotourism promotional materials for Lachen, including a photographic bird booklet, bird checklist, and brochure on Lachen ecotourism activities and set up several nature trail walks around the village for visiting tourists. WWF and partners are also working with tour operators in Gangtok to promote Lachen as a tourism destination, rather than just a transit point for tourists.

WWF also trained locals on handicrafts to develop an additional supplemental source of income. This included a study tour for traditional textile weavers from Lachen to the North East Network in Chizami, Nagaland, which works to train women on weaving and marketing of woven products produced by women's groups. Women from Lachen learned about new weaving techniques; product diversification; sales, marketing and book keeping; and weaving group management. WWF also worked with the Khangchendzonga Conservation Committee (KCC) to hold two trainings on making handicrafts from common household trash, such as plastic wrappers, PET bottles, paper, etc, to sell to tourists and at the same time increase awareness about trash management issues in Sikkim.

West Sikkim

In the Kangchendzonga Biosphere Reserve of West Sikkim, the AHM Project provided support for a series of activities launched earlier under the WWF Sacred Himalaya Landscape Project.

To reduce local deforestation from wood cutting and increase resilience to erosion and landslides, WWF worked with the Kangchendzonga Conservation Committee (KCC) to organize a bio-briquette making training in Yuksam Village, West Sikkim, the main entry point to Kangchendzonga National Park. WWF also worked with the KCC to set up nine shared demonstration solar hot water heating units for homestays in Sangkhola and Yuksam Villages, to reduce need for firewood.

Various training programs were held to build local awareness and capacity for conservation in West Sikkim. These included: a training program for Himal Rakshaks in Uttarey, West Sikkim, to build their capacity with respect to biodiversity monitoring and the illegal wildlife trade; a 6-day wildlife and habitat field survey techniques training at the Barsey Rhododendron Sanctuary in West Sikkim for Himal Rakshaks, community Eco-Development Committee members, FEWMD field personnel and several Indian researchers working in the sanctuary; and monitoring and anti-poaching patrols by trained Himal Rakshaks members in Khangchendzonga National Park (KNP) and the Khangchendzonga Biosphere Reserve (KBR) in West Sikkim.

WWF organized various trainings during the AHM Project to further develop the tourism industry in West and South Sikkim and enhance local livelihoods by supplementing incomes with a source less vulnerable to a shifting climate. These included funding for the KCC to hold a training in Yuksam, for homestay operators from the Phadamchen area in East Sikkim on the basics of homestay management and a training needs assessment for homestay operators and guides in Uttarey Village, West Sikkim, the westernmost gateway village to Kangchendzonga National Park. Homestay operators from Uttarey next participated in a 15-day state government homestay operators training in Gangtok, where participants learned about all facets of homestay management, including promotion, sanitation, food preparation, and activities for tourists. WWF then sponsored a 4-day an exchange for these homestay owners to visit the successful community-based homestay system at Dzongu Village in North Sikkim. To take these efforts further, WWF worked with the FEWMD and KCC to organize a consultation meeting on strengthening sustainability of tourism in Khangchendzonga National Park. The goal of this meeting was to develop an

WWF organized various trainings to further develop the tourism industry and enhance local livelihoods.

action plan for improving the tourism experience and sustainability along the main Yuksam-Dzongri trekking route that starts in Yuksam. Recommendations inlcuded reducing the impact of tourism on wildlife habitat, having community members conduct regular monitoring along the trail, developing conservation awareness materials targeting both locals and tourists, and building the capacity of the local nature guides. WWF and ECOSS also provided support to the Kitam Village Development and Ecotourism Committee (KVDEC) to promote sustainable ecotourism at the recently established Kitam Bird Sanctuary in South Sikkim.

Regional Activities

WWF supported a study tour to Bhutan for Himal Rakshaks and community Eco-Development Committee members from project sites in Sikkim to give participants insight into conservation initiatives in Bhutan, including protected area management; wildlife monitoring practices, especially snow leopard monitoring; management of medicinal plant collection; ecotourism development; and alternative livelihood projects. WWF also worked with the Ecotourism and Conservation Society of Sikkim throughout the AHM project to improve sustainability of the booming ecotourism industry in Sikkim. WWF and ECOSS conducted a survey to document the successes and failures of various community-based ecotourism initiatives at the nine most visited village tourism sites in Sikkim, including initiatives launched by communities, the state government, and individuals. Findings were the basis for a follow-up workshop held in Gangtok attended by tourism stakeholders in Sikkim, including travel agents, tour operators, homestay operators, guides, Sikkim State Tourism and Forest Department officials, and NGO staff. As a result, a committee was formed to review Sikkim state tourism policy, homestay guidelines, and generate more support for sustainable tourism practices among relevant state agencies. At the request of the Sikkim Tourism Department, WWF and ECOSS drafted a tourism policy through a participatory process with various stakeholder groups, which was ultimately submitted to the Sikkim Tourism Department for review.

Recommended Next Steps

In India, major sustainability concerns include ecotourism, volunteer ranger, and wildlife conservation activities. At present, ecotourism is experiencing rapid growth in Lachen. Although great strides have been made towards increasing the sustainability of tourism practices, these gains could be lost to sheer growth in visitor numbers. While the Himal Rakshaks volunteer ranger program has been a success, these volunteers will need further support and training to continue conducting their patrols. More funding is needed for equipment and expeditions for conducting snow leopard monitoring surveys in Sikkim. A strategy also needs to be developed for reducing the feral dog population in North Sikkim that is responsible for far more livestock kills than snow leopards. Finally, findings of the WWF climate vulnerability assessment for North Sikkim will require further dissemination and discussion with government and community partners, particularly with respect to implementing vulnerability assessment recommendations.

The Kyrgyz Republic: The Central Tian Shan Landscape

Central Tian Shan, Engilchek Valley, Kyrgyz Republic. © WWF Central Asia Program

In the Kyrgyz Republic, WWF worked with a variety of government and NGO partners, including the State Agency for Environmental Protection and Forestry (SAEPF), the administration of the Sarychat-Ertash Reserve, the Jeti-Oguz District Forest Department, Snow Leopard Trust (SLT), and various local NGOs and school groups to design and implement a comprehensive set of integrated climate adaptation and conservation activities at project demonstration sites. These activities focused on snow leopard and wildlife research, a climate vulnerability assessment for the Central Tian Shan region, a climate-smart watershed management plan for the Chon Kyzyl Suu River basin, a climate-smart snow leopard landscape management plan for the Central Tian Shan GSLEP Priority Landscape, capacity building for protected area staff, climate adaptation activities to diversify vulnerable household incomes, and public awareness raising events.

Major Achievements

- **Significant advances made in snow leopard research in the Sarychat-Ertash State Reserve, including camera trap surveys, DNA analysis of snow leopard scat, and annual prey species counts that improved knowledge of snow leopard and prey species population status and will inform design of future conservation initiatives.**
- **In partnership with Snow Leopard Trust, Snow Leopard Network Members and others, WWF successfully lobbied the Kyrgyz Government to expand the Sarychat-Ertash State Reserve, the most important snow leopard site in the Kyrgyz Republic, from 72,080 hectares to 149,117 hectares.**
- **WWF provided initial support that led to the establishment of the new 278,500**

Figure 6. Map of the Kyrgyz Republic GSLEP landscapes and locations of the Chon Kyzyl Suu River Basin and Sarychat-Ertash State Reserve AHM demonstration sites.

hectare Khan Tengri National Nature Park in the Central Tian Shan which covers some of the Kyrgyz Republic's most important snow leopard habitat.

- **Preparation of the first climate vulnerability assessment for the Kyrgyz Central Tian Shan region, location of the nation's most important snow leopard habitat, which provided critical input for the GSLEP landscape management plan and will inform future adaptation efforts.**
- **Numerous climate adaptation actions to address climate change impacts and risks and improve livelihood security, including support for yak herding, handicraft production, greenhouse vegetable growing, and beekeeping.**
- **Preparation of a climate-smart watershed management plan for the Chon Kyzyl Suu River basin that presents strategies for improving water security in the basin through improved management of pastures, forests, and agricultural lands as well as more efficient use and equitable sharing of available water resources.**
- **Completion of a draft climate-smart snow leopard landscape management plan for the Kyrgyz Republic's Central Tian Shan GSLEP Priority landscape that will scale up AHM lessons learned in the Sarychat-Ertash State Reserve and Chon Kyzyl Suu Basin to cover this entire 1,320,100 hectare landscape.**

Landscape Overview and Major Threats

In the Kyrgyz Republic, AHM Project work focused on two demonstration sites, the Sarychat-Ertash State Reserve in the nation's Central Tian Shan region and the Chon Kyzyl Suu River basin on the north slope of the Terskey Range, which drains into Lake Issyk Kul. The Sarychat-Ertash Reserve is a high-altitude nature reserve dominated by various types of short growing alpine grasslands that form some of the country's most important snow leopard habitat. Threats to the reserve include potential expansion of gold mining activities now restricted to the reserve buffer zone; poaching of snow leopard prey such as argali and ibex; and climate change impacts on the reserve's glaciers, perennial snow cover, and permafrost, melting of which could severely affect the reserve's grassland ecosystems.

The Chon Kyzyl Suu River basin stretches from the glacier field at the crest of the Terskey Range to Lake Issyk Kul and includes montane forests and meadows, steppe grasslands, and agricultural fields. Threats to this landscape include rampant illegal logging, wildlife poaching, poor pasture and livestock management practices, and the impact of climate change on the basin's glaciers, perennial snow cover, permafrost, and ecosystems. Notably, the upper Chon Kyzyl Suu Basin is location of the Tian Shan Research Station where researchers are currently monitoring both the Kara-Batkak Glacier and the basin's hydro-meteorological conditions with support from the USAID-funded CHARIS Project being implemented by the University of Colorado.

Sarychat-Ertash Demonstration Site

The Sarychat-Ertash demonstration site was focused on the Sarychat-Ertash State Reserve and its three main buffer zone villages of Akshyrak, Engilchek, and Karakolka. Sarychat-Ertash is the location of the Kyrgyz Republic's largest snow leopard and argali populations, and residents of the area subsist primarily by livestock herding, working as guides for trophy hunting companies, or working for the neighboring Kumtor gold mine. Elevations at this demonstration site range from about 2,400 m on the Saryjaz River south of Engilchek to 5,284 on Peak Kuylyutau located 14 km west of Engilchek. Land cover is primarily alpine steppe and meadow, with small isolated patches of shrubs and forest found in riparian areas.

Snow Leopard Research

WWF trained rangers and provided camera traps for monitoring of snow leopards in the Sarychat-Ertash Reserve. Over the course of the first three years of the AHM Project, camera trapping by reserve rangers captured images of 20 snow leopard individuals on the territory of the reserve. WWF also trained Sarychat-Ertash rangers to collect snow leopard scat samples for DNA analysis to estimate population size in the reserve. In the autumn of 2015, rangers collected 253 predator scat samples which were sent to Duquesne University for genetic analysis, which identified 15 snow leopard individuals. WWF also supported annual counts of ibex and argali at Sarychat-Ertash, the primary snow leopard prey species at the reserve, which had peak composite ranger counts of 1,200 ibex in 2014 and 3,050 argali in 2015. WWF also began

Ranger checking a camera trap set for snow leopards, Sarychat-Ertash State Reserve, Kyrgyz Republic. © WWF Central Asia Program

conducting preliminary snow leopard sign and prey species surveys at a number of sites in surrounding areas just outside the Sarychat-Ertash Reserve, showing some limited snow leopard sign and argali presence.

Climate Research

WWF conducted a climate vulnerability assessment for the Central Tian region of southeastern Issyk Kul Province, home to Sarychat-Ertash State Reserve and the neighboring Khan Tengri National Nature Park. This remote, sparsely populated, high-altitude region forms some of Central Asia's most important snow leopard and argali habitat, much of which is a fragile, permafrost-controlled alpine landscape that is highly vulnerable to climate change impacts. It is also the location of Khan Tengri Peak (6,995 m), Central Asia's most sacred mountain, and Peak Pobeda (7,439 m), the highest peak in the Tian Shan Range. The assessment examines climate change impacts on the region's glaciers, biodiversity, and local residents and proposes adaptation strategies. This process included a review of scientific literature and available hydro-meteorological data for the region, a social survey of herders and farmers residing in the Central Tian Shan on climate change impacts, a threat analysis, and compiling a list of possible adaptation actions. The assessment has been shared with relevant partners and is being used to assist in designing and implementing climate adaptation strategies for the Central Tian Shan region.

Climate Adaptation

WWF conducted two climate change adaptation trainings in Akshyrak and Engilchek villages. These trainings introduced residents to both global and local climate change issues, impacts on local mountain ecosystems and

A yak herd being used to demonstrate improved pasture rotation practices and a climate-smart alternative to sheep herding, Sarychat-Ertash State Reserve, Kyrgyz Republic. © WWF Central Asia Program

herding livelihoods, and possible climate adaptation strategies for ecosystems and livelihoods, including alternative livelihood options to diversify local incomes away from near total dependence on livestock herding.

At Sarychat-Ertash, WWF worked to promote yak herding as a climate-smart alternative to the usual local practice of sheep herding. Yaks have a better ability to survive increasingly frequent extreme weather events such as deep snows, are better able to defend themselves against what is believed to be increasing snow leopard and wolf populations, and currently have a higher market value than sheep due to a growing demand for mountain-raised yak meat in nearby cities. WWF established a demonstration yak herd at Sarychat-Ertash in 2011 with 23 yaks which has since grown to 83 yaks. A key aspect is a model grazing plan with an increased rate of pasture rotation to reduce pressure on fragile alpine pastures and increase their resilience to increasingly extreme weather. This was achieved in part by leasing of additional pasture lands from pasture rights holders that had ceased to use them. A second important aspect of the program is regular vaccination against several common livestock diseases to offset loss to diseases that are believed to be increasing in occurrence due to warming temperatures, as well as to offset possible loss to predation by snow leopards and other predators found in the nearby Sarychat-Ertash Reserve. Lastly, ongoing trials are producing and marketing specialty yak milk dairy products and yak wool handicrafts as a higher value alternative to producing to traditional

dairy and handicraft products from cows and sheep. WWF has worked to share lessons learned through this effort in various forums, such as at a recent government-sponsored Shepherd's Day celebration for local livestock herders. Earnings derived from sale of yaks or yak products will be used to assist the families of Sarychat-Ertash Reserve rangers.

Water Resource Management

In Akshyrak Village, the main gateway village to the Sarychat-Ertash Reserve, the Swiss Red Cross and WWF provided support for renovation of the Akshyrak water delivery system that serves 33 households. Before renovation, water was delivered from a spring by a 1 km long pipe that often froze several months each winter to a single tap at the top of the village, forcing residents to walk or drive up to 2 km to the spring source. This pipe was winterized by installing electric heating coils on the pipe at locations prone to freezing, the system storage and pressure tank located above the village was repaired and insulated, and four new taps were installed in each quadrant of the village to reduce collection time.

General Reserve Management

WWF worked together with Snow Leopard Trust, Snow Leopard Network members and other NGOs and government partners on a successful initiative to more than double the size of the Sarychat-Ertash State Nature Reserve from an area of 72,080 hectares to 149,117 hectares. This is a major achievement that will help ensure the long-term survival of snow leopards, argali and other wildlife in the Kyrgyz Republic. To move beyond this designation on paper, WWF supported its establishment in multiple ways, including: sponsoring a workshop to develop the new protection regime for the expanded reserve, including determining its new zoning system and patrolling needs; donating much needed equipment to reserve rangers to improve morale and help them work at full capacity, such as uniforms, winter jackets, boots, binoculars, walkie-talkies, cameras, a laptop computer, tents and spare parts for the reserve patrol vehicle; and supporting installation of two wind generators at two remote ranger posts, giving them electric lighting for the first time.

Every year for the past five years, WWF organized and coordinated anti-poaching patrols at Sarychat-Ertash with anti-poaching patrols conducted by the State Agency for Environmental Protection and Forestry. WWF also coordinated formation of joint anti-poaching patrols with the Issyk Kul Biosphere administration, Sarychat-Ertash rangers, and staff of other protected areas in Issyk Kul Province to help enforce a province-wide ban on trophy hunting and other illegal hunting activities. To raise awareness of these efforts, WWF cooperated with the SAEPF Hunting Department to design and distribute a well-received 2015 poster calendar featuring photos of Tian Shan wildlife and recently increased penalties for illegal hunting of snow leopard, argali, ibex and other species.

To build support for the reserve and diversify local livelihoods, WWF worked with Sarychat-Ertash Reserve staff and local tour operators from Bishkek to develop a snow leopard-themed, 5-day driving and horseback-riding tourist circuit of the Sarychat-Ertash Reserve that will welcome its first visitors in 2018. WWF also trained a small group of local Akshyrak residents to host and serve as guides for tourists.

Community Participation in Conservation

WWF supported numerous environment day celebrations in Akshyrak, Engilchek, and Karakolka Villages, the most notable of these being an annual "Land of the Snow Leopard Day" event held in May and an annual "Interna-

tional Snow Leopard Day" event held on October 23rd. These two events feature spirited competitions between teams from each village in snow leopard-themed art, storytelling, dance, song, quiz, and ecological theatre contests. These events were attended by nearly everyone present in these communities and highlighted the need to protect the Kyrgyz Republic's wildlife and environment, garnering support for conservation activities in the region.

In Engilchek Village, WWF provided support and training to establish a community-based anti-poaching team to remove wildlife snares and traps in the area around their village in the buffer zones of both the Sarychat-Ertash State Reserve and the Khan Tengri National Nature Park, with the goal of ending all violation of nature and wildlife protection laws in the Engilchek area. WWF also organized a community anti-poaching training workshop in Akshyrak Village where participants were taught about different poaching methods used locally and how to conduct community anti-poaching patrols.

Livelihoods

To diversify and increase sustainability of rural livelihoods, WWF supported the establishment of two local development funds (LDFs) in Akshyrak and Engilchek villages to provide microfinance loans for sustainable livelihood activities as an alternative to rampant wildlife poaching in the region. Eight cooperation groups were formed to apply for funding of various activities, and WWF provided additional training on sustainable, climate-smart alternative livelihoods. WWF also organized a study tour for cooperation group leaders to Toguz Bulak Village on Lake Issyk Kul to learn about successes of the LDF program there, particularly with respect to handicraft and agriculture activities. Since their establishment, annual monitoring of LDF activities for sustainability and environmental performance as well as economic and social benefits has been conducted at annual meetings. At these meetings, LDF group members also share the successes and problems of their LDF activities and receive additional training on sustainability, conservation, and climate adaptation. As of the end of the project, LDF cooperation groups were using their LDF funding on production and marketing of felt handicrafts and startup of yak herding operations, with LDF investments doubling since program inception.

WWF has supported women's groups in Akshyrak, Engilchek, and Karakolka Villages to produce and sell high quality wool felt handicrafts, such as slippers, hats, pouches, seat covers, carpets and toy animals. This support has included training on new felt working techniques, use of natural dyes for coloring felt, product diversification, donation of felt-making equipment and felt-working tools, and assistance with marketing products at summer tourist fairs on Lake Issyk Kul. A training was also held in Akshyrak to teach women to make several new varieties of cheese not produced locally from yak milk and market it as a specialty product in market towns of Issyk Kul Province. Through these activities, women have been empowered to diversify their incomes and improve their livelihood security, which is an important strategy to reduce their vulnerability to climate change impacts on traditional livelihood activities such as sheep herding.

Demonstration water-efficient drip irrigation system, Kyzyl Suu Village, Kyrgyz Republic. © WWF Central Asia Program

Chon Kyzyl Suu Demonstration Site

The Chon Kyzyl Suu demonstration site included communities in the Kyzyl-Suu, Svetlopolyansky, Ak Dobo and Orgochor Districts within the Chon Kyzyl Suu River Basin, located just northwest of the Sarychat-Ertash Reserve across the Terskey Range. The basin stretches from 1,600 m on the southern shore of Lake Issyk Kul about 40 km southwest of Karakol, the Issyk Kul provincial capital, to 4,740 m at the crest of the Terskey range to the south. Landcover includes montane meadows, extensive Schrenk's spruce forest and shrublands as wells large areas of cultivation and steppe pasturelands in the lower half of the valley. Residents of the basin subsist both by farming and livestock herding. The Terskey Range was formerly prime snow leopard and prey species habitat prior to the collapse of the Soviet Union and the hunting excesses of the turbulent 1990s. AHM Project work in the Chon Kyzyl Suu River basin did not start until mid-2015 following award of AHM Project amendment funding.

Snow Leopard Research

To determine snow leopard population status in the Terskey Range, WWF conducted a preliminary wildlife camera trap survey in high-altitude areas of the upper Chon Kyzyl Suu Basin, revealing small groups of ibex in winter, an important snow leopard prey species, as well as abundant livestock. However, no snow leopards or other wild predator images were captured, even though snow leopards

are now fairly common just across the Terskey Range in the Sarychat-Ertash State Reserve to the south. WWF is currently developing a proposal to adopt special measures to improve livestock management and control poaching in alpine areas of the Chon Kyzyl Suu River basin.

Climate Adaptation

To address increasing rainfall variability and climate extremes in the region, AHM funded the development of a greenhouse and a small-scale drip irrigation system in the Kelechek orphanage vegetable garden in Kyzyl-Suu Village. These will extend the growing season for the orphanage garden in both spring and autumn, increasing vegetable production and improving nutrition by providing children at the orphanage with fresh vegetables over a longer period of the year. The irrigation system also improves water efficiency in an area where water rights of farming villages are currently in dispute, a situation worsened by an increasing population and worsening climate change impacts. To further diversify livelihoods, WWF also set up an improved beekeeping model in Kyzyl Suu to demonstrate one alternative livelihood to livestock herding.

Watershed Management

WWF also facilitated the development of a climate-smart watershed management plan to guide adaptation, water security planning and create a model process for replication elsewhere in the Kyrgyz Republic. As a first step, WWF held a series of 7 consultation meetings with local communities in 2015, including district officials; village council members; members of local pasture management committees, water users associations, herder groups and staff of the Tian Shan Research Station headquartered in Kyzyl Suu Village. These consultations included goals, objectives, and steps in the climate-smart watershed management planning process; climate change impacts on the basin and adaptation strategies to address these impacts; details of the three functioning water users associations (WUAs) in the basin, including water allocation, irrigation system maintenance, and limitations of the local water supply; water disputes between villages; approaches to resolving water problems; local pasture management systems in the basin; pasture and grazing issues; climate change impacts on pastures in the basin; and approaches to resolving pasture issues.

Following these consultations, a review of available scientific literature on the Chon Kyzyl Suu basin, and site visits, a draft watershed management plan was prepared that addresses climate change impacts and water resource, pasture, and forest management. This draft was presented at two additional stakeholder workshops for feedback where broad discussions were held on unsustainable natural resource use practices in the context of climate change impacts in the basin, climate change impacts on local communities, and possible adaptation strategies. Stakeholder feedback was compiled and incorporated into the draft watershed management plan. The completed climate-smart watershed management plan sets forth a list of actions for improving land use practices in the basin to improve water quality and quantity, including recommendations for improving management of pastures, forests, and agricultural lands. WWF organized a seminar to present the completed plan to representatives of communities, and a road map for its implementation was developed.

A significant portion of the plan aims to create a sustainable system of improved rotational pasture use in the basin to improve watershed management by permitting recovery of degraded high-altitude pastures. WWF worked with local pasture management committees to determine sustainable stocking rates at

The completed climate-smart watershed management plan sets forth a list of actions for improving land use practices in the basin to improve water quality and quantity.

various locations in the basin, delineate areas already suffering from overgrazing and pasture degradation, and estimate the overall carrying capacity of the basin's pastures. With this information, WWF and pasture management committee members designed an improved pasture rotation plan that promotes migration to alpine pastures that have fallen into disuse since the collapse of Soviet-era herding collectives in the early 1990s, and agreement was reached with all four pasture committees in the basin to implement this plan. This is an important step to reduce one pressure on pastures, allowing them to recover and improve their resilience to warmer, more extreme weather.

General Basin Management

During the second half of the AHM Project, WWF conducted discussions with the Jeti-Oguz District Forestry Department to grant the Chon Kyzyl Suu River basin protected status based on its diverse, relatively intact ecosystems, low population density, and high potential for restoring wildlife populations in this part of the Terskey Range. Issues discussed included opposition to a new protected area by residents worried about losing grazing rights, high rates of illegal logging and wildlife poaching in the valley, and the possibility for local residents to earn extra income by providing tourists services should the valley become a protected area. Tentative agreement was reached between WWF and the Jeti-Oguz District Forestry Department to grant the basin a joint botanical-hunting multiple use reserve status.

Community Participation in Conservation

To build support for WWF conservation activities, WWF worked with the Jeti-Oguz District Forest and Education Departments to organize a 2017 Earth Day Celebration at the Saruu Village Secondary School. This event featured ecologically-themed class competitions in poster-drawing, poem and essay writing, dancing, and ecological theatre performances. WWF also reached out directly to residents of the basin, distributing information on wildlife, biodiversity and conservation issues in the valley, including a list of protected mammals and birds found in the valley. Future opportunities for local participation in conservation activities were discussed, with younger residents of the valley showing particular interest in protecting biodiversity in the basin.

Cross-cutting Activities

Protected Area Establishment

During the first year of the AHM Project, WWF led background work on establishment of the 2,785 km^2 Khan Tengri National Nature Park before handing over these responsibilities to the UNDP-managed Central Tian Shan GEF Project at the request of the Kyrgyz government in November 2013. Kyrgyz Prime Minister Temir Sariev signed an order formally establishing this park on February 16, 2016, which is now the Kyrgyz Republic's single largest protected area.

With establishment of this reserve, all of the most important snow leopard range areas in the Kyrgyz Central Tian Shan are now protected.

GSLEP Climate-smart Snow Leopard Landscape Management Plan

WWF provided extensive support for development of a climate-smart snow leopard landscape management plan for the Krygyz Republic's Central Tian Shan Global Snow Leopard and Ecosystem Protection (GSLEP)

Program Priority Landscape. This support included regular participation in joint Kyrgyz government-NGO GSLEP landscape planning committee meetings in Bishkek, where WWF provided expertise on climate change impacts, climate adaptation, community conservation successes, rural pasture management and local governance in the Central Tian Shan. WWF also worked with SLT and the SAEPF to design and conduct a snow leopard presence/absence social survey amongst livestock herders in remote, little studied areas of the Central Tian Shan to further inform writing of the landscape management plan for this GSLEP Priority Landscape. A Regional Landscape Management Planning Coordinator was funded by AHM to lead writing of the landscape management plan, which is complete and under review by the Kyrgyz Government.

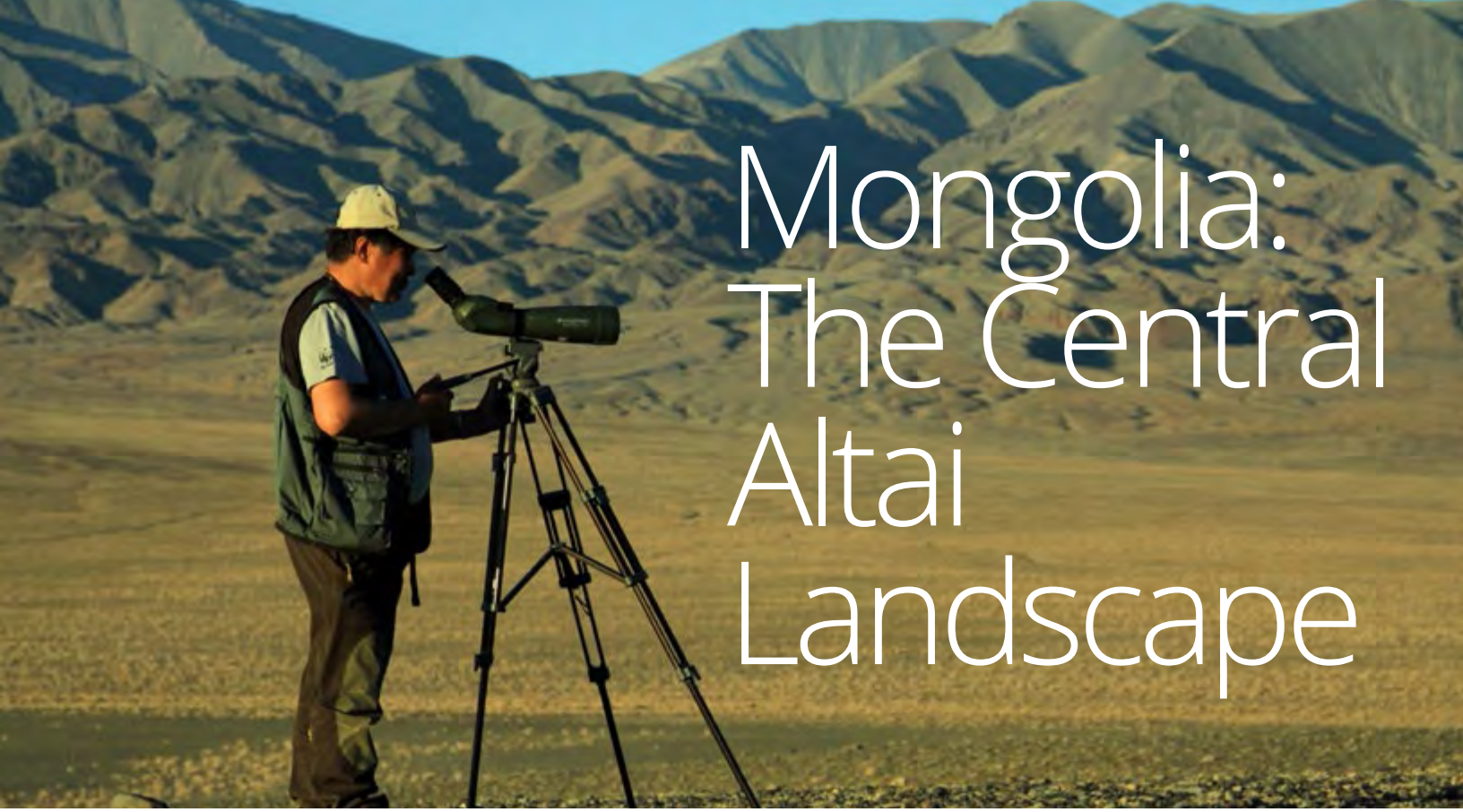
Community Participation in Conservation

WWF organized summer eco-camps for school children at Lake Issyk Kul each summer from 2014 to 2017. Participants included winners of children's school environmental contests in Issyk-Kul Province, children from the Sarychat-Ertash Region, and children from the Kelechek orphanage in Kyzyl Suu village. Activities included lessons on biodiversity, nature conservation, water resources, and climate change, with a particular emphasis on the ecology of snow leopards and other Issyk Kul wildlife. Participants were also taken on short guided nature field trips along the lakeshore and given practical training on water sampling and testing techniques at the lake. A variety of additional ecologically-themed activities included interactive games; ecological theater performances; and drawing, painting, poetry, song, and dance competitions, all with the goal of inspiring the next generation of local conservation leaders.

WWF also prepared a handbook for teachers based on innovative ecological theater work in the Kyrgyz Republic. This handbook contains a collection of scripts and scene photos for ecological theatre performances given by children and adults in high-mountain villages at AHM Project sites. Storylines of short dramas included in the handbook address different aspects of nature and ecosystems, such as wildlife and water, that illustrate conservation issues in simple language. This handbook was distributed to schools, children's ecological clubs, and conservation NGOs in the Kyrgyz Republic and neighbouring countries.

Recommended Next Steps

In the Kyrgyz Republic, a major achievement for the government, United Nations Development Program (UNDP), and WWF was the establishment of the new Khan Tengri Nature Park, the nation's single largest protected area. However, this new park now needs a complete administration and staff training, including training on the findings of the WWF Central Tian Shan Climate Vulnerability Assessment. This will require further support for at least the next several years. In the Chon Kyzyl Suu Basin, although an integrated watershed management plan was prepared, the plan now needs final government approval and funding for implementation. Trial improved rotational pasture practices will also need to be scaled up elsewhere in the region to have widespread benefits.



Mongolia: The Central Altai Landscape

Conducting a wildlife survey at Jargalant Khairkhan Mountain, Khovd Province, Mongolia. © WWF Mongolia

In Mongolia, WWF worked closely with a variety of government and local NGO Partners based in both western Mongolia and the national capital, Ulaanbaatar, to design and implement a comprehensive set of integrated climate adaptation and conservation activities in the Altai Region. These included the Ministry of Environment, Green Development and Tourism (MEGDT); the government of Khovd Aimag (province); various soum (county) governments; the Mongolian Academy of Sciences' Institue of Biology; the Sair Tour Orgil NGO; and the Snow Leopard Trust. Activities focused on a climate vulnerability assessment for snow leopard habitat in Western Mongolia; snow leopard and wildlife research; improving partner capacity to conduct wildlife field research; an innovative wildlife trap collection campaign; improving pasture management; establishment of a series of local protected areas to protect snow leopards and their prey; and an innovative public awareness campaign involving television appearances, production of a well-received film, and holding of international snow leopard day celebrations for schools.

Major Achievements

- **Establishment of three community-managed local protected areas (LPAs) to improve protection of snow leopards and their prey species that cover an area of 66,184 hectares. These LPAs will also contribute to increasing the resilience of grassland ecosystems to climate change impacts**
- **Launch of an innovative wildlife trap collection campaign led by school nature club members at Jargalant Khairkhan**

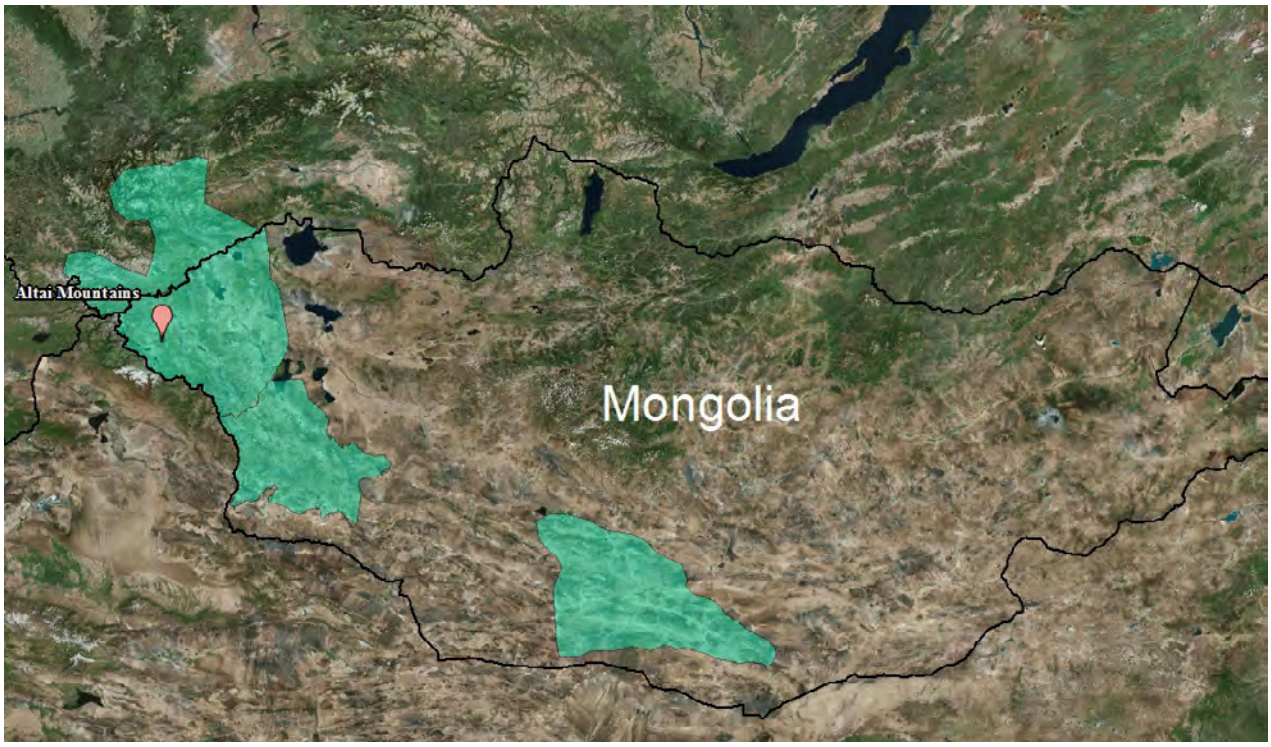


Figure 7. Map of Mongolia GSLEP landscapes (shown in light green) and the location of the Central Altai Range AHM demonstration site.

Mountain in Khovd Aimag that led to a national ban on wildlife trapping and trap collection campaigns in 6 western provinces of Mongolia.

- **Extensive WWF camera trapping work at western Mongolia's Jargalant Khairkhan, Bumbat Khairkhan, and Baatar Khairkhan Mountains revealed much larger snow leopard populations than expected and an urgent need to protect these cats from wildlife trapping.**
- **The first known camera trap photo taken of a snow leopard mother with 4 cubs at Baatar Khairkhan Mountain**
- **Preparation of a climate vulnerability assessment for snow leopard range areas of Western Mongolia that will help guide future snow leopard conservation and development planning in this region.**
- **Preparation of the Khuisiin Gobi-Tsetseg Lake basin integrated water resource management (IWRM) plan at the request of MEGDT, which will guide future water resource protection and management in this arid basin**
- **Training of 18 citizen scientists in snow leopard monitoring techniques who are now champions of snow leopard conservation in their home areas**

Landscape Overview and Threats

In Mongolia, the main AHM Project demonstration site was the Central Altai Range in the closed Khar Us Lake and Khuisiin Gobi-Tsetseg Lake basins. Primary AHM activity locations were Sair Mountain in Bayan-Olgii Aimag,

Turgen Mountain in Uvs Aimag, and Jargalant Khairkhan, Bumbat Khairkhan, Baatar Kharikhan and Khajingiin Nuruu Mountains in Khovd Aimag. Notably, Jargalant Khairkhan Mountain lies entirely within Khar Us Lake National Park. Elevations at these sites range from about 3,984 m atop Baatar Khairkhan Mountain to 1,160 m on the shore of Khar Us Lake with land cover in this region being primarily steppe grasslands. Narrow shrub belts occur along many riparian corridors with glacial ice and perennial snows found on higher peaks. These mountains support snow leopards and ibex, and in some cases have resident argali populations and an abundance of other wildlife, such as wolves, fox, marmots, and birds of prey. All are also home to very traditional Mongolian and Kazakh livestock herding communities that herd sheep, goats, and horses.

The largest direct threat to snow leopards in this landscape is retaliatory killing by herders who lose livestock to predation, followed by steel jaw traps which are set to kill or maim a variety of animals, particularly marmots. A large threat to wild prey species is grazing competition between ever-growing domestic herds of sheep and goats and vastly outnumbered ibex and argali, which are also threatened by transmission of livestock disease. Another threat is loss of ibex and argali habitat due to overgrazing damage caused by large herds of domestic sheep and goats on mountain pastures, a leading cause of desertification in the region. An overarching threat to the region is climate change, which is already permanently altering mountain ecosystems used by snow leopards and their prey. Climate change impacts include melting of glaciers, perennial snow cover, and alpine permafrost, all of which will have severe consequences for future water resource availability and pasture ecosystems in the region. A growing threat is pervasive mining activity throughout the region, which has the potential to eliminate vast tracts of snow leopard habitat as well as vast areas of mountain pastures used by local livestock herders. This threat is only expected to grow as Mongolia develops and improves transportation links in its remote western region.

Central Altai Range Demonstration Site

Snow Leopard Research

One large gap in our knowledge of snow leopards in western Mongolia is simply a detailed picture of their distribution over this vast area. WWF worked with provincial MEGDT departments to organize six snow leopard distribution mapping workshops in the six western aimags of Bayan-Olgii, Khovd, Uvs, Gobi-Altai, Zavkhan and Khovsgol. Nearly 400 people participated in these workshops, including government environmental specialists, provincial rangers, protected area rangers, volunteer rangers, and soum environmental inspectors. Findings were compiled into a comprehensive snow leopard distribution GIS database and map for the Mongolian Altai-Sayan region that highlights habitat hotspots in western Mongolia and connecting corridors in need of more intensive snow leopard conservation efforts. This map serves as an effective tool for illustrating the importance of conducting landscape-level conservation work during discussions with local communities and governments. This distribution database is being updated continuously as new information emerges from camera trap surveys, GPS collaring research, sign surveys, and sighting and conflict reports from protected area rangers and herders.

A camera trap photo of what is believed to be the first mother with four surviving cubs to ever be photographed, Baatar Khairkhan Mountain, Khovd Province, Mongolia. © WWF Mongolia

As another method for determining both distribution and population size, WWF conducted extensive camera trap surveys at Jargalant Khairkhan, Bumbat Khairkhan, and Baatar Khairkhan Mountains in Khovd Aimag with the assistance of WWF-trained citizen scientists. The results were surprising: at Jargalant Khairkhan, WWF captured images of 27 different adult snow leopard individuals and 10 cubs, far more than anticipated. One of these was photographed with a steel jaw trap on its foot while two other individuals had apparently lost legs to jaw traps, revealing the extent of the wildlife trapping problem on Jargalant Khairkhan. At Bumbat Khairkhan, just south of Jargalant Khairkhan, images of 13 adults and 7 cubs were captured. And at Baatar Khairkhan, images of 34 adults and 8 cubs were captured along with what is believed to be the first image of a mother with 4 cubs.

Before, during, and after camera trap surveys, WWF biologists conducted snow leopard sign surveys, recording snow leopard foot print, scat, urine sprays, and tree scratchings. This process guided site selection for setting up camera traps on active travel routes. Scat samples were collected for DNA testing as a second method for estimating population size. In December 2016, 39 predator scat samples from Jargalant Khairkhan Mountain and 41 from Bumbat Khairkhan Mountain were sent to Duquesne University for genetic analysis. Results showed that these samples represented 6 snow leopard individuals from Jargalant Khairkhan and 4 snow leopard individuals from Bumbat Khairkhan. GPS locations of scat collection sites have revealed partial movements of these individuals on their respective mountains. In general, survey results in the Altai revealed higher densities of snow leopards than expected at these three mountains. At the same time, training of citizen scientists to conduct sign and camera trap surveys and the abundance of camera trap photos and videos produced greatly raised public awareness of the plight of snow leopards on these three mountains as well as support for WWF's snow leopard conservation activities in the region.

As a complementary activity, WWF worked in cooperation with provincial MEGDT offices and protected area administrations in the six

western provinces to conduct a comprehensive human-wildlife conflict social survey in Mongolia's Altai-Sayan Ecoregion. Results revealed that 23 percent of respondents felt there was a high rate of conflict between herders and snow leopards in the survey region. These findings were shared with relevant government and NGO workers involved in snow leopard conservation at a round table meeting held in Ulaanbaatar, and WWF is now working with partners to develop a national human-snow leopard conflict management strategy for Mongolia.

Snow Leopard Conservation

To reduce human-wildlife conflict, WWF erected experimental snow leopard-proof corrals at two locations where livestock herders were regularly losing sheep and goats to snow leopard predation, the first at Baatar Khairkhan Mountain in Zereg Soum and the second at Jargalant Khairkhan Mountain in Mankhan Soum, both in Khovd Aimag. In contrast to earlier predator-proof corral designs that consisted of putting roofs and doors on traditional stone wall corrals, the new experimental corrals consisted solely of 2 m high chain link fence enclosures that do not provide snow leopards with a stone wall platform for pouncing on corralled livestock from above. Although snow leopards have been photographed on camera traps set up just outside these corrals to monitor their effectiveness, since their construction in 2016, not a single domestic animal in either corral has been lost to predation by snow leopards or wolves.

Since their construction in 2016, not a single domestic animal in either corral has been lost to predation.

WWF also developed a trial, community-managed, sustainably-financed, human-wildlife conflict compensation scheme based on an analysis of the successes and failures of such livestock insurance programs in other snow leopard range areas. This trial was conducted at the Khoid Otor area of the Turgen Mountain Strictly Protected Area in Uvs Aimag. Nine households at the trial site developed regulations for an insurance system and made proportional contributions to a compensation fund to insure their nearly 2,000 head of livestock against predation by snow leopards and other wild carnivores. This scheme was also accompanied by lessons on preventative measures that can be taken to reduce the likelihood of human-wildlife conflict. In 2013, WWF conducted another brief activity to reduce and mitigate conflict between livestock herders and snow leopards, providing nine families of herders at Bumbat Khairhan Mountain with 21 replacement sheep for sheep killed by snow leopards and other predators during the preceding year. Herders also received lessons on snow leopard behaviour, methods for avoiding loss of livestock to snow leopards in the future, and on the importance of protecting snow leopards.

Climate Research

WWF worked with the Mongolian Academy of Science's Institute of Biology to jointly prepare a climate change vulnerability assessment for snow leopard range areas in the Altai Region of western Mongolia. As a first step in this process, WWF conducted a climate change social survey of 1,564 residents of Khovd, Gobi-Altai, Bayan-Olgii, Uvs, and Zavkhan Aimags to assess local viewpoints on climate change impacts on livelihoods and ecosystems and potential adaptation actions. Climate change impacts widely cited by respondents included drying up of water sources, pasture degradation, and increasing frequency of extreme drought and snowfalls. This was followed by analysis of changes in water balance, aridity index and snow accumulation in the Altai Region from 1950-2000 and modelling of all potential snow leopard habitat in western Mongolia. An analysis of climate change impacts under different future climate scenarios was conducted with respect to future impacts on habitat and a list of preliminary recommendations to prepare for future impacts compiled.

Box 1: Eliminating Steel Traps through Community Education

The camera trap photos and video of three snow leopards maimed by steel jaw traps on Jargalant Khairkhan Mountain revealed an urgent need to halt illegal wildlife trapping in this area of Khar Us Lake National Park. As a first step in this process, WWF showed a video about the maimed snow leopards to school children in nearby Mankhan and Chandmani Soums, who then went home and asked parents, relatives, and neighbors about how many wildlife traps they owned. Children returned to school with a total estimate from their informal survey of about 500 wildlife traps being present in these two communities. Children then attended village administrative meetings and other public gatherings and called on their families and neighbours to participate in a trap-free Jargalant Khairkhan Mountain initiative. Anti-trap campaign banners were displayed and stickers and other campaign promotional materials distributed with the goal of having trap owners voluntarily exchange their wildlife traps for useful household utensils. WWF provided milk cans, cooking pots, bowls, and other household items and exchanged these for wildlife traps on the condition that recipients of these items promise not to resume trapping and help protect snow leopards and other wildlife on Jargalant Khairkhan Mountain. Of an estimated 500 wildlife traps in Mankhan and Chandmani Soums, 234 traps were exchanged for household utensils by 40 local families, proving this campaign to be a great success in reducing the number of traps on the mountain (see photo on page 12). At the same time, both students and adults in these communities were educated about local threats to snow leopard and other wildlife on Jargalant Mountain.

Once collected, the traps needed to be disposed to prevent their reuse for poaching. WWF worked with a local artist to dismantle and melt down these traps, who then cast them into a statue of local wildlife placed in the Khovd Aimag capital as a monument to the children's efforts to protect snow leopards and other wildlife. Afterwards, 13 students from the Mankhan Soum school eco-clubs, aged 7 to 17, traveled with their teacher to Ulaanbaatar for one week to spread the news of their successful anti-trap campaign. At this time, they met with representatives of the national print, internet, and broadcast media to tell their story and appeared on a variety of news and television programs.

These children then met with the Minister of the Environment, Green Development and Tourism, N. Battsereg to inform him about their successful trap collection campaign, which was widely covered in the print and broadcast media. They made an official request to Minister Battsereg to scale up their campaign at the national level. Several months after their visit, Minister Battsereg instructed all provincial governors and protected area administrations to launch a campaign to ban and confiscate all traps and organize anti-trap awareness events in local communities. Since then, WWF has worked with provincial and local county governments, inspection departments, police departments and protected area staff to conduct trap confiscation campaigns, which in 2016 collected a further 438 traps in Khovd Aimag and in 2017 collected 695 traps in the 6 western Mongolian Aimags of Khovd, Uvs, Bayan-Olgii, Zavkhan,

Climate Change Adaptation

Actions in western Mongolia to reduce vulnerability focused on improving pasture management to halt overgrazing damage and build resilience of steppe grasslands to warmer, more extreme weather. As a first step in this process, WWF provided financial and technical support for compiling pasture databases for five soums in Khovd Aimag, namely Darvi, Zereg, Mankhan, Must and Tsetseg Soums that lie within AHM project sites. Pasture data collected in each soum was compiled into a GIS database and included pasture carrying capacity, land use patterns, livestock population data, human population data, location of wells, surface water resources, hydro-meteorological data, pasture reserve data, and seasonal migration patterns of local herders. This data is being used as the basis for developing sustainable, high rotation rate, pasture management plans for these soums.

As a next step, WWF worked with the government of Darvi Soum to formally establish the 105,200 hectare Bayan Nuruu Reserve Pasture. The goal of this reserve pasture is to exclude livestock from the reserve area from April to October so that it can be used as a reliable source of standing fodder during natural disasters in winter, such as severe snow storms. A second intended benefit of the reserve is to create a seasonal livestock-free zone for the benefit of snow leopards and their prey species. WWF recently supported a rangeland study by pasture management experts at this site to assess pasture degradation to develop an improved rotational grazing plan for herders at this location.

In another effort to improve pasture management, WWF commissioned the Environment and Security Center of Mongolia NGO to conduct a pasture management situation analysis for Chandmani, Mankhan, Darvi and Zereg Soums in the AHM Project area of Khovd Aimag and neighboring Khaliun, Sharga, Khukhmorit and Bayan-Uul Soums of Gobi-Altai Aimag. This study recommends improving government pasture policy, developing pasture management plans based on pasture carrying capacity, creating alternative livelihood activities to livestock herding, and starting insurance schemes to reduce the economic impact of human-wildlife conflict on herders. WWF will present findings of this study to herders for feedback on improving pasture management practices at these sites.

WWF also organized a pasture management study tour for representatives of community-based organizations (CBOs) and government officials from Mankhan, Darvi, Zereg, Erdeneburen and Jargalant Soums in Khovd Aimag and Khukhmorit Soum in Gobi-Altai Aimag. This group visited the successful Tsagaan Gol pasture users group in Khovd Aimag and the Tsengel Development Cooperative and Sair Mountain and Yolt pasture users groups in Bayan-Olgii Aimag. Participants learned about successful pasture management practices, economic benefits and pasture improvement achieved by maintaining a stable livestock population through selling excess livestock, and the benefits of using micro-financing for developing new markets and alternative livelihoods.

Watershed Management

WWF worked with MEGDT, Khovd State University, the Khuisiin Gobi-Tsetseg Lake Basin Authority, and Ecocoeur NGO to develop an integrated water resource management (IWRM) plan for the Khuisiin Gobi-Tsetseg Lake Basin in southern Khovd and northern Gobi-Altai Aimags. As a first step in this process, WWF and partners conducted a baseline social survey covering livelihoods, water resource use and availability, environmental issues and climate change impacts in the basin as perceived by the basin's residents. This was followed by an analysis of hydrology, water quality, water resource governance, pasture

Siberian ibex, Sair Mountain, Bayan Olgii Province, Mongolia. © WWF Mongolia

management, and livelihoods in this arid basin and compilation of recommendations for improving water resource management. WWF later worked with the Khovd Aimag government to map water protection zones in the Khuisiin Gobi-Tsetseg Lake Basin and adjacent areas to designate these areas as no-go areas for mining operations to prevent contamination of limited surface water resources by mining activities.

Enacting one recommendation from the IWRM plan, WWF repaired a spring-fed canal and concrete livestock watering pond in Darvi Soum that had fallen into disrepair. This opened an area of grazing land that is in good condition but had fallen into disuse due to a lack of water. This action will bring about 7,000 hectares of pastureland back into rotational use in spring and autumn with benefits for neighboring pastures. This new surface water source will also benefit wildlife such as Siberian ibex and rare Mongolian saiga and goitered gazelle that frequent this area.

Protected Area Management

WWF worked with locals, the Sair Tour Orgil NGO, and the governments of Tolboo Soum and Bayan-Olgii Aimag to formally establish the 23,482 hectare Sair Mountain Local Protected Area (LPA). This community initiative is now protecting important snow leopard and ibex habitat and providing residents with an alternative source of income to livestock herding generated by startup of a local ecotourism program. Since its establishment, WWF has supported additional activities at the Sair LPA, including putting up of boundary signs, preparation of pasture use regulations to increase rates of pasture rotation, closure

and fencing of valleys to keep livestock away from mountain slope pastures favored by ibex, and placement of salt licks for the benefit of ibex. WWF has also trained and equipped a citizen scientist at this site to monitor wildlife and poaching activities and assisted with promotion of ecotourism at Sair Mountain through tour operators in Khovd and Ulaanbaatar, resulting in a sharp increase in tourism rates in 2017.

WWF worked with local residents and the governments of Tsetseg Soum and Khovd Aimag to formally establish the 22,124 hectare Khajingiin Nuruu Range Local Protected Area, home to significant ibex populations and important snow leopard habitat. Additional WWF support included an orientation training for volunteer rangers and other interested local herders on the purpose and various benefits of the new LPA and the Mongolian Law on Fauna, including its hunting regulations and fines for illegal hunting. WWF also provided support for local volunteer rangers and herders to erect LPA boundary signs and an information sign board about the LPA in the Tsegtseg Soum Center. Lastly, WWF provided support and guidance for the soum environment inspector, soum ranger, and 4 local herders to create salt licks at strategic locations for the benefit of ibex and argali that form the prey base of the local snow leopard population. A third local protected area created with WWF support to protect snow leopards and other wildlife was the 20,578 hectare Olon Nuur-Yamaat LPA in Uvs Aimag. This LPA was established in June 2017 and is located in the buffer zone of the national-level Turgen Mountain Strictly Protected Area.

Trainings for Protected Area and Natural Resource Agency Staff

In order to build capacity to conduct snow leopard conservation activities, WWF trained and equipped 18 citizen scientists to conduct snow leopard camera trap, sign, and prey species surveys at Jargalant Khairkhan, Bumbat Khairkhan, Baatar Khairkhan, and Sair Mountains. These trainees included protected area administration specialists, soum rangers, volunteer rangers, and local livestock herders. Trainees then proceeded to effectively assist WWF biologists with snow leopard surveys and built support for conservation activities in their home communities. In support of this effort, WWF translated and distributed a snow leopard monitoring protocol manual at citizen scientist trainings for rangers, volunteer rangers, and local herders interested in participating in snow leopard monitoring. In Ulaanbaatar, WWF provided training to field staff of the Mongolian Department of Protected Areas Management on snow leopard population abundance and density modelling techniques using camera trap data with capture-mark-recapture computer models such as MARK, CAPTURE and SPACECAP.

Community Participation in Conservation

To increase public awareness about the plight of snow leopards in Mongolia, WWF held a series of annual International Snow Leopard Day celebrations in provincial and soum centers in western Mongolia and Ulaanbaatar. These events featured snow leopard-themed student drawing, poetry and quiz contests, and song and dance contests by children dressed in snow leopard costumes. Other activities included signing of a snow leopard protection petition and TV and newspaper stories on WWF's snow leopard protection work. One particularly notable activity was production of an original 45-minute film dramatizing the threats to snow leopards from retaliatory killing and wildlife trapping. Titled "Spirit of the Mountain," this film was shown to audiences throughout western Mongolia and Ulaanbaatar, where it won a Mongolian Film Academy award for best short film. WWF also supported eco-summer camps for school eco-club members from Uvs, Khovd, and

School eco-club performance on the threat of trapping to snow leopards, Khovd City, Mongolia. © WWF Mongolia

Gobi-Altai Aimags which placed a particular emphasis on conservation of snow leopards and other wildlife in western Mongolia. Through these efforts, WWF is training the next generation of conservation leaders in western Mongolia.

Local Livelihoods

To lessen the near total dependence of livestock herders on the local natural resource base in the Altai region, WWF undertook several activities to diversify herder incomes as one adaptation strategy to increase livelihood security in the face of a rapidly changing climate. These activities also strove to discourage participating herders from resorting to wildlife poaching to make ends meet. They included working with the Snow Leopard Trust's Snow Leopard Enterprises program to support development of business plans for five community-based organizations at Jargalant Khairkhan and Turgen Mountains. These plans are now guiding development of ecotourism and felt handicraft enterprises at these sites. WWF held a training for these community groups at Jargalant Khairkhan Mountain on providing wildlife-oriented ecotourism services, followed by direct WWF support to community groups at both Jargalant Khairkhan and Turgen Mountain to host a snow leopard-themed tour for a group of western tourists.

WWF also supported communities in Mankhan Soum at Jargalant Khairkhan Mountain and Zereg Soum at Bumbat Khairkhan Mountain to produce and market felt handicrafts, such as toys, slippers, and cushions. These handicrafts are being marketed internationally in zoo gift shops through Snow Leopard Trust's Snow

Leopard Enterprises program, in souvenir shops in the Khovd Aimag center and directly to tour groups visiting Jargalant Khairkhan Mountain. In an effort to increase incomes by improving marketing of traditional meat and dairy products produced by herders living on Jargalant Khairkhan Mountain, WWF worked with the Nomad Cooperative in Khovd City to sell meat and dairy products from Mankhan Soum in the cooperative shop.

Cross-cutting Activities in Mongolia

WWF is working with Snow Leopard Trust to provide support for developing climate-smart snow leopard landscape management plans for both Mongolia's South Gobi and Altai GSLEP Priority Landscapes. These plans are building upon successes of AHM integrated adaptation and conservation activities demonstrated over the 5-year grant period. For the South Gobi, this support included commissioning the Columbia University Center for Climate Systems Research and international spatial ecology and hydrology experts to develop future climate scenarios and habitat models for this important snow leopard landscape. For the Altai, WWF is working closely with both MEGDT and Snow Leopard Trust to prepare a full climate-smart snow leopard landscape management plan for this priority landscape, based largely on WWF's recent snow leopard research and conservation work in this vast region. In doing so, WWF and partners are taking leading roles in assisting the government of Mongolia in fulfilling their commitments under the 12-nation GSLEP Program.

Mongolian girl with a felt snow leopard ornament made by local herders for sale to tourists, Yamaat Valley, Turgen Mountain, Uvs Province, Mongolia, August 2013.

Recommended Next Steps

In Mongolia, improved pasture management successes in key snow leopard areas need to be scaled up across the vast Altai landscape. Replication of the successful new snow leopard-proof corral design should also be a priority. Another area that needs further work is continued promotion of ecotourism at WWF AHM Project sites in the Altai to make tourism a reliable alternative source of income to livestock herding at these sites. New local protected areas established at AHM Project sites in the Altai will also need support for community training and continued monitoring to ensure effectiveness and sustainability of conservation interventions implemented at these sites.

Nepal: The Kanchenjunga Conservation Area

Yangma Village, Kanchenjunga Conservation Area, Nepal. © WWF Nepal

In Nepal, the AHM Project built upon knowledge gained through WWF's previous 26 years of experience in implementing conservation projects in the Eastern Himalayas, in particular the preceding USAID-funded Sacred Himalayan Landscape (SHL) SCAPES Project. WWF worked closely with the Department of National Parks and Wildlife Conservation (DNPWC), the National Trust for Nature Conservation (NTNC), the Kanchenjunga Conservation Area Management Council (KCAMC), and local community groups in the KCA to design and implement a comprehensive set of integrated climate adaptation and conservation activities. These activities focused on climate change impacts on water, food, and livelihood security; improving pasture and watershed management; sustainable harvest of economically important non-timber forest products (NTFPs); climate-smart alternative incomes; wildlife poaching; improving governance of local natural resource management groups; increasing community participation in conservation activities; snow leopard research; training of citizen scientists; and improving landscape-level conservation of snow leopards in the KCA and beyond. The integrated approach to addressing climate change in combination with improved conservation activities developed in the KCA is serving as a range-wide model for replication through completion of the first climate-smart snow leopard landscape management plan prepared under the GSLEP program.

Major Achievements

- **Launch of the first snow leopard GPS tracking collar research program in Nepal and the Eastern Himalayas which revealed transboundary habitat use by snow leopards in the Kanchenjunga Region of Nepal, India, and China.**
- **A successful citizen scientist training program which secured the involvement**

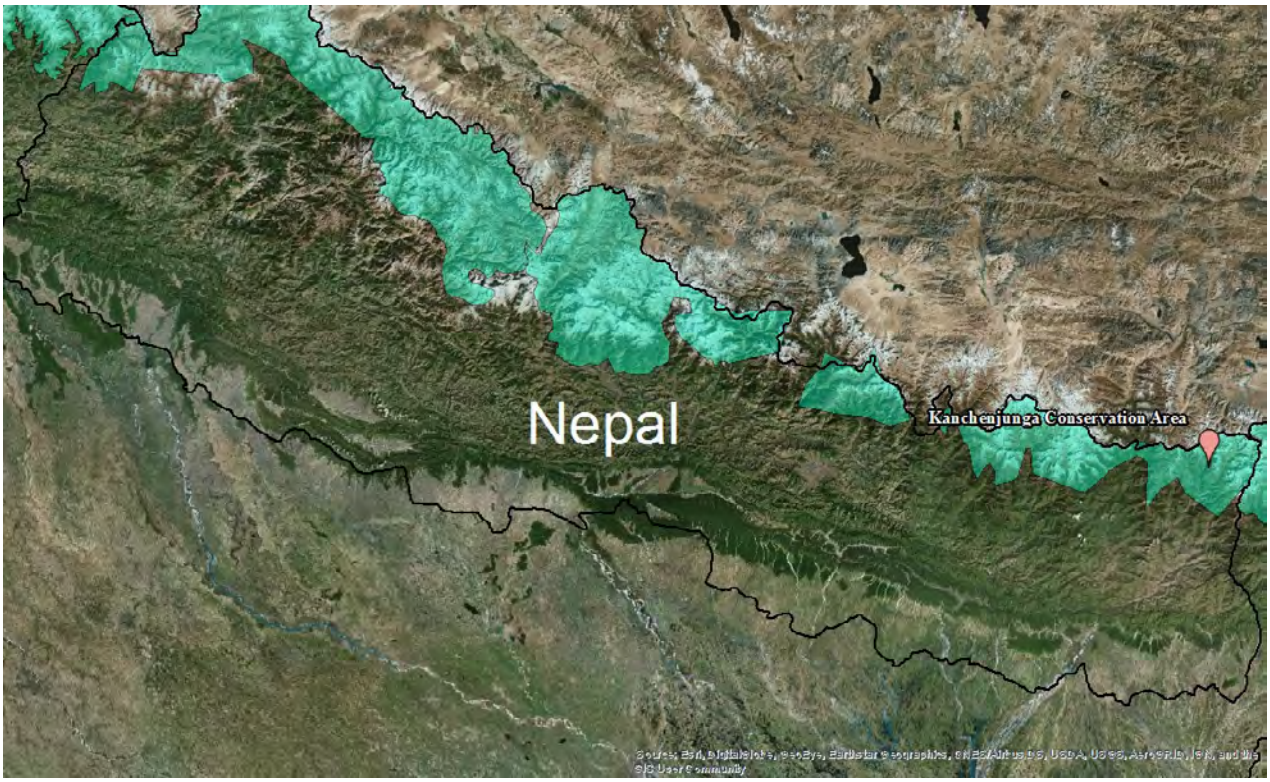


Figure 8. Map of the GSLEP landscapes of Nepal (shown in light green) and the Kanchenjunga Conservation Area AHM demonstration site in eastern Nepal, bordering Sikkim, India.

of local community members in all aspects of snow leopard conservation efforts in the KCA, from anti-poaching work to assisting with snow leopard collaring expeditions

- **A 73 percent average increase in household incomes (about USD 1,325) of farmers adopting water efficient sprinkler irrigation for cardamom farming in the KCA**
- **Widespread replication of highly successful climate adaptation demonstrations on improved cardamom irrigation and greenhouse vegetable growing by both local governments and individuals on their own initiative**
- **Completion of a climate-smart watershed management plan for the Tamor River basin through a participatory process that will guide watershed management improvement activities in the KCA and beyond in a manner that takes into account projected future climate scenarios for this region**
- **Completion of the climate-smart snow leopard landscape management plan for Nepal's Eastern Himalaya GSLEP Priority Landscape that will scale up success of AHM work in the KCA to cover this entire 1,151,600 hectare landscape. This landscape management plan is the first to be completed and approved under the GSLEP Program and will be used as a model for replication by other GSLEP member states.**

Landscape Overview and Major Threats

In Nepal, AHM Project work focused on a single project demonstration site encompass-

ing the entire 203,500 hectare Kanchenjunga Conservation Area (KCA) in the northeast corner of the country, a globally important biodiversity hotspot with stunning mountain scenery and a rich cultural heritage. The KCA borders India's Kangchendzonga Biosphere Reserve (KBR), location of AHM Project activities in Sikkim, and encompasses the western Kanchenjunga massif, the world's third highest mountain. Project site elevations range from 8,586 m atop Kanchenjunga to about 1,175 m on the banks of the Tamor River. This enormous change in elevation over a relatively short distance creates a wide array of ecosystems and some of the highest biodiversity anywhere. Land cover includes dense broad leaf forest at lower elevations, mixed broadleaf and conifer forest stretching up to about 3,600 m, as well as rhododendron and juniper shrublands and alpine meadows at higher elevations and primarily barren rock, perennial snows and glacial ice above 5,600 m. Snow Leopards and blue sheep inhabit areas above 4,000 m while other notable wildlife species in the KCA include red panda, common leopard, musk deer, goral, wolves, marmots, gray langur monkeys, Asiatic black bear, and about 280 bird species. Most of the KCA drains into the Tamor River which flows into the Koshi River, Nepal's largest river and a major tributary of the Ganges. The KCA covers about 5 percent of Nepal's total snow leopard range and is some of the nation's best protected snow leopard and prey species habitat.

The KCA also has rich ethnic diversity that includes Sherpa, Limbu, Lama/Bhutia, Rai, Gurung, Chettri and Tamang peoples, who subsist through a combination of farming, livestock herding, and small-scale trade. Residents of lower villages are primarily farmers growing a variety of grains, but whose primary cash crop is now cardamom, who also keep limited numbers of cows, pigs, goats, and chickens. Above 3,000 m, KCA residents subsist on a mix of yak herding, potato growing, collection of medicinal plants, and providing services for trekking groups. However, yak herding is largely in decline as a primary occupation in the KCA. Awareness of snow leopard conservation issues is relatively high after 20 years of WWF conservation work at this site, and retaliatory killing is limited. Nevertheless, poachers continue to set snares for musk deer and other wildlife, which could also ensnare snow leopards and their prey. The largest existential threat to snow leopards in the KCA is climate change, which in the long term is expected to have a severe impact on the fragile alpine meadow ecosystems they depend on. This includes an upward shift of treeline, disappearance of perennial snow and glacial ice cover, increasingly erratic and intense summer rainfalls, increased drought, increased pasture erosion and landslides, and a general decline in alpine pastures due to warming and disappearance of surface water springs and seep areas.

Kanchenjunga Conservation Area Demonstration Site

Snow Leopard Research

WWF and partners from the DNPWC, the NTNC, the KCAMC, and local Snow Leopard Conservation Committees (SLCC) conducted the first GPS tracking collar study of snow leopards ever undertaken in Nepal. In total, WWF and government and local partners succeeded in collaring 4 snow leopard individ-

Biologist putting a GPS tracking collar on a snow leopard in the Kanchenjunga Conservation Area, Nepal. © WWF Nepal/Sanjog Rai

uals in the KCA between 2013 and 2017. The first was collared in the central KCA in November 2013 and recaptured and re-collared in same area in May 2014. Named Ghanjenjwenga by the collaring team, this snow leopard travelled back and forth between the KCA and the Kanchenjunga landscape of Sikkim State in India five times, providing a wealth of information about the movements and behaviour of this cat including a GPS location point from an elevation of 5,858 m, one of the highest elevations ever recorded for a snow leopard. Ghanjenjwenga's collar dropped off as scheduled in September 2015.

The second snow leopard was collared in May 2015 in the Yangma area of the northern KCA. Named Omi Kangri by the team, it moved about the mountains of the Yangma area for several weeks before the GPS tracking function failed in June 2015. However, the VHF transmitter on the collar continued to function and it was occasionally picked up on a hand-held antenna as it passed through the Yangma area up until May 2016. It was also photographed with its distinctive collar by camera traps in the Yangma area until July 2017. In April 2016, WWF and government and local partners collared a third snow leopard, also in the Yangma area. Named Lapchemba, this snow leopard crossed the Himalaya into China's Qomolangma region before returning to Nepal. Once back in Nepal, it established a home range in the high mountains just west of the KCA on the eastern side of the upper Arun Valley where it's collar dropped off in May 2017. In May 2017, a fourth snow leopard was collared in the Ramche area of the southern KCA. Named Yalung, it travelled into Sikkim along a similar route as Ghanjenjwenga, and

later returned to the KCA. Yalung's collar stopped sending signals near Ramche in October 2017. Data gathered from these four snow leopards is providing researchers with a wealth of new insights into snow leopard ecology, behavior, and migration corridors in the eastern Himalaya. Collaring findings were also used to inform development of the climate-smart snow leopard landscape management plan for Nepal's eastern Himalaya GSLEP Priority Landscape and will be used to design snow leopard conservation strategies for Nepal and the transboundary eastern Himalaya region.

WWF also conducted the first nationwide genetic analysis of snow leopard scat collected from 2011-2014 in Nepal's Eastern, Central, and Western Himalaya GSLEP Priority Landscapes. Analysis revealed 75 snow leopard individuals in the 233 scat samples tested, confirming the minimum estimated snow leopard population for Nepal. These findings have been used to establish a national genetic database of all identified snow leopard individuals in Nepal, which will be used to study phylogenetic relationships and genetic divergence between populations across snow leopard landscapes in Nepal, India and China.

WWF conducted a human-wildlife conflict (HWC) survey to assess the current state of conflict between livestock herders and wild predators and the effectiveness of current mitigation measures in the KCA. The resulting report recommends a seven-pronged strategy for mitigating HWC in KCA, including expanding upon successful long established livestock insurance schemes, construction of predator-proof corrals, building capacity building of local snow leopard conservation committees (SLCC), providing compensation for crops damaged by wildlife, increasing awareness of HWC and conservation issues, starting more sustainable forest product enterprises, and expanding ecotourism to lessen economic dependence on livestock and farming.

Additional efforts to improve snow leopard research and conservation in the KCA included continuous training of citizen scientists throughout the project, many of whom later assisted in snow leopard collaring expeditions. Participants included SLCC members, KCAMC members, DNPWC staff, and local yak herders who were trained in sign, camera trap, and prey species surveys and setting snares for GPS tracking studies. Through this innovative citizen scientist program, significant awareness and support has been built for snow leopard conservation in the KCA, helping secure a long-term future for snow leopards in this remote corner of Nepal. WWF also developed a snow leopard monitoring protocol to standardize research practices for sign, camera trap, prey species, and non-intrusive genetic surveys to assess population size and distribution. The protocol is also being used for training citizen scientists and conservation committee members to assist WWF with snow leopard research and is being distributed to interested researchers, conservationists, students, citizen scientists, and local community members, standardizing research methods and improving comparability.

Species Conservation

WWF supported construction of a predator-proof corral for herding families in Khambachen Village that now houses 20-25 yak calves, effectively demonstrating a simple method for reducing loss of livestock to snow leopards and other predators. This has reduced the likelihood of retaliatory killing of snow leopards occurring in Khambachen. WWF also provided support and training for local residents to conduct annual community-based anti-poaching operations (CBAPO) in the KCA to search for signs of poaching and illegal wildlife trade activity including setting snares. These snares are typically set for musk deer and game birds but can indiscriminately capture any animal that wanders into them, including snow leopards and their prey

Sherpa woman with a greenhouse that has allowed her to grow fresh vegetables for the first time, Olangchung Gola Village, Kanchenjunga Conservation Area, Nepal. © WWF Nepal

species. Over the course of these patrols, CBAPO teams dismantled dozens of snares and removed and destroyed animal remains found in them, including musk deer, goral, blue sheep, Himalayan monal, and blood pheasant remains. WWF support for these teams included training and donation of field gear.

Climate Adaptation

Agriculture

To address adaptation priorities identified in a 2014 vulnerability assessment WWF developed for the SHL SCAPES Project, WWF provided sprinkler irrigation for watering cardamom plots, providing two key benefits: increased efficiency of extremely limited water resources and an unanticipated reduction in incidence of cardamom disease. Believed to be increasing as a result of climate change, cardamom disease was effectively suppressed, perhaps because with more regular watering cardamom plants are less stressed. WWF also promoted irrigation canal improvements through concrete lining to prevent seepage loss as well as digging of small scale home water storage ponds for both watering livestock and vegetable gardens as one method to provide some insurance against increasingly frequent spring droughts.

Another key adaptation action for agriculture was the introduction of greenhouse vegetable gardening to upland areas ranging in elevation from about 1,340 m to 3,425 m, effectively lengthening the growing season by about 4 months per year from early March to early December. As a result, vegetable production increased, improving both spring and autumn nutrition and food security. Greenhouses

Water-efficient cardamom sprinkler irrigation system, Kanchenjunga Conservation Area, Nepal.

allowed recipients in higher areas to grow vegetables for the first time that they otherwise would have to walk a day or two to lower villages to buy. More entrepreneurial greenhouse recipients have been earning extra money by selling surplus vegetables to trekking groups or growing chili peppers as an easily transportable cash crop to sell in local markets. WWF also supported livelihoods diversification in the KCA through planting of apple, walnut, peach, orange and plum trees in lower areas, which will improve food security and nutrition, diversify livelihoods and improve local watershed management characteristics in village areas. Lastly, a WWF-supported improved beehive demonstration in one village nearly tripled honey production over traditional Nepali log-style home beehives.

Cardamom irrigation systems and greenhouse vegetable growing proved to be the most popular and successful of these adaptation activities. Some farmers reported a doubling of their harvested cardamom as a result of irrigation, earning up to USD 4,000-8,000 annually. Although less lucrative, greenhouse farming also proved to be a highly popular sideline activity, improving household food security and adding cash income, particularly in higher villages where fresh vegetables were rarely available. The success of these two activities led to widespread replication in the KCA, both by individual farmers and local government institutions investing in sprinkler irrigation and plastic tarps for greenhouse construction. One success resulting from increased cardamom incomes is a virtual end to sheep herding in the KCA, reducing pressures on highland pastures and the overall ecosystem, including reduced incidence of retaliatory killing of snow leopards after sheep losses.

Pasture Management

Yak herding is a primary occupation in mountain villages located above about 3,000 m in the KCA, however, these pastures are degrading through a combination of livestock overgrazing and climate change impacts, including increasingly irregular rainfall, drying up of pasture springs, an upward shift of snow line, and generally decreasing snowfall. All these factors are believed to be contributing to a general trend of reduced pasture growth, even as livestock numbers decline in the KCA, which also impacts blue sheep, the primary prey for snow leopards. To increase the resilience of these fragile alpine grasslands, WWF worked with yak herders to improve overall pasture health. As a first step in this effort, WWF assessed pasture management practices in the highland villages of Ghunsa, Phale, Gyabla, and Yangma, focusing on delineating which pastures were being actively grazed, not being grazed and the reasons for their disuse, livestock numbers, seasonal livestock movement patterns, and possible areas of grazing competition between livestock and wild ungulates, such as blue sheep.

Blue Sheep, Kanchenjunga Conservation Area, Nepal. © WWF Nepal

WWF also held several participatory pasture management workshops for KCA herders to resolve pasture management issues and build their resilience to climate change. Major problems identified included lack of clean water sources in many remote pastures, difficult access to many pasture areas, and decreasing quality of grass due to the proliferation of unpalatable pasture species. Climate-smart highland pasture management improvement activities were then designed to address these issues, including clean water delivery and storage systems for herders pastures, piping water from distant springs to pasture camps where water is stored in portable plastic water storage tanks; improving livestock access to remote disused pastures by widening trails, restoring trails destroyed by landslides, rebuilding washed out bridges over fast-flowing mountain rivers, and replacing old wooden bridges with sturdier bridges able to safely support livestock. With improved access to these formerly disused pastures, WWF worked with herder groups to improve pasture rotation rates between all pastures to halt pasture degradation on over-used pastures, thereby allowing them to recover and build resilience to warmer, more extreme climates. Through these efforts, WWF has improved livestock rotation rates on approximately 20,000 hectares of pastures in the KCA with benefits for livestock herders, pasture ecosystems and wildlife, such as blue sheep and snow leopards.

NTFP Management

To maintain NTFP harvesting in the KCA as a viable alternative income source, WWF supported the KCAMC in preparing sustainable harvesting plans for three economically important medicinal and aromatic plants (MAP) found in the KCA, namely satuwa *(Paris polyphylla),* lauth salla *(Taxus wallichiana),* and dhupi *(Juniperus indica).* Based on resource

assessments, annual sustainable harvest plans were prepared. While satuwa and lauth salla are important medicinal plants that are generally traded on the KCA's northern border with China, dhupi harvested in the KCA is being processed in two local essential oil plants set up with support from WWF, the first supported by the earlier SHL SCAPES Project in Ghunsa, and the second supported by the AHM Project in Tseram Village, north of Yamphudin. These essential oil plant enterprises are being managed by two conservation area users committees and are registered with the Cottage and Small Industry Development Board. Proceeds of these enterprises are shared amongst two local conservation cooperatives in the KCA which use enterprise profits for local conservation and development projects.

Watershed Management

To improve water security in the KCA Region in the face of a changing climate, WWF built upon the vulnerability assessment conducted for the Tamor River basin to develop a climate-smart watershed management plan for the Tamor basin, which has its headwaters in the KCA. WWF organized five stakeholder consultation workshops along the length of the Tamor River to identify key local ecosystems and their importance with respect to watershed health, climate and non-climate threats, possible solutions, and high priority areas for action. Following these workshops, WWF conducted a literature review, resource mapping, field vulnerability assessment, and detailed analysis of possible future climate scenarios for the Tamor Basin. WWF also examined ecosystem services, potential for collaborative community management of water resources, socially equitable water allocation, and e-flows needed for ensuring ecosystem integrity.

To address the multitude of threats in the basin, the plan proposes activities in the following areas: erosion control, reduction of water pollution, improving groundwater recharge, improving riparian ecosystems, increasing efficiency of water delivery infrastructure, and increasing the adaptive capacity of the basin's residents in general. Notably, the plan was designed to align with Nepal's 2005 National Water Plan and will contribute to implementation of Nepal's broader 2011-2021 Koshi River Basin Management Strategic Plan.

Box 2. Climate Threats in the Tamor Basin

Climate threats identified in the Tamor included melting of glaciers and perennial snow cover which will have consequences for seasonal release of water; increasing possibility of GLOFs; increasing frequency of flooding and landslides as extreme weather event become more frequent; melting of permafrost with potentially large consequences for alpine grassland ecosystems; earlier melting of snow which leaves alpine pastures drier during early spring growth season and reduces pasture productivity; an increase in invasive low altitude species; reduced groundwater recharge as increasingly heavy rains runoff faster; drying up of surface springs and streams; increasingly erratic rainfall patterns; increased frequency of spring drought; and increased evaporation leading to drier agricultural fields. Major human threats to watershed and ecosystem health identified in the Tamor basin included livestock overgrazing, deforestation, forest fires, illegal trade of NTFPs, poaching of endangered species, and illegal woodcutting.

Sherpa women's group that participates in AHM Project ecotourism activities, Gyabla Village, Kanchenjunga Conservation Area, Nepal.

The completed draft plan is currently under review by the Government of Nepal's Water and Energy Commission Secretariat (WECS).

General Conservation Area Management

As one adaptation strategy to reduce woodcutting pressure on KCA forests and build their resilience, WWF provided support for distributing improved metal cook stoves to 360 families cooking over open indoor hearths, which is reducing annual firewood consumption by about 30 percent. WWF also strove to protect the KCA's forests and address increasing climate change-driven fire risks by launching a community-based forest fire management program with the formation of six forest fire fighting groups.

AHM supported general KCA management through various trail improvements along the main tourist trekking routes in the KCA, including bridge repairs, paving muddy and erosion-prone sections with stones, and re-routing trails over and around slide-prone areas, a particularly urgent need after the April 2015 Nepal earthquake. Trash disposal practices in the KCA were also improved by sponsoring village cleanup campaigns along the main tourist trekking routes and digging of 10 village trash burial pits as a better alternative to widespread dumping in the nearest stream or ravine. WWF also supported upgrading the Ghunsa and Yamphudin Village visitor centers to improve the trekking experience in the KCA while CARE posted 11 sign boards in the KCA targeting both locals and tourists with KCA project information, information on KCA regulations, biodiversity and conservation awareness messages, and information on environmental issues in the KCA.

Throughout the AHM Project, WWF provided continuous support to the KCAMC to coordinate its activities with those of the DNPWC, district line agencies, and other stakeholders to maximize effectiveness of conservation

activities. This included support for coordination meetings; government monitoring of KCA conservation activities; donation of computers, printers and photocopy machines to four KCA district offices; and support for KCAMC internal management and planning meetings, in particular with respect to implementation of annual AHM Project work plans for the KCA.

Community Participation in Conservation

WWF and CARE organized a series of trainings in the KCA to increase participation of women, youth, poor, and other vulnerable and socially excluded groups in community natural resource management activities, such as activities of community forest user groups. These included 4 trainings on good governance and gender and social inclusion for natural resource management groups; 7 trainings on leadership skills for members of groups traditionally excluded from community natural resource management organizations and activities; and 3 trainings on pro-poor planning that taught development of community livelihood improvement plans and adequate benefit sharing of natural resource mangement and development acitivities with poor and marginalized groups. WWF and CARE also supported 2 workshops on gender and power analysis that examined access to and control over local natural resources in KCA communities as well as six public hearing and public auditing meetings that assessed CBO activity progress in the KCA and updated members on CBO finances, particularly income and expenditures.

Local Livelihoods

In addition to the cardamom, greenhouse, pasture management and other livelihood activities discussed above, WWF also supported further development of the ecotourism industry in the KCA as an additional adaptation strategy to diversify livelihoods. To this end, WWF supported a study tour for KCA residents to learn about successful homestay programs and climate adaptation initiatives at WWF AHM Project sites in Sikkim.

Cross-cutting Activities in Nepal

In addition to AHM field activities conducted in the KCA, WWF Nepal also undertook several broader activities with AHM Project Support. Under the framework of the GSLEP Program, WWF and DNPWC worked together to develop a model climate-smart snow leopard landscape management plan and planning process for Nepal's Eastern Himalaya GSLEP priority Landscape. This landscape covers 1,151,600 hectares of snow leopard habitat stretching from Nepal's Kanchenjunga Conservation Area in the northeast corner of the country to Langtang National Park just north of Kathmandu, and includes Sagarmatha and Makalu Barun National Parks. A joint WWF-DNPWC drafting committee was formed, an extensive literature review conducted, and GIS mapping of the entire priority landscape performed. Future climate scenarios were also developed, including GIS analysis of impacts on hydrology and snow leopard habitat in Nepal's eastern Himalayas. Final boundaries of the priority landscape were selected, and findings of the above efforts were compiled into a draft management plan.

The draft landscape management plan was presented at a stakeholder workshop organized by WWF and DNPWC in Kathmandu attended by staff of all protected areas and

WWF and DNPWC worked together to develop a model climate-smart snow leopard landscape management plan for Nepal's Eastern Himalaya GSLEP priority landscape.

district forests within the landscape, staff of the DNPWC, Department of Forests, WWF, NTNC, and other conservation NGOs working in Nepal. Information gaps were highlighted and participants provided input and feedback. A second stakeholder meeting was held for community leaders from the Makalu-Barun National Park region to fill in additional information gaps on snow leopard and wildlife presence, climate change impacts, infrastructure, and eco-tourism.

The final "Snow Leopard and Ecosystem Management Plan–Eastern Himalaya Landscape, Nepal," summarizes current and emerging threats to snow leopards, their habitat, and prey, including both direct human threats and climate change impacts, and provides a detailed roadmap for securing the future of snow leopards in the Himalayas of eastern Nepal. With its official launch at the Bishkek Global Snow Leopard and Ecosystem Forum on August 23, 2017, Nepal was the first of the 12 GSLEP member states to complete and approve a landscape management plan for one of its GSLEP Priority Landscapes, creating a model for other snow leopard range states to replicate.

To increase awareness about the plight of Nepal's snow leopards and WWF's snow leopard protection efforts, WWF organized two high profile International Snow Leopard Day celebrations at the Patan Museum in Kathmandu in 2016 and 2017 that were both covered by national media outlets. The first event featured speeches on the importance of snow leopard conservation and the interactive creation of a large 4-panel hand-print portrait of a snow leopard supervised by local artists with handprints contributed by members of the public. The second event featured a student competition between teams from 40 schools in the Kathmandu Valley to create a model of perfect snow leopard habitat, free from human-wildlife conflict, poaching and habitat fragmentation.

To assess the socio-economic benefits of seven years of USAID support in the KCA through the SHL SCAPES (2010-2014) and AHM projects (2012-2017), WWF conducted a comprehensive review of project economic benefits for households in the KCA. This process included a thorough review of project literature, discussions with experts at WWF Nepal, five focus group discussions in the KCA, and a month-long social survey of 230 of the KCA's 1,060 households that covered all four KCA Village Development Committees (VDCs). Findings showed large economic benefits for about 28 percent of KCA households and highlighted successful climate adaptation interventions such as cardamom irrigation, greenhouse vegetable growing and use of improved cookstoves.

Recommended Next Steps

In Nepal, an integrated watershed management plan was prepared but is now under review by Nepal's Water and Energy Commission Secretariat (WECS). Once approved, extensive support will be required for implementing this plan. To ensure a long-term future for the snow leopard in Nepal, WWF's snow leopard research and conservation program in the KCA will require widespread replication along the Nepal Himalaya, in part through implementation of the Eastern Himalaya landscape management plan. Although widely replicated by both VDC governments and individuals in the KCA, popular cardamom irrigation and greenhouse climate adaptation activities have a high potential for successful replication in gateway communities to snow leopard habitat elsewhere in the Himalayas of eastern Nepal.

Pakistan: Gilgit Baltistan and Chitral

Meir Glacier, Hoper Valley, Gilgit-Baltistan, Pakistan. © WWF Pakistan

In Pakistan, WWF worked closely with district and provincial wildlife, forest, and environment departments; village conservation committees; and local NGOs to design and implement a comprehensive set of integrated climate adaptation and conservation activities for the Hoper, Laspur, and Rumbur Valleys. These activities focused on addressing climate change impacts on water, food, and livelihood security; improving pasture, forest, and watershed management; development of climate-smart alternative sources of income; combating wildlife poaching; increasing community participation in conservation activities; snow leopard research; and training of citizen scientists. Despite the difficult working conditions and frequent natural disasters in the region, a groundswell of support has been built for wildlife conservation in these communities that will help ensure a future for snow leopards and other species in these mountains.

Major Achievements

- **Implementation of a comprehensive set of climate adaptation actions addressing pastures, forests, watershed management, and livelihoods in the Hoper, Laspur, and Rumbur valleys that are building the resilience of ecosystems, improving conditions for wildlife, and helping residents adapt to already severe climate change impacts.**
- **Launch of snow leopard and prey species monitoring programs in the Hoper, Laspur, and Rumbur Valleys that are increasing community awareness and support for snow leopard protection activities in these locations.**

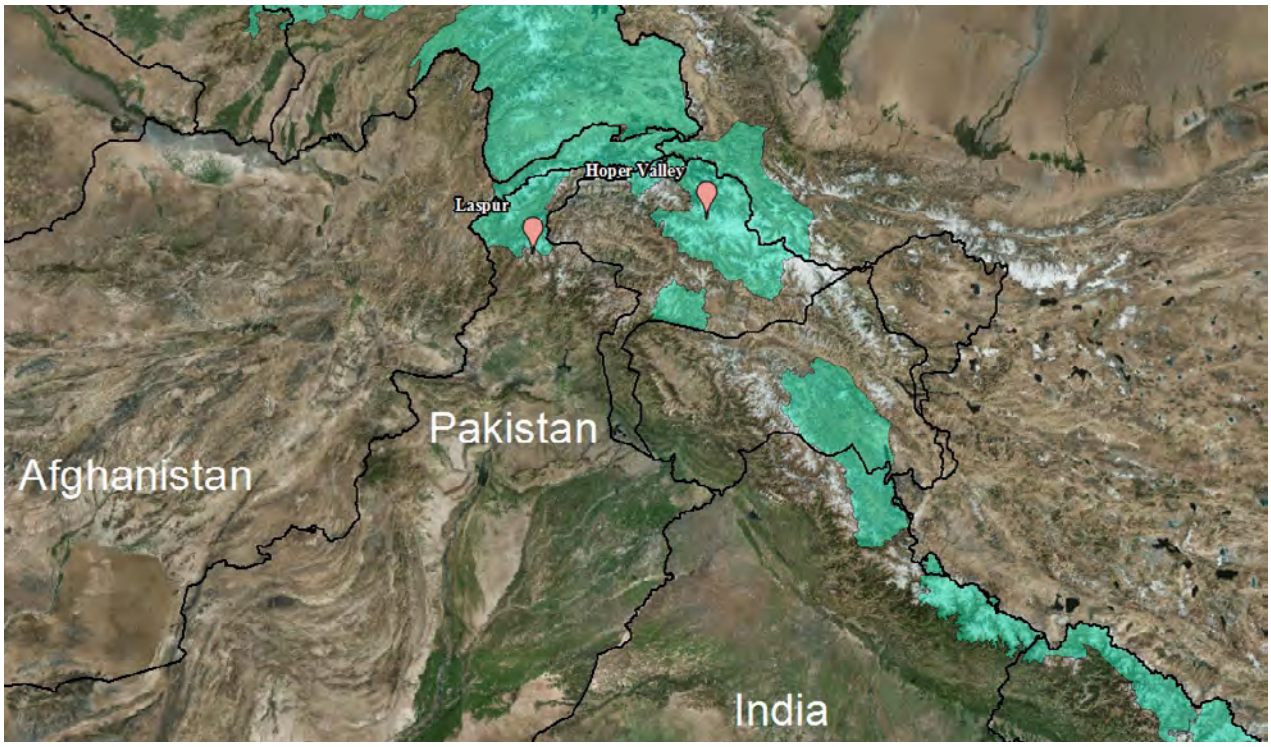


Figure 9. Map of the Pakistan GSLEP landscapes (shown in light green) and Hoper Valley and Laspur AHM demonstration sites in Northern Pakistan.

- **Establishment of a village wildlife guard program in the Hoper, Laspur, and Rumbur Valleys that has reduced illegal wildlife poaching, illegal woodcutting, and illegal livestock grazing in these three areas.**
- **Improved wildlife protection in Hoper has resulted in Siberian ibex populations increasing and Hoper residents being recognized for Zero Poaching of snow leopards from 2014-2017.**
- **Camera trap photos taken of a rare common leopard and other wildlife in Chitral Gol National Park revealed the diversity of wildlife in the Chitral region.**
- **A climate vulnerability assessment was conducted for the Hoper Valley that will serve as a model for replication for conducting vulnerability assessments and developing climate adaptation strategies elsewhere in northern Pakistan.**
- **A series of demonstration water resource management activities were undertaken in Hoper Valley that are improving the water security of participating residents.**
- **Strengthening of village conservation committees at all three AHM Project sites that will lead to future conservation successes in these valleys.**
- **A well-received series of community conservation awareness events were held in both Gilgit-Baltistan and Chitral to mark various conservation days that were attended by thousands and greatly increased community support for snow leopard protection and other conservation activities in northern Pakistan.**

Overview of the AHM Project Landscape and Threats in Pakistan

AHM Project work focused on two project demonstration sites in the Hunza-Nagar District of Gilgit-Baltistan (GB) and in the Chitral District of Khyber-Pakhtunkhwa Province (KP). In GB, the primary AHM Project site was the Hoper Valley in northern Pakistan's rugged Karakorum Mountains, a region famed for its soaring snow-covered peaks and long valley glaciers. Land cover is dominated by arid grasslands with some limited forest cover, particularly in valley bottoms and along riparian corridors. Biodiversity includes snow leopard, Siberian ibex, red fox, wolf, and brown bear as well as Himalayan snowcock, chukar partridge and a variety of other birds. Elevations at this site range from about 7,266 m on Diran Peak about 18 km southwest of Hoper to 2,135 m along the Nagar River just below Hoper.

In KP, the primary project sites were Chitral District's Laspur and Rumbur Valleys in the Hindu Kush Mountains of northern Pakistan's border region with Afghanistan. As in GB, land cover in this arid region area is largely arid grasslands with some conifer forest cover, particularly in Rumbur. Biodiversity includes snow leopard, markhor, red fox, wolf, jackal, common leopard, brown bear, Himalayan snowcock, chukar partridge and many other bird species. Elevations in Laspur range from about 6,542 m on Buni Zom Peak 15 km west of Laspur to 2,700 m along the river just below Laspur. In the Rumbur Valley, elevations range from about 1,500-5,000 m.

Livelihoods in all three valleys are a mix of grain and potato farming and livestock herding, primarily sheep and goats. The Rumbur area is notable as the home of the Kalash people, one of Pakistan's smallest ethnic groups. Rivers in all three project sites ultimately drain into the Indus. Environmental threats in all three project communities include overgrazing, illegal woodcutting, wildlife poaching, and retaliatory killing of wild animals that prey on livestock. However, climate change has already begun to severely affect the region, especially through the rapid melting of glaciers and greatly increased risk for potentially catastrophic GLOFs. A second large climate threat is the increased intensity of rainfall, which is contributing to increasing occurrence of severe annual flooding in northern Pakistan. Other climate-related threats that significantly affect local livelihoods include increasing occurrence of crop and livestock disease outbreaks.

AHM Hoper Valley, Gilgit Baltistan Demonstration Site

Snow Leopard Research

WWF biologists conducted annual snow leopard sign and prey species surveys in the Hoper Valley region with the assistance of up to 18 trained local citizen scientists. These surveys were conducted in a 250 km^2 area of the Shaltar, Bualtar, Meir, Barpu, Hamdar, Daranchi, and Rash pasture areas of Hoper. Predator scat samples were also collected for genetic and diet analysis. Siberian ibex counts along these transects increased from 155 in July 2013 to 268 in July 2015 to a peak count of

Camera trap surveys in Hoper have thus far yielded images of a wide diversity of wildlife in the valley, including snow leopard.

288 ibex in December 2015, presumably due to AHM Project efforts to improve wildlife protection in Hoper. In 2016, WWF received government permission to begin conducting camera trap surveys in Hoper, which have thus far yielded images of a wide diversity of wildlife in the valley, including snow leopard. Findings are being used to prepare a snow leopard distribution map for the Hoper region that will inform design of future conservation activities in the area. In support of these research efforts, WWF held three trainings in GB on conducting snow leopard sign, prey species, and habitat assessment surveys for GB Forests, Wildlife and Parks Department (GBFWPD) staff; game watchers from Central Karakorum National Park (CKNP); village wildlife guards (VWG); and local livestock herders.

Species Conservation

WWF improved protection of wildlife in the Hoper Valley through the hiring, training, and equipping of two village wildlife guards under the supervision of the Hoper Conservation and Development Organization (HCDO) who are responsible for stopping illegal activities such as wildlife poaching, unregulated free grazing, and illegal logging. These two guards monitor wildlife populations in the valley, particularly snow leopards and Siberian ibex, and document human-wildlife conflict incidents. Records of the activities and findings are kept and all incidents of illegal environmental activities reported to the GBFWPD through the HCDO.

In Hoper, WWF conducted a human-wildlife conflict social survey of 647 herders to assess the economic impact of predation on livestock by snow leopards and other wild predators. The survey covered numerous topics including pastoral incomes, livestock rearing and grazing, and human-wildlife conflict. Surveys were used to design a program for mitigating conflict through corral improvement, livestock insurance, and improved herder education. As a first step in reducing human-wildlife conflict, WWF supported construction of a demonstration predator proof corral at a high snow leopard conflict site in the Meir Pasture area, educating users on the utility and value of snow leopard conservation. WWF also organized a livestock vaccination campaign in Hoper Valley to offset the loss of livestock to snow leopards and other predators, vaccinating more than 10,900 animals against common diseases. Participating herders were also taught other methods for reducing snow leopard conflict to discourage retaliatory killing. In addition, this campaign served as an effective climate change adaptation strategy to offset loss of livestock to increasing climate-related livestock disease outbreaks.

Lastly, WWF and the HCDO initiated a community livestock insurance scheme funded by herder insurance registration fees and annual insurance premiums paid by herders that were deposited in the Karakoram Cooperative Bank. Partial compensation payments of USD 50 for yaks and cows and USD 25 for sheep and goats are being made for livestock lost to snow leopards and wolves only. The scheme was launched on the condition that all hunting, retaliatory killing, and direct disturbance of snow leopards and wolves cease in the valley. Wildlife protection efforts in Hoper have been successful, and in May 2017 residents of the Hoper Valley received recognition from WWF and the GBFWPD as having achieved Zero Poaching of snow leopards for the three consecutive years.

Climate Adaptation

WWF conducted a climate vulnerability assessment for the Hoper Valley that involved a review of scientific literature on current and future climate change impacts in northern Pakistan, focus group discussions, and a household survey on climate impacts on rural livelihoods, ecosystems, and water resources.

Major impacts cited by residents included warming temperatures, declining snowfall, shorter winters, more intense rainfall of a shorter annual duration, increased flooding, decline of surface seeps and springs, increased incidence of pest infestations in agricultural crops, declining pasture quality, and increased incidence of livestock disease. Findings were then used to draft a climate adaptation strategy through a participatory process with the assistance of the GBFWED, the GB Environmental Protection Agency (EPA) and ICIMOD. This strategy focuses on educating communities about climate hazards such as GLOFs, increased occurrence of flooding and avalanches, and how to avoid loss of life and property during these events. While developing the climate adaptation strategy for Hoper, WWF provided training on climate change impacts and adaptation for community leaders. WWF also worked with the GB-EPA, ICIMOD and Karakoram International University (KIU) to hold a climate change adaptation seminar for students, professors, government workers, and NGO staff, where experts spoke about climate change science, impacts, adaptation strategies, and the need for sound government climate policy.

In Hoper, WWF demonstrated one effective climate adaption strategy for increasing the resilience of mountain pastures to climate change impacts through planting of alfalfa on disused agricultural land and pastures suffering from overgrazing degradation near villages. The alfalfa produced is harvested in autumn as a fodder crop to stall feed cows and other livestock in winter. Through this effort, winter and early spring grazing pressure on mountain pastures has been effectively reduced while increasing winter dairy production. Erosion from these formerly degraded hillsides and pastures is also expected to decline, benefitting water quality and quantity and improving infiltration. Snow leopards and their prey species are also expected to benefit from this activity through improved alpine pasture quality and reduced human disturbance. To further limit increasing erosion during increasingly extreme storms, WWF supported the planting of thousands of fast-growing multi-purpose trees in Hoper over the course of the AHM Project. Primarily varieties of poplar and willow, these trees were planted on marginal and degraded lands around villages, including on disused agricultural plots. In addition to eventually reducing woodcutting pressure on natural forests, these trees will also contribute to reducing runoff, mitigating soil erosion from degraded land, improving watershed management, alleviating timber shortages, increasing wildlife habitat, and providing fodder for livestock.

Livelihoods

As part of a broader climate adaptation strategy for Hoper, WWF carried out a number of livelihood activities to increase the sustainability of traditional farming and herding livelihoods and to diversify livelihoods to lessen resident's dependence on the local resource base in Hoper.

To diversify crop production with a potential new cash crop, WWF conducted two fruit tree planting campaigns that distributed 2,700 cherry and apricot tree saplings to households for starting home fruit orchards. If successful, the eventual fruits of this labor will also improve local nutrition and food security as well as provide benefits for watershed management in Hoper's settled areas. To increase local soil fertility without the use of chemical fertilizers, WWF organized a climate-smart agriculture training for farmers in Hoper that taught them the Japanese bokashi method for composting all forms of organic waste. At this time farmers also received training on starting plant nurseries to increase crop production.

Tree planting activity to mark World Environment Day, Gilgit Town, Gilgit Baltistan, Pakistan. © WWF Pakistan

WWF and the HCDO partnered to establish a vocational training center for women in the Hoper Valley that teaches modern handicraft making techniques, new products, and marketing as an alternative income source to farming and herding that will increase household livelihood security in the face of a changing climate. Products currently produced include rugs, shawls, gloves, socks, and other products made from local wool that are sold locally in the Hoper and Nagar Valleys as well as in the large market towns of Aliabad and Gilgit. The first 35 women participating in this activity earned on average about $300 each in the first year of sales creating an important income supplement to farming-dominated livelihoods.

Watershed Management

WWF prepared a demonstration integrated watershed management plan for the small Daranchi and Supultar Nullah watersheds, two important primary sources of irrigation water. A literature review and social survey amongst residents were conducted to examine the effects of climate change impacts, deforestation, and pasture degradation on local watersheds and water provision. Input was also provided by staff of district wildlife, livestock, forest and agricultural departments as well as other local leaders. Along the Daranchi Nullah, the watershed management planning process revealed increasingly frequent flooding that is likely the result of climatic warming was causing increased rates of riverbank erosion and loss of valuable agricultural lands in Rathal Village. In response, WWF supported two initial watershed management actions to address this issue: riverbank erosion control bioengineering in critical areas that reinforced riverbanks with densely planted sea buckthorn, willow shrubs, and multiple rows of live

Entry for a student poster contest prepared for a WWF climate change and environmental awareness program, Gilgit-Baltistan. © WWF Pakistan

brushwood spurs; and construction of two sections of stone flood protection walls in densely populated areas where homes are threatened by river bank erosion.

The resulting plan provided a number of recommendations for improving the water security of Hoper's residents that included improving an irrigation system that has been repeatedly damaged by floods, landslides, and avalanches. This involved reinforcing the system intake point with concrete to withstand the increasing frequency of flooding in the Daranchi Nullah drainage and replacing a 75 m stretch of open irrigation canal to prevent leakage and blockage, portions of which were buried to prevent damage by increasingly frequent landslides and avalanches. WWF also supported improved water delivery and storage systems at three villages to improve water security. This included installation of a pipe to a distant clean water spring and construction of a large water storage tank in Hakalshal Village, where residents formerly took drinking water from an open stream. In Broshal Village, a new water storage tank was constructed while in Ghoshoshal Village a damaged water storage tank was repaired.

Community Participation in Conservation

At the outset of the AHM Project, discussions were held with representatives of the HCDO, the central village conservation committee representing all 5 tribes in Hoper Valley, to discuss AHM Project objectives and create essential local buy-in and support. HCDO representatives agreed to participate as the main AHM partner in Gilgit-Baltistan and Hoper Valley was selected as the primary location for AHM field activities in GB. Over the

course of the AHM Project, WWF support for the HCDO included providing partial funding for construction of a new HCDO office, donation of office furniture and a computer, and training, including a 3-day workshop for members on proposal writing and office management to improve their capacity to independently seek funding. WWF also facilitated two to three HCDO progress review and planning meetings each year to discuss successes and shortcomings of AHM activities, implementation plans for upcoming project quarters, and adaptive management. WWF also provided support to organize and hold a semi-annual conservation activity review meeting between the HCDO and the Gilgit-Baltistan District Conservation Committee (DCC) to discuss conservation issues and progress on implementing conservation activities in the Hoper Valley.

WWF worked with government and NGO partners to support a large number of educational conservation day celebration events in the Hoper Valley, Gilgit Town, and elsewhere in Gilgit-Baltistan that marked such days as International Snow Leopard Day, Earth Day, World Water Day, World Environment Day, International Day for Biological Diversity, and International Mountain Day. These events targeted primary and secondary schools, university students, local and district government officials, village conservation committee members, and the general public. They featured speeches by local dignitaries and expert talks on a variety of topics, including snow leopards and wildlife, the importance of wildlife for local ecology, climate change impacts and adaptation, water resource issues, trash management, and sustainable livelihoods. These events also included ecologically-themed children's skit, speech, poster, and drawing contests; village tree planting and trash cleanup activities; and guided walks led by local ecologists. Over the course of the AHM Project, thousands of people attended.

AHM Chitral Demonstration Site

Snow Leopard Research

In Chitral's Laspur Valley, WWF biologists conducted five snow leopard sign and prey species surveys in the Chumarkun Gol, Phargram Gol, and Bashqar Gol areas, collecting predator scat samples for genetic and diet analysis and confirming the presence of snow leopards and a fairly stable Siberian ibex population. In May 2017, WWF deployed four camera traps in the Bashqar Gol area and later redeployed these traps at a second set of locations in Bashqar Gol for a combined total of three months, capturing 1,400 images of ibex but no snow leopards images. Additional sign and presence surveys were conducted in the Rumbur and Chitral Gol areas of Chitral, again collecting scat samples and confirming snow leopard presence along with a wide variety of other wildlife, including markhor goats, wolf, fox, and lynx. These surveys revealed that wolves are now the dominant predator species in the area, with wolf scat and tracks found on almost every transect and one direct wolf sighting having been made. During the March 2017 Chitral Gol survey, four camera traps were also deployed, capturing a common leopard, which are extremely rare in Chitral, as well as markhor, wolf, fox, lynx, and a feral dog pack, the latter of which appear to be a growing problem in Chitral Gol. Survey findings have been compiled into a wildlife database for Chitral and will be used to inform design of new conservation activities in the district.

WWF also held two trainings in Chitral on conducting snow leopard sign and prey species surveys, habitat assessment and management, and ecology of local wildlife for staff of the KP Wildlife Department, the Chitral District Wildlife and Parks Department, the Chitral District Forest Department, NGO workers, and community wildlife watchers. A number of these trainees later assisted WWF with the snow leopard sign and prey species surveys conducted in Chitral.

Species Conservation

WWF provided support for hiring, training, and equipping two village wildlife guards for the Phargram Gol and Bashqar Gol areas of the Laspur Region, an important area of the Booni Wildlife Range, who report to their respective village conservation committees (VCCs). WWF also provided support for hiring, training, and equipping three village wildlife guards in the Rumbur Valley who work under and are supported financially by the Chitral Gol Community Development and Conservation Association. These village wildlife guards are responsible for preventing wildlife poaching; monitoring wildlife, particularly snow leopards and their prey species, and stopping illegal grazing and illegal wood cutting. Guards also conduct snow leopard and prey species monitoring and have increased community awareness of and participation in conservation activities. These guards file monthly reports on their activities and findings with VCCs which are shared with the Chitral and KP wildlife departments.

WWF conducted a human-wildlife conflict survey of livestock owners in the Laspur and Rumbur Valleys focused on livestock predation by wild predators, which revealed disease and accidents to be larger causes of livestock deaths than losses to snow leopards and other predators. This was followed by a second human-wildlife conflict survey in two villages in Laspur, which found that wolves were the single largest cause of livestock kills followed by lynx and jackals, while snow leopard, brown bear and red fox were responsible for very little predation of livestock. Over the preceding two years, local residents lost total of 206 head of livestock to wild predators, the majority of which were sheep and goats, an indication of how large this problem is for livestock owners. Findings of these two surveys have been used to improve design of human-wildlife conflict mitigation efforts in these two regions.

WWF organized three livestock vaccination campaigns in Laspur and one in Rumbur that vaccinated 11,000 head of livestock against a number of common livestock diseases to offset economic losses from predation. Herders were also taught about ways to reduce loss of livestock to predators, building support amongst local herders for snow leopard protection and conservation activities. These campaigns also provide benefits for prey species by reducing the chance of disease transmission from livestock to wild ungulates in high mountain pastures near Laspur and Rumbur. In addition, vaccination provides an effective climate change adaptation strategy to mitigate the loss of livestock to disease outbreaks, which are believed to be increasing as a result of climatic warming.

Climate Adaptation

WWF supported a social survey and focus groups discussions on climate change and its impacts amongst residents of the Laspur and Rumbur Valleys to design effective climate change adaptation actions for these valleys. Findings of the Chitral surveys were similar to those in GB: warmer temperatures, shorter winters, less snowfall, less rainfall, increasing intensity of rainfall, increased incidence of both flooding and drought, melting of glaciers, increased incidence of livestock diseases, and increased insect and fungal infestations in trees. Findings were presented at a joint vulnerability assessment and adaptation

Overgrazed hillslope planted with alfalfa that is harvested for winter stall feeding to livestock, Hoper Valley, Gilgit-Baltistan. © WWF Pakistan

planning workshop for the Laspur and Rumbur Valleys with local residents, staff of relevant government agencies in Chitral District, and local NGOs workers. Climate change and its impacts on ecosystems, natural resources, and livelihoods; future climate scenarios for Laspur and Rumbur; specific vulnerabilities of each community; and possible adaptation actions to address these vulnerabilities were all discussed, resulting in draft adaptation strategies for both valleys.

In Chitral, WWF conducted fodder crop planting activities in both Laspur and Rumbur to increase mountain pasture resilience to worsening erosion and landslides resulting from increasingly extreme weather. As in Hoper, alfalfa was planted as a fodder crop on degraded agricultural and pasture lands near villages, which was then harvested and stall fed to livestock in winter. The resulting benefits are multiple and include reduced grazing pressure; increased dairy production from local livestock; reduced erosion from degraded village pastures; and improved water quality, quantity, and recharge. Snow leopards and their prey species are also expected to benefit through improved alpine pasture quality and a reduced annual period of human disturbance in high pastures.

WWF also worked directly with residents of Laspur and Rumbur to improve pasture management. This included a rangeland assessment for Laspur's Phargram GoI watershed to assess species abundance and productivity, findings of which were used to estimate the livestock carrying capacity of pastures in this basin. The survey team also identified disused pasture sites that can be

Multi-purpose trees for planting on degraded land, Hoper Valley, Gilgit-Baltistan, Pakistan. © WWF Pakistan

used for improving the rotational grazing regime in the Phargram Gol area. Findings were presented to herders at a follow-up workshop to discuss methods for improving pasture management practices and create a draft rotational grazing schedule to reduce grazing pressure. To further improve pasture management and address climate change impacts, WWF worked with residents of Sor Village in Laspur to establish a trial 396 hectare grazing set aside in the Zhoya Zhoe drainage for a period of three years that bans grazing to allow vegetation to recover from years of overgrazing. This action will reduce erosion at this site and improve water quality and fodder availability for wildlife.

In Rumbur, WWF organized a comprehensive pasture assessment for the valley that examined vegetation, ecology, and past pasture management practices. This assessment also included participatory focus group discussions with village conservation committee members and interviews with local herders. Assessment findings were presented at a subsequent stakeholder workshop that resulted in drafting of an improved sustainable pasture management plan for Rumbor. WWF then worked with residents to implement a trial improved pasture rotation plan on the important 1,200 hectare Ossu Nullah pasture.

WWF supported a number of tree planting campaigns in the Laspur and Rumbur Valleys to reduce woodcutting pressure and enhance forest resilience to a changing climate. These campaigns planted thousands of fast-growing multi-purpose trees on marginal and degraded lands in Laspur and Rumbur over the course of the AHM Project, and will eventually be used

for managed woodcutting to reduce woodcutting pressure on natural forests. These trees will contribute to reducing runoff, mitigating soil erosion from degraded land, improving watershed management, alleviating timber shortages, improving wildlife habitat, and providing fodder for livestock.

WWF also worked with the KP Forest Department (KPFD) to implement the department's Billion Tree Tsunami Afforestation Project. The goal of this project is to establish tree plantations on degraded land and to erect livestock exclosures in key areas to permit undisturbed regeneration of damaged natural forests. Livestock exclosures covering over 250 hectares were established in Laspur and Rumbur to demonstrate this technique for regenerating natural forest. WWF also organized a training for exclosure managers from Rumbur and five other valleys in the region.

Watershed Management

In Chitral, WWF prepared a draft management plan for the Phargram Gol Watershed, a primary source of irrigation water for residents of the Laspur Valley. This process was launched with a literature review and an initial field survey to examine the effects of climate change impacts, deforestation, and pasture degradation on the watershed and water provision. Local stakeholders were also consulted on the watershed management plan, including staff of district wildlife, livestock, forest and agricultural departments as well as other local leaders. Following a participatory watershed management planning workshop, findings of the field survey, workshop, and earlier rangeland management assessment were incorporated into a draft climate-smart watershed management plan submitted to relevant government bodies for review. To fill an important information gap in this plan, WWF conducted a comprehensive GLOF vulnerability study in the Laspur Valley which has 8 glacial lakes in the Bashqar Gol, Phargram Gol and Balim Gol drainages to improve disaster preparedness in downstream communities.

Community Participation in Conservation

To launch the AHM Project and create local buy-in and support, WWF held 7 meetings with indigenous natural resource use groups and village conservation committees in the Rumbur and Laspur Valleys to determine local resource management institutions and regimes. While village-level natural resource management committees responsible for regulating livestock grazing and fodder and fuel wood collection were found to previously exist in both Laspur and Rumbur, they were not currently active. In need of reorganization and capacity building, WWF supported reactivation of village conservation committees in both Laspur and Rumbur. This included donation of office furniture and office supplies to establish formal VCC offices, training on writing conservation and natural resource management grant proposals, and hiring and training of wildlife guards who report to VCCs. In Laspur, WWF trained VCC members on forest and pasture management and worked with VCC members to develop a participatory conservation and development plan for the valley. And in both Laspur and Rumbur, WWF facilitated periodic VCC internal conservation activity review meetings and review meetings with the Chitral District Conservation Committee.

WWF worked with government and NGO partners to support numerous educational conservation day celebration events in Laspur Valley, Rumbur Valley, Chitral Town, and elsewhere in Chitral that marked such days as International Day of Forests, World Wildlife Day, World Water Day, and World Nature Conservation Day. These events targeted primary and secondary school students as well as university students, local and district government officials, village conservation committee

members and other interested members of the general public. A main feature of these events were expert talks on a variety of environmental topics, including snow leopards and wildlife, the importance of wildlife for local ecology, climate change impacts and adaptation, water resource issues, local biodiversity, and trash management issues. These events also included village tree planting and trash cleanup activities and guided walks by local ecologists.

Livelihoods

As part of a broader climate adaptation strategy for Laspur and Rumbur, WWF carried out a number of activities to increase the sustainability of traditional farming and herding livelihoods and to diversify livelihoods to lessen resident's dependence on the local natural resource base in these valleys. These included trainings for women on kitchen vegetable gardening in Laspur and poultry raising in Rumbur, and organic produce certification in Laspur. To diversify crop production with a potential new cash crop, WWF conducted fruit and nut tree planting campaigns in both Laspur and Rumbur, where several thousand cherry, apricot, apple, pear, persimmon, peach, walnut, and almond trees were distributed to households for starting home orchards. These orchards will ultimately improve local nutrition and food and livelihood security as well as watershed management in settled areas of Laspur and Rumbur. To ensure the long-term viability of the local wild black cumin harvest in Laspur's Phargram Gol area, WWF provided a training for local residents on sustainable harvesting, packaging and marketing of this valuable product.

WWF also supported the establishment of a vocational training center for women in the Laspur Valley that teaches improved design and production of handicrafts made from local wool, such as socks, sweaters, gloves, and wool matts; and sewing of crafts from purchased cloth, such as cushion covers. With assistance from the center, these products are being sold in local market towns as well as at the popular Shandur tourist festival held each summer at Shandur Lake. Participating women are currently earning about USD 50-150 per month from the sale of their products, providing an alternative income source to farming and herding that will increase household livelihood security in the face of a changing climate.

Disaster Relief

In the summer of 2015, the Laspur and Rumbur Valleys were severely affected by flooding in Chitral District that washed away agricultural lands, orchards, pastures, riparian forests, and a number of homes. WWF worked with village conservation committees to identify and provide disaster relief to the most severely affected families that included food, drinking water purifiers, and solar lanterns. Through this effort, a joint team of WWF staff and village conservation committee leaders provided assistance to more than 200 families with additional funding provided by Qurshi Industries.

Participating women are earning USD 50-150 per month, providing an alternative income source that will increase household livelihood security.

Cross-cutting Activities in Pakistan

WWF biologists developed a snow leopard and prey species monitoring protocol for northern Pakistan to standardize field methods, data collection, and data processing amongst researchers, wildlife department staff, protected area staff, village wildlife guards, and citizen scientists. This protocol will be used in future trainings for government conservation workers and citizen scientists, and data collected will be compiled in a database on the abundance and distribution of snow leopards and their prey species. This draft monitoring protocol was shared with relevant government wildlife departments and snow leopard experts and their comments and feedback were incorporated into the final protocol.

Recommended Next Steps

In Pakistan, extensive tree and home orchard planting activities need continued monitoring and, if necessary, corrective action to ensure the survival of these trees to maturity. The village wildlife guard initiative has proven successful, however, is limited in scope and will require support and training for scaling up to cover more territory on a more frequent basis. AHM Project communities in Pakistan appear to be particularly prone to climate-related disasters such as flooding, making adaptation and disaster risk reduction activities a constant and important priority. Finally, climate adaptation strategies and watershed management plans will need additional support for their continued implementation.

Conclusion

The AHM Project was extremely successful in achieving its stated goal of improving snow leopard conservation across the range while connecting this effort to a broader set of issues, including the water, food, and livelihood security of this region's inhabitants and the growing impact of climate change on these mountain landscapes. Great strides were made in broadening the scope of snow leopard conservation work beyond traditional snow leopard research and mitigation of direct human threats to include climate adaptation, water resource management, and large-scale habitat management.

AHM Project achievements were numerous and diverse: state of the art snow leopard research, original climate change research, creation of new protected areas, introduction of climate change adaptation concepts in snow leopard conservation, a landmark report on the state of snow leopard killing and trade, climate-smart water and natural resource management, innovative climate-smart livelihood options underway in isolated high mountain communities, community pride in snow leopard conservation bolstered by a highly creative series of community conservation activities, and the 12-nation GSLEP Program in place and functioning well, elevating snow leopard conservation to the international stage.

With the close of the AHM Project, however, this work is far from complete. Many of the activities implemented are works in progress while much of the field work undertaken is rather experimental in nature and will require further monitoring and re-evaluation in coming years. Widespread replication of project successes will also be required to have a large-scale impact across the snow leopard's vast range. In addition, with less than three years remaining to achieve the GSLEP goal of securing 20 snow leopard landscapes by 2020, GSLEP member states still require considerable financial and technical support if they are to reach this goal.

The foundation is now in place as a result of the AHM Project. Substantial progress has been made in consolidating the basis for a safe long-term future for snow leopards, the water, food, and livelihood security of the communities who share their mountain range, and the effective management of habitats guarding the lofty headwaters of Asia's great rivers.

Water-efficient cardamom sprinkler irrigation system tank and pipes, Tapethok Village, Kanchenjunga Conservation Area, Nepal.

References

Abbas, S., Karim, F., and Akbar, K., 2017. Climate Change Vulnerability and Capacity Assessment of Hoper Valley, District Nagar, Gilgit Baltistan. Gilgit, Pakistan: World Wide Fund for Nature Pakistan.

Balbakova, F., Alamanov, A., Lipka, O. 2015. Climate Change Vulnerability Assessment for the Central Tien Shan Region of the Kyrgyz Republic. Moscow, Russia: World Wildlife Fund.

Sindorf, N., Forrest, J. and Arakwiy, B., 2014. Guardians of the Headwaters: Snow Leopards, Water Provision, and Climate Vulnerability: Maps and Analysis. Washington, D.C., USA: World Wildlife Fund.

Forrest, J., Sindorff, N., and Bartlett, R., 2017. Guardians of the Headwaters II: Biodiversity, water, and climate in six snow leopard landscapes. Technical Report. Washington, D.C., USA: World Wildlife Fund.

Government of Nepal, 2017. Snow Leopard and Ecosystem Management Plan (2017-2026). Kathmandu, Nepal: Ministry of Forests and Soil Conservation.

Kothari, R., Upadhya, D., Theengh, L. T., Ghose, P. S., Shrestha, P., 2017. Climate change vulnerability assessment in snow leopard habitat: gateway communities in North Sikkim. Washington, D.C., USA: World Wildlife Fund.

Malone, E.L., 2010. Changing Glaciers and Hydrology in Asia Addressing Vulnerabilities to Glacier Melt Impacts. Washington, D.C., USA: World Wildlife Fund.

Nowell, K., Li, J., Paltsyn, M. and Sharma, R.K., 2016. An Ounce of Prevention: Snow Leopard Crime Revisited. Cambridge, UK: TRAFFIC.

Peters, D., Bader, D., McKenna, Marconi, B., M., Shrestha, R., Bartlett, R., Lesk, C., De Mel, M., and Horton, R., 2017. Climate Change in the Snow Leopard Landscapes of Asia's High Mountains: Technical Report. New York, NY, USA: Center for Climate Systems Research and Columbia University and WWF-US.

Sindorff, N., Forrest, J., and Arakwiye, B., 2014. Guardians of the Headwaters: Snow Leopards, Water Provision, and Climate Vulnerability. Maps and Analysis. Washington, D.C., USA: World Wildlife Fund.

Smith, T., 2014. Climate Vulnerability in Asia's High Mountains. Washington, D.C., USA: World Wildlife Fund.

Upadhya, D., Bhandari, A.R., Gnyawali, T.P., Rai, D.P. and Shrestha, S., 2017. Socio-Economic Outcomes of Conservation Interventions in Kanchenjunga Conservation Area, Nepal: 8 Years of USAID Support. Kathmandu, Nepal: World Wildlife Fund.

WCNP and WWF, 2016. Population Status and Distribution of Snow Leopards in Wangchuck Centennial National Park, Bhutan. Thimphu, Bhutan: Wangchuck Centennial National Park and World Wildlife Fund.

WWF, 2015. 2010-2014 Sustainable Conservation Approaches in Priority Ecosystems in the Sacred Himalaya Landscape. Washington, D.C., USA: World Wildlife Fund.

WWF, 2015. Climate Change Vulnerability Assessment for Snow Leopards and their Prey Species in the Altai-Sayan Ecoregion of Mongolia. Ulaanbaatar, Mongolia: World Wildlife Fund.

WWF and SLT, 2017. Advice Document Addendum to the General Guidelines for Snow Leopard Landscape Management Planning. Washington, D.C., USA: World Wildlife Fund.

Appendices

APPENDIX 1:
Project Indicator Summary

Standard Indicators		Target (5-Year Total)	Actual (5-Year Total)	Details
#1	Number of hectares of biological significance under improved management			Includes all areas of AHM Project field sites under improved management as a result of various natural resource management, patrolling, and research activities.
	Bhutan	101,000	491,400	
	India	65,000	146,350	
	Kyrgyz Republic	340,000	167,976	
	Mongolia	235,000	326,184	
	Nepal	26,000	203,500	
	Pakistan	45,000	92,000	
	Total	**812,000**	**1,427,410**	
#2	Number of hectares of biological significance showing improved biophysical conditions			Includes all areas under measurably improved biophysical conditions as a result of various natural resource management and patrolling activities, as evidenced by survival of planted trees and fodder crops, increased prey species counts, pasture recovery etc. In India and Nepal, due to the difficulty involved in quantifying improved biophysical conditions in slow-growing, high-altitude alpine pasture ecosystems and lack of a pre-project baseline data for snow leopard and blue sheep population size, the number of ha under improved biophysical conditions is conservatively reported as 0 ha.
	Bhutan	6,250	114	
	India	4,000	0	
	Kyrgyz Republic	66,000	149,117	
	Mongolia	86,000	6,000	
	Nepal	6,000	0	
	Pakistan	3,400	18,183	
	Total	**171,650**	**173,414**	

Standard Indicators		Target (5-Year Total)	Actual (5-Year Total)	Details
#3	Number of people trained in natural resource management and/or biodiversity conservation			Includes participants of large public conservation awareness raising events and targeted trainings on climate change adaptation, watershed management, natural resource management, forest management, wildlife monitoring, landscape management planning, school programs, and capacity building trainings for protected area staff, citizen scientists, and community conservation group members. Note: These are 5-year totals and some participants have attended multiple trainings and events.
	Bhutan	1,047	7,012	
	India	1,250	2,125	
	Kyrgyz Republic	350	2,598	
	Mongolia	280	3,519	
	Nepal	645	2,936	
	Pakistan	450	8,109	
	Regional	180	667	
	Total	**4,202**	**26,966**	
#4	Number of person hours of training in natural resource management and/or biodiversity conservation			Total person hours for trainings listed under Indicator 3, above.
	Bhutan	5,128	46,308	
	India	7,600	13,062	
	Kyrgyz Republic	7,150	17,052	
	Mongolia	6,560	13,316	
	Nepal	11,260	15,561	
	Pakistan	9,000	30,736	
	Regional	3,360	10,043	
	Total	**50,058**	**146,078**	
#5	Number of people with increased economic benefits derived from sustainable natural resource management and conservation			Includes project beneficiaries with economic benefits derived from improved drinking and irrigation water systems and various climate-smart livelihood trainings and support, such as for livestock vaccination campaigns, greenhouse farming, handicraft production, and ecotourism. Note: These are 5-year totals and some participants have benefited from more than one activity.
	Bhutan	5,200	4,441	
	India	250	462	
	Kyrgyz Republic	470	880	
	Mongolia	2,480	298	
	Nepal	210	5,071	
	Pakistan	18,392	26,304	
	Regional	7,532	0	
	Total	**34,534**	**37,456**	

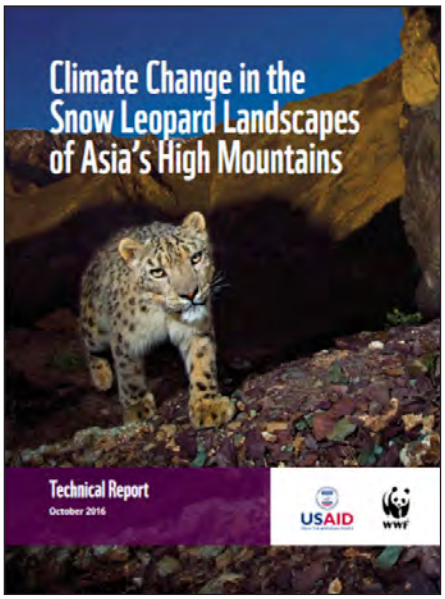
Standard Indicators		Target (5-Year Total)	Actual (5-Year Total)	Details
#6	Number of stakeholders with increased capacity to adapt to the impacts of climate variability and change as a result of USG assistance			Includes project beneficiaries that participated in climate vulnerability assessments, climate change and adaptation trainings, and climate adaptation field and livelihood activities. Note: These are 5-year totals and some participants have participated in more than one activity.
	Bhutan	900	4,251	
	India	230	618	
	Kyrgyz Republic	370	1,063	
	Mongolia	2,580	421	
	Nepal	1,150	7,339	
	Pakistan	400	25,424	
	Regional	260	333	
	Total	**5,890**	**39,449**	
#7	Number of USG-assisted consensus-building processes resulting in an agreement			Includes agreements reached with respect to project activities, such as partner participation and responsibilities in these activities, agreements reached to establish local conservation groups, agreements reached to finalize and implement various conservation strategies and plans, and agreements reached under the GSLEP Process.
	Bhutan	6	12	
	India	20	9	
	Kyrgyz Republic	10	13	
	Mongolia	7	11	
	Nepal	2	5	
	Pakistan	9	19	
	Regional	7	7	
	Total	**61**	**76**	
#8	Number of Civil Society Organizations (CSOs) receiving USG assistance engaged in advocacy interventions			Includes community conservation groups, NGOs, and school nature clubs participating in project activities.
	Bhutan	11	16	
	India	12	32	
	Kyrgyz Republic	24	29	
	Mongolia	8	22	
	Nepal	41	72	
	Pakistan	10	38	
	Regional	6	19	
	Total	**112**	**228**	

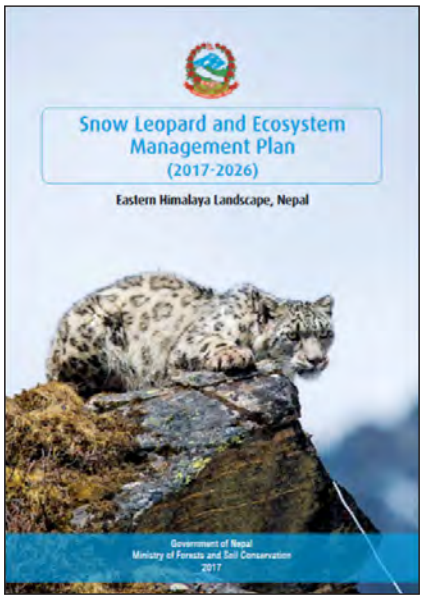
Standard Indicators		Target (5-Year Total)	Actual (5-Year Total)	Details
#9	Number of households benefiting from human-wildlife conflict mitigation schemes			Includes households participating in predator-proof corral, livestock insurance, and livestock vaccination activities. Note: These are 5-year totals and some households have benefited from more than one activity.
	Bhutan	75	67	
	India	80	0	
	Kyrgyz Republic	20	20	
	Mongolia	40	64	
	Nepal	250	119	
	Pakistan	1,900	2,062	
	Total	**2,365**	**2,332**	
#10	Number of households that adopt water-smart technology			Includes households benefiting from irrigation and drinking water system improvements.
	Bhutan	250	335	
	India	220	0	
	Kyrgyz Republic	10	36	
	Mongolia	3	16	
	Nepal	380	904	
	Pakistan	0	850	
	Total	**863**	**2,141**	
#11	Number of wildlife trade recommendations adopted			Includes MoUs signed with government agencies on combating illegal wildlife trade activities, wildlife trade law enforcement trainings, establishment of community anti-poaching groups, anti-poaching trainings, and anti-poaching field patrol activities.
	Bhutan	4	7	
	India	2	4	
	Kyrgyz Republic	6	5	
	Mongolia	4	4	
	Nepal	9	1	
	Pakistan	5	5	
	Regional	7	2	
	Total	**37**	**28**	

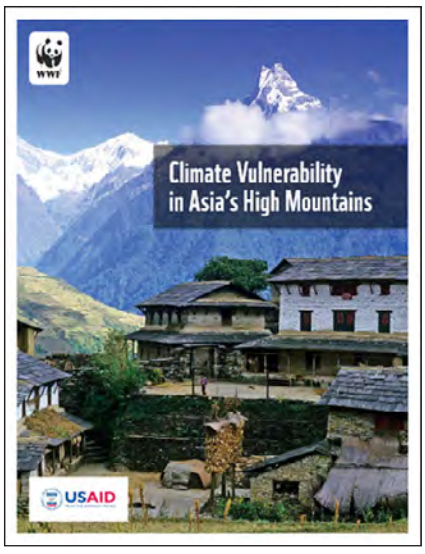
Standard Indicators		Target (5-Year Total)	Actual (5-Year Total)	Details
#12	Number of institutions participating in a transnational alliance			Includes institutions participating in the GSLEP process each project year, such as GSLEP member state government environment ministries, their subsidiary departments, and NGOs and international finance institutions funding the GSLEP process. Note: These are 5-year totals and some institutions have been counted in multiple years.
	Bhutan	2	5	
	India	2	5	
	Kyrgyz Republic	6	5	
	Mongolia	4	6	
	Nepal	8	6	
	Pakistan	3	6	
	Regional	30	75	
	Total	**55**	**108**	

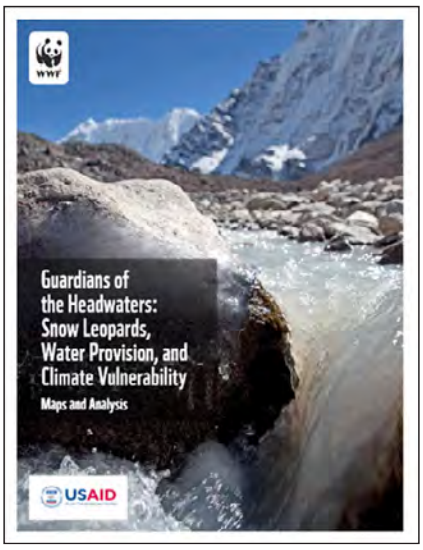
Appendix 2.

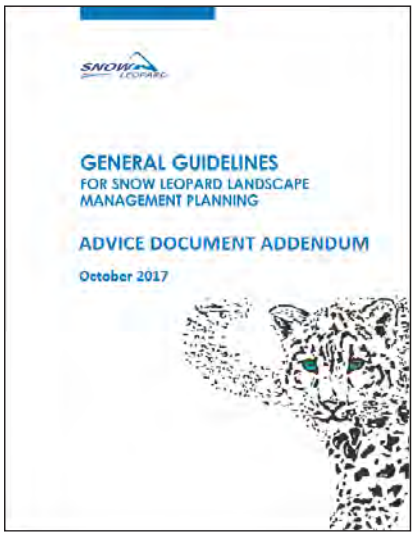
Major Reports and Brochures Produced through the AHM Project

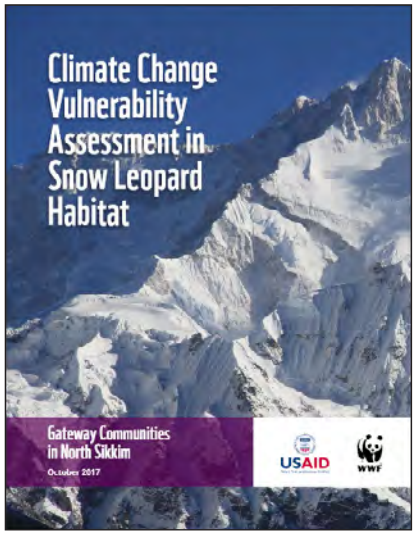


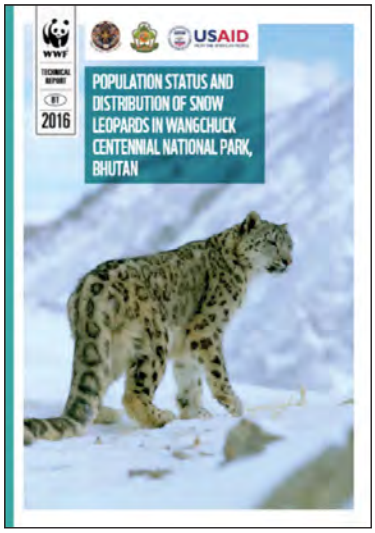







GENERAL GUIDELINES
FOR SNOW LEOPARD LANDSCAPE MANAGEMENT PLANNING
ADVICE DOCUMENT ADDENDUM
October 2017


Climate Change Vulnerability Assessment in Snow Leopard Habitat
Gateway Communities in North Sikkim
October 2017
USAID
WWF

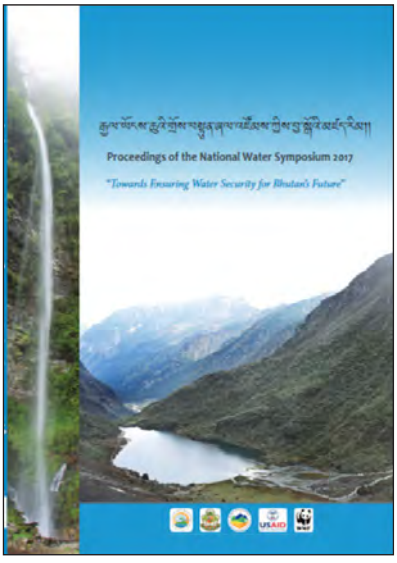

WWF
TECHNICAL REPORT
2016
USAID
POPULATION STATUS AND DISTRIBUTION OF SNOW LEOPARDS IN WANGCHUCK CENTENNIAL NATIONAL PARK, BHUTAN


USAID
WWF
International Snow Leopard and Ecosystem Forum
Science Symposium and Exposition
Presentation Abstracts


WORLD WILDLIFE
DISCOVER KYRGYZSTAN


WWF
OVERVIEW
2017
CLIMATE ADAPTATION HIGHLIGHTS
CONSERVATION AND ADAPTATION IN ASIA'S HIGH MOUNTAIN LANDSCAPES AND COMMUNITIES PROJECT
USAID
TRAFFIC

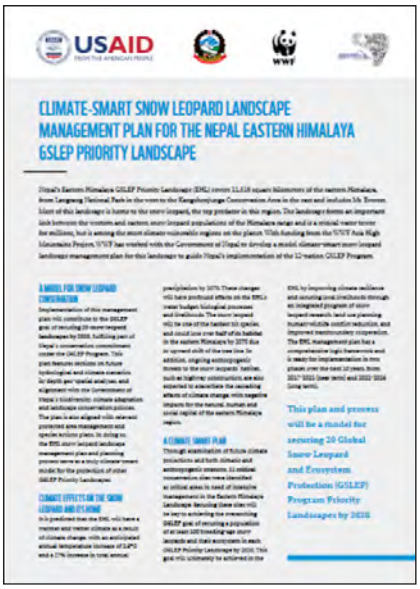

WWF
OVERVIEW
2017
SNOW LEOPARD CONSERVATION HIGHLIGHTS
CONSERVATION AND ADAPTATION IN ASIA'S HIGH MOUNTAIN LANDSCAPES AND COMMUNITIES PROJECT
USAID
TRAFFIC


Proceedings of the National Water Symposium 2017
"Towards Ensuring Water Security for Bhutan's Future"


WWF
OVERVIEW
2016
CONSERVATION AND ADAPTATION IN ASIA'S HIGH MOUNTAIN LANDSCAPES AND COMMUNITIES
USAID
TRAFFIC

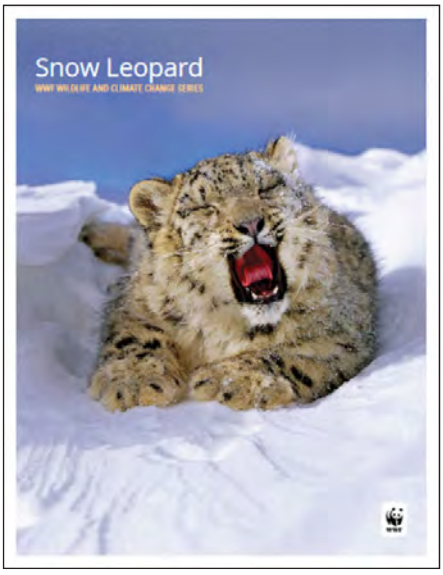

USAID
7 YEARS OF USAID SUPPORT FOR WWF ACTIVITIES IN NEPAL'S KANGCHENJUNGA REGION (2010-2017)
KANCHENJUNGA CONSERVATION AREA, EASTERN NEPAL


USAID
CONSERVATION AND ADAPTATION IN ASIA'S HIGH MOUNTAINS
(2012-2017)
2 billion
6 countries
DEMONSTRATION SITES


USAID
CLIMATE-SMART SNOW LEOPARD LANDSCAPE MANAGEMENT PLAN FOR THE NEPAL EASTERN HIMALAYA GSLEP PRIORITY LANDSCAPE


USAID
WWF ASIA HIGH MOUNTAINS PROJECT SUPPORT FOR THE GLOBAL SNOW LEOPARD AND ECOSYSTEM PROTECTION PROGRAM
A GLOBAL INITIATIVE

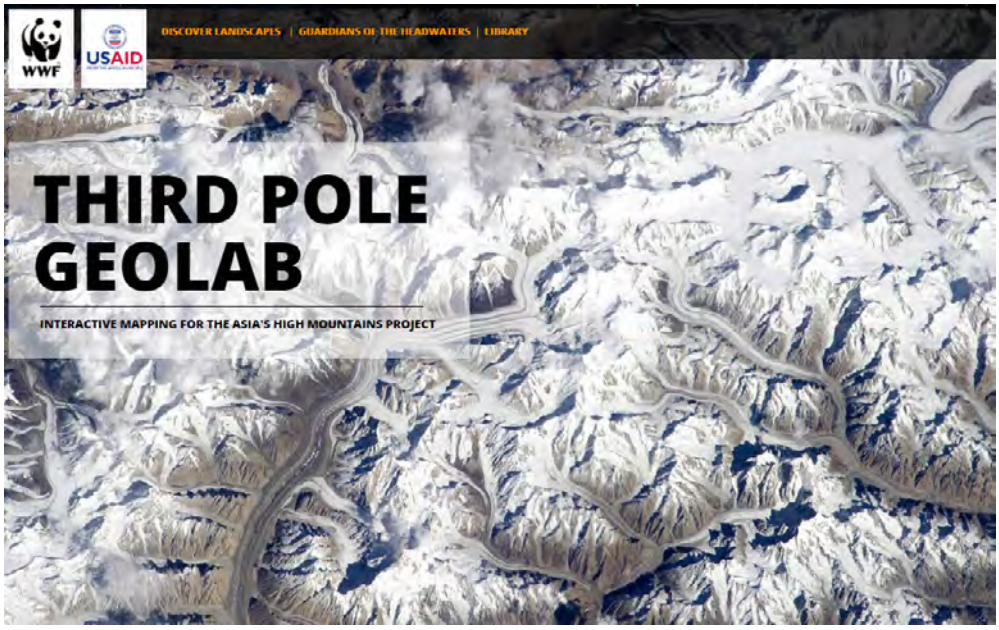

Conservation & Adaptation in
Asia's High Mountains
On Camera: a snow leopard with four cubs spotted in Mongolia
Research: new report estimates more than 4 snow leopards poached every week
In the Press: global coverage of AHM activities
Snow Leopard Landscapes: progress made in securing the snow leopard's home
UPDATE FROM GSLEP

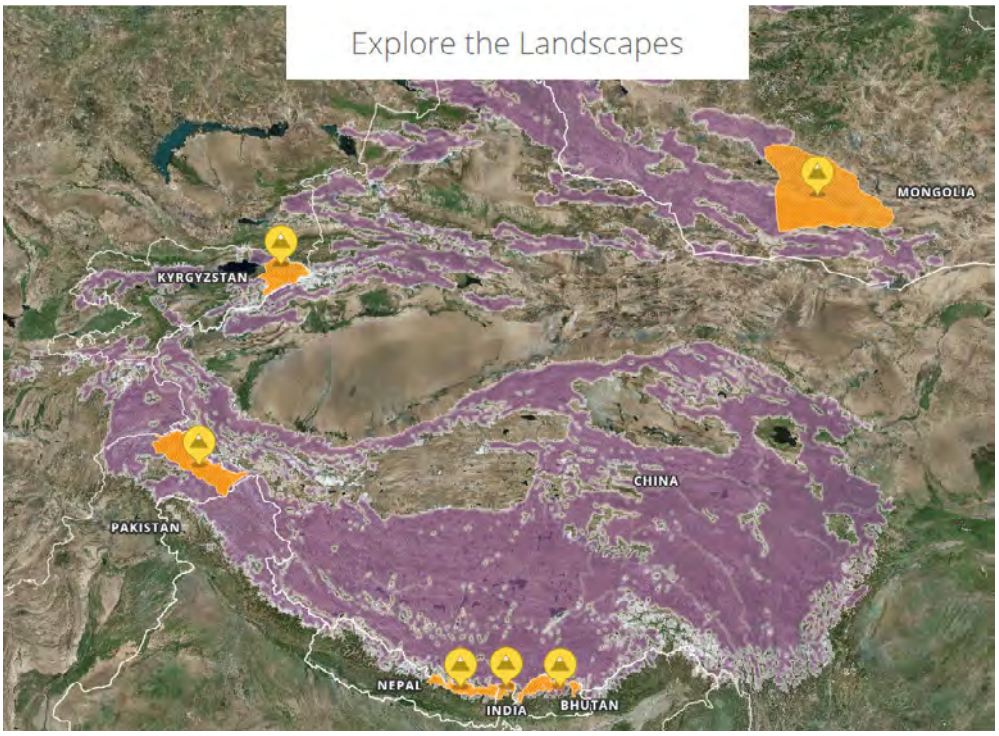

Snow Leopard
WWF WILDLIFE AND CLIMATE CHANGE SERIES

Appendix 3.

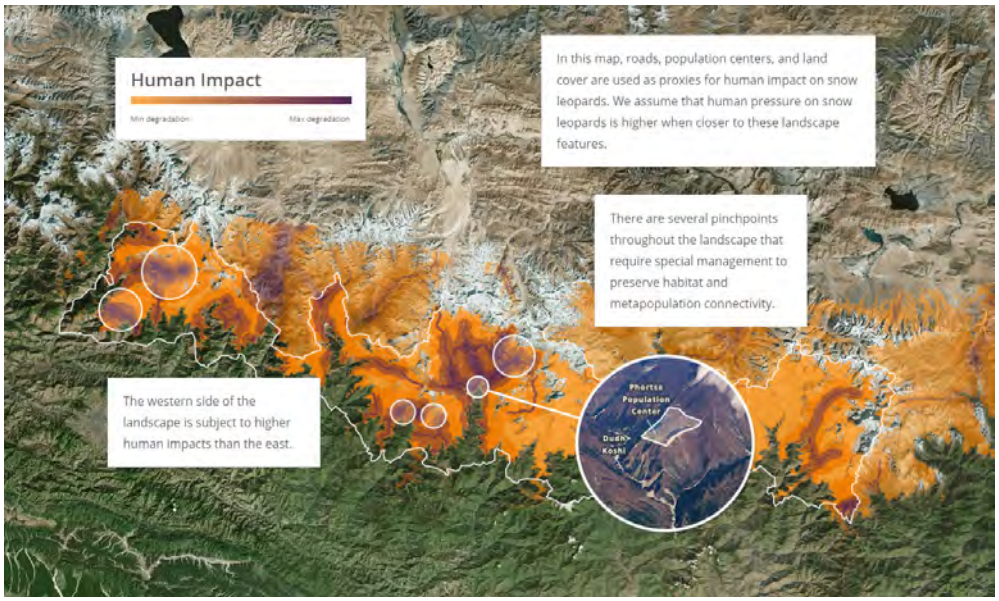
Interactive Communications through the Third Pole Geolab

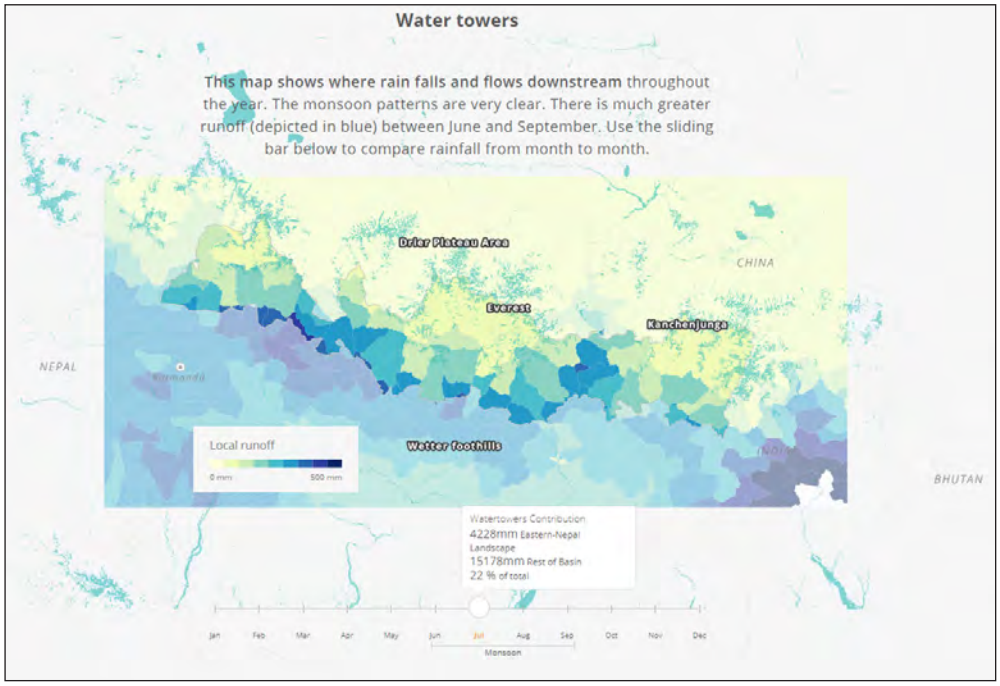
The following are screenshots of sections from the interactive mapping and communications website, www.thirdpolegeolab.org. For full interactivity, including downloads of GIS data used to create the maps, and the accompanying reports that provide full analysis, methods and sources, "Guardians of the Headwaters Volume II: Biodiversity, Water, and Climate in Six Snow Leopard Landscapes," please visit this site and www.worldwildlife.org/ahm.

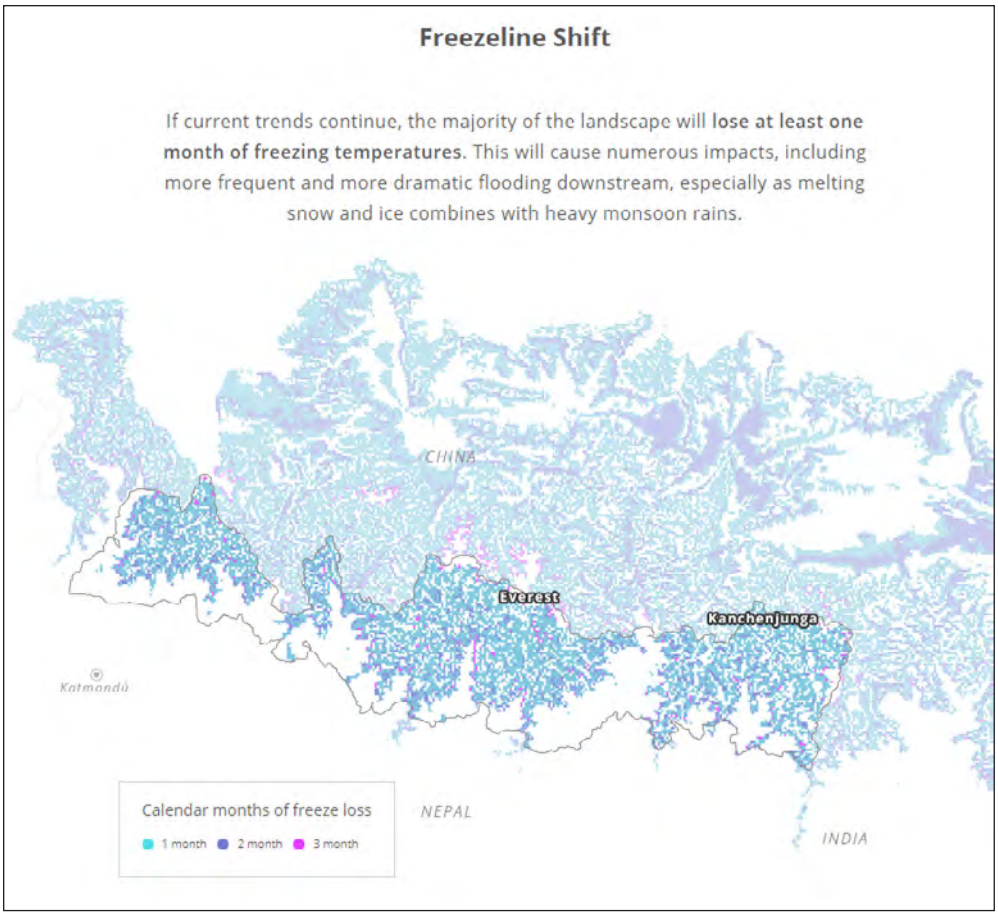


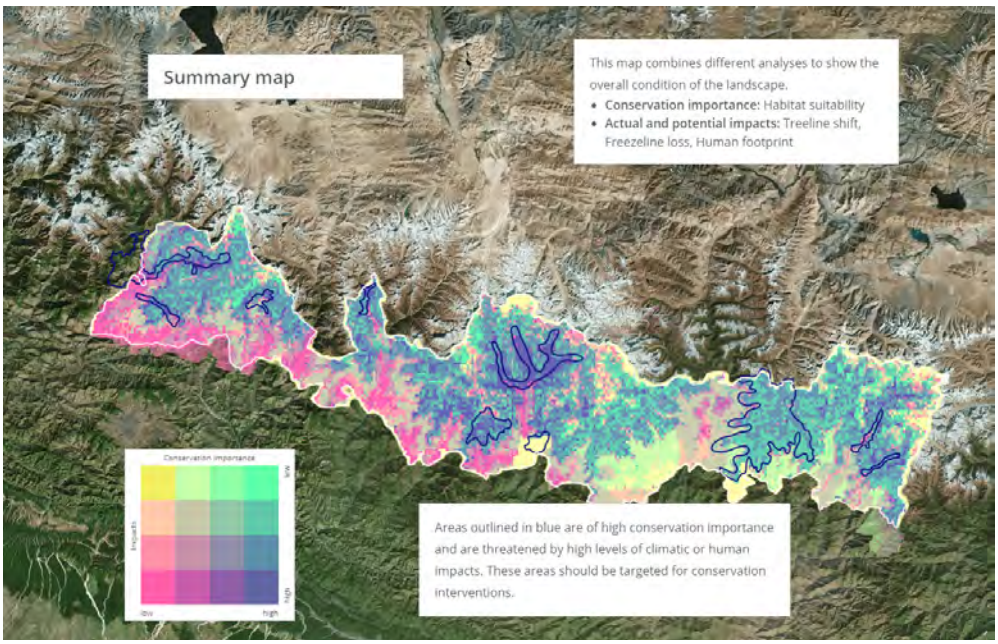

Explore the Landscapes
MONGOLIA
KYRGYZSTAN
CHINA
PAKISTAN
NEPAL
INDIA
BHUTAN


Snow Leopard Habitat in Eastern Nepal
There is approximately 5,800 km2 of snow leopard habitat in eastern Nepal, located in four discrete blocks that are connected via habitat in China.
Snow leopards have been observed travelling to neighboring habitats in India and China, showing the importance of transboundary management.
CHINA
NEPAL
INDIA
Everest
Kanchenjunga
Kathmandu
1
2
3
4
Potential Snow Leopard Habitat
Good Habitat
Fair Habitat


Human Impact
Min degradation
Max degradation
In this map, roads, population centers, and land cover are used as proxies for human impact on snow leopards. We assume that human pressure on snow leopards is higher when closer to these landscape features.
There are several pinchpoints throughout the landscape that require special management to preserve habitat and metapopulation connectivity.
The western side of the landscape is subject to higher human impacts than the east.
Phortse Population Center
Dudh Koshi


Water towers
This map shows where rain falls and flows downstream throughout the year. The monsoon patterns are very clear. There is much greater runoff (depicted in blue) between June and September. Use the sliding bar below to compare rainfall from month to month.
Drier Plateau Area
CHINA
Everest
Kanchenjunga
NEPAL
Kathmandu
Wetter foothills
BHUTAN
Local runoff
0 mm
500 mm
Watertowers Contribution
4228mm Eastern-Nepal Landscape
15178mm Rest of Basin
22 % of total
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monsoon


Freezeline Shift
If current trends continue, the majority of the landscape will lose at least one month of freezing temperatures. This will cause numerous impacts, including more frequent and more dramatic flooding downstream, especially as melting snow and ice combines with heavy monsoon rains.
CHINA
Everest
Kanchenjunga
Katmandú
NEPAL
INDIA
Calendar months of freeze loss
1 month
2 month
3 month


Summary map
This map combines different analyses to show the overall condition of the landscape.
Conservation importance: Habitat suitability
Actual and potential impacts: Treeline shift, Freezeline loss, Human footprint
Areas outlined in blue are of high conservation importance and are threatened by high levels of climatic or human impacts. These areas should be targeted for conservation interventions.

Appendix 4.
AHM Project Communications Products

Product	Description	Link	Location	Date
America Adapts: Conservation and Adaptation in Asia's High Mountain Landscapes	In episode 57 of America Adapts, Doug Parsons talks with experts from all over the world focusing on the conservation of the elusive snow leopard of High Asia and how this species and the communities around this species, are adapting to climate change.	http://americaadapts.org/2018/01/08/conservation-and-adaptation-in-asias-high-mountain-landscapes-the-snow-leopard/	Global	January 2018
Securing the Third Pole: Science, Conservation, and Community Resilience in Asia's High Mountains	Event at The Wilson Center brought together experts on climate change, water provision, and snow leopard conservation to discuss climate change and threats across Asia's high mountains.	https://www.wilsoncenter.org/event/securing-the-third-pole-science-conservation-and-community-resilience-asias-high-mountains	Washington, DC	October 2017
Twitter Chat: Co-Benefits of Integrating Biodiversity Conservation and Adaptation	Explored the intersection of biodiversity conservation and climate adaptation, highlighting the site level and regional interventions pursued by the project	https://www.climatelinks.org/blog/benefits-integrating-biodiversity-conservation-and-climate-change-adaptation-global-development	Global	October 2017
Climate Change Vulnerability Assessment in Snow Leopard Habitat: Gateway Communities in North Sikkim	A vulnerability assessment exercise was undertaken with the purpose of gaining understanding on vulnerability to climate change in limited a geographic scope using desktop review, community consultations and an expert workshop.	https://c402277.ssl.cf1.rackcdn.com/publications/1132/files/original/Vulnerability_Assessment_Sikkim_India-2017.pdf?1513959528	India	October 2017
New weather stations support climate and water research in Bhutan	Researchers have set up four weather stations in the mountains of northern Bhutan, allowing them to monitor conditions at various altitudes over the long-term and help determine the best ways to help wildlife in the region adapt to climate change.	https://www.worldwildlife.org/stories/new-weather-stations-support-climate-and-water-research-in-bhutan	Bhutan	October 2017

Product	Description	Link	Location	Date
General Guidelines for Snow Leopard Landscape Management Planning: Advice Document Addendum	Details the principles of strategic management planning and suggested planning process.	https://c402277.ssl.cf1.rackcdn.com/publications/1137/files/original/GSLEP_Landscape_Mangement_Planning_Advice_Documents-COMPILED-2017.10-NXP.pdf?1515008467	Regional	October 2017
Climatelinks blog: Ensuring Asia's 'Ghosts of the Mountain' thrive in the face of climate change	Description of integrated, climate-smart approach to snow leopard conservation using site-specific climate adaptation activities based on socioeconomic surveys and climate vulnerability assessments	https://www.climatelinks.org/blog/ensuring-asia%E2%80%99s-%E2%80%98ghosts-mountain%E2%80%99-thrive-face-climate-change	Regional	September 2017
Snow Leopard and Ecosystem Management Plan (2017-2026)	This plan is an in-depth analysis of the current bio-climatic and socio-economic situation; an assessment of future scenarios based on anthropogenic pressures and climatic impacts; and development of climate integrated conservation plan.	https://c402277.ssl.cf1.rackcdn.com/publications/1108/files/original/snow_leopard___ecosystem_management_plan.pdf?1509642640	Nepal	August 2017
Climate-Smart Snow Leopard Landscape Management Plan for The Nepal Eastern Himalaya GSLEP Priority Landscape	WWF worked with the Government of Nepal to develop a model climate-smart snow leopard landscape management plan for this landscape to guide Nepal's implementation of the 12-nation GSLEP Program.	https://c402277.ssl.cf1.rackcdn.com/publications/1130/files/original/Summary_Nepal%E2%80%99s_Eastern_Himalaya_Landscape_Management_Plan.pdf?1513019181	Nepal	August 2017
Nepal introduces a climate-smart plan to protect snow leopards	In August 2017, Nepal made conservation history by becoming the first country to launch its climate-smart snow leopard landscape management plan, leading the way in safeguarding the species and its habitat.	https://www.worldwildlife.org/stories/nepal-introduces-a-climate-smart-plan-to-protect-snow-leopards	Nepal	August 2017
Nepal leads the way in snow leopard conservation in global summit	Nepal has made conservation history by becoming the first country to launch its climate-smart snow leopard landscape management plan, leading the way in safeguarding the species and its habitat.	http://www.wwfnepal.org/?uNewsID=309210	Nepal	August 2017
WWF Asia High Mountains Project Support for The Global Snow Leopard and Ecosystem Protection Program	The WWF AHM Project has worked closely with the Snow Leopard Trust (SLT), World Bank Global Tiger Initiative, UNDP, GEF and other partners to support the GSLEP process since its inception, helping strengthen member states' capacity and ability to deliver on their national snow leopard protection programs.	https://c402277.ssl.cf1.rackcdn.com/publications/1128/files/original/AHM_Project_Support_for_the_GSLEP.pdf?1513018915	Regional	August 2017

Product	Description	Link	Location	Date
International Snow Leopard and Ecosystem Forum Science Symposium and Exposition Presentation Abstracts	The symposium brought together leading researchers and conservationists for a discussion covering present and future impacts of climate change on snow leopard range, climate change adaption strategies for communities and ecosystems, community conservation initiatives, and poaching and trafficking of snow leopards.	https://c402277.ssl.cf1.rackcdn.com/publications/1097/files/original/GSLEP_Compiled_Abstracts-2017.09.25-Final.pdf?1507142617	Regional	August 2017
Snow Leopard Conservation Highlights	Summary of GSLEP support, landscape management plan development, and field interventions in the 6 AHM Project countries.	https://c402277.ssl.cf1.rackcdn.com/publications/1135/files/original/Snow_Leopard_Conservation_Highlights.pdf?1513698556	Regional	August 2017
Proceedings of the National Water Symposium 2017	The symposium generated information on management and development of water resources, identified priority areas of cooperation on water resources management and development, and identified priority research areas for water resource management.	https://c402277.ssl.cf1.rackcdn.com/publications/1107/files/original/Proceedings_of_the_National_Water_Symposium_2017.pdf?1509642558	Bhutan	August 2017
Changing People and Landscapes: Farida's Story	Chronicles the experience of a WWF staff member and her engagement with local communities and connection with snow leopard conservation.	https://www.worldwildlife.org/stories/changing-people-and-landscapes-farida-s-story	Kyrgyzstan	May 2017
Nepal successfully collars four snow leopards in four years	A snow leopard was successfully collared in Kanchenjunga Conservation Area on May 8, 2017 making it the fourth one to be collared in Nepal's eastern snow leopard conservation complex.	https://www.worldwildlife.org/stories/nepal-successfully-collars-four-snow-leopards-in-four-years	Nepal	May 2017
AHM Quarterly Newsletter	GSLEP event with snow leopard range countries on climate-smart conservation, snow leopard with 4 cubs in Mongolia, progress on landscape management planning.	https://c402277.ssl.cf1.rackcdn.com/publications/990/files/original/February_Newsletter_2017_Print.pdf?1487773117	Regional	February 2017
Snow leopard range countries gear up for climate-smart conservation	Delegates from the 12 snow leopard range countries met in Kathmandu to strengthen their commitment to snow leopard conservation and chart a way forward to secure a future for this elusive and endangered cat.	https://www.worldwildlife.org/stories/snow-leopard-range-countries-gear-up-for-climate-smart-conservation	Regional	February 2017

Product	Description	Link	Location	Date
Laying the groundwork for snow leopard conservation in Sikkim	Documents citizen scientist engagement in snow leopard monitoring and conservation.	https://www.worldwildlife.org/stories/laying-the-groundwork-for-snow-leopard-conservation-in-sikkim	India	February 2017
Adapting to new challenges in the Tian Shan Mountains	Details climate adaptation and snow leopard conservation interventions in Kyrgyzstan.	https://www.worldwildlife.org/stories/adapting-to-new-challenges-in-the-tian-shan-mountains	Kyrgyzstan	January 2017
AHM Project Overview	Description of AHM work in demonstration sites in 6 countries, and critical support for the GSLEP.	https://c402277.ssl.cf1.rackcdn.com/publications/1131/files/original/USAID_Project_Overview.pdf?1513019316	Regional	2017
7 Years of USAID Support for WWF Activities In Nepal's Kangchenjunga Region (2010-2017)	Two-page brochure summarizing livelihood benefits in Kanchenjunga as a result of sustained USAID investment in the community-managed conservation area.	https://c402277.ssl.cf1.rackcdn.com/publications/1126/files/original/7_Years_of_USAID_Support_for_WWF_Activities_in_Nepal's_Kangchenjunga_Region.pdf?1513018465	Nepal	2017
Climate Adaptation Highlights	Summary of AHM contributions to climate adaptation research and interventions, including vulnerability assessments, regional mapping, and field activities in the 6 project countries.	https://c402277.ssl.cf1.rackcdn.com/publications/1127/files/original/Climate_Adaptation_Highlights.pdf?1513018609	Regional	2017
An Ounce of Prevention: Snow Leopard Crime Revisited	Snow Leopard poaching and trafficking is revisited 13 years after TRAFFIC's first report on the subject, Fading Footprints: The Killing and Trade of Snow Leopards (Theile, 2003).	https://c402277.ssl.cf1.rackcdn.com/publications/963/files/original/Snow-Leopard-Report.pdf?1476907652	Regional	2016
Conservation and Adaptation in Asia's High Mountain Landscapes and Communities	Project overview of demonstration site work in 6 countries, international collaboration, and support for GSLEP management plans.	https://c402277.ssl.cf1.rackcdn.com/publications/961/files/original/AHM_Overview_Brochure-2016.10.17-Web.pdf?1476906099	Regional	2016

Product	Description	Link	Location	Date
Nepal Celebrates International Snow Leopard Day with Participatory Art Event	WWF Nepal joined the global celebration of International Snow Leopard Day by organizing a participatory art event in the historic Patan Durbar Square on 23 October 2016.	http://wwf.panda.org/wwf_news/?282430/Nepal-Celebrates-International-Snow-Leopard-Day-with-Participatory-Art-Event	Nepal	October 2016
Climate Change in the Snow Leopard Landscapes of Asia's High Mountains	This analysis outlines the specific risks posed to six snow leopard landscapes in the following project areas: Eastern Nepal, Sikkim, Bhutan, South Gobi, Central Tienshan/Sarychat, and the Kara- koram-Pamir Range.	https://c402277.ssl.cf1.rackcdn.com/publications/1125/files/original/WWF_AHM_Technical_Climate_Report.pdf?1513959859	Regional	October 2016
Population Status and Distribution of Snow Leopards in Wangchuck Centennial National Park, Bhutan	This study was undertaken to determine the population size, density, and distribution of snow leopards and their prey species in Bhutan's Wangchuck Centennial National Park (WCNP).	https://c402277.ssl.cf1.rackcdn.com/publications/960/files/original/WCP_SL_Survey-Final_Technical_Report-2016.10.05-Final-Lo_Res.pdf?1476907901	Bhutan	October 2016
Snow leopard research provides new challenges to an old hand	The Head of Research in Wangchuck Centennial National Park (WCNP) details his experience with surveying snow leopards.	https://www.worldwildlife.org/stories/snow-leopard-research-provides-new-challenges-to-an-old-hand	Bhutan	October 2016
Children help secure a future for snow leopards in Mongolia	Children in Mongolia mobilized to speak out against trapping at local community meetings attended by their parents, and announced a novel approach to ridding their mountain of traps. In exchange for traps surrendered to school eco-club members, local herders would receive a milk can or other useful household items.	https://www.worldwildlife.org/stories/children-help-secure-a-future-for-snow-leopards-in-mongolia	Mongolia	August 2016
Snow leopard research breathes new life into community conservation in Nepal	Just beyond the remote mountain village of Yangma in the high Himalayas of eastern Nepal, Nepali conservationists fitted a female snow leopard with a GPS collar. The collar will allow scientists to track this snow leopard's movements daily for the next year.	https://www.worldwildlife.org/stories/snow-leopard-research-breathes-new-life-into-community-conservation-in-nepal	Nepal	July 2016
AHM Quarterly Newsletter	Update from GSLEP, snow leopard collaring in Nepal, community-based snow leopard conservation in Mongolia and Pakistan.	https://c402277.ssl.cf1.rackcdn.com/publications/911/files/original/AHM_Newsletter_No2-2016-07-12.pdf?1468331614	Regional	July 2016

Product	Description	Link	Location	Date
Nine snow leopard range countries equipped with tools for climate smart landscape management planning	Over 40 representatives from nine of 12 snow leopard range countries gathered in Kathmandu, Nepal, in April 2016 for a workshop on climate smart conservation planning at the landscape level to protect the iconic snow leopard and its habitat.	https://www.worldwildlife.org/stories/nine-snow-leopard-range-countries-equipped-with-tools-for-climate-smart-landscape-management-planning	Regional	June 2016
A young generation in India takes stewardship of their environment June 2015	Engaging youth to address plastic water bottle waste while boosting ecotourism in North Sikkim.	https://www.worldwildlife.org/stories/a-young-generation-in-india-takes-stewardship-of-their-environment	India	April 2016
AHM Quarterly Newsletter	Update from Paris, Lessons from Mongolia, The Ghost of the Mountains documentary screening.	https://c402277.ssl.cf1.rackcdn.com/publications/854/files/original/AHM_Newsletter-2016.02.01-Final.pdf?1454954157	Regional	January 2016
'Discover Kyrgyzstan' in *World Wildlife* magazine	As climate change makes Asia's high mountains more arid, snow leopards become a rallying point to help the people of Kyrgyzstan seek new ways to adapt.	https://c402277.ssl.cf1.rackcdn.com/publications/923/files/original/WWF-Kyrgyzstan_Reprint_FINAL.pdf?1470667127	Kyrgyzstan	November 2015
The Earth Has a Third Pole—And Millions of People Use Its Water	Warming temperatures are causing many of the Third Pole's glaciers to shrink, seasonal snow to melt rapidly, and thawing Tibet's vast stores of permafrost. That rapid melting and thawing is changing the landscape and posing risks for communities and species in the region—threatening livelihoods, food sources and water security.	https://www.worldwildlife.org/stories/the-earth-has-a-third-pole-and-millions-of-people-use-its-water	Regional	June 2015
What animals live in the Asia high mountains? And eight other Asia high mountains facts	The countries of High Asia, why the mountains are important, the species residing there, and engagement with local communities for conservation.	https://www.worldwildlife.org/stories/what-animals-live-in-the-asia-high-mountains-and-eight-other-asia-high-mountains-facts	Regional	2015
Fragile Connections: Snow Leopards, People, Water and the Global Climate	Explores climate change threats to snow leopards and regional water supplies.	http://d2ouvy59p0dg6k.cloudfront.net/downloads/fragile_connections__final_with_links_.pdf	Range Wide	2015

Product	Description	Link	Location	Date
Citizen Scientists Saving Snow Leopards	Nomadic herders work to help an endangered species and conserve Asia's High Mountains.	https://www.worldwildlife.org/stories/citizen-scientists-saving-snow-leopards	Mongolia	July 2014
Third Pole GeoLab	Interactive mapping and clearinghouse for climate impacts, adaptation, and water security across the snow leopard range.	http://www.thirdpolegeolab.org/	Regional	June 2014
Climate Vulnerability in Asia's High Mountains	Explores regional solutions appropriate for broader approaches to climate change in AHM, and suggests a range of possible interventions to provide more immediate benefits to communities in AHM.	https://c402277.ssl.cf1.rackcdn.com/publications/757/files/original/WWF_Freshwater_AHMClimate_WEB.pdf?1420559752	Regional	May 2014
Guardians of the Headwaters: Snow Leopards, Water Provision, and Climate Vulnerability	Series of maps and analyses surrounding the water provision services of snow leopard habitat and climate change risk.	https://c402277.ssl.cf1.rackcdn.com/publications/758/files/original/WWF_Freshwater_MapBook_WEB.pdf?1420560362	Regional	February 2014
Building a Future for Snow Leopards	Countries come together to ensure 20 healthy snow leopard landscapes by 2020.	https://www.worldwildlife.org/stories/building-a-future-for-snow-leopards		

Videos produced by the AHM Project

Snow Leopards, Water, People and Climate Change
Why protecting the snow leopard is important to the people who live around its mountain habitat.
https://www.youtube.com/watch?v=w-wnuB9uZ-XE
WWF International

The Ghost of the Mountains [LONG VERSION]
See how scientists, local community members and conservationists work together to track and put a satellite collar on a snow leopard in Nepal.
https://www.youtube.com/watch?v=fj8Rd-wNL-NA
WWF Nepal

The Ghost of the Mountains [TRAILER]
The tough terrain in the shadow of the world's third highest mountain is home to one of nature's most elusive cats, the snow leopard.
https://www.youtube.com/watch?v=b6xTvs-juxxE
WWF Nepal

Spirit of the Mountain
Mongolia is home to the second largest snow leopard population in the world. This film was made to encourage Mongolian herders to abandon retaliatory killing of snow leopards and work to protect them instead.
https://www.youtube.com/watch?v=B9IyG-G88kTg
WWF Mongolia

How are Remote Mountain Villages in Eastern Nepal Becoming Climate Smart?
Watch for an in-depth look into how an integrated, climate-smart approach to conservation through WWF's Asia High Mountains Project.
https://www.dropbox.com/s/7cfk3igi1fonwwk/climate%20smart%20final.mp4?dl=0
WWF-US

A Look Back at WWF Achievements in Nepal's Kanchenjunga Conservation Area (KCA)
This short video highlights the remarkable achievements of WWF and KCA communities in securing a future for this globally important treasure.
https://www.dropbox.com/s/g8ntfj0eein5g0l/final%20retrospective%201%20min.mp4?dl=0
WWF Nepal

How does a hunter become a ranger?
Find out in this video from Mongolia.
https://www.youtube.com/watch?v=EXl-jz7qOvsM
WWF Mongolia

Let a snow leopard cub's wish come true
This play by children from a local eco-club played a crucial part in the campaign to save snow leopards.
https://www.youtube.com/watch?v=8Uu4k-F9JvPA
WWF Mongolia

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