RAPID RANGELAND ANALYSIS OF AJAR VALLEY WILDLIFE AREA AND BAND-I-AMIR NATIONAL PARK, BAMIAN PROVINCE

Results from the 2008 Field Season

By

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RAPID RANGELAND ANALYSIS OF AJAR VALLEY AND BAND-I-AMIR, BAMIAN PROVINCE

Preface

Rangeland work in Bamian Province consisted of a rapid rangeland reconnaissance in the Ajar Valley Provisional Wildlife Reserve and Band-i-Amir National Park. The objective of the rapid reconnaissance was to determine rangeland conditions and areas of concern regarding rangeland use. In both areas the WCS rapid rangeland reconnaissance consisted of a survey of rangelands, some plot work to examine plant communities at particular sites and discussion of issues and problems with local peoples. As this work was designed as a "rapid reconnaissance" and time was limited for data collection, a relatively large number of photographs were included in this report to illustrate aspects or concerns observed. Ajar Provisional Wildlife Reserve and Band-i-Amir National Park will be discussed in separate sections as the sites are quite different.

AJAR VALLEY RAPID RANGELAND RECONNAISSANCE

Introduction

A rapid rangeland analysis methodology was used to examine rangeland conditions of Ajar Valley[1] between 3 June and 8 June 2008. Previous to the survey the WCS rangeland specialist reviewed three 1970's reports on Ajar Valley Wildlife Reserve (Larsson, 1978; Shank and others 1977, Skogland, 1976). During the rapid rangeland assessment the rangeland team familiarized itself to vegetation and rangelands by hiking through some of the area and comparing vegetation communities observed with information on rangeland communities by Skogland (1976) and Larsson (1978). The rangeland team established 20 transects for evaluating vegetation cover, determining rangeland health, and for use as permanent photo transects and monitoring sites. For each transect aspect, slope, latitude/longitude, an estimate of rangeland health, and cover of species using a line intercept and point intercept methodology were measured. Ajar Valley is a difficult area to survey as topography is dissected by many canyons and water is very limited. As such, the area surveyed was not as extensive as desired, but the rangeland team was able to observe a number of sites with different conditions associated with grazing use. As such, the survey provided for some interesting site comparisons and indicators regarding rangeland health[2] which are discussed in the following sections.

Rangelands of Ajar Valley

Rangelands of Ajar Valley vary greatly in this mountainous area associated with different physical characteristics (soils, climate, elevation, aspect, and slope) and grazing use. Information on climate, soils, and

[1] In this report Ajar Valley refers to an area of canyons and uplands mostly east of Chiltan Lake of the former Ajar Valley Wildlife Reserve.
[2] Indicators of rangeland health are estimates of rangeland site indicators (vegetation and soil) associated with comparison of the site to potential for the site.

historic and current grazing use are very limited, as no detailed site-specific studies exist. In general, Ajar Valley weather is strongly continental with low air humidity, high evaporation, wide temperature fluctuations, and a winter/spring dominated precipitation pattern. The closest weather station is Bamian City located about 70 km southeast. This station, at an elevation of 2550 m, reports an annual average of 130 mm of precipitation (Fig. 1). Larsson (1978) estimated that annual precipitation varied from about 160 mm in the valley bottoms to over 400 mm in the upper mountainous sections of Ajar. It seems that the 160 mm annual average estimate of Larsson (1978) for the low elevation areas of Ajar Valley is probably somewhat high when compared with Bamian City. It is likely that the lower elevation sites of Ajar receive less than 130 mm annual precipitation and perhaps closer to 100 mm. As the elevation increases precipitation may approach the 400 mm as suggested by Larsson (1978) but exact estimates are not currently possible.

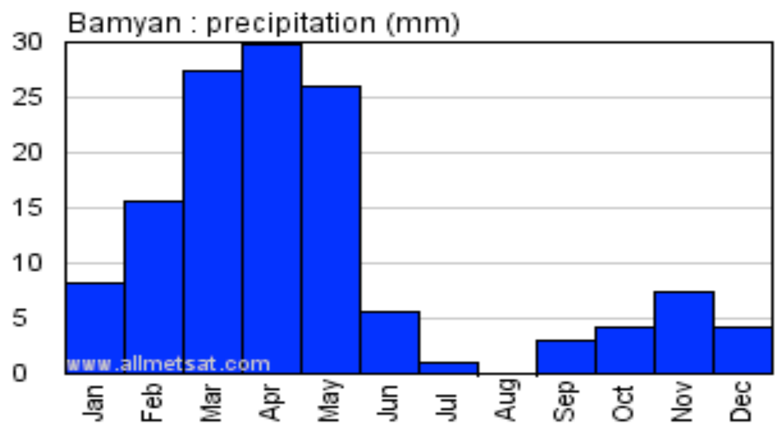

Figure 1. Mean monthly precipitation at Bamian town. (<u>www.allmetsat.com</u> – 20 September 2008).

No known soil surveys exist for the Ajar Valley. Larsson (1978) states that soils are predominantly grey soils with low humus and high carbon content but above 3000 m the organic matter content increases and the soils fall into the chestnut group. He also reported that soils are generally rather permeable with a single grain structure and low water-retention capacity except in the valley bottoms where silty soils may be found (see below regarding finer textured soils being more common in depressions that often had high composition of *Carex stenophylla*). Because the soils are relatively young and topography is extremely varied, relatively large soil differences, such as differences in depth, coarse fragments, textural classes, and texture are found throughout Ajar.

In previous reports by Skogland (1976) and Larsson (1978) vegetation community descriptions were included for major vegetation types. Skogland classified 5 major vegetation types. These were a *Carex stenophylla* short grass type, a *Stipa szowitsiana* tall grass type, an *Artemisia* type, a *Amygdalus* type and a *Cousinia* type. Larsson (1978) included seven vegetation types (River-bank willow community, Canyon-bottom scrub community, *Ephedra* steppe, *Zygophyllum* steppe, *Acantholimon* steppe, *Carex stenophylla* meadow, and *Juniperus excelsea* woodland) and also referred to a Bare rock type and a Scree type which have some vegetation but very little. Larsson (1978) also developed a vegetation type map for the area. Only the *Carex stenophylla* type is designated by both Skoagland and Larsson as a vegetation type and this type seems quite small and likely associated with overgrazing but also with site characteristics such as depressions that help hold additional water and finer soils (these areas are also higher elevation sites). Any vegetation classification is a human construct and this investigator was not able to determine the criteria used by either Larsson or Skogland in the development of their classification systems. However, it is this investigator's opinion that Larsson's vegetation types are more useful than Skogland's, but with that said, much more work needs to be done to provide a more useful plant community classification. Most of the upland rangelands are predominately either a Chenopod type (*Zygophyllum, Ceratoides, Haxolyon* genera shrub dominated) at lower elevations; an *Artemisia* shrub steppe type at moderate elevations; and a *Artemisia-Acantholimon* steppe at higher elevations[3]. As stressed by Larsson a Juniper woodland type may have existed, but currently *Juniper* is found only in rocky steep areas, in "protected" canyons or canyon valleys, or as isolated single trees in a few areas. Out of the uplands a River-bank willow community type (along the Ajar River) and Canyon-bottom scrub community type (distributed widely and extremely variable in plant composition) can be identified. Appendices 1-3 are photos showing some of the communities of the canyon bottoms. A very unique (for this very dry environment) forest type (*Juniperus*) exists in some of the narrow valleys (Appendices 1 and 3), but much of the canyon bottoms are a scrub shrub type (Appendix 2) and likely greatly modified by human uses. The River-bank willow community type (Appendix 4) is found only along the Ajar River. It is an important vegetation type but quite restricted to a narrow area along the river valley.

Ajar Valley was a wildlife reserve used by the Afghanistan royal family as a hunting area beginning in the early 20th century. All grazing of domestic stock was forbidden within the reserve boundaries, an area of approximately 50,000 ha, in the mid-20th century and apparently shrub harvest and local hunting was also mostly eliminated (Shank and others 1977). This resulted in what was believed to be the largest area in Afghanistan where livestock grazing was restricted and thus was considered as a potential reference area for determining how grazing was impacting central Afghanistan rangelands. However, by the 1980s the changing socio-political situation resulted in a loss of livestock grazing control and it is unknown how many livestock have grazed in this area during the recent past.

Rapid Reconnaissance of Rangeland Health

The WCS rangeland team determination of rangeland conditions was a modified health assessment using indicators of rangeland conditions. A U.S. approach to classifying rangeland health attributes is problematic in that there are no reference sites in Ajar Valley[4]. However, the procedure does allow for an estimation of rangeland condition and health attributes. The rangeland team established 20 transects for use as permanent photo points to establish a benchmark for vegetation conditions and to examine rangeland health attributes. These transects were

[3] *Artemisia-Acantholimon* steppe may have been once dominated by *Acantholimon*, a slow growing species often used as fuel.

[4] In the U.S. an Ecological Reference Area(ERA) is needed for site comparisons. The ERA comparisons will be the same site (climate, soils) with information on the natural variability of attributes such as litter cover, different life-forms, rills, bare ground etc. This allows an estimate on "the degree to which the integrity of the soil, vegetation, water, and air, as well as ecological process of the rangeland ecosystem, are balance and sustained". Ecological sites are not available for Afghanistan so rangeland health estimates were based on subjective judgment of hypothesis of current conditions related to what potential conditions might be based on current climate conditions and this investigator's experience on similar sites.

not randomly placed across Ajar Valley but were placed in areas where the rangeland team was working or traveling through. Twenty transects is certainly not sufficient to provide sound statistical information but does provide general information on site characteristics and conditions for those particular sites and most importantly could be used for permanent monitoring sites. The mean site characteristics and canopy cover values of shrubs, forbs, and grasses are shown in Table 1. Mean site characteristics and foliar cover, basal cover, and foliar cover by line intercept methodology are presented in Appendices 5-7 and transect locations are shown in Appendices 8-9. Electronic copies of original data forms with genera and species cover values and photos are archived on DVD.

Table 1. Site characteristics and canopy cover (%) of vegetation groupings for transects measured in June 2008 in Ajar Valley using a point intercept method.

Transect	Elevation (m)	Aspect	Slope	*Acantholimon*	*Ephedra*	Legumes[1]	*Artemisia* shrubs	Annual grasses	Forbs	Perennial Grass	Grass-likes	Salt Desert Shrubs	Total Cover
Jun04_08_1025	3100	352	24	6	4	2	10	0	0	52	0	0	74
Jun04_08_1150	3132	330	20	<1	0	0	8	0	4	52	0	0	64
Jun04_08_1435	3080	18	38	<1	0	2	8	0	10	52	0	0	72
Jun05_08_0820	2912	244	18	<1	0	0	42	0	0	<1	0	0	42
Jun05_08_0920	2936	323	22	6	0	2	16	0	10	10	0	4	48
Jun05_08_1115	3126	310	8	2	0	2	26	0	0	<1	4	0	34
Jun05_08_1155	3160	12	10	6	0	0	22	0	16	16	22	0	82
Jun05_08_1430	2610	300	15	2	0	0	18	0	2	4	0	0	26
Jun05_08_1510	2538	298	8	4	0	0	44	0	0	<1	0	0	48
Jun06_08_1535	2980	340	19	0	8	10	26	0	0	20	6	0	70
Jun06_08_1630	2980	175	16	6	2	0	40	0	0	2	0	0	50
Jun06_08_1725	2953	0	3	0	0	0	32	0	0	8	28	0	68
Jun07_08_0700	3304	320	34	8	0	2	14	0	6	18	0	0	48
Jun07_08_0835	2912	340	8	2	0	2	40	0	0	12	10	0	66
Jun07_08_0945	2724	300	5	6	0	0	18	0	0	4	14	4	46
Jun07_08_1030	2698	32	15	4	0	0	20	0	0	2	0	2	28
Jun07_08_1130	2575	331	8	0	0	0	18	0	0	6	2	4	30
Jun07_08_1200	2537	144	16	0	0	0	0	2	0	<1	0	2	4
Jun07_08_1340	2170	0	0	0	0	0	0	0	0	<1	0	42	42
Jun07_08_1750	2360	313	10	0	0	0	0	2	4	<1	0	2	8

[1] Legumes included herbaceous *Astragalus* and *Oxytropis* species (mostly *Astragalus*) and an occasional *Astragalus* shrub.

Transect elevation varied from 2170 m to 3340 m providing a representative elevation gradient of Ajar Valley. Total canopy cover (%) varied from 4% to 82% and total grass canopy cover varied from < 1 to 52%. As would be expected lower elevation sites had lower total cover and generally lower grass cover but many of the high elevation sites also had very low grass cover. Transect data provides evidence that perennial grass cover is a strong indicator of rangeland condition in Ajar Valley with those sites having little or no measured grass cover as being “unhealthy” or not providing forage grasses in levels that would be expected for “healthy” sites. Rangeland health will be discussed in the following paragraph. For 17 of the sites *Artemisia* was the dominant shrub type. These sites were above 2575 m and would have been mostly in the *Acantholimon* steppe (those sites >? about 2800 m) and *Zygophyllum* steppe of Larsson (1978). None of the sites measured had an *Acantholimon* dominated shrub cover and this may be a significant finding in that Larsson (1978) states that these communities are dominated by *Acantholimon*. It is possible that the use of *Acantholimon* for fuel by local peoples has reduced its stature as the plant is likely very slow growing. Without permanent photo-points or transects it is impossible to determine if *Acantholimon* has actually decreased in these communities. If it has changed from a dominant to a subdominant, it is a significant change in plant communities of this area. Certainly the *Artemisia* shrubs are also used as a fuel source, but the growth rates are much greater for *Artemisia* shrubs compared to *Acantholimon* cushion shrubs and the *Artemisia* often have very high seed production.

A summary of rangeland health attributes determined at the transect sites is presented in Table 2. In the procedure for categorizing rangeland health, it is hypothesized that those sites in “Extreme” and “Moderate to Extreme” departure classes are sites with high degradation and little doubt that rangeland health is compromised. Those sites classified with “Slight to Moderate” and “None to Slight” departure are sites where degradation is not evident and these sites are currently or until recently being grazed in an intensity that allows for sustainable use. The mid class (moderate) is where indicators are not clear and these sites could be degrading or perhaps improving although in general this investigator suspects the former and describes the sites as having slight “unhealthy” conditions.

Table 2. **Summary of rangeland health evaluation indicators determined in June 2008 for Ajar Valley using a rapid rangeland reconnaissance methodology (20 sites measured).**

	Descriptors/Rating Classes				
Indicators	Extreme	Moderate to	Moderate	Slight to Moderate	None to Slight
1. Rills	1	6	3	5	5
2. Water Flow Patterns	2	6	5	3	4
3. Pedestals or Terrecettes	2	5	8	2	3
4. Bare Ground	3	8	5	2	2
5. Gullies	1	1	2	5	11
6. Wind Scoured Areas	1	3	6	4	6
7. Litter Movement	2	5	8	3	2
8. Physical & Chemical Soil Crusts	1	7	4	7	3
9. Soil Surface Organic Matter	0	8	5	5	2
10. Plant Composition/ Distribution Relative to Infiltration/RO	3	9	2	4	2
11. Plant Functional/Structural Groups	6	4	3	5	2
12. Plant Mortality	3	5	5	4	3
13. Litter Amount	2	7	5	4	2
14. Annual Production	2	9	4	2	3
15. Noxious & Invasive Plants	0	2	6	8	4
16. Perennial Plant Reproductive Capability	0	10	5	3	2
Indicator Summary	Mostly Disagree	Moderate Disagree	Slightly Disagree	Moderate Agreement	Mostly Agree
Soil/Site Stability (Indicator 1-9)	4	7	5	2	2
Biotic Integrity (Indicator 10 -16	4	7	5	2	2

Four sites (20%) were rated as having little evidence of site degradation and three of these sites were in areas where livestock grazing was believed to be limited by topographical features. Eleven sites (55%) showed clear evidence of soil/site stability or biotic integrity degraded conditions. The remaining sites (25%) were less clear in their trends regarding site and biotic integrity and these sites were estimated as only slightly “unhealthy.” Of the categories used to indicate changes in health on these sites, the most important are associated with bare ground, plant composition/distribution relative to infiltration, plant functional/structural groups and annual production. Livestock grazing has reduced grass cover and grasses are mostly found beneath shrubs or protected by rocks and this situation is seen as a change in plant composition, plant functional groups (reduced perennial grasses) and in annual production as a decline in grass productivity. Very little litter is present on most sites except occasionally around shrubs. Obviously, in the dryer low elevation sites low soil organic matter and low amounts of litter are natural, but grazing has exacerbated the situation by removing almost all grasses. For most sites, signs of significant water erosion (gullies, rills, water flow patterns) were not evident, but much of the precipitation occurs in the winter/spring and intense rainfall events (thunderstorms) are not common events. With that said, soil movement resulting from water erosion was common on many sites. Wind erosion signs were more common on upland sites but wind erosion was generally not extreme and it is believed that the area is not overly impacted by high winds.

Harvesting of shrubs and other plants (e.g., *Ferula asafoetida*) creates site degradation by decreasing vegetation cover and disturbing soil surface conditions. Many donkey loads of shrubs being transported through the Ajar Valley were observed. Larsson mentions large donkey loads of *Haloxylon griffithii* (*Arthrophytum griffithii* syn) being transported by donkeys for fuel, and although it is likely that *Haloxylon* is still being used for fuel, it was observed that mostly *Artemisia* and *Juniperus* being transported on donkeys during the rangeland rapid reconnaissance.

Comparison of Two Areas Receiving Different Livestock Grazing Use

As stated above, one of the most useful indicators of a change in rangeland conditions or health is associated with a change in grasses. These findings are based partially on a comparison of two areas with similar site characteristics (physiographic features and soil) but different livestock accessibility. These areas will be referred to as site 1, an area with predominately low to moderate grazing use, and site 2, an area with predominately high grazing use or impacts. Locating sites that received no livestock grazing was not possible.

Site 1 was a site that was difficult to access associated with the area being dissected by canyons and rock outcrops. This site received some livestock grazing and there were sheep and goats in the area during the transect measurements. Site 1 was sampled on 4 June 2008 with 3 transects. The three transects had a mean elevation of 3090 m, moderate slopes and mostly northerly aspects (Table 3) and likely would have been included in Larsson's (1978) *Acantholimon* steppe vegetation type[5]. These sites had some of the highest total canopy, foliar, and basal cover of any sites measured, but what is apparent is that perennial grass cover (and estimated grass standing crop) was significantly greater than for any other sites measured. The dominant shrub was *Artemisia lehmanniana* (with *A. rutifolia* present). *Acantholimon* spp and cushion Carophyllaceae were common. Dominant grasses were *Festuca ovina* and *Stipa* spp. (probably *S. szowitsiana*). *Elymus* spp. (probably *E. dahuricus* or perhaps *E. pobanus*) was observed mostly on sites with low grazing pressure or where plants were in "protected" sites" such as around rocks or shrubs or in steep canyons. *Cousinia sp.* was the dominant forbs observed on these sites but no forbs were found at high cover levels.

[5] A comparison of transect location to the georeferenced scan of Larsson's (1978) map placed all of the June 4 transects in the *Carex stenophylla* vegetation type (but very little or no *Carex stenophylla* was present). June 5 transect locations overlaid on Larsson's (1978) map had sites on bare rock vegetation type, canyon and *Acantholimon* steppe.

Table 3. Comparison of transects from two areas with similar physical characteristics (elevation, slopes and aspect) but with different grazing use.

Transect	Elevation (m)	Aspect^0	Slope^0	Shrubs CC*	Shrubs FC	Shrubs BC	Forbs CC	Forbs FC	Forbs BC	Grass/Grass Like CC	Grass/ Grass Like FC	Grass/GL BC	Total Cover CC	Total Cover FC	Total cover BC	Rangeland Heath
Jun04_1025	3100	352	24	18	12	6	0	2	2	52	38	14	74	52	22	G
Jun04_1150	3132	330	20	10	12	2	4	2	0	52	26	14	64	40	16	G
Jun04_1435	3080	18	38	10	6	0	10	4	0	52	32	22	72	42	24	E
Site 1** Mean	3104	233	27	13	10	3	5	3	1	52	32	17	70	45	21	
Jun05_0920	2936	323	22	22	20	4	10	4	0	10	8	0	48	34	4	P
Jun05_1115	3126	310	8	30	22	2	0	0	0	4	4	0	34	26	2	VP
Jun05_1155	3160	12	10	24	16	2	16	10	2	22	18	0	82	44	14	F
Site 2 Mean	3074	215	13	25	19	3	9	5	1	12	10	<1	55	35	7	

* CC, FC, and BC refer to canopy cover, foliar cover, and basal cover, respectively.
** Site 1 was estimated to have light to moderate grazing associated with topography. Site 2 was estimated to have a greater livestock grazing intensity as the site had few topographic barriers to livestock movement.

Site 2 was measured on 5 June using three transects. The three transects had a mean elevation of 3074 m and generally had similar aspects and slope to site 1 transects (4 June transects) (Table 7). This site had relatively easy access to livestock grazing when compared to site 1 as trails into the area were not as steep, or perhaps more importantly not as dissected by many steep canyons. This site was 2.7 km from the lightly grazed site and access to permanent water was about 3 km from this site compared to 5 km for site 1. Two transects measured on this site would be classified in Larsson's as (1978) *Acantholimon* steppe vegetation type and the third a mix of *Acantholimon* steppe and the *Carex stenopylla* meadow vegetation type. Data from these two sites are presented in Table 7 to illustrate some the differences in vegetation associated with livestock grazing in these two areas (species information can be found in Appendices 5-8). In this report four photos are used (Figures 2-5), two transect overview photos and 2 close-up photos to show the similarity of the sites (transect photos) and differences in the site (close-up photos).

The light-moderate grazed site had greater grass/grass-like cover and total cover and less forbs and shrub cover. For these shrub steppe sites, perennial grass cover is the most significant attribute in regards to rangeland condition. Overgrazing is resulting in a loss of grass cover, which is critical in protecting the soil surface, and the lack of grass cover increases soil crusts. The impact of livestock trailing is also evident in canyons, major trails, and on many hillsides through the area as increased bare ground (Appendix 10). For site 1 (04 June transects) rangeland health during fieldwork was estimated as either excellent or good based on greater grass cover, grass productivity, flower-head production and litter (Table 3). The rangeland health estimates of transects measured on site 2 varied from very poor to fair associated with poor grass cover, less grass production, poor vigor of grasses (no flower production or standing litter) and soil crusting was evident when compared to the light to moderately grazed site. It is hypothesized that much of the upper elevation plateau areas with proper grazing should be producing 800-1000 kg/ha of grasses rather than the current estimate of 200 kg/ha of grasses seen on most of the upper plateau areas. Without livestock grazing controls (numbers and season of use) in this area, there will be continued degradation and a loss of rangeland productivity for both livestock and wild ungulates.

Figure 2. Photo of site 1 transect with low to moderate grazing.
Note evident grass cover (transect Jun04_08_1150: Photo 04-06-2008_12.02.26).

Figure 3. Photo of site 2 with greater livestock grazing use.
Note “heavier shrub cover and lack of grass (transect Jun05_08_0920: Photo 05-06-2008_09.45.12).

Figure 4. Close-up photo of plot on site 1 showing greater grass cover.
Transect Jun04_08_1150: Photo 04-06-2008_11.07.50 is a site moderately grazed and although in much better condition than other sites may be digressing in condition.

Figure 5. Photo of close-up plot on site 2 illustrating soil crusting and lack of grass.
Transect Jun05_08_0920: Photo 05-06-2008_09.54.14).

Concluding Statements

Ajar Valley is a diverse landscape with many values that need immediate conservation attention. There is certainly the potential that livestock grazing and cutting of shrubs and trees will increase site degradation and potentially eliminate the juniper seed source as juniper trees are often cut and those remaining are often isolated and in poor condition . It is reported that the wild ungulate population (ibex and urial) have dramatically decreased during the last several decades, and it seems very possible that wild ungulates could be eliminated from the area. It is likely that competition for forage and water with livestock is impacting wild ungulate populations, but past poaching by local peoples has probably been the major driving force for a reduction in these populations. This subjective judgment is based on the belief that there are still many sites in Ajar Valley that are producing moderate amounts of forage that would be available for wild ungulate populations.

From the rapid rangeland assessment, the WCS rangeland team documented that overgrazing is a problem and grass cover is a major indicator in rangeland condition. The time in Ajar Valley was not sufficient for a detailed survey to quantify overall rangeland conditions and additional surveys are needed to better define vegetation types, assess rangeland conditions and to determine a livestock population level that would not significantly compete with wild ungulates and provide for improved grass forage production. Additional work is also needed to determine the impact of shrub/tree harvest for fuel on these rangelands, especially on the impact on juniper and *Acantholimon* types. Information on livestock grazing (timing, numbers, and distribution) is also limited and necessary to determine how livestock grazing could be balanced with conservation needs of the area. Larsson (1978) stated that "compared to the adjacent, over-exploited rangelands, the Ajar Valley Wildlife Reserve show throughout its history of protection signs of general range improvement that are considered unique for the central Afghanistan highland" as the area had been protected from grazing by domestic livestock and shrub-collection for nearly 30 years. It is extremely unfortunate that this protection was lost by the 1980s and there is little doubt that current human uses are degrading rangelands. However, some of the rangelands of the Ajar Valley are still some of the least degraded observed in Band-i-Amir or in the Wakhan Corridor, the WCS other two major study areas. The lightly grazed "Site 1 area" was one such area with high grass productivity and good species diversity of perennial grasses that was not seen in other areas of Bamian. With additional surveys similar sites in Ajar would likely be located.

BAND-I-AMIR NATIONAL PARK
Introduction

The rangeland survey work in Band-i-Amir in 2008 consisted of a modified PRA (participatory rural appraisal) regarding fuel shrub concerns and a comparison of some dry-land farm areas (abandoned) to unplowed sites. The PRA in Band-i-Amir was associated with the rangeland assessment findings in 2007 that dry-land farming (wheat), shrub collecting, and livestock grazing were identified as major areas of concern regarding rangeland condition in Band-i-Amir. Of these, only the lack of shrubs for fuel was unanimously considered as the major rangeland concern by villagers of Band-i-Amir. As such, the major rangeland work in Band-i-Amir in 2008 was a modified PRA to determine if local peoples continued to think shrub harvest was the major issue and if there were consistent responses regarding shrubs used and possible solutions to ensure sustainable use of shrubs. However, it is still evident that livestock grazing and dry-land cultivation (lalmi) are also major threats to sustainable use of rangelands in Band-i-Amir. Therefore, during 2008 the WCS rangeland survey team continued with an analysis of the impact of dry-land farming on rangelands. Dry-land farming has the most visual and direct impact on rangelands, although over a smaller area than livestock grazing or shrub collection which occur in all areas. Some of the more observable impacts of the plowing of rangelands are a loss of natural vegetation cover, increased wind/water erosion, increased "weeds," and decreased aggregate soil structure associated with loss of surface soil structure. In the past dry-land cultivation was done by clearing shrubs and then shallow plowing with a wooden plow pulled behind an ox. These wooden plows disturbed only to a shallow depth and in addition it was difficult to plow large areas as the practice was quite labor intensive. Recently there have been relatively large areas plowed using tractors and the depth of plowing is much deeper which may expose more subsoil to erosive forces. The dry-land farmed areas are almost entirely of wheat. The wheat is planted in April and May when the soil is still moist. Apparently no weed control or fertilization occurs and the only care is to protect the area from livestock. The grain is harvested in late August, and in many years little grain is produced and low yields are the norm. Most planted areas observed in 2008 had very sparse wheat cover.

Methods

Participatory Rural Appraisal Shrub Use Concerns

The WCS rangeland team initiated meetings with a random subset of the 13 villages of Band-i-Amir to better understand concerns regarding shrub collection for fuel and to some extent collection of shrubs for animals as several shrubs are used as both. These 5 villages were Qalia Jafar, Sabzil, Kopruk, Abghol, and Khadkhaw and totaled about 53 % of the population or households of Band-i-Amir. Information on families, total population, animal numbers and group divisions are shown in Appendix 11.

A discussion on methods of the PRA was held with Afghan counterparts after selecting the villages for the PRA. It was determined that a local ranger would accompany the rangeland team to the villages to help in the discussions and to help arrange meetings with villagers. The Hazarajat Conservation Specialist and resident of the area, asked all questions and lead discussions with locals in three out of five of the villages (see Fig. 6). For the other two villages the WCS rangeland technician and the local ranger asked questions of the PRA participants. It was also determined that the PRAs would occur in late morning or early afternoon to eliminate as many work conflicts as possible. The local ranger was instructed to find villagers who were willing to meet for the PRA when entering each of the villages.

Figure 6. Photo 29 May 2008-09:15.18. PRA at Kopruk. Note shrub piles in background.

The meetings were approached as modified PRAs (participatory rural appraisals) where the meeting was initiated with a discussion of why shrub collection was considered an issue, stressed that the rangeland team was not there to make any decisions or in developing restrictions regarding shrub collections. The PRA was initiated by informing villagers that past surveys had found that fuel sources, especially shrubs, had been identified as a major concern by all villages and the rangeland team was there to discuss these concerns. It was stressed that there were no plans to restrict shrub use as it was realized the use of shrubs for fuel was a need for all villages. It was also stressed that the PRA team was there to understand the problems regarding the availability of fuels and communicate concerns of the villagers to others at the provisional and national levels. In general, it seemed that villagers were pleased to have someone discussing the shrub problem and bringing their concerns to politicians. It was very obvious that the people were concerned about restricting land use such as farming and shrub collecting.

The first question was to have villagers identify the 5 most important shrubs for their use. The villagers were asked for the local name of the shrub and asked if they could show us the shrub growing in a nearby area or in one of the nearby piles of shrubs. The PRA then used an informal interview process to determine why these shrubs were the most important to the villagers and how these shrubs had decreased/increased over the last five years, 10 years and 20 years. If shrubs had decreased (all communities stated shrubs had dramatically decreased), it was asked if they knew why the shrubs decreased. It was also determined how much shrubs were used (donkey loads) by an average household and when was the season of highest use. Communities were also asked communities how the situation could be improved and if there were other potential sources of fuel they could use.

Dry-land Farming

The WCS rangeland team examined site cover differences and standing crop between plowed and unplowed areas at four sites. Initially 4 sites were selected that had been plowed and allowed to “go back” and 4 adjacent (paired) sites that showed no signs of plowing (although these areas probably had shrub harvest impacts).

It was not possible to determine how long the plowed sites had been abandoned during this reconnaissance. Estimates were that one site had been cultivated 2 years previously as surface was still ‘rough’ from the past plowing. The other sites had been abandoned for a much longer time and showed no evidence of plowing (very flat and crusted soils) and all had some shrubs reestablishing. It was estimated these sites had not been plowed for at least 10 years although as stated previously this estimate was not possible to verify.

A third comparison was made associated with ‘off-site’ areas that were similar to the lalmi areas but were generally not close to plowed areas so that there was no direct influence of blowing soils or “weedy” conditions. These off-site areas averaged about 100 meters higher in elevation than the lalmi areas but had similar physiographic features (slopes and aspects) and soils as the plowed and unplowed sites. These ‘off-site’ sites were measured because even on unplowed sites adjacent to the plowed sites there were obvious signs of disturbance such as wind blown soils and significant shrub harvest. On one of the off-site transects there had been relatively recent shrub collection, but it is difficult to find sites without signs of relatively recent shrub harvests.

The cover comparisons used three different estimates of cover. Canopy cover, foliar cover, and basal cover was estimated by species using a point intercept method and 50 m transect on each site. Any point (meter mark) that was within a vertical projection of plant foliar spread was considered canopy cover. For foliar cover the point had to intersect a plant leaf or stem. For basal cover the point must intersect the basal stem of the plant. As such, canopy cover will be greater than foliar cover and foliar cover will be greater than basal cover. Because basal cover only considers the contact of the base of the plant, the number of species found is often so low on rangeland sites any comparisons of sites is difficult. All cover values were grouped into different life-forms (shrubs, forbs, perennial grass, annual grass and Carices) for discussion. Three plots ($0.25m^2$) were clipped for each transect. Herbage was air dried and converted to kg/ha.

Results and Discussion

Participatory Rural Appraisal: Shrub Concerns

All of the interviews substantiated that the availability of shrubs for fuels is a very significant concern and that all shrubs had dramatically decreased in recent times with the largest decreases coming in the last several years (5 years). It was difficult to get the groups to suggest the level of change but some said as much as an 80% decrease in the last 5 years (an unlikely high value). Others stated that the problem was that they now had to travel 2 to 3 times farther to collect shrubs. It was generally the same shrubs (4 out of 5 are always on the same list) that are important to different villages surveyed (Table 4). Of these five shrubs the most important genera were *Artemisia*, *Acantholimon* and *Astragalus*. Pastoralists recognized different species within these genera but if the plant was ‘woody’ they were used as fuel. In three of the PRAs participants separated the different *Acantholimon* associated with their importance as either for fuel and animal feed or both. It was learned that red ghuzbai probably *A. diaspensioides* was used as both whereas the other two species were considered mostly as fuel. The woody *Astragalus candolleanus* was strictly mentioned as fuel and not as feed. This tall woody shrub may also be important as a nitrogen fixer and its removal from these rangelands may be impacting soil productivity in unknown ways, and as it is a tall shrub may reduce habitat for wild species. PRA participants often mentioned feed value of the *Artemisia* and of surkhpaicha (possibly *Polygonum polycnemoides*) as animal feed on rangelands, but these shrubs were collected as fuel and not to feed animals. Ali (2006) states that in his Band-i-Amir survey villager's preferred *Astragalus* and *Epehdra* species for fire wood purposes because of high calorie values of these plant species. In this PRA *Ephedra* (jama) was mentioned in only one of the PRAs as the sixth most important shrub. As the question asked by the PRA team was associated with which shrubs were most important (not most preferred on caloric basis) it is not possible to state if these finding are different than Ali's (2006) findings.

Table 4. The five most important shrubs[1] for use as fuel and for animals in 5 communities in Band-i-Amir National Park.

Ranking	**Qalijafar[2]**	**Sabzil[3]**	**Kopruk**	**Abghol**	**Khadkdaw**
1	Butai	Dombeschutor	Ghozbai	Surghozbai	Butai
2	Ghozbai	Surkhpicha	Khirpak	Butai	Ghozbai (Surghozbai
3	Dombeschutor	Butai	Butai	Khirpak	Khirpak
4	Surkhpicha	Ghozbai	Dombeschutor	Sangguzbai	Dombeschutor
5	Char-e-mush	Khirpak	Surkhpicha	Dombeschutor	Otakai

1. The villagers provided common names. Butai or safed butai is *Artemisa* sp. (likely *A. afghanica* and *A. rutifolia*), Ghozabai are cushion shrubs and include *Acantholimon* sp. and *Acanthophyllum* sp. At times Ghozbai was separated by villagers into 3 types: Surghozbai or red ghozbai (*Acantholimon* sp.), Sanghuzbai or rock ghozbai (*Acantholimon* sp.) and Salguzbai (*Acanthophyllum grandiflorum*). Dobeschutor (*Astragalus candolleanus*), Surpaicha (*Polygonum polycnemoides*), Khirpak (*Cousinia* sp.), Otakai (unknown higher elevation large cushion shrub that had no flowers). Char-e-mush was believed to be an *Astragalus*, possibly *A. lasiosemius and A. leisemius.*
2 In Qalijafar it was mentioned that Yawma (*Ephedra*) was also important and some rated in top five but not the majority of the villagers interviewed.
3 In Subsel the first two shrubs were considered of equal importance. Number 5, Khirpak, was important as animal food and villagers said it had mostly disappeared.

Khirpak (*Cousinia* sp) was listed in 3 of the 5 PRAs as an important shrub. This plant is a forb with only a woody base and does not look as if it could be very important as a fuel source. However, it was stressed as an important plant during the PRAs for animals and was also a plant that was mentioned as declining. It was apparent that any woody shrub would be used as fuel, but it is somewhat surprising that *Krascheninnikovia ceratoides* (boujerghani) was never mentioned as an important fuel or feed. *Krascheninnikovia ceratoides* is not very common, but is certainly present on many areas and was often very heavily browsed. It is generally known as a nutritious browse and, although it is a suffrutescent shrub (dies back mostly to base and therefore with little woody top-growth), the woody base is often used in other areas of the world by pastoral groups. It is this investigator's hypothesis that this shrub was not considered important because of its low frequency, which could be associated with past overuse.

Four out five of the villages interviewed stated that shrub collection from "outsiders" was the main reason for a decrease in shrubs. In one village (Khadkhaw) the people stated that shrubs were declining because of the drying climate (2/3 of the reason) and associated with people from outside over collecting shrubs (1/3 of the reason). These "outside" collectors were generally from villages from the Schardai area and also Bamian town. The main problem associated with these outside collectors, as stated by the villagers, was that these outsiders often used trucks and collected all the shrubs leaving little to repopulate the site. When asked what could be done about the outside collectors, all the villagers said they needed to be able to control their village areas from these outsiders and had petitioned local government to support their need to restrict use. However, in all cases these villagers stated that the provincial government had done nothing to help their village restrict outside use of their perceived village lands.

Because all the PRAs stressed that the decrease in shrubs was greatest in the last 5 years, the rangeland team was curious if "outsiders" collecting shrubs was not a problem in the past. Indeed, many of the villagers stated that during Mujahedeen times trucks would come and make people cut shrubs and load the trucks. Some also stated that Mujahedeen would come at other times and just take shrubs that were already stored in the villages.

Even though the villagers clearly stressed the reduction of shrubs during the recent past, it was obvious that shrub density had been decreasing for some time. In one interview an older man who was collecting shrubs said the shrubs started decreasing 45 years ago. He said that the area in which he was presently collecting shrubs was difficult to walk through some 50 years previously as shrubs were much denser. At the Abghol village PRA, villagers stated that 30 years previously adequate large shrubs were easy to collect near the village area and were similar to areas now over 7 km away. Most PRA participants did stress that they now had to go much farther from their villages to collect shrubs, but no one seemed to suggest that other villages within Band-i-Amir used their village areas. In one instance Pasthun were identified as the group coming from outside to gather shrubs. Villagers were asked if these were kuchi (nomads) and were told no. These villagers then stated that the kuchi did not overuse shrubs or collect shrubs outside their areas implying again that the problems regarding overuse of shrubs were not by traditional users of these rangelands.

The rangeland team found it surprising that in none of the PRAs were other local people (people from adjacent villages) considered a problem in the reduction of shrubs within their (PRA) village area. This suggests that either this practice was not done (not likely) or an accepted norm. In one case an individual did state that one reason for the decline of shrubs was associated with increased dry-land cultivation. This individual was quickly scolded by other villagers as there is no doubt that villagers are concerned about land use restrictions, especially regarding dry-land cultivation. It was never asked specifically if dry-land farming was decreasing shrubs as the rangeland team did not want to suggest why shrubs were decreasing, but certainly this investigator believes that dry-land farming has significantly decreased shrubs and decreased the productivity of grazing areas. In fact, the dry-land cultivation of many of the marginal rangelands in Band-i-Amir is the most serious problem regarding rangeland health.

In the PRA villagers were asked in which season was shrub use greatest and at what season was the major collection time. Four out of the 5 PRAs informed us that the greatest use of shrubs is winter. During this period Abghol villagers said they used 4 donkey loads/week[6]. One group (Subsel village participants) stated that greatest use was in spring and summer because more fuel was needed to boil milk. It was obvious that herders spend considerable time harvesting shrubs. The major time in which villagers concentrated on shrub collection was during times when other commitments were less; for example, in late spring (following planting dry-land farming areas) and late fall (after harvest). In an interview a young man collecting shrubs stated that he was paid 100 Afs ($2) per shrub donkey load in the Band-i-Amir park headquarters area.

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[6] The average weight of a donkey load of shrubs was estimated at 70kg.

Figures 7-10 illustrate shrub collection and some concerns regarding the photos and process. Fig. 7 is of an older person who stressed that in the area he was working shrubs were formerly much taller and difficult to walk through (perhaps all the taller *Astragalus candolleanus* removed). On this site *Artemisia* was quite small and likely this area was recovering from past harvest. Figures 8 and 10 show some impacts of shrub harvest on grasses and soils.

Few suggestions were provided by the villagers for decreasing shrub use, but as stated previously certainly villagers wanted to be able to control shrub harvest by restricting outside collectors. Two suggestions for decreasing shrub use mentioned were increasing the availability of electricity and at three villages increasing the use of charcoal. Additional electricity will be available to Qalijafar with the completion of the hydro-turbine this year, but it is unknown if the electricity supplied would be enough for cooking. During the PRA at Subsel village they suggested that they could be supplied electricity from the hydropower station near Qalijafar for approximately $10,000 (estimated cost of power line). It was again unclear if this power line would provide enough power to households for cooking, but this investigator suspects that it will not. The growing of trees, even in villages with irrigation water, was not considered as a potential replacement for shrubs because of the length of time to grow trees. Furthermore, it is believed that most of the trees would be used in construction and not as fuel.

Figure 7. Photo 31 May 2008-08:27.22. Shrub collection site.
In this site shrubs are quite small but because of a lack of fuels harvesting is still taking place. The removal of shrubs not only removes shrubs but also some of the grasses (next Fig.).

Figure 8. Photo 31 May 2008-08:27.44 showing grass (Festuca sp.) damage from shrub harvest.

Note: In addition, the shrubs "protect" grasses from heavy grazing to allow for seed production to revegetate adjacent sites.

Figure 9. Photo 30 May 2008-10:03.21 showing root extraction of large shrub.

WCS rangeland team leader with shrub extracted from site by a shrub collector. Note that at times the entire root system is extracted. As this shrub is a legume (*Astragalus candolleanus*), it is also likely a nitrogen fixer that improves nutrient capacity of the soils.

Figure 10. Photo 9 June 2008-16:14.15 showing loss of soil organic matter from shrub harvest. Estimated that shrubs were collected during the past Fall. Note darker soils (more organic matter) at center of photo where large cushion shrubs were removed. Soils out of shrub interface were lighter in color and with a significant platy structure (crust formation).

Dry-land Cultivation

Dry-land farming is considered a potential negative influence on shrub and forage production, soil productivity, carbon sequestration, wildlife habitat and water quality. In interviews with farmers it was determined that it was common practice to "rest" the area after one crop to reduce soil productivity problems. The rest period may range from 3 to 7 years, but it not clear from the interview on how rest periods were determined. One interviewee stated that each area received 6 years rest following planting. He stated that he planted 7 sirs of seed for 3 jeribs (about 0.6 ha) on May 4. During the rest period there is no attempt to plant these areas to a cover crop or to protect the site from wind or water erosion using conservation tillage practices. Apparently for most sites after planting only a few crops, the area is abandoned as productivity decreases. In one interview, the rangeland team was told that only about 25% of the area previously dry-land farmed is now used. Again, this would seem to suggest that the amount of cultivated area will likely increase as the needs for the increasing number of families to produce more food increases. It is unknown how long it would take these areas to recover to a shrub steppe, but it is estimated that it would take at least 20-30 years. Although apparently dry-land farming (lalmi) is illegal on government land, Shank and Larrson (1977) reported that there were traditional and inheritable rights to access of lalmi land in Band-i-Amir. They reported 3000 – 5000 jeribs (600 – 1000 ha) of dry-land wheat were being farmed every year (this seems a larger area than what this investigator believed was planted in 2008; however, no attempt was made to determine total area planted). The WCS rangeland team strongly believes there is a strong need to determine the current extent of lalmi in Band-i-Amir. In determining the total area impacted by dry-land farming, one should consider not only the area farmed but also recently abandoned and fallowed areas.

As would be expected, perennial grass cover and shrub cover were greater on unplowed than plowed sites measured as canopy, foliar, and basal cover (Table 5). Perennial grass production averaged 230 kg/ha for unplowed sites and only 30 kg/ha for plowed sites. The off-site transects averaged 354 kg/ha of perennial grasses. Shrub standing crop was 80 kg/ha, 10 kg/ha, and 215 kg/ha for the plowed, unplowed, and off-site transects, respectively. There was little difference in forb cover or annual grass cover between plowed and unplowed areas. As cover measurements were in late May and early June, perhaps the annuals may not have had time to show significant growth as this investigator would have expected more annuals on plowed sites (higher annual grasses and forbs were found on plowed sites in 2007). It is also possible that dryer conditions had resulted in less annual species on these sites. High forb cover was observed on several sites (see Fig. 11), but at least for perennial forbs there was little difference between sites. Forb standing crop was also similar across sites averaging 66 kg/ha, 88 kg/ha, and 120 kg/ha for the plowed, unplowed and off-site transects, respectively. These results are certainly not surprising, but show that plowing eliminated shrubs for an unknown period (hypothesized at 20 years as site estimated to be abandoned for 10-years had few shrubs) and also greatly decreased forage grasses. Most of what had come back were forbs that would supply some grazing, but productivity was much less on plowed sites. There is no doubt that the plowing of these areas is also leading to decreased soil carbon, lowered fertility, decreased water-holding capacity, and therefore a loss of natural productivity across relatively large areas of the landscape. The loss of carbon sequestration, grazing values, shrub use areas as well as aesthetic values and biodiversity aspects all point to a strong need for improved land use planning.

Table 5. Comparison of total shrub, forbs, perennial grass, annual grass and total cover for plowed, unplowed sites (n=4) and similar sites away from plowed areas at Band-i-Amir measured using three cover estimation methods.

Site	Shrub	Forbs	Perennial Grass	Annual grass	Total	Perennial
	Canopy Cover (%)					
Plowed	2.0	8.0	1.0	4.0	12.0	8.0
Unplowed	14.0	6.0	8.0	2.0	34.0	32.0
Off-site	20.0	10.0	22.0	0.0	53.0	53.0
	Foliar Cover (%)					
Plowed	1.0	3.0	1.0	1.0	5.0	4.0
Unplowed	12.0	5.0	4.0	2.0	21.0	19.0
Off-site	16.0	8.0	10.0	0.0	34.0	34.0
	Basal Cover (%)					
Plowed	0	1.0	1.0	0	1.0	1.0
Unplowed	3.0	1.0	2.0	0	5.0	5.0
Off-site	2.0	1.0	4.0	0.0	7.0	7.0

Litter averaged 4, 12, and 23% for the plowed, unplowed, and off-site areas. Litter is important in protecting the soil surface from wind and water erosion and insulates the soil surface as well as returning organic matter to the soil. Foliar cover can also be considered as a measure of the ability of plants to protect the soil surface (foliar cover is a measure of foliage above soil surface that would offer soil protection as it would intercept raindrops and shade soil). Combining total foliar cover and litter cover as a surrogate for soil protective influence, it was determined that there was about a 4-fold and 7-fold increase in protective cover for the unplowed and off-site areas compared to the plowed sites, respectively. Although soil erosion was not measured, there is no doubt that erosion is greater on plowed sites for several years following the initial cultivation. It was observed that in other plowed areas soil erosion was very significant but localized in that the plowed areas are quite small in size. For example, in figure 12 soil erosion is evident as rills (small gullies) on this recently plowed area. Figure 8 is a photo showing a site where soil loss was estimated at 30 cm compared to the unplowed hillside. This plowed area had been abandoned, and since much of the soil has been eroded, subsoils are evident in part of the photo. Therefore, it is likely that cultivation would not be successful on the site, and site productivity for other uses has been significantly degraded.

Figure 11. Photo 29 May 2008 16:32.46 showing plowed area dominated by *Euphorbia* sp and *Convulus* sp. This plowed area was not a transect site but shows two species Euphorbia sp. and Convulus arvensis with strong sprouting ability following plowing. The site was dominated by these species and it is likely that little grain was produced on such a site. This site should not have been plowed because of the amount of these species and the ability of these species to spread with disturbance. These species are not used for fuel (forbs with no real woody base) and are generally considered to be an undesirable species for livestock forage.

Figure 12. Photo 30 May 2008-10:08.37 showing rills and soil loss in lalmi (dry-land farm) area. Erosion associated with water movement is generally a concern mostly on steep areas as intense rainfall events are uncommon in Band-i-Amir but significant soil loss does occur from water and wind erosive factors.

Figure 13. Photo 29 May 2008-16:02.50 illustrating difference between lalmi (plowed) and unplowed area. Soil loss is about 30 cm and is estimated that this area had not been cropped for at least 10 years. There were no plow lines and some shrubs were coming back into the site, but no shrubs were large enough to supply a fuel and little forage was available for livestock.

Figure 14. Photo 29 May 2008 16:32.46 showing plowed area on steep north aspect.
Note lack of plant cover to protect site from erosive influences and subsoil exposed. Also, note good shrub and grass cover off the plowed area.

Figure 15. Photo 30 May-16:47.08 showing site above lalmi in previous figure showing grass vigor.
Grass production on this site was estimated at 400 kg/ha with significant shrub and forb production estimated at 200 kg/ha and 100 kg/ha, respectively. As surrounding areas are cultivated, grass productivity is benefiting (note litter which is rarely seen on areas receiving heavy grazing) from a rest from grazing.

Figure 16. Photo 9 June 2008-09:16.56 showing tractor plowed area and adjacent site.
Note adjacent site with moderate grass and shrub production. There is little doubt that without some control on cultivation, the entire area will likely be plowed.

Figure 17. Photo. 9 June 2008-09:27.56. showing same general area as previous photo of tractor plowed area in background and better growth of grasses and shrubs in foreground of unplowed area.
Note, in most cases it was likely that shrubs were being removed from areas near lalmi but in this area shrubs were still quite large. This site was one of transect sites and was an “off-site” transect as the plowed area was just recently plowed and this site was not impacted by nearby plowed areas.

Summary and Management Implications

Participatory Rural Appraisal: Shrub Use Concerns

The PRA substantiated that shrub conservation is a major concern. It is generally the same shrubs (4 out of 5 are always on the same list) that are important to different villages surveyed. All communities also reported that shrubs have significantly decreased during the last 5 years, and that they (the communities) needed to be able to control shrub use in their village area. If villages were able to control their village area, they said they would be able to increase shrubs. It seems obvious that communities do need to be able to control their lands in order to manage resources such as shrubs, but the rangeland specialist also believes all resource use should be considered within these areas. For instance, there is a concern that if dry-land farming continues to increase this will have continued negative impacts on shrub collection and livestock grazing, thereby increasing impacts across rangelands of the area. It is also obvious that alternate fuel sources are needed. Electricity was being supplied from a hydropower turbine at Qalijafar to some local homes, but apparently the wattage was not great enough to allow for cooking. Solar panels were also found in several villages but again this does not provide power for cooking. It is beyond the WCS rangeland team expertise to recommend alternatives for improving fuel use, but it is believed that there is a strong study need for someone with experience in alternative fuels and stove technologies to examine the problem.

The WCS rangeland team's PRA meetings were considered an initial step to initiate the process in conserving shrubs for future generations. It is suggested that experts in facilitating conservation planning approach villages in Band-i-Amir (using a PRA approach) to develop plans for conserving shrubs and other resource values. These villages are ready to develop conservation plans as soon as they have control over their village lands. With the adoption of village shrub/grazing areas' agreements, there also needs to be the adoption of land use restrictions associated with plowing overly steep slopes. In addition, research and demonstration regarding sustainable harvest of shrubs is needed. On two occasions the rangeland specialist observed basically "clear-cutting" of shrubs, removing all shrubs thereby leaving nothing to reestablish or protect the soil resource. Demonstration plots on shrub harvest are needed to illustrate to villagers the impact of shrub harvests on rangeland resources. The rangeland specialist suggests that there is a need to agree on leaving a number of mature shrubs per area (perhaps 1 mature shrub/25m^2), and to restrict shrub collection on steeper slopes (such as leaving more shrubs, perhaps 2 mature shrubs/25m^2).

Dry-land Farming

Using conservation tillage practices, some of the area could be sustainably farmed. However, it is certainly obvious that the steeper hillsides should not be plowed. Therefore, there is the immediate need to provide a land capability classification for placing or delineating sites into areas with low, moderate, high, and severe potential for soil erosion as well as crop failure based on site characteristics such as soils, soil depths and slope. Also, there is a need to better understand the costs/benefits of plowing rangelands in the Band-i-Amir. This will require a research/demonstration project. The WCS rangeland specialist hypothesizes that it is unlikely that in most years the dry-land wheat-fields produce enough grain to make the practice economical. Indeed one farmer interviewed in 2007 said the straw was more valuable than the grain. However, without a research/demonstration project to examine costs/benefits it is unlikely the farmers would be willing to restrict any plowing of areas. As stated previously, the plowing of steeper slopes will result in significant ecological damage and is certainly not sustainable. The reduction in livestock forage, increased weeds, and loss of soil are all costs that should be considered in setting up land use practices in this area (land classification system needs to be established). It is likely that as better equipment (tractors and plows) become available the impacts will increase as more area will be plowed. As such, conservation farming practices need to be explored/adapted for areas that farming is allowed. In any decision to restrict land use, it would be desirable to have locals participate and agree on the type of sites where rangelands should not be plowed (for example, slopes greater than 5% incline).

In Band-i-Amir it is proposed that a project be initiated that includes 4 major programs:

1) Development of community shrub collection areas with methods of shrub use to initiate recovery. This would include some subsidies for fuels.
2) Land classification of dry-land farming areas and agreement on which areas (slopes and soils) could be plowed in the future. Included would be a study examining cost/benefits of dry-land farming,
3) Setting up reference ecological sites (exclosures) in some shrub areas and “go-back” cultivated areas for determining length of time for dry-land farming areas to recover.
4) Establishment of grazing management plans for villages.

SUMMARY AND MANAGEMENT IMPLICATIONS OF RANGELAND ANALYSIS OF AJAR VALLEY AND BAND-I-AMIR NATIONAL PARK

Rangeland work in Bamian Province consisted of a rapid rangeland reconnaissance in the Ajar Valley Provisional Wildlife Reserve and Band-i-Amir National Park. The objective of the rapid reconnaissance was to determine rangeland conditions and areas of concern regarding rangeland use. In both areas the rapid rangeland reconnaissance consisted of a survey of rangelands, some plot work to examine plant communities at particular sites and discussion of issues and problems with local peoples. In Band-i-Amir National Park the rangeland team also initiated studies on shrub use and the impact of dry-land farming on rangeland vegetation.

From the rapid rangeland assessment, the WCS rangeland team has documented that overgrazing is a problem and grass cover is a major indicator in rangeland condition. The time in Ajar Valley and Band-i-Amir National Park was not sufficient for a detailed quantification of rangeland conditions. Additional surveys are needed to better define vegetation types, assess rangeland conditions and to determine livestock population levels that would not significantly impact wild species and provide for improved site conditions. Additional work is also needed to determine the impact of shrub/tree harvest for fuel on these rangelands, especially on the impact on juniper and *Acantholimon* types. Dry-land farming is a serious concern in Band-i-Amir and needs better regulations for proper management. It is recommended that studies begin examining the impact of dry-land farming on soils, long-term productivity, and the economic costs and returns on various sites in Band-i-Amir. It is very likely that dry-land farming, especially on steeper slopes and shallow soils, is having an overall negative impact on resource values and livelihoods.

Ajar Valley is a diverse landscape with many natural resource values that need immediate conservation attention. It is reported that the wild ungulate population (ibex and urial) have dramatically decreased during the last several decades, and it seems very possible that wild ungulates could be eliminated from the area. The WCS rangeland specialist suspects that competition for forage and water with livestock is impacting wild ungulate populations, but likely past poaching by local peoples have been the major driving force for a reduction in these populations. This subjective judgment is based on the findings that there are still many sites in Ajar Valley producing moderate amounts of forage that would be available for wild ungulate populations. Larsson (1978) stated that "compared to the adjacent, over-exploited rangelands, the Ajar Valley Wildlife Reserve show throughout its history of protection signs of general range improvement that are considered unique for the central Afghanistan highland" as the area had been protected from grazing by domestic livestock and shrub-collection for nearly 30 years. It is extremely unfortunate that this protection was lost by the 1980s and there is little doubt that current human uses are degrading rangelands. However, the rangeland specialist believes that some of the rangelands of the Ajar Valley are still some of the least degraded observed in Afghanistan and hypothesizes that there are other similar sites that could be located with additional surveys. To ensure that these sites are not lost to overuse, conservation planning needs to begin as soon as possible.

Band-i-Amir National Park is well-known for its clear, blue lakes and surrounding scenic landscapes. However, the area is under constant threat associated with over utilization of its grazing lands, improper cultivation practices, and overharvest of shrubs for fuel woods. These resource issues need immediate attention or livelihoods of local peoples will continue to deteriorate. In Band-i-Amir the WCS rangeland team recommends that a rangeland project be initiated that should include 4 major programs: (1) Development of community shrub collection areas with methods of proper shrub use to initiate shrub-land recovery; (2) Land classification of dry-land farming areas and agreement on which areas (slopes and soils) could be plowed in the future. Included would be a study examining cost/benefits of dry-land farming; (3) Installation of reference ecological sites (exclosures) in some shrub areas and “go-back” cultivated areas for determining length of time for dry-land farming areas to recover; and (4) Establishment of grazing management plans for villages. One advantage of working in Band-i-Amir is that it is relatively easy to reach and facilities exist to aid workers. As such, the proposed rangeland program could be used to develop a model (with modifications learned) for rangeland improvement in similar areas in Afghanistan.

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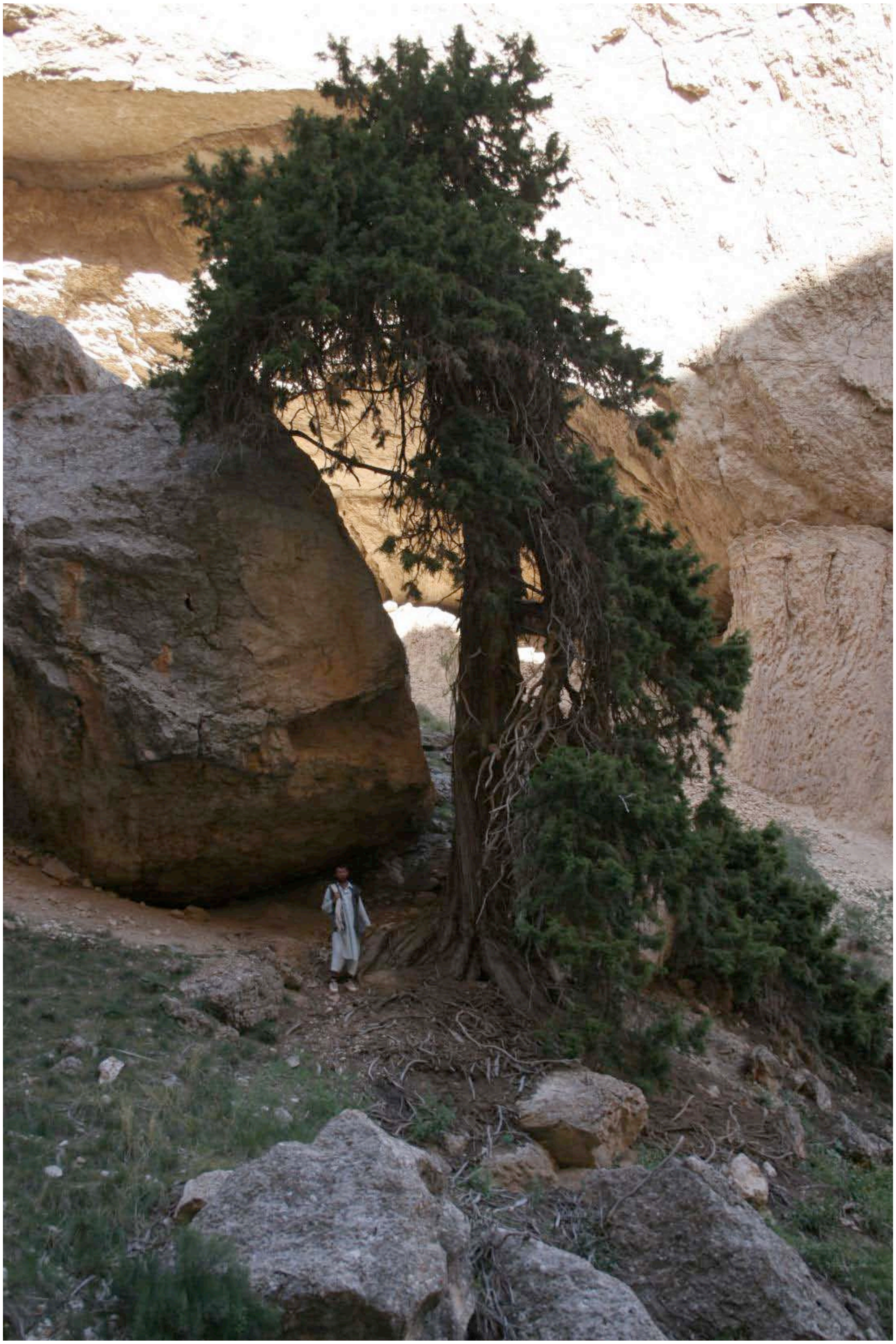
APPENDICES

Appendix 1. Canyon valley forest type (*Juniperus* and *Lonicera*).
A unique “oases” in the dry surrounding environment of the area (Photo 04-06-2008_07.42.14).

Appendix 2. Canyon scrubland vegetation type of wider and dryer valleys.
(Photo 07-06-2008_15.94.54).



Appendix 3. One of the larger juniper trees observed.
Note good grass cover here (Photo 04-06-2008_07.56.10).


Appendix 4. Photo of a River-band willow community type located in the upper Ajar river valley.

Appendix 5. Transect site characteristics* and canopy cover (%) of vegetation groupings for transects measured in June 2008 in Ajar Valley.

Transect	Elevation	Aspect	Slope	*Acantholimon*	*Ephedra*	Legumes	*Artemisia* shrubs	Annual grasses	Forbs	Perennial Grass	Grass-likes	Salt Desert Shrubs	Total Cover
Jun04_08_1025	3100	352	24	6	0	0	6	0	2	38	0	0	52
Jun04_08_1150	3132	330	20	6	0	0	6	0	2	26	0	0	40
Jun04_08_1435	3080	18	38	0	0	0	6	0	4	32	0	0	42
Jun05_08_0820	2912	244	18	0	0	0	22	0	2	0	0	0	24
Jun05_08_0920	2936	323	22	6	0	2	12	0	4	8	0	2	34
Jun05_08_1115	3126	310	8	2	0	0	20	0	0	0	4	0	26
Jun05_08_1155	3160	12	10	6	0	0	10	0	10	12	6	0	44
Jun05_08_1430	2610	300	15	2	0	0	6	0	2	0	0	0	10
Jun05_08_1510	2538	298	8	4	0	0	28	0	0	0	0	0	32
Jun06_08_1535	2980	340	19	2	6	4	12	0	0	14	2	0	40
Jun06_08_1630	2980	175	16	6	4	0	20	0	2	0	0	0	32
Jun06_08_1725	2953	0	3	0	2	0	14	0	0	4	12	0	32
Jun07_08_0700	3304	320	34	8	0	2	8	0	6	16	0	0	40
Jun07_08_0835	2912	340	8	2	0	0	14	0	0	2	2	0	20
Jun07_08_0945	2724	300	5	4	0	0	14	0	0	0	0	4	22
Jun07_08_1030	2698	32	15	4	0	0	8	0	0	0	0	2	14
Jun07_08_1130	2575	331	8	0	0	0	10	0	0	2	0	2	14
Jun07_08_1200	2537	144	16	0	0	0	0	0	0	0	0	0	0
Jun07_08_1340	2170	0	0	0	0	0	0	0	0	0	0	16	16
Jun07_08_1750	2360	313	10	0	0	0	0	0	0	0	0	2	2

* Elevation is in meters and aspect and slope are in degrees. Canopy cover (%) was determined using a point intercept methodology (point at each meter using a 50 m transect).

Appendix 6. Transect site characteristics* and basal cover (%) of vegetation groupings for transects measured in June 2008 in Ajar Valley.

Transect	Elevation	Aspect	Slope	*Acantholimon*	*Ephedra*	Legumes	*Artemisia* shrubs	Annual grasses	Forbs	Perennial Grass	Grass-likes	Salt Desert Shrubs	Total cover
Jun04_08_1025	3100	352	24	6	0	0	0	0	2	14	0	0	22
Jun04_08_1150	3132	330	20	2	0	0	0	0	0	14	0	0	16
Jun04_08_1435	3080	18	38	0	0	2	0	0	0	22	0	0	24
Jun05_08_0820	2912	244	18	0	0	0	0	0	0	0	0	0	0
Jun05_08_0920	2936	323	22	4	0	0	0	0	0	0	0	0	4
Jun05_08_1115	3126	310	8	2	0	0	0	0	0	0	0	0	2
Jun05_08_1155	3160	12	10	2	0	0	0	0	2	10	0	0	14
Jun05_08_1430	2610	300	15	2	0	0	0	0	0	0	0	0	2
Jun05_08_1510	2538	298	8	4	0	0	0	0	0	0	0	0	4
Jun06_08_1535	2980	340	19	2	2	0	0	0	0	4	0	0	8
Jun06_08_1630	2980	175	16	4	0	0	0	0	2	0	0	0	6
Jun06_08_1725	2953	0	3	0	0	0	0	0	0	2	0	0	2
Jun07_08_0700	3304	320	34	8	0	0	0	0	2	10	0	0	20
Jun07_08_0835	2912	340	8	0	0	0	0	0	0	2	0	0	2
Jun07_08_0945	2724	300	5	2	0	0	0	0	0	0	0	0	2
Jun07_08_1030	2698	32	15	2	0	0	0	0	0	0	0	0	2
Jun07_08_1130	2575	331	8	0	0	0	0	0	0	0	0	0	0
Jun07_08_1200	2537	144	16	0	0	0	0	0	0	0	0	0	0
Jun07_08_1340	2170	0	0	0	0	0	0	0	0	0	0	0	0
Jun07_08_1750	2360	313	10	0	0	0	0	0	0	0	0	0	0

* Elevation is in meters and aspect and slope are in degrees. Basal cover (%) was determined using a point intercept methodology (point at each meter using a 50 m transect).

Appendix 7. Transect site characteristics* and foliar cover (%) of vegetation groupings for transects measured in June 2008 in Ajar Valley.

Transect	Elevation	Aspect	Slope	*Acantholimon*	*Ephedra*	Legumes	*Artemisia* shrub	Annual grass	Forbs	Grass	Grass-Likes	Desert Shrub	TOTAL COVER
Jun04_08_1025	3100	352	24	2	0	1	4	0	1	14	0	0	21.6
Jun04_08_1150	3132	330	20	3	0	0	4	0	9	8	0	0	23.6
Jun04_08_1435	3080	18	38	0	0	1	4	0	5	13	0	0	23.6
Jun05_08_0820	2912	244	18	0	0	0	30	0	0	1	0	0	30.7
Jun05_08_0920	2936	323	22	0	0	7	11	0	2	2	0	3	24.6
Jun05_08_1115	3126	310	8	3	0	1	22	0	0	1	1	0	28.6
Jun05_08_1155	3160	12	10	5	0	0	10	0	4	7	0	0	26.1
Jun05_08_1430	2610	300	15	8	0	0	6	0	1	0	0	0	15.2
Jun05_08_1510	2538	298	8	4	0	0	20	0	0	0	0	0	24.4
Jun06_08_1535	2980	340	19	2	6	4	12	0	1	12	3	0	40.6
Jun06_08_1630	2980	175	16	4	2	0	34	0	1	2	0	0	42.4
Jun06_08_1725	2953	0	3	0	2	0	24	0	1	3	0	0	31.1
Jun07_08_0700	3304	320	34	6	0	3	12	0	3	11	0	0	34.7
Jun07_08_0835	2912	340	8	1	0	0	27	0	0	2	0	1	31.0
Jun07_08_0945	2724	300	5	5	0	0	12	0	0	1	0	2	18.9
Jun07_08_1030	2698	32	15	3	0	0	15	0	0	2	0	1	20.4
Jun07_08_1130	2575	331	8	0	0	0	17	0	0	1	0	2	20.5
Jun07_08_1200	2537	144	16	0	0	0	0	1	2	0	0	0	3.3
Jun07_08_1340	2170	0	0	0	0	0	0	0	0	0	0	28	27.6
Jun07_08_1750	2360	313	10	md	md	md	md	md	md	md	md	md	md

* Elevation is in meters and aspect and slope are in degrees. Foliar cover (%) was determined using a point intercept methodology (point at each meter using a 50 m transect).