Identifying Priority Zones for a Protected Area Network in Afghanistan

Convention on Biological Diversity (CBD)

Programme of Work for Protected Areas (PoWPA) - Technical Report

National Environnmental Protection Agency (NEPA) of the Government of the Islamic Republic of Afghanistan

Nina Kanderian, Christopher Shank, McKenzie Johnson & Haqiq Rahmani (Wildlife Conservation Society - WCS)

Charles Hatch (ECODIT on behalf of Biodiversity Support Program (BSP) for NEPA)

December 2009

Identifying Priority Zones for a Protected Area Network in Afghanistan

Programme of Work for Protected Areas (PoWPA)

Analysis and report prepared by the Wildlife Conservation Society (WCS) & the Biodiversity Support Program (BSP) for the National Environment Protection Agency (NEPA)

Government of the Islamic Republic of Afghanistan

December 2009

DISCLAIMER: This report was made possible by the generous support of the Global Environment Facility (GEF) and the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the Wildlife Conservation Society and do not necessarily reflect the views of GEF, USAID or the United States Government.

ACRONYMS

AIMS	Afghanistan Information Management Service
AWEC	Afghanistan Wildlife Executive Committee
AZE	Alliance for Zero Extinction
AOI	Area of Interest
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Flora & Fauna
CoP	Conference of Parties
FAO	Food and Agriculture Organisation
GEF	Global Environment Facility
GIS	Global Information System
GoA	Government of Afghanistan
IBA	Important Bird Area
IUCN	The World Conservation Union
MAIL	Ministry of Agriculture, Irrigation, and Livestock
NEPA	National Environmental Protection Agency
NPASP	National Protected Areas System Plan
PA	Protected Area
PoWPA	Programme of Works for Protected Areas
PZ	Priority Zone
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USGS	United States Geological Survey
WCS	Wildlife Conservation Society
WDPA	World Database on Protected Areas
WWF	World Wildlife Fund for Nature

WWF Ecoregion Names & Codes – for quick reference

WWF Name	WWF code
Afghan Mountains semi-desert	PA1301
Badghyz and Karabil semi-desert	PA1306
Baluchistan xeric woodlands	PA1307
Central Afghan mountains xeric woodlands	PA1309
Central Persian desert basin	PA1313
East Afghan montane conifer forests	PA0506
Ghorat-Hazarajat alpine meadows	PA1004
Gissaro-Alai open woodlands	PA0808
Hindu Kush alpine meadows	PA1005
Karakoram-West Tibetan plateau alpine steppe	PA1006
North Western Himalayan alpine shrub and meadows	PA1012
Pamir alpine desert and tundra	PA1014
Paropamisus xeric woodlands	PA1322
Registan-North Pakistan sandy desert	PA1326
Sulaiman Range alpine meadows	PA1018
Western Himalayan subalpine conifer forests	IM0502

CONTENTS

EXECUTIVE SUMMARY 7

INTRODUCTION 8

THE PROGRAMME OF WORK ON PROTECTED AREAS WITHIN THE CONVENTION ON BIOLOGICAL DIVERSITY: PRINCIPLE GOALS & TARGETS 8
PROGRAMME OF WORK – PROTECTED AREAS IN AFGHANISTAN 10

GAP ANALYSIS AS A CONSERVATION PLANNING TOOL 10

BACKGROUND 10
GAP ANALYSES FOR AFGHANISTAN'S PROTECTED AREA NETWORK 11
NATIONAL TARGETS FOR PROTECTED AREAS IN AFGHANISTAN 15
PRIORITY ZONE CONCEPT 15

ECOREGIONAL AND SPECIES ANALYSES TO IDENTIFY PRIORITY ZONES & POTENTIAL PROTECTED AREAS: METHODOLOGIES 16

THE ECOREGIONAL APPROACH TO IDENTIFYING AFGHANISTAN'S PRIORITY ZONES & FUTURE PROTECTED AREA NETWORK 16
BACKGROUND 16
ECOREGIONAL CLASSIFICATION SYSTEMS & USE FOR SETTING TARGETS 17
PRIORITY ZONE IDENTIFICATION 19
THE FAUNA APPROACH TO IDENTIFYING AFGHANISTAN'S PRIORITY ZONES & FUTURE PROTECTED AREA NETWORK 20
BACKGROUND 20
THE FAUNA APPROACH: PROCESS FOR ESTABLISHING "AREAS OF INTEREST" 21
PROCESS FOR ANALYZING BIOME-RESTRICTED AND AT-RISK BIRD GROUPS 23
PRIORITY ZONE IDENTIFICATION 24
THE FLORA APPROACH TO IDENTIFYING AFGHANISTAN'S PRIORITY ZONES & FUTURE PROTECTED AREA NETWORK 24
BACKGROUND 24
THE FLORA APPROACH: PROCESS FOR ESTABLISHING PRIORITY ZONES 25
PRIORITY ZONE IDENTIFICATION 27

IDENTIFYING PRIORITY ZONES FOR AFGHANISTAN'S NATIONAL PROTECTED AREA SYSTEM PLAN: THE METHODOLOGY 28

JUSTIFICATION FOR APPROACH 28
PRIORITY ZONE CRITERIA 29
PRIORITY ZONE CRITERIA – RANKING & WEIGHTING SYSTEM 33

RESULTS FROM THE PRIORITY ZONE INVESTIGATION 38

PRIORITY ZONE RANKS & WHOLE-COUNTRY MAPS 38
ADDITIONAL INFORMATION FOR FURTHER PRIORITY ZONE REFINEMENT 40
ADDITIONAL INFORMATION ON FOCAL PLANT LOCATIONS 40
ADDITIONAL INFORMATION ON IMPORTANT BIRD AREAS, WETLANDS AND PREVIOUSLY PROPOSED PROTECTED AREAS 42
IDENTIFYING RESEARCH PRIORITY ZONES TO MEET 2015 PROTECTED AREA TARGETS 43
AFGHAN MOUNTAINS SEMI-DESERT 43
BADGHYZ & KARABIL SEMI-DESERT 44

GHORAT-HAZARAJAT ALPINE MEADOW 44
GISSARO-ALAI OPEN WOODLANDS (GLOBAL 200 ECOREGION) 44
HINDU KUSH ALPINE MEADOW (GLOBAL 200 ECOREGION) 45
KARAKORAM-WEST TIBETAN PLATEAU ALPINE STEPPE (GLOBAL 200 ECOREGION) 45
PAMIR ALPINE DESERT & TUNDRA 46
PAROPAMISUS XERIC WOODLANDS 46

SUMMARY AND MAIN CONCLUSIONS FROM THE PRIORITY ZONE INVESTIGATION 47

REFERENCES 50

Figures & Tables Contents

FIGURE 1: OFFICIALLY-DECLARED (BAND-I-AMIR) AND THIRTEEN (13) PREVIOUSLY PROPOSED PROTECTED AREAS OF AFGHANISTAN (WCS, 2009) 12
FIGURE 2: MAP OF WWF ECOREGIONS ACROSS AFGHANISTAN (WCS, 2009) 18
FIGURE 3: POTENTIAL HABITAT OF THE BROWN BEAR (*URSUS ARCTOS*) WITHIN AFGHANISTAN (WCS, 2009) 22
FIGURE 4: NUMBER AND DISTRIBUTION OF BIOME-RESTRICTED BIRD SPECIES WITHIN AFGHANISTAN (WCS, 2009) 24
FIGURE 5. MAP OF AFGHANISTAN DIVIDED INTO 313 2500KM^2 GRID CELLS (WCS, 2009) 31
FIGURE 6: FINAL PRIORITY ZONE MAP FOR AFGHANISTAN, WITH PRIORITY ZONE RANKS DISPLAYED (WCS, 2009) 39
FIGURE 7: FINAL PRIORITY ZONE MAP FOR AFGHANISTAN, WITH CELL REFERENCE NUMBERS DISPLAYED (WCS, 2009) 39
FIGURE 8: PRIORITY ZONE MAP FOR AFGHANISTAN, WITH ADDITIONAL PLANT SIGHTING DATA DISPLAYED (WCS & ECODIT, 2009) 41
FIGURE 9: PRIORITY ZONE MAP FOR AFGHANISTAN, WITH ADDITIONAL DATA DISPLAYING IMPORTANT BIRD AREAS, BIOLOGICALLY-IMPORTANT WETLANDS AND PREVIOUSLY PROPOSED PROTECTED AREAS (WCS, 2009) 42
FIGURE 10: PRIORITY ZONE MAP FOR AFGHANISTAN, WITH "2015 TARGET ECOREGIONS" AND PREVIOUSLY PROPOSED PAS DISPLAYED (WCS, 2009) 43

TABLE 1: RELATIVE AREAS FOR WWF ECOREGIONS ACROSS AFGHANISTAN (OLSEN ET AL. 2001) 17
TABLE 2: WWF ECOREGIONAL DISTRIBUTION AND DESCRIPTIONS WITH GLOBAL CONSERVATION STATUS 19
TABLE 3. THIRTY-THREE (33) SUSPECTED OR KNOWN THREATENED AND ENDANGERED PLANT SPECIES IDENTIFIED WITHIN AFGHANISTAN (ECODIT, 2009) 26
TABLE 4: INDIVIDUAL CRITERION WEIGHTING FACTORS FOR PRIORITY ZONE DESIGNATION 34

BOX 1. COUNTRY MAPS USED WITHIN PRIORITY ZONE ANALYSIS 30
BOX 2. PRIORITY ZONE CRITERIA AND ASSOCIATED GRID CELL SCORE DESCRIPTIONS 32

APPENDICES

APPENDIX I - DRAFT GOAL, OBJECTIVES AND STRATEGIES FOR AFGHANISTAN'S PROTECTED AREA SYSTEM PLAN (1 PAGE)

APPENDIX II - ACCOMPANYING MAPS TO PRIORITY ZONE REPORT (13 PAGES)

APPENDIX III - ECOLOGICAL COMPOSITION OF IDENTIFIED 'HIGH PRIORITY' RESEARCH ZONES (15 PAGES)

Executive Summary

As a principle outcome of the Convention on Biological Diversity's (CBD) strategic goal, the Programme of Work for Protected Areas (PoWPA) was introduced, essentially to help countries implement important conservation activities centered around protected areas (PAs). The CBD defines PAs as 'a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives'. However, to be effective and sustainable, PAs need to be planned thoroughly and systematically involving a range of stakeholders, local and expert opinion, and sound science.

Afghanistan became a Contracting Party to the CBD in September 2002. In February 2008, Afghanistan's work on PoWPA began, with the National Environmental Protection Agency acting as the Government implementing agency. Four activities were selected for action in Afghanistan that includes a comprehensive gap analysis of the country's biodiversity and current conservation activities, and the writing of a national master plan for protected areas - termed the National Protected Area System Plan (NPASP). The NPASP comprises scientific analysis results, potential benefit-sharing options between local communities and the Government of Afghanistan, and further training and capacity-building opportunities in relation to the ongoing management of PAs.

The gap analysis is the first step in accomplishing a well-planned and effective PA network and involves a detailed examination of the ecological, representation and management gaps that often exist. However, Afghanistan has just one legally-established PA to-date, with at least 14 other areas around the country proposed over the last 4 decades as "biologically-interesting" and possible PAs. It was therefore decided to adapt the typical gap analysis approach and instead use recent knowledge and information to examine the potential of these previous PA proposals in current-day Afghanistan, update the existing data on the country's biodiversity, and identify ecological 'hotspots'. These 'hotspots' are termed **Priority Zones.**

Rather than PA proposals, Priority Zones (PZs) are instead designed to act as focal sites for scientific research. Immediate research zones that are designed to help meet the 2015 PA targets for Afghanistan were determined in combination with 8 'conflict-safe' ecoregions. However, in order to achieve the national goal of at least 10% of Afghanistan being represented within a PA by 2030, longer-term research will be concentrated in those PZs around parts of the country that are more difficult to access at this present time. PZs will also feature in the NPASP to guide future research and funding opportunities, and to help preserve the country's unique biodiversity during the process of formal gazettement.

For this purpose, PZs were identified using the results of 3 separate analyses that examined: 1) the varying ecological classification schemes and ecoregional status with regards associated threats and global importance (this analysis was also used to establish the multi-tiered set of goals, objectives and strategies for PAs in Afghanistan); 2) the habitat and potential range of 41 key faunal species and an additional 116 restricted or threatened bird species; and 3) potential vegetation and specific locations of 33 key floral species. These criteria, in combination with elevation range and number of human settlements across the country, helped to identify a set of distinctive PZs. Interesting results were revealed including a number of PZs identified ***outside*** of previous PA proposals. As a final exercise, the network of PZs were combined with the 'conflict-safe' ecoregions. Twenty-eight (28) sites were recognized within these safer areas as holding potentially rich biodiversity, and will therefore be promoted within the NPASP as sites for **immediate investigation**.

Introduction

Being located in the heart of central Asia, bounded by the countries of Turkmenistan, Uzbekistan, Tajikistan, Iran, Pakistan and China, Afghanistan is home to a rich diversity of ecosystems and habitats. There are the high peaks of the Hindu Kush mountain range, the wetlands of Ab-i-Estada, Dasht-i-Nawar and Hamun-i-Puzak, the arid lowlands of the south, the eastern forests of Kunar, Nuristan and Khost provinces that lie on the western periphery of the Indian monsoons, and the large expanses of woodlands that spread across the dry northern plains. The climate is continental with particularly hot summers in the lower-lying plains of the north and south, and very cold winters in the higher altitudes. All of these unique systems provide the right habitats and conditions for a wide range of flora and fauna species, some of which are found nowhere else on earth.

Throughout the early-mid 20th Century, former-King Mohammed Zahir Shah of Afghanistan led important efforts to implement protected areas in the country. Through his tireless work as King, a network of hunting reserves and wildlife sanctuaries was established offering protection to a diversity of species. Certain species such as the Bactrian deer (*Cervus elaphus bactrianus*) were even introduced into other areas, increasing their geographic spread and long-term conservation within the country.

However, the conflicts and natural disasters that have since plagued the country have affected and damaged these natural resources markedly. A vicious circle has been in-motion that centers around destruction to natural resources, unsustainable usage and further degradation of these resources, an inability of the land to support the population's needs, food shortages and increased poverty. For centuries now, a large majority of Afghanistan's people have lived directly off the land whether that is for farming, livestock grazing, hunting or firewood collection. This resource-use used to be sustainable but with the other factors now taking effect, coupled with an increasing human population, this is putting severe pressure on the country's natural resources that will, eventually, be damaged beyond-repair. Thus, not only is it essential to protect the land and the systems it supports for the benefit of the country and the world's biodiversity, it is important for these natural resources to be restored and conserved so that the country's future generations can thrive in the beautiful and naturally-rich land that is Afghanistan.

The Programme of Work on Protected Areas within the Convention on Biological Diversity: Principle Goals & Targets

In 2002, the Conference of the Parties to the Convention on Biological Diversity (CBD) adopted a Plan to address the significant rate of biodiversity loss occurring throughout the world. A principle goal set by all Parties was "*to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national level, as a contribution to poverty alleviation and to the benefit of all life on Earth*".

To achieve its 2010 Biodiversity Target, the CBD Parties developed a Strategic Framework within which to set targets for implementation and monitor progress. The framework highlighted a range of focal areas including protection of biodiversity components as well as identification of their key threats, promoting sustainable use, and protecting traditional knowledge, innovations and practices. One of the major and most ambitious programs to come out of the CBD's conservation vision was the Programme of Work on Protected Areas (herein referred to as PoWPA). PoWPA's main goals are to increase the current number of protected areas across the world while ensuring that protected areas (PAs) are planned and

placed in the best possible locations to allow for effective conservation of globally important and threatened biodiversity.

The International Union for the Conservation of Nature (IUCN) currently recognizes a global protected area network that covers approximately 11.4% of the Earth's land surface. However, according to the best available data the existing global systems of protected areas are not sufficiently large, planned in a systematic fashion, nor well-managed to contribute effectively to biodiversity conservation. Parties to the CBD have yet to fulfill their biodiversity commitments under the convention and as a result, species, ecosystems and ecological processes are not adequately protected by the current protected areas network. Thus, action to improve both coverage and representativeness on a national, regional and global scale is now considered urgent.

Target 1.1 of the CBD - under the Strategic Framework Goal of promoting conservation of the biological diversity of ecosystems, habitats and biomes - states that ***at least 10% of each of the world's ecological regions should be effectively conserved***. Target 1.2 states that ***areas of particular importance to biodiversity are to be protected.*** In turn, PoWPA describes a set of 16 goals and 92 associated activities that are specific to protected areas, all of which are designed to operate with existing thematic work programs and the work of numerous organizations to help achieve the proposed CBD Goals and Targets.

PoWPA is intended to assist CBD Parties in establishing protected area networks within their national context and in setting their own appropriate goals, objectives and strategies Appendix I presents Afghanistan's National Protected Area System Plan (NPASP) Goals, Objectives and Strategies, agreed upon on March 3 2009 by the National Environmental Protection Agency (NEPA) and the Ministry of Agriculture, Irrigation and Livestock (MAIL) of the Government of Afghanistan (GoA). Much of the funding to promote the CBD's objectives comes from the Global Environment Facility (GEF) and is implemented globally by the United Nations Development Programme (UNDP). As the implementing Governmental agency for PoWPA in Afghanistan, NEPA is currently working towards reaching these targets for Afghanistan's protected areas, with technical and financial assistance from GEF and a range of international organizations including the Wildlife Conservation Society (WCS) and the Biodiversity Support Program for NEPA (BSP/NEPA). Through WCS and BSP/NEPA, USAID is contributing funds as part of a PoWPA co-financing agreement.

One central component of PoWPA is the completion of a protected area gap analysis at the national level to determine whether the current protected area network adequately covers the range of biodiversity within each country. The concept of a gap analysis has developed over the past 15 years in response to global recognition that current protected area systems do not fully protect or cover the full biodiversity spectrum.

In 2003, the first global gap analysis of terrestrial species and their representation within the world's current protected areas network was presented to the World Parks Congress (Rodrigues et al., 2004). Five datasets on the distribution of protected areas and 11,633 species across the world were combined. Of the 'covered' species (i.e. those with protected areas overlapping an extent of its mapped distribution), 1,423 species were not represented in any protected area larger than 10km^2, with amphibians as the least represented taxon of all. Overall, 20% of all threatened faunal species analyzed were identified as 'gap species' (i.e. no part of their range was covered by a protected area). The results provided evidence that many protected areas across the world were not originally planned with biodiversity trends and coverage targets taken into full account.

Programme of Work – Protected Areas in Afghanistan

On behalf of NEPA and the Government of Afghanistan, WCS and the BSP/NEPA conducted an analysis of Afghanistan's biodiversity in order to address issues of adequate representation and to help meet the targets set by the CBD and PoWPA.

The protected areas work of NEPA, MAIL and other stakeholders is primarily focused on the ecosystem approach. Ecosystems form the primary framework for universal and coordinated action under the CBD; thus, the accompanying ecoregional analysis report by WCS outlines an approach to set protected area long and short-term targets for the NPASP under an *ecoregional* context. The ecoregional analysis also plays a pivotal role in determining research Priority Zones (important specifically for this analysis). Furthermore, WCS and BSP/NEPA (respectively) conducted a wildlife and plant analysis to contribute towards the identification of sites throughout Afghanistan that could still contain a rich assemblage of species and habitats. The following report combines results from all three sets of analyses in order to achieve the wider objective of setting research Priority Zones. Detailed reports for the three separate analyses are within the accompanying documents.

Gap Analysis as a Conservation Planning Tool

Background

Activity 1.1.5 of PoWPA requires that "Parties should complete protected area system gap analyses at national and regional levels based on the requirements for representative systems of protected areas that adequately conserve terrestrial, marine and inland water biodiversity and ecosystems".

A gap analysis is intended to help countries design a National Protected Area System that promotes the protection of those areas that maximize biodiversity representation within a country. In basic terms, a gap analysis assesses the extent to which a country's protected areas achieve its targets to represent biological diversity. In this context a "gap" can either be a **representation** gap (with very limited or even no particular species or ecosystem represented by the PAs), an **ecological** gap (whereby the actual occurrence of a species or ecosystem is inadequate for ecological processes to occur), or a **management** gap (where existing management systems do not effectively protect a given species, habitat or ecosystem).

Protected area planning to ensure biodiversity representation within the system is a recent concept – the first protected areas were created with limited planning based on local knowledge or unspecific Governmental priorities. As a result, protected area networks were not designed in a systematic manner and the range of many critical species or ecoregions were not covered. For example, temperate grasslands are one of the least protected and most threatened of biomes with just 4.59% of these lands being covered by any kind of protected area throughout the world. To help address these significant and concerning conservation gaps, gap analyses are now being used in many countries to ensure adequate representation of biodiversity.

Gap analyses can range from a simple spatial comparison of areas across the country to complex exercises involving extensive data gathering, mapping work and quantitative analyses. For example, in 2003, the Government of Madagascar pledged to triple the coverage of protected areas in order to fulfill its PoWPA targets and thus carried out an ecological gap analysis to ensure important biodiversity areas were protected (Rasovahiny et al., 2008). Data on species occurrence and threats were collated from sources such as the IUCN and then analyzed using specialized reserve design software tools. The results showed that a large number of threatened vertebrate species were either totally unprotected or without adequate protection within the existing PAs. Thus, it was recommended that a suitable set of conservation targets should be developed incorporating species, habitat types and other biological features.

Gap Analyses for Afghanistan's Protected Area Network

The situation in Afghanistan is different to most other CBD Parties. Although a great deal of work was conducted in the 1970s to identify potential sites for protected areas (see Figure 1) and Afghanistan has fully-committed to the CBD targets since becoming a Contracting Party, Afghanistan's protected area network is still in its infancy. The landscapes, flora and fauna have suffered greatly from decades of conflict. As a result, it has been difficult to prioritize conservation of threatened species and ecoregions, and particularly to achieve targets for protected areas. To-date, only one national park has been formally declared (Band-i-Amir in Bamyan Province) in April 2009.

The World Database of Protected Areas (WDPA - http://www.wdpa.org) lists 12 proposed protected areas in Afghanistan (excluding Zadran, Khulm Landmark, and Bamiyan National Heritage PA which are not considered within this analysis since they are proposed as **cultural** heritage sites). Four of the areas listed by the WDPA were recognized by the GoA in the 1970s, including one Category II national park (Band-i-Amir) and three Category IV wildlife or waterfowl reserves (Ajar Valley Wildlife Reserve, Dasht-i-Nawar National Flamingo and Waterfowl Sanctuary, and the Big Pamir Wildlife Reserve). However, with the exception of Band-i-Amir none of these areas have been officially declared by the current government, none have official boundaries, and none are currently managed as protected areas.

The total area covered by the four proposed parks listed is approximately 1,970km^2, representing about 0.3% of the territory of Afghanistan (the country area is approximately 647,000 km^2 in total)[1]. The other eight proposed protected areas listed by the WDPA are the Northwest Afghanistan Game Reserve, Hamun-i-Puzak, Registan Desert, Ab-i-Estada, Kol-i-Hashmat Khan, Imam Sahib Wildlife Managed Reserve, Nuristan and Darqad Wildlife Managed Reserve. At a total of 38,131km^2, these eight areas represent approximately 5.9% of Afghanistan's land area.

In addition, there have been two protected areas proposed by WCS at the extreme eastern end of the Wakhan (Little Pamir and Waghjir Valley also labeled on Figure 1). Together with the Big Pamir proposed PA, these three sites form the proposed Upper Wakhan National Park. These additional areas of Little Pamir and Waghjir Valley cover 356km^2 (approximately 0.05% of the country), whilst the Upper Wakhan National Park itself is approximately 13,000km^2 in size – around 2% of Afghanistan.

[1] A range of figures are stated in the literature for the total land area of Afghanistan, with 647,000km^2 being the most commonly stated. In this particular analysis, different data from a variety of sources were used to map or analyze the country, leading to slight variations in Afghanistan's boundaries and total area.

Figure 1: Officially-declared (Band-i-Amir) and thirteen (13) previously proposed protected areas of Afghanistan classed as Type I in green (expected to be gazetted within 5 years), Type II in blue (expected gazettement within 10 years) or Type III in purple (possible gazettement within 20 years) (WCS, 2009)[2]

To assess the extent of coverage these areas offer towards achieving targets set by the ecoregional analysis, the 13 previously proposed protected areas of Afghanistan (excluding Band-i-Amir which has since been gazetted and the larger Upper Wakhan National Park which is divided up into its three respective proposed PAs) were reviewed by experts at WCS and split into three categories. The proposed PAs were categorized based on their historic and current status as proposed protected areas, threats from various anthropogenic and environmental factors, and the degree of security in relation to ongoing conflict. The site descriptions are taken primarily from Sayer and Van der Zon (1981) and Evans (1994):-

Type I Previously Proposed Protected Areas - expected gazettement within 5 years (green shading on map):-

- **Ajar Valley** – lying at an elevation of 1,800 – 3,800m along the Ajar River, eroding its way through the soft limestone to form a narrow, twisted canyon. The valley is approximately 55km northwest of Bamyan town and is believed to contain some of the most incredible scenery within this region of Asia. The area was protected for many years as a hunting reserve by the former King Zahir Shah and was established as a wildlife sanctuary in 1978, being later proposed as a national park. There are no management processes currently in place although the Government and WCS has been working with communities in order to facilitate the creation of a PA Committee.

[2] At the time of map production (February 2009), Band-i-Amir was still a proposed PA, and had not yet been officially-declared. Hence, its inclusion as a Type I proposed PA on the map.

- **Big Pamir** – located in the northeastern part of the Wakhan Corridor in Badakhshan Province at altitudes of between 3,250 and 6,103m. The general landscape is composed of spectacular, barren mountains with glaciers, glacial lakes and scree-covered slopes. It was gazetted as a Wildlife Reserve on account of its Marco Polo sheep (*Ovis ammon polii*) population in 1978, but its current status is uncertain and there is no forma management process in place.

- **Little Pamir** – forming the eastern tip of the Wakhan Corridor, separating China, Pakistan and Tajikistan, at between 4,000 – 6,000m and encompassing the valleys of the Aksu and Waghjir rivers. The area is surrounded by the Pamir Mountains and is one of the great historical crossroads of Central Asia. No formal conservation measures have yet been taken in this area.

- **Waghjir Valley** – located in the high Pamirs of Badakhshan Province, at the eastern tip of the Waghjir Valley that borders Pakistan and China. It is approximately 300km^2 in area. Being largely uninhabited and utilized (apart from yak grazing in the winter), the site is in excellent condition and could be considered for PA status in the future. Currently, there is no management process in place.

Type II Previously Proposed Protected Areas - predicted to be gazetted within 5-10 years (blue shading on map):-

- **Ab-i-Estada** – a large, shallow, alkaline lake situated at the foot of the Kohi Baba and Kohi Paghman ranges in southeastern Afghanistan, approximately 130km south of Ghazni city. It was an important wetland for migrating waterfowl, with the lake being recharged primarily by snow-melt every spring (usually 60km at the widest point). A management plan was prepared for the area in 1977 and the area was approved by the former King Zahir Shah as a Wildlife Sanctuary in 1977. The site was later proposed as a National Park in 1981. However, the validity of this site as a protected area in the future is in question. Intensive damming and water extraction schemes from its feeder rivers for irrigation projects over the past two decades has led to a severe decrease in water levels and a possible change in salinity, affecting the entire ecosystem (for example, a noticeable decrease in the growth of sedge tubers as occurred on which the critically-endangered Siberian crane (*Grus leucogeranus*) feed). Grazing pressure is also heavy in areas surrounding Ab-i-Estada.

- **Dasht-i-Nawar** – a large lake in the high desert plateau of south-eastern Afghanistan, approximately 55km west of Ghazni city. It is surrounded by the Kohi Baba Range with water flowing primarily from snowmelt off the surrounding mountains. The area was declared by the former King Zahir Shah as a National Flamingo and Waterfowl Sanctuary in 1974. In comparison with other wetlands in Afghanistan, the problems at Dasht-i-Nawar are relatively low due to the presence of springs as a permanent water source. However, the lake did dry up completely during the severe drought of 1999, and heavy grazing by local livestock is causing excessive disturbance to the breeding patterns of the birds here.

- **Imam Sahib** – this area contains the lowland floodplains of the Amu Darya (Oxus) River in northern Afghanistan, bordering Tajikistan. It lies approximately 60km north of the city of Kunduz at an elevation of approximately 500m. The habitat in this area once consisted of swamp woodlands with *Phragmites* reeds and thickets of *Tamarix* and *Salix* trees. Formally declared a Royal Hunting Preserve in the early

part of the twentieth century, it was never gazetted as such, and no conservation measures were formally proposed. However, habitat destruction is occurring on a large scale, with much of the swamp woodland already destroyed for cultivation purposes. Hunting pressure is also severe with the survival of certain species in doubt (e.g. the Bactrian deer – *Cervus elephus bactrianus*).

- **Darqad** – this area encompasses the lowland floodplains of the Amu Darya (Oxus) River, approximately 80km north of Taloqan City and bordering Tajikistan at 400 – 450m. In the past, extensive swamp woodland dominated this area; however, in recent years, much of this natural habitat has been destroyed and turned into cultivated areas. Formally declared a Royal Hunting Preserve in the early part of the twentieth century, it was never gazetted as such, and no conservation measures were formally proposed. As with Imam Sahib, habitat destruction has occurred on a large-scale, removing much of the former swamp woodlands.

- **Koli Hashmat Khan** – the only wetland remaining from the once extensive Kabul marshes on the southeast outskirts of Kabul city lying in a basin surrounded by the Hindu Kush foothills. Elevation here is approximately 1,800m. Koli Hashmat Khan is a shallow, reed-covered lake approximately 2.5km in-length and between 300 – 1,000m wide. This area was previously a royal hunting ground, before being declared a wildfowl reserve by the former King Zahir Shah in the 1930s with restricted hunting. Although the site has great potential as a PA, it faces a large array of threats, including water diversion for irrigation and cultivation, pollution, egg-collecting and indiscriminate hunting, and extensive reed cutting.

Type III Previously Proposed Protected Areas - possible gazettement within 10-20 years+ (purple shading on map):-

- **Registan Desert** – the largest desert area of Afghanistan, just south of the city of Kandahar at 800 – 1,200m extending over most of southeast Afghanistan to the borders of Pakistani Baluchistan. No official conservation measures are known from this area and overhunting, overgrazing and destruction of the desert crust are of significant concern.

  Hamun-i-Puzak – a very large, shallow and fresh to brackish lake lying in the Seistan desert within extreme southwest Afghanistan at 500m. This lake surrounded by vast *Phragmites* reedbeds receives its inflow from the Khashrud River, carrying water from the central highlands of Afghanistan during the spring. Approximately a third of the swampland lies in Iran, with a permanent wetland located in Afghanistan. Although the site was proposed as a National Park before 1979, no formal conservation measures are known from this area and no part is legally protected for nature conservation. A major threat to this area is the reduced water flow through extensive dam-building, water division, and unregulated irrigation schemes within Afghanistan and Iran. The *Phragmites* beds are also used extensively for fuel, fodder and are burnt to encourage re-growth, ultimately affecting the breeding bird populations.

- **Northwest Afghanistan** – a representative area of the northern *Artemisia* steppe (on lower northern slopes) and *Pistachia vera* woodlands (on higher land), with an elevation between 500 – 1,000m. This area crosses both Herat and Badghis Provinces, approximately 100km north of the city of Herat. Northwest Afghanistan was proposed as a game management reserve/nature reserve because of the

existence of unique species such as the Goitered gazelle (*Gazella subgutturosa*) and Asiatic cheetah (*Acinonyx jubatus),* however no conservation measures have yet been taken in this area.

- **Nuristan** – a mountainous area with peaks of up to 6,300m and a variety of geological formations. The influence of summer monsoons provides enough rainfall to sustain dense forests, including species such as walnut, oak, cedar, spruce, fir and juniper. This diverse area represents a variety of ecosystems and species, and preliminary investigations by WCS during 2006 and 2007 suggest that this previously proposed protected area continues to maintain its high biodiversity value. However, no special status has yet been assigned.

Most of Afghanistan's land surface and associated species do not have legal protection; thus, it would be difficult to conduct a 'conventional' gap analysis for Afghanistan. Afghanistan's protected area network consists of only one officially-declared protected area making direct comparisons between PAs and identification of coverage gaps impossible. Rather than using a gap analysis to expand an existing PA network, Afghanistan therefore requires the actual ***creation*** of a PA network. PoWPA Afghanistan will "update" the proposed PA map from the 1970s (Figure 1) to reflect the biodiversity situation in Afghanistan today, and implement a systematic planning process for the country's future protected area network.

National Targets for Protected Areas in Afghanistan

In March 2009, the GoA (namely NEPA and MAIL) and other PoWPA stakeholders identified a set of comprehensive Goals, Objectives and Strategies to direct the design of the National Protected Area System Plan (NPASP) for Afghanistan. These draft statements are detailed in Appendix I of this report. The goals and objectives are based on the results of a detailed ecoregion analysis conducted by WCS and are divided between short-term targets (i.e. by 2015) or longer-term targets (i.e. by 2030). The short-term targets, based on those ecoregions currently considered "safe" to work within, were used in this Priority Zone analysis to help identify **immediate areas** for further investigation (according to the draft set of NPASP Strategies).

Priority Zone Concept

To assist in the design of an appropriate protected area network for Afghanistan, the accompanying ecoregional and flora/fauna species analyses were used to identify sites of globally important and/or threatened biodiversity. Areas of varying vegetation types and ecoregions were combined with data on human settlements, elevational ranges, occurrence of biome-restricted and/or threatened bird species and the ranges of 41 focal faunal species (refer to accompanying Faunal and Floral Analysis Reports for detailed information), to determine those sites that should be considered as possible 'hotspots' for biodiversity - referred to as **Priority Zones.**

Box 1. Definition of a Priority Zone

Priority Zone (PZ): "an area of predicted high conservation value in which further research will be undertaken to delineate potential protected areasx"

Identified Priority Zones were overlaid onto the eight "conflict-safe" ecoregions to establish sites for **immediate investigation.** The identified Priority Zones will contribute

significantly towards proposing future protected areas because they highlight Afghanistan's remaining areas of significant biodiversity, allowing stakeholders to prioritize scientific surveys and community consultations.

Furthermore, this work will allow for complementary planning between biodiversity 'hotspots' and Afghanistan's strategy for rural development. Enabling informed dialogue between different stakeholders could well support a thorough consideration of the benefits of development projects against the potential detrimental effects they may have on these 'hotspots'. Using these Priority Zones, NEPA and other organizations can also promote the study and possible protection of such areas even before the process of formal gazettement begins. Moreover, the Priority Zone approach is consistent with the CBD Strategic Framework that encourages the protection of a country's biodiversity, identification of key threats and sustainable use as a matter of urgency.

The following sections outline the 3 separate analyses and the steps taken to help delineate Priority Zones.

Ecoregional and Species Analyses to Identify Priority Zones & Potential Protected Areas: Methodologies

Between January – July 2009, three separate analyses were undertaken by the Wildlife Conservation Society and its PoWPA co-financing partner BSP/NEPA (through ECODIT), in order to determine priority zones for globally-threatened or important biodiversity. All three analyses, examining ecoregional range, focal faunal habitats and areas of important plant distribution, were designed to contribute to the identification of areas requiring immediate research, to highlight key sites with the potential to become a protected area in the future, and to help build a greater understanding of Afghanistan's important ecosystems and species.

The details of these analyses are contained within the accompanying reports, with a summary of their contribution towards Priority Zone designation and the placement of future protected areas presented below.

The Ecoregional Approach to Identifying Afghanistan's Priority Zones & Future Protected Area Network

Background

There are many ecological classification systems that define land units in particular ways, and '**ecoregions**' constitute just one classification type. Ecoregions are characterized by a combination of landforms, climate, ecological features and plant and animal communities, and each ecoregion contains distinct ecological components that differ from any other ecoregion. An ecoregional approach therefore provides a systematic way to set justifiable land representation targets and plan for protected areas while incorporating the habitats of many different flora and faunal species. This principle is reflected in Article 38 of Afghanistan's Environment Law which states that one of the three objectives of Afghanistan's protected area system is to preserve ***representative* ecosystems and habitats**.

In the PoWPA process, the ecoregion approach that includes classification of globally-important or threatened ecoregions, also provided a consistent classification scheme under which to identify areas of interest for wildlife species and habitats. The chosen system was intended to form both the basis of the entire Priority Zone analysis and also the approach to protected area target-setting for Afghanistan.

Ecoregional Classification Systems & Use for Setting Targets

Ecoregions can be defined using different criteria and therefore, applied at different spatial scales. Protected area planners may use ecoregions to conserve large and all-encompassing areas that cover a certain percentage of a broadly-defined ecoregion or they may choose small, precisely-defined sites that represent a unique type of environment. However, for the Priority Zone approach it was decided to modify an existing ecological classification system rather than create an entirely new method, given the rather limited information and data available for Afghanistan.

Five potentially useful ecoregional systems were examined in detail based on the literature.

1) Hassanyer (1970): designation of 10 "natural life zones" for Afghanistan
2) Udvardy (1975): designation of 2 biogeographic realms, 4 biomes and 7 biogeographical provinces
3) Habibi (2003): designation of 5 major land units
4) Freitag (1971): designation of 15 varying plant communities; and Freitag (1972): designation of 6 vegetation classes
5) Olson et al., (2001), on behalf of World Wildlife Fund (WWF): designation of 17 different ecoregions for Afghanistan

After reviewing all five systems, PoWPA stakeholders decided to apply the WWF 17 ecoregion classification (Olsen et al., 2001) as the basis for the wildlife species analysis and the final priority zone designation, particularly since the system represents an appropriate level of resolution, it combines other classification schemes (e.g. Freitag's 15 plant communities) and is internationally recognized as the most effective classification system (see Table 1 for ecoregion areas, and Figure 2 for ecoregional map).

Table 1: Relative areas for World Wildlife Fund (WWF) Ecoregions across Afghanistan (Olsen et al., 2001)

ECOREGION NAME	LAND COVERAGE (KM^2)	COUNTRY COVERAGE (% of total)
Afghan Mountains semi-desert	13,689.45	2.11
Badghyz and Karabil semi-desert	53,929.90	8.33
Baluchistan xeric woodlands	34,357.62	5.31
Central Afghan Mountains xeric woodlands	139,693.08	21.57
Central Persian desert basins	23,078.72	3.56
East Afghan montane conifer forests	12,748.86	1.97
Ghorat-Hazarajat alpine meadow	66,560.21	10.28
Gissaro-Alai open woodlands	3,657.51	0.56
Hindu Kush alpine meadow	28,260.19	4.36
Karakoram-West Tibetan Plateau alpine steppe	4,973.00	0.77
Northwestern Himalayan alpine shrub and meadows	1,770.45	0.27
Pamir alpine desert and tundra	5,020.09	0.78
Paropamisus xeric woodlands	92,521.18	14.29
Registan-North Pakistan sandy desert	161,345.76	24.92
Rock and Ice	853.60	0.13

ECOREGION NAME	LAND COVERAGE (KM^2)	COUNTRY COVERAGE (% of total)
Sulaiman Range alpine meadows	4,873.17	0.75
Western Himalayan subalpine conifer forests	247.55	0.04

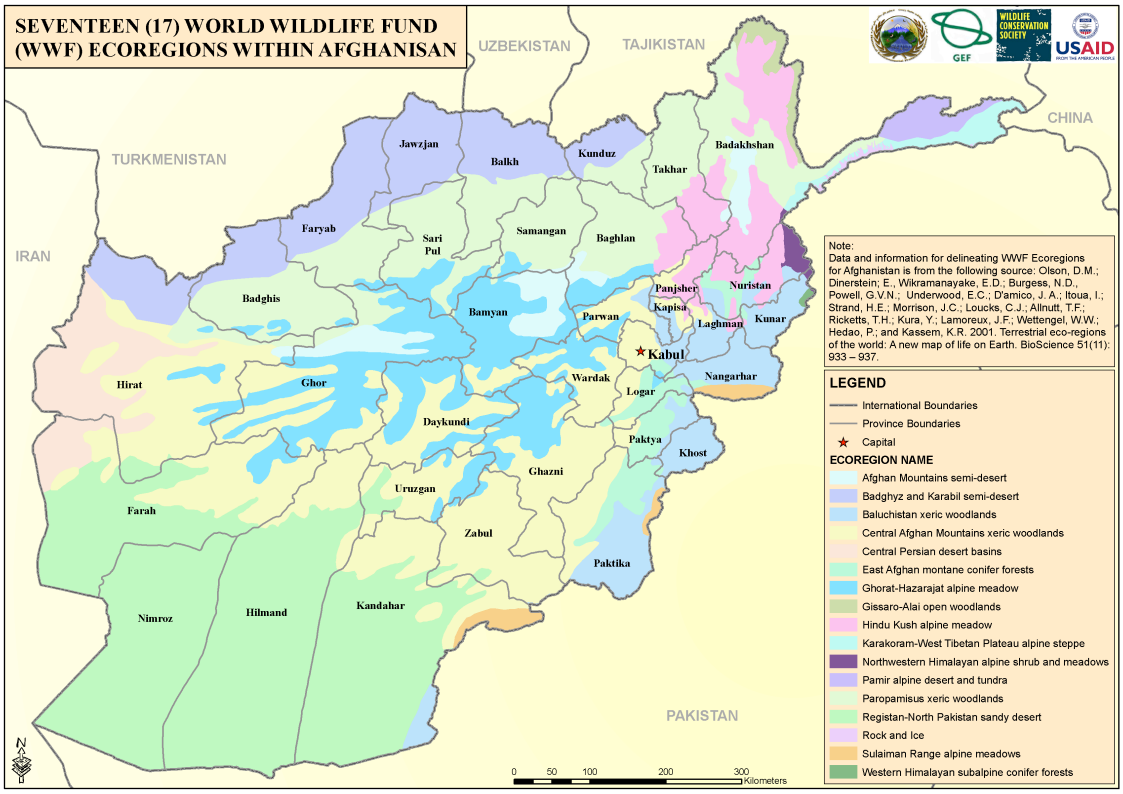

Figure 2: Map of World Wildlife Fund (WWF) ecoregions across Afghanistan defined by Olsen et al. (2001) (WCS, 2009)

Priority Zone Identification

In terms of the Priority Zone demarcation for Afghanistan, it was important to distinguish between those WWF ecoregions that are either globally at-risk and/or considered globally important for the world's biodiversity.

When Olson et al. (2001) classified the Earth into its 867 terrestrial ecoregions the authors also assigned a vulnerability ranking to each ecoregion dependent on the status of the habitats and species it contained. According to this method, 38% of Afghanistan's land area is comprised of ecoregions that are **Globally Endangered**, 61% as **Vulnerable**, and only 1% as **Stable** (see Table 2 below, and Figure 1 within Appendix II). Priority Zone designations are largely dependent on the vulnerability *status* of the ecoregions found at that particular site, with increasing ecoregion vulnerability leading to a higher chance of being classed as a Priority Zone.

Table 2: World Wildlife Fund (WWF) Ecoregional distribution and descriptions with global conservation status based on Olsen et al. (2001)

Ecoregion name	Global status	Description
East Afghan montane conifer forests	**Vulnerable**	Found in Pakistan and Afghanistan. Approximately 20,100km^2
Western Himalayan subalpine conifer forests	**Vulnerable** *(Global 200 ecoregion)*	Found in India, Nepal, Pakistan and Afghanistan. Approximately 39,700km^2
Gissaro-Alai open woodlands	**Critical/ endangered** *(Global 200 ecoregion)*	Found in Kyrgyzstan, Tajikistan, Uzbekistan and Afghanistan. Approximately 168,000km^2
Karakoram- West Tibetan plateau alpine steppe	**Vulnerable** *(Global 200 ecoregion)*	Found in Pakistan, China, Afghanistan and India. Approximately 143,300km^2
Pamir alpine desert & tundra	**Vulnerable** *(Global 200 ecoregion)*	Found in Palaearctic regions which includes the terrestrial ecoregions of Europe, Asia north of the Himalaya foothills, northern Africa and the northern and central parts of the Arabian Peninsula. Approximately 118,000km^2
Hindu Kush alpine meadow	**Vulnerable** *(Global 200 ecoregion)*	Found in northeastern Afghanistan and northern Pakistan. Approximately 28,300km^2
Ghorat-Hazarajat alpine meadow	**Vulnerable**	Found in central Afghanistan. Approximately 66,500km^2
Northwestern Himalayan alpine shrub and meadows	Relatively stable/ intact	Found in China, Pakistan, India and Afghanistan. Approximately 49,400km^2
Sulaiman Range alpine meadow	Stable/ intact	Found in Afghanistan and Pakistan. Approximately 23,900km^2
Baluchistan xeric woodlands	**Critical/ endangered**	Found in Pakistan and Afghanistan. Approximately 288,700km^2
Central Afghan mountains xeric woodlands	**Critical/ endangered**	Found in southeastern Afghanistan only. Approximately 139,400km^2
Afghan mountains semi-desert	**Critical/ endangered**	Found only within Afghanistan. Approximately 13,700km^2
Badghiz-Karabil semi-desert	**Critical/ endangered**	Found in northern Afghanistan, southern Turkmenistan, southern Uzbekistan, extending into Iran and Tajikistan. Approximately 133,600km^2
Central Persian desert basins	**Vulnerable**	Found in central and eastern Iran, and western Afghanistan. Approximately 580,900km^2

Ecoregion name	Global status	Description
Registan-North Pakistan sandy desert	**Vulnerable**	Found in southern Afghanistan into Pakistan and Iran. Approximately 277,300km^2
Paropamisus xeric woodlands	**Vulnerable**	Found in northern Afghanistan. Approximately 92,600km^2

Olson and Dinerstein (2002), on behalf of WWF, also developed a system to distinguish 238 of the world's most ***important*** ecoregions — so-called the "Global 200". The Global 200 together comprise the most outstanding and representative habitats for Earth's biodiversity. These Global 200s are also composites of the 867 identified WWF ecoregions. Afghanistan is represented by the following three Global 200 ecoregions (see Table 2 above and Figure II in Appendix II): **1) the Middle Asian montane woodlands and steppe** (i.e. an aggregation of the WWF Gissaro-Ali open woodlands, Hindu Kush alpine meadow, and Pamir alpine desert and tundra ecoregions); **2) the Global 200 Tibetan Plateau steppe** (the WWF Karakorum-West Tibetan Plateau alpine steppe ecoregion); and **3) the Global 200 Western Himalayan Temperate Forest** (the WWF Western Himalayan subalpine conifer forest).

The 5 Global 200 ecoregions in Afghanistan are not necessarily the most endangered ecological areas in the country, so their protection may not be a *national* priority unlike the critically-endangered ecoregions identified. However, at the *global* scale, these are Afghanistan's most important ecosystems for the preservation of Earth's biodiversity. Thus, protecting them is an international priority and their occurrence over specific areas contributes significantly to whether that site is listed as an important Priority Zone.

The Fauna Approach to Identifying Afghanistan's Priority Zones & Future Protected Area Network

Background

The ecoregional analysis provided a solid foundation for determining the ecoregional classification system used in subsequent analyses and Priority Zone designations. However, protected areas cannot and should not be designed on ecoregional representation alone. Individual species targets for faunal and floral species are essential in ensuring key components of biodiversity are protected, particularly if these components are equally as threatened as the habitats and ecoregions themselves.

This is reflected in the CBD's own Strategic Framework that emphasizes the conservation of ***species diversity*** by "*restoring, maintaining or reducing the decline of species populations or selected taxonomic groups, and improving the status of threatened species within a country*". To address these goals and specific targets within the context of Afghanistan, the gap analysis approach was modified such that prime "areas of interest" (AoIs) across the country were identified for 41 focal faunal species from 5 taxonomic classes. These AoIs representing suitable habitat were then incorporated into the wider Priority Zone analysis. This methodology ensured the final Priority Zones and biodiversity 'hotspots' were likely to contain assemblages of threatened or globally-significant faunal populations, the presence of which could be verified by further investigation.

On consultation with NEPA, MAIL and various stakeholders during the early stages of this analysis (workshops were held in Kabul in July and October 2008), it was decided by all that

there is simply not enough current information or data available to define specific-species targets as other countries have done in their gap analyses. This would entail selecting an arbitrary benchmark for protection of individual species such that 50% of the range of vulnerable 'Species X' is covered within a future protected area, or the range of 10 individuals of critically endangered 'Species Y' should be included in a protected area. Very few population counts and surveys have been conducted and setting such species targets for Afghanistan would, at this stage, be unrealistic and possibly even counter-productive. Therefore, the PoWPA stakeholders agreed to the approach of delineating potential species ranges and ensuring that Priority Zones included those areas with significant range overlap. This process was also designed to be iterative such that, as more knowledge and information is collected on species presence within Afghanistan (particularly in those areas marked as Priority Zones), range maps can be updated and species targets can actually be set.

The Fauna Approach: Process for Establishing "Areas of Interest"

In order to ensure focal faunal species were selected as objectively as possible, a system of prioritization was conducted using the 25 faunal Priority Species identified for a likely 2009 Protected Listing by the Afghanistan Wildlife Executive Committee (AWEC). This initial list was supplemented with three reptilian species that are endemic to Afghanistan, plus a 'threatened' reptile species, and 13 other mammalian species that scored highly from an independent assessment. Using Habibi (2003) as a guide, this assessment took into account the species' status within the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), global/regional threats and population trends according to IUCN, and likely presence within Afghanistan. The resulting focal species selected consisted of 31 mammalian species, 4 avian species, 1 amphibian species, 4 reptilian species and 1 arthropod, for which appropriate habitat suitability modeling exercises were designed.

The two principle land classification systems used for this analysis were:-

1) **Landcover** across Afghanistan as defined by the Food and Agriculture Organization (FAO) in 1990, 1992 and 1993. This divides the country into 21 different classes including rangeland (the majority of the country at 45% coverage), rain fed crops, water bodies, permanent snow and pistachio forest (Figure 3 in Appendix II).

2) **Ecoregions** as defined by Olsen et al. (2001) for WWF and also chosen as the primary classification system for the Priority Zone analysis. This divides the country into 17 different classes, detailed in Table 2 (and Figure 2).

The exact methods for determining species habitat varied extensively between and within taxonomic classes. However it invariably involved an extensive literature review, collection of all available location data, correspondence with specialist groups to obtain regional ranges, and an assessment of the species' affinity with various habitat types. After collecting suitable habitat/range information, the software program 'ArcGIS' was used to model potential species habitat across the land. Certain refinements for many of the 41 focal species were made according to environmental variables such as elevation, slope, hydrogeography, winter snow cover and summer precipitation. Figure 3 shows an example of one such species range map (Brown bear (*Ursus arctos*)) that used ecoregional and landcover associations, combined with 'preferred' elevation range, to produce a prediction of range across Afghanistan.

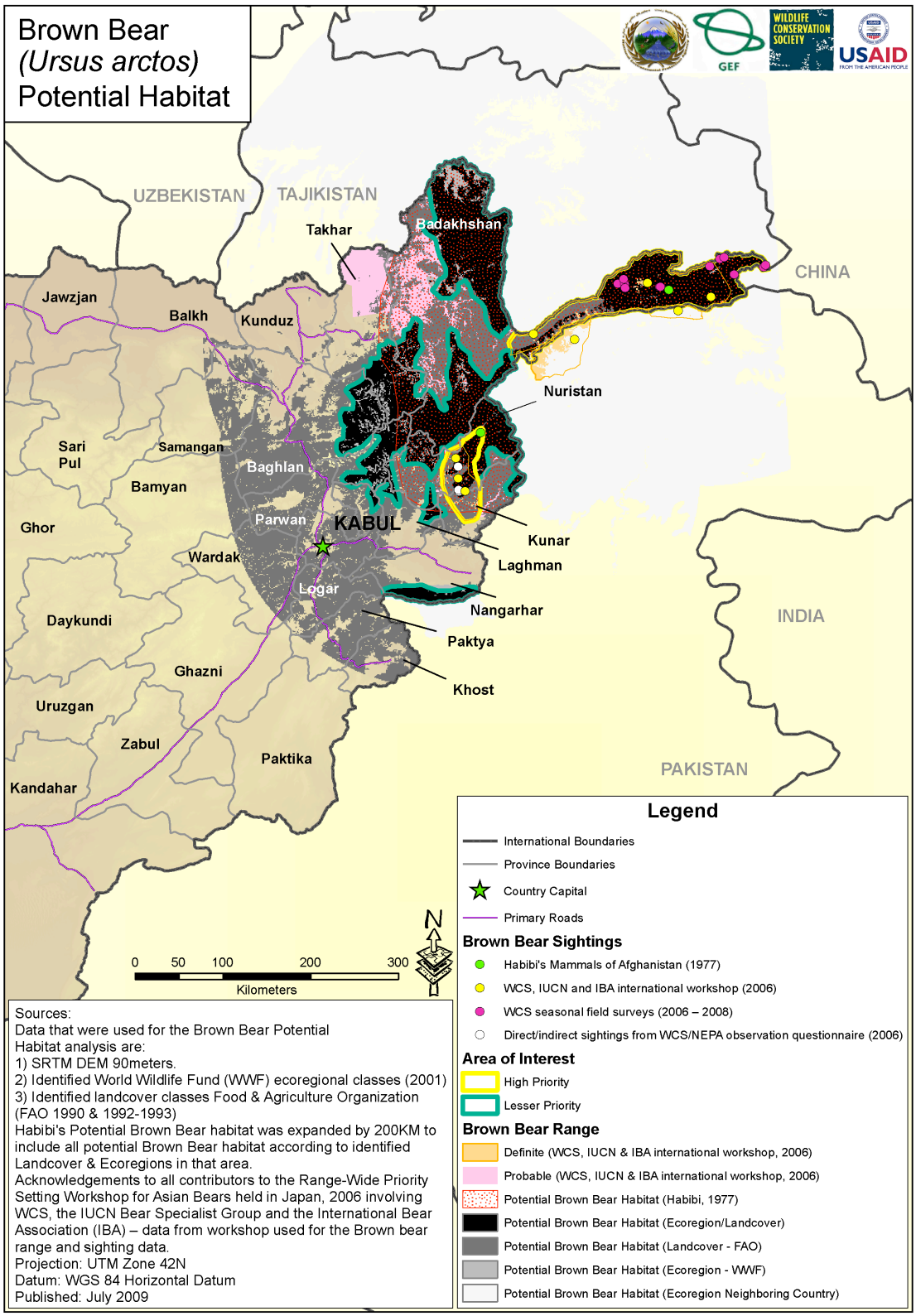

Figure 3: Potential habitat of the Brown bear (*Ursus arctos*) within Afghanistan, based on recent sightings and a variety of landscape-scale geographical filters (WCS, 2009)

"Areas of Interest" (AoIs) were then delineated on each species map to represent areas of either high priority (*where the species is most likely to occur*) or lesser priority (*species is less*

likely to occur but the site is worth investigating). The areas within yellow and green lines on Figure 3 above display these high priority and less priority areas respectively for the Brown bear. The majority of AoIs for the mammalian species were based on areas of significant overlap between suitable landcover, ecoregion, identified species range by Habibi (2003) and/or recent sighting data. This kind of information however was not available for many of the 41 focal species and thus AoI demarcation had to rely largely upon museum records or limited habitat associations.

Process for Analyzing Biome-Restricted and At-Risk Bird Groups

Two other wildlife faunal "layers" to be considered within the Priority Zone analysis were the relative concentrations of two major bird groupings –105 avian species considered "biome-restricted" within 8 biomes of Afghanistan, and 21 species considered "at-risk" by the IUCN (i.e. critically endangered, endangered, vulnerable or near-threatened).

As a result of a large range of biogeographical regions across Afghanistan, the country supports a variety of avifauna. Approximately 460 bird species have been recorded in the country, some ~235 of which are assumed to breed (Evans, 1994). However, many of these birds have relatively narrow ecological requirements such that their entire global distributions are limited to within one of the world's major terrestrial biomes[3]. BirdLife International lists 8 separate biomes for Afghanistan: Eurasian desert and semi-desert, Eurasian high montane alpine and Tibetan, Indo-Ganegetic plains, Indo-Malayan tropical dry zone, Irano-Turanian mountains, Saharo-Sindian desert, Sino-Himalayan subtropical desert and Sino-Himalayan temperate forest. Each of these biomes support a distinctive set of bird species found nowhere else. For their long-term survival, it is therefore essential that the habitat requirements of these ecologically specialized species are taken into consideration, and protected areas should include adequate representation of their ecological boundaries. This is also the case for the "at-risk" species whose continued existence within the country depends on their range representation within protected areas.

We analyzed these two species groups as a collective assemblage, rather than as individual species, since areas shown to be important for either group could potentially contribute to Priority Zone designation based on the concept of Important Bird Areas (defined according to BirdLife International criteria (Birdlife International, 2009)). Data on the occurrence of each of these species in Afghanistan were compiled from the most-recent and peer-reviewed source of information on bird ranges across Afghanistan - Rasmussen & Anderton (2005) - and then combined to produce a map of relative densities across the country within grid cells of 50km x 50km (Figure 4 shows the result of the biome-restricted bird analysis).

[3] Biomes are defined as one of the world's major communities, classified according to the predominant vegetation and characterized by adaptations of organisms to that particular environment (Campbell, 1996).

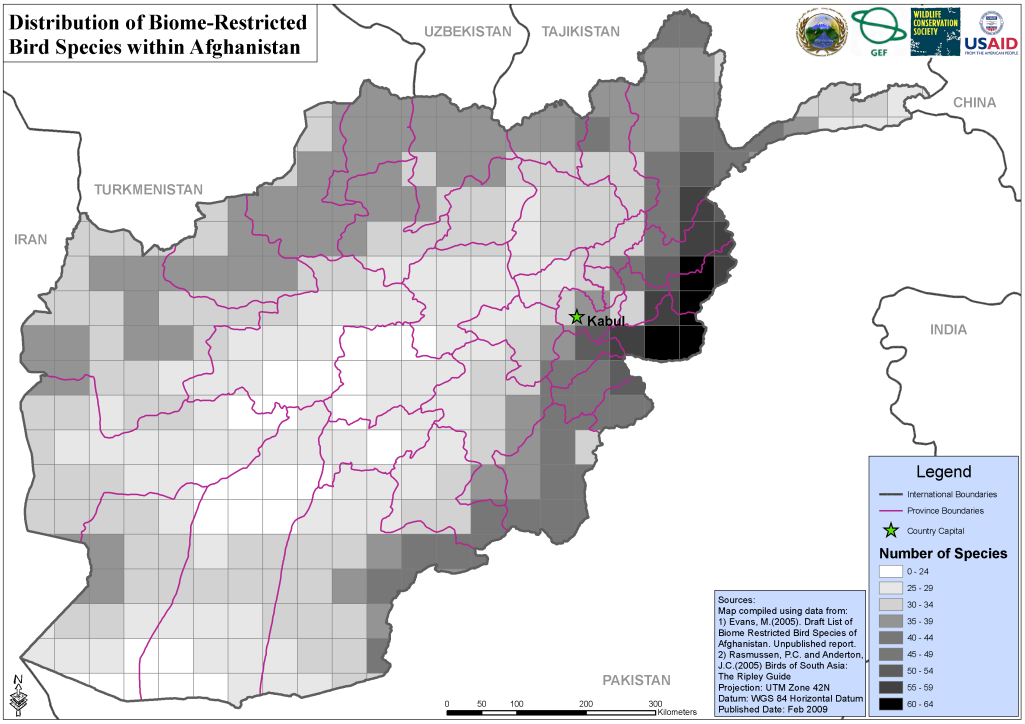

Figure 4: Number and distribution of biome-restricted bird species within Afghanistan (WCS, 2009)

Priority Zone Identification

The high priority and lesser priority AoIs for each of the 41 wildlife species were then overlaid with the biome-restricted and at-risk bird groupings onto a grid map of Afghanistan (Figure 5). Concentrations of species' "areas of interest", with significant groupings of biome-restricted and at-risk birds were usually defined as Priority Zones (see the Priority Zone Methodology section for a full description of criteria used, and accompanying weightings).

This approach had several limitations and constraints - not least the lack of recent data - and should be viewed primarily as an initial approach to predicting potential distribution of key faunal species in Afghanistan rather than a definitive guide to the placement of protected areas. The Priority Zone designation is expected to yield results that encourage further investigation in to the specific fauna "areas of interest" such that these species maps and results become increasingly more accurate.

The Flora Approach to Identifying Afghanistan's Priority Zones & Future Protected Area Network

Background

In 2002 the CBD adopted the Global Strategy for Plant Conservation in an attempt to halt the continuing loss of plant diversity. Some of the 2010 goals specified by this strategy include: 1) a widely-accessible working list of known plant species for the country; 2) a preliminary assessment of the conservation status of all known plant species at national, regional and international levels; 3) protection for 50% of the most important sites for plant diversity assured; and 4) 60% of the world's threatened species conserved in-situ. The CBD's Global

Strategy also emphasized that the national targets developed within this framework may vary from country to country, dependent on national priorities and capacities that take into account differences in plant diversity.

As with the faunal analysis for PoWPA, the context for achieving any kind of species-specific targets in the current situation for Afghanistan is problematic. Without even basic information on current plant distribution, abundance and diversity, an assessment of their conservation status is very difficult, whilst establishing specific targets is almost impossible at this stage. Instead, the goal of the plant analysis, conducted by BSP/NEPA, was to identify focal floral species as well as key locations that contain a diversity of potential vegetation types and provide suitable refuge for plant species in the face of climate change.

The Flora Approach: Process for Establishing Priority Zones

To address both the CBD target of compiling a plant inventory by 2010 and the Priority Zone work itself, the BSP/NEPA designed a suitable plant analysis that first required the compilation of a preliminary plant species list for Afghanistan. Current efforts are underway to construct such a list for Afghanistan, however that work is only in its initial stages, and thus a scoring matrix to select focal species (as was conducted for the faunal analysis) was simply not possible for wild plants.

An alternative list of priority plant species was therefore created by combining species from the following 3 sources:-

1) **Afghanistan Wildlife Executive Committee (AWEC)** – proposed formal protection for 4 plant species - *Corydalis adiantifolia, C. hindukushensis, Ulmus wallichiana* and *Taxus wallichiana.*

2) **Convention on Illegal Trade of Endangered Species (CITES)** – aside from *Taxus wallichiana* which is listed as protected under the AWEC listing process, CITES lists an additional 5 plant species for regulation of trade to and from Afghanistan - *Sternbergia fischeriana*, *Dioscorea deltoidea*, *Dactylorhiza majalis*, *Eulophia turkestanica*, and *Habenaria josephii.*

3) **International Union for the Conservation of Nature (IUCN) Red Listed species for the region (Afghanistan, Iran, Pakistan, Tajikistan, Turkmenistan and Uzbekistan)** – lists 83 plant species, 26 of which are stated by IUCN as occurring in Afghanistan (see http://www.iucnredlist.org). It is worth noting however that this list tends to be biased towards shrubs and trees, with medicinal plants, forbs and grasses largely omitted.

By combining these 3 lists, a total of 90 species were identified as preliminary plant species for priority attention in Afghanistan. However, it was then necessary to confirm the historical presence of these species in Afghanistan using a variety of electronic databases including the UNEP World Conservation Monitoring Center (http://www.unep-wcmc.org/) and Plant Information Centre based at the Royal Botanical Gardens in London (http://epic.kew.org/). Following this screening method, a total of 49 species were confirmed as being present in Afghanistan, at least historically but **not** necessarily from the wild.

The final step to compile the definitive list of analysis species therefore involved examining collection records and reports to confirm presence in the **wild** (for example, from Flora Iranica records (Ehrendorfer et al., 1963 – 2005) and Breckle (2007)). This process resulted

in a total of 33 plant species that became the focal species for this plant and Priority Zone analysis (Table 3). With such limited local knowledge and current information available, the focal species were those largely identified by the international community as being threatened or endangered, introducing some inevitable bias to the list. Furthermore, being based on historical information, the analysis does not address the abundance of species, nor confirm their existence in these sites today.

Table 3. Thirty-three (33) suspected or known threatened and endangered plant species identified within Afghanistan (BSP/NEPA, 2009)

Family	Species	IUCN Risk Status	Podlech	Breckle	Flora Iranica	Number of locations
Pinaceae	*Abies spectabilis*	LR/lc	*		*	13
Aceraceae	*Acer caesium* ssp. *caesium*	DD			*	2
Rosaceae	*Amygdalus bucharica*	V	*	#	*	7
Pinaceae	*Cedrus deodara*	LR/lc	*	#	*	12
Ulmaceae	*Celtis caucasica*	LC	*		*	39
Caesalpineaceae	*Cercis griffithii*	DD	*	*	*	27
Fumariaceae	*Corydalis adiantifolia*	AWEC				0
Fumariaceae	*Corydalis hindukushensis*	AWEC			*	7
Dioscoraeceae	*Dioscorea deltoidea*	CITES			*	3
Ebenaceae	*Diospyros lotus*	LC	*		*	11
Moraceae	*Ficus carica*	LC	*			1
Juglandaceae	*Juglans regia*	NT	*	*	*	12
Cupressaceae	*Juniperus communis*	LR/lc	*		*	15
Cupressaceae	*Juniperus excelsa*	LR/lc	*	#	*	57
Cupressaceae	*Juniperus semiglobosa*	LR/lc	*	#	*	10
Cupressaceae	*Juniperus squamata*	LR/lc	*	#	*	4
Zygophyllaceae	*Malacocarpus crithmifolius*	DD	*		*	9
Pinaceae	*Picea smithiana*	LR/lc	*	#	*	9
Pinaceae	*Pinus gerardiana*	LR/nt	*	#	*	17
Pinaceae	*Pinus wallichiana*	LR/lc	*		*	8

Anacardiaceae	*Pistacia vera*	NT	*	#	*	16
Platanaceae	*Platanus orientalis*	LR/lc	*		*	11
Salicaceae	*Populus pruinosa*	NT	*		*	5
Punicaceae	*Punica granatum*	LC	*		*	17
Rosaceae	*Pyrus korshinskyi*	CE	*		*	5
Ericaceae	*Rhododendron afghanicum*	Na		#		0
Papilionaceae	*Sophora mollis*	LC	*	*	*	48
Tamaricaceae	*Tamarix androssowii*	LC	*			1
Taxaceae	*Taxus wallichiana*	LR/lc	*			1
Ulmaceae	*Ulmus wallichiana*	V			*	4
Vitaceae	*Vitis vinifera*	LC	*		*	3
Rhamnaceae	*Ziziphus jujuba*	LC	*	*	*	19
Zygophyllaceae	*Zygophyllum bucharicum*	CE			*	2

IUCN Risk Status Codes:

LC – Least Concern, LR/lc –Low Risk/least concern,
NT – Near Threatened, LR/nt – Low Risk/near threatened, V – Vulnerable,
E – Endangered, CE – Critically Endangered, DD – deficient data,
na – not available (also includes CITES and AWEC listings)

* Collection record exists
\# Reported observation (Breckle, 2007)

Table 3 also displays the number of locations associated with each of the plant species collected from two main sources of data (with the exception of *Corydalis adiantifolia* and *Rhododendron afghanicum*). These 395 plant locations were derived from collection site information recorded by different individuals over several years. It is worth noting that the precision of the derived locations varies substantially with the collection site information. Nonetheless, this sighting information provided very useful validation and extra biodiversity information for the final Priority Zone selection.

Priority Zone Identification

To guide the actual *selection* of Priority Zones using the botanical information available, two major criteria from the Important Plant Area (IPA) program were applied (Plant Life International, 2009). **Criterion C** from the IPA program refers to threatened habitats – essentially sites that provide an outstanding example of habitat or vegetation type of global or regional plant conservation importance. Within the context of this analysis, this criterion was applied on the basis of vegetation information taken directly from Breckle (2007), who updated Freitag's original work (1971, see Figure 4 in Appendix II) to define 17 different types of 'potential natural vegetation' (PNV). These PNV types represent what the vegetation cover would resemble without detrimental human activities (e.g. grazing, agriculture, irrigation, and deforestation). They provide an idea about the natural potential

and resources of the various regions, but do not reflect the true situation for vegetation cover across Afghanistan (see Figure 5 in Appendix II for Breckle's PNV range).

It is also worth noting that Criterion C is indirectly addressed within the ecoregional analysis since the WWF ecoregions and their global status were originally classified using some information from Freitag's vegetation classification work in the 1970s.

Similarly, **Criterion B** from the IPA program was also applied to help identify Priority Zones. This criterion refers to sites of exceptional species richness that provide a refuge where bio-geographically and bio-climatically restricted plants can 'retreat to' in the face of global climate change. In the context of the information available for Afghanistan at this stage, the identification of 'species-rich sites' is not possible. However, sites that provide plants with 'refuges' against climate change were addressed in the Priority Zone analysis, using the difference in the highest and lowest elevation points within a pre-defined area. Those areas that had a greater altitudinal range were considered as having greater 'refuge potential', with plant species having an increased chance of responding to the varying temperatures and moisture regimes brought about by climate change.

The final Priority Zone analysis applied these two criteria separately, based on three plant analysis factors and a scoring and weighting system described in the following section.

Identifying Priority Zones for Afghanistan's National Protected Area System Plan: The Methodology

Justification for Approach

Given the information deficit that exists for almost all of Afghanistan's biodiversity and the current status of its natural habitats, as well as there being no protected areas network in place, a study was devised that would predict *potential* areas of rich, globally-threatened and/or important biodiversity (so-called 'hotspots'), and promote these as **Priority Zones for investigation**. Although not a 'gap analysis' in the traditional sense, this process forms an alternative and valuable first step to forming a National Protected Area System Plan (NPASP) for Afghanistan, since areas where resources should be targeted in terms of time, finances and effort will be clearly distinguished.

Priority Zones are similar in concept to Key Biodiversity Areas or KBAs (Langhammer et al., 2007), which are defined as sites of **global** significance for biodiversity conservation, identified using globally standard criteria and thresholds, and based on the occurrence of species requiring safeguards at the **site** scale. As such, KBAs (and in this case Priority Zones) provide an effective, justifiable and transparent set of conservation targets from which a gap analysis can later be conducted to prioritize new conservation actions.

Building on such KBA initiatives as the 'Important Bird Areas' program (BirdLife International, 2009), 'Important Plant Areas' program (Plant Life International, 2009) and Alliance for Zero Extinction program (AZE, 2009) (all concepts used within the fauna and flora species analyses), KBAs have been identified in over 100 countries and are currently being used as the foundation for national-level gap analyses and geographic targets for protected area coverage at the site-specific scale, even if species data are not complete. The two primary criteria for KBA identification are *vulnerability* and *irreplaceability*. Vulnerability refers to the regular occurrence of a globally-threatened species, whilst

irreplaceability covers the restricted-range species, those with large but clumped distributions, and globally-significant congregations.

As with the KBAs, it is important to clarify that Priority Zones are neither proposals for protected areas, nor are they definitive. Being based on the rather limited information available, their identification necessarily involves assumptions, predictions and some level of subjectivity. Thus, as research begins within these zones and their "protected area potential" is assessed, it is hoped that their specific biodiversity hotspot sites become refined within a much smaller and more-precise spatial unit so that future protected area proposals are realistic and based on current-day data and information.

This Priority Zone approach, along with its justification in terms of the overall NPASP objectives, was presented in detail at the first NPASP workshop in Kabul on March 3 2009. PoWPA obtained full stakeholder agreement and support from both NEPA and MAIL, and the approach was then implemented using results from all three analyses that examined ecoregional range, critical habitats for focal faunal species and plant diversity across Afghanistan.

Priority Zone Criteria

To establish Priority Zones across Afghanistan, a range of selected maps created in each of the analyses were overlaid onto one national map (see Box 1 below).

The base map of Afghanistan (see Figure 5) comprised a series of 313 cells measuring 50km by 50km each (2,500km^2 area in total). This resolution was selected since it divided the country into individual areas of a suitable size – not so large that specific, targeted research would be problematic, but also not so small that the 'biodiversity composition' of each cell would not be distinctive enough to allow for differentiation between adjacent areas.

In order to identify Priority Zones that incorporated all three analyses, seven major criteria were identified, and each was applied to the 313 individual grid cells (see Box 2 below for full description of the criteria used).

Box 1. Country maps used within Priority Zone analysis

Maps Used for Assessing Priority Zones Across Afghanistan

Plant Analysis

1) Potential Natural Vegetation of Afghanistan (Breckle, 2007). See Figure 5 in Appendix II.

2) Elevation range across Afghanistan. See Figure 6 in Appendix II. Data were extracted from Space Shuttle Radar Topography (SRTM) Digital Elevation Models (DEM) at 90m spatial resolution across Afghanistan, made during 2000. Individual SRTM tiles were downloaded, converted, and re-projected to form a seamless elevation mosaic of Afghanistan at 3-Arc Second Resolution.

Wildlife Analysis

1) All 41 maps of individual species' high priority and lesser priority "areas of interest". See Figure 3 for an example.

2) Biome-restricted bird species across Afghanistan. See Figure 4.

3) At-risk bird species across Afghanistan. See Figure 7 in Appendix II.

Ecoregional Analysis

1) Whole-country map of Afghanistan's 17 ecoregions, as defined by Olsen et al. (2001). See Figure 2.

2) Afghanistan's ecoregions classified according to threat status (Critical/Endangered, Vulnerable or Stable), as defined by Olsen et al. (2001). See Figure 1 in Appendix II.

3) Afghanistan's 'Global 200' ecoregions as defined by Olsen and Dinerstein (2002). See Figure 2 in Appendix II.

Other Data Used

1) Human settlements across Afghanistan. See Figure 8 in Appendix II. Data were taken from the Afghanistan Information Management Service (AIMS) which used the settlements map digitized by USAID from data provided by the US Defense Mapping Agency during the time period 1967 – 1988.

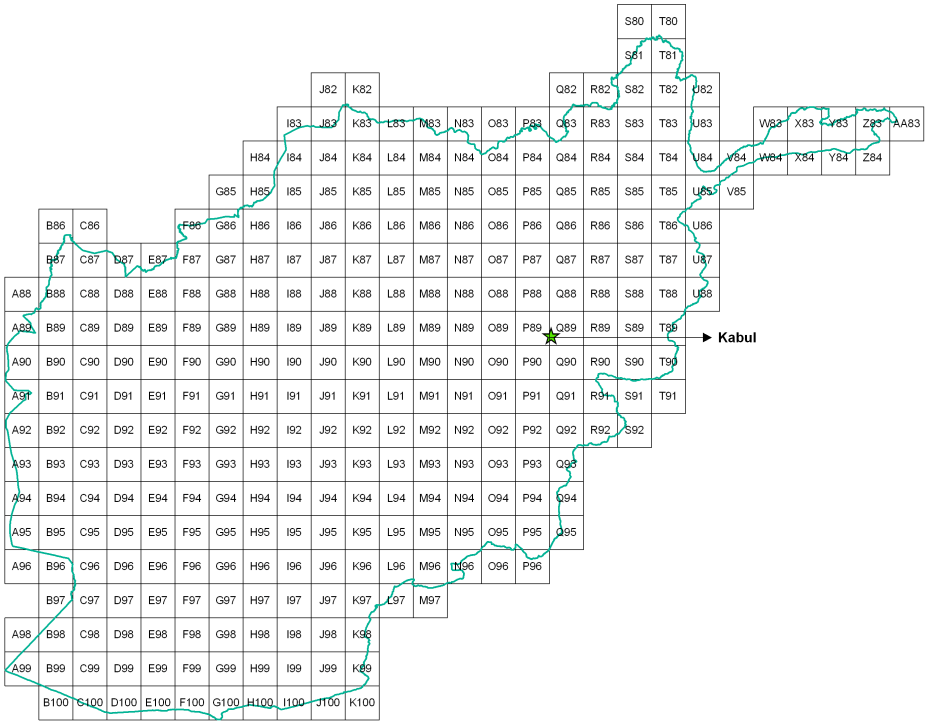

Figure 5. Map of Afghanistan divided into 313 2500km² grid cells and labeled according to the specific cell number (WCS, 2009)

Box 2. Priority Zone criteria and associated grid cell score descriptions

Priority Zone Criteria and Grid Cell Scoring

1) **Number of potential vegetation types within cell** – based on Criterion C of the Important Plant Area (IPA) program to ensure threatened habitats are well represented within protected areas. The grid cell score was simply the total number of vegetation types.

2) **Difference between highest and lowest altitude within the cell** – based on Criterion B of the IPA program to ensure sites of exceptional species richness that provide refuge to bio-climatically and bio-geographically restricted plant species are well-represented within protected areas. The grid cell score was the elevational range within the cell.

3) **Wildlife areas of interest within cell**– ensuring the relative levels of focal species and habitat diversity is considered for each cell and serving as a proxy for faunal 'species richness'. The grid cell score was the total score of all wildlife areas of interest found within that cell (high priority AoIs scored 5, whilst lesser priority AoIs scored 2).

4) **Number of biome-restricted bird species within cell** – based on Criterion A3 of the Important Bird Area (IBA) program to ensure potential protected area sites are considered on the basis that they contain adequate representation of all bird species restricted to a given biome, both across the biome as a whole and, as necessary, for all its species in each range state. The grid cell score was therefore the total number of biome-restricted bird species found there.

5) **Number of at-risk bird species within cell** – based on Criterion A1 of the IBA program to ensure potential protected area sites are considered if they are known, estimated or thought to hold a population of a species categorized by the IUCN as Critically Endangered, Endangered or Vulnerable (in this study, bird species listed under Near-Threatened were also included since their conservation status within Afghanistan was considered concerning enough to warrant future protection). The grid cell score was simply the total number of "at-risk" birds found there.

6) **Regional or global status of ecoregions within cell** – ensuring the diversity and number of threatened and/or globally-important ecoregions is considered for each cell. The grid cell score was based on the following:-

    - Secure ecoregion = 0
    - Vulnerable ecoregion = 1
    - 2x vulnerable ecoregions = 2
    - Critical/endangered = 3
    - 2x critical/endangered or critical/endangered+vulnerable = 4
    - Global 200 ecoregion within cell = 4 (scored 4 regardless of other ecoregion status since their representation is critically important on a global scale)

7) **Number of human settlements within cell** – ensuring that levels of actual or potential 'disturbance' from humans in close proximity is considered for each cell. The grid cell score was simply the total number of human settlements in that area.

Priority Zone Criteria – Ranking & Weighting System

To allow for a simple comparison between the 7 different criteria and to ensure one certain criterion that scores particularly highly does not bias the results, the total scores for each of the criteria within the 313 grid cells were divided up according to **four 25th–percentile classes** that covered the entire total score range. A ranking value from 1 to 4 for each of the 7 criteria was then assigned to every grid cell based on the 25th-percentile classes. Thus, each of the 313 grid cells had 7 separate ranks of 1-4, for 7 of the different criteria, as follows:-

Number of potential vegetation types within cell

Number	*Rank*
1-2	1
3	2
4	3
5-6	4

Elevational range within cell

Range (m)	*Rank*
0-479	1
480-1364	2
1365 – 2171	3
≥ 2172	4

Total wildlife AoI scores within cell

Number	*Rank*
0-41	1
42-52	2
53-63	3
≥ 64	4

Number of biome-restricted bird species within cell

Number	*Rank*
0-29	1
29-32	2
33-37	3
≥ 38	4

Number of "at-risk" bird species within cell

Number	*Rank*
0-5	1
5-6	2
7-9	3
≥ 9	4

Ecoregion conservation status and/or global importance

Ecoregion composition	*Rank*
Vulnerable (V)	1
2x Vulnerable	2
Critical/endangered (CE)	3
2x CE.; CE+V; Global 200	4

Number of human settlements within cell	
Number	*Rank*
0-9	4
10-69	3
70-155	2
≥ 156	1

The final stage of Priority Zone determination relied upon a method of *weighting* the various criteria so that their ranking for each cell would contribute, in a pre-determined and relative manner, to the final cell score (termed '**synthetic score**'). These weightings were chosen after consultation with a range of experts involved in this Priority Zone study and ongoing NPASP document (Table 4 below). They were designed to reflect knowledge and understanding about the relative effects and influence on future protected areas from a large or growing human population, the combination of a range of nationally and/or globally important ecoregions within the area, a relatively large number of wildlife and plant species that depend on a certain biome or habitat for their long-term survival, and the elevational diversity of the landscape. The final weightings were decided upon as follows:-

Table 4: Individual criterion weighting factors for Priority Zone designation

Criterion	Weighting Factor	Justification
Number of different potential vegetation types	**5**	Represents the diversity and long-term viability of the landscape; however this criterion was weighted less than others because it is already covered to some degree within the ecoregional analysis. Furthermore, it is a reflection of *potential* vegetation type across Afghanistan, rather than *actual,* and cannot be taken as a true or current picture of Afghanistan's vegetative cover.
Elevational range	**6**	Serves as an effective and important proxy for assessing the site's ability to act as a refuge in continuing to support a plant or animal's habitat in the face of global climate change. However, it was also important not to exclude flat expanses of land from a possible Priority Zone designation and protected area site, thus this criterion was weighted just above centre.
Wildlife area of	**7**	As the major result from the entire wildlife analysis, this score represents the species richness across the

interest scores		country, as well as the diversity and condition of potential habitat for a range of key species in Afghanistan. Therefore, it is weighted relatively highly.
Number of biome-restricted bird species	**3**	Since the 105 biome-restricted bird species were assessed collectively, rather than individually, it was decided to weight this criterion at a relatively low level so as not to skew the Priority Zone designation towards sites that may just contain a large collection of restricted bird species and little else. Furthermore, this criterion is addressed directly within BirdLife International's IBA program, the results of which are displayed on the final Priority Zone map (enabling further refining of Priority Zones if necessary).
Number of at-risk bird species	**3**	As above, since the 21 "at-risk" bird species were assessed as a collection, it was decided to weight this criteria also at a relatively low level so as not to skew the Priority Zone designation towards sites that may just contain a large collection of "threatened" bird species. This criterion is also addressed directly within BirdLife International's IBA program, the results of which are displayed on the final Priority Zone map (enabling further refining of priority zones if necessary).
Ecoregional conservation status, global importance and diversity	**8**	Assigned the most influential weighting since ecoregional designation combines a large range of data and information (including the conservation status and global importance of flora, fauna and habitats), as well as forming the foundation of the NPASP short and long-term targets. Furthermore, under the Global 200 designation, the 5 Global 200 ecoregions within Afghanistan are the most important areas in the country for the preservation of Earth's biodiversity. Thus protecting them is an international priority and the ranking and weighting system should reflect this.
Number of human settlements	**4**	Since the correlation between population density and level of habitat utilization (or disturbance to plant or animal species) cannot easily be made with the current data available, this criterion was weighted at a relatively low level. However, to some degree, it does represent the potential of the site as a future protected area given the levels of human population there and its impact on the remaining biodiversity.

The use of weightings produced a **final synthetic score** for each grid cell by combining each of the 7 criteria. Thus the synthetic score reflects the value of each site in terms of its

potential for further research and perhaps establishment as a future protected area. For example, those cells scoring higher than 100 generally contain critically endangered or important ecoregions, a relatively high number of key faunal species and potential vegetation types, a diverse landscape in terms of elevational range, and a low level of human 'disturbance'.

To enable a visual and easy representation of these synthetic scores across the country, a second round of ranking was conducted such that each grid cell would be placed within a category of 1 – 10 (i.e. 10th-percentiles). Combining the total synthetic scores across the 313 cells, divided the scores as follows:-

Total synthetic score of cell	
Synthetic Score	*PZ Rank*
0 - 57	1
58 - 72	2
73 – 82	3
83 - 87	4
88 – 93	5
94 – 98	6
99 – 104	7
105 – 113	8
114 – 119	9
≥ 120	10

A classification system using 10th-percentiles was selected since, after comparison with both coarser and finer scales (see Figures 9 and 10 in Appendix II for trial Priority Zone maps using 20th-percentile and 5th-percentile ranges respectively), this system appeared to give the most appropriate resolution for selection of a suitable number of Priority Zones. It is important to note that these Priority Zones divisions are still somewhat subjective and should not be taken as definitive classes of 'priority'. For example, Priority Zones are not just limited to those sites ranked as 9 or 10. Ideally, they should be considered more as a guide to areas of relative ***importance for biodiversity***, with their parameters shifting according to alternative ranking or weighting systems, and future survey requirements or results.

To add further support and validation to the apparent Priority Zones, important plant location data from the BSP/NEPA flora analysis were then added as a layer onto the Priority Zone map. Essentially, these data contributed towards both Criterion B of the IPA program (i.e. exceptional rich flora in a regional context) and Criterion A (i.e. holding significant populations of one or more species that are of global or regional conservation concern). However, due to the limited amount of threatened and endangered plant location information, it was decided not to use these data in the actual Priority Zone designation calculations since the rankings and final synthetic score were biased if the data were used.

Nonetheless, the data can contribute significantly to the final Priority Zone selection, adding useful supplementary information to the Priority Zone map. The results and clear conclusions from this exercise are shown in the Results section to-follow.

Furthermore, identified IBAs by BirdLife International (BirdLife International, 2009), expected/known biologically significant wetlands (MAIL and the Ministry of Public Health of the Government of Afghanistan, 2007) and previously proposed protected areas were also placed onto the Priority Zone map to investigate the extent of overlap between these formerly identified "biodiversity interesting areas" and the current Priority Zones.

As well as enabling accurate proposals for ongoing biological survey work within the country, the Priority Zones were also designed to help focus research over the following five years in order to meet the 2015 NPASP targets. These targets involve protection of at least 2% of the following ecoregions selected on the basis of their "safety" within ongoing security concerns in Afghanistan (see Figure 11 in Appendix II for a map of current security issues, and Figure 12 for these 2015 "target ecoregions"):-

Priority ecoregions identified for targeted action to meet 2015 NPASP targets were as follows:-

- **Badghyz and Karabil semi-desert**
- **Afghan Mountains semi desert**
- **Paropamisus xeric woodlands**
- **Gissaro-Alai open woodlands**
- **Hindu Kush alpine meadow**
- **Karakoram-West Tibetan Plateau alpine steppe**
- **Ghorat-Hazarajat alpine meadow**
- **Pamir alpine desert and tundra**

These eight ecoregions were consequently overlaid onto the Priority Zone map, allowing clear identification of any Priority Zones falling within all eight ecoregions. The result of this overlay is also shown in the following results section.

Results from the Priority Zone Investigation

Priority Zone Ranks & Whole-Country Maps

The final result from combining the ecoregional, plant and wildlife analyses showed the following breakdown of 10 Priority Zone classes within Afghanistan:-

Priority Zone Numbers	
PZ Rank	*Number of cells*
1	33
2	30
3	35
4	28
5	32
6	30
7	32
8	35
9	29
10	29

These Priority Zones are represented visually on the following two maps – with Figure 6 displaying the corresponding cell PZ rank, and Figure 7 displaying the individual cell number for subsequent identification purposes.

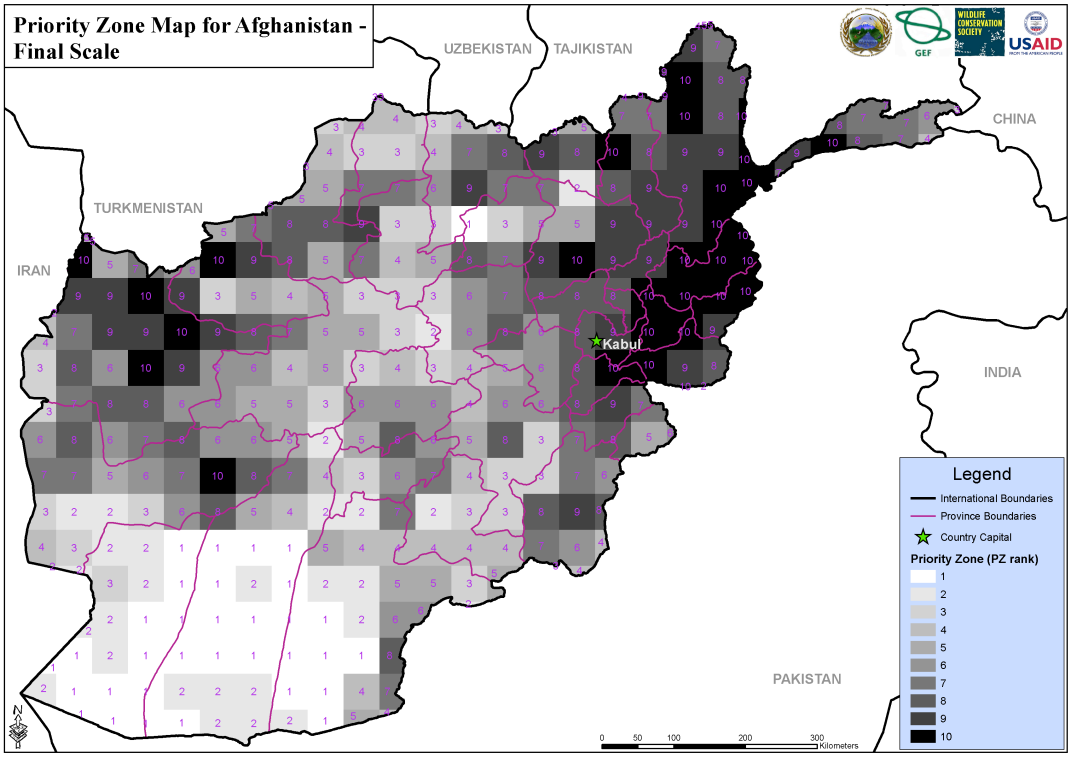

Figure 6: Final Priority Zone map for Afghanistan, with Priority Zone ranks displayed (WCS, 2009)

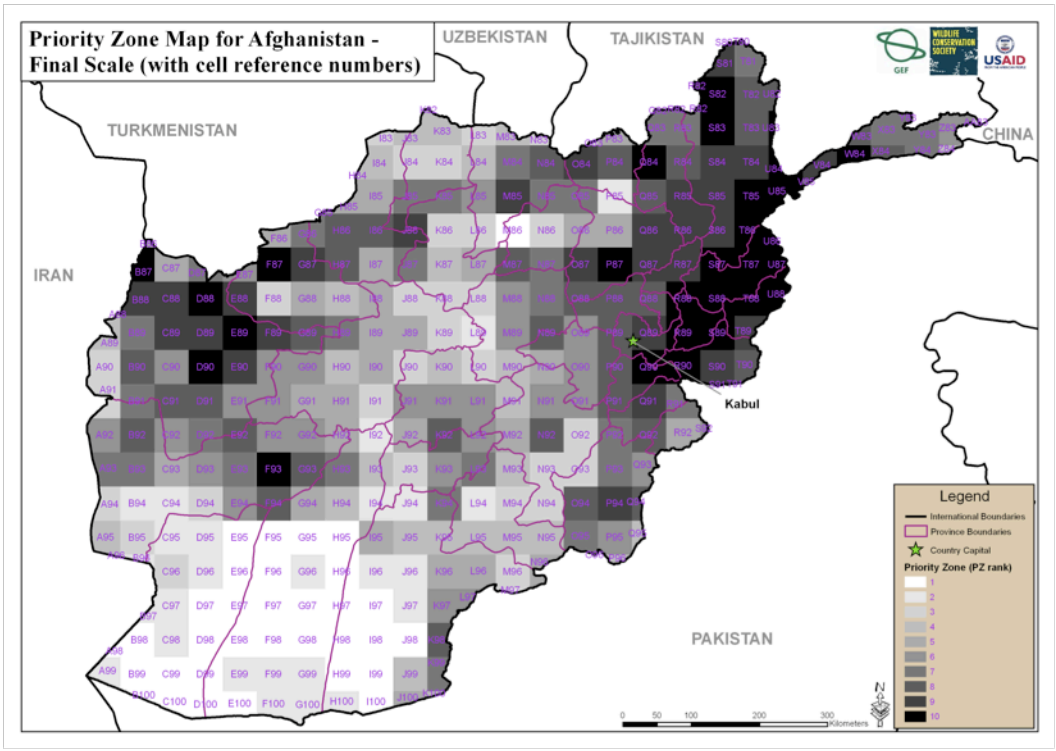

Figure 7: Final Priority Zone map for Afghanistan, with cell reference numbers (WCS, 2009)

At this early stage of designing a NPASP, attention could be focused on the 29 "Highest Priority Zones" that obtained a Priority Zone rank of 10 (listed in full within Table 1 within Appendix III, with their relative compositions). However, as stated above, Priority Zones are not necessarily just those that have been ranked as 10 and they certainly do not represent the final word on biodiversity 'hotspots'. This designation is designed to be flexible, and can change according to requirements.

Additional Information for Further Priority Zone Refinement: Plant Data, Important Bird Areas, Wetlands and Previously Proposed Protected Areas as Examples

Additional Information on Focal Plant Locations

The detailed list of these 29 zones within Table 1 of Appendix III also contains a breakdown of the different plant species that were sighted in that area and their conservation status (although these data should be regarded as representing 'historic presence' since sightings were made during the 1970s). This dataset was not included within the actual Priority Zone designation because there were not sufficient data to avoid biasing the Priority Zone result significantly.

As can be seen from Table 1 in Appendix III and Figure 8 below, some of these preliminary 29 Priority Zones contain no plant sighting data, whilst others contain almost 20 different plant species. Although this information does not represent habitat condition and viability of current-day Afghanistan, it does provide just one example of how additional information such as plant sighting data can help to further refine the Priority Zones. For instance, on this basis alone, 11 Priority Zones out of the original 29 could now be identified as even higher priority, due to the number and IUCN conservation status of the plant species sighted within, as follows:-

1) **Q84** – contains populations of *Pistachia vera* (near-threatened)

2) **R88** – contains populations of *Juglans regia* (near-threatened)

3) **S83** – contains populations of *Amygdalis bucharica* (vulnerable), and *Pyrus korshinskyi* (critically endangered)

4) **S88** – contains populations of *Dioscorea deltoidea* (CITES-listed species), *J. regia* (near-threatened) and *Ulmus wallichiana* (considered vulnerable and an AWEC protected species for Afghanistan). Furthermore, this site contains at least 19 different plant species (perhaps representing increased vegetation, habitat and/or faunal species diversity and viability)

5) **S89** – contains populations of *Taxus wallichiana* (an AWEC protected species for Afghanistan)

6) **T85** – contains populations of *Corydalis hindukushensis* (an AWEC protected species for Afghanistan and possibly one of the main foodplants for the swallowtail butterfly *Parnassius autocrator* – another AWEC protected faunal species)

7) **T86** – contains populations of *J. s regia* (near-threatened) and *P. korshinskyi* (critically-endangered)

8) **T87** – contains populations of *J. regia* (near-threatened) and *U. wallichiana* (vulnerable and an AWEC protected species for Afghanistan)

9) **T88** – contains populations of *D. deltoidea* (CITES-listed plant species) and *U. wallichiana* (vulnerable). This site also contains 15 different plant species, again suggesting a rich diversity of habitats

10) **U84** – contains populations of *C. hindukushensis* (an AWEC protected species) and *P. vera* (near-threatened)

11) **W84** – contains populations of *C. hindukushensis* (an AWEC protected species).

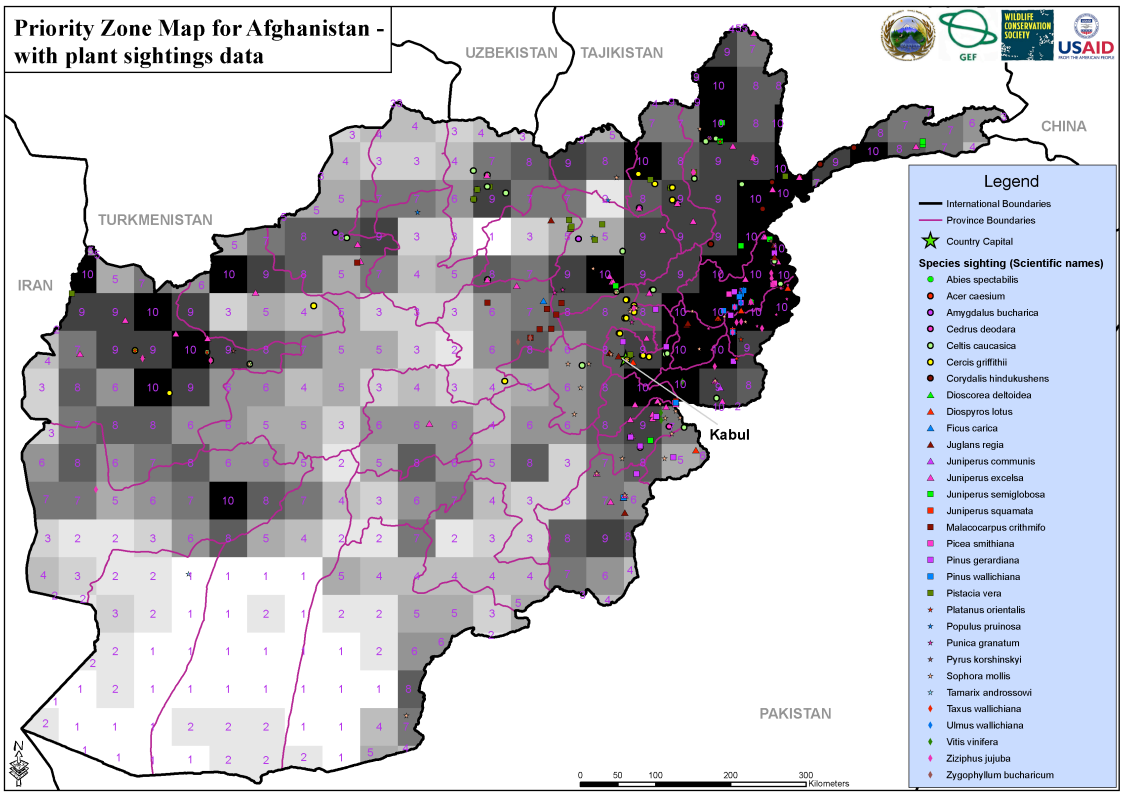

Figure 8: Priority Zone map for Afghanistan, with additional plant sighting data displayed (WCS & BSP/NEPA, 2009)

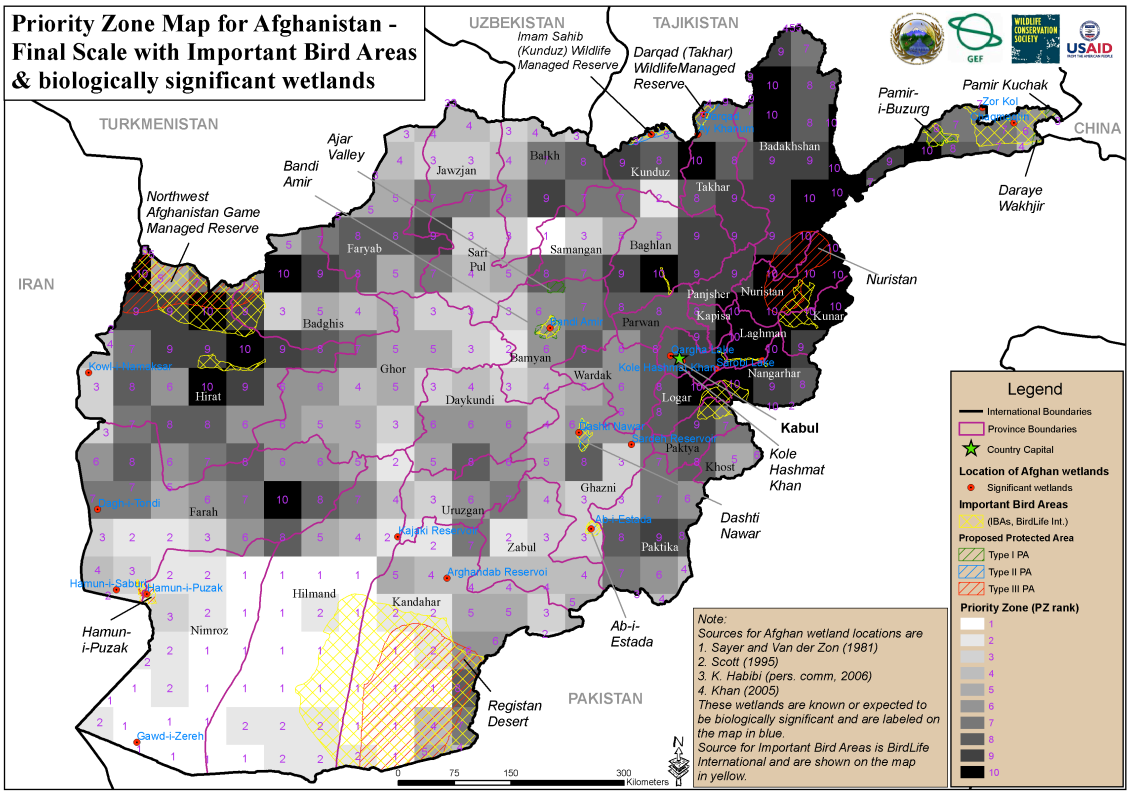

Figure 9: Priority Zone map for Afghanistan, with additional data displaying Important Bird Areas (BirdLife International, 2009), biologically-important wetlands (MAIL, and Ministry of Public Health, Government of Afghanistan, 2007), and previously proposed protected areas from a range of sources (WCS, 2009)

Additional Information on Important Bird Areas, Wetlands and Previously Proposed Protected Areas

A visual examination of Figure 9 above reveals that the BirdLife International IBAs do fall within several identified high Priority Zones, particularly the 2 IBAs in the north-western region of Herat Province, the 3 IBAs in the eastern parts of the country and southeast of Kabul city, 1 IBA in southern Baghlan province and 1 IBA midway along the Wakhan Corridor.

However, there does appear to be a distinct lack of known or expected biologically-significant wetlands represented within the highest Priority Zones. Most of these potentially important areas for this type of ecosystem only fall within Priority Zones ranked between 3 – 7 (for example in the northern areas of Takhar and Kunduz provinces). This re-emphasizes the statement that it is not only Priority Zones ranked as 10 that should necessarily be focused on, and the target areas for research should always remain flexible.

The previously proposed protected areas identified throughout the past three decades do largely appear within areas of relatively high Priority Zones such as the Northwest Afghanistan Game Reserve, Nuristan and the Big Pamir Wildlife Reserve. Furthermore, previously proposed protected areas such as Dasht-i-Nawar, Registan Desert (eastern region), Darqad Wildlife Reserve and the Little Pamir Wildlife Reserve fall within Priority Zones ranked between 6 – 9, also suggesting relatively rich or important 'hotspots' for

biodiversity still in these areas. However, the noticeable discrepancies between these previously proposed protected areas and Priority Zone rank include Hamun-i-Puzak (with a PZ Rank of only 2-3), Ab-i-Estata (Rank 3), Waghjir Valley (Rank 4) and Imam Sahib (Rank 3-5).

Identifying Research Priority Zones to Meet 2015 Protected Area Targets

According to the 2015 targets that concentrate on protecting at least 2% of the 8 selected "safe ecoregions", there are Priority Zones that fall within these 8 important regions (Figure 10).

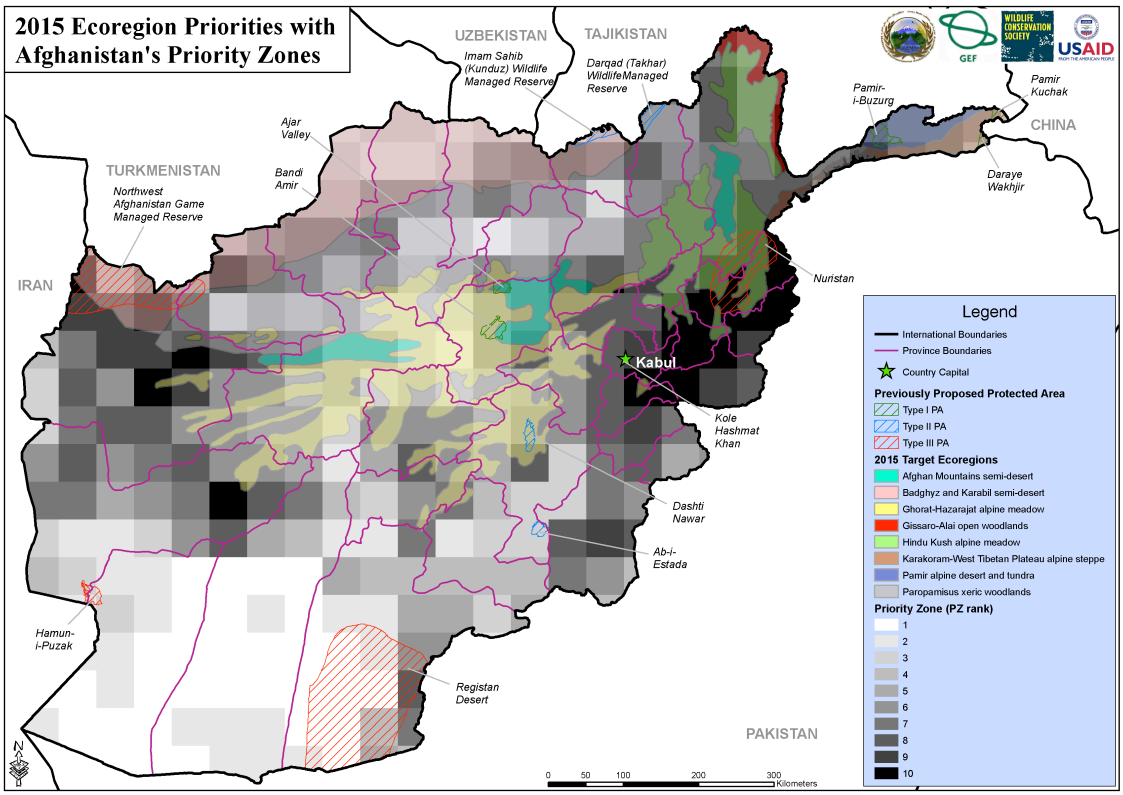

Figure 10: Priority Zone Map for Afghanistan, with "2015 Target Ecoregions" and previously proposed PAs displayed (WCS, 2009)

Twenty-eight (28) Ecoregional Research Recommendations for 2015

From the results of the preliminary Priority Zone work presented within this report, initial investigations and fieldwork could therefore be focused within **28 Priority Zones** of the **8 identified 2015 Target Ecoregions**, as follows:-

Afghan Mountains Semi-desert

- **P87** – lies at the very eastern tip of the Afghan Mountain Semi-desert within Baghlan Province. There is also an IBA identified within this Priority Zone.
- **S84, S85 S86** - all 3 sites ranked as **PZ 9** running north-south within central Badakhshan Province.

- **G89** – ranked as **PZ 8** running north-south crossing both Badghis and Herat provinces. Lies at the very western tip of the Afghan Mountain semi-desert ecoregion.

Badghyz & Karabil Semi-desert

- **B87** – lies at the very western edge of Afghanistan, bordering Iran and close to the border with Turkmenistan, within the previously proposed 'Northwest Afghanistan Game Managed Reserve' proposed protected area in Herat Province. There is also an IBA identified here.
- **D88** – also found within western Afghanistan (Herat Province), with approximately half of the area covered by the 'Northwest Afghanistan Game Managed Reserve' previously proposed protected area. The entire area is also proposed as an IBA.
- **F87 –** found on the northwestern border of Afghanistan with Turkmenistan, within Badghis Province.
- **Q84 –** lies at the very eastern tip of Badghyz & Karabil semi-desert ecoregion, crossing the provinces of Kunduz and Takhar. This zone is relatively close to two identified IBAs and previously proposed protected areas (Darqad and Imam Sahib), as well as being in close proximity to 3 biologically important wetlands.

Ghorat-Hazarajat Alpine Meadow

- **D90** – in the very centre of Herat Province, and at the western edge of the Ghorat-Hazarajat alpine meadow ecoregion. This lies just south of an identified IBA.
- **E89** – lies within Herat Province. An entire 'island' of the Ghorat-Hazarajat alpine meadow ecoregion is found within the site, surrounded by Paropamisus xeric woodlands. It also has two identified IBAs located just north and south of this zone.
- **F93** – found at the very southwestern edge of this ecoregion in Farah Province. No IBAs, significant wetlands or previously proposed protected areas in close proximity.
- **P87** – found within the eastern edge of Ghorat-Hazarajat alpine meadow ecoregion in Baghlan Province. An identified IBA is also located within this zone.

Gissaro-Alai open woodlands (Global 200 Ecoregion)

- **U83** – along the very eastern border of Afghanistan's Badakhshan Province with Tajikistan.
- **U84** – also along the eastern Afghanistan/Tajikistan border.
- **S81** – ranked as **PZ 9**, this area is at the very northern tip of Badakhshan Province, bordering with Tajikistan.

Hindu Kush Alpine Meadow (Global 200 Ecoregion)

This ecoregion contains a number of Priority Zones, perhaps on account of its status as a WWF Global 200 ecoregion, and its relatively large area that covers much of north-eastern Afghanistan. The following Priority Zones are found within the Hindu Kush alpine meadow regions, all ranked as **PZ 10**:-

- **R88** – at the crossroads with 4 different provinces – Nuristan, Panjsher, Kapisa and Laghman.
- **S82** – in northern Badakhshan Province, bordering Tajikistan.
- **S83** – in central/northern Badakhshan Province, relatively close to the border with Takhar Province.
- **S87** – lying across the southern border of Badakhshan, with Nuristan Province. A large area of the site falls within the Nuristan previously proposed protected area and is close to an IBA.
- **S88** – crosses the provinces of Nuristan, Kunar and Laghman, also within the Nuristan proposed protected area and an identified IBA.
- **S89** – crosses the provines of Kunar, Laghman and Nangarhar, relatively close to Afghanistan's border with Pakistan.
- **T85** – at the base of the Wakhan Corridor in central/southern Badakhshan Province.
- **T86** – crossing Badakhshan and Nuristan provinces, a large area of which is covered by the Nuristan proposed protected area. Borders Pakistan.
- **T87** – also within Badakhshan and Nuristan provinces and covered largely by the Nuristan proposed protected area and an identified IBA.
- **T88** – this site crosses the provinces of Nuristan and Kunar, the western side of which falls within the Nuristan proposed protected area and an identified IBA. Borders Pakistan.

Karakoram-West Tibetan Plateau Alpine Steppe (Global 200 Ecoregion)

- **T85** – within central/southern Badakhshan province, close to the base of the Wakhan Corridor.
- **U85** – at the base of the Wakhan Corridor, sharing a border with northern Pakistan.
- **W84** – along the central part of the Wakhan Corridor, its northwestern area bordered by Tajikistan, and its southern area bordered by Pakistan. An identified IBA is also found within this zone.

Pamir Alpine Desert & Tundra

- **W83** – ranked as **PZ 8**, this site covers much of the Big Pamir proposed protected area and an identified IBA, in the central-northern part of the Wakhan Corridor, bordering Tajikistan.
- **W84** - along the central part of the Wakhan Corridor, its northwestern area is bordered by Tajikistan, and its southern area is bordered by Pakistan. The southern edge of the Pamir alpine desert and tundra ecoregion is found here, along with an identified IBA.

Paropamisus Xeric Woodlands

Similar to the Hindu Kush alpine meadow, this ecoregion contains a number of high Priority Zones due to its large expanse across the northern plains of Afghanistan. All the Priority Zones marked below are **PZ 10**:-

- **E89** – at the far eastern edge of the Paropamisus xeric woodlands, found within Herat Province. Two IBAs are found just north and south of this zone.
- **F87** – along the northern border of Afghanistan with Tajikistan, at the northwestern edge of this ecoregion.
- **P87** – in southern Baghlan Province with an identified IBA within.
- **Q84** – close to the northern border of Afghanistan with Tajikistan, crossing Takhar and Kunduz provinces. This site lies between the previously proposed protected areas of Darqad and Imam Sahib and is close to a biologically important wetland.
- **S82 & S83** – in northern/central Badakhshan Province, bordering Tajikistan on the western sides
- **T85** – close to the eastern tip of Paropamisus xeric woodlands within Badakhshan Province. This site is very close to the base of the Wakhan Corridor, near to the Pakistan border.
- **U84, U85 & W84** – these sites are at the very eastern edge of this ecoregion in Afghanistan, at the base of the Wakhan Corridor (U84 and U85) and within the central part of the Corridor (W84). An identified IBA is also located within W84.

For full details on the composition of each of these **28** Priority Zones listed above, including those additional zones ranked as **PZ 8** or **PZ 9**, please refer to Tables 1 and 2 in Appendix III.

Summary and Main Conclusions from the Priority Zone Investigation

In order to begin the planning process for Afghanistan's protected area network, an approach was required that used the information and data available on the three principle components of biodiversity to be addressed – ecoregions, the flora and the fauna – and combined these in an effective manner such that conclusions could be made regarding both the suitability of the previously proposed PA network, and where research efforts would now best be focused to "update" this proposed network. The idea behind a conventional gap analysis was adapted to the context of Afghanistan where the actual **creation** of a protected area system is needed, rather than the **expansion or modification** to an existing system. The end-goal was a set of identified "hotspots" that, based on updated information and knowledge, are expected to contain a range of important ecological components such as unique and threatened habitats, or key faunal/floral populations and communities. These were referred to as Priority Zones, with the emphasis placed on encouraging research within so that short-term (2015) targets for protected area representation could be met.

The underlying guide to this work was the ecoregional classification system defined by Olsen et al. (2001) on behalf of WWF. This classification was based on detailed research that investigated ecoregions and their ecological compositions. In combination with other environmental factors, the 17 identified ecoregions helped designate Priority Zones, set short-term targets, and produce potential "areas of interest" for key faunal species.

Although faunal/floral species targets were not utilized at this stage, it was important to include these components within the Priority Zone analysis so that targets would not be set according to ecoregional representation alone. The methods used for both species analyses (fauna and flora) were devised according to the limited information available, and necessarily involved a range of assumptions and hypotheses. However, the methods attempted to incorporate international standards and criteria for recognizing key biodiversity areas, and the results from both analyses were certainly applicable for the ongoing Priority Zone analysis, adding significant weight to the final result. Twenty-nine of the highest-ranking Priority Zones were identified using this approach, in various areas across Afghanistan – some of which were "new" to the previously proposed PA network (in Farah Province and parts of Badakhshan for example), whilst other Priority Zones 'validated' the previous proposals, particularly within the eastern forests and north-western areas close to Iran. These Priority Zones tended to contain a diversity of faunal and vegetation types, a range of elevations across the landscape, important and/or endangered ecoregions and low human density. The significance of many of these high-ranking Priority Zones was also confirmed using Important Bird Areas, biologically important wetlands and historic plant data.

However, there were several noticeable inconsistencies between areas strongly believed to still contain globally-important or threatened biodiversity and the identified Priority Zones (e.g. northern areas of Takhar and Kunduz provinces close to the border with Tajikistan, and surrounding the previously proposed protected area of Hamun-i-Puzak). These discrepancies demonstrate the need to apply these Priority Zones results with caution. They do not represent the final word on important areas for biodiversity and were designed from the outset to act as a flexible guide to areas for investigation, rather than a firm method for proposing protected areas in current-day Afghanistan. The parameters for Priority Zone selection can be modified at any time, as the scoring and weighting systems are easily

adjustable. This is particularly important since the process will be repeated and/or adapted in the near-future using new data coming directly from the field (e.g. sightings of flora or fauna, or reports on the condition of rangeland at key sites).

The scoring and weighting system, plus the criteria themselves are intended to encourage debate on the various issues that should or could have an impact on what is considered to represent 'rich biodiversity' in Afghanistan. For example, the elevation criteria was particularly debated, with some experts considering a range of elevations as a major benefit in providing refuge in a changing climatic conditions while others felt that this criterion incorrectly focused conservation managers towards less-accessible and therefore possibly less-threatened habitats. Using this kind of argument as an example, it is recommended that the analysis itself be repeated either without elevation as a criterion or at least reducing the elevation weighting to observe the difference in results. The analysis might also be re-run using a different ecosystem classification system entirely (such as biomes), or other criteria could easily be added so that *future* hotspots can be predicted under particular environmental conditions or stochastic events.

In the final step of the analysis, 2015 "priority ecoregions" were combined with the Priority Zone map to direct research efforts in the short-term. This merger identified 28 Priority Zones, ranked from 8-10, that will feature significantly in the National Protected Area System Plan.

Additionally, these 28 Priority Zones will be shared with other Government Ministries to ensure that rural development activities are implemented in cooperation with conservation of Afghanistan's natural resources. Additional refinement of these 28 Priority Zones could also be made through placing a map of 'current research sites' over these zones such that those areas receiving high levels of attention already are distinguished from those where minimal research has yet been conducted. It is these lower-profile zones where the next wave of research could perhaps be focused.

The ideas for this analysis and recommendations for future application have come about through a large collaborative effort between NEPA and the many different individuals and organizations working on conservation of natural resources within Afghanistan. It is hoped that this collaboration continues and that immediate and long-term research is coordinated among stakeholders using the PoWPA Priority Zone analysis. Now that Afghanistan has identified it's biologically important areas, work can begin to address the next challenge to establish Afghanistan's future protected area network.

Acknowledgements

This work would not have been possible without the support and cooperation from the Government of the Islamic Republic of Afghanistan (in particular Director General Zaher and the staff at the National Environmental Protection Agency, and the Ministry of Agriculture, Irrigation & Livestock Facility). Generous support and assistance from the Global Environment Facility, the United Nations Development Programme and USAID also made this work possible and sincere thanks goes to all the agencies concerned, particularly to Maxim Vergeichik and Jamison Ervin – the PoWPA Global Project Co-ordinators. The author also acknowledges the assistance and guidance throughout the design and write-up of the study provided by colleagues at the Wildlife Conservation Society. In particular, the author would like to thank David Lawson, Peter Smallwood, Peter Bowles, Christopher Shank, Stephane Ostrowski, Peter Zahler, and Jim Wingard for their input and comments at all stages. Acknowledgments also to Charles Hatch (BSP/NEPA) for his ideas on the Priority Zone approach and work in conducting the plant analysis, and particularly to the GIS specialists at WCS (Haqiq Rahmani and Rohullah Sanger) for their hard work, dedication and attention to detail during the entire analysis. Finally, thank-you to Save the Environment Afghanistan (SEA), Ms Sweeta Momand, Mutjaba Bashari and Mohammad Naseem Sultani for their translation services and to the PoWPA Management team at WCS – McKenzie Johnson for all her advice and support as PoWPA Manager for Afghanistan, and Hafizullah Rehmani and Hamidullah Sahibi for their tireless work and efforts as the PoWPA national consultants.

References

Alliance for Zero Extinction (AZE). 2009. Alliance for Zero Extinction home page. Global initiative of biodiversity conservation organizations. Available from < http://www.zeroextinction.org/> Downloaded 01 July 2009.

BirdLife International 2009. Global Important Bird Area Criteria. BirdLife International, Cambridge, UK. Available from < http://www.birdlife.org/datazone/sites/global_criteria.html> Downloaded 01 August 2009.

Breckle, S.W. 2007. Flora and Vegetation of Afghanistan. Basic and Applied Dryland Research, **1**(2): 155 – 194.

Campbell, N. A. 1996. Biology. 4th Edition. The Benjamin/Cummings Publishing Company, Menlo Park, California, USA.

Ehrendorfer, F., E. Schonbeck-Temesy, C. Puff and W. Rechinger. 1963 – 2005. Flora Iranica – Plants of Iran (Persia). (Volumes 1-176.) K.H. Rechinger, editor. Flora Iranica Project, Natural History Museum, Vienna, Austria.

Evans, M.I. 1994. Important Bird Areas in the Middle East. BirdLife Conservation Series No.2. BirdLife International, Cambridge, UK.

Freitag, H. 1971. Die natürliche Vegetation Afghanistans. Beiträge zur Flora und Vegetation Afghanistans I. Vegetatio **22**: 285 349.

Freitag, H. 1972. Studies in the natural vegetation of Afghanistan. Pages 89 – 106 in P.H. Davies, editor. The Plant Life of South-West Asia. 1st edition. Royal Botanical Gardens, Edinburgh, UK.

Habibi, K. 2003. Mammals of Afghanistan. 2nd edition. Zoo Outreach Organization (with assistance from the U.S. Fish & Wildlife Service), Coimbatore, India.

Hassanyar, S. A. S. 1970, Ecological Classification of Afghanistan. [in Dari]. Kabul : Kabul University. 33 pages. (Accession # 7995, Afghanistan Centre at Kabul University [ACKU]).

Langhammer, P.F., M. I. Bakarr, L.A. Bennun, T.M. Brooks, R.P. Clay, W. Darwall, N. De Silva, G.J. Edgar, G. Eken, L.D.C. Fishpool, G.A.B. da Fonseca, M.N. Foster, D.H. Knox, P. Matiku, E.A Radford, A.S.L. Rodrigues, P. Salaman, W. Sechrest, and A.W. Tordoff. 2007. Identification and Gap Analysis of Key Biodiversity Areas: Targets for Comprehensive Protected Area Systems (Issue 15 of the Best Practice Protected Area Guideline Series). International Union for the Conservation of Nature (IUCN), Gland Switzerland.

Ministry of Agriculture, Irrigation & Livestock and the Ministry of Public Health. 2007. Afghanistan Avian Influenza Control and Human Pandemic Preparedness and Response Project: Environmental Management Plan. Document number: E1457. Government of the Islamic Republic of Afghanistan, Kabul, Afghanistan.

Olson, D.M., E. Dinerstein, E.D. Wikramanayake, N.D. Burgess, G.V.N. Powell, E.C. Underwood, J.A. D'amico, I. Itoua, H.E. Strand, J.C. Morrison, C.J. Loucks, T.F. Allnutt, T.H. Ricketts, Y. Kura, J.F. Lamoreux, W.W. Wettengel, P. Hedao, and K.R. Kassem. 2001. Terrestrial eco-regions of the world: A new map of life on Earth. BioScience 51(11): 933 – 937.

Olson, D.M. and E. Dinerstein. 2002. The Global 200: Priority ecoregions for global conservation. Annals of the Missouri Botanical Garden **89**:199-224.

Plant Life International. 2009. Important Plant Areas (IPAs). Plant Life International, Salisbury, Wiltshire, UK. Available from <http://www.plantlife.org.uk/international/plantlife-ipas.html> Downloaded 01 August 2009.

Rasoavahiny, L., Andrianarisata, M., Razafimpahanana, A., & Ratsifandrihamanana, A.N. (2008). Conducting an ecological gap analysis for the new Madagascar protected area system. Parks **17**(1): 12 – 21.

Rodrigues, A.S.L., S.J. Andelman, M.I. Bakarr, L. Boitani, T.M. Brooks, R.M. Cowling, L.D.C. Fishpool, G.A.B. da Fonseca, K.J. Gaston, M. Hoffmann, J.S. Long, P.A. Marquet, J.D. Pilgrim, R.L. Pressey, J. Schipper, W. Sechrest, S.N. Stuart, L.G. Underhill, R.W. Waller, M.E.J. Watts, and X. Yan. 2004. Effectiveness of the global protected area network in representing species diversity. Nature **428**: 640 – 643.

Sayer, J.A. and A.P.M. Van der Zon. 1981. National Parks and wildlife management, Afghanistan. A contribution to a conservation strategy. Unpublished Food and Agricultural Organization (FAO) report: FO/DP/AFG/74/016. FAO, Rome, Italy.

Udvardy, M.D.F. 1975. A classification of the biogeographical provinces of the world. International Union for the Conservation of Nature (IUCN). Occasional Paper No. 18. IUCN, Morges, Switzerland.